

Rio Fernando de Taos Watershed Based Planning Project
Contract No. 16-667-3000-0018
RFP# 40-667-14-22759
Prepared By Amigos Bravos
October 2018
Renewal: 1


Rio Fernando de Taos Watershed Based Planning Project

PROJECT QUALITY ASSURANCE PROJECT PLAN

October 30, 2018

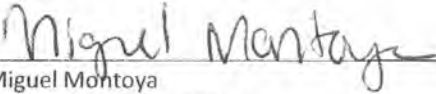
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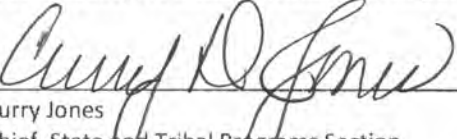
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Quality Assurance Project Plan for the Rio Fernando de Taos Watershed Based Planning Project
Contract No. 16-667-3000-0018
RFP# 40-667-14-22759
Prepared By Amigos Bravos
August 2016

**Quality Assurance Project Plan
for
Monitoring of E. coli in the Rio Fernando de Taos**

Prepared by:

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**Prepared for:
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November 4, 2016

Table of Contents

1.0 Project management.....	3
1.1 Distribution List	3
1.2 Project Organization	3
1.2.1 Key Persons and Coordination Roles and Responsibilities	4
1.2.2 Volunteer Sample Collector Contact Information	4
1.2.3 Sample Transport Contact Information	4
1.2.4 Sample analysis Contact Information	5
1.2.5 Data Reporting Contact Information	5
1.3 Problem definition/background	5
1.4 Project task description/schedule.....	6
1.5 Special training requirements	7
1.6 Documents and records.....	7
2.0 Data Generation and Acquisition.....	9
2.1 Sampling design (experimental)	9
2.2 Sampling methods.....	9
2.2.1 Field Sample Collection Procedures	10
2.2.2 IDEXX Laboratory Analysis Procedures.....	10
2.2.3 Site Locations.....	11
2.3 Sample handling and custody	13
2.4 Quality control requirements	13
3.0 DATA REVIEW AND USABILITY	14
4.0 Appendices.....	15
Appendix A: Filed Sampling Plan-Rio Fernando de Taos	
Appendix A-1: Field Sampling and Chain of Custody Form	
Appendix B: Flow Measurement Form	
Appendix C: Bacteria Record Sheet	
Appendix D: Bacteria Database Upload Form	
Appendix E: Data Verification and Validation Worksheet	
5.0 New Mexico Environment Department Surface Water Quality Bureau Standard Operating Procedures	
SOP 4.1 Probable Source Determination.....	
SOP 9.1 Bacteriological Sampling and Analysis.....	

1.0 PROJECT MANAGEMENT

This Quality Assurance (QA) Project Plan has been prepared for the Watershed Based Planning Process by Amigos Bravos for the Rio Fernando de Taos located in Taos, New Mexico. The Watershed Based Planning Process is funded by Section 319 of the Clean Water Act. This section of the QA Project Plan describes how the project will be managed, organized and implemented.

1.1 Distribution List:

The following is a list of organizations and persons who will receive copies of the approved QA Project Plan and any subsequent revisions:

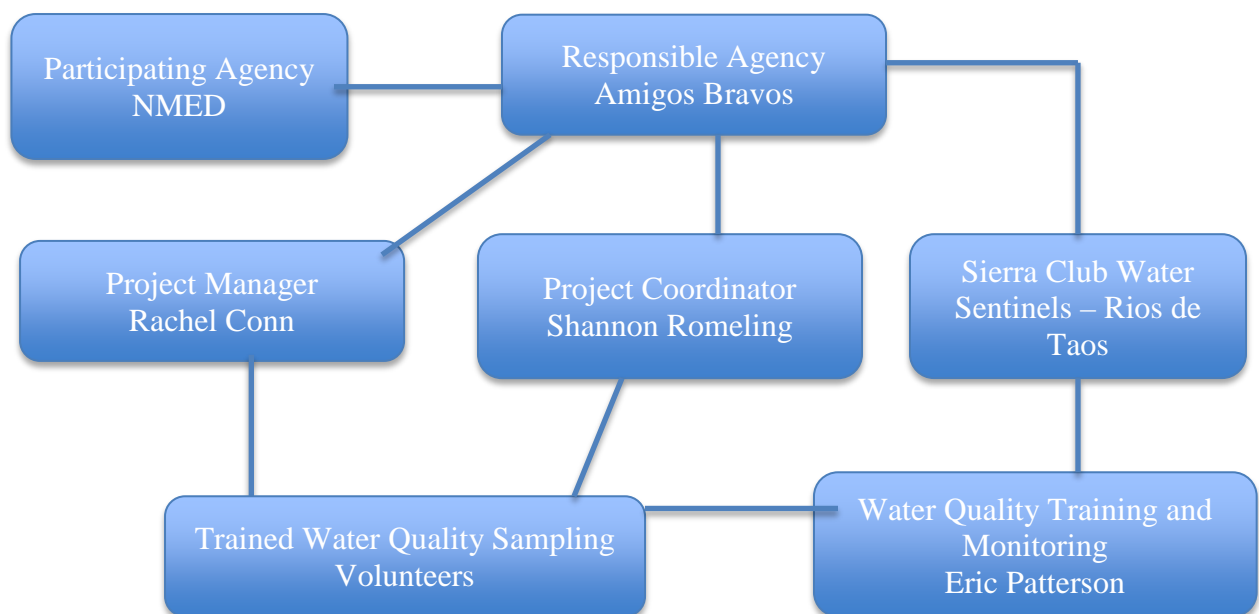
1. Section 6 EPA
2. Abraham Franklin-Project Officer at NMED SWQB
3. Miguel Montoya-Quality Assurance Officer NMED SWQB
4. Amigos Bravos-Rachel Conn and Shannon Romeling
5. Water Sentinels- Sierra Club, Eric Patterson

1.2 Project organization

The responsible agency for this Watershed Based Plan (“WBP”) is Amigos Bravos. The participating agency is the New Mexico Environment Department. The Sierra Club Water Sentinels – Rios de Taos is a volunteer group that has been monitoring water quality in Taos County for 8 years. They will partner on collection and formation of the Watershed Based Plan. The US Forest Service will also be a close partner for this work, as the majority of the Rio Fernando flows through Carson Forest land.

The roles and responsibilities of those involved in the water quality sampling portion of the Watershed Based Plan are described below. An organizational chart for the project is shown as Figure 1-1.

Figure 1-1. Organizational Chart



1.2.1 Key Persons and Coordination Roles and Responsibilities

Project Manager: **Rachel Conn** of Amigos Bravos will serve as Project Manager. Ms. Conn holds a bachelor's degree in Environmental Biology from Colorado College and has 17 years of experience in the environmental field. She has been the project manager for three other 319 grants in Northern New Mexico. As Projects Director for Amigos Bravos, Ms. Conn leads Amigos Bravos' efforts to build a river protection movement for the future, restore watershed health and hold polluters accountable. Contact information: Rachel Conn. P.O. Box 238, Taos NM 87571, rconn@amigosbravos.org / 575-758-3874

Project Coordinator: **Shannon Romeling** of Amigos Bravos will use her skills as a Biologist to coordinate this project. Shannon will conduct stakeholder outreach, water quality monitoring, and ensure that the workplan is executed as planned. Shannon is a full time employee of Amigos Bravos and is responsible for researching, writing, submitting, and tracking proposals and reports regarding grants from foundations, government agencies, and other contractual funders. She is also responsible for any project related work delegated to her by the ED or Projects Director and for guiding and assisting the Membership Coordinator when needed. Contact information: Shannon Romeling. P.O. Box 238 Taos NM 87571 sromeling@amigosbravos.org / 575-758-3874

Amigos Bravos: A non-profit water conservation organization dedicated to protecting the ecological and cultural richness of the Río Grande and other wild rivers in New Mexico, will serve as the project's fiscal sponsor.

Water Sentinels-Rios de Taos: A volunteer group that has been monitoring water quality in Taos County (Rio Hondo, Rio Fernando, Red River and Rio Pueblo de Taos) for the past 7 years will lead up the coordination of the volunteer monitoring component of the project. Contact information: Eric E. Patterson, P.O. Box 334 Valdez, NM 87580. 575-776-2833; eepatt@gmail.com.

1.2.2 Volunteer Sample Collector Contact Information:

Shannon Romeling will collect and hold all volunteer collector contact information. Contact Shannon as shown above.

Sample collectors will conduct sample collection activities according to the methods identified by this QAPP. Responsibilities include:

- Calibration, maintenance and utilization of field equipment for analysis of dissolved oxygen (DO), temperature, pH, and conductivity.
- Obtaining needed sample containers and preservatives for sampling events.
- Following quality assurance procedures for sample collection identified by this QAPP.
- Filling out chain of custody (COC) forms.

1.2.3 Sample Transport Contact Information

Shannon Romeling, Rachel Conn and Eric Patterson (see above).

Shannon, Rachel and Eric will ensure that water samples are delivered to the Amigos Bravos office in a secure and timely manner. Trained volunteers will also transport samples to the Amigos Bravos office when necessary.

Responsibilities include:

- Keeping samples secure between sampling site and the office.
- Maintaining COC document according to procedures identified.
- Delivering samples within specified holding times.

1.2.4 Sample Analysis Contact Information:

Amigos Bravos Office
105A Quesnel St.
Taos, NM 87571

Shannon Romeling and Eric Patterson will ensure that samples are analyzed in a manner that provides the most accurate data possible.

Responsibilities include:

- Analyzing samples according to EPA protocols.
- Analyzing samples within established holding times.
- Analyzing samples with appropriate calibration standards and blanks.
- Reporting Quality Assurance-validated results to Project Coordinator.

1.2.5 Data Reporting Contact Information

Shannon Romeling, Amigos Bravos Projects and Foundation Coordinator
P.O. Box 238
Taos, NM 87571
575-758-3874
sromeling@amigosbravos.org

Data reporting will ensure the data collected by the project is stored appropriately and disseminated to interested parties.

Responsibilities include:

- Organization of final report on data collected by the project.
- Dissemination of report to specified local, state and federal agencies.
- Dissemination of report to newspapers and other local news media and presentation of project information to the public upon request.
- Entering data into Amigos Bravos' water quality database.

1.3 Problem definition/background

In 2006, the Upper Rio Grande Watershed Restoration Action Strategy and Non Point Source Abatement Plan was developed collaboratively under a 319 Grant administered by The Meridian Institute. That WRAS included separate sub-plans for the Rio Fernando and the Rio Hondo. The Rio Don Fernando de Taos NM WRAS Water Restoration Action Strategy & Non Point Source Abatement Plan document can be found at:

<http://www.nmenv.state.nm.us/swqb/wps/WRAS/UpperRioGrandeWRAS.pdf>.

The Rio Fernando WRAS identified grazing, recreational activities, removal of riparian vegetation, stream bank modification/destabilization, runoff from roads and/or parking lots, pollution from municipal point sources, as well as natural leaching as having affected water quality in the Rio Fernando. This combination of sources has resulted in increases in the levels of nutrients, conductivity, pH, temperature, and stream bottom deposits that exceed established water quality standards.

Amigos Bravos and the Water Sentinels-Rios de Taos have been conducting water quality monitoring in the Taos watershed (Rio Hondo, Rio Pueblo de Taos, and the Rio Fernando) for a number of years. The 2011 Taos Water Quality Sampling Report – Rio Hondo, Rio Fernando de Taos, and Rio Pueblo de Taos can be found at:

<http://amigosbravos.org/on-the-ground-restoration>. This monitoring documented the *E. coli* impairment in the Rio Fernando de Taos, which the New Mexico Environment Department accepted and included in its 2012-14 303d list of impaired waters. The list includes the three segments of the Rio Fernando de Taos for the following:

- Tienditas Creek to the Headwaters (in the RFP, AU_ID NM-98.A_001): *E. coli* (with sources from grazing and “unknown”)
- USFS boundary to Tienditas Creek (NM-2120.A_513): *E. coli* (with source from “unknown”)
- Confluence with the Rio Pueblo de Taos to USFS boundary (NM-2120.A_512): *E. coli*, Nutrient/Eutrophication Biological Indicators, Sedimentation/Siltation, Specific Conductance, and Temperature (with a wide variety of typically “urban” sources: highway/ road/bridge runoff, irrigated crop production, natural sources, other recreational sources, rangeland grazing, source unknown, and stream bank modification/destabilization)

TMDLs were established in 2012 for the *E. coli* impairments identified. The sedimentation/siltation and nutrient impairments on the middle segment (USFS boundary to Tienditas Creek) do not yet have established TMDLs. This creates somewhat of a disconnect in dealing with water quality on the Rio Fernando, since the segments above and below this segment have established TMDLs for all of their recognized impairments.

1.4 Project task description/schedule

We envision the WBP work to take a three-pronged approach. The first will be to conduct water quality monitoring – continuing previous work by Water Sentinels and Amigos Bravos – to better characterize the *E. coli* impairment in the Rio Fernando. The second prong will be the stakeholder and public outreach component, building on lessons learned from the WBP process we used for the Rio Pueblo de Taos. There is great similarity in demographic and water quality issues between the lowest segment of the Rio Fernando and the upper segment of the Rio Pueblo de Taos. We anticipate the same, sometimes contentious, dynamic on the lower Rio Fernando that arose at times during the WBP process on the Rio Pueblo de Taos, and will approach this public outreach component appropriately. The third prong will be working with watershed stakeholders to draft the

plan. This will be done by expanding upon the current WRAS to incorporate all nine EPA comprehensive watershed based plan elements.

Total samples taken will depend on landowner permission and number of positive findings of *E. coli*. All samples will be collected as grab samples from the banks and all sampling locations will be recorded using global positioning system (GPS) equipment. Samples will be sent to the Amigos Bravos office for analysis using the IDEXX Laboratories, Inc. Colilert method.

The details of the sampling schedule are available in the Field Sampling Plan (Appendix A). The Field Sampling Plan was developed according the SWQB SOP 2.1 “Field Sampling Plan Development and Execution”.

Sampling Schedule:

Sampling will be conducted along the entire stretch of the Rio Fernando, with a focus on probable source locations. Landowner permission will be required for some sites, and obtained as needed.

- Summer/Fall 2016 – Begin *E. coli* sampling by Amigos Bravos, Water Sentinels, and trained volunteers. 2-12 sites per month.
- Winter 2016-Winter 2017 – Continue sampling by Amigos Bravos Water Sentinels, and trained volunteers. 2-12 sites per month.
- Spring 2018- *E. coli* sampling by Amigos Bravos Water Sentinels, and trained volunteers.
- Spring 2019 through Fall 2019- *E. coli* sampling as needed by Amigos Bravos Water Sentinels, and trained volunteers.

1.5 Special training requirements

No special certification is required to implement this QAPP, however, proper training of field personnel is a critical aspect of Quality Control. All Amigos Bravos staff, Water Sentinels staff, and volunteers with the responsibility of collecting water quality data will have sufficient training and experience.

Additionally, all newly trained volunteers will undergo a period of apprenticeship where they will be accompanied by experienced staff when collecting samples or field measurements until the Project Coordinator determines that the staff person is appropriately trained and qualified to collect quality data.

All Amigos Bravos and Water Sentinels staff who are responsible for collecting and/or managing data/information and producing planning or reporting documents are required to be familiar with this QAPP and the most current associated NMED Surface Water Quality Bureau Standard Operating Procedures for Data Collection [SOPs].

1.6 Documents and records

This QAPP and referenced procedures includes methods related to the collection, processing, analysis, and reporting and tracking of environmental data. This QAPP is

updated annually and made available to SWQB staff and contractors responsible for collecting, processing, and analyzing data. Data generated from projects covered by this QAPP must be of sufficient quality to withstand challenges to their validity, accuracy, and legibility.

