Clean Water Act §319(h) Nonpoint Source Grant Program

Continued Implementation of the Mill Creek Watershed Protection Plan

TSSWCB Project # 19-12

Quality Assurance Project Plan

Texas State Soil and Water Conservation Board

Revision #0

prepared by

Texas A&M AgriLife Extension Service
Texas Water Resources Institute

Texas A&M AgriLife Extension Service
Department of Soil and Crop Sciences

Effective Period: Upon EPA approval through September 30, 2021

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

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Section A1: Approval Sheet

Quality Assurance Project Plan (QAPP) for the *Continued Implementation of the Mill Creek Watershed Protection Plan*

United States Environmental Protection Agency (USEPA), Region VI

Name: Nelly Smith
Title: USEPA Chief State/Tribal Programs Section

Signature: _____ Date:_____

Name: Anthony Suttice
Title: USEPA Texas Nonpoint Source Project Officer

Signature: _____ Date:_____

Texas State Soil and Water Conservation Board (TSSWCB)

Name: Jana Lloyd
Title: TSSWCB Project Manager (PM)

Signature:_____Date:_____

Name: Mitch Conine
Title: TSSWCB Quality Assurance Officer (QAO)

Signature:_____Date:_____

Texas A&M AgriLife Extension Service, Dept. of Soil and Crop Science (SCSC)

Name: Ward Ling
Title: Extension Program Specialist II, Program Lead

Signature:_____Date:_____

Name: Jake Mowrer
Title: Asst. Professor and Extension Specialist, Program Co-Lead

Signature:_____Date:_____

Texas A&M AgriLife Extension Service – Texas Water Resources Institute (TWRI)

Name: Lucas Gregory
Title: TWRI Project Leader & QAO

Signature:_____ Date:_____

Name: Ed Rhodes
Title: TWRI PM

Signature:_____ Date:_____

Name: Stephanie deVilleneuve
Title: TWRI Field Supervisor & Data Manager (DM)

Signature:_____ Date:_____

Aqua-Tech Laboratories, Inc. (ATL)

Name: June Brien
Title: ATL Lab Manager (LM)

Signature:_____Date:_____

Name: Marianne Guzman
Title: ATL QAO

Signature:_____Date:_____

Section A2: Table of Contents

Section: Title

List of Acronyms and Abbreviations

ATL	Aqua-Tech Laboratories, Inc.
AWRL	Ambient Water Reporting Limits
BMP	best management practice
BRA	Brazos River Authority
CAR	corrective action report
CMS	coordinated monitoring schedule
COC	chain of custody
CRP	Clean Rivers Program
CWA	Clean Water Act
DM	Data Manager
DMRG	data management reference guide
DO	dissolved oxygen
DQO	data quality objectives
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LM	Laboratory Manager
LCRA	Lower Colorado River Authority
LOD	limit of detection
LOQ	limit of quantitation
NELAP	National Environmental Laboratory Accreditation Program
NWS	National Weather Service
OSSF	onsite sewage facility
PM	Project Manager
QA	quality assurance
QAC	Quality Assurance Coordinator
QAPP	quality assurance project plan
QAO	Quality Assurance Officer
QC	quality control
QM	quality manual
QPR	quarterly progress report
RPD	relative percent difference
SCSC	Texas A&M AgriLife Extension Service, Dept. of Soil and Crop Sciences
SOP	standard operating procedure
SSL	Spatial Sciences Laboratory
SWCD	Soil and Water Conservation District
SWQM	surface water quality monitoring
SWQMIS	Surface Water Quality Monitoring Information System
TCEQ	Texas Commission on Environmental Quality
TCEQ SOP, V1	TCEQ's Surface Water Quality Monitoring Procedures, Volume 1
TSSWCB	Texas State Soil and Water Conservation Board
TWRI	Texas A&M AgriLife Extension Service, Texas Water Resources Institute
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WPP	watershed protection plan
%R	percent recovery

Section A3: Distribution List

Organizations, and individuals within, which will receive copies of the approved QAPP and any subsequent revisions include:

United States Environmental Protection Agency, Region VI

Water Division
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Dallas, TX 75270-2102

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Title: USEPA Texas Nonpoint Source Project Officer

Texas State Soil and Water Conservation Board

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Name: Jana Lloyd
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Texas A&M AgriLife Extension Service (AgriLife)

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Aqua-Tech Laboratories, Inc.

635 Phil Gramm Blvd.
Bryan, TX 77807

Name: June Brien
Title: ATL LM

Name: Marianne Guzman
Title: ATL QAO

AgriLife SCSC will provide copies of this project plan and any amendments or appendices of this plan to each person on this list and to each sub-tier project participant, e.g., subcontractors, other units of government, laboratories. AgriLife will document distribution of the plan and any amendments and appendices, maintain this documentation as part of the project's quality assurance records, and will be available for review.

Section A4: Project/Task Organization

The following is a list of individuals and organizations participating in the project with their specific roles and responsibilities:

USEPA – United States Environmental Protection Agency, Region VI. Provides project oversight and funding at the federal level.

Anthony Suttice, USEPA Texas Nonpoint Source Project Officer
Responsible for overall performance and direction of the project at the federal level. Ensures that the project assists in achieving the goals of the Clean Water Act (CWA). Reviews and approves the QAPP, project progress, and deliverables.

TSSWCB – Texas State Soil and Water Conservation Board, Temple, Texas. Provides project overview at the State level.

Jana Lloyd, TSSWCB PM
Responsible for ensuring that the project delivers data of known quality, quantity, and type on schedule to achieve project objectives. Provides the primary point of contact between TSSWCB and SCSC/TWRI. Tracks and reviews deliverables to ensure that tasks in the work plan are completed as specified. Reviews and approves QAPP and any amendments or revisions and ensures distribution of approved/revised QAPPs to TSSWCB participants. Notifies TSSWCB QAO of any project non-conformances or corrective actions reported or taken by TWRI.

Mitch Conine, TSSWCB QAO
Reviews and approves QAPP and any amendments or revisions. Responsible for verifying that the QAPP is followed by project participants. Monitors implementation of corrective actions. Coordinates or conducts audits of field and laboratory systems and procedures. Determines that the project meets the requirements for planning, quality assessment (QA), quality control (QC), and reporting under the TSSWCB Nonpoint Source Management Program.

SCSC – Texas A&M AgriLife Extension Service, Dept. of Soil and Crop Sciences, College Station, Texas. Provides project oversight, management and delivery.

Ward Ling, Project Leader
Responsible for managing the project for AgriLife. Reviews project progress and reviews and approves QAPP and QAPP amendments. Responsible for implementing and monitoring MC WPP requirements in the contract and the QAPP. Responsible for maintaining records of QAPP distribution, including appendices and amendments. Responsible for maintaining written records of sub-tier commitment to requirements specified in this QAPP. Coordinates project planning activities and work of project partners. Ensures QAPP is followed by project participants and that project is

producing data of known quality. Ensures that subcontractors are qualified to perform contracted work.

Jake Mowrer, Co-Project Leader

Verifies QAPPs are being followed by TWRI and AquaTech Lab and that project is producing data of known quality. Coordinates project planning with TWRI Project Manager. Reviews and approves data and reports produced by TWRI. Notifies AgriLife Project Leader and TSSWCB PM and QAO 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 TWRI meets deadlines and scheduled commitments.

TWRI – Texas Water Resources Institute, College Station, Texas. Responsible for collection of water quality data, data assessment and QAPP development.

Lucas Gregory, TWRI; Project Lead & QAO

Responsible for determining that the QAPP meets the requirements for planning, QA and QC. Conducts audits of field and laboratory systems and procedures. Responsible for maintaining the official, approved QAPP, as well as conducting quality assurance audits in conjunction with TSSWCB personnel.

Ed Rhodes, TWRI; PM

The TWRI Project Manager is responsible for ensuring that tasks and other requirements in the contract are executed on time and with the QA/QC requirements in the system as defined by the contract and in the project QAPP.

Stephanie deVilleneuve; Field Supervisor & Data Manager

Responsible for supervising all aspects of the sampling and measurement of surface waters and other field parameters. Responsible for the collection of water samples and field data measurements in a timely manner that meet the quality objectives specified in Section A7 (Table A7.1), as well as the requirements of Sections B1 through B8. Responsible for field scheduling, staffing, and ensuring that staff is appropriately trained. Reports status, problems, and progress to TWRI PM.

Responsible for acquisition, verification, and transfer of data to the TSSWCB PM. Oversees data management for the project. Performs data quality assurances prior to transfer of data to the Texas Commission on Environmental Quality (TCEQ) in the format specified in the most recent version of the Surface Water Quality Monitoring (SWQM) Data Management Reference Guide (DMRG). Ensures that the data review checklist is completed and data is submitted with appropriate codes. Provides the point of contact for the TSSWCB PM to resolve issues related to the data and assumes responsibility for the correction of any data errors.

ATL – Aqua-Tech Laboratories, Inc., Bryan, Texas. Responsible for conducting laboratory analysis.

