April 2020
Rev. 12

Quality Assurance Project Plan for Continuous Water Quality Monitoring Network Program

Water Quality Planning Division
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Quality Assurance Project Plan for Continuous Water Quality Monitoring Network Program

Prepared by
Monitoring and Assessment Section
Water Quality Planning Division
(512) 239-1678

April 2020

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A1.1 Preface

Continuous Water Quality Monitoring Network
Quality Assurance Project Plan
EPA Grant No. I – 986653-10, QTRAK No. 20-182

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A1.2 Approval Page

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TCEQ Quality Assurance Manager
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A1.2 Approval Page (continued)

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A1.2 Approval Page (continued)

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A1.2 Approval Page (continued)

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A1.2 Approval Page (continued)

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A1.2 Approval Page (continued)

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A1.2 Approval Page (continued)

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A1.2 Approval Page (continued)

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Nelly Smith Date
Chief
State and Tribal Programs Section

The TCEQ will secure written documentation from each sub-tier project participant (e.g., subcontractors, organizations operating sites, laboratories) stating the organization's commitment to requirements contained in this quality assurance project plan and any amendments. The TCEQ will maintain this documentation as part of the project's quality assurance records and will ensure this documentation is available for review. (See Sample Letter in Appendix E of this document).

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A2.4 CWQMN Project Plans

CWQMN Project Plans document the initiation of new stations and the projects associated with them. The stations represented in the Plans and subsequent changes to the project or stations are updated in the CWQMN QAPP during its annual recertification or biennial revision. In addition to updating the QAPP with project changes, changes to projects may also be captured with new Project Plans for project planning purposes. The Project Plans are retained by the TCEQ Central Office for historical project informational purposes and are available upon request.

A2.5 TCEQ CWQMN Standard Operating Procedures

See Section A5 Tables A5.2 and A5.3 for TCEQ-operated stations following TCEQ procedures. TCEQ CWQMN Standard Operating Procedures are listed in Table A2.5 and are available at:
(http://www.tceq.texas.gov/waterquality/monitoring/swqm_realtime.html)

Table A2.5

Active TCEQ CWQMN Standard Operating Procedures:

Title	Pages	Revision	Effective Date
Analysis of *In Situ* Dissolved Oxygen, Specific Conductance, pH, Water Temperature, and Sample Depth in Ambient Surface Water Using YSI EXO Multi-probes	31	0	6/17/19
In Situ Analysis of Electrical Conductivity and Water Temperature and Total Dissolved Solids in Ambient Surface Water for the Lower Rio Grande Environmental Monitoring and Response System Using Hydrolab-Hydrotech Compact Minisondes	13	3	4/1/2019
Analysis of *In Situ* Specific Conductance, Water Temperature, and Sample Depth for the Bosque River Environmental Monitoring Response System Using Aqua TROLL 200 Multiprobes	13	2	3/14/18
Analysis of *In-Situ* Turbidity in Ambient Surface Water at Pine Island Bayou for the Environmental Monitoring Response System using YSI EXO Multiprobes	11	0	6/17/2019
Validation of Continuous (non-EMRS) Water Quality Monitoring Data Collected by Multiparameter Sonde	9	2	10/07/13

A2.6 USGS Guidelines and Procedures

The USGS has been contracted by TCEQ to collect, validate, and report water quality and stream discharge monitoring from various stations following USGS guidelines and procedures. See Section A5 Table A5.1 for USGS-operated stations. USGS procedures and guidelines (and location of documents) are listed in Table A2.6.

Table A2.6

USGS CWQMN Guidelines and Procedures:

Title	Location
Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting TM1D3.	http://pubs.usgs.gov/tm/2006/tm1D3/
Standard Operating Procedures for the Collection of Water-Quality Data Using a Vertical Profiling Water-Quality Monitor on the Arroyo Colorado South Texas	https://www.tceq.texas.gov/waterquality/monitoring/cwqm_sops.html
USGS/TCEQ – Adaptation of Data Validation and Fouling Correction Procedures for Water-Quality Monitoring Stations on the Upper Rio Grande and Pecos River (May 2013), Revision 1	TCEQ CWQMN QAPP Appendix G
Discharge Measurements at Gaging Stations: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter A8.	http://pubs.usgs.gov/twri/twri3a8/
User's Manual for Aquarius Time Series.	Available from USGS upon request
USGS Aquarius Data Validation, Transmittal, and Data Completeness Report	Appendix H
National Field Manual. Techniques of Water-Resources Investigations Book 9	http://water.usgs.gov/owq/FieldManual/
Quality-Assurance Plan for Water Quality Activities in the Texas Water Science Center.	Available from USGS upon request
Texas Water Science Center Surface-Water Quality-Assurance Plan.	Available from USGS upon request

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Mr. Scott Green (575) 640-3912

The Texas Commission on Environmental Quality will provide copies of this Quality Assurance 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, organizations operating sites, laboratories. The TCEQ 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 ensure this documentation is available for review.

A4 Project/Task Organization

This QAPP is specific to the activities of the TCEQ. The CWQMN is operated by TCEQ regional staff, cooperators, and contractors. The organization of the CWQMN project is shown in Figure A4.1. The interrelationships and responsibilities of the participants in these projects are listed below:

A4.1 Project Sponsor, Monitoring & Assessment Projects, Water Quality Planning Division (Lori Hamilton)

Sets the preliminary objectives for network projects.

- Allocates adequate resources to ensure completion of the project in compliance with the stated objectives.

A4.2 CWQMN Network Coordinator, Monitoring & Assessment Section, Water Quality Planning Division, (Charles Dvorsky)

- Receives input from CWQMN program managers on the various CWQMN projects.
- Facilitates coordination of the entire CWQMN.
- Coordinates the identification of representative project station(s) with input from interested parties.
- Coordinates and facilitates development of station-specific Data Quality Objectives (DQOs) or Measurement Quality Objectives (MQOs).
- Approves monitoring stations after consultation with TCEQ management, TCEQ staff, and stakeholders.
- Provides assistance to program managers for project plan development for new CWQMN projects or stations.
- Responsible for establishing new monitoring stations and integrating stations into the existing monitoring network.
- Coordinates CWQMN deployment schedules with others, as needed.
- Purchases network equipment.
- Manages equipment repair contracts for the network.
- Manages and updates CWQMN web pages in accessible format.
- Maintains the WQPD's EMRS water listserv accounts.
- Completes Station Initiation Forms, Lease Agreements, Station Access Agreements, and Data Validation Initiation forms for new stations.
- Develops various CWQMN processes to help ensure network goals are achieved.
- Advises network participants about known CWQMN data and/or project limitations.
- Assists QC Officer in developing and revising SOPs.
- Assists QC Officer in conducting audits and implementing corrective actions.
- Provides project planning and prepares comments and project status reports.

- Manages various budgets associated with the EPA grants and state funding.
- Receives and maintains USGS contract assessment records.
- Develops and coordinates contracts and intergovernmental agreements of the CWQMN.
- Coordinates station repairs.
- Assists in station installations and repair.
- Provides WQPD Management updates on CWQMN projects and network stations on an as needed basis.
- Organizes training for station operators.
- Coordinates document reviews.
- Notifies Data Management and Analysis staff when stations are deployed and determine a start date for data validation activities.
- Participates in CWQMN QA Meetings.

A4.3 CWQMN Program Manager, Monitoring & Assessment Section, Water Quality Planning Division, (Andrew Sullivan)

- Develops and communicates objectives for CWQMN projects.
- Communicates to management the status, recommended changes, and goals of CWQMN projects.
- Maintains a thorough knowledge of project work activities, commitments, deliverables, and time frames.
- Develops necessary lines of communication and good working relationships between the lead division staff and personnel of other divisions and organizations participating in the program.
- Approves acceptability of the measurement data process and QA/QC protocols.
- Advises management about objectives, timetables, tasks, and coordination not being met.
- Elevates CWQMN/MD scheduling conflicts and other issues requiring resolution through the appropriate management chain(s) when appropriate.
- Maintains oversight of contracts and intergovernmental agreements of the CWQMN.
- Maintains oversight of various budgets associated with the EPA grants and state funding.
- Monitors the effectiveness of the overall program quality system.
- Participates in the development of station specific DQOs or MQOs.
- Selects SWQM Project Leads for specific CWQMN projects.
- Participates in CWQMN QA Meetings.
- Provides feedback to supervisory and administrative personnel as necessary regarding the performance of project leads and managers.

A4.4 Monitoring Division, Office of Compliance and Enforcement

- Provides limited support and logistics for monitoring station deployments depending on personnel availability.
- Assists with shipping, tracking, and receiving of CWQMN parts and supplies purchased and inventoried for CWQMN deployments, operations, maintenance, and repair.
- Maintains a database of modems used by the air and water monitoring programs with assistance from WQPD.
- Provides initial training to CWQMN Network Coordinator and QC Officer on the basic setup, configuration, and troubleshooting techniques for the appropriate communications and electronic data acquisition equipment based on the standard operating procedure (SOP) and/or manufacturer's operations manual.
- Provides limited advanced technical support of communications and electronic data acquisition equipment for issues that CWQMN operators, CWQMN Network Coordinator, and/or CWQMN QC Officer cannot resolve by following the SOP and/or manufacturer's operations manual.
- Manages the Leading Environmental and Analysis Display System (LEADS) umbrella contract. Each program area prepares, processes, and provides funds for their specific work orders.
- Provides LEADS station registration for CWQMN stations and establishes accounts for CWQMN operators and validators to access Manual Validation.
- Administers the LEADS system, including LEADS web pages with water data reports, water data status pages, and other documentation.
- Participates in the revision of the CWQMN QAPP and CWQMN Project Plans.

A4.5 Data Management and Analysis Team, Monitoring & Assessment Section, Water Quality Planning Division

- Reviews and verifies TCEQ EMRS CWQMN station data. Validates TCEQ non-EMRS station data.
- Monitors and reviews the general operational status of all stations in the lower Rio Grande and emails a daily Data Review Report to interested parties.
- Ensures maintenance of records that will demonstrate defensibility of data (Post Deployment Worksheets and data validation notes).
- Provides technical support for analyzing and interpreting the data collected from the CWQMN.
- Provides data validation training to interested parties, cooperators and contractors.
- Provides technical support on statistical evaluation issues that may arise.
- Documents all data management activities.

- Establishes procedures to routinely assess data completeness.
- Participates in the development, approval, implementation and maintenance of written QA standards (e.g., SOPs, QAPPs) and other guidance documents.
- Participates in CWQMN QA Meetings.
- Coordinates the development and maintenance of the SWQMIS for warehousing all CWQMN data.
- Coordinates the development of interfaces between LEADS and SWQMIS with PSS.

A4.6 CWQMN QA Officer, Monitoring Division (Sharon Coleman Acting)

- Provides oversight of all QA activities.
- Participates in the development, approval, implementation and maintenance of written QA standards (e.g., QMP and QAPPs).
- Participates in the preparation of quality reports (e.g., annual reports).
- Determines conformance with program quality system requirements.
- Recommends to division directors and project managers and through them to deputy directors, that work be stopped in order to safeguard programmatic objectives, worker safety, public health, or environmental protection.
- Assists grant, program, and project managers in developing and implementing quality systems.
- Receives and maintains assessment records.
- Provides technical expertise and/or consultation on quality services.
- Prepares and forwards an annual QA report memorandum to EPA.
- Participates in data quality assessments.
- Reports on the status of corrective action programs to EPA.
- Identifies positive and adverse trends in program quality systems.
- Serves as quality system representative.
- Participates in CWQMN QA meetings as needed.

A4.7 CWQMN QC Officer, Monitoring & Assessment Section, Water Quality Planning Division (Edward Ragsdale)

- Responsible for annual CWQMN QAPP revisions.
- Provides QC oversight for network activities.
- Assists program managers, network coordinator, and project managers in developing and implementing quality systems.
- Develops various CWQMN processes to help ensure quality objectives are achieved.
- Advises program managers, data users, and network participants about known CWQMN data and/or project limitations.
- Conducts on-going informal data reviews.
- Reviews and comments on CWQMN Project Plans.

- Researches measurement equipment technical specifications and test equipment if possible.
- Lead for developing, coordinating, writing, and revising CWQMN SOPs.
- Investigate network measurement anomalies.
- Participates in the development of DQOs
- Develops, prepares, conducts, and distributes performance and technical systems/audits/inspections/readiness reviews of CWQMN CAMS.
- Evaluates proposed corrective actions and verifications.
- Concurs with proposed corrective actions and verifications.
- Responsible for determining if responses to audit findings are acceptable or not.
- Maintains files for Project Plans, performance and technical systems/audits/readiness reviews.
- Trains operators on monitoring equipment and QC procedures.
- Assists grant, program, and project managers in developing and implementing quality systems.
- Assist in station installations and repair.
- Facilitates CWQMN QA meetings.
- Assesses the effectiveness of program quality systems.
- Monitors the implementation of corrective actions.

A4.8 Primary Data Users

- Assist in the development of DQOs and MQOs.

A4.9 TCEQ Regional Staff, Local Cooperators, and Contractors

- Participate in locating, evaluating, establishing and documenting locations for monitoring stations.
- Provide overall support for the operation and maintenance of station.
- Operate and maintain monitoring stations and sampling equipment according to current TCEQ QAPPs and SOPs.
- Calibrate measurement instrumentation.
- Perform QC checks on monitoring, sampling equipment according to current TCEQ QAPPs and SOPs.
- Review QC data and ensure quality data is being generated.
- Train operators and cooperators on monitoring equipment and QC procedures.
- Assist auditors with performance evaluations and technical systems audits.
- Participate in the development of SOPs.
- Perform preventative maintenance on monitoring equipment.
- Assist in the development of DQOs or MQOs.

A4.10 Administrative, Water Quality Planning Division

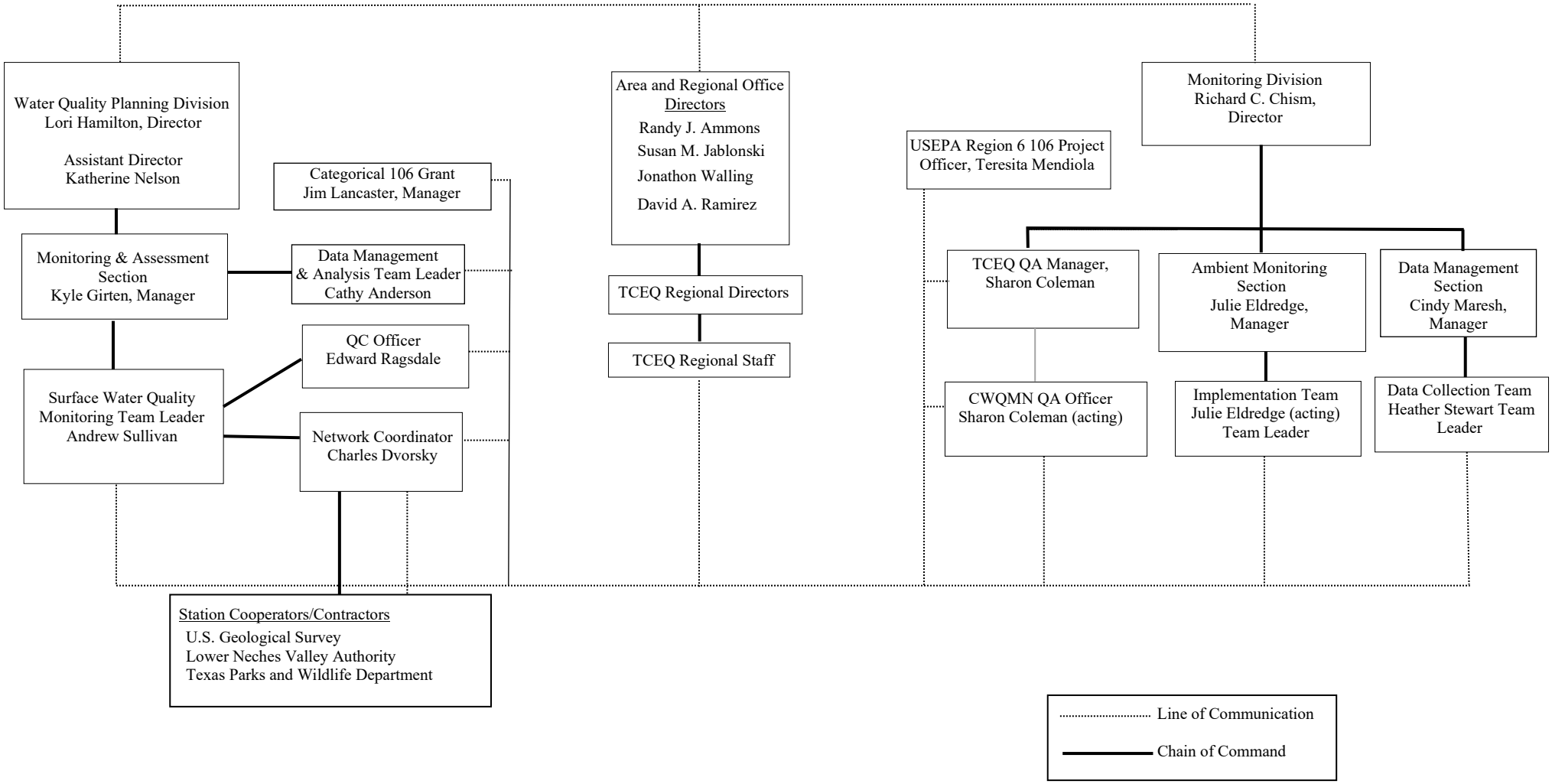
- Performs administrative reviews for CWQMN documents.
- Processes travel authorization and travel reimbursements for CWQMN activities.

A4.11 CWQMN External Web Page Maintenance

- LEADS is maintained by MD with input from WQPD staff if needed. CWQMN web pages and SWQMIS are maintained by WQPD staff.

Figure A4.1

Project Organizational Chart



A5 Project Definition/Background

In 2001, the Texas Legislature charged TCEQ to assess the impacts of CAFOs to water quality on the Bosque River in North Central Texas. The TCEQ was tasked by executive management and commissioners to develop and deploy a CWQMN built on the existing air monitoring infrastructure. The CWQMN provides near real-time high frequency continuous records of water quality. The vision of these leaders was to provide more timely and comprehensive water quality information at selected high priority locations than is possible with grab sampling or short-term deployment of water quality instrumentation.