The documentation of all environmental data collection activities must meet the following minimum requirements: Data and associated information must be documented directly, promptly, and legibly. All original data records include, as appropriate, a description of the data collected, units of measurement, unique sample identification, location identification, name (signature or initials) of the person collecting the data, and date of collection. Any changes to the original (raw data) entry must not obscure the original entry. The reason for the change must be documented, the change must be initialed and dated by the person making the change and approved by the Program Manager.

Field records will be documented on designated forms to provide a secure record of field activities, observations and measurements during sampling. Lab data and observations will be recorded in real time on a lab specific data form. Entries are never erased and mistakes are lined out and initialed by the data recorder. Completion of appropriate field and lab documentation and forms for each sample is the responsibility of the Project Coordinator or designee.

Water quality survey project files are maintained by the Project Coordinator; however, the file is used by numerous staff within the section for various purposes. To ensure consistency and accessibility to all users, water quality survey project files are maintained in three ring binders as follows:

Label each binder on spine and front cover with the following information:

- Survey Title Survey Year(s)
- Project Coordinator [Binder X of X]
- Hydrologic Unit Code/Watershed

Create tab dividers with labels for the sections listed below and place all associated documents and records in the applicable section of the binder in the same order as listed below:

- Introductory Information
 - Map(s) of survey area
 - Field Sampling Plan
- Background Information
 - Site access information
 - Supplemental information pertinent to the survey (land-use, land activities, ect.)
- Field Data – Physical and Biological info

- Water Sampling Field Forms (See Appendix A-1 Field Sampling Form)
- Flow field forms and flow calculation worksheets (See the Flow Sampling Form in Appendix B)
- IDEXX Lab Data
 - Analytical IDEXX Laboratory submittal forms
 - Chain of custody forms
- Data Verification/Validation
 - Data Verification and Validation Worksheet (Appendix D) and associated attachments
- Sources/Causes
 - Probable Source Field Forms (NMED SWQB SOP 4.1)

Quarterly Reports will be submitted throughout the grant period.

2.0 Data Generation and Acquisition

2.1 Sampling design (experimental)

We will determine ways to address the *E. coli* impairment conducting extensive *E. coli* monitoring to pin point sources. We will sample for *E. coli* and measure stream flow at 10-15 sites each month for two years. This intensive sampling will show us seasonal patterns in *E. coli* levels and relate these levels with changes in loading at each site. When necessary and possible, we will consider iterative-targeted sampling, in which a sample event is followed about two days later by another sampling event with more samples in the vicinity of apparent hot spots. This will increase our ability to quickly identify hotspots in addition to monitoring long-term patterns.

If observation leads us to suspect specific septic tanks as contributors of *E. coli* in certain locations, we will use a septic dye test (a tracer) to look for potential leaks, following owner consent. We will also conduct animal source modeling to estimate pollution sources. Animal source modeling will be conducted using a Bacteria Source Load Calculator, or using geospatial modeling in ArcGIS. Consultants will be contracted to help with the modeling and create watershed maps.

2.2 Sampling methods

Samples will be collected using the containers, preservatives, volumes and holding times identified in Table 2-1.

E. coli levels will be determined using the SWQB IDEXX method (Standard Methods, Part 9000 -APHA 2005)

Parameter	Optimum Volume	Container Type	Preservation Method	Holding Time
E. coli and Fecal Coliform	150 mL	Sterile Bottle	Cold (on ice)	8 Hours
Dissolved Oxygen	Determined On-Site			None
Temperature	Determined On-Site			None
Conductivity	Determined On-Site			None
pH	Determined On-Site			None
Stream Flow	Determined On-Site			None

Table 2-1: Parameter information

2.2.1 Field Sample Collection Procedures

Samples will be collected:

- Midstream just below the water's surface.
- Facing upstream to avoid disturbances caused by the sample collector.
- Upstream of minor temporal or spatial impacts, such as bridges and campsites.
- When sampling downstream of certain impacts (sources) care will be taken, using best professional judgment, to sample well-mixed waters.
- Free of floating debris.
- Using appropriate sample containers and preservatives.

Field Equipment:

Temperature, pH, conductivity – Euteck Instruments PCTestr 35 from Oakton

Dissolved Oxygen – CHEMets Dissolved Oxygen Kit, Model K-7512

At a minimum, equipment should be wiped down with sanitizing wipes after use to minimize *E. coli* exposure.

2.2.2 IDEXX Laboratory Analysis Procedures

Field sampling procedures will follow the SWQB Standard Operation Procedure 9.1 for Bacteriological Sampling and Analysis. This SOP is available after Appendices.

Quality assurance of laboratory methods is the sole responsibility of the sample analysis contact previously identified – Shannon Romeling and Eric Patterson.

Samples will be collected:

- Midstream just below the water's surface.
- Facing upstream to avoid disturbances caused by the sample collector.
- Upstream of minor temporal or spatial impacts, such as bridges and campsites.
- When sampling downstream of certain impacts (sources) care will be taken, using best professional judgment, to sample well-mixed waters.
- Free of floating debris.

- Using IDEXX sample containers and preservatives.

Samples will be tagged appropriately with identifying number/information and delivered to appropriate laboratory personnel accompanied by appropriately completed and signed Chain of Custody (COC) forms (Attached as Appendix A-1).

Amigos Bravos uses the IDEXX Laboratories, Inc. Colilert® procedures for enumeration of total coliform and *E. coli* by the most probable number (MPN) method. The procedure is explained in Standard Methods, Part 9000 (APHA 2005). Background on the MPN method can be found in Oblinger and J. A Koburger (1975).

IDEXX Colilert Lab Equipment:

- IDEXX 110V Incubator
- Fluorescent UV lamp, 6-watt, 365 nm
- IDEXX Quanti-Tray sealer
- IDEXX Quanti-Tray/2000 rubber insert
- Appropriate Personal Protective Equipment, “PPE” (i.e., UV protective eyewear, Nitrile gloves)

Because *E. coli* can be an indicator of pathogens harmful to humans, precautions should be taken when sampling potentially contaminated water. Avoid accidental ingestion, contact with mucous membranes, eyes and skin to the extent possible, especially areas with cuts and abrasions. Wear splash protection and eye protection (i.e., goggles, gloves, and aprons) while working with bacteriological samples. Wash hands with soap and water or disinfecting hand cleaner as soon as possible after collecting samples and working with equipment. Equipment exposed to potentially contaminated water should be cleaned using a dilute (1 :10) bleach solution and rinsed in clean water if possible. In the field, at a minimum, equipment should be thoroughly rinsed in clean water (e.g. the stream receiving the effluent above the point of discharge) immediately after use.

2.2.3 Site Locations

Site locations will be added or adjusted in the Field Sampling Plan (Table 5.) as landowner permission is granted and additional sample sites are added. Field Sampling Plan is attached as Appendix A.

2.3 Sample handling and custody

All trained volunteers will sign chain of custody forms before handing off samples to be analyzed for *E. coli*. See Appendix A-1 for the Field sampling and Chain of Custody form.

2.4 Quality control requirements

Measurements will be made using the following equipment:

- CHEMets Dissolved Oxygen Kit, Model K-7512 – measures dissolved oxygen
- Euteck Instruments PCTestr 35 from Oakton – measures pH, temperature, and electrical conductivity
- IDEXX Colilert System
 - IDEXX 110V Incubator
 - Fluorescent UV lamp, 6-watt, 365 nm
 - IDEXX Quanti-Tray sealer
 - IDEXX Quanti-Tray/2000 rubber insert
 - PPE

PARAMETER	DETECTION LIMIT	ACCURACY
Dissolved Oxygen	1 to 12 mg/L	+/- 1 ppm
Temperature	0° to 50° C	+/- 0.5° C
Conductivity	0 to 1999 µS/cm	+/-10 µS/cm
pH	0.00 to 14.00 ph units	+/- .001 pH units
<i>E. coli</i>	NA	

NA=Not Applicable

Table 2-3: Measured parameters and their detection limits

Field instruments will be calibrated according to manufacturers' instructions <24 hours prior to each sampling event. Chemicals used for dissolved oxygen will be replaced according to expiration dates provided by the manufacturer.

New field volunteers will learn sampling techniques through training and apprenticeship with experienced Amigos Bravos or Water Sentinels staff. All personnel who collect environmental data must be familiar with this QAPP and collect data in accordance with the procedures as they are defined in the SOPs.

Deviations from the methods detailed here or in the Rio Fernando de Taos work plan will be proposed, with a statement of reason(s) to the

An additional check on the quality of field activities includes periodic Quality Assurance Audits. Quality Assurance Audits will be performed periodically as resources allow. Field crews to be audited will be randomly selected and the audits will be performed by the QA Officer or designee.

3.0 DATA REVIEW AND USABILITY

Data verification involves examining the data for errors, omissions, and compliance with quality control (QC) acceptance criteria. Once measurement results have been recorded, they are verified to ensure that:

- Data are consistent, correct, and complete, with no errors or omissions.
- Data specified in Sampling Process Design were obtained.
- Methods and protocols specified in the QA Project Plan were followed.
- Results for QC samples accompany the sample results.
- Established criteria for QC results were met.
- Data verification should be performed as close in time as possible to when the sample data was either retrieved from the field. The purpose of rapid data verification/validation is to provide the project coordinator with the most options for re-deployment/additional field collections if problematic data is encountered.

The project coordinator Shannon Romeling is responsible for verifying that field data entries are complete and correct (e.g., decimal point missing from an entry or something doesn't look right, based on experience). The project coordinator will also examine lab results for errors, omissions, and compliance with QC acceptance criteria, as soon as possible, as outlined above.

Results that do not meet quality assurance requirements will be labeled with appropriate qualifiers, and an explanation will be provided and attached to the data package.

Data usability determination will follow verification. This determination is parameter specific and involves a detailed examination of the data package. Professional judgment will be used to determine whether data quality objectives have been met.

4.0 APPENDICES

Appendix A: Filed Sampling Plan-Rio Fernando de Taos

Appendix A-1: Field Sampling and Chain of Custody Form

Appendix B: Flow Measurement Form

Appendix C: Bacteria Record Sheet

Appendix D: Bacteria Database Upload Form

Appendix E: Data Verification and Validation Worksheet

5.0 New Mexico Environment Department Surface Water Quality Standard Operating Procedures [SOPs]

SOP 4.1 Probable Source Determination

SOP 9.1 Bacteriological Sampling and Analysis

FIELD SAMPLING PLAN

Completed November 04, 2016

Revision 1 October 30, 2018

Prepared by

Amigos Bravos

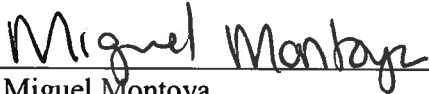
APPROVAL PAGE



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10/31/2018

Date



Miguel Montoya
Quality Assurance Officer, SWQB

10/31/18

Date

TABLE OF CONTENTS

APPROVAL PAGE	i
TABLE OF CONTENTS	ii
ACRONYMS	iii
INTRODUCTION	4
1.0 PROJECT PERSONNEL.....	5
1.1 PERSONNEL ROLES AND RESPONSIBILITIES	5
1.2 ORGANIZATION	5
2.0 PROJECT DESCRIPTION.....	5
2.1 BACKGROUND	5
2.2 OBJECTIVES	7
2.3 SCHEDULE.....	7
2.4 LOCATION	16
3.0 DOCUMENTATION	20
4.0 SAMPLING PLAN	21
4.1 CHEMISTRY SAMPLING	21
4.2 BIOLOGY/HABITAT SAMPLING.....	24
5.0 RESOURCE REQUIREMENTS.....	25
6.0 REFERENCES	26
7.0 APPENDICES.....	27

ACRONYMS

AU	Assessment Unit
CWA	Clean Water Act
DO	Dissolved Oxygen
IR	State of New Mexico Clean Water Act §303(d)/305(b) Integrated Report
NMED	New Mexico Environment Department
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
SOP	Standard Operating Procedures
SWQB	Surface Water Quality Bureau
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
WQ	Water Quality
WQCC	Water Quality Control Commission
WQS	Water Quality Standard

INTRODUCTION

The purpose of this field sampling plan is to provide a detailed description of the procedures to carry out the Watershed Based Plan Water Quality Survey to be conducted in the Rio Fernando de Taos watershed from 2016-2019 under the Agency: New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB). The Contractor, Amigos Bravos has prepared this sampling plan in accordance with the Agency's Standard Operating Procedure 2.1 for Field Sampling Plans. It describes project objectives and decision criteria, and includes the sampling plan with sampling locations, parameters and sampling frequencies for physical, chemical and biological data. It may be amended as the need arises. Amendments will be documented and justified in the survey report.

This plan is a companion document to the Surface Water Quality Bureau Quality Assurance Project Plan (QAPP) for Water Quality Management Programs (NMED/SWQB 2016a). Data will be collected according to the QAPP and the most recent version of the Standard Operating Procedures (SOPs) for Water Quality Data Collection (NMED/SWQB 2016b,c).

1.0 PROJECT PERSONNEL

1.1 Personnel Roles and Responsibilities

Table 1 details the responsibilities for this project. Each team member is responsible for implementing the assigned responsibilities. If an individual is unable to fulfill their duties it is that individual's responsibility to find assistance and/or a replacement, in coordination with appropriate supervisors.

Table 1
Personnel Roles and Responsibilities

Team Member	Position/Role	Responsibilities
<u>Rachel Conn</u>	Project Manager	Coordinates survey planning efforts (integrates the documentation of various team members' information into the field sampling plan and planning spreadsheet).
<u>Shannon Romeling</u>	Project Coordinator	Coordinates and participates in the collection of chemical, biological, and habitat data.
<u>Eric Patterson</u>	Water Quality Trainer and Monitoring Lead	Manages chemical, biological, and habitat data for study (forms, data entry and analysis). Provides chemical, biological, and habitat results for final report and writes appropriate portions of the survey report. Coordinates development of final survey report (integrates information from all team members into final survey report).

1.2 Organization

For the responsibilities defined in this project, the Project Coordinator(s) report to the Monitoring and Assessment Section Program Manager (PM).

2.0 PROJECT DESCRIPTION

2.1 Background

Table 2 shows stream assessment units within the study area and where the designated uses are not being attained based on data collected during the previous survey (NMED/SWQB 2016d). IR Category refers to the New Mexico's Integrated Report categories.

Table 2

Use Attainment Status

Assessment Unit	Water Quality Segment	Impairments	IR Category	Completed TMDLs
NM-98.A_001	Tienditas Creek to the Headwaters	<i>E. coli</i> (with sources from grazing and “unknown”)	4A	Yes – <i>E. coli</i>
NM-2120.A_513	USFS boundary to Tienditas Creek	<i>E. coli</i> (with source from “unknown”)	4A	Yes – <i>E. coli</i> , No – Nutrients. No – Sediment/siltation
NM-2120.A_512	Confluence with the RPdT to USFS boundary	<i>E. coli</i> , Nutrient/Eutrophication Biological Indicators, Sedimentation/Siltation, Specific Conductance, and Temperature (with a wide variety of typically “urban” sources: highway/road/bridge runoff, irrigated crop production, natural sources, other recreational sources, rangeland grazing, source unknown, and stream bank modification/destabilization)	5/5A	Yes – <i>E. coli</i>

TMDLs were established in 2012 for the *E. coli* impairments identified since 2005. The sedimentation/siltation and nutrient impairments on the middle segment (USFS boundary to Tienditas Creek) do not yet have established TMDLs. This creates somewhat of a disconnect in dealing with water quality on the Rio Fernando, since the segments above and below this segment have established TMDLs for all of their recognized impairments.

On the upper segment of the Rio Fernando (Tienditas Creek to headwaters), the NMED has identified grazing as a source of impairment. According to the 2012-14 303d list (p145):

The SWQB Watershed Protection Section completed a special study of *E. coli* levels with associated flow observations in the upper 3 miles of Rio Fernando de Taos and the Apache Canyon tributary to assess potential impacts from livestock grazing in 2006. The study demonstrated instances when grazing on the Flechado Allotment probably increased *E. coli* levels in Apache Canyon and this portion of Rio Fernando de Taos in 2006. The USFS Carson National Forest in cooperation with SWQB collected *E. coli* data in 2007 (combined with 2006 data and assessed for 2008 cycle).