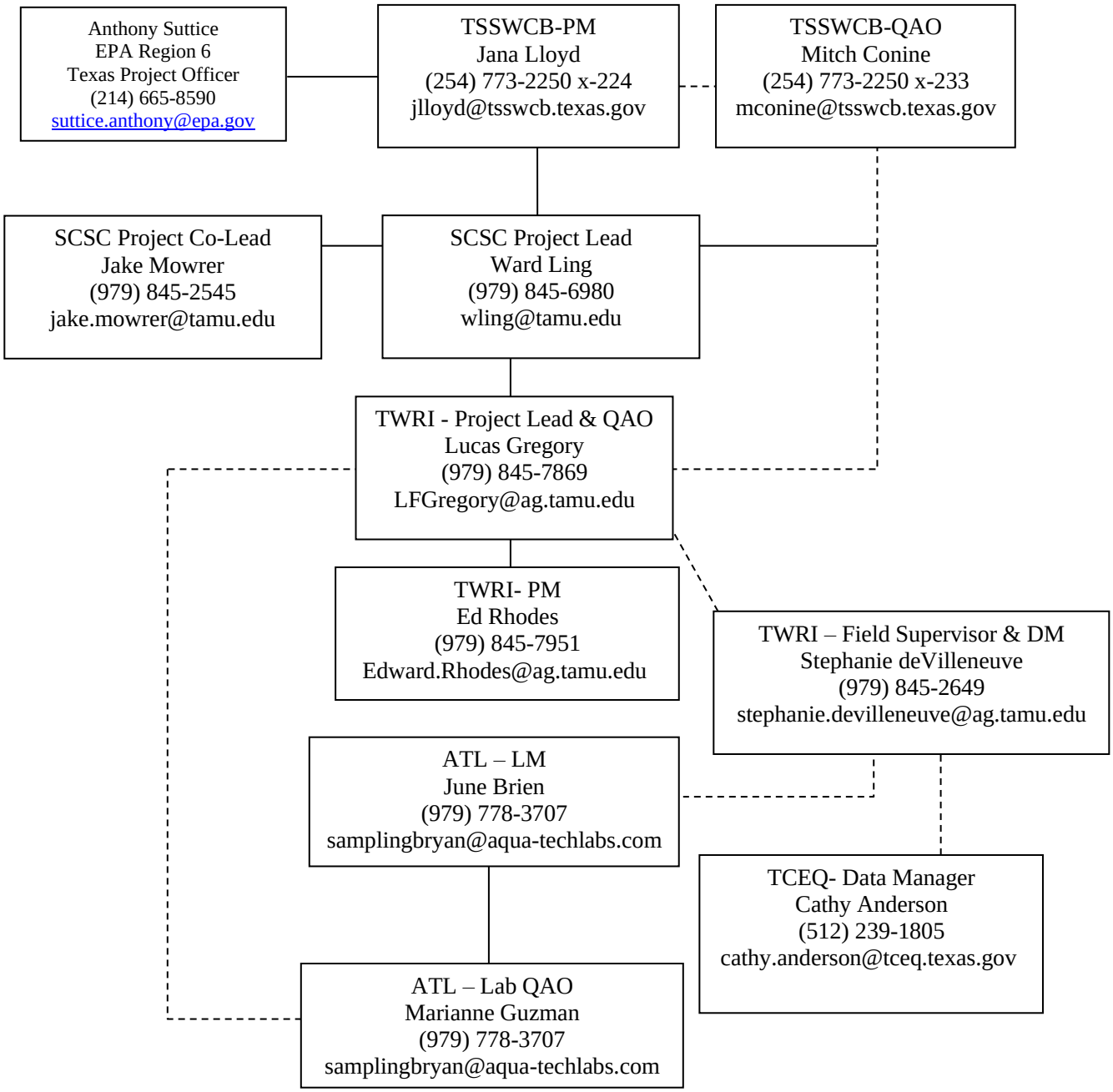
June Brien, ATL LM

Responsible for overall performance, administration, and reporting of analyses performed by ATL. Responsible for supervision of laboratory personnel involved in generating analytical data for the project. Ensures that laboratory personnel have adequate training and a thorough knowledge of the QAPP and related SOPs. Responsible for oversight of all laboratory operations ensuring that all QA/QC requirements are met, documentation is complete and adequately maintained, and results are reported accurately. Enforces corrective action, as required. Facilitates monitoring systems audits. Reviews and verifies all laboratory data for integrity and continuity, reasonableness and conformance to project requirements, and then validates the data against the measurement performance specifications listed in Table A7.1 of the QAPP.

Marianne Guzman, ATL QAO

Monitors the implementation of the QAM and the QAPP within the laboratory to ensure complete compliance with QA objectives as defined by the contract and in the QAPP. Conducts internal audits to identify potential problems and ensure compliance with written SOPs. Responsible for supervising and verifying all aspects of the QA/QC in the laboratory. Performs validation and verification of data before the report is sent to TWRI. Insures that all QA reviews are conducted in a timely manner from real-time review at the bench during analysis to final submittal of data to TWRI QA officer.

Figure A.4.1. Project Organization Chart



Section A5: Problem Definition/Background

A Recreational Use Attainability Analysis (RUAA) was conducted on Mill Creek, segment 1202K in 2007. Results of the analysis showed that Mill Creek currently supports, and has historically supported, contact recreation. In 2008, Mill Creek was listed on the Texas Water Quality Inventory List of Sources of Impairment and Concern related to the fish community. Following further analysis, the Mill Creek was listed in 2010, 2012, and 2014 on the Texas Integrated Report of Impaired Waterways.

In 2013, the TSSWCB and Extension identified Mill Creek for WPP development due to two primary factors: 1) it had been listed as impaired due to bacteria levels in exceedance of the recreational contact use standard, and 2) the aforementioned RUAA had concluded the recreational contact use designation and concurrent water-quality standards were appropriate. The TSSWCB projects 14-57 and 15-54 entitled *Phase 1: Data Collection and Development of Essential Components for the Mill Creek Watershed Protection Plan* and *Phase 2: Development of a Watershed Protection Plan for Mill Creek*, respectively, began in 2014. These projects included water quality monitoring, water quality modeling, and WPP development.

Routine ambient water quality data are collected quarterly by the TCEQ as part of the CRP program at one site (11576) in the watershed. As part of TSSWCB project 16-11, Extension and H-GAC conducted a 10-month water quality monitoring task that included nine monthly routine monitoring sites and four targeted sites in the watershed.

The WPP development was a stakeholder driven process led by Extension with vital support from TSSWCB. The Mill Creek Watershed Partnership Steering Committee included local officials, land and business owners and citizens and is supported by state and federal agency partners. With technical assistance from project staff, the Steering Committee identified issues that are of particular importance to the surrounding communities, contributed information on land use and activities that helped to identify potential sources of bacteria, and guided development of the WPP. Through the WPP development process, stakeholders identified three categories of potential nonpoint sources of bacteria in the watershed: urban, on-site wastewater, and agricultural. SELECT was utilized to estimate distributions and the degree of contribution of these potential pollutant sources within the watershed. Management measures were identified to address each of the potential sources. The timeline for full implementation of management measures identified in the Mill Creek WPP is 10 years. The WPP was approved and signed by the Steering Committee in January of 2016 and accepted by EPA in February of 2016.

Shortly before the first phase of implementation (TSSWCB project 16-11) began in November 2016, a new Extension Program Specialist was hired as the Watershed Coordinator. Due to the 6-month period without a dedicated watershed coordinator, the new Watershed Coordinator focused time and energy into marketing and networking within the Mill Creek WPP and kick-starting youth and adult educational programs within the watershed. Other management measures

addressed include septic system education, well-owner programs with water quality testing, and working with the Austin and Washington Soil and Water Conservation District Technician to encourage stakeholders to consider a WQMP.

Section A6: Project Goals and Task Description

Extension, utilizing an Extension Program Specialist, will continue to facilitate the Mill Creek Watershed Partnership through coordination with all key stakeholder groups (cities, counties, agricultural groups, local businesses, HOAs, etc.) and partner agencies (NRCS, SWCDs, TCEQ, etc.). This will include organizing and conducting quarterly public meetings with the Partnership Steering Committee, as well as other planning and implementation meetings, as necessary and appropriate. Extension will promote public participation in meetings, events, and implementation activities through extensive use of various communication mechanisms, including newsletters, news releases, radio and other mass media, the project website, social media, phone, mail and email contact.

Extension will facilitate collaborative efforts among project partners to implement management measures for all three key categories of nonpoint source pollution: urban, wastewater, and agricultural, including specific emphasis on management measures identified by stakeholders as urban stormwater, septic system, and agricultural, and non-domestic animal and wildlife management. Guidance on these activities is provided in Tables 8.1 and 8.2 of the Mill Creek WPP. This will involve working closely with city and county personnel, as well as local and regional state staff, SWCDs, and federal agency staff.

Extension will assist governmental and non- governmental organizations in the Mill Creek watershed with acquisition of resources to enable WPP implementation. This will include the identification of potential funding sources and assistance with the development of proposals and plans of work to secure supplemental funding from both internal (local) and external (state, federal, etc.) sources, as well as tracking and reporting for successful projects, as appropriate.

Extension will continue to facilitate and coordinate outreach and education activities in the watershed to promote implementation of recommended management measures. This will include active use of local media outlets (newspapers, newsletters, regional magazines, radio, etc.) to communicate project planning efforts and activities, and development and dissemination of factsheets and other educational resources at public events through the project website. Extension will also facilitate and/or conduct a wide range of targeted educational programs consistent with the WPP including: a Texas Watershed Steward Training, Lone Star Healthy Streams workshop, Smart Growth workshops, Master Gardener/Master Naturalist Programs, septic system workshops, agricultural nutrient management education, livestock grazing management education, and feral hog management through TSSWCB Project 14-12 entitled Enhancing Feral Hog Management Through Statewide Implementation of Lone Star Healthy Streams. The issue of the need to address failing septic systems in the watershed has continued to be brought up at Partnership meetings. Because of this, Extension will work with the authorized agents in both Austin and Washington Counties, consistent with Chapter 6 of the WPP, to focus on high risk areas within targeted subwatersheds. This may take the form of increased educational outreach, inspections, seeking additional funding to assist homeowners repair/replace failing septic systems, and/or to assist cities with identifying funding sources to assist with extending sanitary sewer to areas largely served by septic systems with documented high failure rates.

Water quality monitoring is an important component to demonstrating reduced impairment in the Mill Creek Watershed. During WPP development, and the first stage of implementation (TSSWCB Project 16-11), the Partnership contracted with H-GAC to conduct water quality testing. To eventually remove the Mill Creek Watershed from the 303(d) list, direct measurement of reduced concentrations of *E.coli* will be required. Extension will work with TWRI to conduct water quality testing for *E. coli* and nutrients. To ensure the collection of data of a high quality, the sites listed below (Table A6.2) will be monitored, using the indicated parameters, throughout the project according to a quality assurance project plan (QAPP).

