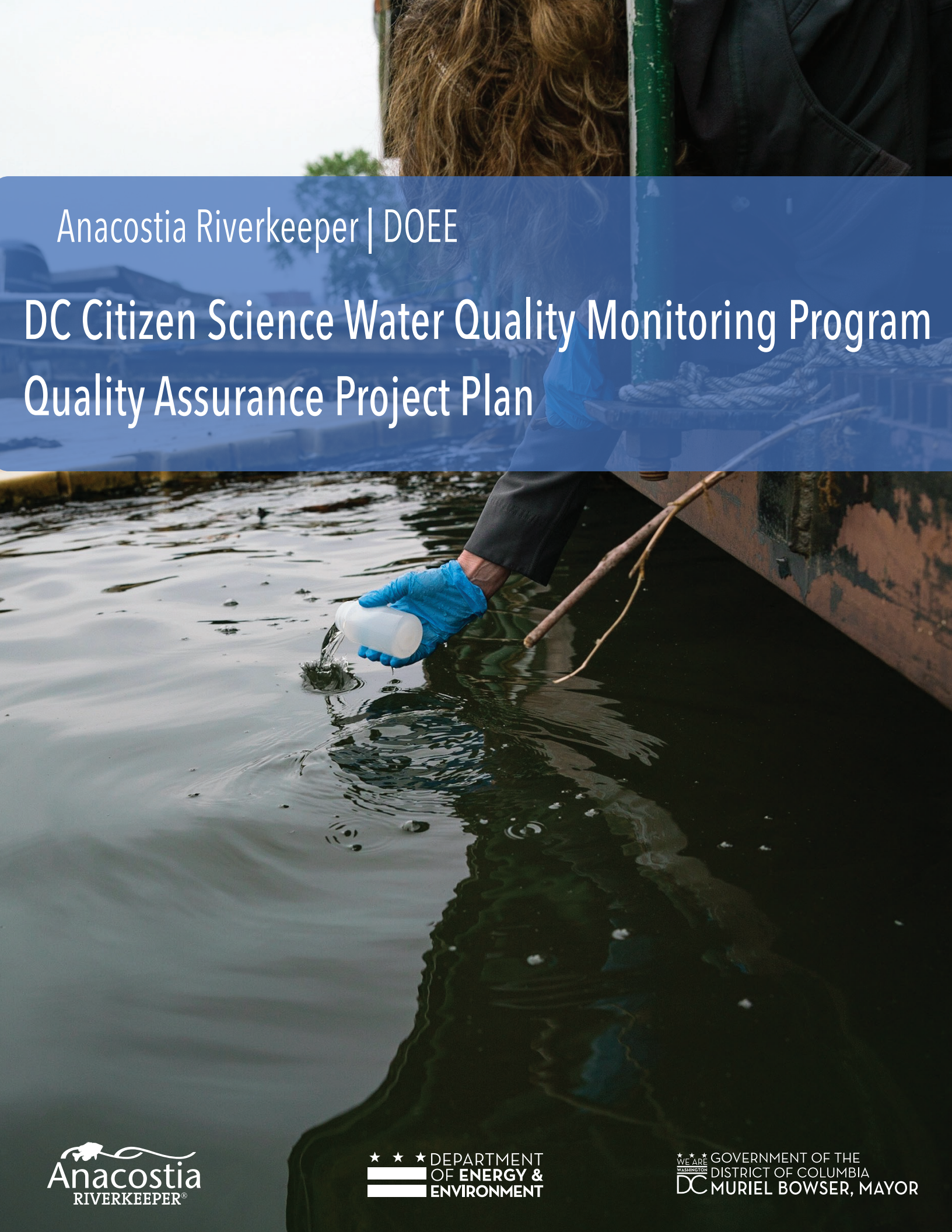

Anacostia Riverkeeper | DOEE

DC Citizen Science Water Quality Monitoring Program Quality Assurance Project Plan

Anacostia RIVERKEEPER®

DEPARTMENT OF ENERGY & ENVIRONMENT

GOVERNMENT OF THE DISTRICT OF COLUMBIA
MURIEL BOWSER, MAYOR

QUALITY ASSURANCE PROJECT PLAN

Volunteer Water Quality Monitoring in District of Columbia Waters

Prepared for:

Department of Energy and Environment, Water Quality Division
Grant#: RFA 2018-1805-WQD-VWQM Project #1

Prepared by:

Anacostia Riverkeeper

Alliance for the Chesapeake Bay

Potomac Riverkeeper Network

Rock Creek Conservancy

Audubon Naturalist Society

May 1, 2019

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Section A – Program Management Elements