As noted above, further sampling work by Amigos Bravos and Water Sentinels has confirmed the *E. coli* presence and this has led to the impairment listing. Grazing is also implicated in the *E.*

coli listing for the lowest segment of the Rio Fernando – the “urban” segment. All three segments have “unknown” sources of *E. coli* as well. It is quite plausible that septic systems could be among the primary “unknown” sources of *E. coli* impairment in addition to the probable grazing source.

2.2 Objectives

**Table 3
Project Objectives**

	Collect Water Quality Data to:	Question to be answered	Products/ Outcomes	Decision Criteria
Primary Objective	Identification of causes and sources of pollution that need to be controlled and complete all 9 elements of a Watershed Based Plan	What sources are causing the current <i>E. coli</i> Impairment on the Rio Fernando	Watershed Based Plan (WBP) Document. Methods to eliminate the impairment	Impairments removed from the 303d list
Secondary Objectives	Estimates of load reductions that could be achieved with new management measures	What is the amount that a pollutant level will be decreased by with new management measures	WBP Document	Management measures reach the estimated load reductions when put into practice
	Descriptions of management measures to achieve goals	What needs to be done to decrease <i>E. coli</i> by a certain amount?	An On-the-Ground Restoration Plan	Securement of funds for On-the-Ground restoration
	A monitoring plan to measure progress	Are the management measures accomplishing the goals that were laid out?	Monitoring Plan	Consistently low levels of <i>E. coli</i> in the Rio Fernando into the future.

2.3 Schedule

As part of the watershed based planning process, public meetings are held to receive public input on any areas of concern within the assessment units surveyed and to inform interested parties about the general water quality survey, assessment and TMDL processes, as well as our specific sampling plans in the watershed this year. For this project, nine public meetings were held during

2016-2018. Amigos Bravos and Water Sentinels completed a water quality monitoring session each year where interested volunteers were trained

Table 4 provides the project timeline.

**Table 4
Project Schedule**

TASK	ESTIMATED DATE	HOW TASK WILL BE ACCOMPLISHED	DELIVERABLE	WHO
Year 1 Review of existing WRAS's to identify data gaps and needs	Winter 2016	Detailed examination of the document	Synopsis of the WRAS and data gaps and needs identified with in it	Project Manager
Employ a facilitator for meetings	Winter 2016	We will research potential meeting facilitators and choose an impartial 3rd party, contracted, facilitator.	A Meeting Facilitator hired on a contractual basis	Project Manager
Initial identification of and outreach to contact Stakeholders	Spring 2016	Contact previous participants in the WRAS development processes for the Río Fernando de Taos and other stakeholders by letter, email, and/or telephone, hold preliminary meetings and conversations initiated to solicit views and to build stakeholder buy-in and trust.	Letters and emails, meeting agendas	Project Coordinator, Water Sentinels, Forest Service, Volunteers

TASK	ESTIMATED DATE	HOW TASK WILL BE ACCOMPLISHED	DELIVERABLE	WHO
Obtain Mailing Addresses Of All Landowners Along The Rio Fernando De Taos And Send Mailing About Watershed Planning Efforts	Spring 2016	County records to obtain mailing addresses and completion of a letter to send	List of mailing addresses and completed letter about planning efforts	Project Coordinator and Amigos Bravos Volunteers, Forest Service, Watershed Stakeholders
Edit Current Sentinels – Rios De Taos /Amigos Bravos Quality Assurance Project Plan (QAPP)	Spring 2016	Identify additional sampling locations to be sampled during year one.	Updated QAPP	Project Coordinator, Water Sentinels, all Stakeholders who would like to comment on the plan - drafts will be circulated.
Radio Interviews To Get The Word Out About The Planning Process.	Spring 2016	Traveling to local radio stations and conduct interviews	Completed radio interviews - some may be available online	Project Manager and Project Coordinator
Watershed Meetings (3 per year)	April – December 2016	Planning for meeting time, location and discussion items, and outreach to increase attendance	Meeting agenda and notes	Amigos Bravos Staff, Watershed Stakeholders, members of the public, and Professional Meeting Facilitator

TASK	ESTIMATED DATE	HOW TASK WILL BE ACCOMPLISHED	DELIVERABLE	WHO
Conduct research, identify data gaps, contact stakeholders, solicit studies and information and review existing planning documents	Summer 2016	Reviewing existing studies and data to help identify sources and loads, contact stakeholders through email/mail/phone, reading documents	Responses from stakeholders, notes on research and data gaps	Watershed Stakeholders, Amigos Bravos Volunteers, Project Coordinator
Organize volunteers for 2015 monitoring season.	Spring 2016	Prepare list of potential volunteers, contact them and organize specific dates	Schedule of when monitoring will occur and by who	Water Sentinels, Amigos Bravos Staff
Plan monitoring activities for 2016	Spring 2016	Use previous work and knowledge to schedule and prepare for monitoring activities	Planning document	Amigos Bravos Staff, Water Sentinels, Watershed Stake-holders, Watershed Consultant
Conduct Water Quality Monitoring Training	Spring 2016	Volunteer water quality monitoring training conducted by Amigos Bravos	Trained water quality monitoring volunteers	Water Sentinels, Amigos Bravos Staff
Conduct monitoring of <i>E. coli</i> and flow throughout the Rio Fernando with goal of identifying geographic source areas.	May – December 2016	Volunteer monitoring by members of the community and Sentinels – Rios de Taos	Results from sampling – IDEXX Laboratory equipment will be used in-house	Water Sentinels, Amigos Bravos Staff, Watershed Stake-holders

TASK	ESTIMATED DATE	HOW TASK WILL BE ACCOMPLISHED	DELIVERABLE	WHO
Help organize annual watershed cleanup.	Summer 2016	Organization of and outreach to volunteers and other watershed partners	The completion of a watershed clean up day	Watershed Stake-holders, Amigos Bravos Staff, Volunteers
Analyze monitoring results from the field season and start to prioritize monitoring for following year.	Fall 2016	IDEXX Laboratory equipment will be used in house to conduct the analysis	Sampling Report	Amigos Bravos Staff, Water Sentinels
Year 2				
Develop monitoring plan for 2016 and organize volunteers.	Winter 2017	Use 2015 data to inform sampling locations and volunteer plans for 2016	A completed monitoring plan	Amigos Bravos Staff, Water Sentinels, GIS Consultants (mapping)
Conduct monitoring of <i>E. coli</i> and flow throughout the Rio Fernando with goal of identifying geographic source areas.	Throughout 2017	Volunteer monitoring by members of the community and Sentinels – Rios de Taos	Results from sampling – IDEXX Laboratory equipment will be used in-house	Amigos Bravos Staff, Water Sentinels, Consultants, Watershed Stakeholders

TASK	ESTIMATED DATE	HOW TASK WILL BE ACCOMPLISHED	DELIVERABLE	WHO
Watershed meetings (3 per year)	Throughout 2017	Planning for meeting time, location and discussion items, and outreach to increase attendance	Meeting agenda and notes	Amigos Bravos Staff, Watershed Stakeholders, members of the public, and Professional Facilitator
Identify and prioritize wetland/wetlands for restoration.	January – June 2017	Work with a consultant to identify and map 2-3 wetland restoration priorities	Map of wetland restoration area priorities	Amigos Bravos Staff, GIS consultant, watershed stakeholders
Conduct Water Quality Monitoring Training	Spring 2017	Volunteer water quality monitoring training conducted by Amigos Bravos	Trained water quality monitoring volunteers	Water Sentinels, Amigos Bravos Staff
Conduct watershed cleanup outreach day	Summer 2017	Organization of and outreach to volunteers and other watershed partners	The completion of a watershed clean up day	Watershed Stake-holders, Amigos Bravos Staff, Volunteers
Identification of specific management measures needed to achieve load reductions	Fall 2017	With help from 1-2 experts and key stakeholders broad management measures as well as specific restoration projects will be identified	List of specific management measures needed	Amigos Bravos Staff, Watershed Stake-holders, Restoration Consultant(s)
Year 3				

TASK	ESTIMATED DATE	HOW TASK WILL BE ACCOMPLISHED	DELIVERABLE	WHO
Conduct monitoring of <i>E. coli</i> and flow throughout the Rio Fernando with goal of identifying geographic source areas.	Spring 2018	Volunteer monitoring by members of the community and Sentinels – Rios de Taos	Results from sampling – IDEXX Laboratory equipment will be used in-house	Amigos Bravos Staff, Water Sentinels, Consultants, Watershed Stakeholders
Outline of plans for implementation of management measures and monitoring	Spring 2018	Using monitoring data, and assistance from experts on specific load reductions	List of specific management measures needed	Amigos Bravos Staff, Restoration Consultant(s)
Develop implementation schedule with milestones	Spring 2018	Project manager will work with local, state and federal agencies	A draft implementation schedule	Project Manager
Identify technical and financial assistance needed to implement plan	Spring 2018	Discussions with all stakeholders, including Carson National Forest, Forest Users, Town and County of Taos, and Taos Soil and Water Conservation District, USFWS, NM Game and Fish, and homeowners and businesses on the Rio Fernando	List of projects with potential funding sources	Project Coordinator, Amigos Bravos Staff, watershed stakeholders
Draft WBP that includes the nine elements and monitoring results for two years of data	January – June 2018	The plan will be drafted by utilizing monitoring results, stakeholder input and consultation with experts.	A draft WBP	Amigos Bravos Staff, Watershed Stakeholders

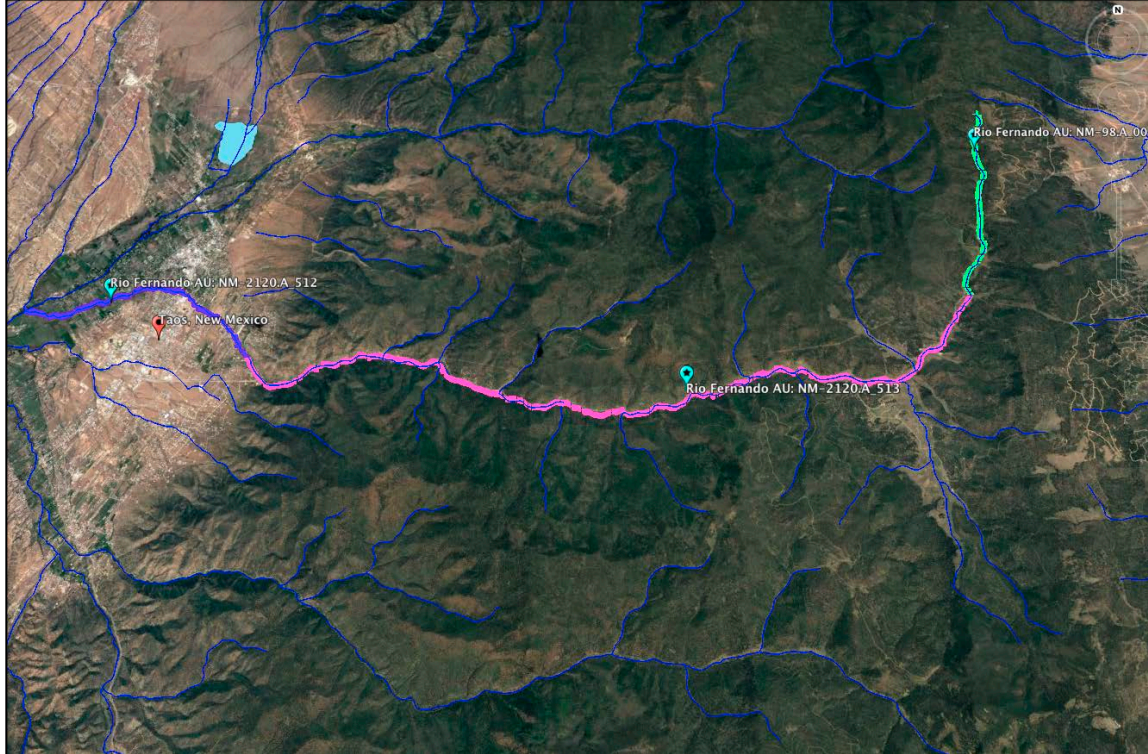
TASK	ESTIMATED DATE	HOW TASK WILL BE ACCOMPLISHED	DELIVERABLE	WHO
Watershed Meetings (3)	January – September 2018	Planning for meeting time, location and discussion items, and outreach to increase attendance	Meeting agenda and notes	Amigos Bravos Staff, Watershed Stakeholders, members of the public, Professional Facilitator
Help organize annual volunteer watershed cleanup	Summer 2018	Bring watershed stakeholders together to learn about the watershed and clean up trash	Completion of watershed clean up day (sign in sheet of volunteers)	Watershed Stakeholders, Amigos Bravos Staff, Volunteers
Solicit Comments And Feedback From Stakeholders, NMED and EPA	Summer 2018	Email/mail/phone	Written and electronic comments	Amigos Bravos Staff
Incorporate Stakeholder Comments And Disseminate Final WBP	Fall 2018	Editing of WBP	Revised WBP	Project Manager
Year 4				

TASK	ESTIMATED DATE	HOW TASK WILL BE ACCOMPLISHED	DELIVERABLE	WHO
Edit Current Sentinels – Rios De Taos /Amigos Bravos Quality Assurance Project Plan (QAPP) and FSP	Fall 2018	Identify additional sampling locations to be sampled during 2019.	Updated QAPP and FSP	Project Coordinator, Water Sentinels, all Stakeholders who would like to comment on the plan - drafts will be circulated.
Conduct monitoring of <i>E. coli</i> and flow throughout the Rio Fernando with goal of identifying geographic source areas.	As needed in 2019	Volunteer monitoring by members of the community and Sentinels – Rios de Taos	Results from sampling – IDEXX Laboratory equipment will be used in-house	Amigos Bravos Staff, Water Sentinels, Consultants, Watershed Stakeholders
<i>Administration</i>				
Track expenses	Ongoing	Amigos Bravos accountant will track expenses	Expense report	Amigos Bravos Staff
Submit reimbursement requests	Ongoing	Amigos Bravos accountant will track reimbursements	Reimbursement request forms	Amigos Bravos Staff
Write and submit quarterly reports	Ongoing	Review of what has been done followed by writing of a report	Completed quarterly report	Amigos Bravos Staff
Track and fulfill other reporting requirements (MBE, WBE, and SBRA monitoring and reporting)	Ongoing	Coordinator will keep track and complete other reports	Completed reports	Amigos Bravos Staff

2.4 Location

Main stem of the Río Fernando de Taos. HUC codes 130201010604 and 130201010601. This segment of the Rio Fernando is approximately 21 miles long. The assessment units included in this planning process are: NM-98.A_001, NM-2120.A_513, and NM-2120.A_512. See map below.