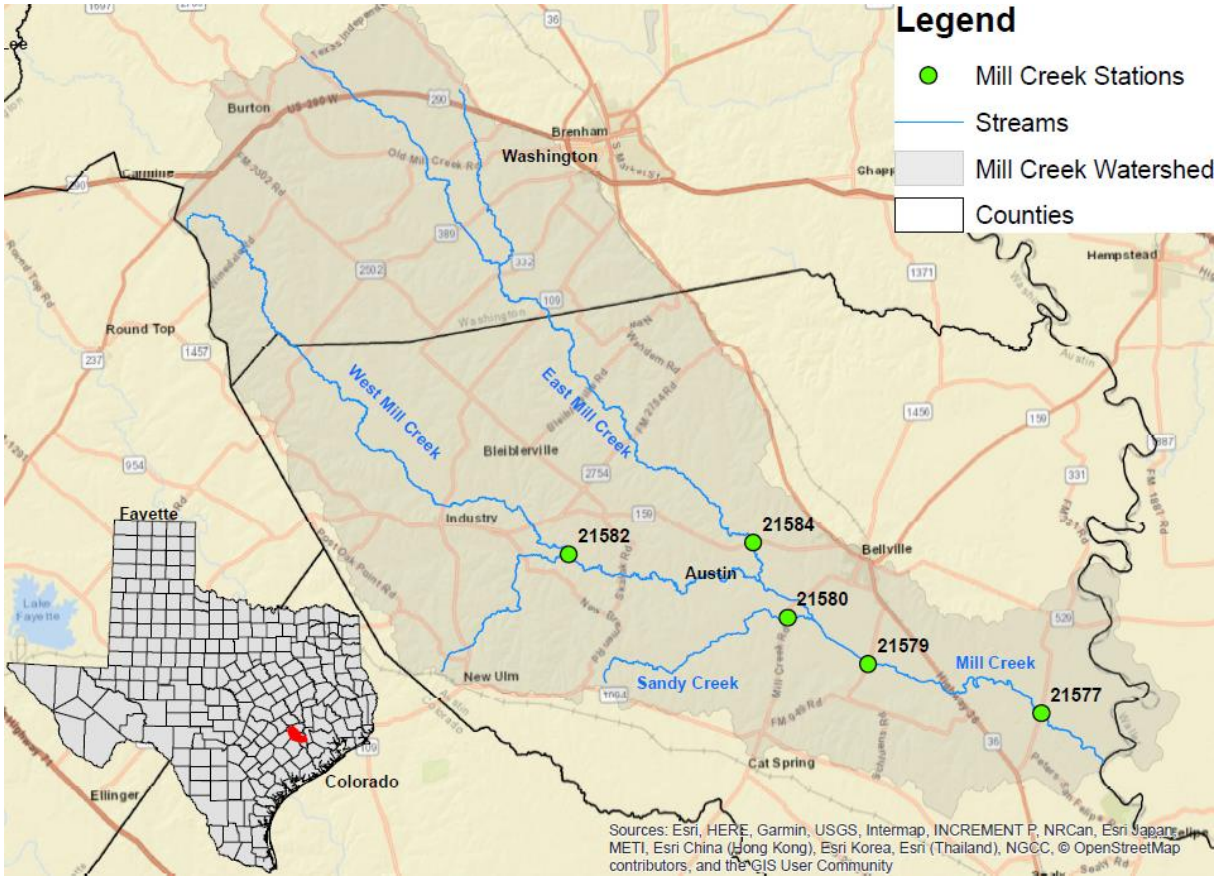


Figure A6.1. The Mill Creek Watershed

Table A6.1. Project Plan Milestones

Task	Project Milestones	Agency	Start Month	End Month
3.1	TWRI will conduct routine monitoring at 5 sites for monthly, collecting field, conventional, flow and bacteria. Sampling period extends over 17 months. Total number of sample events scheduled for collection through this subtask is 85.	TWRI	04	21
3.2	Monitoring data from activities will be uploaded into the TCEQ SWQMIS at least quarterly. Data will be transferred in the correct format using the TCEQ file structure along with a completed Data Summary, as described in the most recent version of the TCEQ Surface Water Quality Monitoring Data Management Reference Guide. Data Correction Request Forms will be submitted to TSSWCB whenever errors are discovered in data already reported. All monitoring data files, data summary reports and data correction request forms will also be provided to AgriLife Extension. TWRI will input monitoring regime, as detailed in the QAPP, into the TCEQ CMS.	TWRI	01	24
3.3	TWRI will summarize water quality data collected and conduct statistical and trend analysis to evaluate the effectiveness of BMPs implemented which will be included in the Report developed in subtask 1.4.	TWRI	01	24

TWRI will be responsible for the collection and transport of all water quality samples to the ATL Lab within appropriate sample holding times and in accordance with this QAPP. Sampling will be conducted routinely at the sampling sites designated in Table A6.2.

ATL will receive water samples and analyze them for *E. coli* enumeration, nutrients, and suspended solids analysis.

Table A6.2. Mill Creek Sampling Site Locations

TCEQ Station ID	Site Description	Latitude	Longitude	Start Date (Upon QAPP approval)	End Date	Mode of Sampling	Sample Matrix	Annual Monitoring Freq.	Agency Responsible for Sampling
21584	East fork Mill Creek at FM 159/Old Nelsonville Rd, 1.5 km west of intersection of Koy Rd and FM 159.	29.959612	-96.320151	1/2020	12/2020	Grab	Water	12	TWRI
21582	West Mill Creek at Tiemann Rd, east of Industry.	29.955712	-96.427633	1/2020	12/2020	Grab	Water	12	TWRI
21580	Sandy Creek at Mill Creek Rd southwest of Bellville	29.921135	-96.301334	1/2020	12/2020	Grab	Water	12	TWRI
21579	Mill Creek at FM 2429 5.13 km upstream of SH 36 and 5.25 km downstream of Mill Creek Road at approximately 5.78 km south of the City of Bellville in Austin County	29.896756	-96.254975	1/2020	12/2020	Grab	Water	12	TWRI
21577	Mill Creek at FM331, immediately downstream of bridge	29.869637	-96.155232	1/2020	12/2020	Grab	Water	12	TWRI

Section A7: Quality Objectives and Criteria for Data Quality

Personnel at TWRI will conduct water quality monitoring to document water quality conditions in the Mill Creek watershed. The objectives of the water quality monitoring for this project are to generate environmental and water quality data of suffficient quality to assess effects of WPP implementation, and to make decisions regarding future implementaton efforts.

Surface Water Quality Monitoring (SWQM) – The goal of this section is to ensure that data collected meets the data quality objectives (DQOs) of the project. The objective of this project is to quantify current bacteria concentrations in the Mill Creek watershed. Achievement of these objectives will support progress documentation relative to best management practices (BMPs) and will aid in future BMP implementation decision making.

Following are actions that will be undertaken by this project to assess bacterial pollution within the Mill Creek watershed:

- Monitor water quality as related to bacterial and nutrient loading

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

Consistent with the most recent version of the TCEQ *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods* (TCEQ SOP, V1) (TCEQ 2012), routine grab samples will be collected on a monthly basis to supplement the quarterly Clean Rivers Program monitoring. During routine sampling measurements of DO, conductivity, pH, stream flow, and water temperature will be obtained *in situ*. These data will be logged on field data sheets, incorporated into a computer-based database maintained by TWRI.

Water samples collected will be transported to the ATL for nutrient analysis, bacteria enumeration and data logging. TWRI will deliver water samples to the ATL laboratory within designated holding times for respective analysis; ATL will use designated methods outlined in Tables A7.1, A7.2 and B2.1. Appropriate DQOs and QA/QC requirements for this analysis are also reported in Tables A7.1 and B2.1.

Ambient Water Reporting Limits (AWRLs)

The AWRL establishes the reporting specification at or below which data for a parameter must be reported to be compared with freshwater screening criteria. The AWRLs specified in Appendix A, Table A7.1 are the program-defined reporting specifications for each analyte and yield data acceptable for the TCEQ's water quality assessment. A full listing of AWRLs can be found at http://www.tceq.state.tx.us/assets/public/waterquality/crp/QA/awrlmaster.pdf.

The limit of quantitation (LOQ) is the minimum level, 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).

The following requirements must be met in order to report results to TCEQ for inclusion in SWQMIS:

- The laboratory's LOQ for each analyte must be at or below the AWRL as a matter of routine practice
- 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.

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 Tables A7.1 and A7.2.

Bias
Bias is a statistical measurement of correctness and includes multiple components of systematic error. A measurement is considered unbiased when the value reported does not differ from the true value. Bias is determined through the analysis of 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 Table A7.1.

Representativeness
Site selection, the appropriate sampling regime, the sampling of all pertinent media according to TCEQ SOP, V1, and use of only approved analytical methods will assure that the measurement data represents the conditions at the site. Routine data collected under CRP for water quality assessment are considered to be spatially and temporally representative of routine 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). For this project, monthly sampling will be conducted over a single calendar year. Although data may be collected during varying regimes of weather and flow, the data sets will not be biased toward unusual conditions of flow, runoff, or season. The goal for meeting total representation of the water body will be tempered by the potential funding for complete representativeness.

Comparability
Confidence in the comparability of routine data sets for this project and for water quality assessments is based on the commitment of project staff to use only approved sampling and analysis methods and QA/QC protocols in accordance with quality system requirements and as described in this QAPP and in TCEQ SOP, V1. 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 Section B10.

Completeness
The completeness of the data is basically a relationship of 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.

Limit of Quantitation

AWRLs (Tables A7.1 & A7.2) are used in this project as the *limit of quantitation specification*, so data collected under this QAPP can be compared against the Texas Surface Water Quality Standards. Laboratory *limits of quantitation* (Tables A7.1 & A7.2) must be at or below the AWRL for each applicable parameter.

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

Analytical Quantitation
To demonstrate the ability to recover at the limit of quantitation, the laboratory will analyze an LOQ check standard for each batch of samples run.

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

Table A7.1. Measurement Performance Specifications for Conventional Parameters in Water

Parameter	Units	Matrix	Method	Parameter Code	TCEQ AWRL	LOQ	LOQ Check Sample %Rec	Precision (RPD)	Bias %Rec of LCS	Lab	% Completeness
RESIDUE, TOTAL NONFILTERABLE (MG/L)	mg/L	Water	SM 2540D	00530	5	2.5	NA	NA	NA	ATL	90
NITROGEN, AMMONIA, TOTAL (MG/L AS N)	mg/L	Water	SM 4500-G	00610	0.1	0.1	70-130	20	80-120	ATL	90
NITRITE PLUS NITRATE, TOTAL ONE LAB DETERMINED VALUE (MG/L AS N)	mg/L	Water	SM 4500-NO3 F	00630	0.05	0.02	70-130	20	80-120	ATL	90
NITRITE NITROGEN, TOTAL (MG/L)	mg/L	Water	SM 4500-NO3 B	00615	0.05	0.05	70-130	20	80-120	ATL	90
NITRATE NITROGEN, TOTAL (MG/L)	mg/L	Water	SM4500	00620	0.05	0.05	70-130	20	80-120	ATL	90
PHOSPHORUS, TOTAL, WET METHOD (MG/L)	mg/L	Water	EPA 200.7	00665	0.06	0.02	70-130	20	80-120	ATL	90
ORTHOPHOSPHATE PHOSPHORUS, DISS (MG/L) FIELD FILTERED <15 MIN	mg/L	water	EPA 365.3	00671	0.04	0.04	70-130	20	80-120	ATL	90
ORTHOPHOSPHATE PHOSPHORUS, DISS (MG/L) FIELD FILTERED >15 MIN	mg/L	water	EPA 365.3	70507	0.04	0.04	70-130	20	80-120	ATL	90

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, or most recent version.

Table A7.2. Measurement Performance Specifications for Bacteriological Parameters in Water

Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**TCEQ AWRL**	**LOQ**	**LOQ Check Sample %Rec**	**Log Difference of Duplicates**	**Bias %Rec. of LCS**	**Lab**	**% Completeness**
E. COLI , COLILERT, IDEXX METHOD, MPN/100ML	MPN/100mL	Water	SM 9223B**	31699	1	1	NA	0.50*	NA	ATL	90

* 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:
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).

