Appendix I to the Trinity River Authority Clean Rivers Program FY 2018/2019 QAPP

E. coli in Sediment: Phase 1

Prepared by the Trinity River Authority in cooperation with the Texas Commission on Environmental Quality (TCEQ)

Effective: Immediately upon approval by all parties

Questions concerning this QAPP should be directed to:
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SS-A1 Approval Page

Texas Commission on Environmental Quality

Water Quality Planning Division

Electronically approved 1/17/2018

Sarah Eagle, Work Leader Date
Clean Rivers Program

Electronically approved 1/17/2018

Kelly Rodibaugh Date
CRP Project Quality Assurance Specialist

Electronically approved 1/17/2018

Cathy Anderson, Team Leader Date
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Electronically approved 1/17/2018

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Mary Gaither Date
TRA CRWS QA Officer

Ana-Lab Corporation

Electronically approved 1/18/2018

Bill Peery Date
Ana-Lab Manager (President)

Electronically approved 1/17/2018

Paul Zhang Date
Ana-Lab Quality Assurance Officer (Director of QA and Ethics)

The Trinity River Authority will secure written documentation from each sub-tier project participant (e.g., subcontractors, other units of government) stating the organization's awareness of and commitment to requirements contained in this quality assurance project plan and any amendments or added appendices of this plan. Alternatively, additional signature blocks for sub-tier participants may be added to section A1. Signatures in section A1 will eliminate the need to adherence letters to be maintained. The Trinity River Authority will maintain this documentation as part of the project's quality assurance records, and will ensure the documentation is available for review.

SS-A2 Table of Contents

List of Acronyms

As described in Section A2 of the basin-wide QAPP.

SS-A3 Distribution List

As described in Section A3 of the basin-wide QAPP for TCEQ and Trinity River Authority staff.

SS-A4 Project/Task Organization

As described in Section A4 of the basin-wide QAPP for TCEQ and Trinity River Authority staff.

Ana-Lab Corporation
2600 Dudley Rd
Kilgore, Texas 75662

Bill Peery, Lab Manager (President)
903-984-0551

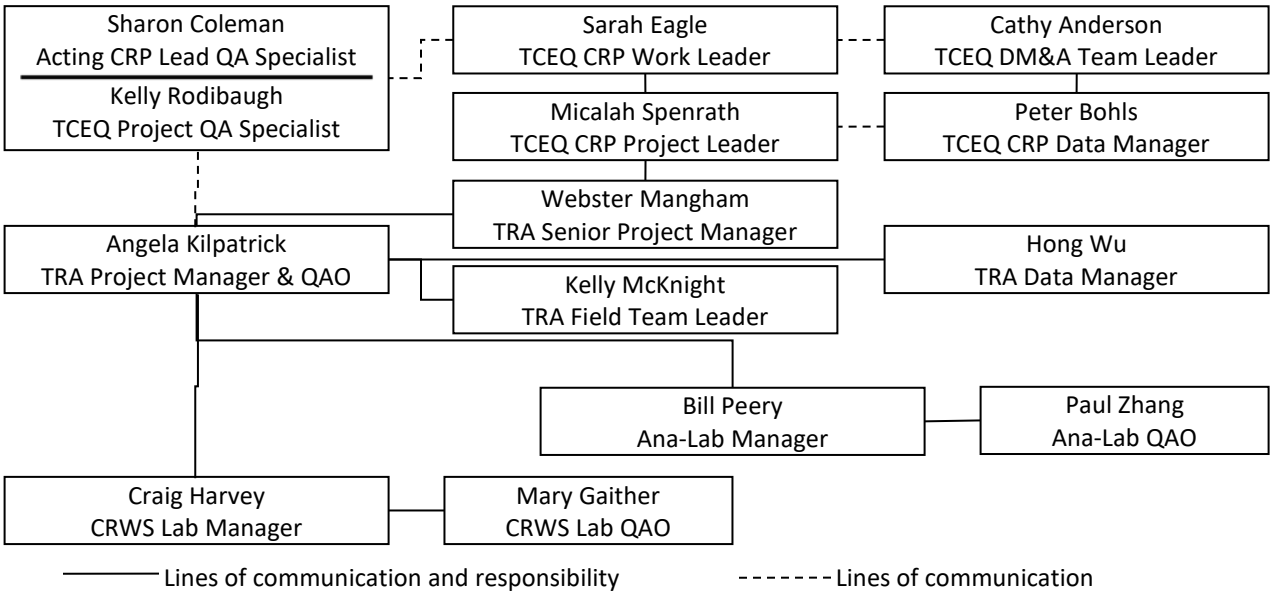
Paul Zhang, Lab QAO (Director of QA and Ethics)
903-984-0551

Ana-Lab Corporation

Bill Peery - Laboratory Manager(President)
The laboratory manager will oversee all analytical work performed at their laboratory to assure that proper and appropriate clean analytical techniques are utilized. When quality assurance issues arise in the laboratory, the laboratory manager will be responsible for initiating corrective actions and for notifying the TRA QAO of any such issues. The laboratory manager will also maintain the laboratory's QA records and analysts' training records.

Paul Zhang - Laboratory Quality Assurance Officer (Director of QA and Ethics)
The laboratory quality assurance officer, in cooperation with the laboratory manager, is responsible for ensuring the data produced by the lab meets CRP requirements as specified in this appendix. Data should be reviewed and approved prior to submittal to the WBPA QAO or TRA DM.

