# TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

*Protecting Texas by Reducing and Preventing Pollution*

May 24, 2012

Ms. Leslie Rauscher
US Environmental Protection Agency (EPA)
(6MD-AT) Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

Re: FY09 319(h) Guadalupe Blanco River Authority Water Quality Monitoring, Data Collection and Validation Quality Assurance Project Plan (QAPP) Update Grant No. 99614614

Approval Date: May 23, 2012 (The QAPP will expire at the projects end date of 8/31/12)

Dear Ms. Rauscher:

The above named QAPP has been approved. The original QAPP and signature page have been uploaded to the Grants Recording Tracking System (GRTS) as documentation of approval.

Should you have any questions, please contact Jack Higginbotham at Jack.Higginbotham@tceq.texas.gov or (512) 239-66969.

Sincerely,

Kerry Niemann
Team Leader, NPS Team
Office of Water

# TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

*Protecting Texas by Reducing and Preventing Pollution*

May 23, 2012

Debbie Magin
Guadalupe-Blanco River Authority
933 E. Court St.
Seguin, Texas 78155

Re: Guadalupe River Basin Network – GBRA Water Quality Monitoring, Data Collection, and Validation Quality Assurance Project Plan (QAPP)

Approved: May 22, 2012 (Effective until Contract #582-10-10-90467 is closed or May 23, 2013, whichever is sooner)

Dear Ms. Magin:

The above named QAPP update has been approved. The original document and signature pages are enclosed as documentation of approval.

In accordance with the terms of the QAPP, **please ensure that copies of this document and any subsequent amendments are distributed to each sub-tier participant as noted in Section A3 of the QAPP.** This approval letter must be available for review during a monitoring systems audit.

Should you have questions, please contact me at (512) 239-0425.

Sincerely,

Kyle Girten
Quality Assurance Specialist

enclosure

cc: Sharon Coleman, Senior Quality Assurance Specialist, MC 165
Jack Higginbotham, Project Manager, MC 203

# Guadalupe River Basin Network – GBRA
# Water Quality Monitoring, Data Collection and Validation

## Quality Assurance Project Plan

Guadalupe-Blanco River Authority
933 E. Court St.
Seguin, TX 78155

Funding Source:

Nonpoint Source Protection Program CWA §319(h)
Prepared in cooperation with the Texas Commission on Environmental Quality
and the U.S. Environmental Protection Agency
Federal ID # 99614614

Effective Period: From QAPP approval until Contract #582-10-90467 is closed.

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

Debbie Magin
Director of Water Quality
933 E. Court St.
Seguin, Texas 78155
(830) 379-5822
dmagin@gbra.org

## A1 APPROVAL PAGE

**TEXAS COMMISSION ON ENVIRONMENTAL QUALITY**

**Field Operations Support Division**

5-22-12
Stephen Stubbs, TCEQ QA Manager Date

5/22/12
Kyle Girten, QA Specialist Date
Quality Assurance Team

**Water Quality Planning Division**

N/A
Monica Harris, Section Manager Date
WQ Planning and Implementation Section

5/21/12
Kerry Niemann, Team Leader Date
Nonpoint Source Program

5/22/12
Nancy Ragland, Team Lead Date
Data Management and Analysis

5/21/2011
Anju Chalise, NPS QA Specialist Date
Nonpoint Source Program

5/21/12
Jack Higginbotham, NPS Project Manager Date
Nonpoint Source Program

SIGN

**GUADALUPE-BLANCO RIVER AUTHORITY**

5/17/12
Debbie Magin, Project Manager/QAO Date
GBRA Water Quality Division

05/17/2012
Lee Gudgell, Project Data Validator Date
GBRA Water Quality Division

5/17/2012
Josie Longoria, Lab Director/QAO Date
GBRA Regional Laboratory

The Guadalupe-Blanco River Authority (GBRA) will secure written documentation from additional project participants (e.g., subcontractors, laboratories) stating the organization's awareness of and commitment to requirements contained in this quality assurance project plan and any amendments or revisions of this plan. The GBRA will maintain this documentation as part of the project's quality assurance records. This documentation will be available for review. Copies of this documentation will also be submitted as deliverables to the TCEQ NPS Project Manager within 30 days of final TCEQ approval of the QAPP. (See sample letter in Appendix K of this document.)

## A2 Table of Contents (continued)

## A2.1 List of Figures

## A2.3 List of Appendices

## A3 Distribution List

The TCEQ QA Specialist will provide original versions of this project plan and any amendments or revisions of this plan to the TCEQ Project Manager and the GBRA Project Manager. The TCEQ Project Manager will provide copies to the TCEQ Data Management and Assessment Work Leader and EPA Project Officer within two weeks of approval. The TCEQ Project Manager will document receipt of the plan and maintain this documentation as part of the project's quality assurance records. This documentation will be available for review.

Nancy Ragland, Team Leader
Data Management and Analysis
MC-234
(512) 239-6546

Charles Dvorsky, CWQMN Coordinator
SWQMN Program
512-2399-5550

**U.S. Environmental Protection Agency Region 6**
**State/Tribal Section**
**1445 Ross Avenue**
**Suite # 1200**
**Dallas, TX 75202-2733**
Leslie Rauscher, Project Officer
(214) 665-2773

The GBRA will provide copies of this project plan and any amendments or revisions of this plan to each project participant defined in the list below. The GBRA will document receipt of the plan by each participant and maintain this documentation as part of the project's quality assurance records. This documentation will be available for review.

**Guadalupe-Blanco River Authority**
**933 E. Court St.**
**Seguin, TX 78155**

Debbie Magin, Project Manager/Project Quality Assurance Officer/Project Data Manager
(830) 379-5822

Lee Gudgell, Water Quality Technician/Project Data Validator
(830) 379-5822

Josie Longoria, Laboratory Director/Laboratory Quality Assurance Officer
(830) 379-5822

| | |
|---|---|
| QAPP | Quality Assurance Project Plan |
| QMP | Quality Management Plan |
| RPE | Relative Percent Error |
| RPD | Relative Percent Difference |
| SLOC | Station Location |
| SOP | Standard Operating Procedure |
| SWQM | Surface Water Quality Monitoring |
| SWQMIS | Surface Water Quality Monitoring Information System |
| TBD | To Be Determined |
| TCEQ | Texas Commission on Environmental Quality |
| TMDL | Total Maximum Daily Load |
| TSSWCB | Texas State Soil and Water Conservation Board |
| TSWQS | Texas Surface Water Quality Standards |

**A4.3 NPS Quality Assurance Specialist**
**Anju Chalise**

- Assists Lead QAS with NPS QA management.
- Serves as liaison between NPS management and Agency QA management.
- Responsible for NPS guidance development related to program quality assurance.
- Serves on planning team for NPS projects.
- Participates in the development, approval, implementation, and maintenance of the QAPP.

**A4.4 NPS Data Manager**
**Rebecca Ross**

- Responsible for coordination and tracking of NPS data sets from initial submittal through NPS Project Manager review and approval.
- Ensures that data is reported following instructions in the Surface Water Quality Monitoring Data Management Reference Guide (January 2010, or most current version).
- Runs automated data validation checks in SWQMIS and coordinates data verification and error correction with NPS Project Managers' data review.
- Generates SWQMIS summary reports to assist NPS Project Managers' data reviews. Provides training and guidance to NPS and Planning Agencies on technical data issues.
- Reviews QAPPs for valid stream monitoring stations.
- Checks validity of parameter codes, submitting entity code(s), collecting entity code(s), and monitoring type code(s).
- Develops and maintains data management-related standard operating procedures for NPS data management.
- Serves on planning team for NPS projects.
- Reviews, verifies and validates CWQMN data for assigned sites.
- 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 for assigned CWQMN sites.
- Establishes procedures to routinely assess data precision, accuracy and completeness.
- Participates in the development, approval, implementation and maintenance of written QA standards (e.g., SOPs, QAPPs) and other guidance documents.
- Audits validation of CWQMN data performed by non-TCEQ data validators.
- Responsible for generating data completeness reports for assigned CWQMN sites.
- Coordinates the development and maintenance of the SWQMIS for warehousing all CWQMN data.
- Coordinates the development of interfaces between LEADS and SWQMIS with FOSD.

### A4.8 Project Quality Assurance Officer
**Debbie Magin**

- Responsible for coordinating development and implementation of the QA program.
- Responsible for writing and maintaining the Guadalupe River Basin Network QAPP.
- Responsible for maintaining records of QAPP distribution, including appendices and amendments.
- Responsible for maintaining written records of sub-tier commitment to requirements specified in this QAPP.
- Responsible for identifying, receiving, and maintaining project quality assurance records.
- Responsible for coordinating with the TCEQ QAS to resolve QA- related issues.
- Notifies the contractor Project Manager and TCEQ Project Manager of particular circumstances which may adversely affect the quality of data.
- Responsible for validation and verification of all data collected according with Table 4 procedures and acquired data procedures after each task is performed.
- Coordinates the research and review of technical QA material and data related to water quality monitoring system design and analytical techniques.
- Conducts laboratory inspections.
- Develops, facilitates, and conducts monitoring systems audits.

### A4.9 Project Data Manager
**Debbie Magin**

- Responsible for the acquisition, verification, and transfer of data to the TCEQ.
- Oversees data management for the study.
- Performs data quality assurances prior to transfer of data to TCEQ.
- Responsible for transferring data to the TCEQ in the Event/Result file format specified in the DMRG.
- Ensures data are submitted according to workplan specifications.
- Provides the point of contact for the TCEQ Data Manager to resolve issues related to the data.

### A4.10 Water Quality Technician/Project Data Validator
**Lee Gudgell**

- Responsible for supervising all aspects of the sampling and measurement of surface waters and other parameters in the field, as necessary.
- Responsible for the acquisition of water samples and field data measurements in a timely manner that meet the quality objectives specified in Table A7.1, as well as the requirements of Sections B1 through B8, as necessary.
- Responsible for field scheduling, staffing, and ensuring that staff is appropriately trained as specified in Sections A6 and A8.
- Provides overall support for the operation and maintenance of the CWQMN monitoring stations associated with this QAPP.

- Performs validation and verification of data before the report is sent to the contractor.
- Ensures that all QA reviews are conducted in a timely manner from real-time review at the bench during analysis to final pass-off of data to the QA officer.

## A4.13 GBRA Regional Laboratory Analysts and Technicians

- Responsible for receipt of sampling bottles, chain of custodies and field sheets, as necessary
- Responsible for reviewing chains of custodies for completeness, as necessary.
- Responsible for checking temperatures and preservation status of samples received in accordance with laboratory SOPs and QASM, as necessary.
- Responsible for sample analyses according to laboratory SOPs and QASM requirements, as necessary.
- Responsible for inputting laboratory sample data into the laboratory database and creating sample reports for review, as necessary.

## U.S. EPA Region 6

## A4.14 EPA Project Officer
**Leslie Rauscher**

- Responsible for managing the CWA Section 319 funded grant on the behalf on EPA.
- Assists the TCEQ in approving projects that are consistent with the management goals designated under the State's NPS management plan and meet federal guidance.
- Coordinates the review of project work plans, draft deliverables, and works with the State in making these items approvable.
- Meets with the State at least semi-annually to evaluate the progress of each project and when conditions permit, participate in a site visit on the project.
- Fosters communication within EPA by updating management and others, both verbally and in writing, on the progress of the State's program and on other issues as they arise.
- Assists the regional NPS coordinator in tracking a State's annual progress in its management of the NPS program.
- Assists in grant close-out procedures ensuring all deliverables have been satisfied prior to closing a grant.

## A5 Problem Definition/Background

Fourteen segments have been identified in the Guadalupe River Basin for having impairments or water quality concerns. Most of the impairments are based on the monthly or quarterly sampling of one or two sites on the respective segments over a period of at least seven years. A TMDL is in the final stages of development on Sandies Creek in DeWitt County. Watershed planning efforts have also begun on the Cypress Creek watershed in Hays County and the Geronimo Creek watershed in Guadalupe and Comal Counties. All three of these segments have been listed on the 305b report and/or the 303d list of impaired water bodies with impairments or concerns for dissolved oxygen, nutrients and/or bacteria. The 2008 Texas Water Quality Inventory and 303(d) List identifies the Geronimo Creek (TCEQ segment 1804A) as not supporting recreational use because it exceeded the geometric mean level for E. coli. The Geronimo Creek was also listed as a concern for general use in 2008 because it exceeded nitrate nitrogen nutrient screening levels. The 2008 Texas Water Quality Inventory and 303(d) List identifies the Cypress Creek (TCEQ segment 1815) with a concern for the aquatic life use dissolved oxygen grab standard. The 2006 Texas Water Quality Inventory and 303(d) List identifies the Sandies Creek (TCEQ segment 1803B) as not supporting recreational use because it exceeded the geometric mean level for bacteria. The Sandies Creek was also listed as not supporting 24 hour average and 24 hour minimum dissolved oxygen criteria for aquatic life use. Each water body has septic tanks and other anthropogenic non-point source activities identified as possible sources of the impairment and/or concern.

The deployment of the continuous monitoring modules specified in this QAPP is in support of the ongoing TMDL and watershed planning processes. Implementation projects or best management practices (BMPs) will be recommended at the conclusion of the TMDL study on Sandies Creek and the planning studies on the Cypress and Geronimo Creeks as a means to reduce the loading and help bring the streams back into compliance with stream standards. Continuous monitoring stations installed prior to the implementation projects can monitor the changes that occur in the stream after installation and demonstrate the effectiveness of any BMPs that are implemented.

Additionally, stakeholders have voiced concerns during the TMDL and planning process that a true picture is not being represented by a monthly sample or by a short study. They see these studies or monitoring events as "snap shots in time", which may be less than adequate in representing the overall water quality of the streams in their areas of interest. Continuous water quality stream monitoring would paint a continuous picture of the ambient water quality as well as document the way the stream reacts to storm events and temporal spring flow and runoff cycles. These water quality monitoring stations will be incorporated into the TCEQ continuous water quality monitoring network (CWQMN) and hosted on the associated webpage at www.texaswaterdata.org, which will provide access to real-time data for stakeholders in the water bodies of concern. The TCEQ CWQMN measures water quality parameters in various watersheds around the state at

# Table A5.1
# Guadalupe River Basin Network Objectives and Locations

| River Basin | Segment No. | CAMS No. | Station Location | TCEQ Station | Objective | Station Parameter |
|---|---|---|---|---|---|---|
| Guadalupe | 1804A | 741 | Geronimo Creek at SH123 | 14932 | 1) Providing timely turbidity, gage height and field parameter data to the Geronimo Creek Watershed Partnership and other interested stakeholders in the Geronimo Creek watershed;<br><br>2) Assessing impacts of non-point source discharges, including short term pollution events in the Geronimo Creek watershed. | <u>Surface</u><br>Turbidity<br>pH<br>Water Temperature<br>Dissolved Oxygen<br>Specific Conductance<br>Gage Height<br>Stream Flow |
| Guadalupe | 1815 | 797 | Cypress Creek 200 meters upstream of Confluence with Blanco River | 12673 | 1) Providing timely turbidity, gage height and field parameter data to the Cypress Creek Watershed Partnership and other interested stakeholders in the Cypress Creek watershed;<br><br>2) Assessing impacts of non-point source discharges, including short term pollution events in the Cypress Creek watershed. | <u>Surface</u><br>Turbidity<br>pH<br>Water Temperature<br>Dissolved Oxygen<br>Specific Conductance<br>Gage Height<br>Stream Flow |
| Guadalupe | 1803B | 732 | Sandies Creek at Cheapside Road, 2.0 NE of Westhoff | 13657 | 1) Providing timely turbidity, gage height and field parameter data to the TCEQ Sandies Creek TMDL and other interested stakeholders in the Cypress Creek watershed;<br><br>2) Assessing impacts of non-point source discharges, including short term pollution events in the Sandies Creek watershed. | <u>Surface</u><br>Turbidity<br>pH<br>Water Temperature<br>Dissolved Oxygen<br>Specific Conductance |

# Figure A6.1
# Numerical Model for Acoustic Doppler Stream Flow Calculation

1. **Assume a power law to generate velocity distribution of a cross-section:**

$$V(y,z) = \alpha(y) \cdot (z - z_b)^{\beta}$$

**V(x,z) = velocity perpendicular to the channel cross-section where a CM H-ADCP is installed.**

**$Z_b$ = channel bottom elevation.**

**α(y) = velocity distribution coefficient as a function of y.**

**β = empirical constant. β = 1/6 is usually used for open channel flows.**

2. **Extrapolation is employed to obtain α(y) in the unmeasured region near each bank.**

**α(y) can be solved by :**

$$\alpha(y) = \frac{V(y,z)}{(z - z_b)^{\beta}}$$

3. **The cross-section is divided into grids, velocity is calculated at each of the nodes and Gaussian integration is employed to obtain Q.**

$$Q = \iint_S V(y,z)\, dxdy$$

**s = wetted area of the cross-section.**

The second continuous monitoring station installation will occur at the Cypress Creek near the confluence with the Blanco River in Wimberley, TX (TCEQ Station #12673). This station is one of the surface water quality monitoring stations that contributed data to the original listing on the 303(d) and is located approximately 200 meters upstream of the confluence with the Blanco River. This station is positioned to capture non-point source runoff throughout the entirety of the Cypress Creek watershed. In order to quantify any water quality changes over time, this site will be equipped with a

Appendix L will not be applicable to stormwater monitoring unless specifically referenced in Appendix L of this document.

## A6.1 Revisions to the QAPP

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

## A6.2 QAPP Amendments

Amendments to the QAPP may be necessary to reflect changes in project organization, tasks, schedules, objectives, and methods; address deficiencies and non-conformances; improve operational efficiency; and/or accommodate unique or unanticipated circumstances. Requests for amendments are directed from the GBRA Project Manager to the TCEQ NPS Project Manager in writing using the QAPP Amendment shell. The changes are effective immediately upon approval by the TCEQ NPS Project Manager and Quality Assurance Specialist, or their designees, and the EPA Project Officer (if necessary).