Table A7.3. Measurement Performance Specifications for Field Parameters

Parameter	Units	Matrix	Method	Parameter Code	AWRL	LOQ	LOQ Check Sample %Rec	Precision (RPD)	Bias %Rec of LCS	% Completeness
PH (STANDARD UNITS)	s.u.	water	EPA 150.1 and TCEQ SOP	00400	NA	NA	NA	NA	NA	90
OXYGEN, DISSOLVED	mg/L	water	SM4500 O-G and TCEQ SOP	00300	NA	NA	NA	NA	NA	90
SPECIFIC CONDUCTANCE, FIELD (US/CM @ 25C)	uS/cm	water	EPA 120.1 and TCEQ SOP	00094	NA	NA	NA	NA	NA	90
TEMPERATURE	°C	water	SM2500B and TCEQ SOP	00010	NA	NA	NA	NA	NA	90
FLOW STREAM, INSTANTANEOUS (CUBIC FEET PER SEC)	cfs	water	TCEQ SOP V1 or USGS 2005-5183	00061	NA	NA	NA	NA	NA	90
FLOW SEVERITY: 1=No Flow, 2=Low, 3=Normal, 4=Flood, 5=High, 6=Dry	NU	water	TCEQ SOP V1	01351	NA	NA	NA	NA	NA	90
STREAM FLOW ESTIMATE (CFS)	cfs	water	TCEQ SOP V1	74069	NA	NA	NA	NA	NA	90
FLOW MTH 1=GAGE 2=ELEC 3=MECH 4=WEIR/FLU 5=DOPPLER	NU	other	TCEQ SOP V1	89835	NA	NA	NA	NA	NA	90
SECCHI DEPTH	meters	water	TCEQ SOP V1	00078	NA	NA	NA	NA	NA	90
DAYS SINCE LAST SIGNIFICANT RAINFALL	days	NA	TCEQ SOP V1	72053	NA	NA	NA	NA	NA	90
DEPTH OF BOTTOM OF WATER BODY AT SAMPLE SITE	meters	water	TCEQ SOP V2	82903	NA	NA	NA	NA	NA	90
MAXIMUM POOL WIDTH[1]	meters	water	TCEQ SOP V1	89864	NA	NA	NA	NA	NA	90
MAXIMUM POOL DEPTH[1]	meters	water	TCEQ SOP V1	89865	NA	NA	NA	NA	NA	90
POOL LENGTH IN METERS[1]	meters	water	TCEQ SOP V1	89869	NA	NA	NA	NA	NA	90
PERCENTAGE THE POOL COVERS WITHIN A 500 METER REACH[1]	meters	water	TCEQ SOP V1	89870	NA	NA	NA	NA	NA	90

[1] Parameters for pools to be reported only if pooled conditions are sampled as outlined under the TCEQ Interim Guidance for Routine Surface Water Quality Monitoring During Extended Drought.

References:

United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998. (Note: The 21st edition may be cited if it becomes available.)
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).

Section A8: Special Training Requirements/Certification

Surface Water Quality Monitoring
Work conducted for this project is covered under and documented in this QAPP. Personnel conducting work associated with this project are deemed qualified to perform their work through educational credentials, specific job/task training, required demonstrations of competency, and internal and external assessments. Laboratories are NELAP-accredited as required. Records of educational credentials, training, demonstrations of competency, assessments, and corrective actions are retained by project management and are available for review.

Staff responsible for operating the field-use multi-parameter sondes and flow loggers will undergo training event by a qualified trainer (the equipment manufacturer, TCEQ SWQM personnel, an experienced field sampler, or the QA Officer). Training may also occur at set statewide training events, such as the annual SWQM Workshop.

Field personnel will receive training in proper sampling and field analysis. Before actual sampling or field analysis occurs, they will demonstrate to the QA officer (in the field), their ability to properly operate the field-use multi-parameter sondes, flow loggers and retrieve the samples. The QA officer will sign off each field staff in the training logbooks. Field personnel training is documented and retained in the personnel file, and will be available during a monitoring systems audit.

Section A9: Documentation and Records

SWQM- Hard copies of general maintenance records, all field data sheets, chain of custody (COC) forms, laboratory data entry sheets, calibration logs, and corrective action reports (CARs) will be archived for at least five years. In addition, TWRI will archive electronic forms of all project data for at least five years. All electronic data are backed up on an external networked server. A blank CAR form is presented in Appendix A, a blank COC form is presented in Appendix C, and blank field data reporting forms are presented in Appendix B.

Laboratory Documentation

Test/data reports from the laboratory must document the test results clearly and accurately. Routine data reports should be consistent with the *TNI Volume 1, Module 2, Section 5.10* (2009) and include the information necessary for the interpretation and validation of data. The requirements for reporting data and the procedures are provided.

Reports of results of analytical tests performed by the laboratory contain the following elements:

- Title of report
- Name and address of the laboratory
- Name and address of the client
- A clear identification of the sample(s) analyzed (unique identifiers)
- Identification of method used
- Identification of samples that did not meet QA requirements (by use of data qualifiers)
- Sample results
- Units of measurement
- Sample matrix
- Station information
- Date and time of collection
- LOQ and limit of detection (LOD) (formerly referred to as the reporting limit and the method detection limit, respectively), and qualification of results outside the working range (if applicable)
- Certification of NELAP compliance
- Clearly identified subcontract laboratory results (as applicable)
- A name and title of the person accepting responsibility for the report
- Project-specific QC results

Upon completion of all analyses, the ATL generates a Report Cover Page, a Laboratory Analysis Report, and a Quality Control Data Report. The chain of custody documentation, field data sheets, and subcontract laboratory reports (if applicable) are attached to form the final report. ATL reviews the report and submits it to the TWRI QAO for additional review. Upon final review by the TWRI QAO, the report is submitted to the TWRI PM for electronic submittal to SWQMIS.

Electronic Data

Data will be submitted to the TCEQ by TWRI in the event/result format specified in the most current version of the TCEQ DMRG for upload to SWQMIS. The DMRG can be found at https://www.tceq.texas.gov/waterquality/data-management/dmrg_index.html. The Data Review Checklist and Summary as contained in Appendix D of this document will be submitted with the data.

All reported Events will have a unique TagID (see DMRG). TagIDs used in this project will be seven-character alphanumeric codes with the structure of the two-letter Tag prefix followed by a five-digit number: for example – TX01234, TX01235, etc.

Submitting Entity, Collecting Entity, and Monitoring Type codes will reflect the project organization and monitoring type in accordance with the DMRG. The proper coding of Monitoring Type is essential to accurately capture any bias toward certain environmental condition (for example, high flow events).

Table A9.1. SWQMIS Data Entry Codes

Sample Description	Tag Prefix	Submitting Entity	Collecting Entity	Monitoring Type
Routine Monitoring, BMP Effectiveness	TX	TX	WR	RTBA

Combined Project Documentation

Quarterly progress reports disseminated to the individuals listed in section A3 will note activities conducted in connection with the water quality modeling project, items or areas identified as potential problems, and any variations or supplements to the QAPP.

CARs will be utilized when necessary (Appendix A). CARs will be maintained in an accessible location for reference at TWRI and will be disseminated to the individuals listed in section A3. CARs resulting in any changes or variations from the QAPP will be made known to pertinent project personnel and documented in updates or amendments to the QAPP.

All electronic data are backed up routinely. A blank CAR is presented in Appendix A and a blank COC form is presented in Appendix C.

The TSSWCB may elect to take possession of records at the conclusion of the specified retention period.

Table A9.2. Project Documents and Records

Document/Record	Location	Retention	Form
QAPP, amendments, and appendices	TWRI/SCSC	5 years	Electronic
QAPP distribution documentation	TWRI/SCSC	5 years	Paper/Electronic
Corrective Action Reports (CARs)	TWRI/SCSC	5 years	Paper/Electronic
Training Records	TWRI	5 years	Paper/Electronic
Field notebooks or field data sheets	TWRI	5 years	Paper/Electronic
Field equipment calibration/maintenance	TWRI	5 years	Paper/Electronic
Chain of custody records	TWRI/ATL	5 years	Paper/Electronic
Laboratory QA manuals	ATL	5 years	Paper/Electronic
Laboratory SOPs	ATL	5 years	Paper/Electronic
Laboratory procedures	ATL	5 years	Paper/Electronic
Instrument raw data files	ATL	5 years	Paper/Electronic
Instrument readings/printouts	ATL	5 years	Paper/Electronic
Laboratory data reports/results	TWRI/ATL	5 years	Paper/Electronic
Laboratory equipment maintenance logs	ATL	5 years	Paper/Electronic
Laboratory calibration records	ATL	5 years	Paper/Electronic

Data Transfer between Entities

Data transfer between entities occurs via electronic means. Specific format of the data transferred depends on the specific data and includes MS Office and PDF formats.

QAPP Revision and Amendments

Until the work described is completed, this QAPP shall be revised as necessary and reissued annually on the anniversary date, or revised and reissued within 120 days of significant changes, whichever is sooner. The last approved versions of QAPPs shall remain in effect until revised versions have been fully approved; the revision must be submitted to the TSSWCB for approval before the last approved version has expired. If the entire QAPP is current, valid, and accurately reflects the project goals and the organization's policy, the annual re-issuance may be done by a certification that the plan is current. This can be accomplished by submitting a cover letter stating the status of the QAPP and a copy of new, signed approval pages for the QAPP.

Amendments to the QAPP may be necessary to reflect changes in project organization, tasks, schedules, objectives and methods; address deficiencies and non-conformances; improve operational efficiency; and/or accommodate unique or unanticipated circumstances. Requests or amendments are directed from the SCSC Project Lead to the TSSWCB PM in writing. The changes are effective immediately upon approval by the TSSWCB PM and QAO, or their designees, and the USEPA Project Officer. Amendments to the QAPP and the reasons for the changes will be documented, and copies of the approved QAPP Expedited Amendment form will be distributed to all individuals on the QAPP distribution list by the TWRI QAO. Amendments shall be reviewed, approved, and incorporated into a revised QAPP during the annual revision process.

Section B1: Sampling Process Design (Experimental Design)

SWQM- The sample design was developed to provide critical data and information necessary for supporting the implementation of a watershed protections plan for Mill Creek. After utilizing historical knowledge of the watershed, conducting a reconnaissance of the watershed, and review of data results collected during the development of the WPP, project participants devised a sampling plan to ensure a representative water monitoring strategy within the watershed as related to implementation efforts. In this project, routine systematic monitoring is still designed to evaluate water quality during a variety of spatial, seasonal and meteorological conditions. The water quality data and evaluations of water quality conditions will be communicated to the public and the Mill Creek stakeholders to support adaptive management of the Mill Creek WPP and expand public knowledge of Mill Creek water quality data.

Routine data collected from Mill Creek, the East and West Forks of Mill Creek and two other tributaries will be used to support implementation of the approved watershed protection plan for Mill Creek. This data will also be submitted to the TCEQ for storage in SWQMIS. Achievable water quality objectives and priorities and the identification of water quality issues were used to develop the work plan, in accordance with available resources.