Figure SS-A4.1. Organization Chart - Lines of Communication



SS-A5 Problem Definition / Background

During the development of the Village Creek-Lake Arlington Watershed Protection Plan, stakeholders expressed interest in understanding factors that influence bacteria levels in the water column. There are many sources in scientific literature that indicate that sediments can be a significant reservoir of bacteria in waterbodies. Most studies have focused on swimming beaches of reservoirs and coastal areas; little work has been conducted on flowing/eroding systems. To more fully understand bacterial impairment issues in the streams of the Trinity basin, a study will be undertaken to identify the extent to which bacteria in sediments may affect water column concentrations. There is some acknowledgment that sediments affect water quality as noted in the following excerpts from the TCEQ *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods* (RG-415, Revised August 2012):

- Field Measurements, Page 3-19: "If flow is measured first, take care not to deploy a multiprobe instrument or to collect water samples in the area disturbed during flow measurement."
- Bacteriological Samples, Page 4-3: "In streams and rivers, take care to find an undisturbed location if other work, like flow or sediment collection, is being done at the site."
- Bacteriological Samples, Page 4-3: "Flowing streams. Dip the open sample container to a depth of 0.3 m, or roughly half the depth in very shallow streams. Avoid contact with the sediment. With the open end facing upstream, push the mouth of the bag upstream at this depth until full. Always hold the mouth of the sample container upstream of the sampler, the sampling apparatus, and any disturbed sediments."
- Collecting Water Samples, Page 5-1: "If other work is being done at the site—for example, measuring flow, collecting sediment samples, collecting biological samples, or habitat assessment activities—make sure to collect representative samples from an undisturbed area of the stream."

- Collecting Sediment Samples, Page 6-1: “Sediment chemistry samples can give information both on trends in contaminant loading and on the potential for adverse effects on sediment and aquatic biota.”

It is anticipated that this study may expand into future years with additional sampling and analyses based on the results of this first phase. However, the first phase of this study will focus on sediment and water column *E. coli* enumeration.

SS-A6 Project / Task Description

Samples will be collected every other month at seven sites on four streams: one site on an unnamed tributary to Lake Arlington, one site on Village Creek, one on a tributary of Village Creek, and two sites each on Mountain Creek and Walnut Creek. Bacteria sampling activities will consist of the collection of sediment *E. coli* as well as water column *E. coli*. Water column *E. coli* samples will be collected before and after artificial sediment disturbance.

Sediment samples will be collected from a layer of sediment that is no deeper than 10 cm as significant contributions of *E. coli* to the water column from below this sediment depth are not expected under low to normal flow conditions. Research by Brinkmeyer et. al 2014 (DOI: 10.1016/ j.scitotenv.2014.09.071) noted that *E. coli* in the sediments of two bayous in Houston, were consistently found to be highest in the top 1 cm and that there was “a significant order of magnitude or more reduction in [*E. coli*] and [enterococci] concentrations from the top 1 cm to the deeper 15, 30, and 60 cm horizons”. Further, Pachepsky and Sheldon 2011 (http://dx.doi.org/10.1080/ 10643380903392718) noted that there was a more than twofold decrease in *E. coli* levels in 5 cm increments down to a depth of 15 cm in a rural Maryland creek.

Sediment *E. coli* data will be submitted to TCEQ under parameter code 31702. A water column *E. coli* sample will be collected prior to disturbing the sediments and this data will be submitted to SWQMIS under parameter code 31699. An additional water column sample will be collected slightly downstream after sediment has been disturbed and re-suspended. As the post-disturbance water column samples will be collected outside of normal CRP sampling protocols, these *E. coli* data will not be submitted to SWQMIS. Rather, they will be used for data analysis to determine if sediment disturbances significantly changed the concentration of *E. coli* in the water column.

Samples will be collected under flow severities of low to normal flow. It is expected that there will be limited sediment mobility under these flow conditions which should reduce background influences from sediments in the pre-disturbance samples. Therefore, high and flood flow conditions will not be sampled. Additionally, each site will be inspected prior to sampling to ensure that bed sediments are not being excessively mobilized at low and normal flows due to outside influences such as animal or human activity and channel disturbances such as construction and erosion. If it is apparent that bed sediments are being resuspended due to these influences, sampling will be delayed until a time when the channel has stabilized and there is reduced sediment movement.

The following tasks will be completed during each sample event:

1) Upon arrival at each site, a distance of 30 seconds downstream of the sediment collection

location will be determined. One field staff member will introduce a biodegradable neutrally-buoyant item into the stream. A second field staff member will identify where the floating item is after 30 seconds and will enter the stream at that location.

2) The second field staff member will collect a pre-disturbance water column *E. coli* sample.
3) The first field staff member will enter the stream and collect a sediment sample for laboratory analysis of *E. coli* and sediment conventionals. These samples will be collected with a scoop or dredge depending on the depth of the water at the time of sampling.
4) The first field staff member will adequately disturb the sediments by kicking up the sediments in a wide zig-zagging pattern across the stream channel. During the sediment disturbance a second biodegradable neutrally-buoyant item will be introduced into the stream.
5) The second field staff member will collect a post-disturbance water column sample once the floating item has reached their location.
6) A sonde will be placed upstream of the disturbed area for determination of field parameters.
7) Instantaneous flow will be measured at the upstream site and reported under parameter code 00061.
8) *E. coli* and sediment conventionals samples will be delivered to AnaLab for analysis.