Amendments to the QAPP and the reasons for the changes will be documented, and full copies of the amendments will be forwarded to all persons on the QAPP distribution list by the GBRA QAO. Amendments shall be reviewed, approved, and incorporated into a revised QAPP during the annual revision process or within 120 days of the initial approval in cases of significant changes.

## A7 Quality Objectives and Criteria

The MQOs and DQOs to support the Guadalupe River Basin Network (GRBN) and CWQMN objectives are specified in Tables A7.1 and A7.3. The DQOs for GRBN and CWQMN DO, SC, pH and Temperature data that can be used in the CWA 305(b) and CWA 303(d) List are specified in Tables A7.1 and Table A7.3. Only data collected that have a valid parameter code in Table A7.1 will be stored in SWQMIS. The QC program has been developed with these objectives in mind. Methods used for water quality measurements in the CWQMN are based on *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998 unless otherwise noted.

All quality objectives and criteria information relevant to the short-term portion of this project dealing with the collection and laboratory analysis of nitrate nitrogen and *Escherichia coli* in stormwater will be addressed in section A7 of Appendix L of the Guadalupe River Basin Network QAPP. All quality control procedures found outside of Appendix L will not be applicable to stormwater monitoring unless specifically referenced in Appendix L of this document.

## A7.1 Multiprobe Sensor Fouling and Calibration Verification Samples

. 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. The CWQMN CVS protocols may not accurately assess potential sensor fouling effects on data quality. The USGS has developed protocols for assessing sensor fouling. The TCEQ is currently evaluating the application of USGS procedures. Sensor fouling will not be addressed by the GRBN project at this time. If the TCEQ determines a method for accurately assessing sensor fouling, then those procedures will be included in a future amendment to this QAPP and future revisions of the GBRA-001, *In-Situ Inc. Multi-Parameter TROLL 9500 SOP* when the procedures are finalized.

## A7.2 In-Situ TROLL 500 Level Sensor

CWQMN water level and sample depth measurements are used for water quality measurement data interpretation at all network sites where level sensors are deployed, providing information to data validators, site operators, and data users to remotely (via website) survey near real-time or historic conditions at a given station. The TROLL 500 is equipped with an SDI-12 interface in order to transfer data to a Zeno data logger at the Cypress Creek Upstream of the Blanco River Confluence (Station#12673). The Zeno datalogger is capable of utilizing simple math calculations to predict stream flow in the Cypress Creek from a linear regression analysis of gage height data versus instantaneous flow readings. The stream flow measurement becomes more accurate as more stage height and instantaneous flow readings are measured and added into the calculation.

**Table A7.2**
**MQOs for In-Situ TROLL 500 Level Sensors**

| PARAMETER | LEADS PARAMETER CODE | UNITS | INSTRUMENT | RANGE | METHOD | Acceptance Criteria |
|---|---|---|---|---|---|---|
| Gage Height | 10065 | feet | In-Situ MP TROLL 500 | 0-33 feet | Vented Pressure Transducer | ± 6.0 in.* |

*If sensor does not meet acceptance criteria, sensor corrective action and/or sensor re-calibration is performed. Data is not invalidated as a result of not meeting acceptance criteria
in. = inches
MQO = Monitoring Quality Objectives

## A7.3 Teledyne RD Instruments ChannelMaster H-ADCP

The Teledyne RD Instruments ChannelMaster horizontally oriented acoustic Doppler current profiler (H-ADCP) is used to measure stream stage, velocity and discharge at the Geronimo Creek at SH123 (Station #14932). The RD ChannelMaster is equipped with a temperature gage, pressure transducer, and vertical beam system in order to provide more accurate water velocity, stage and discharge data and an SDI-12 interface to transfer collected data to an attached Sutron data logger. This system is designed to

The AWRL establishes the reporting specifications at or below which data for a parameter must be reported to be compared with freshwater criteria. AWRLs have been set by water programs for ambient data to be used in assessments that have a regulatory purpose. These levels are established for each analyte as a minimum concentration where data can be reliably reported. AWRLs will not be analyzed with the Guadalupe River Basin Network continuous monitoring instrumentation. AWRL information relating to laboratory testing methods performed as a part of the stormwater portion of this project can be found in Appendix L of this document.

### A7.6 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. In general, monitoring locations are chosen based on the location being representative of the water body. Areas of excessive vegetation, turbulence, shifting stream bottoms should be avoided. Back-water area with little flow should be avoided unless the type of area is representative of the water body. Site selection, the appropriate sampling regime, the sampling of all pertinent media according to TCEQ SOPs, and use of only approved analytical methods will assure that the measurement data represents the conditions at the site. Continuous water quality data are collected on a routine frequency and are separated by approximately even time intervals.

### A7.7 Comparability

Confidence in the comparability of data sets for this project and for water quality assessments is based on the commitment of project staff to use only approved sampling and analysis methods and QA/QC protocols in accordance with quality system requirements and as described in this QAPP and in TCEQ approved SOPs. Water quality measurements for CWQMN and this project are based on *Standard Methods for the Examination of Water and Wastewater*, 20$^{th}$ 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.

### A7.8 Precision

Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions, expressed generally in terms of the standard deviation, and is an indication of random error. Determining and calculating precision for the purposes of this quality assurance project plan is only applicable to the stormwater portion of this project which can be found in Section B5 of Appendix L of this QAPP.

Laboratory precision is assessed by comparing replicate analyses of laboratory control samples in the sample matrix (e.g. de-ionized water, sand, commercially available tissue) or sample/duplicate pairs in the case of bacterial analysis. Precision results are accordance with *SWQMN Procedures Vol. 1,* in order to determine acceptability of the data.

## A7.13 Data Verification and Validation

The GBRA will monitor data weekly via the internet at www.texaswaterdata.org in order to ensure that the continuous monitors are functioning correctly. A TCEQ trained data validator from the GBRA staff will validate the continuous monitoring data using the MeteoStar/LEADS validation tools according to TCEQ SOP DQRP-015.

# A9 Documents and Records

The GBRA 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 sample collection, measurement instrument calibration, QC checks of sampling or measurement equipment, "as collected" measurement values, an audit trail for any modification made to the "as collected" measurement values, an audit trail for any modifications made to the "as collected" measurement values traceability documentation for reference standards.

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

All documents and records information relevant to the short-term portion of this project dealing with the collection and laboratory analysis of nitrate nitrogen and *Escherichia coli* in stormwater will be addressed in section A9 of Appendix L of the Guadalupe River Basin Network QAPP. All quality control procedures found outside of Appendix L will not be applicable to stormwater monitoring unless specifically referenced in Appendix L of this document.

## A9.1 Documentation of Procedures and Objectives

1. Published guidance (*Code of Federal Regulations* U.S. Environmental Protection Agency (EPA) and EPA *Quality Assurance Handbook*).
2. Continuous Water Quality Monitoring Network Project Plan
3. Method specific SOPs
4. Instrument manufacturer's technical support manuals
5. *GBRA Guadalupe River Basin Network Quality Assurance Project Plan, TCEQ Quality Management Plan*, GBRA and TCEQ Standard Operating Procedures and the *CWQMN Quality Assurance Project Plan.*
6. *TCEQ Surface Water Quality Monitoring Procedures, Volume 1.*
7. TCEQ SOP DQRP-015 *Validation of Continuous Water Quality Monitoring Data by Multi-parameter Sonde.*

## A9.2 Record Keeping

Guadalupe River Basin Network paper records are kept for a minimum of one year. GRBN written records are archived after one year and kept as retrievable electronic records indefinitely, or for the life of the project. Electronic Data records stored in the TCEQ LEADS system are kept indefinitely or for the life of a project. Please see Table A9.1 for type of record and location.

Guadalupe River Basin Network and CWQMN environmental data is stored electronically in the MeteoStar/LEADS System. Selected validated data is loaded in the SWQMIS database. See Section B10 and Section D1 and D2 for more details.

### A9.4 Documentation Control Plan

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

All SOPs utilized by the Guadalupe River Basin Network Project will either be attached to the this Quality Assurance Project Plan for approval or the most current version of TCEQ CWQMN Standard Operating Procedures. Document control procedures for laboratory SOPs utilized for the short term stormwater portion of this project can be found in Appendix L of this QAPP.
PDFs of the current CWQMN QAPP, SOPs and Project Plans are available via the internet at: (www.texaswaterdata.org). The GRBN QAPP and project specific SOPs will be distributed to everyone on the distribution list of this document and held for the length of the project.

It is the responsibility of the GBRA to ensure they are properly following the most current revision of these documents. The TCEQ Water Quality Planning Monitoring & Assessment Section Manager, CWQMN Program Manager and QC Officer are responsible for approving new TCEQ SOPs and SOP revisions. The QC officer is responsible for changes to the TCEQ SOPs. The GRBN QC officer is responsible for submitting new QAPP amendments, SOP amendments, and SOPs and the TCEQ NPS Project Manager is responsible for approving all QAPP amendments, SOP amendments and SOPs for this project.

All logbooks containing data or sample information are uniquely identified with a logbook number. Each site operator has the responsibility of maintaining the logbooks for a minimum of five years or until the end of the project Analytical data records are stored on site for a minimum of one year in paper format and a minimum of five years in electronic format. 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.

# B2 Sampling Methods

The In-Situ TROLL 9500 (field parameters) measures ambient surface water by making a discrete measurement of water in the stream. The instrument is deployed directly in the water body of interest and, anchored to an immovable fixture located on the shoreline. This configuration was selected because of the potential for flash flooding that could lead to the loss of the equipment to high flows and/or subject the unit to high suspended solids associated with flood flows. The probe is positioned as close as possible to the portion of the stream which contains 50 percent of the total flow. The In-Situ TROLL 9500 takes measurements directly from the stream for field parameters and turbidity. This meter will record measurements every 15 minutes. The flow meters and gage height meters will also take measurements every 15 minutes

All sampling methods information relevant to the short-term portion of this project dealing with the collection and laboratory analysis of nitrate nitrogen and *Escherichia coli* in stormwater will be addressed in section B2 of Appendix L of the Guadalupe River Basin Network QAPP. All quality control procedures found outside of Appendix L will not be applicable to stormwater monitoring unless specifically referenced in Appendix L of this document.

## B2.1 Monitoring Equipment

Instrument specific analytical standard operating procedures (SOPs) describe support equipment, sampling and analytical procedures. Currently, In-Situ TROLL 9500, and In-Situ TROLL 500 operating manuals are being used as guidance for maintenance activities. Table B2.1 lists the monitoring methods and equipment that will be implemented at each continuous monitoring station.

be resolved by GBRA Water Quality Technician, the GBRA Water Quality Technician notifies the GBRA Project Manager who is responsible for coordination with the NPS project manager to resolve the problem. The GBRA Water Quality Technician may be authorized by the GBRA Project Manager to utilize budget funds to coordinate instrument repair by vendors and vendor contractors in order to repair malfunctioning equipment. The GBRA Project Manager reports the problem and necessary corrective action to the NPS Project Manager.

The GBRA Water Quality Technician is responsible for documenting problems and corrective actions in the appropriate instrument logbook. When problems could affect data quality the GBRA Water Quality Technician is also responsible for making note of the problems on the data summary form that accompanies the electronic submittal of the data to TCEQ for data assessment purposes.

## B4 Analytical Methods

The methods used by the In-Situ Inc. MP TROLL 9500 for pH and conductivity are based on *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 1998. The method used by the In-Situ Inc. MP TROLL 9500 for temperature is based on "*Methods for Chemical Analysis of Water and Wastes*," Manual #EPA-600/4-79-020. The method used by the In-Situ Inc. MP TROLL 9500 for dissolved oxygen is ASTM No. D888-05 Method C. Data comparability is achieved by following approved standardized analytical methods and operating procedures. Methods must be documented to minimize variation in procedures and results. The In-Situ TROLL 500 calculates water level from pressure transducer measurements and known reference point.

The continuous monitoring method summaries are presented in Table A7.1. This table includes method, analytical technique and performance criteria.

Analytical system corrective actions are addressed in Section C1 of this QAPP.

All analytical methods information relevant to the short-term portion of this project dealing with the collection and laboratory analysis of nitrate nitrogen and *Escherichia coli* in stormwater will be addressed in section B4 of Appendix L of the Guadalupe River Basin Network QAPP. All quality control procedures found outside of Appendix L will not be applicable to stormwater monitoring unless specifically referenced in Appendix L of this document.

**New Technology**

The continuous monitoring station is using experimental technology with the turbidity probe on the In-Situ Inc. MP TROLL 9500 and the Teledyne RD Instruments ChannelMaster H-ADCP. Consequently, method performance determination can take place after sampling equipment has been deployed and begins recording data. If necessary after deployment, the QAPP will be amended to reflect changes in method performance criteria that more appropriately reflect the performance capabilities of the instrument. The GBRA Project Manager and Water Quality Technician are responsible for developing new sampling and measurement technology.

New method performance is evaluated and documented. Method performance for new methods may be evaluated by examining frequency of calibration verification failures.

## Water Quality Calibration Verification Samples

Instrument calibration is periodically assessed using CVSs. These standards are analyzed to determine if fouling and/or instrument drift has caused sensors to exceed criteria. The CVS is prepared from the same standard used to generate the initial calibration curve. The CWQMN CVS procedures may not accurately characterize the effects of fouling on sensor performance. The TCEQ is currently evaluating the application of USGS fouling measurement procedures.

## Bias

Currently, sonde measurement bias is determined using CVSs. Tables in Section A7 list sonde performance specifications.

Conversely, measurement bias can be expressed in terms of relative percent error (RPE):

$$RPE = \frac{(Y - X)}{X} \times 100$$

Where: Y = measured value; and
X = known value.

## Sensitivity

Method sensitivity is estimated using method detection limit studies after initial instrument setup, after major modifications, and at least annually thereafter. Detection limit determination is consistent with *40 CFR Part 136*, Appendix B to the extent possible. This requires replicate fortification of seven different blanks at a concentration three to five times the expected detection limit, if possible. Each fortified sample is analyzed and the measured analytical standard deviation is multiplied by the appropriate Student's "t" value to determine concentration at which there is a 99 percent certainty that the measured concentration is not due to background noise. The calculated detection limit is confirmed by analyzing one standard at two to five times the calculated detection limit. Method sensitivity is not evaluated for multi-probe pH, Temperature, Dissolved Oxygen, Conductivity or Turbidity analysis.

## Corrective Action Related to QC

Any deviation from the procedures documented in the SOP, including any QC samples which do not meet the frequency requirement or acceptance criteria, will be documented in the operator's log by the GBRA Water Quality Technician. The log entry will contain a description of the exception, the cause (if possible), the affected data, and the impact on the data record. Any affected data will be qualified 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,

## B6 Instrument/Equipment Testing, Inspection and Maintenance

Instrument maintenance activities are documented in equipment dedicated logbooks. Preventative maintenance records contain information on periodic routine maintenance, symptoms, troubleshooting effort descriptions, results and follow-up observations. Records will include the date, time, and the name or initials of the individual performing the maintenance. These records are vital tools in historic instrument performance and are an aid to future troubleshooting. GBRA maintenance documents are based on the manufacturer's recommendations and experience gained with the instrument after deployment during the method development project phase.

GBRA stocks various consumable and replacement items for the continuous monitoring stations. The GBRA Water Quality Technician is responsible for coordinating the necessary supply and parts in stock. When necessary, C.C. Lynch and Associates will travel to the monitoring site to assist in the repair or replace support equipment that cannot be repaired or replaced by GBRA personnel.

The In-Situ MP TROLL 9500 is deployed directly in the water body of interest, and anchored to an immovable fixture located on the shoreline. This configuration was selected because of the potential for flash flooding that could lead to the loss of the equipment to high flows and/or subject the unit to high suspended solids associated with flood flows. However, it is accepted that the support system and components will need periodic replacement and repair.

Currently the instrument's operating manuals are being used as guidance for maintenance activities.

All instrument/equipment testing, inspection and maintenance procedures relevant to the short-term portion of this project dealing with the collection and laboratory analysis of nitrate nitrogen and *Escherichia coli* in stormwater will be addressed in section B6 of Appendix L of the Guadalupe River Basin Network QAPP. All quality control procedures found outside of Appendix L will not be applicable to stormwater monitoring unless specifically referenced in Appendix L of this document.

## B8 Inspection/Acceptance of Supplies and Consumables

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

All inspection/acceptance of supplies and consumables relevant to the short-term portion of this project dealing with the collection and laboratory analysis of nitrate nitrogen and *Escherichia coli* in stormwater will be addressed in section B8 of Appendix L of the Guadalupe River Basin Network QAPP. All quality control procedures found outside of Appendix L will not be applicable to stormwater monitoring unless specifically referenced in Appendix L of this document.

## B10 Data Management

Water quality, water gage height, sample depth data and operator logs (containing quality control results and other information) are transferred to the TCEQ headquarters (Austin, Texas) Comms Front-End Processor (CFEP) computer through Regional Hewlett Packard 712/60 computers that automatically download data every 15 minutes by wireless modem. The data are secured from tampering or corruption over the carrier line through an unlisted telephone number, pass code protection, and error checking protocol.

The measurement instrumentation is connected to a Zeno or Sutron data logger system. The data loggers system records the analog output voltage of each instrument once a second, digitizes it, and stores the data sequentially as five-minute averages in a record. A record consists of sequential fields of data for as many channels as are activated for the monitoring station. Every 15 minutes, the Hub computer collects the previous data from the monitoring station's Zeno data logger by modem. The data are secured from tampering or corruption over the carrier line through an unlisted telephone number, pass code protection and error checking protocol.