All data collection efforts will use monitoring procedures consistent with the TCEQ SWQM program and results will be provided to TCEQ, via TSSCWB, for inclusion in the statewide database maintained by TCEQ.

Site Descriptions
Monitoring will be conducted at five stations that have been historically monitored in the watershed. The stations are as follows:

Station 21584, East Fork Mill Creek at FM 159/Old Nelsonville Rd., is located 6.7 km West of Bellville. This monitoring station is located on Segment 1202K.

Station 21582, West Fork Mill Creek at Tiemann Rd., is located 7.7 km East of the City of Industry. This monitoring station is located on Segment 1202K.

Station 21580, Sandy Creek at Mill Creek Rd., is located 4.3 km West and 2.3 km South of Bellville. This monitoring station is located on Segment 1202K.

Station 21579, Mill Creek at FM 2429, is located 6 km South of Bellville and 3.2 km North of FM 949. This monitoring station is located on Segment 1202K.

Station 21577, Mill Creek at FM 331, is located 5.7 km South of the FM 529 and FM 331 intersection and the community of Burleigh. This monitoring station is located on Segment 1202K.

The monitoring stations are included in Table A6.2. The monitoring stations for this project will be added to the Coordinated Monitoring Schedule (CMS) located at cms.lcra.org. A detailed site location map is located in Section A6.

Section B2: Sampling Method Requirements / Data Collection Method

SWQM

Field Sampling Procedures

Field sampling for the procedures and parameters listed in this QAPP will be conducted according to procedures documented in the latest version of the TCEQ SOP, V1. Additional aspects outlined in Section B below reflect specific requirements for sampling. Field sampling activities are documented on field data reporting forms as presented in Appendix B.

All sample information will be logged into a field log. The following will be recorded for all water sampling:

- station ID
- location
- sampling time
- date
- water depth
- flow rate
- sample collector's name/signature

Detailed observational data are recorded including water appearance, weather, , unusual odors, specific sample information, days since last significant rainfall, and flow severity.

Typically, water samples will be collected directly from the stream (midway in the stream channel) into approved sample containers.

Certificates from sample container manufacturers are maintained by ATL.

All sample containers will be labeled with the following information:

- collection date
- collection time
- sample location
- and sampler's initials

Care will be exercised to avoid the surface microlayer of water, which may be enriched with bacteria and not representative of the water column. In cases where, for safety reasons, it is inadvisable to enter the stream bed, and boat access is not practical, staff will use a clean bucket and rope from a bridge to collect the samples from the stream. If a bucket is used, care will be taken to avoid contaminating the sample. Specifically, technicians must exert care to ensure that the bucket and rope do not come into contact with the bridge. The bucket must be thoroughly rinsed between stations. Buckets are also to be sanitized between sampling stations with a bleach- or isopropyl alcohol-soaked wipe. The first bucketful of water collected from a bridge is used to rinse the bucket. Rinse water is not returned to the stream, but is instead disposed of away from the sampling site to ensure that the collected sample will not be affected by the bleach or alcohol residual. Samples are collected from subsequent buckets of water. This type of sampling will be noted in the field records.

Water temperature, pH, specific conductivity, specific conductance, and DO will be measured and recorded *in situ* with a multiprobe whenever samples are collected. Flow is measured with

an electronic flow meter as described in the TCEQ SOP, V1 or in USGS Quality Assurance Plan for Discharge Measurements Using Acoustic Doppler Current Profilers (USGS 2005-5183). All field measurements will be conducted in accordance with the methods listed in Table B.4-1. All samples will be transported in an iced container to the laboratory for analysis.

Table B2.1. Storage, Preservation and Handling Requirements

Parameter	Matrix	Container	Preservation	Sample Volume (mL)	Holding Time
TSS	Water	Plastic	<6°C (but not frozen)	1000	7 days
Ammonia-N	Water	Plastic	pH<2 with H_2SO_4, <6°C (but not frozen)	500	28 days
Nitrate+Nitrite-N	Water	Plastic	pH<2 with H_2SO_4, <6°C (but not frozen)	500	28 days
Nitrate-N	Water	Plastic	<6°C (but not frozen)	500	48 hours
Nitrite-N					48 hours
Phosphorus, Total	Water	Plastic	pH<2 with H_2SO_4, <6°C (but not frozen)	500	28 days
Orthophosphate Phosphorus	water	Plastic	Cool to 4°C	250 mL	48 hours
E. coli *	Water	SPS	<6°C (but not frozen), sodium thiosulfate	250	8 hours

**E. coli* samples should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 8 hours, the holding time may be extended and samples must be processed as soon as possible and within 30 hours.

Sample Containers

The preferred bacteriological sample containers are the 120 and 290 mL bottles from QEC or IDEXX (or equivalent). The bottles contain sufficient sodium thiosulfate to remove 10 mg/L or 15 mg/L total chlorine, respectively. ATL will provide sealed, sterile glass and/or plastic bottles for bacteria samples.

Sample containers used for conventional parameters are purchased pre-cleaned and are disposable. Sample containers are either High Density Polyethylene (HDPE) or Low Density Polyethylene (LDPE). Certificates from sample container manufacturers are maintained by the ATL.

Processes to Prevent Contamination

The most recent version of the TCEQ SOP, V1 outlines the necessary steps to prevent contamination of samples. These include: direct collection into sample containers, when possible. Field QC samples as discussed in Section B5 are collected to verify that contamination has not occurred.

Failures in Sampling Methods Requirements and/or Deviations from Sample Design and Corrective Action

Examples of failures in sampling methods and/or deviations from sample design requirements include but are not limited to such things as sample container problems, sample site considerations, etc. Failures or deviations from the QAPP are documented on the field data reporting form and reported to the TWRI. The project managers in consultation will determine

if the deviation from the QAPP compromises the validity of the resulting data. The project managers, in consultation with the SCSC, TWRI and TSSWCB PM and QAO, will decide to accept or reject data associated with the sampling event, based on best professional judgment. The resolution of the situation will be reported to the TSSWCB in the quarterly progress report (QPR).

Section B3: Sample Handling and Custody Requirements

SWQM

Chain-of-Custody (COC)

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

A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. The COC form is a record that documents the possession of the samples from the time of collection to receipt in the laboratory. The list of items below is included on the COC form (See Appendix C for sample form).

1. Date and time of sample collection, shipping and receiving
2. Site identification
3. Sample matrix
4. Number of containers
5. Preservative used
6. Analyses required
7. Name of collector
8. Custody transfer signatures and dates and time of transfer

Sample Labeling

Samples will be labeled on the container with an indelible, waterproof marker. Label information will include site identification, date, sampler's initials, and time of sampling. The COC form will accompany all sets of sample containers.

Sample Handling

Field data sheets (Appendix B) are supplied to all field personnel prior to initiation of collection procedures. The field data sheets have spaces dedicated to recording of all pertinent field observations and water quality parameters. The field staff has the prime responsibility to insure that all pertinent information is recorded correctly and in the proper units.

Upon collection, sealing of the sample and following proper labeling, water samples are placed in an insulated cooler on ice and transported to the designated lab along with appropriate COCs within prescribed holding times. Routine samples will be delivered to ATL for processing. Once at the lab, samples and COCs are transferred to lab staff, are logged into the lab and analysis/bench sheets specific to the respective laboratory are established for each sample. Samples are placed in a refrigerated cooler dedicated to sample storage until sample processing begins. The LM has the responsibility to ensure that holding times are met with water samples. The holding time is documented on the COC.

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 COC form is used to document sample handling during transfer from the field to the laboratory and among contractors. The following information concerning the sample is recorded on the COC form (See Appendix C):

- 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 Tracking Procedure Deficiencies and Corrective Action

All failures associated with chain-of-custody procedures as described in this QAPP are immediately reported to the TWRI PM. 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 TWRI PM, in consultation with the TWRI QAO, 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 TSSWCB PM in the project progress report. CARs will be prepared by the TWRI QAO and submitted to the TSSWCB PM along with project progress reports.

Section B4: Analytical Methods

SWQM- The analytical methods are listed in Tables A7.1, A7.2, and A7.3 of Section A7. Laboratories must be accredited in accordance with NELAP requirements for the matrix, method, parameter combinations listed in Tables A7.1, A7.2, and A7.3 of this QAPP. Procedures for laboratory analysis will be in accordance with the most recently published or online edition of *Standard Methods for the Examination of Water and Wastewater*, the latest version of the TCEQ SOP, V1 or other reliable procedures acceptable to TCEQ.

Laboratories that produce analytical data under this QAPP must be NELAP accredited. Copies of laboratory quality manuals (QMs) and SOPs are available for review by the TCEQ.

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

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 ATL LM, who will make the determination and notify the TWRI QAO. If the analytical system failure may compromise the sample results, the resulting data will not be reported to the TCEQ SWQMIS database. The nature and disposition of the problem is reported on the data report. The TWRI PM/QAO will include this information in the CAR and submit it with the QPR, which is sent to the TSSWCB PM.

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

The TCEQ has determined that analyses associated with the qualifier codes (e.g. "holding time exceedance", "sample received unpreserved", "estimated value", etc.) may have unacceptable measurement uncertainty associated with them. This will immediately disqualify analyses from submittal to 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 must have an appropriate data qualifier assigned which can be found in the most recent version of the SWQM DMRG.

Failures in Measurement Systems and Corrective Actions

Failures in field and laboratory measurement systems involve, but are not limited to such things as instrument malfunctions, failures in calibration, blank contamination, QC 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 ATL LM, who will make the determination in coordination with the TWRI PM/QAO. If the analytical system failure may compromise the sample results, the resulting data will not be reported to the TSSWCB as part of this project. The nature and disposition of the problem is reported on the data report. The TWRI PM/QAO will include this information in the CAR and submit with the QPR which is sent to the TSSWCB PM.

Section B5: Quality Control Requirements

SWQM
Sampling Quality Control Requirements and Acceptability Criteria

Samples are collected in accordance with the TCEQ SOP, V1 for the parameters listed. These procedures were revised in 2014 to eliminate the requirement for a Field Split.

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 25 hours. An **analytical batch** is composed of prepared environmental samples (extract, digestate. 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. 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 QMs. The minimum requirements that all participants abide by are stated below.

Limit of Quantitation (LOQ)
The laboratory will analyze a calibration standard (if applicable) at the LOQ listed in Table A7.1 and A7.2 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 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 near

the LOQ listed in Table A7.1 for each analyte for each analytical batch of 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.

The LOQ check sample is carried through the complete preparation and analytical process. LOQ Check Samples are run 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 Standard analyses as specified in Table A7.1.

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 mid-point 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. LCSs are run 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 Table A7.1.