The TCEQ responded by establishing two CWQMN stations on the North Bosque River and two CWQMN stations on the Leon River. CWQMN was expanded to include the additional stations in various watersheds around the state. The current stations are listed in Tables A5.1 – A5.3. These Tables list active stations/projects and are updated as part of QAPP revisions. CWQMN stations may be added and/or de-activated throughout the course of the year. These tables are not intended to list the operational status of CWQMN stations.

The CWQMN designates stations as USGS-operated, TCEQ EMRS, and TCEQ non-EMRS stations. At EMRS stations, the data are used on a near-real time basis for a variety of purposes. Due to the near-real time data uses, data from these stations are not validated. Data records are validated at USGS-operated and TCEQ non-EMRS stations using QC measurement results.

See Tables A5.1 - A5.3 for project objectives and station measurement parameters for each station designation.

Station monitoring data are available at:
(http://www.tceq.texas.gov/waterquality/monitoring/swqm_realtime.html)

Table A5.1
Objectives and Locations for CWQMN USGS-Operated Non-EMRS Stations

River Basin	Seg. No.	CAMS	Station Location	Objectives	Station Parameters
Rio Grande	2307	757	Rio Grande upstream of the confluence of Rio Conchos near Presidio, TX	1) Provide comprehensive water quality and stream discharge data at remote locations of the Big Bend Region of Texas. 2) Monitor SC and stream discharge in the basin to provide information about increasing TDS to protect domestic and agricultural water supplies. 3) Provide water quality and stream discharge data to USNPS and USGS to develop managed stream flow program from upstream reservoirs to improve and maintain aquatic stream habitats and water quality. 4) Provide data to the USFWS to support Rio Grande Silvery Minnow reintroduction efforts. 5) Provide data for high flow and low DO related fish kills. 6) Provide data to USNPS on spring flows in the lower canyons. 7) Document SC levels entering Amistad Reservoir. 8) Provide stream discharge data to NOAA and USNWS for flood forecasting. 9) Provide stream discharge data for recreational river use.	Surface Water Temperature[1] SC[1] DO[1] pH[1] USGS measures discharge in addition to water quality at CAMS 721[1] USGS measures discharge only at CAMS 720[1] USIBWC measures discharge at CAMSs 757, 758, & 759[2]
	2306	758	Rio Grande downstream of the confluence of Rio Conchos near Presidio, TX		
		803	Rio Grande River at Santa Elena Canyon, Big Bend National Park		
		720	Rio Grande at Castolon, TX Big Bend National Park		
		721	Rio Grande River at Rio Grande Village, TX Big Bend National Park		
		759	Rio Grande at Fosters Ranch upstream of Amistad Reservoir		
	2312	788	Pecos River near Red Bluff New Mexico. ~8.8 stream miles upstream of the headwaters of Red Bluff Reservoir in TX.	Document SC levels entering Texas for the Pecos River Compact Commission.	Surface Water Temperature[1] SC[1] Discharge[3]
	2311	798	Pecos River near Orla, TX	1) Provide comprehensive water quality and stream discharge data at locations in the Upper and Lower Pecos River. 2) Monitor SC and stream discharge in the basin to provide information about increasing TDS to protect domestic and agricultural water supplies. 3) Provide data to the US Army Corps of Engineers Pecos River Salinity Assessment Project. 4) Provide SC data to determine the amount of usable water for Pecos River Commission water delivery requirements.	Surface Water temperature[1] SC/TDS[1] DO[1] USGS measures low range discharge at CAMS 709, 729, 735, and 807[1]

Table A5.1 continued

River Basin	Seg. No.	CAMS	Station Location	Objectives	Station Parameters
Rio Grande	2311	807	Pecos River near Pecos, Texas at FM 3398	5) Provide SC data to TCEQ's Interstate Compact Program for management discussions and negotiations with New Mexico. 6) Provide TWRI's WPP improved temporal and spatial DO and SC data to identify improvements in water quality for impaired Sections of the Pecos River. 7) Provide data to TIAER for various DO modeling-related activities. 8) Monitor changes in water quality and stream discharge associated with salt cedar eradication. 9) Characterize water quality conditions that lead to blooms of toxic golden alga. 10) Document SC levels entering Amistad Reservoir.	USIBWC measures discharge at CAMS 799[2] USGS measures discharge at CAMS 785 and 798[3]
		709	Pecos River at FM 1776 near Coyanosa, TX		
		785	Pecos River near Girven TX upstream of US Hwy 67/385 Pecos River Bridge		
		735	Pecos River near US Hwy 290 Southeast of Sheffield, TX		
	2310	729	Lower Pecos River near Terrel/Val Verde/Crocket County Lines		
		799	Lower Pecos River at USIBWC discharge monitoring location near Langtry, TX		
		764	Independence Creek at Caroline Springs (T-5) on the Nature Conservancy's Independence Creek Preserve south of Sheffield, TX	Independence Creek and associated springs provide critical freshwater inputs into the Lower Pecos River. The station was initiated to monitor potential water quality impacts from oil and gas exploration and development in the area. 1) Monitor SC of spring water to detect any changes in water quality. 2) Monitor SC in the basin to provide information about increasing TDS to protect domestic and agricultural water supplies. 3) Monitor SC in the basin to aid Golden alga research efforts	Surface Water temperature[1] SC/TDS[1]
Rio Grande Coastal	2201	730	Arroyo Colorado Tidal at Rio Hondo FM 106 Bridge	1) Provide vertical profile water quality data to support modeling efforts by TIAER for the impaired portion of the tidal segment and for public education and outreach for the Arroyo Colorado WPP. 2) Provide data to evaluate the effectiveness of BMPs associated with the WPP	Vertical profile Water Temperature[1] DO[1] SC[1] Gage Height[1]

[1]The TCEQ funds USGS water quality and stream discharge monitoring and these stations are under the CWQMN QAPP.
[2]The USIBWC monitors stream discharge and the stations are not under the CWQMN QAPP.
[3]The USGS monitors stream discharge using non-TCEQ funds and these stations are not covered under the CWQMN QAPP.

BMP = Best Management Practice
CAMS = Continuous Ambient Monitoring Station
DO = Dissolved Oxygen
NOAA = National Oceanic and Atmospheric administration
SC = Specific Conductance
TDS = Total Dissolved Solids. TDS is calculated from SC using TCEQ's correction factor of 0.65.
TIAER = Texas Institute for Applied Environmental Research
TWRI = Texas Water Resource Institute
USGS = United States Geological Survey
USFWS = United States Fish and Wildlife Service
USIBWC = United States International Boundary Water Commission
USNWS = United States National Weather Service

USNPS = United States National Park Service
WPP = Watershed Protection Plan

Table A5.2
Objectives and Locations for CWQMN TCEQ Non-EMRS Stations

River Basin	Seg. No.	CAMS	Station Location	Objectives	Station Parameters
Rio Grande	2309	768	Devils River downstream of Hwy 163 at Baker's Crossing	The Devils River, a spring-fed stream, is one of the most pristine water bodies in the state of Texas. The station was initiated to monitor potential water quality impacts from oil and gas exploration and development in the watershed. One underground natural gas and one crude oil pipeline now cross the Devils River upstream of the station location. 1) Provide time-varying trends in water quality data to document status and trends to ensure existing conditions are maintained. 2) Monitor SC in the Rio Grande basin to provide information about increasing TDS in the Rio Grande basin. Station deactivated. Existing monitoring location at USIBWC discharge monitoring station filled in with sediment and aquatic vegetation. TCEQ is in the process of identifying an alternative monitoring location.	Surface Water Temperature SC/TDS DO pH Discharge[1]
NA	NA	808	San Solomon Springs Southern Discharge Canal at Balmorhea State Park in Toyahvale, TX	San Solomon and the surrounding springs in far West Texas contribute a substantial amount of the region's water quality and quantity and provides habitat for a number of rare and Federally listed endangered species. Concerns exist regarding the potential impacts of recent oil and gas discoveries in the Alpine High play on these springs. 1) Provide baseline SC and pH water quality to TPWD.	Canal Water Temperature SC pH Sample Depth Discharge[2]
Neches	0607	749	Pine Island Bayou at Lower Neches Valley Authority Pump Station near U.S Hwy 69	1) Develop methods to use DO data to support TSWQS review. 2) Forecast water quality for LNVA's raw water canal system for municipal, industrial, and agricultural users.	Surface SC/TDS[3] DO pH Turbidity[3] Water temperature Sample Depth

[1] The USIBWC monitors stream discharge and this station is not under the CWQMN QAPP.
[2] The USGS monitors stream discharge using non-TCEQ funds. Discharge monitoring is not covered under the CWQMN QAPP.
[3]Turbidity and SC data are used on a near real-time basis by the Lower Neches River authority. Turbidity data records are not validated. See Table A5.3.

CAMS = Continuous Ambient Monitoring Station
DO = Dissolved Oxygen
LNVA = Lower Neches Valley Authority
SC = Specific Conductance
TDS = Total Dissolved Solids. TDS is calculated from SC using TCEQ's correction factor of 0.65.
TPWD = Texas Parks & Wildlife Department
TSWQS = Texas Surface Water Quality Standards
USIBWC = United States International Boundary Water Commission

Table A5.3

Objectives and Locations for CWQMN TCEQ EMRS Stations

River Basin	Seg. No.	CAMS	Station Location	Objective	Station Parameters
Brazos	NA	804	Tributary of Upper Green Creek near the intersection of CR385 and 382	1) Provide near real-time SC and water depth data for screening and targeting field responses and investigations associated with dairy-related discharges for the North Bosque River EMRS project. 2) Provide near real-time SC data as an indicator to detect major changes in microwatershed water quality during rainfall run-off events.	Located in rainfall-dependent creeks SC Sample Depth Temperature
	1226K	728	Little Duffau Creek near FM1824		
	1255C	726	Scarborough Creek at CR 423		
	1226	805	Indian Creek just east of U.S. Hwy 281		
	NA	765	Un-named Tributary of Little Duffau Creek near FM 1824		
Neches	0607	749	Pine Island Bayou near U.S. Hwy 69	1) Provide near real-time data to the LNVA for water management decisions. 2) Provide various officials valuable fresh water quality information from potential storm-related saltwater intrusion into Pine Island Bayou.	SC/TDS Turbidity
Rio Grande	2302	767	Rio Grande at Roma, Texas	1) The stations provide SC data to alert the TCEQ when estimated TDS concentrations exceeds established notification levels. 2) Data can be used to identify and document possible sources of high TDS waters entering the Lower Rio Grande from Mexico or Texas downstream of Falcon Reservoir.	Surface Water Temperature SC/TDS
		796	Rio Grande downstream of Arroyo Los Olmos		
		791	Rio Grande ~2.7 miles upstream of the confluence with El Morillo Drain (United Irrigation District)		
		792	Rio Grande ~2.5 miles downstream of the confluence of El Morillo Drain (Hidalgo County Irrigation District #18)		
		736	Anzalduas Dam near Pier 7		
		793	Rio Grande ~5.0 miles downstream of FM 1015 (HC&CC Irrigation District #9)		
		789	Rio Grande ~3.45 miles upstream of the of the bridge at CR. 409 (Harlingen Irrigation District # 1)		

CAMS = Continuous Ambient Monitoring Station
EMRS = Environmental Monitoring Response System
HC&CCID #9 = Hidalgo & Cameron County Irrigation District #9
LNVA = Lower Neches Valley Authority
SC = Specific Conductance
TDS = Total Dissolved Solids. TDS is calculated from SC using TCEQ's correction factor of 0.65.

A6 Project/Task Description

Network Description

Continuous surface water quality, sample depth, water level, and stream discharge may be measured automatically (365 days a year) at CWQMN stations located on water bodies of interest. Data from CWQMN stations are telemetered to the TCEQ headquarters in Austin, Texas.

See TCEQ's website for data, maps, and locations of stations. (http://www.tceq.texas.gov/waterquality/monitoring/swqm_realtime.html)

Some TCEQ CWQMN projects are funded in whole or in part by federal funds under CWA Sec 106 or other federal grants. Other projects are funded entirely with state and local funds. All TCEQ CWQMN projects listed in Table A5.1, A5.2, and A5.3 regardless of funding source(s), are covered under the TCEQ CWQMN QAPP. Independent CWQMN stations are covered under separate quality assurance systems and are not included under the TCEQ CWQMN QAPP.

This QAPP describes and documents policies, procedures, infrastructure requirements, assessments and response actions, and data management, needed to provide and maintain quality data for the monitoring objectives in Section A5.

During extended extreme circumstances, the practices and procedures detailed in this QAPP may not be possible. Such circumstances may include, but are not limited to, adverse environmental, health, safety, and administrative conditions. Should these or other circumstances arise that would compromise health and human safety, TCEQ or TCEQ cooperators and contractors may be required to deviate from the practices and procedures detailed in this QAPP. TCEQ will notify EPA of the deviation(s) from the QAPP in writing no later than thirty (30) calendar days after the onset of the precipitating circumstances. TCEQ will also notify EPA when the circumstances are resolved and conformance with the QAPP is achieved in writing within thirty (30) calendar days of resolution.

The CWQMN QAPP is updated every two years. The QAPP is reviewed in the interim year as part of the required annual certification process. During that process, a list is compiled of new and deactivated stations, and the list is included in the Detail of Changes in the annual certification document submitted to the TCEQ QA Manager and to EPA.

Amendments to the QAPP may be necessary to address incorrectly documented information or to reflect changes in project organization, tasks, objectives, methods, and equipment.

Requests for amendments will be directed from the QA Officer to the EPA Project Officer. Amendments are effective immediately upon approval by the Network Coordinator, Program manager, QA Officer, the QC Officer, the TCEQ QA Manager (or designee), and the EPA Project Officer.

When new stations are added to the network during the year, the program will document project details and requirements in CWQMN Project Plans (Project Plan Shell

Appendix C) using EPA QA/R5 format. The plans will set forth project-specific requirements (or criteria) against which results can be compared and help ensure that project data will be of the type and quality needed for its intended use. Project Plans will refer to the CWQMN QAPP where applicable.

CWQMN Project Plans will be written as addenda to the CWQMN QAPP and will require an abbreviated sign-off by the CWQMN Network Coordinator, various TCEQ managers and staff, CWQMN Program QA Officer, CWQMN QC Officer, Data Management & Analysis, and relevant project participants/cooperators or contractors.

If a new project is substantially different from those described in the QAPP, and if the project is supported with §106 monies, TCEQ will send the associated project plan to EPA for comment during project development. Copies of all completed/approved Project Plans will be available to EPA regardless of project funding sources and will remain on file in the central office CWQMN program QA files.

Project Plans may be written and approved throughout the year. Once approved, the plans are available upon request.

Continuous water quality monitoring network stations (CWQMNs) are operated by Station Operators who may be:

- Staff in some of the TCEQ's 16 regional offices;
- Local Cooperators; and/or
- Contractors working with Central SWQM staff.

USGS Generated Data

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at stations on the Upper Rio Grande, Pecos River and Arroyo Colorado basins. See Table A5.1 for USGS station locations and parameters and Section A2.6 for the internet locations of USGS Guidelines and Procedures. USGS Texas Water Science Center QAPPs are also listed in Section A6.2 and are available upon request.

Table A6.1
Station Operators and Data Validators

Basin	TCEQ Region	CAMS Number	Station ID	Operator CWQMN Element	Data Validator CWQMN Element	Station Location
Rio Grande	6	803	20617	USGS-Water Quality/Discharge	USGS-Water Quality/Discharge	Big Bend National Park-Santa Helena Canyon
Rio Grande	6	721	18483	USGS-Water Quality/Discharge	USGS-Water Quality/Discharge	Big Bend National Park-Rio Grande Village
Rio Grande	16	799	13420	USGS-Water Quality	USGS-Water Quality	Lower Pecos at IBWC discharge monitoring location near Langtry
Rio Grande	7	788	NA	USGS-Water Quality/Discharge	USGS-Water Quality	Pecos River near Red Bluff New Mexico
Rio Grande	7	785	13257	USGS-Water Quality/Discharge	USGS-Water Quality/Discharge	Pecos River Girvin, TX
Rio Grande	7	709	13260	USGS-Water Quality/Discharge	USGS-Water Quality/Discharge	FM 1776 near Coyanosa, TX (Upper Pecos)
Rio Grande	7	710	13261	USGS-Water Quality/Discharge	USGS-Water Quality/Discharge	Pecos River near Pecos, TX at FM 3398
Rio Grande	7	729	18801	USGS-Water Quality/Discharge	USGS-Water Quality/Discharge	Pecos River near the Terrel/Val Verde/ Crocket County lines
Rio Grande	16	759	13223	USGS-Water Quality	USGS-Water Quality	Rio Grande at Fosters Ranch upstream of Amistad Reservoir
Rio Grande	7	798	13265	USGS-Water Quality/Discharge	USGS-Water Quality/Discharge	Pecos River near Orla, TX
Rio Grande	6	757	13230	USGS-Water Quality	USGS-Water Quality	Rio Grande upstream of the confluence of Rio Conchos near Presidio, TX
Rio Grande	6	758	13229	USGS-Water Quality	USGS-Water Quality	Rio Grande downstream of the confluence of Rio Conchos near Presidio, TX
Rio Grande	7	735	13249	USGS-Water Quality/Discharge	USGS-Water Quality/Discharge	Pecos River near US Hwy 290 southeast of Sheffield, TX
Rio Grande Coastal	15	730	13072	USGS-Water Quality	USGS-Water Quality	Arroyo Colorado at FM 106, Rio Hondo, TX
Rio Grande	16	768	13238	TCEQ Region 16-Water Quality	TCEQ/WQPD-Water Quality	Devils River downstream of SH 163
Rio Grande	7	764	20338	USGS-Water Quality	USGS-Water Quality	Independence Creek at Caroline T-5 Spring, Independence Creek Preserve
Rio Grande	7	808	NA	TPWD Balmorhea State Park-Water Quality	TCEQ/WQPD-Water Quality	San Solomon Springs at Balmorhea State Park
Rio Grande	15	736	13182	TCEQ SWQM Central & Harlingen Staff	NV	Rio Grande at Anzalduas Dam near Pier 7
Rio Grande	15	767	20737	TCEQ SWQM Central & Harlingen Staff	NV	Rio Grande at Roma, Texas
Rio Grande	15	796	TBD	TCEQ SWQM Central & Harlingen Staff	NV	Rio Grande downstream of arroyo Los Olmos
Rio Grande	15	789	TBD	TCEQ SWQM Central & Harlingen Staff	NV	Harlingen Irrigation District #1

Table A6.1 (continued)
Station Operators and Data Validators

Basin	TCEQ Region	CAMS Number	Station ID	Operator CWQMN Element	Data Validator CWQMN Element	Station Location
Rio Grande	15	791	TBD	TCEQ SWQM Central & Harlingen Staff	NV	United Irrigation District
Rio Grande	15	792	TBD	TCEQ SWQM Central & Harlingen Staff	NV	Hidalgo Irrigation District #18
Rio Grande	15	793	TBD	TCEQ SWQM Central & Harlingen Staff	NV	HC&CC Irrigation District # 9
Brazos	4	726	17222	TCEQ Region 4, Stephenville-Water Quality	NV	Scarborough Creek (Upper North Bosque River tributary) at CR 423
Brazos	4	728	20322	TCEQ Region 4, Stephenville-Water Quality	NV	Little Duffau Creek (Upper North Bosque River Tributary) near FM 1824
Brazos	4	765	20323	TCEQ Region 4, Stephenville-Water Quality	NV	Unnamed Tributary of Little Duffau Creek (Bosque River Tributary) near FM 1824
Brazos	4	804	TBD	TCEQ Region 4, Stephenville-Water Quality	NV	Tributary of Upper Green Creek near the intersection of CR 385 and 382
Brazos	4	805	17235	TCEQ Region 4, Stephenville-Water Quality	NV	Indian Creek just east of U.S. Hwy 281
Neches	10	749	10602	Lower Neches Valley Authority	TCEQ/WQPD-Water Quality. Turbidity data collected at the station is not validated.	Pine Island Bayou near U.S. Hwy 69

CAMS = Continuous Ambient Monitoring Station
HC&CCID#9 = Hidalgo & Cameron County Irrigation District #9
NA = Not applicable. San Solomon Springs is not associated with a TCEQ Segment number
NV = Not validated. EMRS project data not validated
TBD = To be determined
TCEQ-WQPD Texas Commission on Environmental Quality Water Quality Planning Division
TPWD = Texas Parks and Wildlife Department
USGS = United States Geological Survey
USIBWC = United States International Boundary Water Commission

Table A6.2
Schedule of Activities

Table A6.2 contains a list of activities required to plan, implement, and assess the CWQMN.