Amendments to the QAPP

Revisions to the Special Study Appendix may be necessary to address incorrectly documented information or to reflect changes in project organization, tasks, schedules, objectives, and methods. Requests for amendments will be directed from the TRA Project Manager to the CRP Project Manager electronically. The TRA will submit a completed Special Study Appendix Amendment document, including a justification of the amendment, a table of changes, and all pages, sections or attachments affected by the amendment. Amendments are effective immediately upon approval by the TRA Project Manager, the TRA QAO, the CRP Project Manager, the CRP Lead QA Specialist, the CRP Project QA Specialist, the TCEQ QA Manager or designee, and additional parties affected by the amendment. Amendments are not retroactive. No work shall be implemented without an approved special study appendix or amendment prior to the start of work. Any activities under this contract that commence prior to the approval of the governing QA document constitute a deficiency and are subject to corrective action as described in section C1 of this QAPP. Any deviation or deficiency from this QAPP which occurs after the execution of this QAPP should be addressed through a Corrective Action Plan (CAP). An Amendment may be a component of a CAP to prevent future recurrence of a deviation. Amendments will be incorporated into the QAPP by way of attachment and distributed to personnel on the distribution list by the TRA Project Manager.

SS-A7 Quality Objectives and Criteria

The intent of the monitoring covered under this appendix is to characterize how *E. coli* in sediments may affect water column *E. coli* under conditions in which the sediments are disturbed. A further objective of this study is to use its findings to improve the understanding of the causes of increased *E. coli* loading in streams under stormwater disturbance conditions by establishing a baseline absent of nonpoint source stormwater inputs from the watershed. Additional data analysis will attempt to determine if there are any correlations between sediment *E. coli* levels and specific sediment particle sizes. Only the pre-disturbance water column *E. coli* sample, sediment *E. coli* samples, sediment particle size determinations, standard field parameters, and flow will be collected in accordance with the TCEQ *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring*

Methods (RG-415, Revised August 2012) and the resultant data will be submitted for inclusion in SWQMIS. The post-disturbance *E. coli* samples will not conform to CRP requirements for inclusion in SWQMIS. These data points will be used for data analysis and narrative in the project report.

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

Ambient Water Reporting Limits (AWRLs)

As described in Section A7 of the basin-wide QAPP.

Precision

As described in Section A7 of the basin-wide QAPP.

Bias

As described in Section A7 of the basin-wide QAPP.

Representativeness

Several sources in scientific literature have noted that sediments can be a significant reservoir of *E. coli* in waterbodies. However, very little information is available on the significance of sediment *E. coli* in flowing systems. This study will attempt to characterize the extent to which sediment *E. coli* levels affect water column *E. coli* levels under conditions in which the sediments are disturbed and to determine if *E. coli* have a preference for specific sediment particle sizes in flowing systems. To that end, the sites selected for this study will be located in areas that are both wadeable and expected to have a range of sediment particle sizes. Wadeable sites and flows will be preferred as these conditions are necessary to artificially disturb the sediments during each sampling event. The sites to be sampled will be considered representative of small flowing systems in rural areas and suburban areas – those areas being expected to have bacterial loadings primarily from wildlife, livestock, and pets.

Comparability

As described in Section A7 of the basin-wide QAPP.

Completeness

As described in Section A7 of the basin-wide QAPP.