Laboratory Duplicates
A laboratory duplicate is prepared by taking aliquots of a sample from the same container under laboratory conditions and processed and analyzed independently. For most parameters except bacteria, precision is evaluated using the relative percent difference (RPD) between duplicate LCS 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:

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

For bacteriological parameters, precision is evaluated using the results from laboratory duplicates. Bacteriological duplicates are collected on a 10% frequency (or once per sampling run, whichever is more frequent). These duplicates will be collected in sufficient volume (200 mL or more) for analysis of the sample and its laboratory duplicate from the same container.

The base-10 logarithms of the result from the original sample and the result from its duplicate will be calculated. The absolute value of the difference between the two logarithms will be calculated, and that difference will be compared to the precision criterion in Table A7.1.

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

The precision criterion in Table A7.1 for bacteriological duplicates applies only to samples with concentrations > 10 MPN/100mL. Field splits will not be collected for bacteriological analyses.

Matrix Spike (MS)
Matrix spikes are prepared by adding a known mass 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. 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 unspiked 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 same acceptance criteria established for the associated LCS recoveries, rather than the matrix spike recoveries published in the mandated

test method. The EPA 1993 methods (i.e. ammonia-nitrogen, ion chromatography, TKN) that establish matrix spike recovery acceptance criteria are based on recoveries from drinking water that has very low interferences and variability. If the matrix spike results are outside laboratory-established criteria, there will be a review of all other associated quality control data in that batch. If all of quality control data in the associated batch passes, it will be the decision of the TWRI QAO or TWRI PM to report the data for the analyte that failed in the parent sample to TCEQ or to determine that the result from the parent sample associated with that failed matrix spike is considered to have excessive analytical variability and does not meet project QC requirements.

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 blanks are performed at a rate of once per preparation batch. 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 or data qualifying codes). In all cases the corrective action must be documented.

The method blank shall be analyzed at a minimum of once per preparation batch. In those instances for which no separate preparation method is used (example: volatiles in water) 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 Requirement Deficiencies and Corrective Actions

Sampling QC excursions are evaluated by the TWRI PM, in consultation with the TWRI QAO. In that differences in sample results are used to assess the entire sampling process, including environmental variability, the rejection of results based on pre-determined limits may not be necessary for project purposes. Therefore, the professional judgment of the TWRI PM and QAO will be relied upon in evaluating results.

Field blanks for trace elements and trace organics are not required for this project, as analyses for trace elements and trace organics are not required for this project.

Equipment blanks for metals analysis are not required for this project, as metals analysis is not included in the scope of the project.

The requirements for Field Split analysis were removed from the SWQM Procedures in 2014.

Laboratory measurement quality control failures are evaluated by the laboratory staff. The disposition of such failures and the nature and disposition of the problem is reported to the ATL QAO. The Laboratory QAO will discuss with the TWRI PM. If applicable, the TWRI PM will include this information in the CAR and submit with the Progress Report which is sent to the TSSWCB PM.

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

Failures in Quality Control and Corrective Action

Notations of blank contamination will be noted in QPRs and the final report. Corrective action will involve identification of the possible cause (where possible) of the contamination failure. Any failure that has potential to compromise data validity will invalidate data, and the sampling event should be repeated. The resolution of the situation will be discussed with pertinent project PMs and QAOs. The TWRI PM and QAO will include this information in the CAR and submit with the Progress Report which is sent to the TSSWCB PM.

Section B6: Equipment Testing, Inspection, & Maintenance Requirements

SWQM
All sampling equipment testing and maintenance requirements are detailed in the most recent version of the TCEQ SOP, V1. 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).

Section B7: Instrument Calibration and Frequency

SWQM- In-stream field equipment calibration requirements are contained in the most recent version of the TCEQ SOP, V1 or manufacturers manuals. Equipment will be tested, maintained, inspected, and calibrated according to these procedures. Post calibration error limits and the disposition resulting from error are adhered to. Data not meeting post-error limit requirements invalidates associated data collected subsequent to the pre-calibration and are not submitted to the TCEQ.

Detailed laboratory calibrations are contained within the laboratory QM(s), SOPs, and manufacturers manuals as appropriate and will be tested, maintained, inspected, and calibrated according to these procedures.

Section B8: Inspection/Acceptance Requirements for Supplies and Consumables

SWQM- New batches of supplies are tested before use to verify that they function properly and are not contaminated. The laboratory QM provides additional details on acceptance requirements for laboratory supplies and consumables.

Section B9: Data Acquisition Requirements (Non-direct Measurements)

SWQM- Water quality data available in TCEQ's SWQMIS will be used as historical references for instream water quality and conditions. US Geologic Survey (USGS) flow data available in the watershed may also be useful for evaluating instream conditions. These data will support the development of trend analysis. Rainfall data will be acquired from multiple sources to report parameter code 72053 (Days Since Precipitation Event) with each set of water quality data submitted to TCEQ. H-GAC will use the internet source that best addresses the rainfall events occurring closest to but upstream of or within the drainage area affecting their various monitoring stations. Historical rainfall data is accessible on these web sites to determine the "number of days since" requirement for reporting the parameter code 72053. These sites include:

- National Oceanic and Atmospheric Administration's (NOAA's) National Climatic Data Center (NCDC) (http://www.ncdc.noaa.gov/). The NCDC is responsible for preserving, monitoring, assessing, and providing public access to the nation's climate and historical weather data and information
- Weather Underground (http://www.wunderground.com/) which collects and maintains precipitation data from numerous sources in the selected area

Table B9.1. Monitoring Data Sources

Data Type	Monitoring Project/Program	Collecting Entity	Dates of Collection	QA Information	Data Use(s)
Monitoring Data	BRA Clean Rivers Program	BRA	9/1/1990 - Current at stations historically monitored by BRA in Table A6.2	BRA-CRP QAPP; SWQMIS database	summary statistics, trend analysis
Monitoring Data	TCEQ SWQM Program	TCEQ	9/1/1990 - Current at stations historically monitored by TCEQ in Table A6.2	TCEQ SWQM QAPP; SWQMIS database	summary statistics, trend analysis
Flow Data	United States Geological Survey (USGS) flow data	USGS	USGS Gage 08111700; Day prior to sampling trips	USGS QAPP; USGS database	Flow measurements; information regarding sampling safety
Precipitation Data	National Weather Service (NWS)	NWS	Most up-to-date precipitation data will be downloaded from the NWS website	NWS Website	Days since last precipitation
	WeatherUnderground	Personal	Most up-to-date precipitation data will be accessed online	WeatherUnderground website	Days since last precipitation

Any non-direct measurements will comply with all requirements under this QAPP. Sampling conducted by the TCEQ, the USGS and Texas Clean Rivers Program partners is not covered

under this QAPP and will not be reported to the TSSWCB PM by the TWRI. However, data collected by the above organizations that meet the data quality objectives of this project will be useful in satisfying the data and informational needs of the project. The collection and qualification of the TCEQ and USGS data are addressed in the TCEQ Surface Water Quality Monitoring QAPP. The collection and qualification of the Texas CRP data are addressed in the Texas Clean Rivers Program QAPPs. Historic water quality data collected through TCEQ's CRP program and under its approved QAPP will be utilized in this project. Parameters utilized will include instantaneous stream flow, temperature, pH, specific conductivity, DO, nitrate, nitrite, nitrate+nitrite (alternative for nitrate, nitrite), ammonia, sulfate, total phosphorus, chloride, total suspended solids, and *E. coli* as available. Potential sources where data will be acquired from are included in Table B9.1. No limitations will be placed on these data as they have been vetted by the TCEQ SWQM Data Management and Assessment Team and were collected under a TCEQ approved QAPP.

Only data collected directly under this QAPP will be submitted to the TCEQ for storage in SWQMIS. This project will not submit any acquired or non-direct measurement data to SWQMIS that has been or is going to be collected under another QAPP. All data collected under this QAPP and any acquired or non-direct measurements will comply with all requirements/guidance of the project.

Section B10: Data Management

Data Management Process

Samples are collected by field staff and delivered to the laboratory for analyses as described in Sections B1 and B2. Sampling information (e.g. site location, date, time, sampling depth, etc.) is used to generate a unique sampling event in alphanumeric format by TWRI into a Microsoft Access database. Measurement results from the field data sheets are manually entered by field personnel into the TWRI database for their corresponding event. Data generated by the lab are entered on to the lab data sheets which are then transferred to TWRI. TWRI staff will enter these lab data into their database for the corresponding event. Customized data entry forms facilitate accurate data entry. Following data verification and validation by the TWRI Data Manager, the data are exported from the TWRI database into the pipe delimited Event/Result format required for submission to TCEQ's SWQMIS (as described in the SWQM DMRG December 2016 or later version). Once TCEQ approval of the data is obtained, the data are loaded into SWQMIS by TCEQ data managers.

Personnel

Dr. Lucas Gregory is the TWRI Project Lead and QA Officer and is responsible for overseeing and supervising the project as well as the rest of the project team at TWRI. He is also responsible for ensuring that project data are scientifically valid, legally defensible, of known precision, accuracy and integrity, meet the data quality objectives of the project, and are reportable to TSSWCB.

Mr. Ed Rhodes is the TWRI PM and will provide overall project management for TWRI and is responsible for ensuring that the data are managed according to the data management plan and QAPP.

Ms. Stephanie deVilleneuve is the TWRI Field Supervisor/Data Manager and is responsible for ensuring the use of appropriate data collection techniques in the field, its proper documentation on field data sheets and the timely delivery of samples to the appropriate lab. She is also responsible for data storage, processing and delivery to TSSWCB.

Hardware and Software Requirements

Hardware configurations used at TWRI are sufficient to run Microsoft SQL database or newer under the Windows 10 or newer operating systems in a networked environment. Information Technology (IT) staff are responsible for assuring hardware configurations meet the requirements for running current and future data management/database software as well as providing technical support. Software development and database administration are also the responsibility of the IT department.

Data Dictionary - Terminology and field descriptions are included in the most recent version of the *SWQM Data Management Reference Guide*. For the purposes of verifying which entity codes are included in this QAPP, the following will be used when submitting data under this QAPP:

Tag Prefix: TX - Texas State Soil and Water Conservation Board

Submitting Entity: TX - Texas State Soil and Water Conservation Board

Collecting Entity: WR- Texas Water Resources Institute

Data Errors and Loss

To prevent loss of data and minimize errors, all data generated under this QAPP are verified against the appropriate quality assurance checks as defined in the QAPP, including but not limited to chain of custody procedures, field sampling documentation, laboratory analysis results, and quality control data.