A1. Title and Approval Page

Project Name: Volunteer Water Quality Monitoring in District of Columbia Waters
Responsible Agency: Anacostia Riverkeeper
Date: May 1, 2019
Revision No.: 3
Updated: April 21, 2021

Name: Suzy Kelly

Title and Organization: Acting President, Anacostia Riverkeeper

Signature and Date: 4/16/2021

Name: Jeanne Braha

Title and Organization: Executive Director, Rock Creek Conservancy

Signature and Date: 4/16/2021

Name: Liz Chudoba

Title and Organization: Water Quality Program Manager, Alliance for the Chesapeake Bay

Signature and Date: 4/16/2021

Name: Eliza Cava

Title and Organization: Director of Conservation, Audubon Naturalist Society

Signature and Date: 4/21/2021

Name: Efeturi Oghenekaro

Title and Organization: Environmental Protection Specialist, DOEE

Signature and Date: 05-03-2021

This document has been prepared according to the United States Environmental Protection Agency publications – *Th Volunteer Monitor's Guide to Quality Assurance Project Plans,* EPA 841-B-96-003, 1996*,* available at http://water.epa.gov/type/rsl/monitoring/qappcovr.cfm and *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, 2001, available at http://www.epa.gov/quality/qs-docs/r5-final.pdf

A2. Table of Contents

A3. Distribution List

Table 1. Distribution List for Quality Assurance Project Plan.

Name	Organization	E-mail	Phone
Suzy Kelly Trey Sherard Robert O'Donnell Christine Burns	Anacostia Riverkeeper	suzykelly@anacostiariverkeeper.org Trey@anacostiariverkeeper.org robbie@anacostiariverkeeper.org christine@anacostiariverkeeper.org	202-863-0158 910-200-0788 540-454-0731 215-435-3757
Jeanne Braha John Boland	Rock Creek Conservancy	jbraha@rockcreekconservancy.org jboland@rockcreekconservancy.org	301-579-3105
Liz Chuboda	Alliance for the Chesapeake Bay	lchudoba@allianceforthebay.org	804-793-8785
Eliza Cava Ari Eisenstadt Gregg Trilling	Audubon Naturalist Society	eliza.cava@anshome.org ari.eisenstadt@anshome.org gregg.trilling@anshome.org	301-652-9188 ex22 347-743-1546

A4. Project/Task Organization

A4.1 Project Organization

Anacostia Riverkeeper (ARK) is the lead project manager in this volunteer-based monitoring program that will implement a bacteria monitoring program in the surface waters of the District of Columbia utilizing volunteers. Volunteers and lead personnel from partner organizations will be trained through a citizen-science based training program. Anacostia Riverkeeper has partnered with Rock Creek Conservancy (RCC), Alliance for the Chesapeake Bay (AFB), the Audubon Naturalist Society (ANS), and other organizations or local stakeholder groups, further referred to as "Project Team", to recruit and train volunteers to collect samples and other water quality data during the recreational season (April-September).

Alliance for the Chesapeake Bay, Rock Creek Conservancy and Audubon Naturalist Society will be the lead partners in volunteer training. Anacostia Riverkeeper, Rock Creek Conservancy, and Audubon Naturalist Society will take the lead in and providing support for volunteers to collect water quality samples and proper maintenance of sampling equipment. Rock Creek Conservancy, Audubon Naturalist Society, and ARK will recruit and motivate volunteers for this monitoring program. Anacostia Riverkeeper is the primary partner that tests the collected water quality samples.

Table 2. Roles and Responsibilities in this project.

Team Member	Organization	Responsibilities
Suzy Kelly Acting President	Anacostia Riverkeeper	Schedule and attend planning meetings, prepare and submit quarterly reports and the final report.
Trey Sherard Outreach Coordinator	Anacostia Riverkeeper	Attend planning meetings and training sessions, recruit and manage volunteers, monitor and oversee volunteers' monitoring, manage IDEXX lab-work and other sample processing, receive volunteer samples delivered to ARK offices.
Robbie O'Donnell Program Manager	Anacostia Riverkeeper	Attend planning meetings, project management and logistics, process samples when necessary, monitoring management for Anacostia River sites, upload data to online platforms for dissemination, perform data quality assurance and validation, data management.
Christine Burns Project Coordinator	Anacostia Riverkeeper	Attend planning meetings, process samples, work with ARK personnel on data upload to online platforms for dissemination, receive volunteer samples delivered to ARK offices and/or other designated location, data entry.
Water Quality Associate	Anacostia Riverkeeper	Receive volunteer samples at "satellite office" or ARK offices, process samples, data entry, assist with data upload to online platforms for dissemination, maintain lab space.
Jeanne Braha John Boland	Rock Creek Conservancy	Planning Team, volunteer recruitment and management for selected sites in Rock Creek, ensure weekly monitoring of Rock Creek, assist in sample delivery to ARK offices.
Liz Chudoba	Alliance for the Chesapeake Bay	Planning Team to develop training manual and plan volunteer training, assist with upload to CMC.