Table SS-A7.1 - Measurement Performance Specifications

Parameter	Units	Matrix	Method	Parameter Code	AWRL	LOQ	LOQ Check Sample %Rec	Precision (RPD of LCS/LCSD)	Bias %Rec. of LCS	Lab
Field Parameters										
TEMPERATURE, WATER (DEGREES CENTIGRADE)	DEG C	water	SM 2550 B and TCEQ SOP V1	00010	NA*	NA	NA	NA	NA	Field
TEMPERATURE, AIR (DEGREES CENTIGRADE)	DEG C	air	SM 2550 B and TCEQ SOP V1	00020	NA*	NA	NA	NA	NA	Field
TRANSPARENCY, SECCHI DISC (METERS)	meters	water	TCEQ SOP V1	00078	NA*	NA	NA	NA	NA	Field
SPECIFIC CONDUCTANCE,FIELD (US/CM @ 25C)	us/cm	water	EPA 120.1 and TCEQ SOP, V1	00094	NA*	NA	NA	NA	NA	Field
OXYGEN, DISSOLVED (MG/L)	mg/L	water	SM 4500-O G and TCEQ SOP V1	00300	NA*	NA	NA	NA	NA	Field
PH (STANDARD UNITS)	s.u	water	EPA 150.1 and TCEQ SOP V1	00400	NA*	NA	NA	NA	NA	Field
DAYS SINCE PRECIPITATION EVENT (DAYS)	days	other	TCEQ SOP V1	72053	NA*	NA	NA	NA	NA	Field
DEPTH OF BOTTOM OF WATER BODY AT SAMPLE SITE	meters	water	TCEQ SOP V2	82903	NA*	NA	NA	NA	NA	Field
Flow Parameters										
FLOW STREAM, INSTANTANEOUS (CUBIC FEET PER SEC)	cfs	water	TCEQ SOP V1	00061	NA*	NA	NA	NA	NA	Field
FLOW SEVERITY:1=No Flow,2=Low,3=Normal,4=Flood,5=High,6=Dry	NU	water	TCEQ SOP V1	01351	NA*	NA	NA	NA	NA	Field
FLOW MTH 1=GAGE 2=ELEC 3=MECH 4=WEIR/FLU 5=DOPPLER	NU	other	TCEQ SOP V1	89835	NA*	NA	NA	NA	NA	Field
Bacteriological Parameters in Water										
E. COLI, COLILERT, IDEXX METHOD, MPN/100ML	MPN/100 mL	water	Colilert/ Colilert-18	31699	1	1	NA	0.50**	NA	TRA
Bacteriological Parameters in Sediment										
E COLI, SEDIMENT, MPN/100G	MPN/100 G	sediment	SM 9223 B	31702	1	1	NA	0.50**	NA	AnaLab
Sediment Conventionals										
SEDIMENT, GRAIN SIZE, CLAY, <0.005 MM, %Dry WT	% DRY WT	sediment	CAS:GCO (ASTM D422)	17521	NA	NA	NA	20	NA	AnaLab
SEDIMENT, GRAIN SIZE, SILT, 0.005-0.074 mm ,%DRY WT	% DRY WT	sediment	CAS:GCO (ASTM D422	17522	NA	NA	NA	20	NA	AnaLab
SEDIMENT, GRAIN SIZE, FINE SAND, 0.075-0.425 mm, %DRY WT	% DRY WT	sediment	CAS:GCO (ASTM D422	17523	NA	NA	NA	20	NA	AnaLab
SEDIMENT, GRAIN SIZE, MEDIUM SAND, 0.425 mm - 2 mm, %DRY WT	% DRY WT	sediment	CAS:GCO (ASTM D422	17524	NA	NA	NA	20	NA	AnaLab
SEDIMENT, GRAIN SIZE, COARSE SAND, 2mm-4.75mm, %DRY WT	% DRY WT	sediment	CAS:GCO (ASTM D422	17525	NA	NA	NA	20	NA	AnaLab
SEDIMENT, GRAIN SIZE, GRAVEL, 4.75 mm - 3 inches, %DRY WT	% DRY WT	sediment	CAS:GCO (ASTM D422	17526	NA	NA	NA	20	NA	AnaLab
TOTAL ORGANIC CARBON, NPOC(TOC), SED DRY WT	mg/kg	sediment	SSA/ASA Part 3:34 (Walkley-Black)	81951	NA	NA	65-135	30	65-135	AnaLab
SOLIDS IN SEDIMENT, PERCENT BY WEIGHT (DRY)	% DRY WT	sediment	SM 2540-G	81373	NA	NA	NA	20	NA	AnaLab

* Reporting to be consistent with SWQM guidance and based on measurement capability.

** This value is not expressed as a relative percent difference. It represents the maximum allowable difference between the logarithm of the result of a sample and the logarithm of the duplicate result. See Section B5.

References:

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

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998. (Note: The 21st edition may be cited if it becomes available.)

TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).

TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416)

SS-A8 Special Training / Certification

As described in section A7 of the basin-wide QAPP.

TRA staff are experienced in both water column and sediment sampling techniques required for this project.

SS-A9 Documents and Records

As described in Section A9 of the basin-wide QAPP, with the exception of Table A9.1. Table SS-A9.1 below describes document retention for this project.

Table SS-A9.1 Project Documents and Records

Document/Record	Location	Retention (yrs)	Format
QAPPs, amendments and appendices	TCEQ, TRA	Min 7 years	Paper or Electronic
Field SOPs	TRA	Min 7 years	Paper or Electronic
Laboratory Quality Manuals	TRA, Laboratories	Min 7 years	Paper or Electronic
Laboratory SOPs	TRA, Laboratories	Min 7 years	Paper or Electronic
QAPP distribution documentation	TRA	Min 7 years	Paper or Electronic
Field staff training records	TRA	Min 7 years	Paper
Field equipment calibration/maintenance logs	TRA	Min 7 years	Paper
Field instrument printouts	TRA	Min 7 years	Paper or Electronic
Field notebooks or data sheets	TRA	Min 7 years	Paper or Electronic
Field SOPs	TRA	Min 7 years	Paper or Electronic
Laboratory calibration records	Laboratories	Min 7 years	Paper or Electronic
Laboratory instrument printouts	Laboratories	Min 7 years	Paper or Electronic
Laboratory data reports/results	TRA, Laboratories	Min 7 years	Paper or Electronic
Laboratory equipment maintenance logs	Laboratories	Min 7 years	Paper or Electronic
Corrective Action Documentation	TRA, Laboratories	Min 7 years	Paper or Electronic

SS-B1 Sampling Process Design

The data collection design is summarized in Table SS-B1 (Sampling Sites and Monitoring Frequencies) and Figure SS-B1 (Sample Site Maps).

Sample Design Rationale and Site Selection Criteria

The sites selected for this study are wadeable and have a range of sediment particle sizes. Additional site selection criteria are detailed below.

- **10798** – This site was sampled during the Village Creek-Lake Arlington Watershed Protection Plan water quality monitoring effort. This stream flows through a suburban residential area. The watershed is fairly small but there has been consistent flow and elevated *E. coli* levels.
- **10786** – This site is downstream of the Deer Creek and Village Creek confluence. It captures all of the flow from the upper and middle portions of the Village Creek watershed. There is a USGS gage (08048970) located at this site.
- **21759** - Downstream point in the Quil Miller Creek subwatershed. This site captures an upstream portion of the Village Creek watershed. Represents rangeland/ag land uses in southeastern part of watershed.
- **13621** – This site is located on the Walnut Creek arm of the Mountain Creek watershed which flows in to Joe Pool Lake. It is located downstream of the confluence of Walnut Creek and Hogpen Branch which flows through a mostly suburban area. It is located at the USGS gage 08049700.