Automated and manual Data Reviews are performed prior to data transmittal to TCEQ. Examples of checks that are used to review for data errors and data loss include:

- Parameter codes are contained in the QAPP
- Sites are in the QAPP Coordinated Monitoring Schedule
- Transcription or input errors
- Count of reported analytes (ex: # pH = # DO = # Temperature)
- Significant figures
- Values are at or above the LOQs
- Values are below the highest standard of the calibration curve, and appropriate dilutions (if necessary) have been used
- Check for outliers
- Use of correct reporting units
- Flows should have a flow method associated with the data
- If flow severity = 1, then flow = 0
- If flow severity = 6, then no value is reported for flow
- Depth of surface sample is reported
- Data not meeting post-cal requirements
- Post-calibration error limits for multiprobe instrumentation (Table 8.3 in SWQM PM)

Data exceeding holding times, improperly preserved samples, and estimated concentrations have unacceptable measurement uncertainty associated with them. This uncertainty will immediately disqualify analyses for submittal to SWQMIS. Therefore, data with these types of issues are not reported to the TCEQ and will be noted in the Data Summary Report.

All data is uploaded to the SWQMIS User Acceptance Test environment, and a validator report is generated. The validator report is reviewed and any issues are corrected prior to the data being transmitted to the TCEQ.

Archives/Data Retention
Complete original data sets are archived on permanent paper and electronic media and retained on-site by TWRI for a retention period specified in section A9.

Record-keeping and Data Storage
TWRI record keeping and document control procedures are contained in the water quality sampling and SOPs and this QAPP. Original field and laboratory data sheets are stored in the TWRI offices in accordance with the record-retention schedule in Section A9. Electronic copies of the data sheets are also maintained on network servers, external drives and personal computers. The database backed up following each data entry event on network servers, external drives and personal computers. If necessary, disaster recovery will be accomplished by information resources staff using the backup database.

Data Verification/Validation
The control mechanisms for detecting and correcting errors and for preventing loss of data during data reduction, data reporting, and data entry are contained in Sections D1, D2, and D3.

Forms and Checklists
See Appendix D for the Data Review Checklist and Summary.
See Appendix B for the Field Data Reporting Form.
See Appendix C for the Chain-of-Custody Form

Data Dissemination
At the conclusion of the project, the TWRI Project Leader will provide a copy of the complete project electronic spreadsheet via recordable media to the SCSC PM. The TSSWCB may elect to take possession of all project records.

Section C1: Assessments and Response Actions

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

Table C1.1. Assessments and Response Actions

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	TWRI	Monitor project status and records to ensure requirements are being fulfilled. Monitoring & review performance & data quality	Report to TSSWCB in QPR.
Equipment testing	As needed	ATL/TWRI	Pass/Fail equipment testing	Repair or replace
Data completeness	As needed	ATL/TWRI	Assess samples analyzed vs. planned analysis	Reanalyze or amend objectives
Laboratory Inspections	TBD by TSSWCB	TSSWCB	Analytical and QC procedures in the laboratory	45 days to respond to TSSWCB with corrective actions
Technical systems audit	As needed	TSSWCB	Assess compliance with QAPP; review facility and data management as they relate to the project	45 days to respond to TSSWCB with corrective actions
Monitoring Systems Audit	Once per life of project	TSSWCB	Assess compliance with QAPP; review field sampling and data management as they relate to the project	45 days to respond to TSSWCB with corrective actions

In-house review of data quality and staff performance to assure that work is being performed according to standards will be conducted by all entities. If review show that the work is not being performed according to standards, immediate corrective action will be implemented. CARs will be submitted to TSSWCB and documented in the project QPRs.

The TSSWCB QAO (or designee) may conduct an audit of the field or technical systems activities for this project as needed. Each entity will have the responsibility for initiating and implementing response actions associated with findings identified during the on-site audit. Once the response actions have been implemented, the TSSWCB QAO (or designee) may perform a follow-up audit to verify and document that the response actions were implemented effectively. Records of audit findings and corrective actions are maintained by the TSSWCB PM and TWRI QAO. Corrective action documentation will be submitted to the TSSWCB PM with the progress report. If audit findings and corrective actions cannot be resolved, then the authority and responsibility for terminating work is specified in agreements or contracts between participating organizations.

Corrective Action Process for Deficiencies

Deficiencies are any deviation from the QAPP, TCEQ SOP, V1, DMRG, or lab QMs or SOPs. Deficiencies may invalidate resulting data and may require corrective action. Corrective action may include for samples to be discarded and re-collected. Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff. It is the responsibility of each respective entity's Project Leader or PM, in consultation with the TWRI 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 TSSWCB PM both verbally and in writing in the project progress reports and by completion of a CAR. All deficiencies identified by each entity will trigger a corrective action plan.

Corrective Action

Corrective Action Reports (CARs) 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
- Evaluate the need for Corrective Action
- Use 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

The status of CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately.

The Project Lead or PM or each respective entity is responsible for implementing and tracking corrective actions. Records of audit findings and corrective actions are maintained by the Project Lead or PM of each respective entity. Audit reports and corrective action documentation will be submitted to the TSSWCB with the Progress Report.

Section C2: Reports to Management

Information for quarterly progress reports developed by the SCSC PM will note activities conducted in connection with the project, items or areas identified as potential problems, and any variations or supplements to the QAPP. CAR forms will be utilized when necessary (Appendix A). CARs will be maintained in an accessible location for reference by all project personnel and at TWRI and disseminated to individuals listed in section A3. CARs that result in any changes or variations from the QAPP will be made known to pertinent project personnel and documented in an update or amendment to the QAPP.

If the procedures and guidelines established in this QAPP are not successful, corrective action is required to ensure that conditions adverse to quality data are identified promptly and corrected as soon as possible. Corrective actions include identification of root causes of problems and successful correction of identified problem. CARs will be filled out to document the problems and the remedial action taken. Copies of CARs will be included with the project's quarterly reports. These reports will discuss any problems encountered and solutions made. These reports are the responsibility of the QAO and the PM and will be disseminated to individuals listed in section A3.

The final report for this project will be a technical report detailing the current status of water quality as determined by monitoring activities through this project in the Mill Creek watershed.

Section D1: Data Review, Validation and Verification

For the purposes of this document, data verification is a systematic process for evaluating performance and compliance of a set of data to ascertain its completeness, correctness, and consistency using the methods and criteria defined in the QAPP. Validation means those processes taken independently of the data-generation processes to evaluate the technical usability of the verified data with respect to the planned objectives or intention of the project. Additionally, validation can provide a level of overall confidence in the reporting of the data based on the methods used.

All data obtained from field and laboratory measurements will be reviewed and verified for conformance to project requirements, and then validated against the data quality objectives which are listed in Section A7. Only those data which are supported by appropriate quality control data and meet the measurement performance specification defined for this project will be considered acceptable and submitted to the TCEQ for entry into SWQMIS.

The procedures for verification and validation of data are described in Section D2, below. The ATL LM and ATL QAO are responsible for ensuring that laboratory data are scientifically valid, defensible, of acceptable precision and bias, and reviewed for integrity. The TWRI DM will be responsible for ensuring that all data are properly reviewed and verified, and submitted in the required format to be loaded into SWQMIS. The ATL QAO is responsible for validating a minimum of 10% of the data produced in each task. Finally, the ATL QAO is responsible for validating that all data to be reported meet the objectives of the project and are suitable for reporting to TCEQ.

Section D2: Validation Methods

SWQM

Field and laboratory data will be reviewed, verified and validated to ensure conformance with project specifications and adherence to end use as described in Section A7 of this document.

Data review, verification, and validation will be performed using self-assessments and peer and management review as appropriate to the project task. The data review tasks to be performed by field and laboratory staffs are listed in the first column of Table D2.1. Potential errors are identified by examination of documentation and by manual or computer-assisted examination of corollary or unreasonable data. If a question arises or an error is identified, the manager of the task responsible for generating the data is contacted to resolve the issue. Issues which can be corrected are corrected and documented. If an issue cannot be corrected, the task manager consults with 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 TSSWCB for submission to TCEQ for storage in SWQMIS. Field and laboratory reviews, verifications, and validations are documented.

Table D2.1. Data Review Tasks

Data to be Verified	Field	Lab	Data Manager
Sample documentation complete; samples labeled, sites identified	Y	Y	
Field QC samples collected for all analytes as prescribed in the TCEQ *SWQM Procedures Manual*	Y		
Standards and reagents traceable	Y	Y	
Chain of custody complete/acceptable	Y	Y	
NELAP Accreditation is current		Y	
Sample preservation and handling acceptable	Y	Y	
Holding times not exceeded	Y	Y	
Collection, preparation, and analysis consistent with SOPs and QAPP	Y	Y	Y
Field documentation (e.g., biological, stream habitat) complete	Y		Y
Instrument calibration data complete	Y	Y	Y
Bacteriological records complete	Y	Y	
QC samples analyzed at required frequency	Y	Y	Y
QC results meet performance and program specifications	Y	Y	Y
Analytical sensitivity (LOQ/AWRL) consistent with QAPP	Y	Y	Y
Results, calculations, transcriptions checked	Y	Y	Y
Laboratory bench-level review performed		Y	
All laboratory samples analyzed for all scheduled parameters	Y	Y	Y
Corollary data agree	Y	Y	Y
Nonconforming activities documented	Y	Y	Y
Outliers confirmed and documented; reasonableness check performed		Y	Y
Time based on 24-hour clock			Y
Absence of transcription error confirmed	Y	Y	Y
Absence of electronic errors confirmed	Y	Y	Y
Sampling and analytical data gaps checked	Y	Y	Y
Field instrument pre and post calibration results within limits			Y
10% of data manually reviewed	Y	Y	Y

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 TWRI DM 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 D) 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 TSSWCB 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 TSSWCB QAO. 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 TWRI PM validates that the data meet the data quality objectives of the project and are suitable for reporting to TSSWCB and subsequently TCEQ.

If any requirements or specifications of the QAPP 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 TWRI DM with the data. This information is communicated to the TSSWCB by TWRI in the Data Summary (See Appendix D).

Section D3: Reconciliation with User Requirements

SWQM

Data produced in this project, and data collected by other organizations (i.e., TCEQ, etc.), will be analyzed and reconciled with project data quality requirements. Data meeting project requirements will be used in the implementation of the Mill Creek WPP and will be submitted to TCEQ SWQMIS for use as appropriate in the development of the biennial Texas Integrated Report for Clean Water Act Sections 305(b) and for WPP development, water quality standards development, and permit decisions. Data which do not meet requirements will not be submitted to SWQMIS nor will be considered appropriate for any of the uses noted above.

References

TCEQ. 2016. Surface Water Quality Data Management Reference Guide. Water Quality Planning Division, Monitoring & Assessment Section, Data Management & Analysis Team. https://www.tceq.texas.gov/assets/public/waterquality/dma/dmrg/dmrg_complete.pdf.

TCEQ. 2015. 2014 Guidance for Assessing and Reporting Surface Water Quality in Texas (June 2015): In Compliance with Sections 305(b) and 303(d) of the Federal Clean Water Act.