Administrative Activities	**Status**
Biannual CWQMN QAPP Revision	QAPP re-certified on 3/27/2019. Biannual revision will be delivered to EPA by 3/31/2020.
CWQMN Project Plans	Ongoing, for each new CWQMN Project
CWQMN Data Quality Objectives (measurement performance specifications for multiprobe fouling and drift quality control measurements). When applicable.	Ongoing for new non-EMRS stations
General Activities	**Status**
Devils River CAMS 768 off-line due to change in stream morphology causing sediment deposition and aquatic plant growth at deployment tube.	TBD, TCEQ in the process of identifying an alternative monitoring location.
Lower Rio Grande CAMS 792 off-line due to stream bank erosion.	New station installed and on-line.
Install and test a vendor's long-term multiprobe deployment module (LDM) at Pine Island Bayou CAMS 749 Module designed to greatly reduce sensor fouling.	Module installed on 2/24/17. Data evaluated and it was determined LDM not suitable in a bayou application.
CWQMN Audits and Readiness Reviews	Ongoing

TBD = To be determined

A7 Quality Objectives and Criteria

CWQMN water quality measurements are used for a variety of purposes. Section A7 describes quality objectives for the various projects.

A7.1 CWQMN Multiprobe Quality Objectives and Criteria

CWQMN Multiprobe Long Term Deployments

CWQMN multiprobe water quality measurement sensors are deployed in various water bodies around the state for extended periods of time. Over deployment periods, the interface between sensors and the environment can become fouled by a variety of organisms, sedimentation, and chemical coatings. Sensor fouling can compromise data quality.

Quality Objectives for TCEQ CWQMN Stations

The TCEQ CWQMN has two types of multiprobe stations, non-EMRS, and EMRS. At non-EMRS stations, data records are validated using QC measurement results. At EMRS stations, near real-time measurements are used to screen water quality for water management decisions or potential field investigations and data records are not validated.

For non-EMRS stations, the TCEQ has adopted USGS-based multiprobe fouling measurement procedures. Multi-probe sensor drift is quantified through the analysis of standards. Data records are validated using fouling and sensor drift QC measurement results. The TCEQ procedure compares fouling and drift measurement results against project specific DQOs. The TCEQ does not use sensor fouling and drift measurements to apply prorated data adjustments over deployment periods.

See section B5.1 for a summary of TCEQ multiprobe QC procedures, calculations, and limitations. For complete details concerning a project's or station's quality objectives criteria see TCEQ SOPs. TCEQ SOPs used for projects and stations are cited in this Section.

Quality Objectives for USGS-Operated CWQMN Stations

Beginning September 1, 2011, the TCEQ contracted USGS to operate, maintain, and validate all CWQMN water quality stations in the Upper Rio Grande, Pecos River, and Arroyo Colorado basins according to: USGS – *Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting TM1D3*. Generally stated, the USGS uses multiprobe fouling and sensor electronic drift measurements to apply prorated data corrections over deployment periods. Multiprobe fouling and sensor drift measurements are used by USGS to determine data quality.

Due to multiprobe data collection problems at some stations on the Upper Rio Grande and Pecos Rivers, the USGS and TCEQ worked collaboratively to interpret and adapt guidelines and standard procedures found in TM1D3. The following procedures are now in use by USGS: USGS/TCEQ - *Adaptation of Data Validation and Fouling Correction*

Procedures for Water-Quality Monitoring Stations on the Upper Rio Grande and Pecos River (May 2013), Rev 1. These procedures are in Appendix G of this QAPP.

The USGS ADAPS data validation platform was replaced in May of 2017 with an Aquatic Informatics platform named Aquarius. The Aquarius platform, while still based on the USGS TM1D3 Guidelines and the Adaptation, does not generate data quality ratings like the previous platform. The USGS developed a TCEQ script for Aquarius that validates data using TM1D3 "Fair" data rating as acceptance criteria. See Appendix H for details concerning the process USGS developed to validate and deliver data to TCEQ.

There are circumstances when data quality cannot be rated because sensor fouling measurements are not available for particular time periods. These data can be reported to TCEQ; however, the quality of these data is not known. See procedures in Appendix G for details.

USGS-Operated NON-EMRS Stations

Table A7.1.1

Quality Objectives
USGS Operated Multiprobe CAMSs 709, 721, 729, 730, 735, 757, 758, 759, 764, 785, 788, 798, 799, 803, and 807

Parameter[1]	Acceptance Limits (TM1D3 "Fair" data ratings) (based on combined fouling and calibration drift corrections applied to the record)
Temperature	±0.8 ºC
Specific Conductance	±15%
Dissolved Oxygen	±0.8 mg/l or ±15%, whichever is greater
pH	±0.8 pH units

ºC = degrees centigrade
mg/l = milligrams per liter
[1]See Table A5.1 for a list of water quality parameters measured at each station.

TCEQ NON-EMRS Stations

Table A7.1.2
Quality Objectives
TCEQ Multiprobe CAMSs 749, 768, and 808[1]

Parameter	Fouling & Drift/(CVS) Acceptance Limits (sum and individual fouling & drift acceptance limits)	Temperature Acceptance Limit	SOP
Specific Conductance/ Total Dissolved Solids	±5 RPE	±0.5 ºC[2]	Analysis of In Situ Dissolved Oxygen, Specific Conductance, pH, Water Temperature, and Sample Depth in Ambient Surface Water Using Yellow Springs Instrument EXO Multi-probes, Rev. 0
Dissolved Oxygen	±0.5 mg/l		
pH	±0.5 units		
Temperature		±0.5 ºC	
Sample Depth	NA		

[1]CAMS 808 parameters only include specific conductance, pH, temperature, and sample depth.
[2]If temperature sensor checks do not meet the ±0.5 ºC criterion, the corresponding temperature, DO, SC, and calculated total

dissolved solids data are considered invalid.
ºC = degrees centigrade
CVS = calibration verification sample
NA = not applicable, sample depth measurements not assessed for accuracy.
mg/l = milligrams per liter
RPE = Relative percent error
YSI = Yellow Spring Instrument

TCEQ EMRS Stations

North Bosque River Specific Conductance EMRS Project

EMRS data are intended to assist TCEQ Stephenville, TX staff in targeting field investigations to identify dairy-related discharge sources. SC, sample depth, and temperature multiprobes are deployed at five rainfall-dependent microwatershed locations downgradient of dairy CAFOs. When water quality trigger level(s) are exceeded at a station, an email is automatically sent to TCEQ Stephenville staff and other interested parties. Stephenville staff reviews station data to determine if an investigation is warranted. SC, depth, and temperature data records from the stations are not validated.

Table A7.1.3
Quality Objectives
TCEQ Multiprobe CAMS 726, 728, 765, 804, and 805

Parameter	Drift (CVS) Acceptance Limits	Temperature Acceptance Limit	SOP
Specific Conductance	±5 RPE [1]	±0.5 ºC [1]	Analysis of In Situ Specific Conductance, Water Temperature, and Sample Depth for the Bosque River Environmental Monitoring Response System Using Aqua TROLL 200 Multi-probes, Rev 2

[1] CVS and temperature check criteria are used as guidelines to ensure measurement equipment is operating within limits.
ºC = degrees centigrade
RPE = relative percent error

Lower Neches Valley Authority EMRS Project

The Lower Neches Valley Authority (LNVA) operates CAMS 749 at Pine Island Bayou. The LNVA uses SC/TDS and turbidity data on a near real-time basis. The LNVA may divert water from Pine Island Bayou to supply a secondary source of freshwater to various consumers. SC/TDS data provides information from potential storm-related saltwater intrusions into Pine Island Bayou. Turbidity data provides LNVA information about potential water treatment needs of this secondary source of water. Turbidity data records are not validated.

Table A7.1.4
Quality Objectives
LNVA Multiprobe CAMS 749

Parameter	Drift (CVS) Acceptance Limits[1]	SOP
Turbidity	± 3 NTU/FNU or 5 RPE[1]	Analysis of In-Situ Turbidity in Ambient Surface Water at Pine Island Bayou for the Environmental Monitoring Response System using YSI EXO Multiprobes, Rev. 0
Total Dissolved Solids	For Acceptance Limits see Table A7.1.2	Analysis of In Situ Dissolved Oxygen, Specific Conductance, pH, Water Temperature, and Sample Depth in Ambient Surface Water Using Yellow Springs Instrument EXO Multi-probes, Rev. 0

[1] CVS criteria are used to ensure measurement equipment is operating within limits.
FNU = Formazin Nephelometric Units
NTU = Nephelometric Turbidity Units
RPE = relative percent error

Lower Rio Grande EMRS Project

SC and temperature sensor multi-probes are deployed at seven stations downstream from Falcoń Reservoir. The stations were designed and deployed to automatically alert the TCEQ via email when estimated TDS concentrations exceed established notification levels. The stations are currently serviced on a monthly basis to confirm operation and, to the extent possible, to ensure the stations are producing data of known quality at the completion of the service.

Table A7.1.5
Quality Objectives
TCEQ Multiprobe CAMSs 736, 767, 789, 791, 792, 793, and 796

Parameter	Temperature Acceptance Limit	SOP
Specific Conductance/ Total Dissolved Solids	±0.5 ºC [1]	In Situ Analysis of Electrical Conductivity and Water Temperature and Estimation of Total Dissolved Solids in Ambient Surface Water for the Lower Rio Grande Environmental Monitoring and Response System Using Hydrolab-Hydrotech Compact Minisondes, Rev. 3

[1] Temperature check criteria are used as guidelines to ensure measurement equipment is operating within limits
ºC = degrees centigrade

A7.2 USGS Stream Stage and Discharge Quality Objectives

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at various stations around the state. See Table A5.1 for USGS station locations and parameters.

A7.3 Representativeness

By design, the CWQMN measures water quality in greater temporal detail and resolution than is possible with grab samples or short-term deployments of monitoring

instrumentation. See Section B2.1 for information concerning multiprobe deployment and sampling.

A7.4 Comparability

CWQMN water quality measurements are based on *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998, unless otherwise noted. Comparability is also achieved by using SOPs, reporting data in standard units by using accepted rules for significant figures, and by reporting data in standard formats.

As previously discussed in Section A7.1, USGS applies prorated data adjustments to data records based on multiprobe fouling and drift measurements for the Rio Grande River, Pecos River, and Arroyo Colorado basin stations. The TCEQ does not adjust data records.

A7.5 Bias

Definitions for bias are provided in Appendix A. Determining and calculating bias for the purposes of this quality assurance project plan is discussed in Section B5.

A7.6 Completeness

A general requirement for data completeness has been set at 75 percent data return. Periods of no flow or dry conditions necessitate shutdown of some instrumentation and these times are not considered in the goal for data completeness. Data completeness is discussed in Section C.

A8 Special Training/Certification

Work conducted for this project is covered under a documented quality management system. Personnel conducting work associated with this project are deemed qualified to perform their work through educational credentials, specific job/task training, demonstrations of competency, and internal and external assessments.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at stations on the Upper Rio Grande River, Pecos Rivers, and Arroyo Colorado basins. See Section A2.6 for the internet locations of USGS Guidelines and Procedures. USGS Texas Water Science Center QAPPs are also listed in Section A6.2 and are available upon request.

Personnel covered by this QAPP may be TCEQ employees, cooperators, or external contractors. Agency organizations and staff and external contractors are bound by the requirements delineated the TCEQ QMP. TCEQ training records are maintained according to TCEQ agency policy. Contractor training records are maintained by their respective employers and are available for review.

Position descriptions for key personnel detail major responsibilities and qualifications for TCEQ staff and external contractors. The network maintains quality assurance project plans for data collection activities for water quality monitoring, as well as Standard Operating Procedures for the use of monitoring instruments and station operation.

Project Readiness Reviews may be conducted when a new contractor begins work or a new station is installed to ensure that personnel are competent to produce data for the network. Technical Systems Audits and Performance Evaluation Audits are periodically conducted and on an as-needed basis as described in Section C1 and in Table C2.1.

All participants in the network have been successful, ongoing contributors. Work conducted under this revision of the QAPP is similar or identical to the work performed by these participants in the past.

Remove A9 Documents and Records

The CWQMN QAPP, Project Plans, SOPs, Audit Reports, and Finding Summary Reports are filed and maintained by the SWQM Central Office. Measurement data and other station information can be found on TCEQ's CWQMN website. Various SOP worksheet forms and certificate of analysis are filed and maintained by stations operators.

Each station operator is expected to maintain records that include sufficient information to reconstruct each final reported measurement from the variables originally gathered in the measurement process. This includes, but is not limited to, information (raw data, electronic files, and/or hard copy printouts) related to measurement instrument calibration, QC checks of sampling or measurement equipment, "as collected" measurement values, an audit trail for any modifications made to the "as collected" measurement values and traceability documentation for reference standards.

Difficulties encountered during sampling or analyses are documented in operator logs to clearly indicate the affected measurements.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at stations on the Upper Rio Grande, Pecos Rivers, and Arroyo Colorado basins. See Section A2.6 for the internet locations of USGS Guidelines and Procedures. USGS Texas Water Science Center QAPPs are also listed in Section A6.2 and are available upon request.

A9.1 Documentation of Procedures and Objectives

1. Published guidance (Code of Federal Regulations EPA, and EPA Quality Assurance Handbook)
2. CWQMN Project Plans
3. Project/instrument specific SOPs
4. Instrument manufacturer's user manuals
5. TCEQ QMP, SOPs, and the CWQMN Quality Assurance Project Plan
6. TCEQ SWQM Procedures, Volume 1
7. *United States Geological Survey* – Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting TM1D3
8. USGS/TCEQ - *Adaptation of Data Validation and Fouling Correction Procedures for Water-Quality Monitoring Stations on the Upper Rio Grande and Pecos River (May 2013)*

A9.2 Record Keeping

CWQMN written records are kept for five years. Electronic records are kept indefinitely or for a life of a project. Please see Table A9.1 for type of record and location.

Table A9.1

CWQMN Record Location

Record	Location
Sampling Information	TCEQ Website
Project/Instrument-specific SOP worksheet forms	TCEQ Regional offices/Cooperators/Contractors
Certificate of Analysis for pH and Conductivity standards	TCEQ Regional offices/Cooperators
Multi-probe sensor component replacement and multi-probe repairs records for TCEQ non-EMRS stations	Instrument-specific logbook or electronically in the comment Section of Post Deployment Excel Worksheets.
LEADS electronic Operator logs and Validator logs	CFEP
Validators notes	Data Validators office/LEADS
Post Deployment Worksheets (Excel Workbooks)	WQPD Austin Server
CWQMN Project Plans	SWQM Central Office
Standard Operating Procedures	http://www.tceq.texas.gov/waterquality/monitoring/swqm_realtime.html
Technical systems, performance evaluation audits, and readiness reviews	SWQM Central Office

CFEP = Comms Front-End Processor computer located at TCEQ headquarters in Austin, Texas
WQPD = Water Quality Planning Division

A9.3 Data Reporting

CWQMN environmental data is stored electronically in the LEADS. Selected validated CWQMN data may be loaded into the SWQMIS database. See Section B10 and Sections D1 and D2 for more details.

A9.4 Documentation Control Plan

This section describes the procedure and responsibilities for document control used by the TCEQ CWQMN Project for environmental sample collection and analysis.

All SOPs must have a document title, a revision number, approval signatures, and effective date. SOPs are formally reviewed and re-signed on an as needed basis. SOPs stay in effect until superseded by a later version or the project is completed.

The current QAPP and official SOPs are available via the internet at: (http://www.tceq.texas.gov/waterquality/monitoring/swqm_realtime.html)). Project Plans are available upon request.