If the telemetry method fails, the data logger is capable of recording and storing data until the data are overwritten with newly generated data. Once communications are re-established the data are automatically downloaded to the CFEP computer. GBRA will check the operational status of the station every business day via the TCEQ website. If communications problems are detected, the GBRA Water Quality Field Technician will initiate corrective action after notifying the GBRA Project Manager. The GBRA Project Manager will ensure that corrective action was taken and that the action was effective.

The MeteoStar/LEADS processing program checks for correct date, time, sampling site number and proper formatting of raw data fields. It then calculates five-minute and hourly averages, converting voltages to engineering units. The data are stored in a temporary disk file. The Guadalupe River Basin Network CWQMN data validator will work from this file through a GBRA computer on a graphical interface and behind the TCEQ LEADS firewall to validate the field parameter data. The GBRA data validators obtain field sonde QC information from the MeteoStar/LEADS operator log, which is entered by GBRA. GBRA will access the MeteoStar/LEADS TCEQ webpage operator log at http://tceqwatercal.ipsmtx.com to enter operator logs. Site cooperators who have obtained authorization can access the MeteoStar/LEADS TCEQ web page operator log via the Virtual Private Network to enter operator logs.

After data validation, the data are coded in the file. The coded data in this file are considered "validated data" and are archived on optical disk indefinitely.

All data management information relevant to the short-term portion of this project dealing with the collection and laboratory analysis of nitrate nitrogen and *Escherichia coli* in stormwater will be addressed in section B10 of Appendix L of the Guadalupe

Data are reported internally on the RHONE Daily Reporting Page at various frequencies, which are dependent upon project monitoring instrumentation. Data collected with multiprobes and level sensors every 15 minutes are reported in the SWQM Daily Report in the 15-minute increment of their collection.

Hourly data summary reports are externally available on the TCEQ-hosted website (www.texaswaterdata.org) for all station in the network.

**Record-keeping and Data Storage**

GBRA recordkeeping and document control procedures are contained in the water quality sampling and laboratory standard operating procedures (SOPs) and this QAPP. Original instrument calibration logs, maintenance logs and field sheets are stored in the GBRA offices in accordance with the record-retention schedule in Section A9. Original lab sheets are stored in the GBRA offices in fireproof files. Two copies of the GBRA database are backed up each Friday on magnetic tape. One copy is stored in a fireproof safe in a GBRA office, and one copy is stored off-site. If necessary, disaster recovery will be accomplished by information resources staff using the backup database.

**Archives/Data Retention**

Complete original data sets are archived as permanent scanned electronic media and retained on-site by the GBRA for a retention period specified in Section A9.

**Data Verification/Validation**

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

**Forms and Checklists**

See Appendix F for the Calibration/CVS Log.
See Table D2.1 for the Data Review Checklist and Summary.

**Data Handling**

All instrument data is transferred to the MeteoStar/LEADS system and retained on the TCEQ database.

Any laboratory data collected are processed using the GBRA Regional Laboratory Information System (LIMS). Data integrity is maintained by the implementation of password protections which control access to the LIMS and by limiting update rights to a select user group. No data from external sources are maintained in the database. The database administrator is responsible for assigning user rights and assuring database integrity.

## C1 Assessments and Response Actions

### Table C1.1
### Assessments and Response Requirements

| Assessment Activity | Approximate Schedule | Responsible Party | Scope | Response Requirements |
|---|---|---|---|---|
| Status Monitoring Oversight, etc. | Continuous | GBRA | Monitoring of the project status and records to ensure requirements are being fulfilled | Report to TCEQ in Quarterly Report |
| Monitoring Systems Audit of GBRA | Dates to be determined by TCEQ NPS | TCEQ | Field sampling, handling and measurement; facility review; and data management as they relate to NPS | 30 days to respond in writing to the TCEQ to address corrective actions |
| Laboratory Inspection | Dates to be determined by the GBRA | GBRA Quality Assurance Officer | Analytical and quality control procedures employed at the laboratory and the contract laboratory | Submit corrective actions that effect samples collected under this project to the TCEQ. |
| QA of External Party CWQMN Data Validation | Dates to be determined by TCEQ Data Management & Analysis | TCEQ Data Management & Analysis | Review of CWQMN data validation performed by parties external to TCEQ to ensure requirements are being fulfilled and TCEQ SOPs are adhered to. | To be determined |

**Data Completeness Assessment**

See calculation below for how data completeness is calculated. Sites in the GRBN may be located in intermittent streams. Suspension of water monitoring can occur in times of drought.

Data completeness is calculated as follows for stream sites:

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

**Corrective Action Process for Deficiencies**

# Figure C1.1 Corrective Action Process for Deficiencies

Status of CAPs will be documented on the Corrective Action Status Table (See Appendix I) and included with Quarterly Progress Reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TCEQ immediately.

The GBRA Project Manager is responsible for implementing and tracking corrective actions. Corrective action plans will be documented on the Corrective Action Plan Form (CAF) (See Appendix J) and submitted, when complete, to the TCEQ Project Manager. Records of audit findings and corrective actions are maintained by both the TCEQ and the GBRA Project Manager. Audit reports and corrective action documentation will be submitted to the TCEQ with the Quarterly Progress Report.

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

Overall project progress reports are made quarterly. CAF will be submitted with the data set that it is related to, with a copy included in the quarterly progress report.

## D1 Data Review, Verification, and Validation

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

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

The procedures for verification and validation of data are described in Section D2, below. The GBRA Water Quality Technician/Project Data Validator is responsible for ensuring that any field data or continuous monitoring data are properly reviewed and verified for integrity. The GBRA Laboratory Director is responsible for ensuring that any laboratory data generated for this project are scientifically valid, defensible, of acceptable precision and bias, and reviewed for integrity. The GBRA Data Manager will be responsible for ensuring that all data are properly reviewed and verified, and/or submitted in the required format to the to the TCEQ, as necessary. The GBRA Data Manager is responsible for ensuring that all continuous monitoring data have been validated by the GBRA data validator and also performs a validation check on 10% of any laboratory data generated for this project. Finally, the GBRA Project Manager, with the concurrence of the GBRA QAO, is responsible for validating that all data to be reported meet the objectives of the project and are suitable for reporting to TCEQ.

GBRA verifies and validates water quality generated by the continuous monitoring stations. The In-Situ TROLL 500 will be validated based on the TCEQ SOP DQRP-015 by GBRA staff. The In-Situ TROLL 9500 will be validated based on an SOP DQRP-015. The Water depth and flow measurement data will be verified for reasonableness utilizing the validation tools on MeteoStar/LEADS database, but the validation procedure for these parameters will be utilized to initiate instrument corrective actions. GBRA staffs have been trained by TCEQ Data Management staff to validate data based on LEADS procedures. Table D1.1 lists the data validator and operator.

outside of Appendix L will not be applicable to stormwater monitoring unless specifically referenced in Appendix L of this document.

**Data Verification Sondes (Multi-probes)**

Table A7.1 lists the criteria for QC sample results for sonde measurement data. Verification of conductivity, pH, and dissolved oxygen (DO) includes the analysis of a DO, pH and conductivity calibration verification sample (CVS) performed at least monthly after instrument deployment. GBRA analyzes the CVSs at least monthly or quarterly as defined in table D1.3. GBRA records in the Operators Log whether the CVS passed or failed on a parameter specific basis. GBRA manually verifies the sonde CVS data that is accessed from the Operators Log via an internal TCEQ webpage. The log notes are reviewed for a given batch of ambient measurements. The log contains CVS information, as well as any other site observations. Any failed CVSs will result in all data back to the last calibration (usually a month) and/or CVS of that parameter being qualified as invalid. All data within one hour after any preventative maintenance (PMA flag) will also be qualified as invalid, in order for the sonde to stabilize.

The In-Situ TROLL 9500 will collect data for pH, temperature, dissolved oxygen and conductivity once every 15 minutes. The In-Situ TROLL 500 will record the pressure changes in pressure exerted by the water on an internal media. Water level is calculated from a reference depth to the surface of the water. The data from both units are transmitted to TCEQ via a wireless modem. The TCEQ MeteoStar/LEADS will average the results and post an hourly value.

## Table D1.2
## In-Situ TROLL Sondes Performance Criteria and Frequency of QC Checks

| Parameter | Units | Standard Concentration | Frequency of QC checks | Operating Limits |
|---|---|---|---|---|
| pH | pH units | 7 and 10 | Once a month | 0-12 S.U. |
| DO | mg/L | 100% Saturated water | Once a month | 0-20 mg/L |
| Specific Conductance | umhos/cm | 1000 umhos/cm | Once a month | 5-20,000 umhos/cm |
| Temperature | °C | NA | Once per quarter | 5-50°C |
| Turbidity | NTU | 20.0 NTU | Once a month | 0-2000 NTU |
| Gage height | feet | NA | Once per quarter | 0-33 feet |
| Stream Flow | cfs | NA | Once per quarter | Dependent upon location |

After validating any data, GBRA will enter validator notes. These notes document and explain any data qualifications made, other than valid (VAL) flags and why the qualification was made. In addition to the electronic validator notes, each validator also keeps a hard copy validator's notebook that has the same information. These notebooks are stored at GBRA and will be kept on file indefinitely.

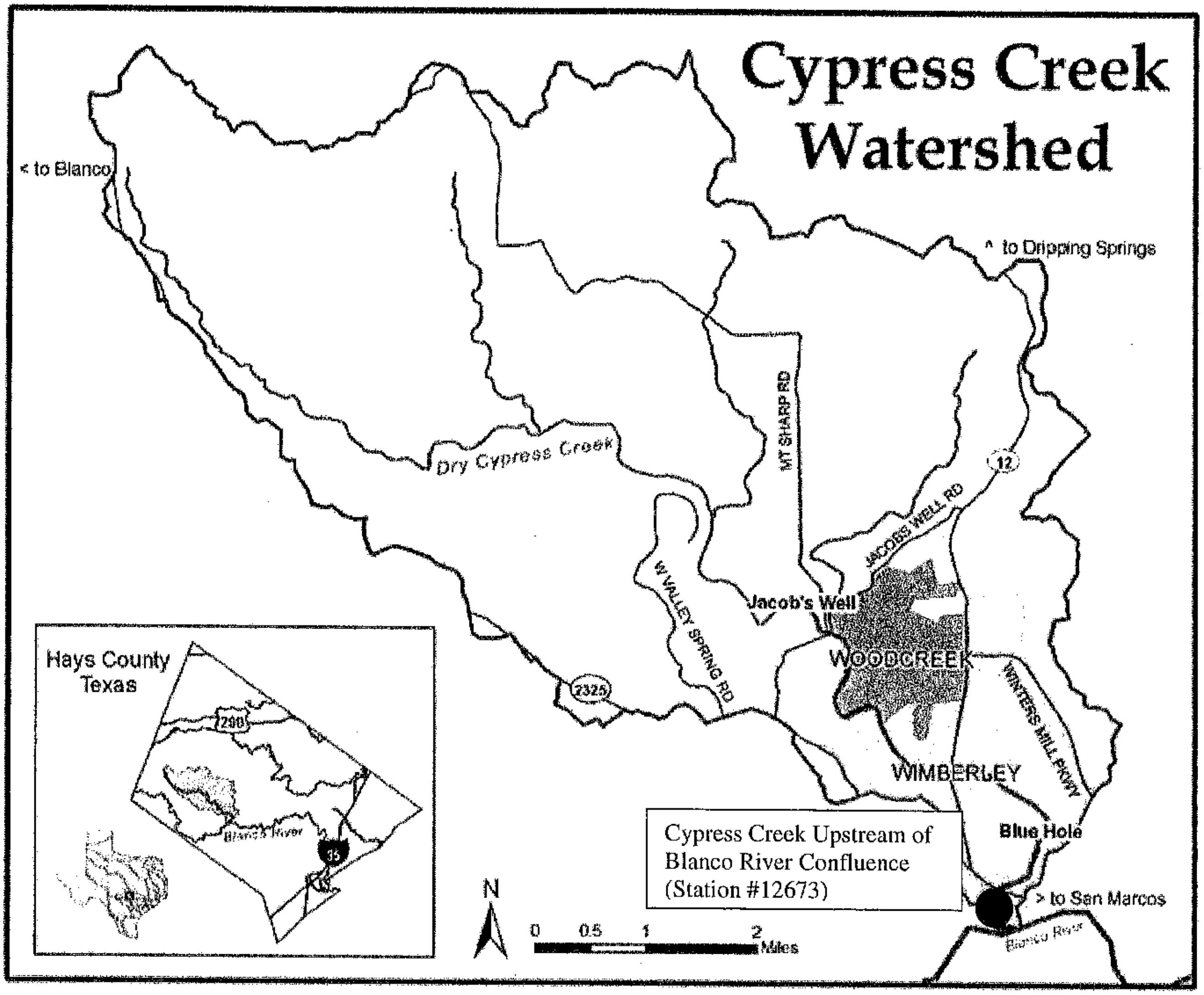
All verification and validation methods relevant to the short-term portion of this project dealing with the collection and laboratory analysis of nitrate nitrogen and *Escherichia coli* in stormwater will be addressed in section D2 of Appendix L of the Guadalupe River Basin Network QAPP. All quality control procedures found outside of Appendix L will not be applicable to stormwater monitoring unless specifically referenced in Appendix L of this document.

| Data to be Verified | Field Task | Laboratory Task | Data Manager Task |
|---|---|---|---|
| Analytical sensitivity (Minimum Analytical Levels/Ambient Water Reporting Limits) consistent with QAPP | | GBRA Laboratory Analysts/ Technicians<br><br>Josie Longoria GBRA Lab Director/QAO | Debbie Magin GBRA Data Manager* |
| Results, calculations, transcriptions checked | | GBRA Laboratory Analysts/ Technicians<br><br>Josie Longoria GBRA Lab Director/QAO | Debbie Magin GBRA Data Manager* |
| Laboratory bench-level review performed | | | Debbie Magin GBRA Data Manager* |
| All laboratory samples analyzed for all parameters | | GBRA Laboratory Analysts/ Technicians<br><br>Josie Longoria GBRA Lab Director/QAO | Debbie Magin GBRA Data Manager* |
| Corollary data agree | | | Debbie Magin GBRA Data Manager* |
| Nonconforming activities documented | | GBRA Laboratory Analysts/ Technicians<br><br>Josie Longoria GBRA Lab Director/QAO | Debbie Magin GBRA Data Manager* |
| Outliers confirmed and documented; reasonableness check performed | | | Debbie Magin GBRA Data Manager* |
| Dates formatted correctly | | | Debbie Magin GBRA Data Manager* |
| TAG IDs correct | | | Debbie Magin GBRA Data Manager* |
| TCEQ ID number assigned | | | Debbie Magin GBRA Data Manager* |
| Valid parameter codes | | | Debbie Magin GBRA Data Manager* |

## Table D2.2
## Data Validation Flags (Qualifiers)

| Flag | Definition |
|---|---|
| AQI | Ambient Quality Invalid – Flag manually assigned when data point deemed invalid by data validator. |
| PMA | Preventative Maintenance – Flag manually assigned when site operator is performing maintenance on analytical equipment. |
| VAL | Valid – Flag automatically assigned to any data point that does not fall above or below pre-defined limits.<br><br>Valid – Flag manually assigned to any data that was previously automatically assigned a Laboratory Information System flag that was later deemed valid by the data validator. |
| LIM | Limit Exceeded – Flag automatically assigned to any data that fall above or below 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. |

# Appendix A. Area Location Map


Cypress Creek
Watershed
< to Blanco
^ to Dripping Springs
MT SHARP RD
Dry Cypress Creek
JACOBS WELL RD
12
W VALLEY SPRING RD
Jacob's Well
WOODCREEK
WINTERS MILL PKWY
2325
WIMBERLEY
Blue Hole
> to San Marcos
Blanco River
Hays County
Texas
290
Blanco River
35
N
0 0.5 1 2
Miles
Cypress Creek Upstream of
Blanco River Confluence
(Station #12673)

# Appendix B. Work Plan

| | | | | | | |
|---|---|---|---|---|---|---|
| **Texas NPS Management Program Elements:** | **Element 1 (LTG Objectives 1, 2, 5, 6, 7; STG 1B, STG 1C, STG 1E, STG 3A, STG 3B, STG 3D,<br>Element 2<br>Element 3<br>Element 5<br>Element 8** | | | | | |
| **Project Costs:** | **Federal:** | **$124,914** | **Non-Federal:** | **$83,276** | **Total:** | **$208,190** |
| **Project Management:** | **Guadalupe Blanco River Authority** | | | | | |
| **Project Period:** | **January 1, 2010 – August 31, 2012** | | | | | |

## Part I – Applicant Information

| Applicant | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project Lead** | **Debbie Magin** | | | | | | |
| **Title** | **Director of Water Quality Services/Regional Laboratory** | | | | | | |
| **Organization** | **Guadalupe-Blanco River Authority** | | | | | | |
| **E-mail Address** | **dmagin@gbra.org** | | | | | | |
| **Street Address** | **933 E. Court Street** | | | | | | |
| **City** | **Seguin** | **County** | **Guadalupe** | **State** | **TX** | **Zip Code** | **78155** |
| **Telephone Number** | **(830) 379-5822** | | | **Fax Number** | **(830) 372-2757** | | |

| Project Partners | |
|---|---|
| **Names** | **Roles & Responsibilities** |
| **Texas Commission On Environmental Quality (TCEQ)** | **Provide state oversight and management of all project activities and ensure coordination of activities with related projects and TSSWCB.** |
| | |
| | |
| | |
| | |

| | | | |
|---|---|---|---|
| **2006** | | | |
| | **the upper end of the waterbody** | **dissolved oxygen (24 hr min)** | **5a** |
| **2006** | | | |

**Segment 1804A: Geronimo Creek: Entire waterbody**

| | | |
|---|---|---|
| **1804A _01: Entire waterbody** **2006** | **bacteria (geomean)** *E. coli* | **5c** |

CONCERNS (*2008 Texas Water Quality Inventory*)

| | | Level of Concern |
|---|---|---|
| **1804A_01: Geronimo Creek: Entire Waterbody** | **Nitrates** | **CS (concern for screening level)** |

## Project Narrative

### Problem/Need Statement

Fourteen segments have been identified in the Guadalupe River Basin as being impaired or having water quality concerns. Most of the impairments are based on the monthly or quarterly sampling of one or two sites on the respective segments over a period of at least seven years. A TMDL is in the final stages of development on Sandies Creek in DeWitt County, and Watershed planning efforts have begun on the Cypress Creek in Hays County and the Geronimo Creek watershed in Guadalupe and Comal Counties. All three of these segments have been listed on the 305b report and/or the 303d list of impaired water bodies with impairments or concerns for dissolved oxygen, nutrients and/or bacteria. Each water body has septic tanks and other anthropogenic nonpoint source (NPS) activities identified as possible sources of the impairment and/or concern.