Eliza Cava Ari Eisenstadt Gregg Trilling	Audubon Naturalist Society	Planning Team, Volunteer recruitment and management for the Potomac River, conduct volunteer training, ensure weekly monitoring of Potomac sites. Plan and coordinate public outreach activities to educate and engage students and community members in learning about bacteria in DC's waterways.

A4.2 Roles and Responsibilities

Project Manager: Anacostia Riverkeeper

- Manages the Project Team to ensure the Quality Management Plan (QMP), QAPPs, and Quality Assurance (QA) policies are implemented;
- Develops the QMP and annual reviews, and updates the documents as needed. Small changes will be reported to the DOEE in bi-annual reports. When substantial changes that impact the quality system are made to this QAPP, the Project Manager will re-submit the QAPP to DOEE for review and approval;
- Oversees the effective implementation of the QAPPs;
- Ensures that the quality program has adequate resources to accomplish all of the requirements established in the QAPP;
- Schedule and coordinate on-site assessments of ARK volunteer monitors;
- Schedule regular Project Team meetings;
- Coordinate with Project Team the scheduling and carrying out of training sessions; and
- Is responsible for all items listed under Project Team.

QA Management: Anacostia Riverkeeper and Alliance for the Chesapeake Bay, Rock Creek Conservancy, and Audubon Naturalist Society

- Reviews the project QAPPs and provides guidance to the Project Team for effective implementation of the QAPPs;
- Reviews the QA/QC programs, practices, systems, training materials, and performance annually to ensure practices are in accordance with the QMP. Subsequently documents and responds to QA/QC needs and issues;
- Acts as a liaison between the Project Team and the volunteers;
- Assists with QA dispute resolutions (if/when needed); and
- Assesses data management procedures for the monitoring programs and the project database to ensure they meet data quality objectives outlined in the QAPP.

Project Team: Anacostia Riverkeeper, Alliance for the Chesapeake Bay, Rock Creek Conservancy, Audubon Naturalist Society

- Ensures that all monitoring groups adhere to the QMP and approved QAPPs;
- Ensures that all monitoring operations are covered by the appropriate documentation (i.e., SOPs, QAPPs, project plans);
- Develops, reviews, updates, and approves SOPs for monitoring activities;
- Conducts trainings and certifies monitors;

- Continually assesses collected data and monitors performance through data QC, trainings, and re-certifications to identify QA compliance or deficiencies. All QA deficiencies will be properly documented and attempted to be resolved;
- Provide training and guidance to volunteer monitors;
- Attends regular Project Team meetings;
- Complies with findings and recommendations from QA reviews and audits; and
- Resolves disputes regarding quality system requirements, QA/QC procedures, certifications, or corrective actions.

Volunteer Trainers: Anacostia Riverkeeper, Alliance for the Chesapeake Bay, Audubon Naturalist Society

- Conducts trainings and certifies monitors;
- Adheres to the Certified Trainer requirements;
- Adheres to SOP guidelines;
- Maintains annual certification;
- Reports QA issues to Project Team leaders; and
- Complies with QA reviews or audits.

Monitoring Volunteers

- Adheres to SOPs and complies with QAPP guidelines;
- Evaluates and reports QA issues to designated Project Team leaders, regional liaison, or QA Manager as they occur; and
- Maintains certification as outlined in the project's QAPP.
- Maintained and monitored by Anacostia Riverkeeper, Audubon Naturalist Society, and Rock Creek Conservancy.

Data Management: Anacostia Riverkeeper and Alliance for the Chesapeake Bay

- Submit water quality data reports to DOEE weekly;
- Share water quality data with Chesapeake Monitoring Cooperative (CMC);
- Weekly upload of water quality data to Water Reporter; and
- Make water quality data publicly available through Project Team connections.