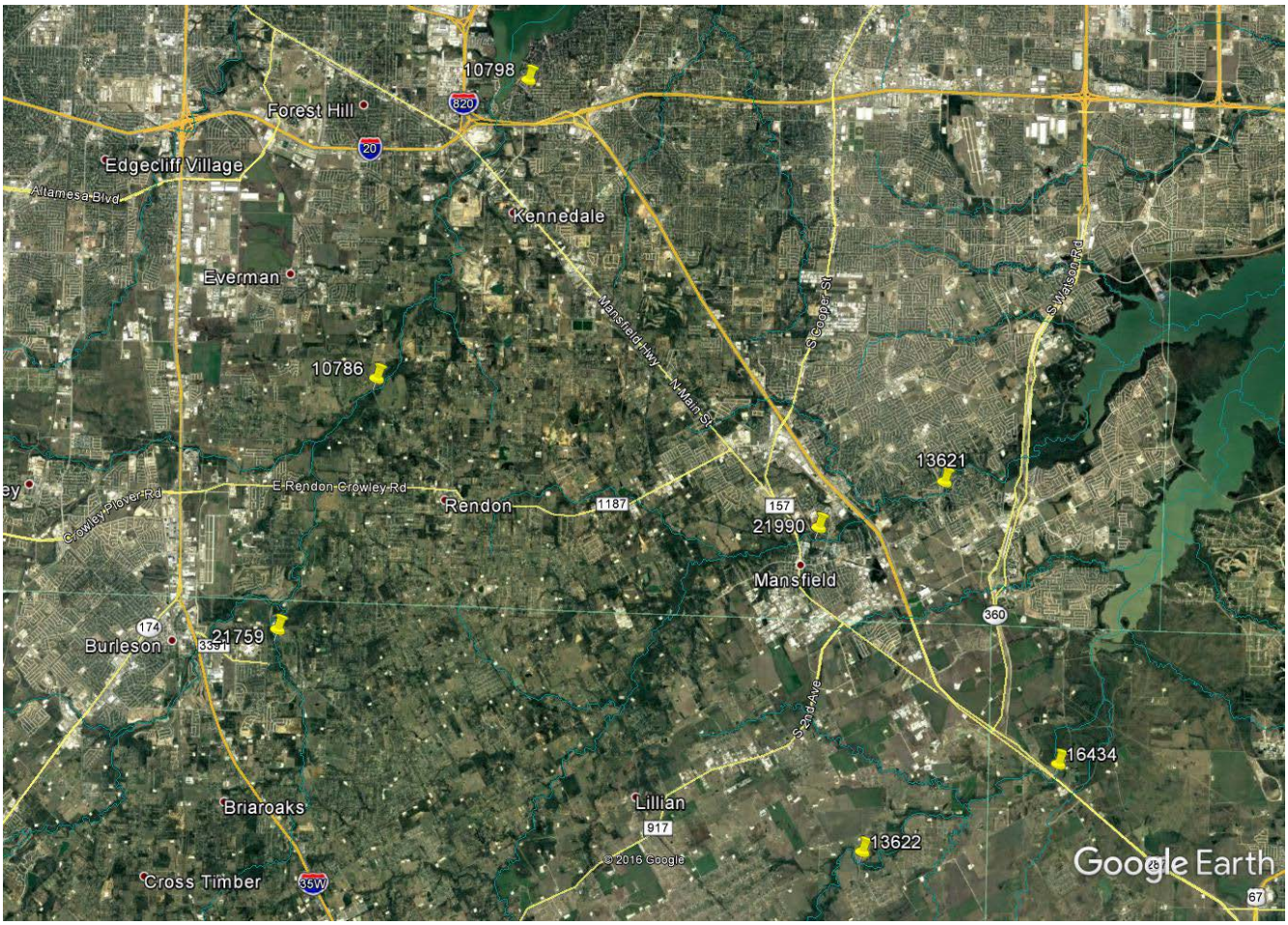
- **21990** – This site is located on the Walnut Creek arm of the Mountain Creek watershed which flows in to Joe Pool Lake. It is located in a park and is just downstream of the interface between rural and suburban land uses.
- **16434** – This site is located on the Mountain Creek arm of the Mountain Creek watershed which flows in to Joe Pool Lake. It is downstream of the confluences of Mountain Creek, Grassy Creek, and Reece Branch. Land use is similar to that of 13622.
- **13622** – This site is located on the Mountain Creek arm of the Mountain Creek watershed which flows in to Joe Pool Lake. It is located at the USGS gage 08049580 and drains a mostly rural watershed with some light residential development upstream.