Implementation projects or best management practices (BMPs) will be recommended at the conclusion of the planning studies on Cypress and Geronimo Creeks. It has been well documented that nitrifying bacteria are capable of converting ammonia-nitrogen to nitrate-nitrogen under highly aerobic conditions during a process called nitrification. Approximately 4.3 milligrams of dissolved oxygen is consumed for every 1.0 milligram of ammonia-nitrogen converted to nitrate-nitrogen during nitrification. By establishing the relationship between real-time concentrations of dissolved oxygen and nitrate-nitrogen during base flow and during storm events, the extent of nitrification can be examined. Because of the inverse relationship of ammonia-nitrogen and nitrate-nitrogen during nitrification and if the real-time monitoring provides evidence of the nitrification process, there would be support for best management practices that reduce sources of stormwater that contribute ammonia-nitrogen to the stream. In addition to representing ambient water quality, continuous monitoring stations installed prior to the execution of implementation projects can record the changes in water quality during the BMP implementation.

**Additionally, stakeholders have voiced concerns during the TMDL and planning process that a true picture is not being represented by a monthly sample or by a short study. They see these studies or monitoring events as "snap shots in time" that may be less than adequate in representing the overall water quality of the streams in their area. Temperature impacts the**

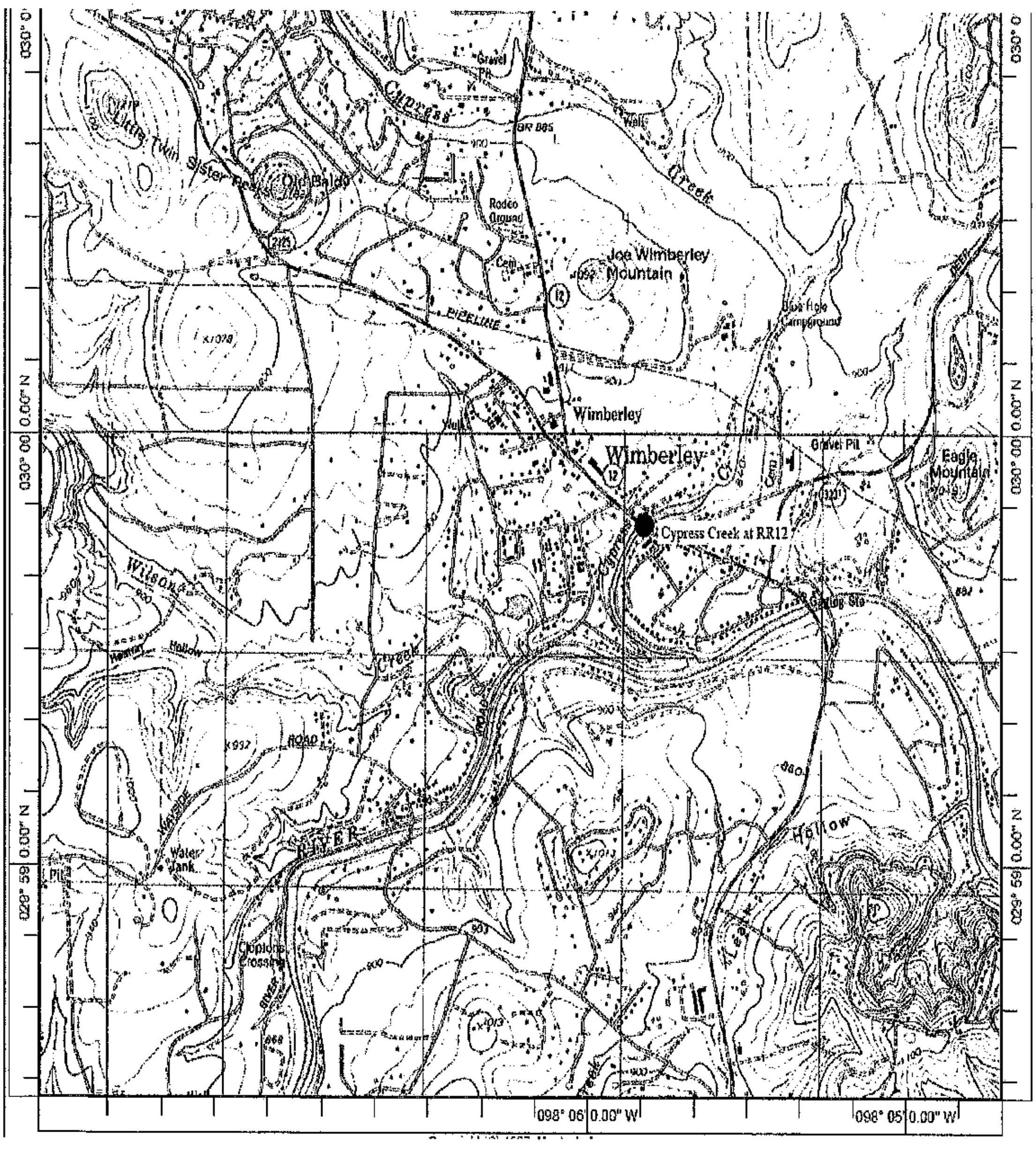
producing real-time data for public use. The project will notify stakeholders identified in the TMDL planning process when the sites go "live," using mass media, direct mail, email, and a kick off event. A computer kiosk in each watershed will be established in a location such as a public library, NRCS or Extension office, or governmental building. The kiosk will be available for those stakeholders that do not have access to the web or have problems using the technology from their home. Electronic notifications will be automatically sent to all registered stakeholders when established criteria fail to be met. All stakeholders will be encouraged to register to receive notifications. GBRA may conduct field investigations based on these notifications and contact appropriate authorities.

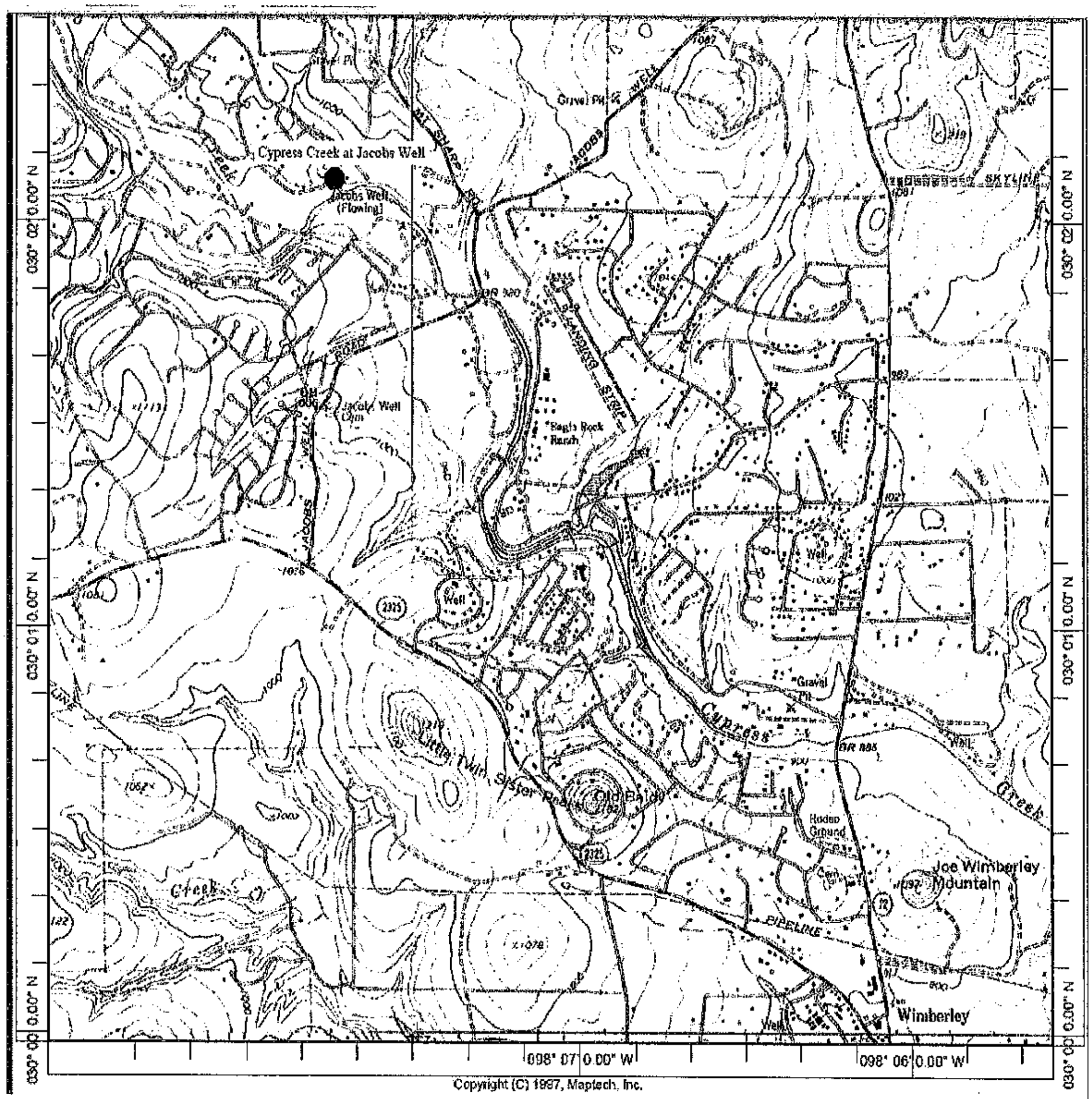
**In order for the project to be sustainable beyond the grant period, the project partners will recruit sponsors for the established sites so that the sites would continue to operate and remain functional after the three-year project.**

Geronimo Creek (Station 14932) at SH123

Sandies Creek (Station 13657)

Cypress Creek (Station 12673)




Cypress Creek at Jacobs Well
Jacobs Well (Flowing)
Jacobs Well Cem
Eagle Rock Ranch
Gravel Pit
Cypress
Creek
Little Twin Sister Peaks
Old Baldy
Rodeo Ground
Joe Wimberley Mountain
PIPELINE
Wimberley
Well
030° 02' 0.00" N
030° 01' 0.00" N
030° 00' 0.00" N
098° 07' 0.00" W
098° 06' 0.00" W

| | | | | |
|---|---|---|---|---|
| **Subtask 1.4** | GBRA will participate in a post-award orientation meeting with TCEQ within 60 days of contract execution. GBRA will maintain regular telephone and/or email communication with the TCEQ Project Manager regarding the status and progress of the project in regard to any matters that require attention between QPRs. This will include a call or meeting each January, April, July, and October. Minutes recording the important items discussed and decisions made during each call will be attached to each QPR. Matters that must be communicated to the TCEQ Project Manager in the interim between QPRs may include:<br>• Requests for prior approval of activities or expenditures for which the contract requires advance approval or that are not specifically included in the scope of work.<br>• Notification in advance when GBRA has scheduled public meetings or events, initiation of construction, or other major task activities under this contract.<br>• Information regarding events or circumstances that may require changes to the budget, scope of work, or schedule of deliverables. Such information must be reported within 48 hours of discovering these events or circumstances. | | | |
| | Start Date | May 1, 2010 | Completion Date | June 30, 2010 |
| **Subtask 1.5** | GBRA will participate in an annual Contractor Evaluation. | | | |
| | Start Date | Sept 15, 2010 | Completion Date | August 31, 2012 |
| **Subtask 1.6** | GBRA will develop a one-page fact sheet of the project using the TCEQ NPS Projects Template. The fact sheet will briefly describe what the project is going to accomplish, and will provide background information on why the project is being conducted, the current status of the project, and who is involved in the project. The project fact sheet will be submitted to the TCEQ within 60 days after contract initiation. The fact sheet will be updated annually, and submitted with the fourth QPR. The fact sheet will be updated more often, as the project status changes. The fact sheet will be published on GBRA's website after approval from the TCEQ Project Manager. | | | |
| | Start Date | May 1, 2010 | Completion Date | June 30, 2010 |
| **Subtask 1.7** | GBRA will provide an article for the Nonpoint Source Annual Report upon request by the TCEQ. This report is produced annually in accordance with Section 319(h) of the Clean Water Act (CWA), and is used to report Texas' progress toward meeting the CWA § 319 goals and objectives, and toward implementing it's strategies as defined in the Texas Nonpoint Source Management Program. The article will include a brief summary of the project and describe the activities of the past fiscal year. | | | |
| | Start Date | July 15, 2010 | Completion Date | August 31, 2012 |

| Tasks, Objectives and Schedules (Replicate or modify table as needed) | | | | | | |
|---|---|---|---|---|---|---|
| **Task 2:** | **Purchase and Installation of Equipment** | | | | | |
| **Costs:** | **Federal:** | **$80,000** | **Non-Federal:** | **$50,025.02** | **Total:** | **$130,025.02** |

| | |
|---|---|
| **Deliverables** | • **Documentation of operator training**<br>• **Status report on data captured and telemetered to project website and kiosks**<br>• **Documentation of procurement of equipment**<br>• **Report to include equipment procurement, purchase, installation and cost accounting** |

| Tasks, Objectives and Schedules (Replicate or modify table as needed) | | | | | |
|---|---|---|---|---|---|
| **Task 3:** | **Quality Assurance** | | | | |
| **Costs:** | **Federal:** $0 | **Non-Federal:** | **$5,138.74** | **Total:** | **$5,138.74** |
| **Objective:** | **To develop data quality objectives (DQOs) and quality assurance/control (QA/QC) activities to ensure data of known and acceptable quality are generated through this project. To conduct data collection activities in accordance with an integrated system of quality management activities involving planning, assessment, implementation, training, and quality improvement.** | | | | |
| **Subtask 3.1:** | GBRA will develop data quality objectives which will clarify the purpose of the continuous water quality monitoring, define the most appropriate type of data to collect, and help determine the most appropriate methods and frequency in which to collect them. The data quality objectives will also cover the *E. coli* and nitrate-nitrogen samples collected during the storm events on Geronimo Creek. | | | | |
| | **Start Date:** | **May 1, 2010** | **Completion Date:** | **July 31, 2010** | |
| **Subtask 3.2:** | GBRA will schedule QAPP planning meetings with the TCEQ Project Manager, Quality Assurance staff, technical staff, management, and contractors, to implement a systematic planning process, based on the elements of the TCEQ NPS QAPP Shell. The information developed during the planning meetings will be incorporated into a QAPP. Additional planning meetings may also be conducted to determine if any changes need to be made to an existing QAPP. | | | | |
| | **Start Date:** | **May 1, 2010** | **Completion Date:** | **August 31, 2012** | |

| | | | | |
|---|---|---|---|---|
| **Objective:** | **To continuously monitor water quality in the Cypress, Geronimo, and Sandies Creeks to identify potential causes of NPS pollution by capturing data scheduled to be collected at assigned monitoring locations. Deployed monitoring units will collect pH, temperature, dissolved oxygen, specific conductance, and turbidity at 15 minute intervals. Turbidity and nitrate-nitrogen will be measured every 15 minutes and used to observe changes or trends in water quality.** | | | |
| **Subtask 4.1:** | **GBRA will attend training events and request technical assistance from TCEQ in order to manage each project site using CWQMN protocol and the project QAPP, including data collection and validation. Training events and technical assistance will be documented in the QPR.** | | | |
| | **Start Date:** | **May 1, 2010** | **Completion Date:** | **September 1, 2010** |
| **Subtask 4.2:** | **GBRA will develop a monitoring program and conduct monitoring, as outlined in the QAPP, to achieve data quality objectives. The monitoring program will include the data collected by continuous real-time monitoring sondes as well as *E. coli* and nitrate-nitrogen samples collected during storm events on Geronimo Creek. GBRA will establish trigger levels for notification to stakeholders that stream water quality conditions are not being met.** | | | |
| | **Start Date:** | **August 1, 2010** | **Completion Date:** | **August 1, 2012** |
| **Subtask 4.3:** | **Data will be telemetered and stored on a server at the TCEQ headquarters. GBRA will perform data validation consistent with the TCEQ Standard Operating Procedures for validation of continuous water quality monitoring data. These activities will be documented in the each QPR.** | | | |
| | **Start Date:** | **August 1, 2010** | **Completion Date:** | **August 31, 2012** |
| **Subtask 4.4:** | GBRA will purchase and maintain a standing stock of items regularly required for performing routine maintenance of the project sites. GBRA will participate in CWQMN conference calls. Information regarding coordination activities will be reported in the QPRs. | | | |
| | **Start Date:** | **January 1, 2010** | **Completion Date:** | **August 31, 2012** |
| **Deliverables** | • **Documentation of operator training**<br>• Status report on data captured and telemetered to project website and kiosks<br>• Provide a report on establishment of trigger measurements that notify stakeholders that water quality conditions are not being met<br>• Summaries of operation and maintenance<br>• CWQMN conference calls as required<br>• GRBN CWQMN data captured and telemetered and validated monthly<br>• Report on coordination activities<br>• Report to combine deliverables for Task 4<br>• Water quality monitoring non-conformances will be reported to TCEQ Project Manager | | | |