It is the responsibility of each CWQMN participant to ensure they are properly following the most current revision of these documents.

Standard Operating Procedure Approval Signatures

In addition to TCEQ Monitoring & Assessment managers, TCEQ regional managers may also sign SOPs when their staff perform work under the SOPs. SOPs that are specific to a station/project may be also be signed by cooperators who are performing the work. At a minimum the CWQMN QC Officer signs all SOPs.

Handwritten Documents

Indelible ink will be used for all hand-written documents. Changes made to hand-written documents must be done by using a single line to strike-out the text. The changes are then initialed and dated.

B1 Sampling Process Design

B1.1 Network Design/Siting Rationale

The CWQMN measurement stations and parameters are outlined in Tables A5.1 – A5.3.

B1.2 CWQMN Station Proposals

The TCEQ continues to improve the CWQMN. TCEQ accepts suggestions for new CWQMN stations. Interested parties may download the CWQMN Pre-Proposal Form (link to Pre-Proposal Form), complete the form and submit it to swqm@tceq.texas.gov. Pre-Proposals will be evaluated by a TCEQ panel familiar with the project river basin. TCEQ will consider the data need and expected use, the availability of instruments to monitor the water quality parameter of concern, and the availability of TCEQ and/or in-kind resources for deployment, operation, maintenance, and/or data validation when evaluating project proposals. TCEQ will evaluate each proposal submitted and may, or may not, develop and deploy the proposed project. TCEQ will consider the information submitted, the data need/use to be addressed, the availability of TCEQ and in-kind resources in the evaluation of the proposed project.

United States Geological Survey Stations

The USGS has been contracted by TCEQ to collect, validate, and report water quality and discharge monitoring data from stations in the Upper Rio Grande, Pecos River, and Arroyo Colorado basins (See Section A5.1). See Section A2.6 for the internet locations of USGS Guidelines and Procedures. USGS Texas Water Science Center QAPPs are also listed in Section A6.2 and are available upon request.

B2 Sampling Methods

Continuous monitoring multiprobe sensors measure water quality *in situ*. Table B2.1 lists equipment, sampling method, and telemetry methods for each CWQMN station.

The USGS has been contracted by TCEQ to collect, validate, and report water quality and discharge monitoring data from stations in the Upper Rio Grande, Pecos River, and Arroyo Colorado basins (see section A5.1) following USGS guidelines and procedures. See Section A2.6 for the internet locations of USGS Guidelines and Procedures. USGS Texas Water Science Center QAPPs are also listed in Section A6.2 and are available upon request.

B2.1 TCEQ Multiprobe Monitoring Methods and Equipment

Discrete multiprobe in-situ water quality and sample depth measurements are logged once every 15 minutes by a Sutron data logger. The data are transmitted via wireless modem or GOES to the TCEQ LEADS system in Austin, Texas, where the data are ingested and archived. Data are then posted to the appropriate TCEQ internet site.

Support equipment is usually installed in a weather-tight aluminum “Traffic Box” containing a data logger, wireless cellular modem, deep cycle battery, and a solar charge controller. Solar panels are installed for battery charging purposes. If wireless cellular service is available at the monitoring station, a wireless modem is used to transmit data to TCEQ. In remote areas, equipment can be installed that will relay data using GOES. Table B2.1 describes equipment, sampling method, and telemetry method for specific CWQMN stations.

Station multi-probes are typically deployed at a fixed position in the water column using poly vinyl chloride (PVC) deployment tubes that are attached to support structures. PVC deployment tubes have at least 48 evenly spaced 1-inch diameter holes per linear foot for at least the lower two feet of the deployment tube to allow water to flow across the sensors.

TCEQ Surface Water Quality Procedures, Volume 1, prescribes collecting multi-probe data at a location that is representative of the water body in the centroid of flow and within the mixed surface layer at 0.3 meters of depth. Depending on the monitoring location, it may not be possible to locate deployment tubes in or near the centroid of flow.

Deployment tubes are typically positioned to collect data during low water levels. As a result, data can be collected at depths greater than 0.3 meters during higher water levels. In general, (non-tidal streams) flowing waters remain mixed and unstratified.

When buoys or other floatation devices are used to deploy multi-probes at stations with variable water levels, the multi-probes must collect data at approximately 0.3 meters during periods of no stream flow.

Bosque River SC EMRS Station Deployment and Sampling

Multiprobes are deployed in dry rainfall-dependent creek channels. During rainfall run-off events, water quality is measured *in-situ*. When no water is present, measurements are collected from dry creek channels.

USGS Operated Multiprobe Stations
In-situ water quality measurements are logged once every 15 minutes by the data logger. The data are transmitted by GOES telemetry to the USGS National Water Information System, and then delivered to LEADS system in Austin, Texas where the discrete data are stored. Vertical profile data from the Arroyo Colorado are not delivered to the LEADS system. Data are averaged into one-hour averages and displayed on the external TCEQ web pages and on an external USGS web display (NWIS Web).

USGS Stage and Discharge Measurements
For stream discharge, USGS hydrographers develop and maintain a stage to discharge rating. A "Look-up Table" is developed for each station, this table is used to provide discharge values for a given stage measurement. Stream discharge data is periodically uploaded from USGS to the TCEQ LEADS system.

Stage and water quality measurements are logged once every 15 minutes by the data logger. The data are then transmitted to the LEADS system in Austin, Texas where the data are stored. Data are averaged into one-hour averages and displayed on the external TCEQ web pages and on an external USGS web page (NWISWeb).

Limitations and Performance Criteria
See Section A7 for performance criteria for the network.

Table B2.1

Monitoring Methods and Equipment

CAMS	Station Location	Measurement Method	Measurement Equipment	Telemetry	Station Parameters
759	Rio Grande at Fosters Ranch upstream of Amistad Reservoir	Multiprobe: *In situ*	YSI 6600 EDS	GOES	Surface Water Temperature SC DO pH
757	Rio Grande upstream of the confluence of Rio Conchos near Presidio, TX		YSI 6920		
758	Rio Grande downstream of the confluence of Rio Conchos near Presidio, TX				
803	Rio Grande River at Santa Helena Canyon, Big Bend National Park		YSI 6600 EDS		
721	Rio Grande River at Rio Grande Village, Big Bend National Park	Multiprobe: *in-situ*, swing pipe installation, Bubbler	YSI 6920 DA H350/355		Surface Water Temperature SC DO pH Gage Height, Discharge
720	Rio Grande at Castolon, TX Big Bend National Park	Bubbler	DA H350/355		Gage Height, Discharge
788	Pecos River near Red Bluff New Mexico	Multiprobe: *In situ*	YSI 6920		Surface Water Temperature SC
798	Pecos River near Orla, TX	Multiprobe: *In situ*	YSI 6920		Surface Water Temperature SC/TDS DO
709	Pecos River at FM 1776 near Coyanosa, TX				
785	Pecos River near Girven upstream of US 67/385	Bubbler	DA H350/355		CAMS 709, 729, 735, and 807 Gage Height, Discharge (Low Range)
807	Pecos River near Pecos, TX, at FM 3398				
729	Pecos River near the Terrel/Val Verde/ Crocket County lines				
799	Lower Pecos at IBWC discharge monitoring location near Langrty, TX				

Table B2.1

Monitoring Methods and Equipment (continued)

CAMS	Station Location	Measurement Method	Measurement Equipment	Telemetry	Station Parameters
735	Pecos River near US Hwy 290 Southeast of Sheffield, TX				
730	Arroyo Colorado Tidal at Rio Hondo FM 106 Bridge	Multiprobe: *In situ* OTT Vented Pressure Transducer	EXO 3	GOES & Wireless Modem	Vertical Profile Water Temperature DO SC Gage Height
767	Rio Grande at Roma, Texas	Multiprobe: *In situ*	Hydrolab-Hydrotech MiniSondes	Wireless Modem	Surface Water Temperature SC/TDS
796	Rio Grande downstream of Arroyo Los Olmos				
789	Rio Grande ~3.45 miles upstream of the of the bridge at County Rd. 409 (Harlingen Irrigation DST #1)				
791	Rio Grande ~2.7 miles upstream of the confluence with El Morillo Drain (United Irrigation DST)				
792	Rio Grande ~2.5 miles downstream of the confluence of El Morillo Drain (Hidalgo County Irrigation DST#18)				
793	Rio Grande ~5.0 miles downstream of FM 1015 (Hidalgo County and Cameron County Irrigation District #9)				
736	Rio Grande (Anzalduas Dam) near Pier 7				
768	Devils River downstream of (SH 163) Baker's Crossing	Multiprobe: *In situ*	YSI EXO 2	GOES	Surface Water Temperature SC/TDS DO pH Sample depth
764	Independence Creek at Caroline Springs (T-5) on the Nature Conservancy's Independence Creek Preserve south of Sheffield, TX	Multiprobe: *In situ*	YSI 6920	GOES	Surface Water Temperature SC
808	San Solomon Springs southern discharge canal at Balmorhea State Park in Toyahvale, TX	Multiprobe: *In situ*	YSI EXO 1	Wireless Modem	Surface Water Temperature SC pH Sample Depth

Table B2.1

Monitoring Methods and Equipment (continued)

CAMS	Station Location	Measurement Method	Measurement Equipment	Telemetry	Station Parameters
804	Tributary of Upper Green Creek near the intersection of CR385 and 382	Multiprobe: *In situ* *Multiprobes located in dry rainfall-dependent creek channels*	In-Situ Aqua TROLL 200	Wireless Modem	SC Temperature Sample depth
765	Un-Named Tributary of Little Duffau Creek near FM 1824				
805	Indian Creek just east of U.S. Hwy 281				
728	Little Duffau Creek near FM 1824				
726	Scarborough Creek at CR 423				
749	Pine Island Bayou at Lower Neches Valley Authority Pump Station near U.S. Hwy 69	Multiprobe: *In situ*	YSI EXO 3		Surface Water Temperature SC/TDS DO pH Turbidity Sample Depth

DA = design analysis
DO = dissolved oxygen
GOES = Geostationary Operational Environmental Satellite
SC = specific conductance
TDS = Total Dissolved Solids. TDS is calculated from SC using TCEQ's correction factor of 0.65.
USGS = United States Geological survey
YSI = Yellow Springs Instrument

B2.2 Sampling/Measurement System Corrective Action

Corrective action measures in the CWQMN will be taken to ensure the DQOs are attained. The station operator is responsible for monitoring the performance of the measurement and support equipment and identifying problems or potential problems.

It is expected that any individual in the CWQMN who discovers a problem will initiate corrective action appropriate to the situation. Corrective action is accomplished at the lowest level and shall be documented in the LEADS operator log. The QC Officer and Network Coordinator must be notified of any proposed corrective action that can affect data quality and/or CWQMN protocols. When problems are identified that cannot be resolved by the station operator, the station operator notifies the Network Coordinator. The Network Coordinator is responsible for coordination with appropriate personnel to resolve the problems.

The Network Coordinator and the CWQMN QC officer are responsible for coordinating the necessary supply and parts shipments to the station operator. When necessary, personnel from MD travel to a particular station to repair or replace support equipment that cannot be repaired or replaced by the station operators. Monitoring equipment that cannot be repaired by TCEQ staff is sent back to the manufacturer if within the equipment's warranty period; if not, the equipment is sent to a qualified vendor for

repair. If monitoring equipment cannot be repaired or if it is not economical to repair a piece of equipment, the equipment may be surplused.

Some CWQMN stations are located in or near flood plains. Consequently, various CWQMN stations have the potential to be damaged or destroyed by flood waters during severe floods. Potential flooding is a consideration in the station development process. Additionally, multiprobes, sampling and/or support equipment are located in stream beds and are subject to frequent flooding. These components are secured to the stream banks and have proved capable of surviving a given flood. However, it is accepted that the support systems and components will need periodic replacement and repair.

B3 Sample Handling and Custody

See Section B10 for electronic managing of CWQMN data. Water quality is measured *in situ* for the multiprobe instrumentation.

B4 Analytical Methods

Water quality measurement methods used by the CWQMN are based on the *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998, unless otherwise noted.

Section A7 summarizes and lists procedures and quality objectives for the various CWQMN projects/CAMSs. CWQMN measurement equipment and analytical methods are listed in Tables B4.1, and B4.2.

Analytical system corrective actions are addressed in Section C1 of this quality assurance project plan.

For stations following TCEQ procedures, instrument and project-specific analytical SOPs are used to document procedures necessary to perform the method and to operate a specific instrument.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at stations on the Upper Rio Grande, Pecos River, and Arroyo Colorado Basins. See Section A2.6 for the internet locations of USGS Guidelines and Procedures. USGS Texas Water Science Center QAPPs are also listed in Section A6.2 and are available upon request.

The TCEQ and USGS use water quality measurement methods found in Table B4.1.

Table B4.1

CWQMN Multiprobe Analytical Methods

Parameter	LEADS Parameter Code	Units	Measurement Equipment	Method
pH	10400	pH/units	YSI 6-Series, YSIEXO	Glass electrode, Standard Method 4500-H+B
DO[1,2]	10300	mg/L	YSI 6-Series, YSI EXO	Optical (luminescence quenching) ASTM D888-05
SC[4]	10095	µS/cm	YSI 6-Series, YSI EXO In-Situ Aqua TROLL 200 Hydrolab-Hydrotech	Conductivity cell, Standard Method 2510B
Turbidity[1]	10104	NTU[3]	YSI EXO	Method number ISO 7027
Temperature	10010	ºC	Thermistor	Standard Method 2550 B
Sample Depth	10078	Feet	YSI 6-Series, YSI EXO, In-Situ Aqua TROLL 200	Pressure Transducer
TDS	10294	mg/L	YSI 6-Series, YSI EXO In-Situ Aqua TROLL 200 Hydrolab-Hydrotech	Calculated by LEADS. SC measurements are multiplied by TCEQ's Statewide conversion factor 0.65

[1]Method not based on *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998. U. S
[2]Environmental Protection Agency (EPA) Region 6 has approved Optical DO methods for use in the CWQMN.
[3]LEADS reports turbidity measurements in NTUs. USGS reports FNU (parameter code 63680) and TCEQ will recode the unit values as NTU (LEADS parameter code 10104) in order to populate the LEADS database until an appropriate Surface Water Quality Monitoring Information System (SWQMIS)/EPA Storage and Retrieval Database (STORET) code can be identified.
[4]Modern conductivity sensors utilize auto-ranging sensors.
°C = degrees centigrade
mg/L = milligrams per liter
µS/cm = micro siemens per centimeter
ASTM = American Society for Testing and Materials
DO = dissolved oxygen
FNU = Formazin Nephelometric Units
ISO = International Organization for Standardization
LEADS = Leading Environmental Analysis and Display System
NTU = Nephelometric Turbidity Unit
TDS = total dissolved solids
YSI = Yellow Springs Instrument

Sample Depth Measurement Methods

YSI multiprobes utilize non-vented pressure sensors to measure sample depth. Aqua TROLL 200 multiprobes utilize vented pressure sensors. Vented sensors correct sample depth measurements for changes in barometric pressure.

Table B4.2

Water level and Sample Depth Analytical Methods

Instrument/Parameter	LEADS Parameter Code	Units	Range	Method
(YSI EXO Multiprobes) Sample Depth	10078	Meter	Various	Non-vented Pressure Transducer
(Aqua TROLL 200)- Sample Depth	10078	Meter	Various	Vented Pressure Transducer

LEADS = Leading Environmental Analysis and Display System

CWQMN Turbidity Method

Pine Island CAMS 749 turbidity measurement methods are not based on *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998. Currently, the CWQMN utilizes ISO Method 7027 for turbidity. The turbidity data generated by ISO Method 7027 are not appropriate for regulatory purposes. A variety of measurement techniques can be used to measure turbidity. Data from differing instrumentation and sample matrixes can be highly variable. The only approved EPA method for turbidity is EPA Method 180.1. EPA Method 180.1 utilizes a white or broadband light source. Data produced by Method 180.1 are reported as NTU and is a laboratory method.

ISO Method 7027 turbidity measurements are made using near-infrared (780 – 900 nanometers) or monochrome light source with single-detector nephelometry at a 90-degree angle making it compliant with ISO Method 7027. Formazin Nephelometric Units (FNU) are the designated measurement units for data collected using this ISO method. The CWQMN uses NTUs to report turbidity data collected by the ISO Method 7027 until the appropriate SWQMIS/Parameter code can be identified. All CWQMN

turbidity data stored in LEADS is coded as NTU. When the appropriate parameter code is identified, the parameter code will be updated for all CWQMN turbidity data.

B5 Quality Control (QC)

Quality Control includes technical activities that measure the attributes and performance of the sampling and analysis process against defined standards to verify that they meet the needs of the project. Data quality is measured, assessed, and controlled, according to procedures and criteria in TCEQ instrument/project-specific SOPs. Audits can also be used to assess data quality.

Project/station-defined quality objectives are specified in Section A7.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at stations on the Upper Rio Grande, Pecos River, and the Arroyo Colorado basins. See Section A2.6 for the internet locations of USGS Guidelines and Procedures. USGS Texas Water Science Center QAPPs are also listed in Section A6.2 and are available upon request.

B5.1 TCEQ Multiprobe Quality Control

Section B5.1 is intended to summarize TCEQ CWQMN QC activities. For complete details, TCEQ SOPs are available at: (http://www.tceq.texas.gov/waterquality/monitoring/swqm_realtime.html)

TCEQ-operated stations include EMRS and non-EMRS stations. Data from EMRS stations are used on a near-real time basis to screen water quality for a variety of purposes. EMRS data records are not validated. Non-EMRS station data records are validated using results from QC measurements. See Table B5.1.1 for CAMS designations and TCEQ SOPs followed at each station.