TCEQ. 2012. Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods. TCEQ, RG-415 Revised August 2012.

TCEQ. 2014. Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data. TCEQ, RG-416. Revised May 2014.

United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes. Manual #EPA-600/4-79-020

USGS 2005. Quality-Assurance Plan for Discharge Measurements Using Acoustic Doppler Current Profilers. Special Investigations Report 2005-5183.

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Appendix A: Corrective Action Report

SOP-QA-001
CAR #:_____

Date:_____ Area/Location:_____

Reported by:_____ Activity:_____

State the nature of the problem, nonconformance or out-of-control situation:
_____
_____
_____
_____

Possible causes:
_____
_____
_____

Recommended Corrective Actions:
_____
_____
_____

CAR routed to:_____
Received by:_____

Corrective Actions taken:
_____
_____
_____
_____

Has problem been corrected?: YES NO

Immediate Supervisor:_____

Program Manager:_____

TWRI Quality Assurance Officer:_____

TSSWCB Quality Assurance Officer:_____

Appendix B: Field Data Reporting Form

Mill Creek Water Quality Monitoring Field Data Sheet

Texas Water Resources Institute * 578 John Kimbrough Blvd., 2260 TAMU * College Station, TX 77843-2260 * 979-845-1851

Monitor's Name: Station ID #:

Sample Location: Sample Type: Routine

Date: (M M D D Y Y) Sample Time (24 hr): (H H M M) Sample Depth (Meters): Not Total Depth

Field Measurements

Code	Data	Descriptor
00400		pH (Standard Units)
00010		Water Temperature (Celsius)
00300		Dissolved Oxygen (mg/L)
00094		Specific Conductance (micro S/cm)
00061		Instantaneous Stream Flow (cfs)
74069		Streamflow Estimate (cfs) IF NEEDED ONLY
00078		Secchi Depth (meters)
82903		Depth to water bottom at sample site (Meters)

Field Observations Cont.

Code	Data	Descriptor	
20424		Water Clarity	(1-excellent, 2-good 3-fair, 4-poor)
89969		Water Color	(1-brown, 2-red, 3-green 4-black, 5-clear, 6-other)
89971		Water Odor	(1-sewer, 2-oil/chem., 3-rotten egg, 4-musky, 5-fishy, 6-none, 7-other)

Field Observations

01351		Flow Severity (1-no flow, 2-low, 3-normal, 4-flood, 5-high, 6-dry)
89835		Flow Measurement Method (1-gage, 2-electric, 3-mechanical, 4-wier/flume, 5-doppler)
89966		Present Weather (1-clear, 2-prt. Cloudy, 3-cloudy, 4-rain, 5-other)
89968		Water Surface (1-calm, 2-ripples, 3-waves, 4-white caps)
89965		Wind Intensity (1-calm, 2-slight, 3-moderate, 4-strong)
72053		Days since last significant rainfall

If sampling from an perennial pool (isolated pool)

89864		Maximum pool width (Meters)
89865		Maximum pool depth (Meters)
89869		Pool length (Meters)
89870		Percentage the pool covers within a 500 meter reach

Parameters Collected (Complete Once Lab Report is Received):

E. coli (IDEXX) 9223B	31699	Total Kjeldahl Nitrogen	00625
TSS, Nonfilterable Residue	00530	Nitrate + Nitrite Nitrogen	00630
Ammonia Nitrogen	00610	Total Phosphorus	00665
Nitrite Nitrogen	00615	OrthoP Field Filter<15 min	00671
Nitrate Nitrigen	00620	OrthoP Field Filter>15 min	70507

Other Observations:

Comments:

TAG ID #

I CERTIFY THAT ALL PROCEDURES HAVE BEEN FOLLOWED AND THIS INFORMATION IS ACCURATE TO THE BEST OF MY ABILITY.

CERTIFIED MONITOR'S SIGNATURE DATE DATA MANAGER'S SIGNATURE DATE

Appendix C: Chain of Custody Record

AQUA-TECH LABORATORIES, INC.

Bryan Lab: ☐
635 Phil Gramm Blvd.
Bryan, Texas 77807
Phone: (979) 778-3707
Fax: (979) 778-3193

Austin Lab: ☐
7500 W. Hwy. 71, Suite 105
Austin, Texas 78735
Phone: (512) 301-9559
Email: corp@aqua-techlabs.com

C-O-C #

NELAP ACCREDITED TNI LABORATORY

Chain-of-Custody & Analysis Request

V-0023 R01

Client / Project Name:

* DEFINITIONS: **DW** - Drinking Water **NP** - Non-Potable Water **S** – Solid
CM – Custody Maintained **CTU** – Custody Transfer Unbroken

LAB USE ONLY (initials _____)

Field Sample ID	Start Date / Time	End Date / Time	Composite Type	Sample Matrix*	Container Volume	Container Type	Sample Pres. +	Analysis Requested	Cooler ID	Bottle pH	Sub-contract	Lab ID #

By relinquishing the above samples to Aqua-Tech, the client agrees to the following terms. Samples will be analyzed by a method that is within Aqua-Tech Laboratories' NELAC fields of accreditation. Analytes requiring a certified method that is not within Aqua-Tech's fields of accreditation will be subcontracted to a NELAC certified lab that is certified for that method. Clients will be notified of the subcontract lab's details. Other analytes not requiring accreditation will be analyzed by a compendial method. If a specific method is required, the client will note the method in the "Analysis Requested" column. The client approves all method modifications documented by Aqua-Tech or the subcontract lab. A current list of Aqua-Tech's NELAC fields of accreditation and other methods are available on request.

Relinquished by: (print & sign) ☐Client ☐ATL Field ☐Sampler	Date	Time	Sample Info "X" all that apply	Rec'd by: (print & sign) ☐Client ☐ATL Field	Date	Time	Sample Info "X" all that apply
			☐ Iced ☐ Chilled/Refrig ☐ Cust. Sealed ☐ Not Chilled				☐ Rec'd Chilled ☐ Cond Good ☐ CTU * ☐ Iced in Transit
Relinquished by: (print & sign) ☐Client ☐ATL Field	Date	Time	☐ Iced ☐ Chilled/Refrig ☐ CM * ☐ Not Chilled	Rec'd by: (print & sign) ☐Client ☐ATL Field	Date	Time	☐ Rec'd Chilled ☐ Cond Good ☐ CTU * ☐ Iced in Transit
Relinquished by: (print & sign) ☐Client ☐ATL Field arrival in Lab	Date	Time	☐ Iced ☐ Chilled/Refrig ☐ CM * ☐ Not Chilled	Rec'd by: (print & sign) ☐Received in Lab	Date	Time	☐ Rec'd Iced ☐ Not Rec'd Iced ☐ CTU * ☐ Cond Good

Field Sample ID	Time	pH	D.O.	Cl_2	Flow

Client Address and Phone # :

Client Comments:

+ Sample Pres.

pH Paper ID#:	1 ≤ 6 °C (not frozen)	2 = H_2SO_4	3 = HCl	4 = HNO_3
5 = $Na_2S_2O_3$	6 = NaOH	7 =	8 =	9 =

Laboratory Comments:

(Line below documents condition at receipt in Laboratory by Sample Custodian. Lab location noted by check box at top of C-O-C.)

Cooler ID:	Temp °C: /	CT	Therm ID:	Cooler ID:	Temp °C: /	CT	Therm ID:

Appendix D: Data Review Checklist and Data Summary Sheet

Data Review Checklist

Title of associated QAPP: _____

√, X, or N/A

Data Format and Structure

A. Are there any duplicate *Tag ID* numbers? _____
B. Are the *Tag prefixes* correct? _____
C. Are all *Tag ID* numbers 7 characters? _____
D. Are TCEQ station location (SLOC) numbers assigned? _____
E. Are sampling *Dates* in the correct format, MM/DD/YYYY? _____
F. Is the sampling *Time* based on the 24-hour clock (e.g. 13:04)? _____
G. Is the *Comment* field filled in where appropriate (e.g. unusual occurrence, sampling problems, unrepresentative of ambient water quality) and any punctuation deleted?

_____

H. *Source Code 1, 2* and *Program Code* are valid and used correctly? _____
I. Is the sampling date in the *Results* file the same as the one in the *Events* file? _____
J. Values represented by a valid parameter (*STORET*) code with the correct units and leading zeros? _____
K. Are there any duplicate parameter codes for the same *Tag Id*? _____
L. Are there any invalid symbols in the Greater Than/Less Than (*GT/LT*) field? _____
M. Are there any tag numbers in the *Results* file that are not in the *Events* file? _____
N. Have confirmed outliers been identified? (with a "1" in the Verify_flg field) _____
O. Have grab data (bacteria, for example) taken during 24-hr events been reported separately as RT samples? _____
P. Is the file in the correct format (ASCII pipe-delimited text)? _____

Data Quality Review

A. Are all the values reported at or below the AWRL? _____
B. Have the outliers been verified? _____
C. Checks on correctness of analysis or data reasonableness performed?
e.g.: Is ortho-phosphorus less than total phosphorus?
Are dissolved metal concentrations less than or equal to total metals? _____
D. Have at least 10% of the data in the data set been reviewed against the field and laboratory data sheets? _____
E. Are all parameter codes in the data set listed in the QAPP? _____
F. Are all stations in the data set listed in the QAPP? _____

Documentation Review

A. Are blank results acceptable as specified in the QAPP? _____
B. Were control charts used to determine the acceptability of field duplicates? _____
C. Was documentation of any unusual occurrences that may affect water quality included in the Event file Comments field? _____
D. Were there any failures in sampling methods and/or deviations from sample design requirements that resulted in unreportable data? If yes, explain on next page. _____
E. Were there any failures in field and laboratory measurement systems that were not resolvable and resulted in unreportable data? If yes, explain on next page. _____

√ = Yes **X = No** **N/A** = Not applicable

Describe any data reporting inconsistencies with AWRL specifications. Explain failures in sampling methods and field and laboratory measurement systems that resulted in data that could not be reported to the TCEQ. (attach another page if necessary):

_____

_____

_____

_____

_____

Date Submitted to TCEQ: _____
Tag ID Series: _____
Date Range: _____
Data Source: _____
Comments (attach README.TXT file if applicable):

_____

_____

_____

_____

Planning Agency's Data Manager Signature: _____

Date: _____

DATA SUMMARY

Data Set Information

Data Source: _____.

Date Submitted: _____.

Tag_id Range: _____.

Date Range: _____.

Comments:

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

- Inconsistencies with AWRL specifications or 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).
- Include completed Corrective Action Plans with the applicable Progress Report.

_____

_____

_____

_____

_____

_____

_____

_____

☐ 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 Data Review Checklist.

Planning Agency Data Manager: _____.

Date: _____.