| | | | | |
|---|---|---|---|---|
| **Objective:** | **To develop an information and communication process that informs the public of the real-time water quality conditions in each of the three project areas, Cypress Creek, Geronimo Creek, and Sandies Creek. The process will be used to enhance partnerships with stakeholders; foster a public understanding of project goals and objectives; and encourage participation in developing, selecting, designing, implementing, and maintaining appropriate BMPs. The process will also help the public achieve a better understanding of land use activities and their impact on water quality.** | | | |
| **Subtask 6.1:** | **Stakeholders will be identified in the watershed where each monitoring station is established. A list that includes names, addresses and email addresses will be compiled prior to the station going "live" and will be included with QPRs. GBRA will notify stakeholders identified in each watershed when the sites go "live," using mass media, direct mail, email, and a kick off event.** | | | |
| | **Start Date:** | **May 1, 2010** | **Completion Date:** | **June 30, 2012** |
| **Subtask 6.2:** | **A computer kiosk in each watershed will be established in a location such as a public library, Natural Resources Conservation Service or Extension office, or governmental office. The kiosk will be available for those stakeholders that do not have access to the web or have problems using the technology from their home. The kiosks would provide, not only the link to the monitoring networks for real-time data but additional information on the TMDL or planning project, the ability to post a question to the project partners, and have access to basic water quality information. Additional activities will be engaged to disseminate information about the project to the public. Updates will be provided for inclusion on the TCEQ web site and GBRA's web site. It is expected that periodic newspaper articles may be published.** | | | |
| | **Start Date:** | **November 30, 2010** | **Completion Date:** | **June 30, 2012** |
| **Subtask 6.3:** | **Electronic notifications will be automatically sent to all registered stakeholders when established criteria measured by the continuous monitoring equipment fail to be met. All stakeholders will be encouraged to register to receive notifications. Field investigations may be initiated based on these notifications. GBRA will coordinate with project partners to solicit input, participate in public meetings, and provide information and input on project development.** | | | |
| | **Start Date:** | **May 1, 2010** | **Completion Date:** | **August 31, 2012** |
| **Subtask 6.4:** | **Coordinate with ongoing outreach programs (i.e.: Texas Watershed Steward Program and Texas Stream Team) to inform and educate the public and solicit their input on BMP development. In order for the project to be sustainable beyond the grant period, the project partners will make attempts to recruit sponsors for the established sites so that after the three year project the sites will continue to operate and be functional. Any contacts made with potential sponsors will be compiled and included in quarterly progress reports.** | | | |
| | **Start Date:** | **May 1, 2010** | **Completion Date:** | **August 1, 2012** |
| **Subtask 6.5:** | **Update GBRA web pages, including project information.** | | | |
| | **Start Date:** | **September 30, 2010** | **Completion Date:** | **August 1, 2012** |

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| Measures of Success (Expand from NPS Summary Page) |
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|---|
| **Element 5 - The state program identifies waters and their watersheds impaired by nonpoint source pollution and identifies important unimpaired waters that are threatened or otherwise at risk. Further, the state establishes a process to progressively address these identified waters by conducting more detailed watershed assessments and developing watershed implementation plans, and then by implementing the plans.** |
| **Element 8 - The state manages and implements its nonpoint source program efficiently and effectively, including necessary financial management.** |
| **Milestones:**<br>**1 Employ or develop a local Watershed Committee to solicit input and encourage the participation of affected stakeholders in the decision-making process**<br>**3 Complete water quality monitoring. Analyze data, assess loadings and determine the origin and distribution of pollutants.**<br>**6 Implement voluntary and regulatory actions in the watershed and adjust the BMP implementation based on follow-up verification monitoring of effectiveness.** |
| |

**The TCEQ CWA §319(h) Nonpoint Source Grant Program has a 60/40% match requirement. The cooperating entity will be reimbursed 60% from federal funds and must contribute a minimum of 40% of the total costs to conduct the project. The 40% match must be from non-federal sources and should be described in the budget justification. Reimbursable indirect costs are limited to 15% of total federal direct costs. The project budget is an estimate of spending and generally covers a three year period.**

# NPS DATA REVIEW CHECKLIST AND SUMMARY

**A completed checklist must accompany all data sets submitted to the TCEQ by the GBRA.**

**Data Format and Structure** **Y, N, or N/A**

A. Are there any duplicate *Tag_Ids* in the *Events* file? ________

B. Are all *StationIds* associated with assigned station location numbers? ________

C. Are all dates in the correct format, MM/DD/YYYY? ________

D. Are all times based on the 24 hour clock format, HH:MM? ________

E. Is the *Comment* field filled in where appropriate (e.g. unusual occurrence, sampling problems)? ________

F. Are*Submitting Entity*, *CollectingEntity*, and *Monitoring Type* codes used correctly?

G. Do the *Enddates* in the *Results* file match those in the *Events* file for each *Tag_Id*? ________

H. Are all measurements represented by a valid *parameter code* with the correct units?

________

I.. Are there any duplicate *parameter codes* for the same *Tag_Id*?

________

J. Are there any invalid symbols in the Greater Than/Less Than (*Gt/lt*) field? ________

K. Are there any tag numbers in the *Result* file that are not in the *Event* file? ________

L. Have verified outliers been identified with a "1" in the *Remark* field? ________

**Data Quality Review**

A. Are all the "less-than" values reported at or below the specified reporting limit? ________

B. Have checks on correctness of analysis or data reasonableness performed? ________

e.g.: Is ortho-phosphorus less than total phosphorus? ________

Are dissolved metal concentrations less than or equal to total metals? ________

C. Have at least 10% of the data in the data set been reviewed against the field and laboratory data sheets? ________

D. Are all *Parameter codes* in the data set listed in the QAPP? ________

E. Are all *StationIds* in the data set listed in the QAPP? ________

**Documentation Review**

A. Are blank results acceptable as specified in the QAPP? ________

B. Was documentation of any unusual occurrences that may affect water quality included in the *Event* table's *Comments* field? ________

C. Were there any failures in sampling methods and/or deviations from sample design requirements that resulted in unreportable data? If yes, explain on next page.

D. Were there any failures in field and laboratory measurement systems that were not resolvable and resulted in unreportable data? If yes, explain on next page.

# Data Summary Report

Date Submitted to TCEQ: ________________________________

TAG Series: ________________________________

DateRange: ________________________________

Data Source: ________________________________

Comments (attach file if necessary): ________________________________

________________________________________________________________

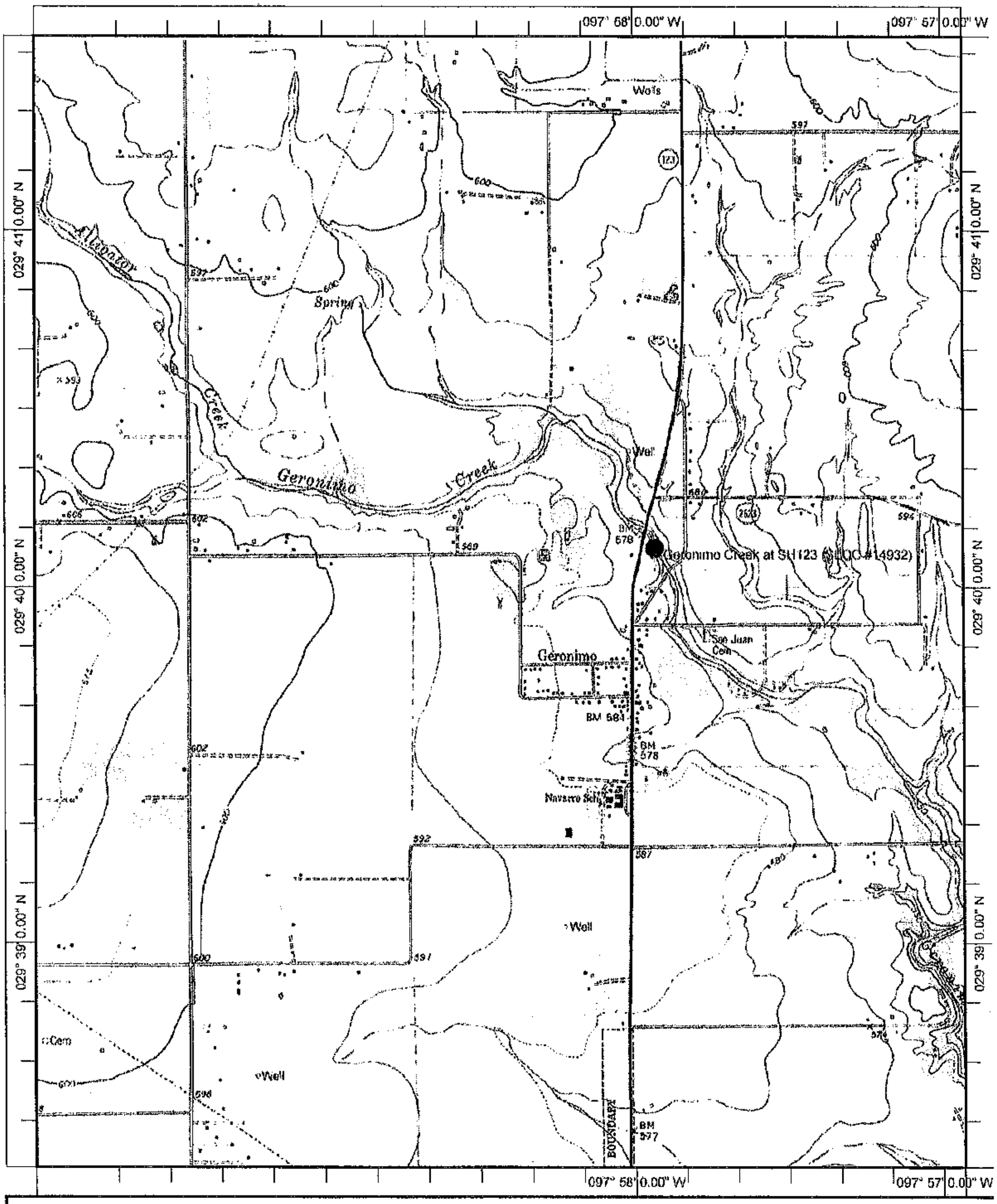
________________________________________________________________

________________________________________________________________

________________________________________________________________

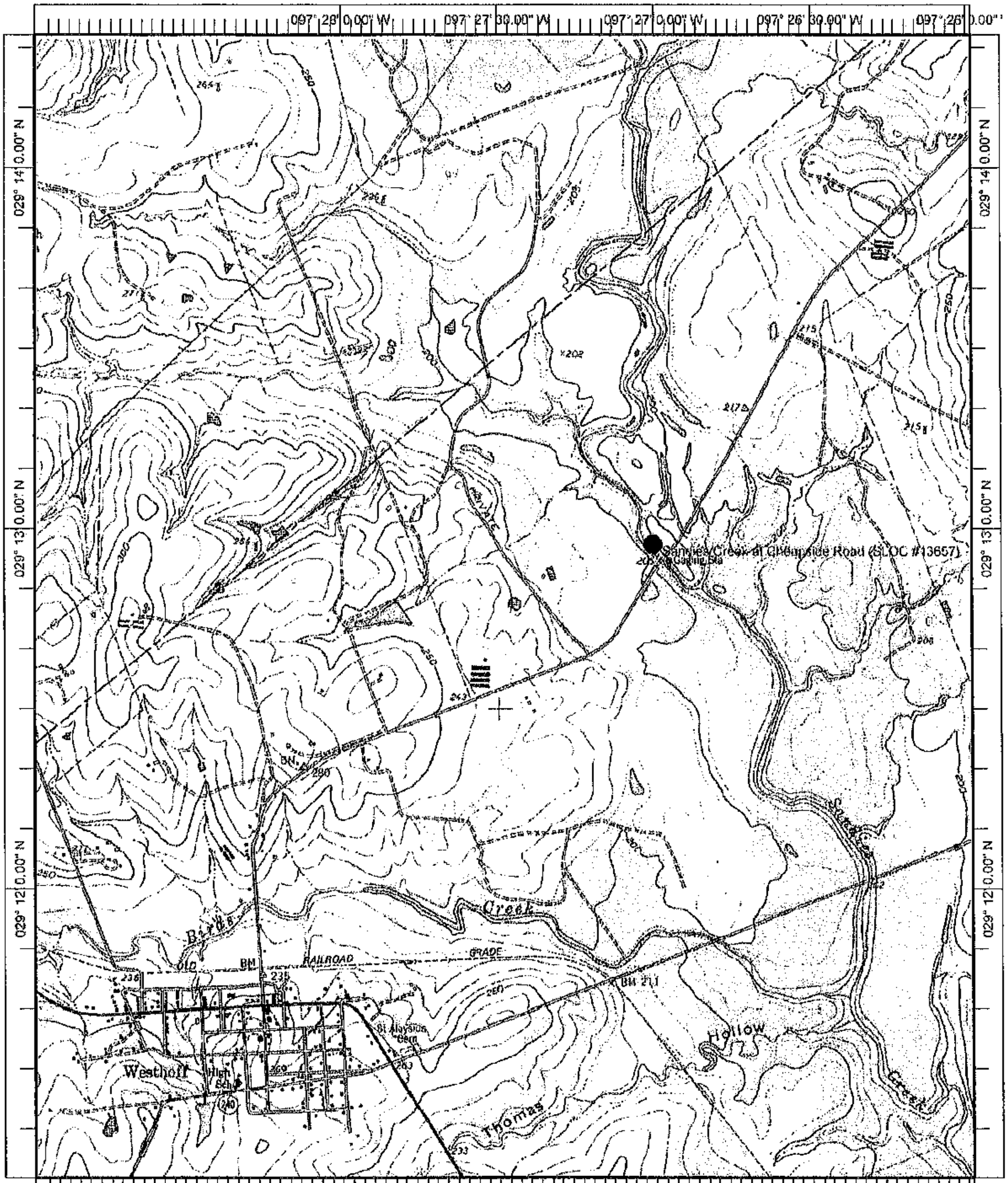
**GBRA Data Manager's Signature:** ________________________________
**GBRA Project Manager's Signature:** ________________________________

**Date:** ________________________________




Name: GERONIMO
Date: 2/3/2011
Scale: 1 inch equals 2000 feet

Location: 029° 39' 57.5" N 097° 58' 25.8" W




Name: WESTHOFF
Date: 2/3/2011
Scale: 1 inch equals 2000 feet

Location: 029° 12' 46.9" N 097° 27' 28.8" W

Analysis of Dissolved Oxygen (DO), Specific Conductance (SC), pH, Temperature and Turbidity in Ambient Surface Water Using the In-Situ Inc. Multi-Parameter Water Quality TROLL 9500

| | |
|---|---|
| Standard Operating Procedure (SOP) GBRA-001 | |
| Title: Analysis of Dissolved Oxygen (DO), Specific Conductance (SC), pH, Temperature, and Turbidity in Ambient Surface Water Using the In-Situ Inc. Multi-Parameter Water Quality TROLL 9500 | |
| Team Leader:______________________ | Date:________________ |
| Quality Control Review:______________________ | Date:________________ |
| Section Manager:______________________ | Date:________________ |
| Effective Date:______________________ | |

1.0 Purpose

This document describes the analytical procedures for continuous automated analysis of DO, SC, pH, Temperature and Turbidity in ambient surface water using the In-Situ Inc. Multi-Parameter Water Quality TROLL 9500.

2.0 Scope and Applicability

2.1 This procedure is intended for use in the Guadalupe River Basin Network (GRBN) Project.

2.2 Due to the extended length of time that TROLLs are deployed the data can be used to establish baseline conditions, identify trends, and characterize pollution events and seasonal variations in water quality.

2.3 SC, DO, pH, and Temperature data meeting Surface Water Quality Monitoring Data (SWQM) Quality Objective Criteria (DQOs) may be used for the Federal Clean water Act Sections 305(b) Report and 303(d) lists.

2.4 TROLL Turbidity measurements can be used for data validation purposes. The working range of the sensors is listed below.

| Parameter | Working Range | Reported Accuracy |
|---|---|---|
| DO (opitical, RDO) | 0-20 milligrams/Liter (mg/L) | +/- 0.2 milligrams/Liter (mg/L) |
| SC (low range sensor) | 5-20,000 micro Siemens/cubic centimeter (uS/cm) | +/- 2 micro Siemens/cubic centimeter (uS/cm) or 0.5% (whichever is greater) |
| pH | 0-12 pH Standard Units | +/- 0.1 pH Standard Units |
| Temperature | -5 to 50 Degrees Celsius ($^oC$) | +/- 0.1 ($^oC$) |
| Turbidity (Nephelometer, $90^o$ light scattering, 870 nm LED, solid state) | 0-2000 Nephelometric Turbidity Units (NTU) | +/- 3 Nephelometric Turbidity Units (NTU) or +/- 5% (whichever is greater) |

3.0 Method Summary

3.1 The TROLL is deployed in the water body of interest, or ambient surface water is pumped through a flow cell near the water body of interest, and DO, SC, pH, Temperature and Turbidity are measured in situ.

3.2 The DO is measured with an optical sensor that uses the principle of "dynamic luminescence quenching". With this principle, "lumiphore" molecules fluoresce when excited by light of a specific wavelength. The oxygen molecules present act to quench this fluorescence. The "lumiphores" in the sensor are embedded in a gas-permeable sensing foil in a replaceable cap. The sensor optics includes a lens, blue LED with filter, measurements are affected by temperature and can cause long term drift. The pH electrode can only accurately measure up to 12 standard units.