Figure 1: Project Area and Assessment Units of the Rio Fernando de Taos (Green = upper segment, Pink = middle segment, Purple = Lower segment)



**Table 5
Updated Water Quality stations in the Rio Fernando 2016 WBP Monitoring**

Site Name	2016 Initial Sample location	Segment #	Site Description	Segment Name	Coordinates (DDM)
F2	X	NM-2120.A_512	Bridge over the Paseo just west of the County courthouse	Lower	N 36 24.011 W 105 34.955
F4	X	NM-2120.A_512	Fred Baca Park just upstream of the foot bridge	Lower	N 36 24.010 W 105 35.013
F5	X	NM-2120.A_512	Taos Land Trust Property just upstream of Fred Baca Park	Lower	N 36 24.005 W 105 35.244
F6	X	NM-2120.A_512	Vigil property near confluence with Rio Pueblo	Lower	N 36 23.681 W 105 37.083

F7	X	NM-2120.A_512	John Hall property near the Martinez Hacienda	Lower	N 36 23.801 W 105 35.821
F9	X	NM-2120.A_512	Under the brdige that crosses Salazar Road--by Habitat for Humanity building	Lower	N36 24.013 W 105 34.958
F11	X	NM-2120.A_512	Angladas and Los Pandos intersection, down from bridge.	Lower	N 36 23.421 W 105 33.807
F12	X	NM-2120.A_512	Los Pandos rd between Witt rd and Dolan st bridge interseptions	Lower	N 36 23.595 W 105 34.099
F16		NM-2120.A_512	Santistevan Lane just downstream of F9	Lower	N 36 24.010 W 105 35.013
F17		NM-2120.A_512	Dolan Street Bridge	Lower	N 36 23.712 W 105 34.247
F18		NM-2120.A_512	David Frazer Land	Lower	N 36 23.740 W 105 36.183
F19		NM-2120.A_512	North Acequia at Baca Lane	Lower	N 36 23.304 W 105 33.629
F20		NM-2120.A_512	Marcias land	Lower	N 36 21.351 W 105 22.177
F22		NM-2120.A_512	Karan Monson house	Lower	N 36 23.701 W 105 36.284
F23		NM-2120.A_512	Karen downstream by road	Lower	N 36 23.672 W 105 36.383
F24		NM-2120.A_512	Karen acequia going into F23	Lower	N 36 23.671 W 105 36.372
F25		NM-2120.A_512	Between top and bottom of la jara	Lower	N 36 25.9537 W 105 20.5015
F26		NM-2120.A_512	Down stream of Angladas where acequia comes in	Lower	N 36 23.473 W 105 33.867
F31		NM-2120.A_512	Octaviano Road brige crossing	Lower	N 36 23.195 W 105 33.589
F32		NM-2120.A_512	Acequia on Witt Road	Lower	N 36 23.003 W 105 33.558
F33		NM-2120.A_512	Farther down acequia on Witt Road	Lower	N 36 23.0185 W 105 33.5831
F34		NM-2120.A_512	Los Pandos Bridge here it goes over the RF by Dolan Street. By large homelss camp and dump site	Lower	N 36 23.7733 W 105 34.368
F37		NM-2120.A_512	homeless camp just west of Taos County Courthouse on other side of the Paseo - tons of trash	Lower	N 36 23.950 W 105 34.742

F39		NM-2120.A_512	Merris spring at Charlies driveway - just before it reaches the Rio Pueblo.	Lower	N 36 24.2983 W 105 35.9163
F40		NM-2120.A_512	Rio Pueblo at confluence of Merris Spring on Sandoval Property	Lower	N 36 24.2945 W 105 35.912
F41		NM-2120.A_512	Judy Kanthack property -600 camino Medio. Spring next to river- can see pools. Inbetween John Miera and Cathy Baca - 2 houses from Karen Monson, 2 from John Hall	Lower	N 36 23.753 W 105 36.069
F42		NM-2120.A_512	End of Fred Baca Park past /acequia pipes right before it flows under camino de Medio (Found big crayfish- alive in river)	Lower	N 36 23.906 W 105 35.554
MS2		NM-2120.A_512	Merris Spring Pool - By lavadia road	Lower	N 36 24.2499 W 105 35.9287
MS3		NM-2120.A_512	Merris Spring Pool (Spring) in wetland just south of Sandoval House.	Lower	N 36 24.286 W 105 35.9137
PA1		NM-2120.A_512	near drive way to the house next to the church (Pacheco Acequia)	Lower	N 36 24.3566 W 105 35.8145
PA2		NM-2120.A_512	just downstream of PA1 by corner of house that is closest to church	Lower	N 36 24.3411 W 105 35.8322
PS3		NM-2120.A_512	Merris spring as it crossed Upper Ranchitos by the Good News Church	Lower	N 36 24.288 W 105 35.885
PS3-2		NM-2120.A_512	Acequia at culvert where it goes under the church driveway. Partially frozen, slow flow.	Lower	N 36 24.2719 W 105 35.8327
PS3-A		NM-2120.A_512	farthest up before fence - eastern side of church	Lower	N 36 24.007 W 105 35.016
PS3-B		NM-2120.A_512	Where pipe comes out see picture of pipe and house	Lower	N 36 24.303 W 105 35.782
PS3-C		NM-2120.A_512	Spot closest to church - going into culvert and then into wetland	Lower	N 36 24.283 W 105 35.814
PS3-E		NM-2120.A_512	above confluence of spring and acequia above the culvert.	Lower	N 36 24.2769 W 105 35.8274
PS3-F		NM-2120.A_512	Where acequia crosses lower ranchitos	Lower	N 36 24.2325 W 105 35.8529
PS3-H		NM-2120.A_512	Puddle behind empty building on the corner.	Lower	N 36 24.2636 W 105 35.8748
PS7		NM-2120.A_512	Rio Pueblo Diversion as it goes into the San Francisco Ditch	Lower	N 36 24.2086 W 105 35.9986
F1A	X	NM-2120.A_513	USFS boundary to Tienditas Creek	Middle	N 36 22.333 W 105 23.125

F1B	X	NM-2120.A_513	USFS boundary to Tienditas Creek	Middle	N 36 22.113 W 105 28.350
F1	X	NM-2120.A_513	USFS boundary to Tienditas Creek	Middle	N 36 22.536 W 105 32.834
F13	X	NM-2120.A_513	USFS boundary to Tienditas Creek	Middle	N 36 22.191 W 105 28.878
F14	X	NM-2120.A_513	USFS boundary to Tienditas Creek	Middle	N 36 22.274 W 105 25.371
F14-Spring		NM-2120.A_514	USFS boundary to Tienditas Creek	Middle	N 36 22.300 W 105 25.380
F27		NM-2120.A_514	headgate byd rum building-2ndd split	Middle	N 36 22.5605 W 105 33.0362
F28		NM-2120.A_514	Giant headgate farther up from rum building	Middle	N 36 22.5441 W 105 32.9941
F35		NM-2120.A_514	Vaughn property 1st sample, Also got house sample. Just downstream of Sierra Village RV	Middle	N 36 22.723 W 105d 30.432
F36		NM-2120.A_514	Just upstream of F35 - closer to Sierra Village Rv Park - check septic status (clear, shallow,can see bottom)	Middle	N 36 23.727 W 105 30.408
F46		NM-2120.A_514	Victoria Grey's house 25994 address, mile marker 259. A lot of algae on the bottom and growing near the surface.	Middle	N 36 22.777 W 105 30.150
F45		NM-2120.A_514	puddles with barely any flow. Natica Dahlkamp's house 26264 US 64 River View Road. Sampled at bridge. Just upstream of Shady Brook	Middle	N 36 22.023 W 105 27.731
RF-M		NM-2120.A_514	Mondragon trail head.	Middle	N 36 22.0564 W 105 26.3068
FLJ	X	NM-98.A_001	Tienditas Creek to the Headwaters	Upper	N 36 25.149 W 105 20.590
FRE	X	NM-98.A_001	Tienditas Creek to the Headwaters	Upper	N 36 23.801 W 105 35.836
F15	X	NM-98.A_001	Tienditas Creek to the Headwaters	Upper	N 36 22.194 W 105 28.884
F21		NM-98.A_001	Tienditas Creek	Upper	N 36 21.352 W 105 22.178
F15P		NM-98.A_001	Pond at F15	Upper	N 36 26.517 W 105 20.344
RF-S		NM-98.A_001	New Spot b/c water was gone at FRE - across from Pottery House	Upper	N 36 22.724 W 105 22.023

Table 6

Table 6. Inactive Water Quality stations in the Rio Fernando 2016 WBP Monitoring

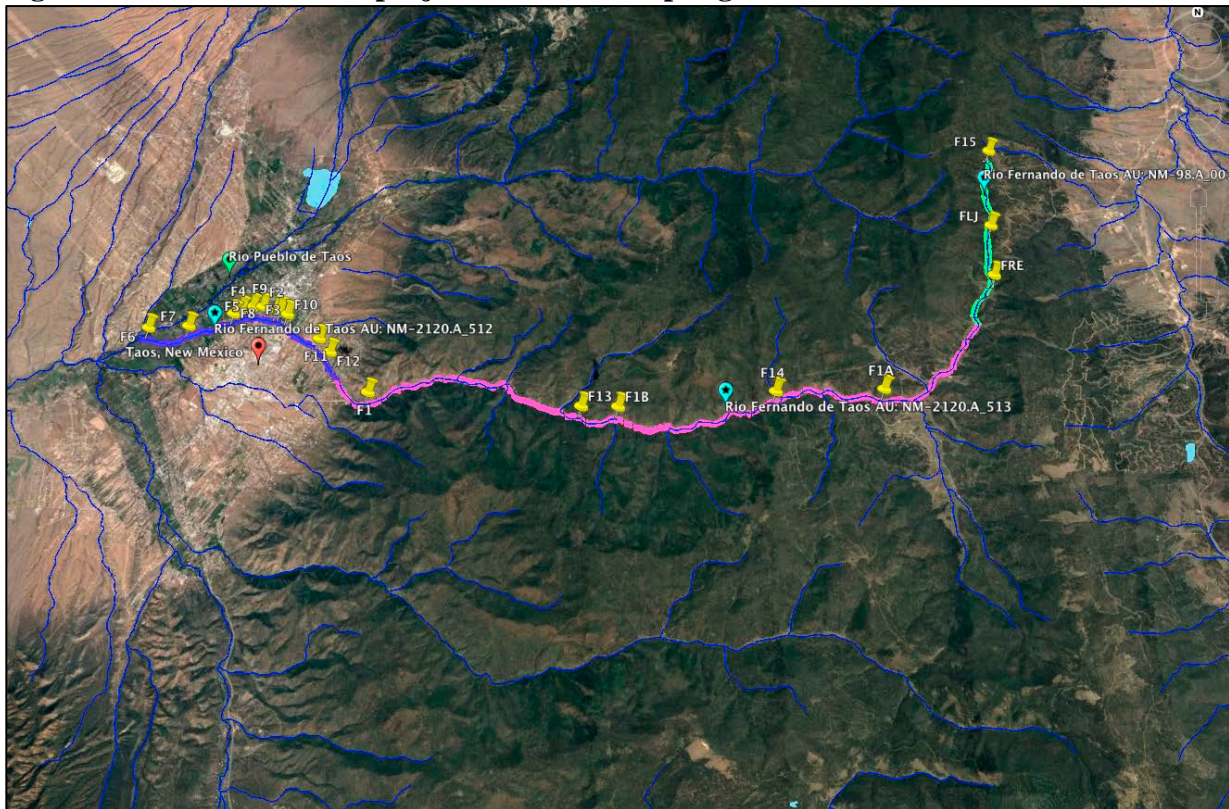
Site Name		Segment #	Site Description	Segment Name	Coordinates (DDM)
F3	X	NM-2120.A_512	About 25 yards downstream from Paseo del Pueblo Sur, by ABC Lock. On the south bank, by a concrete bar.	Lower	N 36 23.917 W105 34.654
F8	X	NM-2120.A_512	Just downstream of the Los Nidos condominium discharge	Lower	N 36 23.906 W105 35.505
F10	X	NM-2120.A_512	Just below Taos News Discharge	Lower	N 36 23.868 W105 34.463

3.0 DOCUMENTATION

Project documents include this field sampling plan, calibration records, work plan, QAPP, validation and verification records (available here: <https://www.env.nm.gov/swqb/SOP/>), sample collection data, records of analytical data in hard copy or in electronic form and QC records. Documents will be maintained in accordance with the requirements of the Bureau QAPP.

Project activities will be documented on Amigos Bravos Field Sheets and entered into an Excel database, which will then be backed up. The project is completed with the completion of the Watershed Based Plan.

Figure 2. Illustrates initial project area and sampling locations



4.0 SAMPLING PLAN

Sampling site locations are chosen based on existing or potential point or non-point sources of pollution. Existing and potential sources of pollution are identified from visual identification on maps, from point source permits, historical data, information from other agencies, and local residents. Sampling stations were selected at locations that bracket perceived pollution sources, allow access to the waterbody, and represent each of the assessment units in the watershed. Where possible the use of established stations allows for the examination of trends.

Regularly occurring water sampling occurred from Feb 01, 2016 - October 2018. Table 5 identifies the sites that were sampled between Feb-2016 and October-2018. Some of these sites may be monitored again in 2019 to test whether earlier results are persistent, and to further narrow geographic source areas of *E. coli* contributing to water quality impairment. The sampling plan began with approximately 19 identified sites to sample regularly. Additional sample sites were added as discussed under section 2.2 of the approved QAPP for Monitoring *E. Coli* on the Rio Fernando de Taos. A total of 59 sites have been sampled at least once and a total of 315 samples have been taken at sample locations identified on Table 5. New sample site locations may also be added during 2019 to bracket perceived pollution sources and further narrow geographic source areas of *E. coli* on the Rio Fernando de Taos.

4.1 Chemistry Sampling

E. coli water collection methods

In the field, at a minimum, equipment should be wiped down with sanitizing wipes immediately after use to minimize exposure to bacteria.

Before going in the field, fill out a “Bacteria Record Sheet” (attachment to this SOP) and use this form to record all requested information for each sample.

Collect both routine and quality control (blank) samples. In most cases, collect one set of quality control samples with each group of samples collected on consecutive days within one week.

Generally, no less than 5% of the samples should be quality control samples. Prepare the field blank using distilled water and process quality control samples at the same as a routine sample.

Collect samples in sterile bottles. Do not rinse sample bottles before use and do not remove the caps or shrink wrap until immediately before sampling. For compliance sampling, the samples must be collected directly into the sample bottles. Otherwise, collect samples directly into the sample bottles whenever possible. If it is necessary to transfer to the sample bottle from another vessel, note this on the data sheet.

Verify that the bottle is properly labeled and remove and dispose of the shrink band or sealing tape. In a stream, it is preferable to sample where the stream is flowing, well mixed and more than 6 inches deep.

Stand downstream of the sampling bottle to avoid getting streambed sediment in the sample. Wear disposable gloves if you are sampling effluent water or are working downstream of a wastewater treatment plant. Uncap the sample bottle. Holding the cap in one hand and the bottle in the other, submerge the bottle in as upright a position as possible to retain the sodium thiosulfate chlorine neutralizer. Collect a sample from the water column, minimizing the amount of surface material entering the bottle. Attempt to fill the bottle just to the 100-mL line. If the bottle is filled above the 100-mL line, immediately decant excess water. Carefully replace the cap.

After collecting the sample, ice or refrigerate it at a temperature less than 10°C. Use insulated containers to assure proper maintenance of storage temperature. Ensure that sample vessels are not totally immersed in water during transit.

Processing *E. coli* Samples using IDEXX in the Amigos Bravos Laboratory

Amigos Bravos will use the SWQB approved method of IDEXX Laboratories, Inc. Colilert® procedures for enumeration of total coliform and *E. coli* by the most probable number (MPN) method. The procedure is explained in the Colilert® reagent snap packs and in Standard Methods, Part 9000 (APHA 2005).

Background on the MPN method can be found in Oblinger and J. A Koburger (1975). Because *E. coli* can be an indicator of pathogens harmful to humans, precautions should be taken when sampling potentially contaminated water. Avoid accidental ingestion, contact with mucous membranes, eyes and skin to the extent possible, especially areas with cuts and abrasions. Wear splash protection and eye protection (i.e., goggles, gloves) while working with bacteriological samples. Wash hands with soap and water or disinfecting hand cleaner as soon as possible after collecting samples and working with equipment.

Equipment exposed to potentially contaminated water should be cleaned using a dilute (1:10) bleach solution and rinsed in clean water if possible. This would only occur during the event of a spill while in the processing samples for incubation.