Table B5.1.1

TCEQ-Operated CAMS Designations and SOPs

CAMS	Station Designation	Multiprobe Instrument	SOP
749, 768, 808	Non-EMRS	YSI EXO	Analysis of *In Situ* Dissolved Oxygen, Specific Conductance, pH, Water Temperature, and Sample Depth in Ambient Surface Water Using Yellow Springs Instrument EXO Multi-probes, Rev. 0
736, 767, 789, 791, 792, 793, 796	EMRS	Hydrolab-Hydrotech Minisonde	*In Situ* Analysis of Electrical Conductivity and Water Temperature and Estimation of Total Dissolved Solids in Ambient Surface Water for the Lower Rio Grande Environmental Monitoring and Response System Using Hydrolab-Hydrotech Compact Minisondes Rev. 3
726, 728, 765, 804, 805	EMRS	Aqua TROLL 200	TCEQ - Analysis of In-Situ Specific Conductance, Water Temperature, and Sample Depth for the Bosque River Environmental Monitoring Response System Using Aqua TROLL 200 Multi-probes, Rev. 2
749	EMRS	YSI EXO	Analysis of *In-Situ* Turbidity in Ambient Surface Water at Pine Island Bayou for the Environmental Monitoring Response System using YSI EXO Multiprobes, Rev.0

EMRS = Environmental Monitoring Response system
YSI = Yellow Springs Instrument

Non-EMRS Multiprobe Quality Control

Quality control measurements consists of measuring sensor fouling and calibration drift. Temperature sensors are checked with NIST-traceable thermistors at the conclusion of deployments. Sensor fouling is measured using USGS-based procedures. Fouling measurements are estimates of environmental effects on sensor performance. Results from these QC checks are used to validate station data records over the course of the multiprobe deployment periods.

Multiprobe Sensor Fouling and Drift

The USGS-based fouling measurement procedures are designed to measure the potential combined effects of various forms of sensor and deployment tube fouling on sensor performance. The procedure measures and compares the responses of non-cleaned and cleaned sensors and deployment tubes in the water body at the conclusion of deployment periods. Sensor drift is also measured at the conclusion of deployments using standards.

Total Error Multiprobe Fouling and Drift

The sum (Total Error) and individual fouling and drift measurements are compared against project quality objectives.

1.0 Total error (*T)* for DO, pH, and conductivity is expressed as the sum of fouling (*F*) and calibration drift (C_d).

$$T = F + C_d$$

Where:

F = fouling; and

C_d= calibration drift.

2.0 Change in water quality (C_w) during the fouling measurement procedure (for DO, pH, SC, and temperature) is determined by the field meter.

$$C_w = F_i - F_f$$

Where:

F_i = field meter response initial; and

F_f = field meter response final.

As part of the fouling measurement procedure, an additional multiprobe/field meter is deployed at the same location as the deployed multiprobe. Field meter measurements are made at the beginning and at the conclusion of the procedure. Field meter measurements are used to correct fouling measurements for any

changes in water quality that have occurred during the fouling measurement procedure.

Fouling measurement procedures are intended for use in situations when water quality conditions are not considered rapidly changing or fluctuating. The USGS defines (*TM1D3*) rapidly changing for DO, EC, pH and temperature as follows: "*Rapid change is relative to the length of time needed to service the monitor and generally is defined as a change that exceeds the (USGS) calibration criteria within 5 minutes"*. If changes in water quality exceed criteria found in Table B5.1.2 for a given parameter(s), the fouling measurement is not considered valid and the corresponding data are invalidated. This is general criteria and station-specific change in water quality criteria can be developed.

Table B5.1.2

USGS Change in Water Quality Criteria

Parameter	USGS Criteria
SC	±5 µS/cm or 3% use greatest value
DO	±0.3 mg/l
pH	±0.2 pH units

3.0 Multiprobe conductivity sensor fouling (*F*) is evaluated by using RPE to compare not cleaned and cleaned conductivity sensor responses:

$$F = \left(\frac{\left(S_i - S_f\right) - \left(F_i - F_f\right)}{S_f} \right) 100$$

Where:

S_i = sensor response initial (not cleaned);

S_f = sensor response final (cleaned);

F_i = field meter response initial; and

F_f = field meter response final.

4.0 Multiprobe, DO (mg/l), pH (SU), and temperature (ºC) sensor fouling (*F*) is evaluated by using Absolute Error (AE) to compare not cleaned and cleaned sensor responses:

$$F = \left(S_i - S_f\right) - \left(F_i - F_f\right)$$

Where:

S_i = sensor response initial (not cleaned);

S_f = sensor response final (cleaned);

F_i = field meter response initial; and

F_f = field meter response final.

Temperature sensor fouling measurements are collected for informational purposes. Temperature sensors are not typically affected by fouling unless an extreme fouling event has occurred that has plugged sensors and deployment tubes with sediment. When this occurs, all collected data (DO, SC, pH, and Temperature) are invalidated back to the last service event.

Sensor Calibration Drift

Multiprobe sensor calibrations are assessed at the conclusion of deployment periods using CVSs. The CVS is prepared from the same standard used to generate the initial calibration curve.

5.0 Multiprobe conductivity sensor calibration drift (C_d) is evaluated using RPE:

$$C_d = \frac{(S_r - S_v)}{S_v}(100)$$

Where:

S_r= sensor response; and

S_v = specific conductance KCl standard value.

6.0 DO and pH C_d is evaluated using AE:

$$C_d = (S_r - S_v)$$

Where:

S_r = DO or pH sensor response; and

S_v = DO mg/l theoretical value; pH buffer standard value

Known Multiprobe Fouling Measurement Limitations

- Fluctuating water quality or unstable sensors can cause fouling measurement errors. When performing the procedure, multiprobe sensor measurements must not be fluctuating due to changes in water quality or sensor instability. Measurement stability criteria have not been developed.

- In some streams, scouring events can clean sensor interfaces and deployment tubes prior to performing the fouling measurement procedure; this can result in the measurement not being representative of the entire deployment period.
- At some locations (and/or times of year) there is not enough stream flow to disperse biological and/or sediment debris clouds that can result from deployment tube cleaning activities. The debris can cause changes in water

quality that are not representative of stream conditions and can skew Sensor Response Final (S_f) and Field Meter Final (F_f) measurements. Debris clouds can also cause water quality measurements to fluctuate. Consequently, during low or no stream flow, station operators at some stations are allowing significant amounts of time to elapse for debris clouds to disperse before S_f and F_f measurements are recorded. Due to extended time allowed, changes in water quality can exceed Table B5.1.2 criteria as measured by the field meter.

- Fouling measurement procedures compare the responses of non-cleaned and cleaned sensors in the water body. The effectiveness of sensor cleaning activities is not assessed quantitatively.

EMRS Quality Control

EMRS multiprobe data are used on a near real-time basis. Data records for these stations are not validated. For high quality data, sensors and deployment tubes must be kept free of fouling through multi-probe and deployment tube cleanings.

Bosque River (stations 726, 728, 765, 804, and 805) and Pine Island (station 749)

Multiprobe exchanges occur at a minimum of once a month, Quality Control consists of monthly SC sensor calibrations, measuring sensor calibration drift, , and checking temperature sensors. These checks are conducted to ensure the multiprobes are operating within limits.

Lower Rio Grande (stations 767, 796, 789, 791, 792, 793, and 736)

Multiprobe exchanges at the Lower Rio Grande stations occur at a minimum of once every month. Quality control consists of monthly SC sensor calibrations, temperature sensor checks, and deployment tube cleanings.

Multiprobe Temperature Checks

After every deployment period (EMRS and non-EMRS stations), multiprobe temperature sensors are checked in the laboratory against NIST-traceable thermistors. The criterion for this check is ±0.50 ºC. For non-EMRS stations, when a multiprobe fails this check, temperature, DO, and SC data collected during the deployment are invalidated. Calculated TDS concentrations are also invalidated.

Multiprobe Deployment Tube Cleaning

A variety of organisms and sediment can foul multiprobe deployment tubes. Deployment tube fouling can compromise data quality. Every multiprobe deployment tube in the network must be cleaned with a chimney brush as part of every routine service event. Bosque River EMRS stations do not utilize deployment tubes. Multiprobes are secured to stream beds by various means.

Multiprobe Anti-Fouling Measures

Multiprobes can be equipped with various anti-fouling measures. Anti-fouling measures can improve data quality and increase deployment periods. USGS-based fouling measurement procedures can be useful in evaluating the various anti-fouling measures. YSI EXO 2 and 3 multiprobes are equipped with a central wiper that brushes sensors

prior to each measurement. Wiper brushes must be cleaned or replaced prior to each deployment period.

Multiprobe Sample Depth Measurements

CWQMN sample depth measurements are used qualitatively. Data from these measurements are not assessed for accuracy.

Station Monitoring

Every business day, all CWQMN station operators must monitor and screen water quality measurements, sample depth measurements, and station communications for anomalies. If problems are identified, a station visit may be needed to correct any problems.

B5.2 Corrective Action Related to QC

Any deviation from the procedures documented in the SOP should be documented in the operators log by the station operator. The log entry should contain a description of the exception, the cause (if possible), the affected data, and the impact on the data record. Any affected data should be qualified by a data validator accordingly. **Note:** A failing QC sample can be followed by a single replicate analysis to determine if there is a systematic problem. If the replicate analysis meets all acceptance criteria, then the system may be deemed as providing acceptable data. Conducting multiple analyses, however, to obtain a single passing QC sample when no corrective action as a result of an assignable cause or instrument maintenance is performed is not acceptable. If either the original QC sample or its rerun passes, then the failing QC analysis is considered to be an anomaly, and its results are not used for data assessment. Best professional judgment is needed at times to determine if the QC sample is representative of ambient measurements. QC sample anomalies should be documented.

B6 Instrument/Equipment Testing, Inspection and Maintenance

Instruments and equipment for specific projects included in the *CWQMN QAPP* may be funded by any combination of federal funds (Clean Water Act Sec 106 or other federal grants) and/or non-federal funds (state and local funds).

Multiprobe maintenance activities are documented in equipment dedicated logbooks or electronically in the comment Section of the Post Deployment Excel Worksheets. This requirement only applies to TCEQ non-EMRS stations. Records must include multi-probe repair information, sensor component replacements, and the dates of these activities.

Other helpful information can include symptoms, troubleshooting effort descriptions, results, and follow-up observations. Records can aid future troubleshooting. TCEQ maintenance documents are based on manufacturers' recommendations.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at stations on the Upper Rio Grande, Pecos River, and Arroyo Colorado Basins. See Section A2.6 for the internet locations of USGS Guidelines and Procedures. USGS Texas Water Science Center QAPPs are also listed in Section A6.2 and are available upon request.

Multiprobes

Manufacturers user manuals are used as guidance for maintenance activities.

Multiprobe Optical DO Membranes (YSI)

The manufacturer recommends replacing optical DO membranes on an annual basis. Among the reasons for replacing membranes provided by the manufacturer is degradation of the luminescence dye in the sensing element due to photo-bleaching and membrane age. According to the manufacturer, as the membranes age, they lose accuracy at the low-end first. The low-end was defined as less than 1.0 mg/l.

Optical DO calibration adjustments are automatically tracked through changes in sensor gain. The manufacturer recommends DO calibrations be rejected and the sensor not be used to collect data when a calibration causes the gain to exceed acceptance criteria. When a sensor exceeds gain criteria, the problem can be associated with membrane or other sensor components.

Optical DO membranes are coated with a black material to keep ambient light from causing sensor measurement interferences. In abrasive stream environments, DO wiper pads can trap abrasive particles and damage membrane coatings. If coatings are scratched off by more than 25%, the membrane must be replaced.

The current TCEQ policy is to routinely replace optical DO membranes every twelve months. The date the membrane is installed on the DO sensor is considered the starting date for the twelve-month replacement frequency. See TCEQ YSI EXO SOP Rev. 0 for membrane replacement and documentation instructions.

B7 Instrument Calibration and Frequency

Before multiprobe deployments, calibration standards are analyzed to establish instrument response. Concentrations or constituents are calculated using single-point and multi-point calibration responses.

Standards

Calibration and CVSs shall be National Institute of Standards and Technology (NIST) - traceable standards. All CWQMN multiprobe conductivity and pH standards must have a Certificate of Analysis (COA) that contains traceability and accuracy statements. Expired standards cannot be used.

Pine Island Bayou CAM749 Formazin Turbidity Standards

Turbidity sensors are calibrated using Hach Formazin standards and reagent grade water. Class A pipettes are used to dilute a 4000 NTU Formazin standard.

Instrument Calibrations

Single-point or multi-point calibrations are performed whenever:

1. The instrument response has drifted so that the CVSs or other quality control checks do not meet established acceptance criteria; or
2. Instrumentation is calibrated at routine frequencies; or
3. Prior to *in situ* field deployment.

Multiprobe Temperature Sensor Checks

After every deployment period, network multiprobe temperature thermistors are checked against NIST- traceable thermistors; the TCEQ employs single-point checks using tap water in a temperature-controlled environment.

The TCEQ station operators and cooperators have been issued digital thermistors. These thermistors must be re-certified/calibrated every two years. The stated accuracy of these thermistors is ± 0.05 °C. Since the checks are not conducted in a circulated vessel of water, there can be an additional 0.05 °C approximate error with the method.

On an annual basis, USGS station operators use NIST-traceable thermistors to check multiprobe thermistors in a circulated water bath.

USGS Instrument Calibration and Frequency

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at stations on the Upper Rio Grande, Pecos River, and Arroyo Colorado basins. See Section A2.6 for the internet locations of USGS Guidelines and Procedures. USGS Texas Water Science Center QAPPs are also listed in Section A2.6 and are available upon request.

As part of TCEQ's contracts with USGS, multiprobes must be calibrated in a temperature-controlled environment at a minimum of once a month.

B8 Inspection/Acceptance of Supplies and Consumables

The TCEQ procures, stores, and dispenses various spare parts, equipment, consumable items, and other items for CWQMN TCEQ staff and Cooperators.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at stations on the Upper Rio Grande, Pecos River, and Arroyo Colorado basins. See Section A2.6 for the internet locations of USGS Guidelines and Procedures. USGS Texas Water Science Center QAPPs are also listed in Section A6.2 and are available upon request.

B8.1 Equipment and Spare Parts

The CWQMN Network Coordinator purchases and distributes equipment and spare parts for TCEQ stations. Consumable items such as optical DO membranes and pH sensors/cartridges, are purchased and distributed on an annual basis and as needed throughout the year. The Network Coordinator manages contracts for a vendor to repair equipment and recertify CWQMN NIST-traceable thermometers. A supply of critical items including station electronic components, multi-probes, and cables is maintained for immediate distribution. Equipment failures occurring within warranty periods are sent back to the various manufacturers for repair.

B8.2 Standards

For stations operated by TCEQ staff, SC and pH standards are purchased through the state contract system or through inter-agency contracts. For TCEQ stations that are operated by cooperators, the cooperator is typically responsible for purchasing standards.

B9 Non-Direct Measurements

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

B10 Data Management

TCEQ Stations

Discrete water quality and sample depth measurements are logged by Sutron data loggers every fifteen minutes. Near real-time data from the data loggers are automatically sent to TCEQ Headquarters' (Austin, Texas) OTT HydroMet/LEADS communications server via wireless telemetry or GOES. Wireless telemetry data are secured from tampering or corruption over the carrier line through an unlisted telephone number, pass code protection, and error checking protocol.

The LEADS processing program checks the data for correct date, time, sampling station number, and proper formatting of raw data fields. For water quality parameters, LEADS then calculates and stores hourly averages as engineering units.

The station operator and data validator check the operational status of the station every business day via the TCEQ website. If communication problems are detected, the station operator and/or the data validator alerts the Network Coordinator and QC Officer to initiate corrective action and coordinate with other staff as necessary. To resolve problems a station service visit may be needed.

USGS Stations

Discrete water quality and gage height measurements from the Upper Rio Grande, Pecos River, and Arroyo Colorado stations are logged by Sutron SatLink data loggers every fifteen minutes. Once every hour, near real-time data from the data loggers are relayed to the GOES. The data are then decoded and ingested from the NOAA port to the USGS's National Water Information System (NWIS) database. The USGS uses an automated water quality data ingest system that retrieves, formats, and scans incoming data for errors.

USGS Provisional and Approved Data Submissions to TCEQ

Two data sets are routinely delivered to TCEQ. The two data sets are "provisional" and "approved."

Near-real time provisional station data are sent to TCEQ LEADS using an automated script that extracts data hourly from the USGS NWIS data base, formats it and sends the data to a file transfer protocol (FTP) site where it is received by TCEQ and ingested into the LEADS database.

Site visit, instrument drift, multi-probe fouling, and calibration information are recorded in the Site Visit Mobile for Aquarius field software. The recorded field information is uploaded to the Aquarius time-series database where Auto Correction Loader (ACL) is used to compute, view, and apply multi-probe fouling and drift corrections to the data.

The ACL step is when data not meeting the "Fair" TM1D3 data rating criteria are identified. In Aquarius, data not meeting "Fair" criteria are flagged with a unique code (99) using a script developed by USGS and these data are invalidated. The remaining

data that passes an additional review are flagged "Approved". Throughout this process, data are transferred to USGS' National Water Information System database (NWISWeb) in near real-time.

After data approval, an R script is used to retrieve the data from NWISWeb water services. The data are formatted to meet SWQMIS database input requirements for each unique combination of site and parameter code. The approved data are delivered electronically via email, ftp, or some other medium to TCEQ.

Approved data for each state fiscal year quarter is delivered to TCEQ no later than the last day of the subsequent state fiscal year quarter. The USGS reviews data on an on-going basis. If problems with data are identified as part of this review, the USGS may re-submit data to TCEQ.

TCEQ's public webpages provide links to USGS NWIS station data for the upper Rio Grande and Pecos stations. LEADS cannot ingest profiler data, so data from the Arroyo Colorado vertical profiler station (CAMS 730) is available via the web from USGS's NWIS data base. A link to USGS NWIS CAMS 730 data is provided on the TCEQ public webpages.

SWQMIS Database

A data loader has been developed to load validated CWQMN data into the SWQMIS database for long term storage and management. Only data collected and validated under an EPA or TCEQ approved QAPP will be stored in SWQMIS. These data may be requested from the Water Data Management & Analysis (WDMA) team.

Calculated parameters such as total dissolved solids are not stored in the SWQMIS database. Additionally, water level and sample depth parameters are not stored in SWQMIS.

See Table B10.1 for a complete list of CWQMN parameters that will be stored in SWQMIS. The table also contains a crosswalk of parameters codes from LEADS to SWQMIS.