4.5 Expired standards should not be used.

5.0 Safety

This procedure includes processes that can be hazardous. Therefore, before attempting this process, review the TCEQ Chemical Hygiene Plan for proper equipment and procedures necessary for the safe completion of this procedure. Operators must read and be familiar with the Material safety Data Sheets for all reagents listed in section 6.0 of this document. Lab Coasts, safety glasses with side shields and/or splash goggles, and chemical resistant gloves should be worn when handling harmful chemicals. Some of these chemicals have the potential to be skin and eye irritants.

6.0 Equipment and Reagents

6.1 Equipment

6.1.1 In-Situ Multi Parameter TROLL 9500 with EC, RDO, pH, Temperature, and Turbidity Sensors.

6.1.2 RS232 Connection Cable

6.1.3 Personal Computer

6.1.4 Instrument Logbook

6.1.5 Calibration Forms

6.1.6 Calibration Cup

6.1.7 Ring Stand and Clamp

6.1.8 Thermister or Thermometer traceable to National Institute of Standards and Technology (NIST) with a 0.1°C tolerance.

6.1.9 100 ml volumetric flask

6.1.10 100-1000 ml pipette

6.1.11 100-1000 ml pipette tips

Optional Equipment

6.1.12 Peristaltic Pump

6.1.13 TROLL 9500 Flow Cell

6.2 Standards and Reagents (All reagents/chemicals must be AR grade)

6.2.1 pH 7.00 +/- 0.01 S.U. @ 25°C Buffer (ACS traceable reagent grade Dibasic Sodium Phosphate $Na_2HPO_4$ – Monobasic Potassium Phosphate $KH_2PO_4$ Buffer)

7.2 Station Monitoring

The site operator should monitor water quality and other parameters daily to ensure the station is operational.

7.2.1 Every business day, the site operator will monitor (via TCEQ website http:// http://www.texaswaterdata.org) and screen EC, DO, pH , Temperature and Turbidity measurements for anomalies. If problems are identified, a site visit may be needed to correct any problems.

7.2.2 If online data is not available the site operator shall visit the site once per week to download data and identify any problems.

7.3 DO, EC, pH, and Turbidity Sensor Calibration Verification Samples (CVS) and Temperature QC.

EC, DO, and pH CVSs are analyzed and the sensors are re-calibrated at a minimum of once every month. Turbidity CVSs are analyzed at a minimum of once every month, but the Turbidity sensor is only recalibrated if the CVS check standard shows more than a +/- 5.0 % recovery difference from the nominal. More frequent sensor re-calibrations may be needed in high fouling environments. The site operator will need to determine sensor re-calibration frequency for their water body. Temperature sensors are checked monthly. Note: The TCEQ Surface water Quality Monitoring Program has used the phrase "Post-Calibration" to describe QC samples used to assess analytical drift from previous sensor calibrations. For the purposes of this document, CVS is used in place of "Post-Calibration".

7.3.1 EC, DO, pH and Turbidity CVS are analyzed at a minimum of once every month (or more frequently), before the TROLL EC, DO, pH and Turbidity sensors are re-calibrated.

7.3.1.1 A check of a CVS standard can be made by connecting to the TROLL with the Win-Situ software and a laptop PC and selecting the TROLL in the Navigation tree.

7.3.1.2 The TROLL is washed with tap water and de-ionized water and shaken to remove the water.

7.3.1.3 The TROLL sensor is placed into the applicable CVS standard.

7.3.1.4 Select one of the appropriate parameter in the Win-Situ display and Tap the "Read" button in the navigation window. Multiple parameters can be selected and read at the same time by holding down the control key on the keyboard while selecting parameters. The Temperature parameter should be read alongside all of the other CVS readings.

7.3.1.5 Record the CVS reading and temperature for each parameter in the calibration logbook

7.3.2 The Temperature sensor should be checked against an NIST traceable thermometer at the same time that CVS samples are analyzed. If the sensor does not meet the acceptance criteria listed in Table 9-1, the temperature data must be invalidated back to the last temperature check. For further details, see Section 9.0.

7.3.3 If barometric pressure for DO calibrations is determined by barometer, the accuracy of the barometer will need to be checked once a year.

7.4 EC, DO, pH and Turbidity Sensor Calibration

DO, EC, and pH calibrations are performed at least once a month, prior to TROLL deployment, and after the monthly EC, DO, pH and turbidity CVSs have been analyzed. A Turbidity sensor calibration is performed if the Turbidity CVS recovery is reported at +/- 5.0% of the known value of the standard. After the EC, DO, pH and Turbidity sensor calibrations, calibration parameters/constants are recorded in the instrument logbook.

### 7.4.2 Two-Point pH Calibration

The pH calibration requires two pH buffer solutions (pH 4.00 and 7.00 or pH 7.00 and 10.00). Choose the solutions that bracket the expected pH range of the water body.

7.4.2.1 Rinse the pH sensor with tap water followed by de-ionized water.
7.4.2.2 Shake the probe to remove the rinse water from the sensor.
7.4.2.3 Pour the first calibration standard into a beaker and insert the MP TROLL 9500 Turbidity sensor into the solution.
7.4.2.4 Connect the MP TROLL 9500 to a PC and establish a connection with the Win-Situ 4 software.
7.4.2.5 Select the MP TROLL 9500 in the Navigation tree.
7.4.2.6 Select pH in the Parameters list. The sensor serial number and recent calibration information is shown.
7.4.2.7 Select Calibrate to launch the pH Calibration Wizard
7.4.2.8 Change the number of calibration points to 2 in the drop down menu.
7.4.2.9 Select the values of the two calibration points that will be used in the drop down menus.
7.4.2.10 Select "Next" to continue.
7.4.2.11 Select "Run." The screen will automatically advance when the word "Stable" is displayed under the stabilization readings column.
7.4.2.12 Remove the pH sensor from the first calibration solution and wash it with tap water and de-ionized water.
7.4.2.13 Place the sensor into a beaker containing the second calibration solution. Select "Run" to begin the stabilization process.
7.4.2.14 The word "Stable" will appear and automatically advance the screen.
7.4.2.15 Record the pH slope and offset milli-volts (mV) for the pH 7.00 and pH 10.00 solutions in the calibration logbook and press "Finish" to apply the calculated calibration.

### 7.4.3 DO Calibration

The DO sensor is calibrated in water that is 100 % saturated with air. An oxygen bubbler is placed into beaker of tap water and allowed to run for at least 5 minutes prior to the calibration procedure.

7.4.3.1 Rinse the RDO sensor with tap water followed by de-ionized water.
7.4.3.2 Shake the probe to remove the rinse water from the sensor.
7.4.3.3 If necessary, utilize a lens wipe to clean the sensor lens.
7.4.3.4 Submerge the RDO sensor in a beaker of tap water aerated with a bubbler. Ensure that the sensor is completely submerged and the sensor cap is not directly in the bubble stream. The bubbler is allowed to run for 5 to 10 minutes before continuing.
7.4.3.5 Connect the TROLL 9500 to a PC and establish a connection with the Win-Situ 4 software.
7.4.3.6 Select the TROLL 9500 in the Navigation tree on the display screen. The software will automatically detect and display the installed sensors.
7.4.3.7 Select Rugged Dissolved Oxygen in the Parameters list. Information on the RDO sensor is shown, including its serial number (SN).
7.4.3.8 Select Calibrate
7.4.3.9 A screen will ask if the barometric pressure settings should be edited at this time. Press the "Yes" button. On the next screen, check the box indicating a non-vented cable for deployment and enter a barometric

7.4.4.17 Select the "Run" button to calibrate the next calibration point. Wait for the screen to show "Stable" and automatically advance to the next calibration point.
7.4.4.18 Repeat steps 7.4.4.16-7.4.4.17 for the final two calibration points.
7.4.4.19 The final screen will show the sensor slope and offset calculated during the calibration process. A slope and offset value will also be shown for each point in used in the calibration. Record these values in the Calibration Logbook.
7.4.4.20 Select the "Finish" button on the display to program the sensor with the calculated calibration coefficients.

## 8.0 Calculations

### 8.1 Seal Level Corrected barometric Pressure Uncorrected to Actual Barometric Pressure

This equation is used to uncorrected sea level corrected barometric to actual barometric pressure. Local barometric pressure obtained from the National Weather Service is corrected to sea level and is usually reported in inches of Hg (inches HG x 2.54 = mm Hg).

ABP = CBP – (2.5 mm Hg)(A/100)
Where:

ABP = Actual Barometric Pressure in mm Hg.
CBP = Barometric Pressure corrected to sea level in mm Hg.
A – local altitude in feet above mean sea level.
2.5 mm Hg = constant.

### 8.2 Sample Conductivity

Electrical Conductivity is reported as SC using Equation 8.2.1

8.2.1 SC is actual conductivity corrected to 25°C:

SC = (AC)/(1 + 0.0191 x (t-25.0))

Where:

AC = non-standardized conductivity in uS/cm.
t = the solution temperature in degrees Celsius.

8.3.1 To determine un-normalized (raw) conductivity standard EC concentration from normalized Raw EC = normalized EC in uS/cm (1 + 0.0191 (temp measured – 25)).

### 8.3 QC calculations

8.3.1 Recovery (percent recovery) = $\frac{X1 \text{ X } 100}{X2}$

X1 = measured CVS concentration

X2 = theoretical (known) CVS concentration

## 9.0 QC Samples

Note: Analyze EC, DO, pH and Turbidity CVSs as close to 25.0°C as possible.

should be entered into the operator log. The results should also be logged in the instrument logbook and/or recorded in the Calibration Logbook.

Temperature QC

9.1.7 Once every quarter (3 months), check the accuracy of the TROLL temperature sensor with a NIST traceable thermometer or thermister. Fill a container with tap water and immerse the TROLL sensors into the water. Place the thermometer or thermister thermocouple next to the TROLL temperature sensor and allow both temperature measuring devices time to stabilize. The TROLL Temperature measurement should be within 0.5°C of the NIST traceable thermometer or thermistor. If the TROLL temperature accuracy is not within acceptance criteria with the NIST traceable thermometer or thermistor the temperature data collected prior to the last NIST check should be invalidated. If it is determined that the TROLL's temperature sensor does not meet acceptance criteria, the sensor needs to be sent back to the factory for repairs/calibration. The temperature check should be entered into the operator log. The results should also be logged in the instrument logbook and/or recorded in the Calibration Worksheet.

Turbidity QC Samples

9.1.8 A Turbidity CVS is analyzed at a minimum of once monthly (before calibration of the Turbidity sensor) to assess analytical drift from the previous calibration. The CVS should be a different standard than the one used to generate the initial 3 point calibration.

9.1.9 The CVS Formazin solution is introduced using a beaker or Cal Cup. Rinse the sensor with Tap water followed by DI Water and shake off the water before introducing the CVS. The Percent Recovery of the CVS should be +/- 5.0% or +/- 3 NTU of the theoretical value. If the CVS does not meet acceptance criteria, the previous month's Turbidity (back to the last Turbidity calibration) data should be invalidated. Note: a failing CVS could be the result of an aged Turbidity CVS standard. If CVS failed, re-analyze the CVS using a fresh Turbidity standard. Any bio-fouling on the optical port should be wiped off with a lens wipe and the CVS should be reanalyzed to determine if the calibration has drifted or if the CVS failed due to instrument fouling. CVS results should be entered into the operator log and instrument logbook.

Table 9-1

| QC Check | Purpose | Frequency | Acceptance Criteria | Response Action |
|---|---|---|---|---|
| Single-Point EC Calibration | To establish slope used for quantitation | A minimum of once monthly or after failing CVS | Stable Concentration level is detected | 1. Analyze standard again<br>2. Perform corrective action as necessary<br>3. Re-calibrate |
| Single-Point DO Calibration | To establish slope used for quantitation | A minimum of once monthly or after failing CVS | Stable Concentration level is detected | 1.Analyze standard again<br>2. Perform corrective action as necessary<br>3. Re-calibrate |
| Two-Point pH Calibration | To establish slope used for quantitation | A minimum of once monthly or after failing CVS | Stable Concentration level is detected | 1. Analyze standard again<br>2. Perform corrective |

10.5 mg/l – milligrams per liter (unit of concentration)

10.6 SU – Standard Units (units of pH measurement)

11.0 References

In-Situ Inc. TROLL 9500 Operator's Manual
Surface Water Quality Monitoring procedures Manual, Volume I
Continuous Water Quality Monitoring Network Quality Assurance Project Plan
GBRA Chemical Hygiene Plan

12.0 Pollution Prevention and Waste Management

Supervisors, sampling personnel, and laboratory analysts should identify and implement innovative and cost saving water reduction procedures as part of the method development, review, and revision of standard operating procedures. Wastes that result from these procedures are managed and disposed of in accordance with appropriate state and federal regulations.

The Reagents, washes, standards, and waste associated with this procedure do not require special disposal. Before disposing waste into a municipal sewer system check with respective municipal sewer system on what concentration levels are allowed to be put into their system.

13.0 Shorthand Procedure

- Setup Procedures (Section 7.1 and 7.3).
- Calibrate EC, DO, and pH sensors once a month at a minimum.
- Deploy TROLL
- Monitoring and Sensor Verification (Section 7.2 and 7.4).
- Monitor TROLLS weekly via the internet if online data is available.
- Analyze EC, DO, pH and Turbidity CVSs once a month.
- Check TROLL temperature sensors every 3 months with an NIST traceable thermometer.

4.2 A Field calibration can be performed at zero PSI, however, a factory recalibration is recommended if the offset from zero is greater than +/- 0.015 PSI of ambient pressure or +/- 0.1% FS.

5.0 Safety

Operators must read and be familiar with the Material safety Data Sheets for all reagents listed in section 6.0 of this document. Lab Coasts, safety glasses with side shields and/or splash goggles, and chemical resistant gloves should be worn when handling harmful chemicals.

6.0 Equipment and Reagents

6.1 Equipment

6.1.1 In-Situ Level TROLL 500 Pressure/Level and Temperature Sensors.

6.1.2 RS232 Connection Cable

6.1.3 Personal Computer

6.1.4 Instrument Logbook

6.1.5 Calibration Forms

6.1.6 Calibration Cup

6.1.7 Ring Stand and Clamp

6.1.8 Thermister or Thermometer traceable to National Institute of Standards and Technology (NIST) with a 0.1°C tolerance.

6.1.9 Graduated Measuring Stick or Survey Rod with markings at 1 inch intervals.

7.0 Procedure

Before water quality is monitored, the sensors are calibrated and quality control (QC) samples are analyzed at a minimum of once a quarter. The station's water quality parameters are monitored by the site operator, remotely, or with weekly data downloads to a laptop computer, to evaluate operational status of the station.

7.1 Monitoring

The TROLL measures ambient surface water while in situ. The TROLL can be deployed in poly vinyl chloride (PVC) tubing that is attached to a support structure.

7.1.1 The TROLL should be deployed in a representative section of the water body. When monitoring rivers and streams, the TROLL should be located as close as possible to the centroid of flow. Centroid is defined as the midpoint of that portion of stream or river width which contains 50 percent of the total flow.

7.1.2 Sensors should be positioned at a known water depth. If the TROLL is attached to a weight at the bottom of the water body the initial deployment depth must be measured. Areas of excessive vegetation, turbulence, or silt should be avoided.

7.1.3 Drill holes in the PVC to allow for an exchange of water into the tubing.

the temperature data must be invalidated back to the last temperature check. For further details, see Section 9.0.

7.4 Pressure/Level Sensor Calibration

Pressure/Level calibrations are performed prior to initial TROLL deployment, and in response to failed quality control calibration verification check. Sensor calibrations are recorded in the instrument logbook.

7.4.1 The TROLL is removed from the water cleaned of any debris that has accumulated on its surface by the operator.

7.4.2 Connect to the TROLL with the Win-Situ 5 software and a laptop PC and select the Level TROLL in the Navigation tree.

7.4.3 Press the yellow connect button in the lower right corner of the Win-Situ 5 software screen after the TROLL is connected to the laptop computers serial port.

7.4.4 The Connect button will change its appearance to a blue color to show that a connection has been established with the instrument.

7.4.5 While connected to the Level TROLL select the "Sensors" tab.

7.4.6 Select the pressure sensor and click the calibrate button.

7.4.7 Ensure that the device has been removed from the water and press the "Calibrate" button. The current pressure reading will be set to zero. Record the pressure reading in the calibration logbook

7.5 Downloading Data

7.5.1 Connect to the Device as shown in Section 7.4.2

7.5.2 Select the "Logging" Tab

7.5.3 Select the appropriate log (data file) to be viewed

7.5.4 Click "Download" in the control panel

7.5.5 In the next screen, select the download option: "New Data" for data recorded since the last data download.

7.5.6 The log will be downloaded to the connected PC.

7.5.7 Ate the end of the download the option of viewing the data is presented.

7.5.7.1 Click the Yes prompt to display the data downloaded or the No prompt if it is not be viewed at the current time.

8.0 Calculations

8.1 Seal Level Corrected barometric Pressure Uncorrected to Actual Barometric Pressure

| QC Check | Purpose | Frequency | Acceptance Criteria | Response Action |
|---|---|---|---|---|
| Single-Point Ambient Air Pressure/Level Calibration | To establish slope used for quantitation | After failing CVS | 0 PSI +/- 0.015 PSI | 1. Re-calibrate pressure sensor in ambient air. |
| Pressure/Level QC Check | To assess sensor drift | Before Sensor re-calibration. A minimum of once a quarter | Manually Measured Depth +/- 6.0 inches | 1. Re-Analyze depth measurement<br>2. If still failing perform corrective action and/or recalibrate |
| Temperature QC Check | To assess sensor drift | A minimum of once every quarter | +/- 0.5 degrees Celsius | 1. Re-Analyze temperature reading<br>2. If still failing, send to manufacturer for repairs<br>3. Invalidate data accordingly |

.10.0 Definitions

10.1 CVS - Calibration Verification Sample

10.7 PSI = Pounds per square inch (unit of pressure)

10.8 PSIG = Pounds per square inch "gauged" (unit of pressure measured with a vented pressure gauge).

10.9 kPa = Kilopascal (unit of pressure describing force per unit area)

10.0 References

In-Situ Inc. Level TROLL 500 Operator's Manual

Surface Water Quality Monitoring procedures Manual, Volume I
Continuous Water Quality Monitoring Network Quality Assurance Project Plan
GBRA Chemical Hygiene Plan

11.0 Pollution Prevention and Waste Management

Supervisors, sampling personnel, and laboratory analysts should identify and implement innovative and cost saving water reduction procedures as part of the method development, review, and revision of standard operating procedures. Wastes that result from these procedures are managed and disposed of in accordance with appropriate state and federal regulations.