A5. Problem Definition/Background

As a result of concerted efforts to clean up the Anacostia and Potomac Rivers, our waterways have become visually more appealing primarily due to reductions in floating debris. However, contamination from fecal bacteria released into the water after a heavy rain (including raw sewage and pet and wildlife waste) still poses a significant human health risk. The District of Columbia and its Department of Energy and Environment (DOEE) have demonstrated a commitment to increasing recreational access to District waterways. Thus, timely public notification of the presence of *E. Coli* during the primary recreation season from April through September, via easily downloadable

applications (e.g., Water Reporter) and accessible websites (www.anacostiariverkeeper.org) will support District wide recreational use goals, and public health and safety for citizens who recreate on and in our local waters.

A5.1 Goals and Objectives

The purpose of this monitoring project is to increase understanding of water quality health in areas with large amounts of water recreational activities and to make *E. coli* data directly accessible to the public as well as to produce scientifically defensible datasets that may be used for development of swim advisories in the future. Data collected through this monitoring project may be used to assess the effectiveness of capital investments to reduce bacteria loading into select District tributaries, streams and rivers. Results from weekly sample collections will be reported within 48 hours to DOEE identified staff, and to the public via upload to the Chesapeake Monitoring Cooperative (CMC), distribution on Water Reporter, and ARK website and social media.

A5.2 Data Use

The primary target audiences are: residents and visitors to Washington DC who may recreate in and on its waters; on-water recreational outfitters; marinas; local high school and adult rowing and sailing clubs; canoers and boaters; recreational fishers; park goers whose children and dogs may enter streams and come in direct contact with river water; school age children and volunteers who are interested in participating in training; District government decision makers who may use this data to establish swim advisories; anyone else seeking open-source data on *E. coli* presence in District waterways (through the CMC).

A6. Project Description

A6.1 Project Timeline

Table 3. Sample Work Plan

DATE	Activity	Who Responsible
August	1.Schedule Planning meetings 2.Hold Planning meetings	ARK ARK, ANS, RCC, AFB
Sept	Sample once at each site	ARK, RCC, ANS
Oct	Submit Quarterly Report	ARK

Sept - Jan	Planning Meetings: 1. Develop Training Program 2. Begin Volunteer Recruitment 3. QAPP 4. One sample run in September (2018 only) 5. Share results with DOEE	 1. ANS, Alliance for Bay, ARK 2. ARK, RCC, ANS 3. ARK 4. ARK, ANS, RCC, AFB 5. ARK
Jan	Submit Quarterly Report	ARK
Aug - Jan	1. Develop parameters of Recreational Use Survey (RUS)	ALL
Jan - Apr	Recruit Volunteers Volunteer training sessions: 1. Promote Training Events 2. Lead 2 – 3 Training Events	ALL ALL RCC, ANS, Alliance for Bay
Apr	Submit Quarterly Report	ARK
May - Sept	1. Conduct RUS	Volunteers overseen by ARK, ANS, RCC
July	Submit Quarterly Report	ARK