Table B10.1

Surface Water Quality Monitoring Information System Parameters

Parameter	LEADS Parameter Code	SWQMIS Parameter Code	Units
Temperature	10010	00010	°C
Specific Conductance	10095	00094	µS/cm
Dissolved Oxygen	10300	00300	mg/L
pH	10400	00400	pH units

FNU = Formazin Nephelometric Units
mg/L = milligrams/Liter
µS/cm = micro Siemens / centimeter
°C = Degrees Centigrade

Data Users

Data stored in the LEADS system may be provided to internal users (TCEQ data analyst, etc.) by email, on disk, on printouts, or through TCEQ web page reports. Other internal customers have read-only access. Public requests for CWQMN data, as well as LEADS

data, are made through the WDMA team. Non-validated data may be released to the public with disclaimers regarding the validity of the data.

Data Reporting

Data collected in the CWQMN are internally hosted on the LEADS TCEQ RHONE data server. Internal and external reports and summaries are compiled from data hosted on this server.

Data collected with multiprobes every 15 minutes are reported in the SWQM Daily Report in the 15-minute increment of their collection. Internal summary reports are available for all CWQMN data.

Hourly data summary reports are available on the TCEQ public websitewww.tceq.texas.gov/waterquality/monitoring/swqm_realtime.html for all stations.

C1 Assessments and Response Actions

The CWQMN Program advocates and encourages a "continuous improvement" philosophy in personnel development and work processes. Each employee is responsible for implementing and evaluating the effectiveness of quality improvement activities with which he/she is involved. Fostering a "no-fault" attitude to encourage the identification of opportunities for improvement so they can be brought to the forefront and addressed accordingly is recognized to be a critical factor in a continuous improvement environment. Review of process performance is done on a continuous basis. This section addresses the assessment and response actions for the CWQMN.

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at stations on the Upper Rio Grande and Pecos Rivers. See Section A2.6 for the internet locations of USGS Guidelines and Procedures. USGS Texas Water Science Center QAPPs are also listed in Section A6.2 and are available upon request. These documents contain information about USGS stage and discharge assessments and response actions. TCEQ does not currently have staff with required expertise to conduct assessments of stage and discharge monitoring related activities.

Based upon audit reports, the Network Coordinator, QA Officer, and QC Officer will work collaboratively on recommendations to the appropriate Manager(s) to stop work if necessary, to safeguard programmatic objectives, worker safety, public health, or environmental protection.

CWQMN Participant-Initiated Corrective Action

It is expected that any individual in the CWQMN who discovers a problem will initiate corrective action appropriate to the situation. Corrective action is accomplished at the lowest level and shall be documented in the LEADS operator log. The QC Officer and Network Coordinator must be notified of any proposed corrective action that can affect data quality and/or CWQMN protocols.

CWQMN Assessments

The following types of assessments are conducted under the CWQMN Program:

- Readiness Reviews
- Monitoring Station TSAs and PEAs
- Annual Station Multiprobe Data Completeness Assessments for all stations

The program has a goal of conducting a total of two assessments each fiscal year (Readiness Reviews and/or Monitoring Station TSAs and PEAs).

Readiness Reviews

Station readiness reviews may be conducted at the beginning of a new project to ensure a project is a functioning correctly. Readiness reviews may also be conducted after a major change to an existing project.

Monitoring Station TSAs and PEAs

The TCEQ staff conducts monitoring station TSAs/Performance Evaluation Audits (PEAs) and readiness reviews for CWQMN water quality monitoring related activities.

Monitoring station TSAs/PEAs focus on project objectives, station operations, and measurement systems.

TSAs include a thorough systematic, on-site qualitative audit of station operation, equipment, training, personnel, documentation, sampling and measurement systems, QC procedures, and safety of a system. TSAs focus on conformance to procedures, if available.

PEA audit procedures test the ability of measurement systems to obtain acceptable results. Audit results are compared against applicable quality control acceptance criteria. Audit results are documented on forms and spreadsheets.

To help communicate the structure and approach of an upcoming audit, the auditor notifies the auditee and details the scope, participating auditors, and the expected schedule. The auditors and participants review and discuss preliminary results during a post-audit conference. The auditor prepares a detailed audit report for each monitoring station audit.

Each audit report is individually numbered, dated, and identifies the auditor, auditee, and nonconformity (findings and observations). The audit report may suggest recommended corrective action to findings.

Data Completeness Assessments

The CWQMN has a general data completeness requirement of 75% data return. Data completeness is defined as data meeting QC performance criteria described in Sections A7 and B5.

Stations in the CWQMN may be located in intermittent streams. Suspension of water monitoring can occur in times of drought.

TCEQ Data completeness is calculated as follows for stream stations:

$$\% \text{ Completeness} = \frac{\text{Number of valid measurements during stream flow} \times 100}{\text{Total possible measurements} - \text{Total possible measurements during no stream flow}}$$

USGS Data Completeness Reports

Quarterly, USGS provides TCEQ data completeness reports for TCEQ/USGS contract stations. The general data completeness requirement for USGS contract stations is 75% data return meeting quality objectives in Table A7.1.1.

TCEQ Data Completeness Reports

Data completeness reports for TCEQ-operated stations are submitted by Data Management & Analysis on an annual basis (end of the FY).

TCEQ Monitoring Station Audit Response Requirements

If an audit report contains negative findings, a written response to the findings is required within thirty days of the issuance of the audit report. Written responses are used to track and verify the proposed corrective action initiated by the finding.

Audit report findings and observations can be categorized as program or project. Program findings/observations are typically associated with SOP/QC procedures, measurement systems, multiprobe deployments, or are process related. Project findings are typically associated with the station operator not following procedures. It is the responsibility of the Network Coordinator to respond to program findings. Responses to Project findings are the responsibility of TCEQ station operators. TCEQ Management may respond/provide comments as appropriate for station operators.

It is the responsibility of the CWQMN QC Officer to determine if responses to audit findings are acceptable or not. If a finding or proposed corrective action is disputed and cannot be readily resolved, the recommendation is pushed to successively higher management levels for resolution. The Network Coordinator is responsible for managing this process. Corrective actions can be verified during subsequent inspections.

Audit Finding Response Requirements

Written audit responses are required within thirty (30) days of the issuance of the Audit Report. The response to finding must describe:

1. The root cause of the finding (nonconformance);
2. The nature and extent of the finding's impact on data quality;
3. The specific corrective actions taken or planned to address the finding;
4. Actions taken or planned to prevent recurrence;
5. The timetable for completing each action; and,
6. The means to be used to document and verify completion and effectiveness of each action.

The Network Coordinator is responsible for executing TCEQ corrective actions when findings are program related. The TCEQ station operator's management is responsible for executing TCEQ corrective actions when findings are project related.

For stations operated by a contractor, the Network Coordinator is responsible for applying applicable contractual authority to resolve corrective actions.

The Network Coordinator is responsible for documenting and verifying completion of all corrective actions.

Audit findings will remain open until an acceptable response has been received for negative findings. Audit finding responses may be submitted via email to the CWQMN QC Officer, Ed.Ragsdale@tceq.texas.gov.

C2 Reports to Management

Reports are distributed according to the TCEQ *Quality Management Plan*.

Audit Reports
Final reports are submitted to the auditee and the various TCEQ managers who support the CWQMN, team leaders, Categorical 106 Grant Project Manager, and to the QA Officer. Audit reports and audit responses are available upon request.

USGS Water Quality and Discharge Data
The USGS must notify TCEQ CWQMN Network Coordinator in writing if any USGS collected data that has been subsequently identified by USGS and/or TCEQ as not meeting USGS/TCEQ quality objectives or criteria.

Reports to TCEQ Project Management

USGS will provide TCEQ with a report providing the following information when any USGS validated data does not meet quality objectives or criteria:

- Specific data not meeting quality objectives or criteria.
- The quality objective or criteria not met.
- An explanation of impact to data.
- Corrective action

USGS Monthly Progress Reports

The USGS submits monthly progress reports to the CWQMN Network Coordinator for all USGS-operated stations. These reports document activities from the first day of the subject month to the last day of the subject month and are due on the 15th of the subsequent month. Each monthly report details each station service event, fouling and drift measurements, issues encountered and the resolution of issues.

Table C2.1

Reports to Management and Actions Taken

Report Title	Frequency	Originator	Recipient	Actions To be Taken
Monitoring Station TSA (partial) and PEA or Readiness Reviews	A goal of a total of two assessments each fiscal year	QC Officer	Network Coordinator TCEQ Regional Manager CWQMN Program Manager Station Operator/Cooperator CWQMN QA Officer CWQMN QC Officer Categorical 106 Grant Project Manager Monitoring & Assessment Section Manager WQPD Quality Assurance & Data Management Team Leader	1. Contact the Station operator to determine probable cause operator to determine 2. Determine corrective action. 3. Notify QA/QC Officers, Categorical 106 Grant Project Manager, and Project Management if DQOs and/or MQOs are not met.
Multiprobe Data Completeness Reports	Annual (end of fiscal year)	Data Management	Network Coordinator TCEQ Regional Manager CWQMN Program Manager Station Operator/Cooperator CWQMN QA Officer CWQMN QC Officer Categorical 106 Grant Project Manager WQPD Quality Assurance & Data Management Team Leader	
Annual QA Report	Annual	QC Officer	Network Coordinator TCEQ QA Manager	TCEQ QA Manager analyzes all agency QA reports and provides summary memorandum to TCEQ Executive Director and EPA Region 6 QA Manager
CWQMN site update and progress reports	Biannual	Network Coordinator	Categorical 106 Grant Project Manager	NA

DQO = Data Quality Objective
EPA = U.S. Environmental Protection Agency
MQO = Monitoring Quality Objective
NA = Not Applicable
PEA = performance evaluation audit
SOP = standard operating procedure
TSA = technical systems audit
WQPD = Water Quality Planning Division

D1 Data Review, Verifications, and Validation

The TCEQ WQPD staff and contractors review and validate water quality data generated by the CWQMN. See Table A6.1 for CWQMN data validators.

USGS Operated Stations
The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at stations on the Upper Rio Grande, Pecos Rivers, and Arroyo Colorado Basins. See Section A2.6 for the internet locations of USGS Guidelines and Procedures. USGS Texas Water Science Center QAPPs are also listed in Section A6.2 and are available upon request.

For the Upper Rio Grande and Pecos River stations, the USGS is validating and processing data according to procedures found in Appendix F. *Adaptation of Data Validation and Fouling Correction Procedures for Water-Quality Monitoring Stations on the Upper Rio Grande and Pecos River*, 2013.

D1.1 Data Reviews and Validation for Stations Following TCEQ Procedures

The WQPD Data Management & Analysis Team is responsible for assigning data validation flags in the LEADS database. For a complete list of Data Validation flags, see Table D2.1. TCEQ data is validated based on data reviews and by comparing applicable QC sample results against project/CAMS quality objectives found in Section A7.

TCEQ Data Reviews
For each CAMS, data are reviewed by station operators, electronically by LEADS, and manually by the data validators. See Table D1.1 for TCEQ data reviews.

Table D1.1

Data Reviews

Data Reviews	Responsibility
The station operator documents any problems identified during a station visit in LEADS operator logs that detail any anomalies and affected data (see Appendix F for operator log content). Data validators may qualify data based on this information.	Station Operators
Every business day, station operators and the assigned data validator (or designees) monitor (via TCEQ daily report on Rhone web station) and screen water quality measurements, sample depth measurements, and station communications for anomalies. Data validators may qualify data based on this information.	Station Operators and Assigned WQPD Data Validator
The LEADS system automatically flags data when values exceed station-specific pre-defined ranges. Limit Exceeded (LIM) – Flags are automatically assigned to any data that fall above or below station-specific pre-defined ranges. Data are automatically flagged Lost Data (LST) when data is not retrieved by the data logger because of power outages, equipment malfunction, etc.	MeteoStar/LEADS
On a monthly basis, data validators perform data review using the LEADS interface to graphically display the data. Data are reviewed for integrity, continuity, and reasonableness. Any data deemed questionable by the data validator due to inexplicable extreme values, data dropouts, flat-lined data, etc. may be qualified Ambient Quality Invalidated (AQI).	Assigned WQPD Data Validator

During data validator data reviews, certain issues or questions may arise about particular data point(s); in these cases, the data validator will refer to the operator logs.

If no logs exist, or the log does not identify a source for the questionable data, the validator contacts the station operator via phone or email to try to resolve any issues and verify affected data. Additionally, data validators may use multiprobe sample depth, water level, and discharge measurement data as a source of additional information for data qualifying decisions.

TCEQ non-EMRS Multiprobe Data Validation Using QC Sample Results

For each project/CAMS, Section A7.1 lists quality objectives used to accept or reject project data. Compliance with Section A7.1 quality objectives are based on QC sample results.

CAMS: 749, 768, and 808

Data validations for these stations are based on the following QC results:

1. Calibration Verification Sample (calibration drift) results
2. Sensor/deployment tube fouling measurement results
3. Change in water body measurement results
4. Laboratory multiprobe temperature check results

After each multiprobe deployment period, station operators enter fouling, CVS, and temperature check measurement results into the Post Deployment Worksheet (PDW) Excel spreadsheets. The PDW calculates results for these checks. See Section B5.1 for calculations.

Spreadsheet Pass/Fail fields include the following:

1. The sum (Total Error) of fouling and CVS results
2. Individual fouling and CVS results
3. Change in water body results
4. Temperature check results

If any of these fields indicate “Fail” for a given parameter(s), the corresponding data (including TDS calculated from SC) back to the last passing multiprobe exchange are invalidated using the Ambient Quality Invalidated flag (AQI).

Multiprobe temperature checks are done at the conclusion of deployment periods. If the check fails, the ±0.5 º Celsius criterion, the corresponding temperature, DO, SC, and calculated TDS data are invalidated (flagged as AQI) back to the last passing multiprobe exchange.

TCEQ EMRS Multiprobe Stations

Data records for EMRS stations are not validated; CVS and temperature check criteria are used as guidelines to ensure measurement equipment are operating within limits.

Lower Neches Valley Authority Turbidity CAMS 749

The LNVA uses turbidity data on a near real-time basis for water management decisions.

Bosque River SC EMRS Project (CAMS: 726, 728, 765, 804, and 805)

The TCEQ uses data from these stations to provide timely run-off SC data for screening and targeting field responses and investigations.

TCEQ Lower Rio Grande EMRS Project (CAMS: 736, 767, 789, 791, 792, 793, and 796,) Data Review Reports

Every business day, WQPD staff remotely monitors and reviews the general operational status of all stations in the lower Rio Grande and emails a daily Data Review Report to interested parties. The report contains the following information:

- Stations on-line
- Measurement values
- Stations reporting data
- Reasonableness of the data
- Data concerns
- Other comments

D2 Verification and Validation Methods

USGS Operated Stations

The TCEQ has contracted with the USGS to provide stream discharge and water quality measurement data at stations on the Upper Rio Grande, Pecos Rivers, and Arroyo Colorado stations. See Section A2.6 for the internet locations of USGS Guidelines and Procedures. USGS Texas Water Science Center QAPPs are also listed in Section A6.2 and are available upon request.

D2.1 Data Verification and Validation Methods for Stations Following TCEQ Procedures

Data Validation Notes and Audits

After validating any data, and for LEADS to consider the data as being validated, the data validator must enter validator notes. These notes document and explain any data qualifications made, other than valid (VAL flag), and why the qualification was made. In addition to the electronic validator notes, each validator also keeps a hard copy Validator Notebook containing the same information. Data validators keep these notebooks on file for 5 years and make them available for audits upon request.

Data Tracking

End data users can access validated data via the Internet (TCEQ web pages). Actual measurement values (or averages of these) are shown for data that has been qualified as valid, while the validation flag is shown for data that were qualified as invalid. For stations where data is validated, all data is manually verified, no matter the qualifier assigned by the system. For a list of validation flags and their definitions, see Table D2.1. After data is reviewed and validated by the data validator, it is flagged as such in LEADS.

Table D2.1

Data Validation Flags (Qualifiers)

Flag	Definition
AQI	Ambient Quality Invalid – Flag manually assigned when data point deemed invalid by the data validator.
PMA*	Preventive Maintenance – Flag manually assigned when station operator is performing maintenance on analytical equipment.
VAL	Valid – Flag automatically assigned to any data that does not fall above or below pre-defined limits. Valid – Flag manually assigned to any data that was previously automatically assigned a Limit Exceeded (LIM) flag that was later deemed valid by the data validator.
LIM	Limit Exceeded – Flag automatically assigned to any data that fall above or below a pre-defined range.
LST	Lost Data – Flag automatically assigned when data is not retrievable by the data logger because of power outages, equipment malfunction, etc.

*All data within one hour after any PMA flag is qualified as invalid (AQI). This 1-hour time-period allows the multiprobe to equilibrate/stabilize to ambient water quality conditions before data may be considered valid.

D3 Reconciliation with User Requirements

Problems with potential limitations of the data are handled at three different levels:

1. At the time of audit of the monitoring stations or by the station operators, who have prime responsibility for routine calibrations, maintenance, and analysis of quality control samples;
2. Data validators who review verify and validate station data; and
3. By users of the data.

Issues are reconciled at the lowest level and at the earliest time possible. The mechanisms for communication between the producers and the users of the data are telephone, e-mail, and the operator's log.

The auditors, validators, station operators, project leads, and managers are empowered to review and question any part of the measurement process and may initiate data reviews and corrective actions to bring the process back into compliance.

Appendix A – Definitions

General Terminology

Accuracy

The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator.

Audit (quality)

A systematic and independent examination and evaluation to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve specified objectives.

Bias

The systematic or persistent distortion of a measurement process that causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).

Calibration standard (CS)

Definition - A mixture prepared from the primary standard mixture or stock standard mixture and, when appropriate, containing the internal standards and surrogates.

Application - Used to calibrate the instrument response with respect to analyte concentration.

Calibration verification sample (CVS)

Definition - An analytical standard analyzed during a batch to ensure acceptable instrument calibration.

Application - Used to verify analytical system calibration.

Comparability

A measure of the confidence with which one data set can be compared to another.

Completeness

A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions.

Data Quality Objectives (DQOs)

Established quantitative measurements (with associated precision and bias or acceptable uncertainty) that must be obtained from the environmental data operations to demonstrate that the desired and expected result has been achieved.