Table B1.1 Sample Design and Schedule, FY 2018-2019

Site Description	Station ID	Latitude	Longitude	Waterbody ID	Region	SE	CE	MT	Bacteria in Sediment	Bacteria in Water	Inst Flow	Field	Comment
UNNAMED TRIBUTARY OF LAKE ARLINGTON AT BOWMAN SPRINGS ROAD	10798	32.67605	-97.22318	0828	04	TR	TR	BFSI	6	6	6	6	
VILLAGE CREEK IMMEDIATELY DOWNSTREAM OF RENDON ROAD SW OF ARLINGTON	10786	32.60328	-97.26470	0828A	04	TR	TR	BFSI	6	6	6	6	
QUIL MILLER CREEK AT COUNTY ROAD 532 IN BURLESON	21759	32.54225	-97.29188	0828A	04	TR	TR	BFSI	6	6	6	6	
WALNUT CREEK AT MATLOCK ROAD 2.6 MI NORTHEAST OF MANSFIELD	13621	32.58086	-97.10214	0838C	04	TR	TR	BFSI	6	6	6	6	
WALNUT CREEK AT KATHERINE ROSE MEMORIAL PARK FOOT BRIDGE 400 METERS UPSTREAM OF N WALNUT CREEK DRIVE IN MANSFIELD	21990	32.56931	-97.13768	0838C	04	TR	TR	BFSI	6	6	6	6	
MOUNTAIN CREEK AT US287 1.6KM NORTHWEST OF INTERSECTION OF US 287 AND FM 661	16434	32.51278	-97.06756	0838	04	TR	TR	BFSI	6	6	6	6	
MOUNTAIN CREEK AT FM 157 3.9 MI NORTH OF VENUS 3.0 MI UPSTREAM FROM GRASSY CREEK	13622	32.49132	-97.12315	0838A	04	TR	TR	BFSI	6	6	6	6	

Figure SS-B1.1 Sampling Site Map

A map of the stations monitored by the TRA for this project is provided below. This map was generated by the TRA. This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries. For more information concerning this map, contact the TRA Project Manager at 817-467-4343.



SS-B2 Sampling Methods

Field Sampling Procedures

Section SS-A6 details the steps that will be followed during each sample event. There are four types of sample collection that will be conducted during each event.

1) Standard Field Parameter Collection – This will include the parameters listed under the Field Parameters and Flow Parameters sections of Table SS-A7.1. This sampling will be conducted in accordance with the TCEQ *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods* (RG-415, Revised August 2012). These data will be submitted to SWQMIS.
2) Pre-Disturbance Water Column *E. coli* Collection – This will include the parameters listed in the Bacteriological Parameters in Water section of Table SS-A7.1. This sampling will be conducted in accordance with the TCEQ *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods* (RG-415, Revised August 2012). This sample will be collected in a sterile plastic container with that has been pre-dosed with sodium thiosulfate by the manufacturer. These data will be submitted to SWQMIS.
3) Sediment Conventionals and Sediment *E. coli* Collection – This will include the parameters listed under the Bacteriological Parameters in Sediment and the Sediment Conventionals sections of Table SS-A7.1. This sampling will be conducted in accordance with the TCEQ *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods* (RG-415, Revised August 2012). Sub-samples will be collected across the width of the stream where artificial disturbance of the sediments will take place in order to collect the post-disturbance water column *E. coli* sample (detailed below in #4). These sub-samples will be composited and homogenized. A portion of this homogenized sediment will be collected for sediment *E. coli* determination and a second portion will be collected for sediment conventionals analysis. Sediment *E. coli* samples will be collected in new pre-cleaned glass containers with a Teflon lined lid. The container will be filled with no head space to prevent mixing of the sample after collection. Sediment conventionals samples will be collected in a plastic or glass container. These data will be submitted to SWQMIS.
4) Post-Disturbance Water Column *E. coli* Collection – This sampling will be conducted in accordance with the TCEQ *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods* (RG-415, Revised August 2012) with one exception. This sample is specifically intended to be influenced by disrupted sediments and therefore will be collected downstream of where a field team member is kicking up the sediments in the stream. This sample will be collected in a sterile plastic container with that has been pre-dosed with sodium thiosulfate by the manufacturer. These data will not be submitted to SWQMIS. They are intended only for data analysis and will be included in the project report.

Sample volume, container types, minimum sampling volume, preservation requirements, and holding time requirements

See Table SS-B2.1 for sample storage, preservation, and handling requirements.

Table SS-B2.1 Sample Storage, Preservation, and Handling Requirements

Parameter	Matrix	Container	Preservation	Minumum Sample Volume	Holding Time
E.coli	Water	Sterile Plastic	Place on ice to cool to <6C but not frozen (bottles provided by TRA are pre-dosed with sodium thiosulfate by the manufacturer)	100 mL	8 hours
E.coli	Sediment	Glass	Place on ice to cool to <6C but not frozen	250 mL	30 hours
Particle Size and % Solids	Sediment	Plastic or Glass	Place on ice to cool to <6C but not frozen	2000 mL	28 days
TOC	Sediment	Plastic or Glass	Place on ice to cool to <6C but not frozen	250 mL	28 days

Sample Containers

Sample containers used for water column bacteriological samples are purchased sterilized and have 1% sodium thiosulfate added. Sample containers for sediment *E. coli* are purchased new and pre-cleaned. Sample containers for sediment conventionals may be plastic or glass and may be reused by washing with soap and water.

Processes to Prevent Contamination

As described in Section B2 of the basin-wide QAPP.

Documentation of Field Sampling Activities

As described in Section B2 of the basin-wide QAPP. See Attachment A of this appendix for an example of the field data sheet to be used for this project.

Recording Data

As described in Section B2 of the basin-wide QAPP.

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

As described in Section B2 of the basin-wide QAPP.

B3 Sample Handling and Custody

Sample Tracking

As described in Section B3 of the basin-wide QAPP. See Attachment A of this appendix for an example of the field data sheet to be used for this project.