Equipment and Supplies

- IDEXX 110V Incubator
- Fluorescent UV lamp, 6-watt, 365 nm
- Plastic or glass-lensed goggles may be sufficient to protect the analyst from the brief exposures to UV from this method and are recommended for safety.
- IDEXX Quanti-Tray sealer, “lab”
- IDEXX Quanti-Tray/2000 rubber insert
- IDEXX Colilert Reagent “Snap Packs” for 24-28 hour incubation
- IDEXX Colilert-18 Reagent “Snap Packs” for 18-22 hour incubation
- IDEXX Quanti-Tray/2000 bacterial enumeration trays
- IDEXX Shrink Banded Sample Bottles

1. Remove the samples from the cooler approximately 30 minutes prior to arriving at the processing site and allow to warm to ambient temperature. Add the IDEXX Colilert® reagent

packet. Although the reagent will dissolve in chilled samples, it dissolves better if the samples are at room temperature. Carry out this and all additional steps with aseptic techniques to avoid contamination of sample and field blanks.

2. Switch on the Quanti-Tray® Sealer and allow it to warm up until the green light on the cover comes on. Warm up times greater than 14 minutes improve sealing.

3. Fill out a “Bacteria Record Sheet” (attachment to this SOP) and use this form to record all requested information for each sample.

4. As appropriate based on read-time, select either Colilert-18 (18-22 hr incubation) or Colilert-24 (24 - 28 hr incubation) reagent.

5. Add one reagent packet directly to each sample bottle. Invert gently at 2-3 min intervals until completely dissolved.

6. Pour the solution into a Quanti-Tray2000 incubation tray while holding it vertically. Gently tap the incubation tray to dislodge any bubbles that may be trapped in the cells.

7. Place the tray into the black rubber frame and insert the frame and tray into the bay in the front of the sealer.

8. Carefully ease the frame and tray forward until the sealer activates and feeds the tray automatically. The sealer may occasionally jam while processing the tray. If this occurs, press the reverse button on the cover and the track will reverse, depositing the frame on the bay. Wait until the green light activates again and repeat the loading process. The tray will be deposited on the counter behind the sealer.

9. Record initial incubator temperature on the Bacteria Record Sheet.

10. Start the incubation within 8 hours of sample collection. Place the sealed tray into the 35°C +/- .05°C incubator and incubate 18-22 hrs for Colilert-18 reagent or 24-28 hrs for Colilert reagent. Observe and record internal temperature of the incubator using a thermometer.

11. After the appropriate incubation period, record the final incubator temperature and duration of the incubation on the Bacteria Record Sheet. Remove the sealed tray and record the incubation time. Do not read trays that have been incubated beyond the appropriate incubation time, as they may produce false positives.

12. Under visible light, enumerate total coliform bacteria by counting the number of large and small cells that turn cloudy-yellow (i.e., turbid) after incubation. These may appear only slightly turbid so the yellow color development is the true indicator (see: <https://www.youtube.com/watch?v=xukXJIOVeIc>) Enumerate *E. coli* by counting the number of large and small cells that fluoresce under UV illumination with the black light. For both total coliform and *E. coli*, the Colilert® and Colilert® -18 Quanti-Tray®/2000 Comparator should be

used to verify positive or negative cells. The large window at the top of the tray should be counted as the 49th large cell.

13. Enter the sample date, method, sample ID (RID#), and the number of positive large and small cells counted into the IDEXX MPN generator. Photograph sample ID and resultant incubated tray.

Record QA sample results (including zero) the same as routine results (MPN expressed as cfu/100 ml and 95% upper and lower confidence limits).

14. Transfer IDEXX results to the Bacteria Database Upload Form (Appendix D) and enter additional data, as recorded on the Bacteria Record Sheet (Appendix C). Confirm that there are no data QA issues and then enter it into excel and save multiple copies.

15. Properly dispose of IDEXX quantitrays consistent with local regulatory guidelines as they are now considered a microbiological hazardous waste. (Confer with SWQB monitoring staff regarding this requirement).

Field Sampling for Other Parameters:

Field parameters (temperature, specific conductance, dissolved oxygen concentration, pH, and flow) will be measured at each site before E. coli samples are collected. The following equipment will be used:

Temperature, pH, conductivity – Euteck Instruments PCTestr 35 from Oakton
Dissolved Oxygen – CHEMets Dissolved Oxygen Kit, Model K-7512

Flow will be measured using the float method or the weir method, when possible. Data will be recorded on flow field forms and flow calculation worksheets.

If certain septic systems are suspected to be a source, dye tracer kits will be used when permitted by the landowner.

4.2 Biology/Habitat Sampling

Measuring biological response indicators concurrent to physical habitat and chemistry gives an overall interpretation of the biological integrity of the reach represented, provides more complete information on characteristics of sediment and nutrients currently cycling through the stream and may provide enough information to investigate or eliminate specific potential sources of water quality stress. See Appendix A and B for our Field Sampling Form and our Flow Measurement Form.

Resources such as staff and budgets and other issues such as property ownership do not allow for the collection of biological and habitat data at all stations. Additional sites determined as the project progressed will be included in updates of the QAPP and this Field Sampling Plan. Adaptations or changes to this sampling and analysis plan will be discussed with the Project

Manager and the Surface Water Quality Assurance Officer prior to implementation of the changes.

5.0 RESOURCE REQUIREMENTS

Each sample processed using the IDEXX method costs approximately \$18.31. Initial costs for one year of equipment (bottles and powder) and the starter equipment was approximately 7,687.98.

Each sampling site, depending on where the sample site is along the Rio Fernando, is 5.6 to 39.0 miles round trip from the center of Taos. At 0.55cents/mile, this is approximately \$3.08 to \$21.45.

Water quality sampling trips will require one staff per 2-12 monthly surveys. This is 2 to 6 hours at 30-\$50 per hour. Depending on which staff and time, this will be between \$100 and \$300 per month.

6.0 REFERENCES

New Mexico Environment Department Surface Water Quality Bureau (NMED/SWQB). 2006. *Water Quality Survey Report for the Lower Rio Grande (from the International Boundary with Mexico to Elephant Butte Dam) 2004*. Santa Fe, NM. (<http://www.nmenv.state.nm.us/swqb/Surveys/LRG-SurveyReport2004.pdf>)

New Mexico Environment Department Surface Water Quality Bureau. 2009. *Water Quality Survey Report for the Lower Rio Grande Tributaries 2004*. Santa Fe, NM. (<ftp://ftp.nmenv.state.nm.us/www/swqb/MAS/Surveys/LowerRioGrandeTributaries-2004Survey.pdf>)

New Mexico Environment Department Surface Water Quality Bureau. 2010b. *2010 – 2012 State of New Mexico Clean Water Act §303(d)/§305(b) Integrated Report*. Santa Fe, NM.

New Mexico Environment Department Surface Water Quality Bureau. 2016a. *Quality Assurance Project Plan for Water Quality Management Programs*, Santa Fe, NM.

New Mexico Environment Department Surface Water Quality Bureau.. Santa Fe, NM. 2016b. *Standard Operating Procedures for Chemical Sampling in Lotic Environments*.

New Mexico Environment Department Surface Water Quality Bureau. 2016c. *Standard Operating Procedures for Bacteriological Sampling*. Santa Fe, NM.

7.0 APPENDICIES

APPENDIX A-1: Field Sampling and Chain of Custody Form (2 pages):

WATER SENTINELS RIOS de TAOS	
FIELD DATA SHEET AND CHAIN OF CUSTODY FORM	
Site ID Code: _____	Stream Name: _____
Sampler Names: _____	
Sample Date: _____	Sample Time: _____
General description of site and water	
Conditions: _____	
Precipitation in the last 24 hours(check one):	
___ Storm(heavy rain >2.5 cm)	___ Steady rain (.85 cm to 2.4 cm)
___ Showers(up to .85cm)	___ Overcast ___ Clear
Precipitation in the last week: _____	
General Notes: _____	

Physical Characteristics Assessment (Check all that apply):	
Water appearance:	
Clear _____	Cloudy _____
Muddy _____	Dark brown _____
Foamy _____	Orange scum _____
	Milky/white _____
Water Conditions:	
_____ Normal	Dry _____
Flooded _____	High _____
	Low _____
	Very low _____
Water Odors:	
_____ No unusual smell	_____ Chlorine
	_____ Fishy
	_____ Sulfur(rotten eggs)
_____ Sewage	_____ Moldy
_____ Musty	_____ Earthy
	_____ Petroleum
	_____ Other Sediment
_____ Clear, gravel or sandy bottom	_____ Muddy, silty
	_____ Algae coating bottom
_____ Strands of filamentous algae	

DATE

SITE ID CODE

PARAMETERS—Streamside Analysis

Temperature, degrees Celsius _____

pH, units

Dissolved oxygen, mg/L or ppm

Electrical Conductivity, microsiemens/cm _____

Flow: Transfer Final Adjusted Stream Flow from “Calculating and Measuring Stream Flow” Data Sheet

Laboratory Analysis Check off tests desired:

_____ E. coli _____

CHAIN OF CUSTODY

Important! Anytime samples change hands, they must be signed for below:

Sample ID Code:

Signature of Receiver:

Relinquished by:

Date and Time:

APPENDIX B: Flow Measurement Form

CALCULATING AND MEASURING STREAM FLOW

Ver 0605

Date: _____

Location: _____

Recorder's name: _____

Measuring

1. Find a fairly straight stretch of river where the water flows fast and the bottom is relatively flat. Measure a 3-meter section, marking where it begins and ends. Record this as the distance in column A.
2. Drop a ping pong ball in the center of the river at least one meter upstream of the starting point. When the ball reaches the start point, begin timing in seconds. When the ball reaches the end point, stop the timer. Record the amount of seconds in column B. Repeat this step two more times. (If the ball gets lodged in a rock or stuck in an eddy, begin the trial over.)
3. Measure the width of the river at the start point, at the end point, and at a point midway between the start and end. Record these measurements in column D. (See lines with arrows, above.)
4. Measure the depth of the river 3 times along each width line for a total of nine depth measurements. Record these measurements in column F. (See dots on lines with arrows, above.)

A	B	C	D	E	F	G
Distance (meters or feet)	Time (sec.)	Average Time (sec.)	Width of River at 3 points	Average Width of River	Depth of River at 9 points	Average Depth of River

Calculating

5. Calculate the averages for columns B, D and F and record the averages in columns C, E and G.
6. Now, divide the distance (column A) by the average time (column C) to obtain the velocity. Record this number in the equation below.
7. Multiply the average width (column E) by the average depth (column G) to obtain the area. Record this number in the equation below.
8. Multiply the velocity by the area to obtain the streamflow and record that in the equation below.

$$\underline{\hspace{2cm}} \text{ velocity} \times \underline{\hspace{2cm}} \text{ area} = \underline{\hspace{2cm}} \text{ streamflow}$$

9. To calculate the final adjusted streamflow, you must multiply your result by a factor which takes into consideration the uneven surface bottom of your river or stream. For streams with rocky bottoms use a factor of 0.8, but for smooth bottomed streams, use a factor of 0.9.

$$\underline{\hspace{2cm}} \text{ streamflow from} \times \underline{\hspace{2cm}} \text{ factor of 0.9 or 0.8} = \underline{\hspace{2cm}} \text{ Final Adjusted Streamflow}$$

APPENDIX E:

Attachment A-1 Chemical Data Verification and Validation Worksheet

Study Name: _____

Year: _____

Project Coordinator: _____

Data covered by this worksheet: _____

Version of Verification/Validation Procedures: _____ **QAPP**

Step 1: Verify Field Data

A. Are all Field Data forms present and complete? Yes No

If yes, proceed; if no, attempt to locate missing forms, then indicate any remaining missing forms and action taken.

Missing Field Data Forms	Action Taken
_____	_____
_____	_____

Total number of occurrences: _____

B. Are station name and ID, and sampling date and time (ACT_START_DATE) on forms consistent with database? Yes No

If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station and Parameter	Action Taken	Re-verified?
_____	_____	_____
_____	_____	_____

Total number of occurrences: _____

C. Are field data (sonde readings, Flow Condition Rating and Nutrient Level I Screening variables) on forms consistent with database? Yes

No

If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station	Sampling Date	Parameter(s) Corrected	Re-verified?
_____	_____	_____	_____
_____	_____	_____	_____

Total number of occurrences: _____

D. Are RIDs correct and associated with the correct analytical suite, media subdivision (e.g. surface water, municipal waste, etc.) and activity type (e.g. Field observation, Routine sample, QA sample etc.)?

Yes No

If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify

Station/RID	Sampling Date	RID Corrected	Re-verified?
_____	_____	_____	_____
_____	_____	_____	_____

Total number of occurrences: _____

Step 1 Completed Initials: _____ Date: _____

Step 2: Verify Data Deliverables

A. Have all data in question been delivered? Yes No

If yes, proceed; if no, indicate RIDs with missing data (samples or blanks) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken. Complete this step upon receipt of all missing data.

RID	Submittal Date	Missing Data/Parameters	Date of Initial Verification	Date Missing Data Were Received
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Total number of occurrences: _____

B. Do all of the analytical suites have the correct number and type of analytes. Yes No

If yes, proceed; if no, indicate RIDs with missing or incorrect analyte(s) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken.

RID	Submittal Date	Missing or Incorrect Parameters	Action Taken	Re-verified?
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Step 2 Completed Initials: _____ Date: _____

Step 3: Verify Flow Data

A. Identify incorrect or missing data on the flow calculation spreadsheet and correct errors.

Station	Sampling Date	Flow data missing or incorrect?
_____	_____	_____
_____	_____	_____

Total number of occurrences: _____

B. Identify incorrect or missing discharge measurements, correct errors in database and re-verify.

Station	Sampling Date	Flow data missing or incorrect?	Re-verified?
_____	_____	_____	_____
_____	_____	_____	_____

Total number of occurrences: _____

Step 3 Completed Initials: _____ Date: _____

Step 4: Verify Analytical Results for Missing Information or Questionable Results

Were any results with missing/questionable information identified? Yes No

If no, proceed; if yes, indicate results with missing information or questionable results or attach report. Contact data source and indicate action taken. Complete this step upon receipt of missing information or clarification of questionable results (clarify questionable results only, DO NOT change results without written approval (from lab or QA officer) and associated documentation).

RID	Sample Date	Missing or Questionable Information/Results	Action Taken
_____	_____	_____	_____
_____	_____	_____	_____

Total number of occurrences: _____

Step 4 Completed Initials: _____ Date: _____

Step 5: Validate Blanks Results

Were any analytes of concern detected in blank samples? Yes No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager, with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes have been added to database correctly.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database? *
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

*See validation procedures to determine which associated data need to be flagged and include on *Validation Codes Form*.

Total number of occurrences: _____

Step 5 Completed Initials: _____ Date: _____

Step 6: Validate Holding Times Violations

Were any samples submitted that did not meet specified holding times? Yes No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database to ALL associated data?*
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

*See validation procedures to determine which associated data need to be flagged.

Total number of occurrences: _____

Step 6 Completed Initials: _____ Date: _____

Step 7: Validate Replicate/Duplicate Results (if applicable)

Were any replicate/duplicate pairs submitted outside of the established control limit of 20%?

Yes No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID Pairs	Replicate or Duplicate?	Sample Date	Parameter	RPD	Validation Code/Flag Applied	Code/Flag verified in database applied?*
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

*See validation procedures to determine which associated data need to be flagged.

Total number of occurrences: _____

Step 7 Completed *Initials:* _____ *Date:* _____

After all of the above steps have been completed, save and print the worksheet, attach all applicable supplemental information and sign below.

I acknowledge that the data verification and validation process has been completed for the data identified above in accordance with the procedures described in the SWQB QAPP.

Data Verifier/Validator Signature

Date

COMPLETION OF DATA VERIFICATION AND VALIDATION PROCESS

Once the data verification and validation process has been completed for the entire study (note: if the worksheet is for a subset of the data from a study, be sure ALL the data for the entire study is included before final completion of the data verification and validation process), notify the NMSQUID administrator that the process is complete and request that "V V in STORET" be added to the project title.

Once all data have been verified and validated for a study provide copies of ALL *Data Verification and Validation Worksheets* and attachments associated with the study to the Quality Assurance Officer and retain originals in the project binder.