Deficiency

An unauthorized deviation from acceptable procedures or practices, or a defect in an item.

Matrix

Substance being tested.

Precision

A measure of agreement among individual measurements of the same property, usually under prescribed similar conditions, expressed generally in terms of the standard deviation.

Quality

The sum of features and properties/characteristics of a process, item, or service that bears on its ability to meet the stated needs and expectations of the user.

Quality Assurance (QA)

An integrated system of activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer.

Quality Assurance Project Plan (QAPP)

A formal document describing in comprehensive detail the necessary QA, QC, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria.

Quality Control (QC)

The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality

Quality Management Plan (QMP)

A formal document or manual, usually prepared once for an organization that describes the quality system in terms of the organizational structure, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, and assessing all activities conducted.

Representativeness

A measure of the degree to which data accurately and precisely represent a characteristic of a population, parameter, variations at a sampling point, a process condition, or an environmental condition.

Sample Depth

Depth of multi-probe in the water column (TCEQ).

Standard Operating Procedure (SOP)

A written document that details the method of an operation, analysis, or action whose techniques and procedures are thoroughly prescribed and that is accepted as the method for performing certain routine or repetitive tasks.

Water Level (also known as stage)

Height of water in the stream above a reference point. (USGS)

Appendix B - Acronyms

A

AE	Absolute Error
AQI	Ambient Quality Invalid
ASTM	American Society for Testing and Materials

B

BMP	Best Management Practices

C

C	
CAFO	Concentrated Animal Feeding Operation
CAMS	Continuous Ambient Monitoring Station
CFEP	Comms Front End Processor
CFR	Code of Federal Regulations
cfs	cubic feet per second
COA	Certificate of Analysis
COMMS	Communications
CRP	Clean Rivers Program
CVS	Calibration Verification Sample
CWA	Clean Water Act
CWQMN	Continuous Water Quality Monitoring Network

D

DI	De-ionized water
DO	Dissolved Oxygen
DQO	Data Quality Objective

E

EC	Electrical Conductance (Reported as Specific Conductance)
EMRS	Environmental Monitoring Response System
EPA	United States Environmental Protection Agency

F

FNU	Formazin Nephelometric Units
FTP	File Transfer Protocol
ft/s	Feet per Second
FY	Fiscal Year

G

GOES	Geostationary Operational Environmental Satellite

H

HC&CC	Hidalgo & Cameron County Irrigation District

I

ISO	International Organization for Standards

K

KCl	Potassium Chloride

L

LEADS	OTT HydroMet Leading Environmental Analysis and Display System
LIM	Limit Exceeded
LNVA	Lower Neches Valley Authority
LRG	Lower Rio Grande
LST	Lost Data

M

MA	Monitoring and Assessment Section
MD	Monitoring Divisionmg/L milligram per liter
MOA	Memorandum of Agreement
MQO	Measurement Quality Objective

N

NA	Not Applicable
NIST	National Institute of Standards and Technology
NOAA	National Oceanic & Atmospheric Administration
NTU	Nephelometric Turbidity Units
USNWS	United States National Weather Service
NV	EMRS project data not validated
NWIS	USGS's National Water Information data base

P

PC	Personal Computer
PDW	Post Deployment Worksheet
PEA	Performance Evaluation Audit
PMA	preventative maintenance
PSS	Program Support Section
PVC	Polyvinyl Chloride

Q

QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QMP	Quality Management Plan

R

RPE	Relative Percent Error

S

SAS	Statistical Analysis Software
SC	Specific Conductance
SOP	Standard Operating Procedure
STORET	Storage and Retrieval

SWQM	Surface Water Quality Monitoring Team
SWQMIS	Surface Water Quality Monitoring Information System

T

T	Temperature
TBD	To Be Determined
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TIAER	Texas Institute of Applied Environmental Research
TMDL	Total Maximum Daily Load
TPWD	Texas Parks & Wildlife Department
TSA	Technical System Audit
TSWQS	Texas Surface Water Quality Standards
TWRI	Texas Water Resource Institute

U

µS/cm	micro siemens per centimeter
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USIBWC	United States International Boundary Water Commission
USNWS	United States National Weather Service
USNPS	United States National Park Service

W

WDMA	Water Data Management and Analysis
WPP	Watershed Protection Plan
WQPD	Water Quality Planning Division

Y

YSI	Yellow Springs Instrument

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

(Project Name)

CONTINUOUS WATER QUALITY MONITORING

NETWORK PROJECT PLAN

(Note to user: This form provides some of the text to be used in the project plan. Instructions are provided in italics and should be deleted during completion of the form.)

A1 APPROVAL PAGE

_____ _____
Charles Dvorsky Date
CWQMN Network Coordinator, TCEQ SWQM

_____ _____
Andrew Sullivan Date
SWQM Program Manager, TCEQ SWQM

_____ _____
Kyle Girten Date
Section Manager, TCEQ Monitoring & Assessment Section

_____ _____
Sharon Coleman Date
CWQMN Quality Assurance Officer

_____ _____
Name Date
Project Lead, TCEQ SWQM Program

_____ _____
Edward Ragsdale Date
CWQMN Quality Control Officer, TCEQ SWQM

_____ _____
Cathy Anderson Date
Team Leader Data Management and Analysis Section

_____ _____
Other Project Participants Date

This plan documents specific details for new continuous water quality projects. Critical project-specific details for new CWQMN stations are not covered in the CWQMN QAPP. Please see the CWQMN QAPP for other network details.

A2 TABLE OF CONTENTS

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A2 Table of Contents
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B7 Instrument Calibration and Frequency
B8 Inspection/Acceptance of Supplies and Consumables
B9 Non-Direct Measurements
B10 Data Management
C1 Assessment and Response Actions
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D1 Data Review, Verification, and Validation
D2 Verification and Validation Methods
D3 Reconciliation with User Requirements

TABLES:

Table A7.1: Multiprobe Measurement Performance Specifications

LIST OF ACRONYMS

List applicable acronyms

A3 DISTRIBUTION LIST

Include project participants (e.g., station operators, contractors, etc.).

Project Plan distribution will include any new project personnel and applicable TCEQ staff members in the distribution list from the most recent QAPP revision or certification.

A4 PROJECT/TASK ORGANIZATION

This section is intended to identify individuals and organizations that will be responsible for developing and/or supporting new CWQMN projects. For a list of additional project/task and responsibilities please refer to section A4 of the CWQMN QAPP.

The Project Lead is responsible for the development of the Project Plan.

A4.1 TCEQ CWQMN Coordinator (Charles Dvorsky)

A4.2 TCEQ SWQM Project Lead *(Name)*

X Develop Project Plan

A4.3 Station Operator (Name and Agency)

X Station Operation and Maintenance

A4.4 (Name and Agency)

X Data Validation

A4.5 Project Participant (Name and Agency)

A4.6 Contractor (Name)

A5 PROBLEM DEFINITION/BACKGROUND

State the specific problem to be solved or decision to be made, or the outcome to be achieved. Include enough background information to provide a historical perspective and scientific perspective.

The discussion should include enough information (i.e., history, regulatory context, and previous work) to understand the project objective.

A6 PROJECT/TASK DESCRIPTION

Summarize the work to be performed and the schedule for implementation as well as monitoring station geographic location(s) and TCEQ segment numbers.

In some CWQMN projects, project/task descriptions are laid out **in detail** in contractual/ subcontractual work plans. If the work plan addresses the following information **in detail**, then the contractual/subcontractual work plan may be attached and referenced.

A7 QUALITY OBJECTIVES AND CRITERIA

The measurement performance specifications to support the project objectives are specified in Table(s) A7.1 – x.

Add tables as needed. Reference applicable CWQMN analytical SOPs if available.

Methods used are based on Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998 unless otherwise noted.

Table A7.1

Quality Objectives
TCEQ Multiprobe CAMS

Parameter	Fouling & Drift/(CVS) Acceptance Limits (sum and individual fouling & drift acceptance limits)	Temperature Acceptance Limit	Instrument/SOP
Specific Conductance/ Total Dissolved Solids	±5%	±0.5 º C*	*Add instrument and applicable SOP*
Dissolved Oxygen	±0.5 mg/l		
pH	±0.5 units		
Temperature		±0.5 º C	
Sample Depth	NA		

*If temperature sensor checks do not meet the ±0.5 º C criterion, the corresponding temperature, DO, SC, and calculated total dissolved solids data are considered invalid
CVS = calibration verification sample
NA = not applicable, sample depth measurements not assessed for accuracy
ºC = degrees centigrade
mg/l = milligrams per liter

Ambient Water Reporting Limits (AWRLs)

As described in Section A7 of the CWQMN QAPP. (*If applicable)*

Precision

As described in Section A7 of the CWQMN QAPP. (*If applicable)*

Bias

As described in Section A7 of the CWQMN QAPP. (*If applicable)*

Representativeness

As described in Section A7 of the CWQMN QAPP. (*If applicable)*

Comparability

As described in Section A7 of the CWQMN QAPP. (*If applicable)*

Completeness

As described in Section A7 of the CWQMN QAPP. (*If applicable)*

A8 SPECIAL TRAINING/CERTIFICATION

Indicate who will train station operators, and how.
Discuss training schedule for station operators, data validators, or other needed project training.
Provide any other training requirements.

A9 DOCUMENTS AND RECORDS

As described in sections A9 of the CWQMN QAPP. (*If applicable)*

B1 SAMPLING PROCESS DESIGN

Station Selection Criteria

Describe the rationale for selecting monitoring station(s).

Monitoring Station Design

Describe how monitoring equipment will be configured (including measurement frequencies) to collect data that will answer project objectives.

List specific monitoring and support equipment: measurement equipment, data logger, telemetry, modems, trailer, traffic box, etc.

Detail station developmental needs; pad, electricity, fence, phone, special items, etc. Discuss station development schedule.

Indicate who will be responsible for station operation and maintenance.

B2 SAMPLING METHODS

As described in sections B2 of the CWQMN QAPP. (*If applicable)*

Sampling/Measurement System Corrective Action

As described in sections B2.2 of the CWQMN QAPP.

B3 SAMPLE HANDLING AND CUSTODY

As described in Section B3 of the CWQMN QAPP. (*If applicable)*

B4 ANALYTICAL METHODS

Analytical methods and analytical SOPs are listed in Section A.7.

B5 QUALITY CONTROL

As described in Section B5 of the CWQMN QAPP. (*If applicable)*

Analytical method SOPs are listed in Section A.7 detailing QC procedures. *If SOPs are not available describe QC program for project.*

Corrective Action Related to Quality Control

As described in Section B5 of the CWQMN QAPP. (*If applicable)*

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

As described in CWQMN QAPP. (If applicable)

List the equipment and/or systems needing periodic maintenance, testing, or inspection, and the schedule for such.

List all applicable equipment maintenance SOPs or equipment manuals.

B7 INSTRUMENT CALIBRATION AND FREQUENCY

As described in CWQMN QAPP. (*If applicable)*

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

As described in CWQMN QAPP. (If applicable)

Describe how spare parts, standards and reagents will be obtained by station operators.

B9 NON-DIRECT MEASUREMENTS

There are no non-direct measurements used in this project. (*If applicable)*

B10 DATA MANAGEMENT

Indicate who will manage project data, and how, including communication, telemetry, data processing, and depository. State who is performing data analysis (and how) and what action will be taken with data results.

As described in CWQMN QAPP. (If applicable)

C1 ASSESSMENTS AND RESPONSE ACTIONS

As described in CWQMN QAPP. (*If applicable)*

Corrective Action

As described in Section C1 of the CWQMN QAPP. (*If applicable)*

C2 REPORTS TO MANAGEMENT

As described in Section C2 of the CWQMN QAPP.

Reports to TCEQ Project Management

As described in Section C2 of the CWQMN QAPP.

D1 DATA REVIEW, VERIFICATION, AND VALIDATION

As described in Section D1 of the CWQMN QAPP.

List the TCEQ data validation SOPs that will be used.
Indicate who will be responsible for validating station data, and if the person(s) will require training.

D2 VERIFICATION AND VALIDATION METHODS

As described in Section D2 of the CWQMN QAPP.

D3 RECONCILIATION WITH USER REQUIREMENTS

As described in Section D3 of the CWQMN QAPP.

Appendix D - References

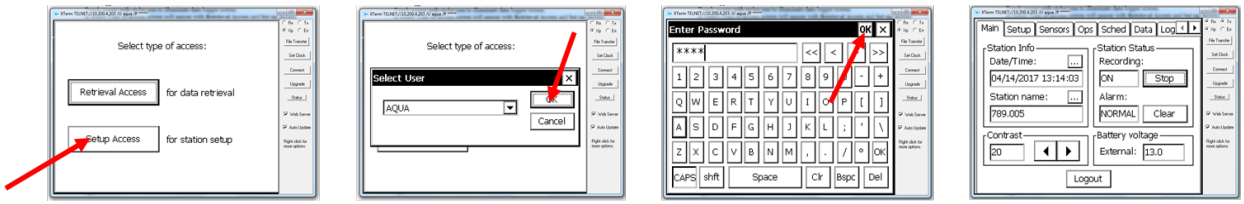
1. Current Revision of the Texas Commission on Environmental Quality, *Quality Management Plan*
2. United States Geological Survey – *Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting TM1D3*
3. United States Geological Survey – *Turbidity 6.7, Version 2.1* (9/2005)
4. United States Environmental Protection Agency, *Requirements for Quality Assurance Project Plans QA/R-5,* March 2001, reissued May 2006.
5. *Standard Methods for the Examination of Water and Wastewater*. American Public Health Association, Washington, DC, 20th edition, 1998.
6. *Guidance for the Data Quality Objectives Process*, Appendix D, Glossary of Quality Assurance Terms. United States Environmental Protection Agency, Quality Assurance Management Staff QA/G-4, Washington, DC, 1994.
8. *American National Standard Institute* [ANSI]*/American Society for Quality Control* [ASQC]*Z1,* Standard E4-19.
9. *Surface Water Quality Monitoring Quality Assurance Project Plan*. Texas Commission on Environmental Quality, Rev. 13, January 2010.
10. *Surface Water Quality Monitoring Procedures, Volume1: Physical and Chemical Monitoring Methods,* October 2008, RG-415
11. *Chemical Hygiene Plan*. Texas Commission on Environmental Quality, November 2000

Appendix E

Instructions for using the Sutron Xpert Data Logger for Station Service Visits

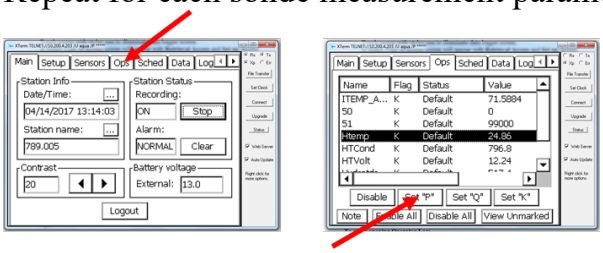
Enter Data Logger Password:

Touch screen with stylus pen to illuminate data logger screen.
A Select Type of Access screen will appear with **Retrieval Access** and **Set up Access** buttons.
Touch "**Setup Access"** button.
A screen with "**Select User**" will appear with AQUA in the selection box.
Touch "**OK"** button.
A screen with Enter Password will appear.
In password entry box, type in the password letters **"AQUA"** using the touch screen**.**
Touch "**OK"** button.
The Tab menu screen will appear with the **Main** tab selected.



To place the sonde in "P" code:

From the **Main Menu** screen tab, touch "**Ops"** tab.
Highlight the first sonde measurement parameter by touching it with the stylus.
Touch "**Set P"** button.
Repeat for each sonde measurement parameter until they all say "P" instead of "K".



To enter opening Operator Log:

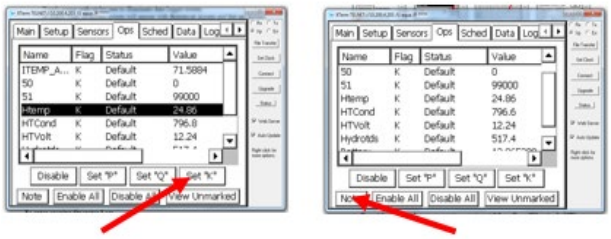
From the "**Ops"** screen tab, touch "**Note"** button from the choices at the bottom.
Enter an operator log using the touch screen including technicians' initials and task(s) to be performed. Do not use special characters.
Select "**OK"** from the top right.
Review the operator log, correct if necessary, select "**OK"** button at the bottom right.

When station service is complete, return parameters to "K" code:

From the "**Ops"** tab, highlight the first sonde measurement parameter by touching it with the stylus.

Touch "**Set K"** button.

Repeat for each sonde measurement parameter until they all say "K" instead of "P".



To enter closing Operator Log:

From the "**Ops"** screen tab, touch "**Note"** button from the choices at the bottom.

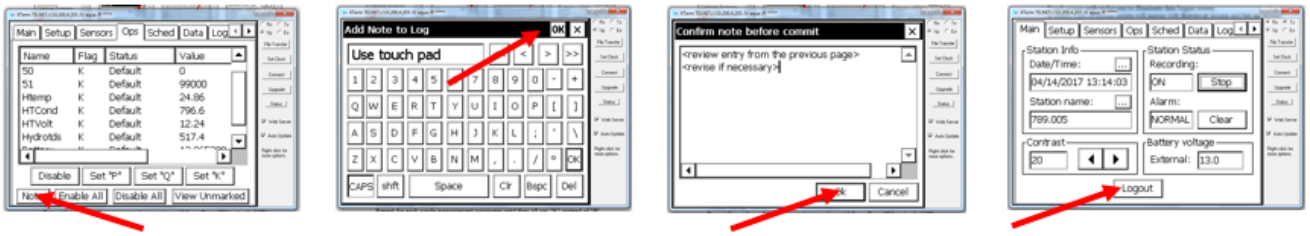
Enter an operator log using the touch screen including technicians' initials and task(s) performed. Do not use special characters.

Select "**OK"** from the top right.

Review the operator log, correct if necessary, and select "**OK"** button at the bottom right.

Select the "**Main Menu"** tab at the top left, and make sure it says "Recording ON".

Touch "**Log Out" button**.