The Reagents, washes, standards, and waste associated with this procedure do not require special disposal. Before disposing waste into a municipal sewer system check with respective municipal sewer system on what concentration levels are allowed to be put into their system.

12.0Shorthand Procedure

- Setup Procedures (Section 7.1 and 7.3).
- Calibrate Pressure sensor once after a failed QC check.

| STANDARD OPERATING PROCEDURE (SOP) | |
|---|---|
| **Title: Validation of Continuous Water Quality Monitoring Data Collected by Muliparameter Sonde** | |
| Team Leader: ______________________ | Date: ______________ |
| Quality Control Review: ______________________ | Date: ______________ |
| Effective Date: 01/19/2010 | |

## 1.0 PURPOSE

This SOP describes the procedure for validation of ambient water quality data acquired from continuous water quality monitoring stations located within selected river basins of the State of Texas utilizing existing infrastructure and Leading Environmental Analysis and Display System (MeteoStar/LEADS) data processing software.

## 2.0 SCOPE AND APPLICABILITY

Continuous water quality monitoring data for validation may include, but are not limited to: temperature, pH, dissolved oxygen (DO), specific conductance, turbidity, nitrate, ortho-phosphorus, and ammonia. LEADS calculated parameters such as Total Dissolved Solids (TDS) and salinity are not subject to validation. The LEADS computer system performs automated validation, and manual validation procedures are performed by the DM&A Data Validator.

## 3.0 METHOD OR PROCEDURAL SUMMARY

Validation of Continuous Water Quality Monitoring (CWQMN) Data is initiated by submittal of the Data Validation Initiation form completed by the CWQMN Network Coordinator. The DM&A team lead maintains the original form and assigns a validator to the site, while the assigned Data Validator receives a copy of the Data Validation Initiation form for their records.

Data is examined for record completeness and reporting accuracy. Operator logs are reviewed for calibration and post-calibration records, post deployment temperature check results, and unusual events. Data losses are investigated and data values exceeding or falling below established critical limits (Appendix A) are reviewed and qualified as invalid or valid.

## 4.0 LIMITATIONS

4.1 Data validation is dependent upon the quality of field observations and reported calibration information in the Operator Log.

4.2 If data is reloaded or reprocessed after validation, previously qualified and/or recovered data defaults to the original status. Data must be validated again by referring to the Validator's Log and operator logs.

4.3 LEADS is a developing system. The software tools used to validate data may contain defects that may or may not be identified. This may necessitate checking one tool against another.

## 5.0 SAFETY

## 7.0 PROCEDURES

After the DM&A Data Validator receives a copy of the Data Validation Initiation form, the Data Validator can start the data validation activities.

### 7.1 Daily procedure

7.1.1 Verify the operation of the *in-situ* multi-parameter data sonde, the ZENO data logger, and completed data transmission in the morning and at close of business, at a minimum.

- Using an internet browser, access the Texas Commission on Environmental Quality (TCEQ) internal server at **http://rhone.tceq.state.tx.us/**. Within the **Water Data** section, view the *Daily Report.* Select the monitoring site, date, number of days to report, parameters of interest, and generate a report. Confirm the data retrieval for all parameters.
- If data is missing, access the *Comms Report* within the Status Pages section to confirm communication between the remote sites and the central computer site.
- Access the *Operator Logs* to check for unscheduled maintenance or unusual events.
- Contact the site operators and the project lead for possible site investigation/repairs, if necessary.
- Contact the LEADS administrator for possible data recovery and/or to resolve communications problems.

### 7.2 Weekly Procedure

7.2.1 Using an internet browser, access the TCEQ internal server at http://rhone.tceq.state.tx.us/. Within the Status Pages Section, review the *Operator Logs* for each site to be validated. Confirm timely reporting of preventative maintenance information and calibration/post-calibration data.

7.2.2 Access the LEADS Interface via an x-terminal emulation package (Exceed). Contact the LEADS Administrator for access rights, validation rights, and passwords.

7.2.3 Access the Manual Validation Retrieve window via Manual Validation Login.

7.2.3.1 Validation of Discrete Data and Five Minute (Profiler) Data.

- Select the beginning year, month, day, and time of the data validation interval.
- Select the end year, month, day, and time of the data validation interval. Please note that manual validation

changes are documented in the hard copy and the electronic copy of Validator's Log.

- Select the "Validate" button on the Manual Validation Notes Page to complete the validation procedure.

7.2.3.2 Validation of Hourly Average Data for Discrete Data.

- The data validator ensures that the "Discrete Data" have been validated.
- Select the beginning year, month, day, and time of the data validation interval.
- Select the end year, month, day, and time of the data validation interval. Please note that manual validation will only allow you to select up to a maximum of 31 days of data.
- Select the appropriate time zone.
- Select the "Hourly Average" Database.
- Select the Region.
- Select sort by "CAMS."
- Select "Show Sites."
- Highlight the CAMS site for validation from the site list.
- Select "Show Available Parameters."
- Highlight the validation parameters. Hold down the CTRL key to select up to four validation parameters at one time.
- Select "Display Data."
- Review the data flags assigned to the hourly average data and verify the flags with the associated discrete data. See Appendix A for data flags.
- Choose "Validate Data" from the FILE drop-down menu. Enter the validator's comments in the Manual Validation Notes window. Initial all entries. Ensure all comments are documented in the hard copy and the electronic copy of Validator's Log.
- Select the "Validate" button on the Manual Validation Notes Page to complete the validation procedure.
- Please note that if you validate the hourly average data, then you go and change the associated discrete data validation, the hourly average data will be un-validated. The hourly average data must be validated again.

## 8.0 CALCULATIONS

Not applicable.

## 9.0 QUALITY CONTROL

9.1 Each experienced data validator is responsible for review, validation, and verification of data from assigned ambient stations.

9.2 Maintain detailed records in the form of both a hardcopy and an electronic copy of the Validator's Log that includes all activities and follow-up

13.2.1 Validation of Discrete Data and Five Minute (Profiler) Data.

- Investigate any irregular data patterns.
- Confirm all data qualifiers generated by LEADS.
- Edit any incorrect data qualifiers
- Evaluate all data with LIM qualifiers.
- Document any data changes in the Validator's Log.
- Validate data.

13.2.2 Validation of Hourly Average Data for Discrete Data.

- Ensure the Discrete Data have been validated.
- Verify the data flags with the associated Discrete Data.
- Document the validator's notes in the Validator's Log.
- Validate the hourly average data.
- Revalidate any hourly average data if changes have been made to the associated discrete data

# Appendix F:
# In-Situ TROLL 9500 Calibration and Verification Worksheet

# Appendix G. Chain of Custody Form

# Appendix H. Data Management Process Flow Chart

# Appendix I: Corrective Action Status Table

# Appendix J: Corrective Action Plan Form

# Appendix K:
# Example Letter to Document Adherence to the QAPP

TO: (name)
(organization)

FROM: (name)
(organization)

RE: "Guadalupe River Basin Network – GBRA Water Quality Monitoring Data Collection and Validation Quality Assurance Project Plan, Revision 0, 04/11/2011"

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

(address)

I acknowledge receipt of the "Guadalupe River Basin Network – GBRA Water Quality Monitoring, Data Collection and Validation Quality Assurance Project Plan, Revision 0, 03/18/2011"I understand that the document describes 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.

My signature on this document signifies that I have read and approved the document contents. Furthermore, I will ensure that all staff members participating in activities covered under this QAPP will be required to familiarize themselves with the document contents and adhere to the contents as well.

Signature Date

*Copies of the signed forms should be sent by the GBRA to the TCEQ NPS Project Manager within 60 days of TCEQ approval of the QAPP.*

# Guadalupe River Basin Network Appendix L User Notes (Please Read):

Appendix L has been specifically included in this Quality Assurance Project Plan for the Guadalupe River Basin Network Project to address the short term special study collection of *E. coli* and Nitrate Nitrogen (NO3-N) data during storm water runoff events at the Geronimo Creek at SH123 (Station #14932) continuous monitoring station. The intention of this appendix is to completely dictate the information needed to complete these monitoring objectives. All aspects of the Guadalupe River Basin Network Quality Assurance Project Plan that are applicable to *E. coli* and NO3-N sampling will be addressed in this Appendix L. If a section of the continuous monitoring QAPP is relevant to the monitoring outlined in this appendix then it will be referenced in an effort to reduce redundancy. Any duplicate names of tables or figures that are referenced in this Appendix L are only applicable to the monitoring in this appendix and not applicable to monitoring conducted in other sections of this QAPP. If a table or figure is referenced and not replicated in this appendix then it should be referenced from the original QAPP.

occurred. These E. coli and NO3-N samples will be retrieved by the GBRA Water Quality Technician and transported to the GBRA Regional laboratory for analysis within 40 hours of the initial trigger event. The E. coli samples will be analyzed with the extended 48 hour holding time variance described in the *TCEQ SWQM Procedures Manual, Vol 1.* The GBRA will attempt to catch one of these storm water events every three months for a one year period. The results of these storm water samples will be compared to the continuous monitoring information available at this location to see if any correlations exist between the measured field parameters and the analyzed laboratory samples. The ultimate goal of this study is to provide the data necessary to model the prediction of NO3-N and E. coli data on the Geronimo Creek from continuously available field measurements.

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

See Section B1 for monitoring to be conducted under this QAPP.

### A6.1 Revisions to QAPP

See Section A6.1 of the Guadalupe River Basin Network Quality Assurance Project Plan

### A6.2 QAPP Amendments

See Section A6.2 of the Guadalupe River Basin Network Quality Assurance Project Plan

## A7 Quality Objectives and Criteria

Quantitative and qualitative information regarding measurement data needed to measure E. coli and NO3-N data are provided in table A7.1 below.

**Table A7.1 Measurement Performance Specifications for BMP Effectiveness Monitoring**

| PARAMETER | UNITS | MATRIX | METHOD | SWQMIS PARAMETER CODE | AWRL* | Limit of Quantitation (LOQ) | Recovery at LOQ (%) | PRECISION (RPD of LCS/LCSD) | BIAS %Rec. of LCS | Completeness (%) | Lab |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E. coli, IDEXX Colilert | MPN/100 mL | water | Colilert-18 | 31699 | 1 | 1 | NA | 0.5[1] | NA | 90 | GBRA |
| Nitrate-N, total | mg/L | water | EPA 300.0 Rev. 2.1 (1993) | 00620 | 0.05 | 0.05 | 70-130 | 20 | 80-120 | 90 | GBRA |

1 Based on range statistic as described in Standard Methods, 20[th] Edition, Section 9020-B, " Quality Assurance / Quality Control –
Intralaboratory Quality Control Guidelines." This criterion applies to bacteriological duplicates with concentrations greater than 10 MPN/100mL or greater than 10 organisms/100mL.

*the most up-to-date AWRL is located at http://www.tceq.state.tx.us/compliance/monitoring/nps/grants/NPS-QAPP.html volume, broken or lost samples, etc. is to be expected. Therefore, it will be a general goal of the project(s) that 90% data completion is achieved.

**Comparability**

Confidence in the comparability of routine data sets for this project and for water quality assessments is based on the commitment of project staff to use only approved sampling and analysis methods and QA/QC protocols in accordance with quality system requirements and as described in this QAPP and in TCEQ SOPs. Comparability is also guaranteed by reporting data in standard units, by using accepted rules for rounding figures, and by reporting data in a standard format as specified in Section B10.

**Limit of Quantitation**

AWRLs (Table A7.1) are used in this project as the *limit of quantitation specifications*. Laboratory *limits of quantitation* (Table A7.1) must be at or below the AWRL for each applicable parameter.

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

**Analytical Quantitation**

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

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

## A8 Special Training/Certification

GBRA Staff responsible for operating the automated samplers and flow loggers will undergo a one day training event by the equipment manufacturer.

GBRA Field personnel will receive training in proper sampling and field analysis by the equipment manufacturer.

GBRA laboratory analyzing samples under this QAPP meets the requirements contained in section 5.4.4 of the NELAC standards (concerning Review of Requests, Tenders, and Contracts).

# B1 Sampling Process Design

The sample design rationale for the study is based on the intent to demonstrate that *E. coli* and NO3-N stream concentrations can be predicted by the field parameters continuously monitored by a multi-parameter Sonde in the Geronimo Creek. The Monitoring site is specified in Table B1.1 and depicted in Appendix D. Laboratory samples will be automatically collected at a defined interval in order to determine E. coli and NO3-N concentrations during different stream flow conditions.

The monitoring station on the Geronimo Creek will be equipped with an ISCO 6712 automatic sampler with 24 bottle carousel. The bubbler flow meter will measure the stream level once it is calibrated by the GBRA field technician. The automatic sampler will begin collecting twenty-four discrete samples at one hour intervals once the height of the water in the channel is above the defined trigger level at that station. Once the trigger level has been reached, the sampler will purge the inlet line with air and then pull water through the inlet tube into a sterile one liter bottle and repeat this process until 24 hours have passed and all bottles have been filled. The automatic sampler at the monitoring station will begin sampling when a storm event causes the flow in the creek to rise one inch from a user defined ambient water level. The water level will be assessed by the GBRA water quality technician prior to an imminent storm event and current stream level will be set on the sampler. The sampler will stop sampling after a maximum of 24 hours have elapsed from the beginning of the event. Storm events will be monitored at a frequency of once per quarter, for a one year period. Other storm events that occur within the quarter will be disregarded once a successful event has been collected. If an event satisfies the defined trigger level, samples are collected and analyses completed, the autosampler will be disabled until the next quarter. If no qualifying storm event occurs within a quarter, two storm events can be collected in the following quarter, if two qualifying events occur that are separated by at least two weeks. Weather cooperating, the GBRA will attempt to target 4 storm events within a one year period.

Twenty-four sample bottles will be collected from the autosampler within 40 hours of the beginning of each triggered sampling event. Each sample bottle will be put on ice and transported to the laboratory where they will be stored at 0-$6^0$ C and transferred to appropriately preserved bottles prior to analysis. Due to the unpredictable nature of stormwater sample collection, ambient samples will not be cooled by ice until they have been collected from the automatic sampler by the GBRA water quality technician. The holding time for each discrete sample will begin at the time that each corresponding bottle is collected by the automatic sampler. A laptop computer will be used to download stream depth, flow and sampler information at the time that the sample bottles are collected from the autosampler.

Samples will be collected following procedures detailed in the latest version of the TCEQ guidance document, *Surface Water Quality Monitoring Procedures, Volume 1 (RG-415)* The TCEQ SWQM 48 hour extended holding time variance procedure for *Escherichia coli* samples in ambient water will be utilized as described in the TCEQ RG-415, Volume 1-Chapter 4 Interim change document #4 from 05/15/2009,

## Sample Containers

The ISCO sampler bottles are cleaned with the following procedure: 1) wash containers with tap water and alconox (laboratory detergent), 2) triple rinse with hot tap water, and 3) triple rinse with deionized water. The bottles are autoclaved for 45 minutes at 15.5 psi for sterility and then sealed. Bottles that are used by the laboratory staff are cleaned and returned to the field crew in order to have the autosampler prepared for the next event.

## Processes to Prevent Cross Contamination

Procedures outlined in the TCEQ Surface Water Quality Procedures describe the necessary steps to prevent cross-contamination of samples. These include such things as direct collection into sample containers and the use of commercially pre-cleaned sample containers.

## Documentation of Field Sampling Activities

Field sampling activities are documented on the Chain of custody for the samples collected. For all visits, station ID, location, sampling time, sampling date, volume of water collected and sample collector's name/signature are recorded. Detailed observational data are recorded including water appearance, weather, unusual odors, specific sample information, days since last significant rainfall, and flow severity.

## Recording Data

For the purposes of this section and subsequent sections, all personnel follow the basic rules for recording information as documented below:

1. Legible writing in indelible, waterproof ink with no modifications, write-overs or cross-outs;
2. Changes should be made by crossing out original entries with a single line, entering the changes, and initialing and dating the corrections.
3. Close-outs on incomplete pages with an initialed and dated diagonal line.

## Sampling Method Requirement or Sampling Process Design Deficiencies and Corrective Action

Examples of sampling method requirements or sample design deficiencies include but are not limited to such things as inadequate sample volume due to spillage or container leaks, failure to preserve samples appropriately, contamination of a sample bottle during collection, storage temperature and holding time exceedance, sampling at the wrong site, etc. Any deviations from the QAPP and appropriate sampling procedures may invalidate resulting data and may require corrective action. Corrective action may include for samples to be discarded and re-collected. It is the responsibility of the Guadalupe River Basin Network Project Manager, in consultation with the TCEQ NPS Project manager, to ensure that the actions and resolutions to the problems are documented and that records are maintained in accordance with this QAPP. In addition,

**Sample Tracking**

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

A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. The COC form is used to document sample handling during transfer from the field to the laboratory. The following information concerning the sample is recorded on the COC form (See Appendix G).