Attachment A-2 Physical/Habitat Data Verification and Validation Worksheet

Study Name: _____
Year: _____
Project Coordinator: _____
Data covered by this worksheet: _____

Version of Verification/Validation Procedures: _____ QAPP

Step 1: Verify Field Data

Are all field forms present and complete and indicated as having been verified in field?

Yes No

If yes, proceed; if no, attempt to locate missing forms or identify unverified forms, then indicate any remaining missing information and action taken.

Station	Date	List Form(s)	Missing or Unverified?	Action Taken
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Total number of occurrences: _____

Step 1 Completed *Initials:* _____ *Date:* _____

Step 2: Verify Data Transcription

Based on field forms from previous step, are field data on forms consistent with database?

Yes No

If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station	Sampling Date	Parameter(s) Corrected	Re-verified?
_____	_____	_____	_____
_____	_____	_____	_____

Total number of occurrences: _____

Step 2 Completed Initials: _____ Date: _____

Step 3: Validate Replicate/Duplicate Samples

Were any replicate/duplicate pairs identified as out of control ($\geq 15\%$ RPD)? Yes No

If no, proceed; if yes, identify which sampling events and associated metrics/indices were out of control and note RPD value on associated field sheets and comment sections of electronic versions.

Station	Sampling Date(s)	Replicate or Duplicate?	Metric/Index	Relative Percent Difference
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Total number of occurrences: _____

Step 3 Completed Initials: _____ Date: _____

After all of the above steps have been completed, save and print the worksheet, attach all applicable supplemental information and sign below.

I acknowledge that the data verification and validation process has been completed for the data identified above in accordance with the procedures described in the SWQB QAPP.

Data Verifier/Validator Signature

Date

COMPLETION OF DATA VERIFICATION AND VALIDATION PROCESS

Once the data verification and validation process has been completed for the entire study (note: if the worksheet is for a subset of the data from a study, be sure ALL the data for the entire study is included before final completion of the data verification and validation process), provide copies of ALL *Data Verification and Validation Worksheets* and attachments associated with the study to the Quality Assurance Officer and retain originals in the project binder.

Attachment A-3 Biological Data Verification and Validation Worksheet

Study Name: _____
 Year: _____
 Project Coordinator: _____
 Type of Biological Data Being Verified and Validated: _____
 Data covered by this worksheet: _____

Version of Verification/Validation Procedures: _____ QAPP

Step 1: Verify Field Data

Are all field forms containing biological collection information complete and indicated as having been verified in field?

Yes No

If yes, proceed; if no, attempt to locate missing forms or identify unverified forms, then indicate any remaining missing information and action taken.

Station	Date	List Form(s)	Missing or Unverified?	Action Taken
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Total number of occurrences: _____

Step 1 Completed *Initials:* _____ *Date:* _____

Step 2: Verify Completeness of Data Deliverables (taxonomic results received from laboratory)

Have all data in question been delivered? Yes No

If yes, proceed; if no, indicate missing data. Contact data source and indicate action taken. Complete this step upon receipt of all missing data.

Station	Date	Missing Data/Parameters	Date of Initial Verification	Date Missing Data Were Received
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Total number of occurrences: _____

Step 2 Completed *Initials:* _____ *Date:* _____

Step 3: Verify Laboratory Results for Missing or Questionable Information

Were any results with missing/questionable information identified? Yes No

If no, proceed; if yes, indicate results with missing information or questionable results or attach report. Contact data source and indicate action taken. Complete this step upon receipt of missing information or clarification of questionable results (clarify questionable results only, DO NOT change results without written approval (from lab) and associated documentation).

Station	Sample Date	Missing or Questionable Information/Results	Action Taken
_____	_____	_____	_____
_____	_____	_____	_____

Total number of occurrences: _____

Step 3 Completed *Initials:* _____ *Date:* _____

Step 4: Verify Data Transcription

Based on field forms or results received from laboratory from previous step, are data on forms consistent with database? Yes No

If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station	Sampling Date	Parameter(s) Corrected	Re-verified?
_____	_____	_____	_____
_____	_____	_____	_____

Total number of occurrences: _____

Step 4 Completed *Initials:* _____ *Date:* _____

Step 5: Validate Reported Quality Control Results

Were any laboratory reported quality controls identified as out of control? Yes No

If no, proceed; if yes, identify which measures were out of control and the corrective action taken.

Station	Sampling Date(s)	QC measure	Value	Action taken
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Total number of occurrences: _____

Step 5 Completed *Initials:* _____ *Date:* _____

After all of the above steps have been completed, save and print the worksheet, attach all applicable supplemental information and sign below.

I acknowledge that the data verification and validation process has been completed for the data identified above in accordance with the procedures described in the SWQB QAPP.

Data Verifier/Validator Signature Date

COMPLETION OF DATA VERIFICATION AND VALIDATION PROCESS

Once the data verification and validation process has been completed for the entire study (note: if the worksheet is for a subset of the data from a study, be sure ALL the data for the entire study is included before final completion of the data verification and validation process), provide copies of ALL *Data Verification and Validation Worksheets* and attachments associated with the study to the Quality Assurance Officer and retain originals in the project binder.

Attachment A-3 LTD Data Verification and Validation Worksheet

Study Name: _____
 Year: _____
 Project Coordinator: _____
 Type of LTD Data Being Verified and Validated: _____
 Data covered by this worksheet: _____

Version of Verification/Validation Procedures: _____ QAPP

Step 1: Verify Field Data, csv File, and Station and Event Metadata

Are all field deployment forms complete and match station and study metadata in database including but not limited to filename, deployment and retrieval dates, and sampling events?

Yes No

If yes, proceed; if no, attempt to locate missing forms or incorrect station and file metadata, then indicate any remaining missing information and action taken.

Station	Date	List Form(s)	Missing or Unverified?	Action Taken
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Total number of occurrences: _____

Step 1 Completed *Initials:* _____ *Date:* _____

Step 2: Verify that all LTD data has been reviewed, truncated to deployment and retrieval dates, qualified as necessary, and summary statistics generated and accurately recorded in database

Have all LTD data in question been delivered, attributed, and faithfully transcribed? Yes No

If yes, proceed; if no, indicate missing or incorrect data. Contact data source and indicate action taken after receipt of all missing data.

Station	Date	Missing Data/Parameters	Date of Initial Verification	Date Missing Data Were Received
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Total number of occurrences: _____

Step 2 Completed *Initials:* _____ *Date:* _____

Attachment B-1 SWQB Validation Codes

Field and analytical data are verified and validated for completeness, correctness and conformance of the dataset against specified method, procedural or contractual requirements..

When deficiencies are identified through the data verification and validation process, the SWQB documents or “flags” the deficiencies by assigning validation codes. All data collected from the last compliant QC sample and up to the next compliant QC sample are assigned validation codes. The validation code alerts the data user that the results are outside QA control limits and may require re-sampling or a separate, qualitative analysis based on professional judgment.

Validation Code	Definition	WQX Equivalent
A1	Sample not collected according to SOP	
B1	Chemical was detected in the field blank at a concentration less than 5% of the sample concentration.	
BN	Blanks NOT collected during sampling run	
BU	Detection in blank. Analyte was not detected in this sample above the method's sample detection limit.	BU
RB1	Chemical was detected in the field blank at a concentration greater than or equal to 5% of the sample concentration. Results for this sample are rejected because they may be the result of contamination; the results may not be reported or used for regulatory compliance purposes.	B
R1	Rejected due to incorrect sample preservation	R
R2	Rejected due to equipment failure in the field	R
R3	Rejected based on best professional judgment	R
D1	Spike recovery not within method acceptance limits	
F1	Sample filter time exceeded	
J1	Estimated: the analyte was positively identified and the associated value is an approximate concentration of the analyte in the sample	J
K1	Holding time violation	H
Ea	Estimated-Incubation temperature between 35.5 and 38.0° Celsius	
Er	Rejected-Incubation temperature < 34.5 or >38.0° Celsius	
PD1	Percent difference between duplicate samples excessive	
S1	Per SLD, uncertainties (sigmas) are expressed as one standard deviation, i.e. one standard error. Small negative or positive values that are less than two standard deviations should be interpreted as “less than the detection limit.”	

S2	Data are suspect but deemed usable based on best professional judgment; documentation of justification is required and should be included in the Data Verification and Validation Packet and reported with results	
Z1	Macroinvertebrate data did not meet QC criteria specified in Section 2.5 of QAPP	
H1	Habitat data did not meet QC criteria specified in Section 2.5 of QAPP	

Attachment B-2 SLD Data Qualifiers

The following description of data qualifiers is from SLD (2011):

In some cases, it may be necessary to report data using associated data qualifiers. Circumstances warranting the use of data qualifiers are varied, but generally reflect an anomaly with QC criteria, which may or may not disqualify the use of the data for its intended purpose. Qualifiers are meant to inform the user of inconsistencies that occurred during the course of analysis due to matrix effects, sampler or analyst error, lab accident, or any other uncontrollable situation. Qualifiers aid the user in making judgments regarding data quality and use.

This Appendix provides a list of New Mexico Scientific Laboratory Division Chemistry Bureau data qualifiers (SLD 2011). Data qualifiers used by other laboratories in previous years are found in previous QAPPs.

Data Qualifier	Description	WQX Equivalent
A	See note/comments.	
B	Analyte was detected in the laboratory blank.	B
C	Spike recovery in laboratory fortified blank is within method acceptance limits.	
D	Spike recovery in laboratory fortified blank is not within method acceptance limits.	
E	Analyte value exceeded calibration range.	
F	Sample matrix interference suspected.	
H	Sample was analyzed in duplicate.	
I	Sample was analyzed in triplicate.	
J	Analyte was detected at a level below the method's sample detection limit.	
K	Holding time was exceeded at laboratory.	H
L	Regulated parameter value equals or exceeds the EPA SDWA Maximum Contamination Level.	
M	Regulated parameter value equals or exceeds the EPA SDWA Action Level.	
N	Insufficient sample to verify results.	
O	Method internal standard(s) not within method acceptance limits when analyzed undiluted.	
P	Sample rejected/voided at laboratory.	R
Q	Sample submitted to laboratory past holding time.	H

Data Qualifier	Description	WQX Equivalent
R	Results based on four or more replicates.	
S	Relative percent difference between duplicates greater than 10% (waters).	
T	Relative percent difference between duplicates greater than 30% (soils).	
U	Analyte was not detected in this sample above the method's sample detection limit.	U

Attachment B-3 Field Quality Control Summary

Data Type	QC Check	QC Criteria	Action for Data Not Meeting QC Requirements	Information Provided	QC Frequency
Chemical Data	Field Blank for nutrients, cyanide and <i>E. coli</i>	Parameter detected at concentration \geq SDL	Flag data appropriately; determine source of contamination and implement corrective action	Sample collection, transportation and/or handling bias	1 per sampling run
	Equipment Blank for dissolved metals	Parameter detected at concentration \geq SDL	Flag data appropriately; determine source of contamination and implement corrective action	Sample collection, transportation and/or handling bias	1 per sampling run
	Trip Blank for VOCs	Parameter detected at concentration \geq SDL	Flag data appropriately; determine source of contamination and implement corrective action	Sample collection, transportation and/or handling bias	1 per sampling run
	Replicates/Duplicates	RPD between samples greater than analytical uncertainty	Determine possible cause (variability in environmental conditions, improper sampling technique, lack of training, etc.); flag data if appropriate and implement corrective action	Performance characteristics for sampling protocols; environmental variability	Determined on project specific basis
Macro-invertebrate Data	Sample Sorting Efficiency (done by contractor)	\geq 95% sorting efficiency* defined as: $SE = \frac{n_1}{n_2} \times 100$	Re-sort entire sample and adjust data, with proper notations, to incorporate missed specimens; determine cause and implement corrective actions (retrain sorter, use larger magnification, etc.)	Sample sorter bias	100% of total samples
	Taxonomic Verification (done by contractor)	\geq 95% similarity between original and QC identifications	Adjust data, with proper notations, according to mutual agreement of the original and QC taxonomists; determine source of differences (specimen damage, regional familiarity, etc.) and implement corrective action	Taxonomic Identification bias	10% of total samples
Fish	Taxonomic Verification (performed by Museum of Southwestern Biology)	N/A	Adjust data, with proper notations, according to mutual agreement of the original and QC taxonomists	Taxonomic Identification bias	100% of total samples
Habitat Data	Field Replicates (Site sampled by different field crew)	For % sand and fines, Rp100 and other metrics and attributes as appropriate: • RPD $<$ 15%	Determine possible cause (variability in environmental conditions, improper sampling technique, lack of training, etc.); flag data appropriately and implement corrective action	Data collector bias; performance characteristics for sampling protocols (primarily field sampling precision)	1 per sample index period
Hydrology Protocol	Field Replicates (Site sampled by different field crew)	For all attributes measures: • +/- one scoring category For aggregate score:	Determine possible cause (variability in environmental conditions, improper sampling technique, lack of training, etc.); flag data appropriately and implement corrective action	Data collector bias; performance characteristics for sampling protocols (primarily field sampling precision)	1 per sample field season

		• difference ≤ 3		
--	--	-----------------------	--	--

NOTES:

RPD = Relative Percent Difference

* Independent observers microscopically re-examine 20% of sorted substrate from each sample. All organisms that were missed are counted. n_1 is the total number of specimens in the first sort, and n_2 is the total number of specimens in the first and second sorts combined.

Attachment B-4 SLD Detection Flags

LABORATORY DETECTION QUALIFIERS AND REPORTING CONVENTIONS				
		Logical Response ⁽¹⁾	Flag	Reporting Convention
not detected a $C \geq \text{SDL}$	$C < \text{SDL}$	TRUE	U	Report SDL
detected at $C \geq \text{SDL}$ but $< \text{MRL}$	$\text{SDL} \leq C < \text{MRL}$	FALSE	J	Report estimated value
detected at $C \geq \text{MRL}$	$C \geq \text{MRL}$	FALSE	No Flag	Report value
...				

New Mexico Environment Department Surface Water Quality Bureau

SOPs:

SOP 4.1 Probable Source(s) Determination
SOP 9.1 Bacteriological Sampling and Analysis

Title: Probable Source(s) Determination	No: SOP 4.1	Page 1 of 7
	Revision 2	
Effective Date: 4/15/2015	Next Revision Date 4/15/2017	

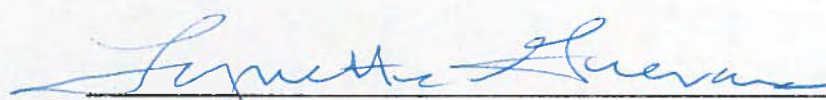

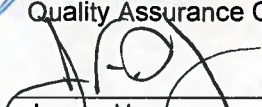
New Mexico Environment Department
Surface Water Quality Bureau

Standard Operating Procedure (SOP)

for

PROBABLE SOURCE(S) DETERMINATION

Approval Signatures

	<u>4/20/15</u>
Lynette Guevara Subject Matter Expert	Date
	<u>4/20/15</u>
Jodey Kougioufis Quality Assurance Officer	Date
	<u>4.20.15</u>
James Hogan Acting Program Manager	Date

1.0 Purpose and Scope

The purpose of this document is to describe the order and process of 1) developing a qualitative evaluation of probable sources of impairment based on visual observations made by professionals in the field and input from the public; 2) reviewing these evaluations through both internal and public processes; and 3) incorporating this information into Total Maximum Daily Loads (TMDLs) and the Clean Water Act (CWA) §303d/§305b Integrated List (i.e., Appendix A of the Integrated Report). This approach, as detailed in Table 1, is intended only to provide a qualitative list of probable sources

2.0 Responsibilities

Bureau personnel who conduct watershed surveys or work with watershed groups in developing watershed based plans (WBPs) as well as those who supervise these individuals are responsible for implementing this procedure.