Additional Data Logger Operations

To make an instantaneous measurement with the sonde:

Select "**Sensors"** tab screen from the top.
Select "**Measure All"** button.
If an LDM is present, highlight one instrument by touching it with the stylus and select "**Measure**" button.
An hourglass symbol will appear, and after a minute or so, the sonde values will appear in the programmed order.

To view the last logged data:

Select **"Ops"** tab from the top. The values will update every 15 minutes.

To verify the data is being collected:

Select **"Ops"** tab from the top.
Select "**View Unmarked**" at the lower right.
Under [SSP.LOG] there should generally be only one data record and it should be on 00:00, 00:15, 00:30, or 00:45. There may be multiple unmarked records if the station has been offline for more than 15 minutes.
Under [OPERATOR.LOG] there should be no logs unless you have entered a log since the last LEADS polling at 00:00, 00:15, 00:30, or 00:45 minutes or if the station has been offline for more than 15 minutes.
Select **"OK" or "Cancel"** buttons to go back to the **"Ops"** tab screen.

To adjust screen contrast:

The SUTRON XPert starts with the contrast at a fixed value which may include several readable contrast setting, fully bright, or fully dark. With the latter two, you can bring the screen content into a visible range with two hidden buttons on the login screen. When the screen to login and the screen is either fully bright or fully dark, you can the touch screen in the upper right corner to darken the contrast or touching the lower right corner to lighten the contrast. Wait at least 2 seconds between each tap to give the display a chance to adjust to the new contrast setting. You can also tweak the contrast with these buttons anytime the login screen is displayed. Once logged in, adjust the contrast from the "**Main**" tab using the Contrast dialog box by touching the ◄ or ► buttons to decrease or increase the contrast.

Appendix F

Multiprobe Operator Log Entry and Excel Post Deployment Worksheets (Revision 2)

For TCEQ stations, Operator Logs are required for non-EMRS and EMRS CWQMN stations. Station Operator Logs are electronic logs entered into LEADS via the station's Sutron Data Logger after routine and non-routine station service visits. For instructions on how to enter Operator Logs using the Sutron data logger, see instructions in Appendix E.

The USGS is not required to enter Station Operator Logs for USGS-operated CWQMN stations.

TCEQ Operator Log Content Instructions

TCEQ Non-EMRS and EMRS Stations

At a minimum, routine Operator Logs must list the following information:

1. Initials
2. Conducted routine station service
3. Note applicable field observations: water conditions, meteorological conditions, drought, flood etc.

When applicable, Station Operator Log entries must contain the following:

1. Name, date, and time
2. Any problems with data collection that can affect data quality
3. Change in operating procedures, data collection circumstances, or measurement equipment
4. Station equipment/communication problems and any troubleshooting activities
5. Station either being taken off-line or being brought on-line
6. Non-routine station service events
7. Date and time (or exact time frames) of the event must be included in Operator Logs

TCEQ Post Deployment Worksheets

For TCEQ non-EMRS stations, station operators are required to enter multiprobe QC results into TCEQ's Post Deployment Excel Worksheets (PDW) and email worksheets to the applicable data validator and QC Officer. PDWs are Excel spreadsheets developed to document fouling, drift, and multiprobe exchanges at TCEQ non-EMRS stations.

For TCEQ non-EMRS stations after each routine station visit, station operators enter the following information into Post Deployment Worksheets (PDW):

1. CAMS Number and Location
2. Operator
3. Date
4. Service Start/Stop time
5. Multiprobe, SN/asset number, Model, pH sensor type
6. Multiprobe Retrieval Date

7. Multiprobe Deployment Data
8. Field Meter SN/asset number
9. Field Meter pH millivolt (mV) responses to standards 7.00 and 10.00 pH. PDW calculates pH mV slope.
10. Field meter conductivity cell constant after calibration
11. Flow at Deployment Tube
12. Severity of Debris cloud
13. Multiprobe Fouling and Drift Measurements
14. Measurement depth (Pine Island Bayou only)
15. Observed Sensor Fouling
16. Multiprobe NIST temperature Check

The PDWs calculates results for fouling and drift and compares these results to project DQO's. After each station service event, the station operator emails the PDW to their TCEQ data validator. The PDW is used by the data validator to validate project data.

PDW workbooks for each station and calendar year are labeled using the following naming convention (PDW_CAMSXXX_CalendarYear). When a new calendar year starts a new PDW workbook will be started. Tabs within the workbook contain individual PDWs and are labeled with the month, day, and year station service occurred.

The following naming convention examples need to be used for each Post Deployment workbook and the tabs within the workbook.

Workbook Naming Convention Example:
PDW_CAMS787_2011

Workbook Tab Naming Convention Example:
March 13, 2011

The TCEQ data validator will store the Post Deployment Workbook on their team's electronic folder for CWQMN documents.

Optional Photos of multiprobes and Sensors

It is preferred that photos be taken during each station visit of the multiprobe and its sensors. The purpose of the photos is to photo-document fouling conditions of the probe and other pertinent areas at the CAMS. These optional photos will be emailed to the Station's data validator along with the required PDW.

Adaptation of Data Validation and Fouling Correction Procedures for Water-Quality Monitoring Stations on the Upper Rio Grande and Pecos River

Effective Date: May 2013 (rev. 0), Document Modified December 2013 (rev.2), See Section 7.0.

1.0 Purpose/Scope

This document is an adaptation and interpretation of guidelines and standard procedures for continuous water-quality monitors published by USGS: "Station operation, record computation, and data reporting: U.S. Geological Survey (USGS) Techniques and Methods 1–D3 (TM1D3) for the application of fouling corrections and validating data when water-quality monitors are silted in by sediment, when monitors are partially silted in, when monitor fouling conditions change over time, and when fouling is caused by aquatic insect activity. These procedures are for USGS-operated Texas Commission of Environmental Quality (TCEQ) Continuous Water Quality Monitoring Network stations on the Upper Rio Grande. These procedures will also be applied to similar monitor fouling situations that can occur at USGS-operated TCEQ Pecos River Stations.

On September 1, 2011, the USGS began operating TCEQ Upper Rio Grande and Pecos River stations according to guidelines and procedures in TM1D3. The procedures detailed in this document apply to all data collected at these stations beginning September 1, 2011. The USGS data validation system has recently been replaced with an Aquatic Informatics program named Aquarius. The Aquarius-base system, while still based on the USGS TM1D3 Guidelines and the Adaptation, does not generate data quality ratings. TCEQ and USGS will develop an alternate approach to describe data quality and will submit that approach as an amendment to this QAPP during FY2020. Monitoring stations affected by the change are CAMSs 709, 721, 729, 730, 735, 757, 758, 759, 764, 785, 788, 798, 799, 803, and 807.

As data are validated and processed, these procedures may be modified as needed. If significant changes to procedures are required, the USGS will contact the TCEQ for concurrence/approval. The USGS will track and update procedures within this SOP when changes are made. When changes are made, the USGS will provide TCEQ updated procedures. Section 7.0 is used to track changes to the SOP.

2.0 Background

Upper Rio Grande water-quality monitoring measurement sensors at USGS-operated Continuous Ambient Monitoring Stations (CAMS) 757 (upstream Rio Conchos), Station

720 (Castolon), and 721 (Rio Grande Village) in the Upper Rio Grande can be fouled and plugged by sediment due to sudden stream discharge pulses, existing degraded monitoring equipment deployments locations, deployment location stream dynamics, and less than ideal deployment designs. Additionally, monitor fouling conditions can change over time during and after periods of dynamic stream discharge particularly when CAMS 720 in-stream deployment tube was located on a gravel bar. At CAMS 758 (downstream Rio Conchos), conductivity sensor cells are prone to fouling by aquatic insect activity.

The USGS is re-locating and re-designing monitoring equipment deployments at CAMS 757, 720, and 721. Monitors will be suspended vertically using swing-pipes. These improvements are expected to reduce sensor fouling/plugging. To immediately alleviate monitor fouling and fouling conditions changing over time at the existing CAMS 720 station, the USGS has moved CAMS 720 from a gravel bar to an area closer to the stream bank. The USGS is periodically modifying the stream channel/deployment at CAMS 757 with compressed water (trash pump) to aid sample collection. Data collection is further complicated due to the ephemeral nature of the stream at this location.

Water-quality monitors on the Upper Pecos may also become silted as a result of rain fall run-off events, low base stream flows, and due to deployment tubes being deployed at angles (not vertically). Due to periods of low base flows and abundant sediment at Upper Pecos stations, the USGS is also using a trash pump to modify stream channels/deployments at CAMS 709 and 785.

The TCEQ, USGS Texas Water Science Center, and the National Water Quality Monitoring Council Methods Board met February 4 - 6, 2013, in Alpine, Texas, to discuss data validation and data processing issues related to water-quality monitor fouling. The team was able to develop a framework for the development of the following working draft procedures and to identify limitations associated with the procedures.

3.0 Procedural Summary

3.1 Water-quality monitor data collected when sensors/deployment tubes are silted in / isolated from the stream are invalidated and not reported to TCEQ. Data collected prior to the onset of a monitor silting in event can be reported to TCEQ. These data are not corrected using fouling measurement results and can be corrected for drift measurement results. These data are not assigned TM1D3 data ratings.

3.2 Data collected during changing or transient monitor fouling conditions are invalidated and not reported to TCEQ back to the onset of the initial event. Data collected prior to the onset of changing fouling conditions can be reported to TCEQ. These data are not corrected using fouling

measurement results and can be corrected for drift measurement results. These data are not assigned TM1D3 data ratings.

3.3 When it is determined monitor sensors/deployment tubes are not completely silted in, pH and temperature fouling measurement results are used to validate data as described in Section 6.2.1.

3.4 When conductivity sensor cells are fouled by sediment at stations in the Upper Rio Grande, fouling measurement results are generally not used for data validation decisions.

3.5 Conductivity sensors can be significantly impacted by aquatic insect activity; affected data are invalidated and not reported to TCEQ.

3.6 Water-quality monitor sensor drift measurement results are applied to data records according to TM1D3 procedures.

3.7 Water-quality monitor temperature sensor fouling is calculated using the USGS TM1D3 pH and DO calculation method instead of the monitor-to-monitor comparison method (field monitor before cleaning minus deployed monitor dirty).

4.0 Limitations

4.1 No data quality fouling measurements are available for data reported prior to monitor silting in/isolation events and when data are reported prior to changing fouling conditions.

It is possible alternative methods may be developed to statistically characterize data quality prior to silting in events by comparing historical fouling measurement results against distinct stream flow regimes. Data for CAMS 721 was compiled and it was decided there were not enough data points to proceed. If USGS's time and budget allow, it may be ideal at a later date to determine if this approach is feasible.

4.2 When water-quality monitors are not found silted in/isolated during station service events and linear prorated fouling measurement corrections are applied to the data, computation errors will occur if fouling occurred at non-linear rates. These errors are limited to acceptance criteria listed in Section 6.2.1.

4.3 Sensor/deployment tube fouling can range from minimal to completely silt in/isolated from the stream. Individual sensor sedimentation can be dependent on the particular deployment, orientation of sensors in the deployment tube, stream sedimentation event type, stream flow etc.

4.4 Numeric data acceptance criteria for aquatic insect activity are not available. Best professional judgment is used by the hydrographer to accept data and apply fouling measurement computations to data affected by insect activity.

5.0 Field Procedures

5.1 Documenting Water-Quality Monitor Fouling Status and Station Operation

5.1.1 During station service events, the hydrographer will complete a set of detailed field notes describing the fouling status of the sensors. Pictures will be taken of the monitors and the sensor water interfaces. Field notes will document occurrences when the monitor is found buried in stream sediments and isolated from the stream.

5.1.2 When monitors are found silted in, the hydrographer will conduct station field service according to TM1D3 procedures.

5.1.3 When an event causes the monitor to become silted in, the Texas Water Science Center will service the station as soon as possible to minimize the loss of data.

6.0 Data Validation and Processing

Stage and discharge measurements collected by USGS or other entities may be used in this procedure. Station Analysis Notes will be used to document data validation and processing decision logic and data processing outcomes.

6.1 Monitors Silted in/Isolated from the stream

6.1.1 When field observations determine monitors are silted in/isolated from the stream data are invalidated/not reported back to a conservative point prior to the fouling event. When the fouling event occurred is determined by using stream stage/discharge and/or optical DO measurements. Typically, during a severe fouling event, optical DO measurements will rapidly decline and stay near zero mg/l. The rapid decline of DO measurements usually corresponds to a stream discharge pulse. However, at CAMS 757, the monitor can become suddenly silted in/isolated from the stream due to decreasing stream stage/discharge; the monitor's deployment tube is located at an incised pocket of the stream bank. Decreases in stream stage/discharge can cause sediment to deposit in this pocket. Stream bank collapses at this station can also cause the monitor to become suddenly silted in/isolated from the stream.

6.1.2 If the initial onset of fouling is determined, sensor drift corrections are applied as appropriate, no fouling corrections (zero correction) are applied to the data collected prior to the initial fouling/discharge event and no TM1D3 data ratings are applied to these data.

6.1.3 When it cannot be determined when the initial fouling event occurred, all data back to the last service event are invalidated.

6.1.4 Fouling measurement results collected while the monitors are silted in/isolated from the stream are considered invalid.

6.2 Monitor Partially Silted in

6.2.1 When field observations determine monitors are not completely silted in/isolated from the stream and DO measurement response does not go to zero, pH and temperature fouling measurement results are used to validate data. When pH fouling measurement results are greater than ±0.50 pH units and/or temperature fouling measurements are greater than ±0.50 °C, all monitor parameters (DO, pH, T, SC) are invalidated back to the last service event unless the onset of fouling can be determined.

6.2.2 If the initial onset of fouling is determined, sensor drift corrections are applied as appropriate, no fouling corrections (zero corrections) are applied to the data collected prior to the initial fouling/discharge event and no TM1D3 data ratings are applied to these data.

6.3 Changing Monitor Fouling Conditions

6.3.1 When the monitor experiences changing fouling conditions, all data are invalidated back to the initial fouling/discharge event. Fouling measurements collected during changing fouling conditions are considered invalid.

6.3.2 If the initial onset of fouling is determined, sensor drift corrections are applied as appropriate, no fouling corrections (zero correction) are applied to the data collected prior to the initial fouling/discharge event and no TM1D3 data ratings are applied to these data.

6.3.3 If it cannot be determined when the initial fouling event occurred, all data back to the last service event are invalidated.

6.4 Conductivity Sensor Insect Fouling

6.4.1 Data collected during periods of insect activity that causes major spikes will be deleted. Noisy data points and minor spikes will not

be deleted. Periods of erratic data will be deleted. The period prior to insect activity will not be deleted. Professional judgment will be used to determine what constitutes major / minor spikes and erratic data.

7.0 SOP Revision Tracking

This Section is used to track changes made to this SOP.

7.1 Revision 1 change (December 2013). Section 6.1.1 updated to include station-specific (CAMS 757) circumstances that can cause the monitor to become suddenly silted in / isolated from the stream.

Section 6.1.1 Revision: *At CAMS 757 the monitor can become suddenly silted in/isolated from the stream due to decreasing stream discharge/stage heights; stream flow decreases causing sediment to deposit. The monitor's deployment tube is located at an incised pocket of the stream bank. Stream bank collapses at this station can also cause the monitor to become suddenly silted in/isolated from the stream.*

In Section 6.1.1, the sentence below was modified to include "or" after "and" since stage/discharge measurements may not be usable as a collaborative piece of information to determine when the monitor became silted in. Rapidly declining DO measurements can be used to determine when the monitor was silted in.

*When the fouling event occurred is determined by using stream stage/discharge and/**or** optical DO measurements*

7.2 Revision 2 change (January 31, 2020). Section 1.0 updated.

The USGS data validation system has recently been replaced with an Aquatic Informatics program named Aquarius. The Aquarius-base system, while still based on the USGS TM1D3 Guidelines and the Adaptation, does not generate data quality ratings. TCEQ and USGS will develop an alternate approach to describe data quality and will submit that approach as an amendment to this QAPP during FY2020. Monitoring stations affected by the change are CAMSs 709, 721, 729, 730, 735, 757, 758, 759, 764, 785, 788, 798, 799, 803, and 807.

The following passage from 1.0 was removed. *Excluding extreme events, a minimum of seventy-five percent (75%) of the scheduled data will be collected and validated, meeting at least the USGS "fair" data criteria as outlined in TM1D3.*

Appendix H

USGS Aquarius Data Validation, Transmittal, and Data Completeness Report

February 20, 2020

Site visit, instrument drift, multi-probe fouling, and calibration information are recorded in the Site Visit Mobile for Aquarius field software. The recorded field information is uploaded to the Aquarius time-series database where Auto Correction Loader (ACL) is used to compute, view, and apply multi-probe fouling and drift corrections to the data.

The ACL step is when data not meeting the “Fair” TM1D3 data rating criteria are identified. In Aquarius, data not meeting “Fair” criteria are flagged with a unique code (99) using a script developed by USGS and these data are invalidated. The remaining data that passes an additional review are flagged “Approved”. Throughout this process, data are transferred to USGS’ National Water Information System database (NWISWeb) in near real-time.

After data approval, an R script is used to retrieve the data from NWISWeb water services. The data are formatted to meet Surface Water Quality Monitoring Information System (SWQMIS) database input requirements for each unique combination of site and parameter code. The approved data and data completeness report are delivered electronically via email, ftp, or some other medium to TCEQ.

The data for each State Fiscal Year Quarter are delivered the day after the end of subsequent State of Texas quarter.

Appendix H

Example Letter to Document Adherence to the QAPP

TO: (name)
(organization)

FROM: (name)
(organization)

Subject: RE: Commitments to requirements contained in Continuous Water Quality Monitoring Network (CWQMN) Quality Assurance Project Plan (QAPP) Revision 6

Please sign and return this form by (date) to:

(address)

I acknowledge receipt of the referenced document(s). I understand the document(s) describe quality assurance, quality control, data management and reporting, and other technical activities that must be implemented to ensure the results of work performed will satisfy stated performance criteria.

Signature Date

Copies of the signed forms should be sent by the Operator/Cooperator to the TCEQ CWQMN Network Coordinator within 60 days of TCEQ approval of the QAPP.