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

**Sample Tracking Procedure Deficiencies and Corrective Action**

All deficiencies associated with chain-of-custody procedures as described in this QAPP are immediately reported to the GRBN Project Manager. These include such items as delays in transfer, resulting in holding time violations; violations of sample preservation requirements; incomplete documentation, including signatures; possible tampering of samples; broken or spilled samples, etc. The GBRA Project Manager in consultation with the GBRA QAO will determine if the procedural violation may have compromised the validity of the resulting data. Any failures that have reasonable potential to compromise data validity will invalidate data, and the sampling event should be repeated. The resolution of the situation will be reported to the TCEQ NPS Project Manager in the project progress report. Corrective Action Plans will be prepared by the GBRA QAO and submitted to GBRA Manager who in turn, will report effectiveness monitoring results to the TCEQ NPS Project Manager.

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

# B5 QUALITY CONTROL

**Sampling Quality Control Requirements and Acceptability Criteria**
**Sampling QC Requirements and and Accetability Criteria**

Due to the limited number of bottles collected by the automated stormwater sampler Field QC samples will not be collected and analyzed as a part of this project.

**Laboratory Measurement Quality Control Requirements and Acceptability Criteria**

Batch – A batch is defined as environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 25 hours. An **analytical batch** is composed of prepared environmental samples (extract, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

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

Detailed GBRA laboratory QC requirements and corrective action procedures are contained within the GBRA quality assurance system manual (QASM) and standard operating procedures (SOPs). The GBRA laboratory performs the following quality control checks.

Limit of Quantitation (LOQ) – The laboratory will analyze a calibration standard (if applicable) at the LOQ on each day calibrations are performed. In addition, an LOQ check standard will be analyzed with each analytical batch. Calibrations including the standard at the LOQ will meet the calibration requirements of the analytical method or corrective action will be implemented.

LOQ Check Standard – An LOQ check standard consists of a sample matrix (e.g., deionized water, sand, commercially available tissue) free from the analytes of interest spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is used to establish intra-laboratory bias to assess the performance of the measurement system at the lower limits of analysis. The LOQ check standard is spiked into the sample matrix at a level less than or near the LOQ for each analyte for each analytical batch of samples run.

divided by the average value (mean) of the set. For duplicate results, $X_1$ and $X_2$, the RPD is calculated from the following equation:

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

A bacteriological duplicate is considered to be a special type of laboratory duplicate and applies when bacteriological samples are run in the field as well as in the lab. Bacteriological duplicate analyses are performed on samples from the sample bottle on a 10% basis. Results of bacteriological duplicates are evaluated by calculating the logarithm of each result and determining the range of each pair.

Measurement performance specifications are used to determine the acceptability of duplicate analyses-as specified in Table A7.1. The specifications for bacteriological duplicates in Table A7.1 apply to samples with concentrations > 10 org./100mL.

Matrix spike (MS) – Matrix spikes are prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Percent recovery of the known concentration of added analyte is used to assess accuracy of the analytical process. The spiking occurs prior to sample preparation and analysis. Spiked samples are routinely prepared and analyzed at a rate of 10% of samples processed, or one per preparation batch whichever is greater. The information from these controls is sample/matrix specific and is not used to determine the validity of the entire batch. The MS is spiked at a level less than or equal to the midpoint of the calibration or analysis range for each analyte. Percent recovery (%R) is defined as 100 times the observed concentration, minus the sample concentration, divided by the true concentration of the spike.

The results from matrix spikes are primarily designed to assess the validity of analytical results in a given matrix and are expressed as percent recovery (%R). The laboratory shall document the calculation for %R. The percent recovery of the matrix spike is calculated using the following equation in which %R is percent recovery, SSR is the observed spiked sample concentration, SR is the sample result, and SA is the reference concentration of the spike added:

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

Measurement performance specifications for matrix spikes are not specified in this document.

The results are compared to the acceptance criteria as published in the mandated test method. Where there are no established criteria, the laboratory shall determine the internal criteria and document the method used to establish the limits. For matrix spike results outside

## B6 Instrument/Equipment Testing, Inspection and Maintenance

Automated sampler testing and maintenance requirements are contained in manufacturer's operating procedures (Attachment 1) of this document.

Equipment records are kept on all field equipment and a supply of critical spare parts is maintained by the GBRA water quality technician.

All laboratory tools, gauges, instrument, and equipment testing and maintenance requirements are contained within laboratory QAM(s). Testing and maintenance records are maintained and are available for inspection by the TCEQ. Instruments requiring daily or in-use testing may include, but are not limited to, water baths, ovens, autoclaves, incubators, refrigerators, and laboratory pure water. Critical spare parts for essential equipment are maintained to prevent downtime. Maintenance records are available for inspection by the TCEQ.

## B7 Instrument Calibration and Frequency

Calibration requirements for the automated monitoring equipment are included in Attachment 1 of the Guadalupe River Basin Network QAPP.

Detailed laboratory calibrations are contained within the GBRA QASM and SOP(s).

## B8 Inspection/Acceptance for Supplies and Consumables

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

## B9 Non-Direct Measurements

Only data collected directly under this QAPP will be reported to the TCEQ NPS Project Manager. This project will not report any acquired or non-direct measurement data to the TCEQ NPS Project Manager that has been or is going to be collected under another QAPP. All data collected under this QAPP and any acquired or non-direct measurements will comply with all requirements/guidance of the project.

The following flow diagram outlines the path that data that is generated in the field takes:

Field data collected → Recorded on Chain of Custody→ Lab database → Quality control review by GBRA Lab Director/QAO → Report generation → Data checked for reasonableness by GBRA Data Manager → Data transferred by email written lab report to GBRA Project Manager→ Final report to TCEQ NPS Project Manager

The following flow diagram outlines the path that data that is generated by the lab takes:

Laboratory data → Laboratory analysis logs → Lab database → Quality control review by GBRA Lab Director/QAO→ Report generation → Data checked for reasonableness by GBRA Data Manager → Data transferred by email written lab report to GBRA Project Manager→ Final report to TCEQ NPS Project Manager

Stormwater Monitoring data will not be submitted to SWQMIS..

**Record-keeping and Data Storage**

GBRA record keeping and document control procedures are contained in the water quality sampling and laboratory standard operating procedures (SOPs) and this QAPP. Original field sheets are stored in the GBRA offices in accordance with the record-retention schedule in Section A9. Original lab sheets are stored in the GBRA offices in fireproof files. Two copies of the GBRA database are backed up each Friday on magnetic tape. One copy is stored in a fireproof safe in a GBRA office, and one copy is stored off-site. If necessary, disaster recovery will be accomplished by information resources staff using the backup database.

**Archives/Data Retention**

**Complete original data sets are archived as permanent scanned electronic media and retained on-site by the GBRA for a retention period specified in Section A9.**

**Data Verification/Validation**

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

**Forms and Checklists**

See Appendix F for the Field Data Sheets.
See Appendix C for the Data Review Checklist and Summary.

**Data Handling**

Additionally, validation can provide a level of overall confidence in the reporting of the data based on the methods used.

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

The procedures for verification and validation of data are described in Section D2, below. The GBRA Quality Assurance Officer is responsible for ensuring that field data are properly reviewed and verified for integrity. The GBRA Laboratory Director is responsible for ensuring that laboratory data are scientifically valid, defensible, of acceptable precision and bias, and reviewed for integrity. The GBRA Data Manager will be responsible for ensuring that all data are properly reviewed and verified, and submitted in the required format to the TCEQ NPS project manager. The GBRA Data Manager is responsible for validating a minimum of 10% of the data produced in each task. Finally, the GBRA Project Manager, with the concurrence of the GBRA QAO, is responsible for validating that all data to be reported meet the objectives of the project and are suitable for reporting to TCEQ.

## D2 VERIFICATION AND VALIDATION METHODS

All data will be verified to ensure they are representative of the samples analyzed and locations where measurements were made, and that the data and associated quality control data conform to project specifications. The staff and management of the respective field, laboratory, and data management tasks are responsible for the integrity, validation and verification of the data each task generates or handles throughout each process. The field and laboratory tasks ensure the verification of raw data, electronically generated data, and data on chain-of-custody forms and hard copy output from instruments.

Verification, validation and integrity review of data will be performed using self-assessments and peer review, as appropriate to the project task, followed by technical review by the manager of the task. The data to be verified (listed in Table D2.1) are evaluated against project performance specifications (Section A7) and are checked for errors, especially errors in transcription, calculations, and data input. If a question arises or an error is identified, the manager of the task responsible for generating the data is contacted to resolve the issue. Issues which can be corrected are corrected and documented electronically or by initialing and dating the associated paperwork. If an issue cannot be corrected, the task manager consults with the higher level project management to establish the appropriate course of action, or the data associated with the issue are rejected and not reported to the TCEQ. The performance of these tasks is documented by completion of the Data Review Checklist and Summary (Appendix C).

The GBRA Data Manager and GBRA Laboratory Director /QAO are each responsible for validating that the verified data are scientifically valid, defensible, of known precision, bias,

# Attachment 1
# Stormwater Monitoring Standard Operating Procedure (SOP) Utilizing an ISCO 6712 Automated Sampler and ISCO 730 Bubbler Module

the operator of the site. The operator can also program the instrument to calculate flow in any area with a known level-to-flow relationship.

3.2 The ISCO 6712 is calibrated to a known water level, by the operator. The current water level is measured with a yard stick or survey rod by the operator during each site visit. This manually measured water level is recorded in an operator log for the automated sampler along with the current instrument water level reading.

3.3 The ISCO 6712 automated sampler is programmed by the operator or manufacturer's representative to begin collecting storm water samples at a defined frequency once the water level reaches a location specific trigger level. This water trigger level will always be at or above the position of the inlet suction line in the stream.

3.4 The operator of the automated sampler will check the instrument every morning following a defined rainfall event near the deployment location to determine if a storm runoff event has been collected by the automated sampler. If a triggered storm water collection event has occurred the operator will record the date and time of sample collection, any observational data relevant to the event, the volume of water collected and any errors encountered or repairs made to the instrument. The operator will label the bottle carousel with the date, time and location of the bottle collection and download the event data with a laptop computer utilizing the ISCO Flowlink software. The operator will transfer the collection bottle and downloaded flow information to the GBRA environmental laboratory for final preservation and analysis.

**4.0 Limitations**

4.1 The ISCO 6712 peristaltic pump contains replaceable pump tubing, which can develop holes and punctures during the course of normal operation. A breach in the pump tubing will prevent the automated sampler from creating enough pressure to retrieve samples through the inlet hose. The pump tubing should be inspected on a regular basis to ensure that it is does not have any punctures.

4.2 The ISCO 6712 3/8" ID vinyl inlet tubing and 1/8" ID vinyl bubble tubing are capable of developing holes or punctures as a result of physical damage from floating debris, high volumes of water or radiation from the sun. A breach in the inlet hose will prevent the automated sampler from properly retrieving a sample and a breach in the bubbler line will prevent the sampler from accurately measuring water level, calculating flow and triggering a storm runoff event. These hoses should be inspected for damage on a regular basis and will ideally be covered by some type of protective sheath.

4.3 The strainer or outlet for the ISCO 6712 3/8" ID vinyl inlet tubing and 1/8" ID vinyl bubble tubing are capable of becoming obstructed by sediment, algae or debris, which can prevent the proper functioning of the sampler. The outlets for each of these tubes should be inspected on a regular basis for clogging and cleaned as needed.

4.4 The ISCO 730 bubbler module is capable of minor shifts in level variance due to environmental conditions, which can have an effect on calculated flow values and storm water trigger levels over extended periods of time. The measured water level should be checked manually on a regular basis to ensure that no major shifts have occurred and corrected if these values fall outside of the QC criteria described in section 9.0.

4.5 The flow calculations produced by the ISCO sampler are only as accurate as the physical characteristics of the stream that are programmed by the operator. It is very possible that an automated sampler deployed in a channel with excessive vegetation, water back flows and pressurized flows, a very irregular channel cross section, an immeasurable water surface slope, or

7.1.1 The ISCO 6712 automated sampler should be placed within a 100 foot radius of the channel that is to be monitored.

7.1.1.1 The sampler should not be placed more than 30 feet above the sampler inlet suction hose.

7.1.1.2 The sampler should not be placed directly in the floodplain unless it is completely unavoidable as a result of the previous distance restrictions.

7.1.1.2.1 The sampler should be secured to a permanent fixture such as a tree or metal post to ensure that it is not removed from the sample location by high waters or vandals.

7.1.2 The sampler inlet suction hose should be permanently attached to the channel of interest, at a representative section of the water body, near the centroid of the stream flow.

7.1.2.1 One end of the suction hose should be attached to a stainless steel strainer, this end of the hose should be attached to an immovable object near a representative section of the water body, such as the center of the channel.

7.1.2.2 The strainer will ideally be attached to a concrete structure with concrete screws and anchors, but if no immovable structures are available, a metal post may be mounted in the center of the channel in order to attach the hose with mounting brackets or cable ties.

7.1.2.3 The stainless steel strainer should not be placed in areas of excessive vegetation, or siltation.

7.1.2.4 The opposite end of the inlet suction hose should be attached to the pump tubing on the 6712 automated sampler. The inlet tubing should be cut to the approximate length of the distance between the automated sampler and the position of the stainless steel strainer, with approximately 3 extra feet left on the sampler end.

7.1.2.5 This inlet tubing should be covered with a protective sheath such as flexible plastic tubing, or PVC piping in order to prevent physical damage from adverse weather conditions and vandals.

7.1.3 The bubbler hose should be permanently attached to the channel of interest, at a representative section of the water body, near the centroid of the stream flow.

7.1.3.1 The bubbler hose should be mounted in the same manner as the sampler suction hose described in sections 7.1.2.1-7.1.2.5.

7.1.3.1.1 The bubbler hose may share the same protective casing and mounting brackets as the sampler inlet hose, however the stainless steel bubbler hose extender is much longer than the strainer of the sampler hose and the amount of space used for the final mount will be proportionately larger.

7.2.15 The next quick view menu will ask to confirm that a new module has been setup. Select "done" and advance to the next screen.
7.2.16 Select the "adjust current level" screen and type in the current water level in feet at the area of the channel wear the bubble hose was affixed. This measurement will need to be made by the operator of the site with a yardstick or other appropriate measuring device. Advance to the next quick view screen
7.2.17 Adjust the "data storage interval" on the next screen to "5 minutes".
7.2.18 The next quick view screen will be the will ask about the number of bottles in the kit. Highlight this menu and press the return key. Highlight "24" and press the return key once again and then advance to the next quick view screen.
7.2.19 The next screen will ask about the bottle volume. Highlight this menu and press the return key. Enter 10,00 ml into the text box with the numeric keypad and then press the return key. Continue to advance to the next quick view screen.
7.2.20 The next quick view screen will ask about the suction line length. Access this menu and type the measured length of the suction line from one end to the other and then press the return key. Advance to the next quick view screen.
7.2.21 Select "Auto Suction Head" from the next quickview screen.
7.2.22 Select "0 rinse cycles" from the next quick view screen.
7.2.23 Select "0 retries" from the next quick view screen.
7.2.24 Select "One-Part Program" from the next quick view screen.
7.2.25 Select "uniform time paced" from the next quick view screen.
7.2.26 Type 1 hours and 0 Minutes into the "time between sample events" field using the numerical keypad on the sampler. Advance to the next quick view screen.
7.2.27 Select "1 bottles per sample event"
7.2.28 Select "switch bottles every 1 samples"
7.2.29 Select "No" when the program asks if it should run continuously. Select 1000 mL with the numeric keypad when the program asks about sample volume.
7.2.30 Select Enable with "Level"
7.2.31 Select Enable set point and enter a set point level condition that will be just above the height of the suction line from the bottom with the numeric keypad on the instrument.
7.2.32 Select enabled when "above set point"
7.2.33 Select "once enabled stay enabled".
7.2.34 Select "Yes" under the "sample at enable" quick view screen.
7.2.35 Select "Done"
7.2.36 "Select "No Delay to Start" The system is now programmed to begin sampling when storm water flows through the channel at a level greater than the position of the intake suction line in the channel.

7.3 Collecting Automated Stormwater Samples

7.3.1 If the sampler is powered on, The ISCO storm water sampler will be checked every weekday immediately following a period of measurable rainfall within the City of Seguin by the site operator.
7.3.2 The site operator will check the instrument LCD display upon arriving at the location and examine the location to see if any water is passing through the storm water channel
7.3.2.1 If the Instrument display says that the program is "enabled", it will also say the number of the next bottle that it will sample and will give a countdown time. The amount of time needed for the sampler to complete its full cycle can be calculated by subtracted the current bottle sampling number from 24.
7.3.2.2 If the Instrument display says that sampling has completed it will also display the total flow for the event.
7.3.2.2.1 The time that the sampling cycle started and ended can be determined by navigating to the "view" and "sampling report"

outlets for these hoses will be cleared of any debris that could prevent the efficient passage of water.

7.4.2.1 The operator will replace the inlet suction hose or bubble tubing if a breach is discovered.

7.4.3 The Operator will record the current water depth level displayed on the instrument LCD upon each site visit in the operator log for each instrument. The operator will measure the water height with a yard stick and compare this measurement with the current height displayed by the instrument. If the value measured by the operator differs by more than 0.025 form the value displayed by the instrument then the operator will adjust the instrument current level to the manually measured value by programming in the instrument as described in section 7.2.16 and recording this new value in the operator logbook for the instrument.

7.4.3.1 If there is no water in the channel the current level reading should be 0.00 feet +/- 0.025 feet.

7.5 ISCO 6712 References

7.5.1 Further in-depth knowledge of ISCO 6712 procedures, programming, calibration & maintenance can be found in the ISCO 6712 Portable Sampler Installation and Operation Guide, 2001 Revision V, April 2, 2007, published by Teledyne ISCO.