3.0 Background and Precautions

USEPA through listing guidance documents requires states to include a list of probable sources for each impairment. According to the 1998 305(b) report guidance, "... states must always provide aggregate source category totals..." in the biennial submittal that fulfills CWA §305(b)(1)(C) through (E) (USEPA 1997). The 2006 Integrated Report guidance states that all states must submit to USEPA a description of the nature and extent of nonpoint source pollution, as well as state-level summaries of causes and sources of impairment to waters (USEPA 2005). The term "probable" to describe sources is specifically noted in Appendix A of the 2006 Integrated

Title: Probable Source(s) Determination	No: SOP 4.1	Page 2 of 7
	Revision 2	
Effective Date: 4/15/2015	Next Revision Date 4/15/2017	

Report Guidance (USEPA 2005). New Mexico's Integrated List includes both cause(s) of impairment and probable source(s) of impairment.

There are usually multiple probable sources listed for any given cause in an impaired water body or assessment unit (AU). This is because the probable sources list is intended to include any and all activities that are known to occur within the impaired assessment unit, and have the potential to contribute to the identified cause of impairment. It is not intended to single out any particular land owner or land management activity, and has therefore been labeled "probable." Probable sources listed for any particular AU have not been verified to be the only sources of the identified impairment and all probable sources may not be listed.

Probable source information is currently housed in SWQB's Surface water Quality Information Database (SQUID), which is used to generate the Integrated List and associated cause and probable source statistics. USEPA has a standard list of probable sources with definitions that they would prefer states utilize to compile compatible source information from all states in order to generate national statistics (see Attachment 1). More specific information on probable sources of impairment is often provided in individual watershed planning documents (i.e., TMDLs, WBPs, etc.) as they are prepared to address individual causes of impairment by AU.

4.0 Definitions

Probable - Supported by evidence strong enough to establish presumption but not proof

Cause(s) of Impairment - Parameters or constituents that cause non-attainment of designated or existing uses (USEPA 1997).

Probable Source(s) of Impairment - Activities that may contribute pollutants or stressors to a water body (USEPA 1997).

5.0 Equipment

None

6.0 Probable Source Determination (Process Description)

The overall order and approach for identifying probable sources of impairment (Table 1) is as follows:

- Probable Source/Site Condition Class Field Forms will be filled out during rotational watershed surveys and watershed restoration activities by SWQB staff.
- A Public Probable Source Survey is utilized to solicit public input, and is available to submit online (<http://www.nmenv.state.nm.us/swqb/PS/>), as well as at public meetings.
- During development of the biennial draft Integrated List, any newly identified cause(s) of impairment will be assigned a probable source of "Source Unknown" as a starting point.
- Probable sources noted on the most recent Probable Source/Site Condition Class Field Forms, as well as common sources for the particular pollutant, will be used to generate a draft probable source list in subsequent TMDL planning documents. These draft probable source lists will be finalized with watershed group/stakeholder input during the TMDL public meeting and associated comment period.
- The final probable source list in the TMDL will be used to update the subsequent Integrated List.

Title: Probable Source(s) Determination	No: SOP 4.1	Page 3 of 7
	Revision 2	
Effective Date: 4/15/2015	Next Revision Date 4/15/2017	

6.1 Completion of Probable Source(s) & Site Condition Class Field Form

Project Coordinator(s) should fill out a *Probable Source(s) & Site Condition Class Field Form (Field Form)* for each AU in the survey after reconnaissance during the 1st or 2nd site visit. The forms should be reviewed and revised by the survey lead(s) at the end of the survey. Finally, all survey forms should be reviewed by Watershed Protection staff with knowledge of the particular watershed as a QA measure. This review may include soliciting input from watershed groups as appropriate. The completed forms will be placed in the administrative record upon completion of the survey. Copies will also be placed in the appropriate survey binder along with all other pertinent survey forms.

Completion of the *Field Form* is based on a qualitative visual analysis combined with knowledge of land management activities in the contributing watershed that have the potential to negatively impact water quality. The goal of this qualitative evaluation is to determine the potential for a particular land management activity to impact water quality at the station where water quality data are being collected. As such, the evaluation only considers those activities within the AU upstream of the station. The evaluation uses a qualitative rating based on proximity (distance from site – e.g., at site, within 1 km or within the AU) or intensity (low, moderate, high). See the legend provided on the *Field Form* for details on scoring. GIS land use coverage or satellite imagery may be used to supplement or confirm staff observation in the field.

6.2 Incorporation of Probable Source lists into TMDLs and the 303d/305b Integrated List

During development of the Integrated List, any newly identified cause of impairment will be assigned a probable source of “Source Unknown.” Existing causes of impairment that were confirmed during a given survey will retain their probable source list as a starting point.

The probable source(s) of impairment will be improved upon during the TMDL process. Probable source(s) identified on all *Field Forms* found in the administrative record will be reviewed and used as a starting point for the development of a draft list of the probable sources of impairment in the TMDL. If multiple *Field Forms* exist for an AU, the most recent survey will be emphasized in development of a draft list. Probable Sources that scored either a (3) or a (5) for the impaired AU will be included unless those sources identified on the *Field Forms* are reasonably expected not to contribute to a specific impairment (e.g. stream channel incision for an *E. coli* impairment). In addition, common sources for the particular pollutant not identified on the *Field Forms* but known to occur within the AU may be added to the draft probable source list at the discretion of the TMDL writer or based on other staff/public input. Public input of probable source received either before the TMDL or during the TMDL process will be reviewed and incorporated as appropriate. Public input may be field verified if necessary to confirm. The draft probable source lists will be finalized with public as well as targeted watershed group/stakeholder input during the TMDL public comment period and meeting.

Following WQCC and EPA approval of the TMDL, the final probable source lists in the TMDL will be used to update the subsequent Integrated List. During development of the Integrated List, the TMDL and Assessment Team Leader will notify the Assessment Coordinator with a spreadsheet of changes to the final probable source lists for all TMDLs that have been approved since the previous listing cycle.

6.3 Public Comment and Input

The opportunity for public comment and input on probable source(s) of impairment is provided at multiple times during the process of collecting water quality data, performing water quality assessment, and writing TMDLs. These opportunities are described in Figure 1 below and include but are not limited to the following:

Title: Probable Source(s) Determination	No: SOP 4.1	Page 4 of 7
	Revision 2	
Effective Date: 4/15/2015	Next Revision Date 4/15/2017	

- Public comment at watershed survey meetings, TMDL public meeting or at any time through the SWQB website (<http://www.nmenv.state.nm.us/swqb/PS/>),
- Public comment on probable sources listed in TMDL planning documents, or
- Public comment on probable sources listed in the Integrated List.

Table 1. Individual steps in the development of probable source(s) of impairment

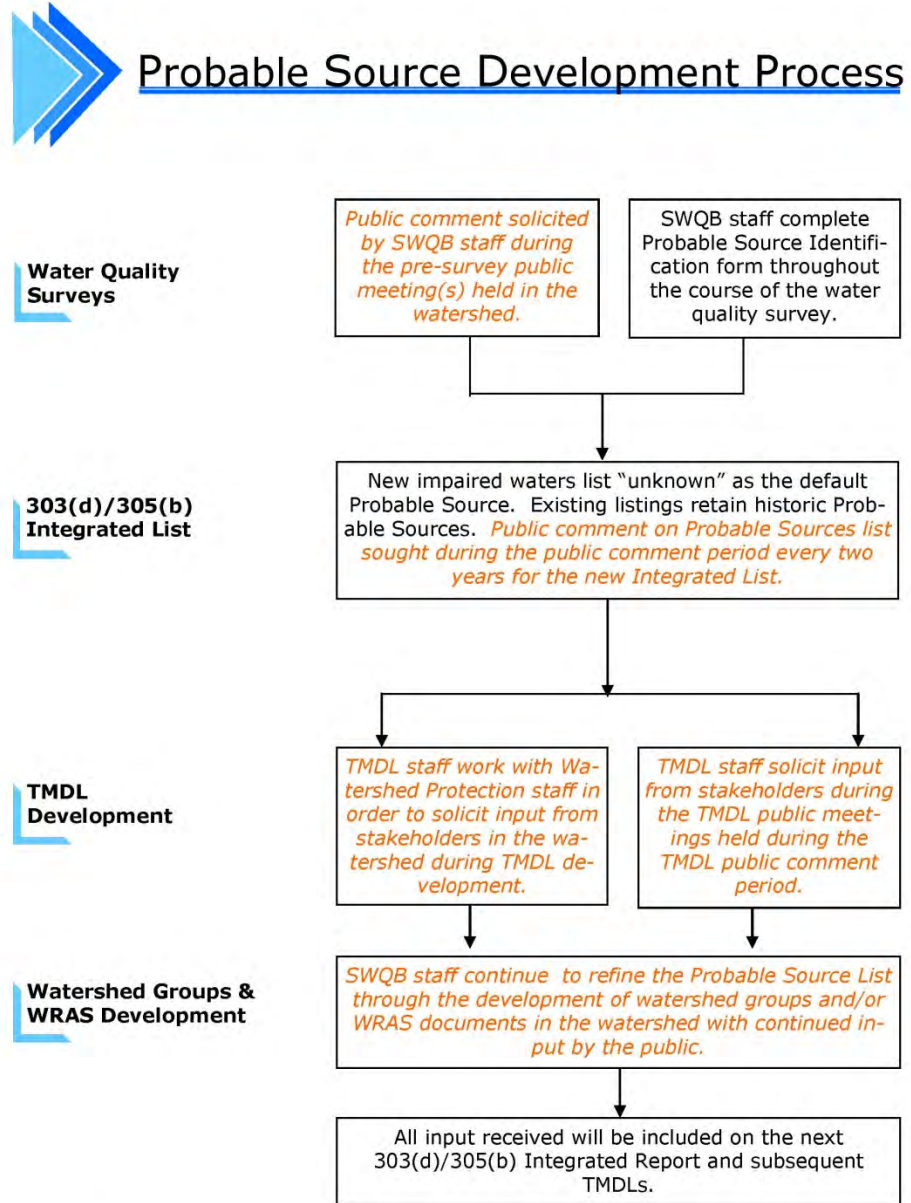
STEPS	RESPONSIBLE PARTY	WHERE HOUSED
<p><u>ROTATIONAL WATERSHED SURVEY:</u> Provide public with Probable Source survey form at pre-survey public meetings and make survey form available on-line</p>	<p>MASS Project Coordinator (s) and TMDL lead</p>	<p>Original in survey binder, scanned copy sent to AC for electronic Administrative Record by AU</p>
<p><u>IN FIELD:</u> Fill out Probable Source/Site Condition Class Field Forms during rotational watershed surveys</p>	<p>MASS Project Coordinator (s) and review by WPS staff</p>	<p>Original in survey binder, scanned copy sent to AC for electronic Administrative Record by AU</p>
<p><u>LISTING PROCESS:</u> Note new impairment listings on Integrated List as "Source Unknown"; retain previous on confirmed impairments.</p>	<p>Assessment Coordinator</p>	<p>in-house SQUID database</p>
<p><u>TMDL PROCESS:</u> Generate draft Probable Source List and Linkages section in the TMDL using Probable Source/Site Condition Class Field Forms as well as common sources per pollutant(s)</p>	<p>TMDL lead</p>	<p>Draft TMDL</p>
<p><u>TMDL PROCESS:</u> Finalize draft Probable Source List and Linkages section with watershed group input</p>	<p>WPS staff and TMDL lead</p>	<p>Draft TMDL</p>
<p><u>TMDL PROCESS:</u> Finalize Probable Source List and Linkages section with input from public meetings</p>	<p>TMDL lead</p>	<p>Final TMDL</p>
<p><u>WPS WBP PROCESS:</u> Fill out Probable Source/Site Condition Class Field Forms during watershed restoration planning or field work; provide watershed group with Probable Source survey forms and make survey form available on-line</p>	<p>WPS project lead</p>	<p>Original to AC for electronic Administrative Record by AU</p>
<p><u>LISTING PROCESS:</u> Update</p>	<p>Assessment Coordinator</p>	<p>in-house SQUID</p>

Title: Probable Source(s) Determination	No: SOP 4.1	Page 5 of 7
	Revision 2	
Effective Date: 4/15/2015	Next Revision Date 4/15/2017	

probable source list for impairments database
with final TMDL source lists for
upcoming listing cycle. If no TMDL in
place, continue to note as "Source
Unknown" or retain previous list for
confirmed impairments.

MASS – Monitoring, Assessment, and Standards Section; TMDL – Total Maximum Daily Load;
AC – Assessment Coordinator; AU – assessment unit; WPS – Watershed Protection Section;
WBP – Watershed Based Plan

Figure 1. Probable Source Development Process and Public Participation Flowchart



Title: Probable Source(s) Determination	No: SOP 4.1	Page 7 of 7
	Revision 2	
Effective Date: 4/15/2015	Next Revision Date 4/15/2017	

7.0 Quality Assurance / Quality Control Activities

As described above, all *Probable Source(s) & Site Condition Class Field Forms*, which are completed by watershed Project Coordinator(s) are reviewed by Watershed Protection staff that are knowledgeable about the watershed(s) in question. In addition, the public participation process for both TMDLs and the Integrated List provides opportunities for review and comment by stakeholders, including entities and individuals living and working in particular watersheds who provide specific information regarding probable sources of impairment that may have not been identified by SWQB.

8.0 Forms

- Attachment #1 - USEPA List of Probable Sources
- Public Probable Source Survey
- Probable Source(s) & Site Condition Class Field Form

9.0 Revision History

Revision 2 – April 2015 – The “Where Housed” column in Table 1 was updated to reflect the continuing movement towards an electronic Administrative Record. Section 6.2 was revised to clarify SQUID update roles during development of the Integrated List.

Revision 1 – March 2013 – The word “probable” was dropped from the phrase “probable cause” because there are quantitative procedures (i.e., SWQB’s Assessment Protocols) to determine causes of impairment. All referenced to the Assessment Database (ADB) were changed to the Surface water QUality Information Database (SQUID), which is a result of a database merger. Public Probable Source Survey form was updated to better match the scoring in the staff form.

10.0 References

USEPA. 1997. Guidelines for preparation of the comprehensive state water quality assessments (305(b) reports) and electronic uptakes. EPA-841-B-97-002A. Washington, D.C.

USEPA. 2005 Guidance for 2006 assessment, listing and reporting requirements pursuant to sections 303(d), 305(b), and 314 of the Clean Water Act. Watershed Branch, Assessment and Watershed Protection Division, Office of Wetlands, Oceans, and Watersheds. Washington, D.C.

Title: Bacteriological Sampling and Analysis	No: SOP 9.1	Page 1 of 6
Effective Date: 3/01/2013	Revision 1	
	Next Revision Date 3/01/2015	

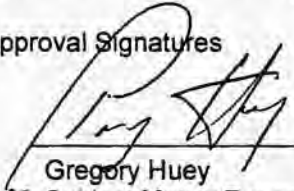
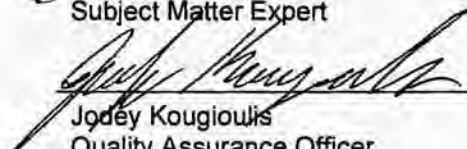
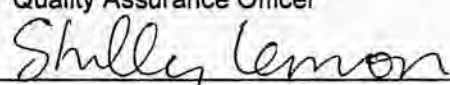
New Mexico Environment Department
Surface Water Quality Bureau

Standard Operating Procedure

for

Bacteriological Sampling and Analysis

Approval Signatures

 <hr/> Gregory Huey Subject Matter Expert	<u>4/3/13</u> Date
 <hr/> Jodey Kougioulis Quality Assurance Officer	<u>4/3/13</u> Date
 <hr/> Shelly Lemon Acting Program Manager	<u>4-3-2013</u> Date

1.0 Purpose and Scope

This procedure describes the collection and analysis of ambient water and wastewater samples for total coliform and *Escherichia coli* (*E. coli*) bacteria using the IDEXX Laboratories, Inc. Colilert® method for both water quality standards assessment and permit compliance monitoring purposes.