Sample Labeling

As described in Section B3 of the basin-wide QAPP.

Sample Handling

As described in Section B3 of the basin-wide QAPP.

Sample Tracking Procedure Deficiencies and Corrective Action

As described in Section B3 of the basin-wide QAPP.

B4 Analytical Methods

The analytical methods, associated matrices, and performing laboratories are listed in Table SS-A7.1 of section SS-A7. The authority for analysis methodologies under CRP is derived from the 30 Tex. Admin. Code Ch. 307, in that data generally are generated for comparison to those standards and/or criteria. The Standards state "Procedures for laboratory analysis must be in accordance with the most recently published edition of the book entitled Standard Methods for the Examination of Water and Wastewater, the TCEQ Surface Water Quality Monitoring Procedures as amended, 40 CFR 136, or other reliable procedures acceptable to the TCEQ, and in accordance with Chapter 25 of this title." Copies of laboratory SOPs are available for review by the TCEQ. Laboratory SOPs are consistent with EPA requirements, as specified in the method.

Standards Traceability

As described in Section B4 of the basin-wide QAPP.

Analytical Method Deficiencies and Corrective Actions

As described in Section B4 of the basin-wide QAPP.

B5 Quality Control

Sampling Quality Control Requirements and Acceptability Criteria

As described in Section B5 of the basin-wide QAPP.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria

As described in Section B5 of the basin-wide QAPP.

LOQ Sediment Samples

When considering LOQs for solid samples and how they apply to results, two aspects of the analysis are considered: (1) the LOQ of the sample, based on the real-world in which moisture content and interferences affect the result and (2) the LOQ in the QAPP which is a value less than or equal to the AWRL based on an idealized sample with zero % moisture.

The LOQ for a solid sample is based on the lowest non-zero calibration standard (as are those for water samples), the moisture content of the solid sample, and any sample concentration or dilution factors resulting from sample preparation or clean-up.

To establish solid-phase LOQs to be listed in Table SS-A7.1 of the QAPP, the laboratory will adjust the

concentration of the lowest non-zero calibration standard for the amount of sample extracted, the final extract volume, and moisture content (assumed to be zero % moisture). Each calculated LOQ will be less than or equal to the AWRL on the dry-weight basis to satisfy the AWRL requirement for sediment and tissue analyses. When data are reviewed for consistency with the QAPP, they are evaluated based on this requirement. Results may not appear to meet the AWRL requirement due to high moisture content, high concentrations of non-target analytes necessitating sample dilution, etc. These sample results will be submitted to the TCEQ with an explanation on the data summary as to why results do not appear to meet the AWRL requirement.

Quality Control or Acceptability Requirements Deficiencies and Corrective Actions

As described in Section B5 of the basin-wide QAPP.

B6 Instrument/Equipment Testing, Inspection, and Maintenance

As described in Section B6 of the basin-wide QAPP.

B7 Instrument Calibration and Frequency

As described in Section B7 of the basin-wide QAPP.

B8 Inspection/Acceptance of Supplies and Consumables

As described in Section B8 of the basin-wide QAPP.

B9 Acquired Data

As described in Section B9 of the basin-wide QAPP.

B10 Data Management

As described in Section B10 of the basin-wide QAPP, with the exception of the Collecting Entity table found in the Record Keeping and Data Storage section. The Collecting Entity table for the project detailed in this appendix is provided below.

Name of Entity	Tag Prefix	Submitting Entity	Collecting Entity	Monitoring Type Code
Trinity River Authority	TR	TR	TR	BFSI*

*Biased to Flow Source Identification

C1 Assessments and Response Actions

As described in Section C1 of the basin-wide QAPP.

Corrective Action Process for Deficiencies

As described in Section C1 of the basin-wide QAPP.

Corrective Action

As described in Section C1 of the basin-wide QAPP.

C2 Reports to Management

Reports to TRA Project Management

As described in Section C2 of the basin-wide QAPP.

Reports to TCEQ Project Management

As described in Section C2 of the basin-wide QAPP.

Reports by TCEQ Project Management

As described in Section C2 of the basin-wide QAPP.

D1 Data Review, Verification, and Validation

As described in Section D1 of the basin-wide QAPP.

D2 Verification and Validation Methods

As described in Section D2 of the basin-wide QAPP.

D3 Reconciliation with User Requirements

As described in Section B10 of the basin-wide QAPP.

Attachment A – Field Data Sheet & Chain of Custody Forms

E. COLI IN SEDIMENT STUDY

PEM CRP

Water Tag No: _____ **Date:** _____

Station: Time:

Sample(s) Collected By:_____

Secchi Depth (m): Appears_____ Disappears_____ Avg _____ Chlor(ug/L):_____ BGA (ug/L)_____

Air Temperature(^{0}C):_____ Days Since Last Rain:_____ Flow(cfs):_____

Flow:_____ Flow Measurement Method:_____ Flow Severity:_____

Contact Recreation Parameters

Evidence of Primary Contact Rec (0=Not Observed, 1=Observed):_____ # of People Observed:_____

Drought Parameters (depth of water body, max pool width & depth, pool length, % pool coverage):_____

If site is wadeable, depth of water column (m): _____

<0.5 m: collect at 1/3 depth from surface
>0.5 m & <1.5 m: collect at 0.3 meters from surface
>1.5 m: profiles if possible otherwise at 0.3 meters from surface
>1.5 m to <3 m: 0.3 m from surface, mid-depth, 0.3 m from bottom