2.0 Personnel Responsibilities

All personnel who collect or process samples for total coliform or *E. coli* analysis are responsible for implementing this procedure.

One individual within SWQB is designated as the "Bacteriological Equipment Manager." The manager is responsible for keeping the equipment used for bacteriological sampling in working order and ready for use. The manager is responsible for verifying that the dates on the lots have not exceeded their expiration dates.

3.0 Background and Precautions

The SWQB and the New Mexico State Laboratory Division (SLD) both use the IDEXX Laboratories, Inc. Colilert® procedures for enumeration of total coliform and *E. coli* by the most probable number (MPN) method. The procedure is explained in the Colilert® reagent snap packs and in *Standard Methods*, Part 9000 (APHA 2005). Background on the MPN method can be found in Oblinger and J. A. Koburger (1975).

Because *E. coli* can be an indicator of pathogens harmful to humans, precautions should be taken when sampling potentially contaminated water. Avoid accidental ingestion, contact with mucous membranes, eyes and skin to the extent possible, especially areas with cuts and abrasions. Wear splash protection and eye protection (i.e., goggles, gloves, and aprons) while working with bacteriological samples. Wash hands with soap and water or disinfecting hand cleaner as soon as possible after collecting samples and working with equipment. Hepatitis vaccinations are available for staff, if desired. Equipment exposed to potentially contaminated water should be cleaned using a dilute (1:10) bleach solution and rinsed in clean

Title: Bacteriological Sampling and Analysis	No: SOP 9.1	Page 2 of 6
	Revision 1	
Effective Date: 3/01/2013	Next Revision Date 3/01/2015	

water if possible. In the field, at a minimum, equipment should be thoroughly rinsed in clean water (e.g. the stream receiving the effluent above the point of discharge) immediately after use.

4.0 Definitions

None.

5.0 Equipment and Supplies

Equipment

There are two primary sets of IDEXX equipment available through the SWQB laboratory: a lab kit and a field kit.

Lab Kit:

- IDEXX 110V Incubator
- Fluorescent UV lamp, 6-watt, 365 nm
- IDEXX Quanti-Tray® sealer, “lab”
- IDEXX Quanti-Tray®/2000 rubber insert

Field Kit:

- Portable Incubator with DC power plug for vehicle operation
- IDEXX 6 watt fluorescent UV lamp, 365 nm
- IDEXX Quanti-Tray® sealer, “field”
- IDEXX Quanti-Tray®/2000 rubber insert
- 12 V Deep Cycle or Regular Automotive Starting Battery
- AC/DC inverter to power the portable incubator via a typical 110V outlet
- DC/AC 800 watt inverter and: +/- alligator clips to allow connection of sealer to vehicle alternator
- DC/DC adapter allowing vehicle power port conversion to +/- alligator clips for deep cycle battery power

Supplies

Materials for Samples Processed by SWQB

- IDEXX Colilert® Reagent “Snap Packs” for 24-28 hour incubation
- IDEXX Colilert®-18 Reagent “Snap Packs” for 18-22 hour incubation
- IDEXX Quanti-Tray®/2000 bacterial enumeration trays
- IDEXX Shrink Banded Sample Bottles

Materials for SWQB QC

- Colilert® and Colilert®-18 Quanti-Tray®/2000 Comparator

Materials for Samples processed by SLD

- 125 ml, sterile polypropylene sample bottles (available from SLD)
- **Note:** SLD does not accept samples in IDEXX bottles
- “Do not tamper” seals for lids (available from SLD)
- Submittal form (download from <http://www.sld.state.nm.us/Documents/waterform.pdf>)

The Environmental Microbiology section at SLD should be consulted (505-383-9129) at least 2-3 weeks in advance of the proposed sampling date to assure availability of media and incubator space.

6.0 Step-by-step Process Description

Title: Bacteriological Sampling and Analysis	No: SOP 9.1	Page 3 of 6
	Revision 1	
Effective Date: 3/01/2013	Next Revision Date 3/01/2015	

***E. coli* sample collection**

Before going in the field, fill out a “Bacteria Record Sheet” (attachment to this SOP) and use this form to record all requested information for each sample.

Collect both routine and quality control (blank) samples. In most cases, collect one set of quality control samples with each group of samples collected on consecutive days within one week. Generally, no less than 5% of the samples should be quality control samples. Prepare the field blank using distilled water and process quality control samples at the same as a routine sample.

Collect samples in sterile bottles. Do not rinse sample bottles before use and do not remove the caps or shrink wrap until immediately before sampling. For compliance sampling, the samples must be collected directly into the sample bottles. Otherwise, collect samples directly into the sample bottles whenever possible. If it is necessary to transfer to the sample bottle from another vessel, note this in the comment field when the sampling event is entered into NMEDAS.

Verify that the bottle is properly labeled and remove and dispose of the shrink band or sealing tape. In a stream, it is preferable to sample where the stream is flowing, well mixed and more than 6 inches deep. Stand downstream of the sampling bottle to avoid getting streambed sediment in the sample. In a lake or reservoir, collect the samples from the side of a boat at the sampling station or from the water’s edge.

Wear disposable gloves if you are sampling effluent water or are working downstream of a wastewater treatment plant. Uncap the sample bottle. Holding the cap in one hand and the bottle in the other, submerge the bottle in as upright a position as possible to retain the sodium thiosulfate chlorine neutralizer. Collect a sample from the water column, minimizing the amount of surface material entering the bottle. Attempt to fill the bottle just to the 100-mL line. If the bottle is filled above the 100-mL line, immediately decant excess water. Carefully replace the cap.

After collecting the sample, ice or refrigerate it at a temperature less than 10°C. Use insulated containers to assure proper maintenance of storage temperature. Ensure that sample vessels are not totally immersed in water during transit.

Samples for Submittal to SLD

Use 125 ml, sterile polypropylene sample bottles containing sodium thiosulfate (available from SLD).

Note: SLD will not accept samples in IDEXX bottles. Contact SLD in advance of delivery of the samples to verify that the samples can be processed within the required time.

Note the temperature of the samples when they are submitted to SLD receiving. Fill out one submittal form for each sample and apply “Do Not Tamper” seals to bottles before submitting. Maximum transport time is 6 hrs from time of collection until time of delivery at SLD, and 8 hours from collection to the start of incubation.

Samples for IDEXX processing

Use IDEXX sample bottles (120-mL shrink-banded containers with sodium thiosulfate, IDEXX Part Number WV120SBST).

Processing IDEXX Samples in the SWQB Laboratory



Figure 1. IDEXX Bottle

1. Remove the samples from the cooler approximately 30 minutes prior to arriving at the processing site and allow to warm to ambient temperature. Add the IDEXX Colilert® reagent packet. Although the reagent will dissolve in chilled samples, it dissolves better if the samples are at room temperature.

Title: Bacteriological Sampling and Analysis	No: SOP 9.1	Page 4 of 6
	Revision 1	
Effective Date: 3/01/2013	Next Revision Date 3/01/2015	

2. Switch on the Quanti-Tray® Sealer and allow it to warm up until the green light on the cover comes on. Warm up times greater than 14 minutes improve sealing.
3. Fill out a “Bacteria Record Sheet” (attachment to this SOP) and use this form to record all requested information for each sample.
4. As appropriate based on read-time, select either Colilert®-18 (18-22 hr incubation) or Colilert®-24 (24 - 28 hr incubation) reagent.
5. Add one reagent packet directly to each sample bottle. Invert gently at 2-3 min intervals until completely dissolved.
6. Pour the solution into a Quanti-Tray®2000 incubation tray while holding it vertically. Gently tap the incubation tray to dislodge any bubbles that may be trapped in the cells.
7. Place the tray into the red rubber frame and insert the frame and tray into the bay in the front of the sealer.
8. Carefully ease the frame and tray forward until the sealer activates and feeds the tray automatically. The sealer may occasionally jam while processing the tray. If this occurs, press the reverse button on the cover and the track will reverse, depositing the frame on the bay. Wait until the green light activates again and repeat the loading process. The tray will be deposited on the counter behind the sealer.
9. Record initial incubator temperature on the Bacteria Record Sheet.
10. Start the incubation within 8 hours of sample collection. Place the sealed tray into the 35°C incubator and incubate 18-22 hrs for Colilert®-18 reagent or 24-28 hrs for Colilert® reagent.
11. After the appropriate incubation period, record the final incubator temperature on the Bacteria Record Sheet. Remove the sealed tray and record the incubation time. Do not read trays that have been incubated beyond the appropriate incubation time, as they may produce false positives.
12. Enumerate total coliform bacteria by counting the number of large and small cells that turn yellow after incubation. Enumerate *E. coli* by counting the number of large and small cells that fluoresce under UV illumination with the black light. For both total coliform and *E. coli*, the Colilert® and Colilert®-18 Quanti-Tray®/2000 Comparator should be used to verify positive or negative cells. The large window at the top of the tray should be counted as the 49th large cell.
13. Enter the sample date, method, sample ID (RID#), and the number of positive large and small cells counted into the IDEXX MPN generator (P:\SWQB PUBLIC\MAS Core Documents\IDEXX MPN Generator\IDEXXMPN.exe – be sure to enter the “Default Directory to Save Files” under “options” menu to record data). Press calculate and then log to record the mpn/100 ml and the upper and lower boundaries of the 95% confidence interval. *Record QA sample results (including zero) the same as routine results (MPN expressed as cfu/100 ml and 95% upper and lower confidence limits).*
14. Transfer IDEXX log file to the Bacteria Database Upload Form (attachment to this SOP) and enter additional data, as recorded on the Bacteria Record Sheet. Confirm that there are no data QA issues and then convert data file to csv for upload to NMEDAS database. Additional instructions and details are provided on the Bacteria Database Upload Form.

Title: Bacteriological Sampling and Analysis	No: SOP 9.1	Page 5 of 6
	Revision 1	
Effective Date: 3/01/2013	Next Revision Date 3/01/2015	

Processing IDEXX Samples in the Field

A field kit has been assembled for IDEXX sample processing in the field. Procedures are the same as for laboratory processing, however a 12 volt incubator and adaptors and voltage converters to operate the sealer off the electrical system of a vehicle are available. There is a checkout sheet for the field kit in the SWQB public folders: [SWQB PUBLIC\Sonde&Equipment Checkout](#). Use this sheet when taking the kit from the building.

Before leaving on a sampling run, it is advisable to test all field kit components to ensure that they are all working and present.

If it is necessary to seal Quanti-Trays in the field, the IDEXX sealer may be powered by the vehicle alternator.

To operate the 110V sealer,

power must be converted from the 12V supplied by the vehicle alternator, and the vehicle must be running to supply sufficient amperage. A DC/AC 800 watt converter is used for this power conversion. To use the 110V sealer:

1. Clamp the alligator clips on the leads to the converter to the respective terminals on the vehicle battery.
2. Plug the sealer into the converter.
3. Start the vehicle.
4. Turn the converter on.
5. Turn the sealer on.

Follow procedures 1-8 under SWQB laboratory processing.

Use the portable DC incubators for field incubation. These are supplied with a power cord that allows them to be plugged into a vehicle's cigarette lighter. However, they draw sufficient amperage to drain the vehicle battery if the vehicle is not running. There is also an AC/DC converter that converts 110V AC to 12V DC allowing the incubator to be powered by a standard home 3-prong electric outlet for use in a hotel room or field office. The power cord for the Thermotote[®] model can be inserted two ways: one orientation will heat the incubator (red lamp lights) and the other will cool it (green lamp lights).

To incubate the samples, follow steps 9-11 under SWQB laboratory processing.

It may be necessary to enumerate Quanti-Trays in the field. Follow steps 12 and 13 under SWQB laboratory processing. The biggest challenge to this task is finding a dark place to discern which cells fluoresce. Service station washrooms, WWTP laboratories and SWQB field offices are often used for this purpose.

Storage and Disposal of Used Quanti-Trays

Following the sample incubation period, Quanti-Trays are considered a bacteriological biohazard and must be handled and disposed of accordingly. Trays collected in the field must be stored in a red or

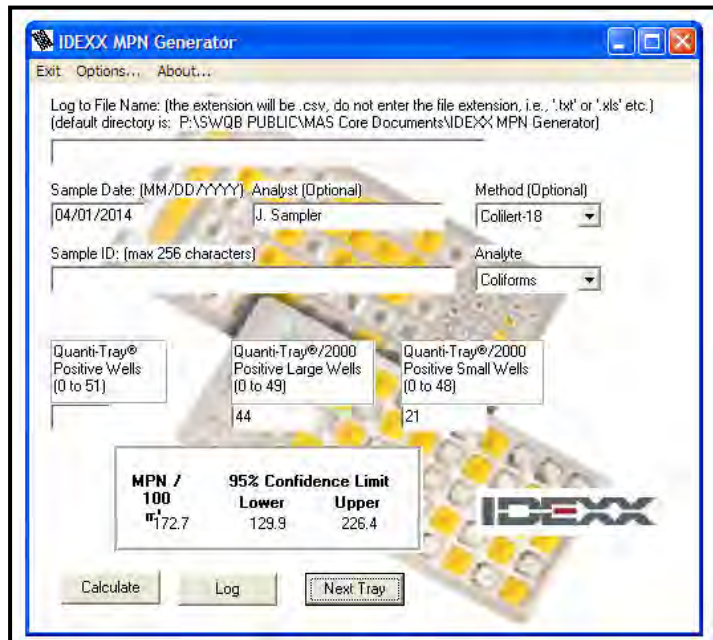


Figure 2. IDEXX MPN Generator Screenshot

Title: Bacteriological Sampling and Analysis	No: SOP 9.1	Page 6 of 6
	Revision 1	
Effective Date: 3/01/2013	Next Revision Date 3/01/2015	

orange “biohazard” bag inside a rigid container (e.g., small cooler, cardboard box, etc) and returned to the Runnels Building laboratory for storage. Used Quanti-Trays that are generated in the field or in the lab must be stored in an appropriate containment area until they can be properly disposed. A red bagged storage container is kept in the Runnels laboratory walk-in cooler and has been designated for staging of all used Quanti-Trays. This container is periodically emptied by Stericycle for proper disposal. Consult the *SWQB Chemical Hygiene Plan* for more information on handling and storage of used Quanti-Trays, as necessary.

Quality Assurance

If the samples are analyzed by SLD, the Laboratory should provide information to verify that the incubation temperature was maintained within the method-specified range, that the incubation began within 2 hours after sample receipt, and that the incubation time was within that required by the method.

If the samples were processed using SWQB equipment, the following sample rejection rules apply:

If both the temperature at the initiation and conclusion of the incubation were within $35 \pm 0.5^\circ\text{C}$, the data is not flagged (i.e. no qualifier code) . If either temperature is less than 34.5°C , the data is rejected (qualifier code = Er). If either temperature is between 35.5 and 38°C , the data is flagged and may only be used as supporting evidence for assessments (qualifier code = Ea). If either temperature is greater than 38°C , the data is rejected (qualifier code = Er).

The sealed trays should be read within the period indicated by the reagent. If trays are read before the nominal incubation time or more than 4 hours after, the data is rejected.

If the blank shows a value greater than the blank validation criteria value, then all of the results since the last in-range sample are rejected. This is summarized below:

	Validation Criteria	Validation Codes and Action	
Blank Sample	<1 cfu/100 mL	<1 cfu/100 mL, no code	≥ 1 cfu/100mL RB1, reject results

7.0 Related Forms

Bacteria Record Sheet
Bacteria Database Upload Form

8.0 Revision History

Revision 1 – 3/01/2013 – added information on the precautions one should take when working with potentially contaminated water and on the proper storage and disposal of used Quanti-Trays to be consistent with *SWQB’s Chemical Hygiene Plan*.

Original – 3/21/2011.

9.0 References

Oblinger, J.L. and J.A.Koburger (1975) Understanding and Teaching the Most Probable Number Technique. *J. Milk Food Technol.* 38(9): 540-545.

American Public Health Association (2005) Standard methods for the examination of water and wastewater. 21st edition. American Public Health Association