Sample Depth	Water Temp (^{o}C)	Sp Cond (uS/cm)	pH (SU)	DO (mg/L)
Calibration Acceptable				

Observations (weather, obvious signs of eutrophication, etc.): turbidity= NTU

Analyses to be Conducted	quantity	volume	Matrix	preservative	filtered	Parameters
By TRA				**TRA**		
E. coli	2	100 mL Na Thio	water	ICE	NO	E. coli
By Ana-Lab				**Ana-Lab**		
Particle Size & % Solids	2	1000 mL glass	Sediment	ICE	NO	Particle Size & % Solids
Sediment TOC	1	8 oz glass	Sediment	ICE	NO	Sediment TOC
E. coli in sediment	1	8 oz glass	Sediment	ICE	NO	E. coli in sediment

Sediment Tag No: _____ **Composite Type: B (Both time and space)**

Start Time:_____ **End Time:**_____

Information for sediment comments

Depth of water column at sample sites:_____

Depth of dredge/scoop penetration:_____

Method of collection (dredge, scoop):_____

Number of dredge grabs or scoops:_____

Thickness of top aerobic layer:_____

Sediment color:_____

Texture:_____

Relinquished By:_____ Relinquished By:_____

Date/Time:_____ Date/Time:_____

Received By:_____ Received By:_____

Date/Time:_____ Date/Time:_____

Copy before delivering original to lab; sheet must be signed prior to submittal of samples.

Customer: Environmental Planning and Management
Attention: Angela Kilpatrick
Trinity River Authority Clean Rivers Program
5300 South Collins, Arlington, TX 76018

Ana-Lab Corp. P.O. Box 9000 Kilgore, TX 75663
Phone 903/984-0551 FAX 903/984-5914 e-Mail corp@ana-lab.com LELAP-accredited #02008

Chain of Custody

11/17/2017 Page 1 of 2

Report To

Trinity River Authority of Texas
Angela Kilpatrick
PO Box 60
Arlington, TX 76004

TRAK-4

102

Phone
Fax

Sediment Particle Size and E C

Accredited	Test	Name	Method

Matrix: Non-Potable Water

Sampler Printed Name	*Sampler Affiliation*	*Sampler Signature*

	1	**Na2S2O3 (0.008%) Polystyrene-100 mL Sterilized**			
N	**Short Hold**	**SMPN**	MPN, E.coli, Colilert-18 - Soil	SM 9223 B-MOD (1.29 days)	
	1	**Unpreserved**			
	Subcontract	**MSnd**	Medium Sand (0.45-2 mm)		
	Subcontract	**clay**	Clay (< 0.005 mm)	CAS:GCO	
	Subcontract	**CSnd**	Coarse Sand (2-4.75 mm)	CAS:GCO	
	Subcontract	**FSnd**	Fine Sand (0.075-0.425 mm)	CAS:GCO	
	4	**Polyethylene 1/2 gal (White)**			
	Subcontract	**grav**	Gravel (4.75 mm-3 in	CAS:GCO	
	1	**Z -- No bottle required**			
		ARDW	As Received to Dry Weight Basis		
	1	**Glass Qt**			
		TOCS	Organic Carbon	(28.0 days)	
	1	**Polyethylene Quart (White)**			
N		**TS%**	Total Solids for Dry Wt	SM2540 G-1997 /MOD	

Ana-Lab #	Sample ID	Bottles	Date	Time	Notes

Corporate Shipping: 2600 Dudley Rd. Kilgore, TX 75662
North Texas Region: 11105 Shady Trl Ste. 123 Dallas TX 75229-7633

NELAP-accredited #T104704201

Ana-Lab Corp. P.O. Box 9000 Kilgore, TX 75663
Phone 903/984-0551 FAX 903/984-5914 e-Mail corp@ana-lab.com LELAP-accredited #02008

Chain of Custody

Report To

Trinity River Authority of Texas
Angela Kilpatrick
PO Box 60
Arlington, TX 76004

TRAK-4

102

Phone
Fax

Sediment Particle Size and E C

Ambient Conditions/Comments

Date	Time	Relinquished		Received	
		Printed Name	*Affiliation*	*Printed Name*	*Affiliation*
		Signature		*Signature*	
		Printed Name	*Affiliation*	*Printed Name*	*Affiliation*
		Signature		*Signature*	
		Printed Name	*Affiliation*	*Printed Name*	*Affiliation*
		Signature		*Signature*	
		Printed Name	*Affiliation*	*Printed Name*	*Affiliation*
		Signature		*Signature*	

Sample Recieved on Ice? ☐ *Yes* ☐ *No* **Method of Shipment:** ☐ *UPS* ☐ *Bus* ☐ *FedEx* ☐ *Lone Star* ☐ *Hand Delivered* ☐ *Other*

Cooler/Sample Secure? ☐ *Yes* ☐ *No* **Tracking/Shipping Label Attached**

The accredited column designates accreditation by A - A2LA, N - NELAC, or z - not listed under scope of accreditation. Unless otherwise specified, ANA-LAB shall provide these ordered services pursuant to our Standard Terms & Conditions Agreement (available for download from the welcome page at <http://www.ana-lab.com>). Ana-Lab personnel collect samples as specified by Ana-Lab SOP #000323.

Comments

Corporate Shipping: 2600 Dudley Rd. Kilgore, TX 75662 North Texas Region: 11105 Shady Trl Ste. 123 Dallas TX 75229-7633

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