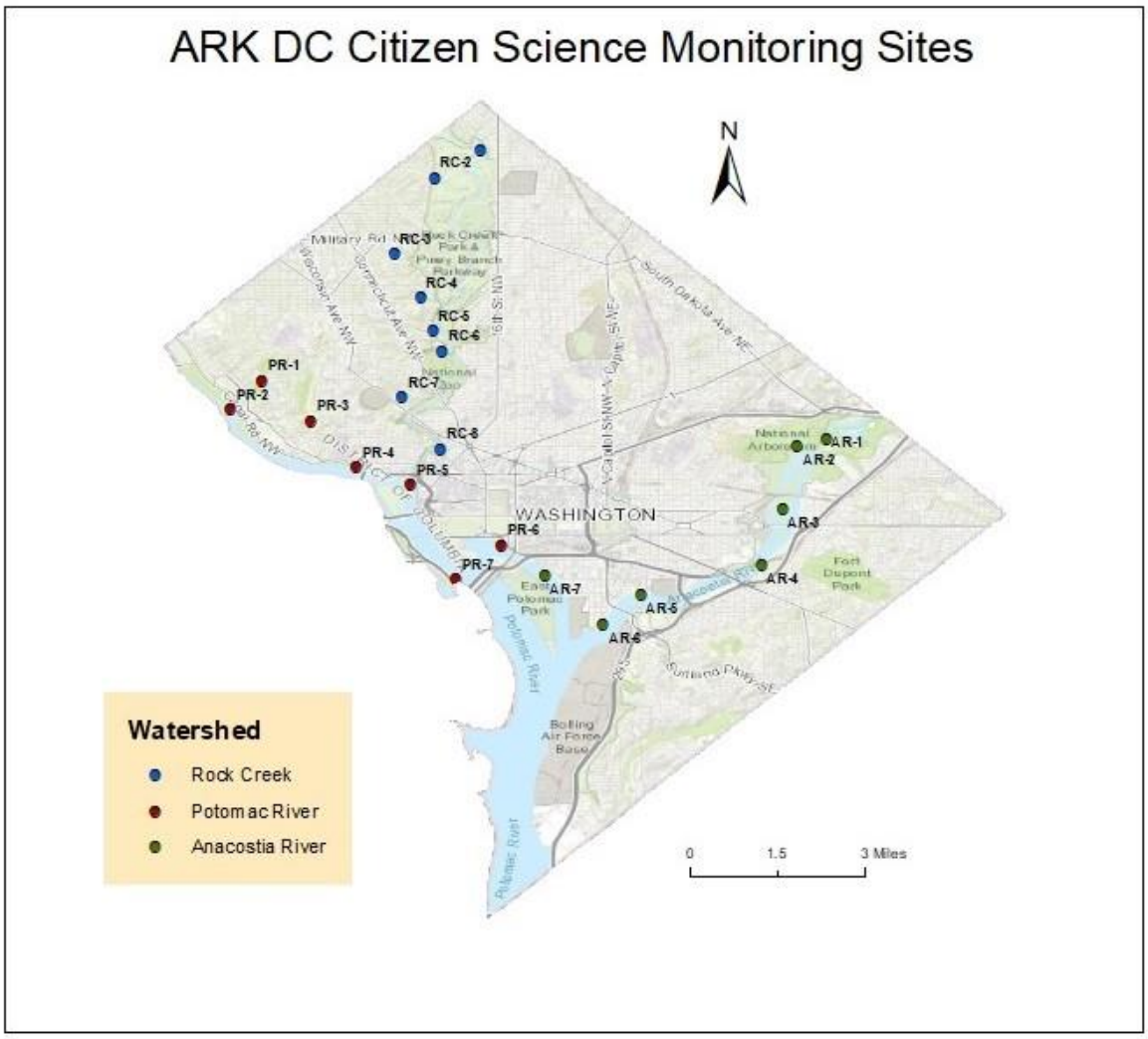
Weekly May - Sept	1. Collect Samples 2. Upload to CMC 3. Report out on Water Reporter 3. Share with DOEE 4. Conduct Recreational Use Survey	Volunteers Alliance for Bay ARK ARK Volunteers
Sept	Report Results of RUS	ARK
Oct	Submit Final Report	ARK

A6.2 Site Selection

Sites will be selected based on several criteria including: ease of public access to the waterway (not only for recreants, but also for volunteers collecting water samples), what is upstream, and areas of high public recreation. Considerations to take into account are tributaries, commercial industries of interest, dog parks, parking lots, recent development, installation of stormwater controls, or other factors that will influence the sample. Also sites already being sampled by the local stormwater divisions will be considered as to not duplicate testing efforts. All sites selected will be tagged with latitude and longitude coordinates to ensure samples are collected from the same location each time, eliminating the possibility of sampling site errors when several volunteers rotate through the same location. In addition, special consideration will be made to sites that have been designated as impaired by DOEE in its 2015 Annual Report to EPA (ie. DOEE reported that Pinehurst Branch, Broad Branch, Soapstone Creek, Melvin Hazen Valley Branch, Normanstone Creek, and other tributaries of Rock Creek are impaired for *E.Coli*.).

A final list of sample locations and their descriptions along with GPS coordinates can be found in Appendix A. A map is included in Figure 1.

Figure 1. Sampling location Map



A6.3 Water Quality Parameters

The primary water quality parameter for this monitoring project is a type of bacteria known as *E. coli*. This type of bacteria is a common representative water quality parameter for human health in waters that have been designated recreational. The EPA along with State water regulatory agencies have set water quality standards for this parameter to ensure a safe environment for recreation through water contact. The level of *E. coli* bacteria is also used to assess the safety of a beach or other water access points. Other water quality parameters (pH, temperature, turbidity) will also be assessed. Temperature and pH will be measured in-situ while bacteria and turbidity will be measured in-lab by Anacostia Riverkeeper.

The techniques used to measure these parameters are performed with accessible and affordable equipment, making the process feasible for citizen and nontraditional monitoring groups. The parameters to be analyzed and the equipment to be used are found in Appendix B.

A6.4 Data Management

Results will be reported within 24 hours of analysis to: DOEE; uploaded on the CMC; and reported to the public on Water Reporter, and Anacostia Riverkeeper's website.

A7. Data Quality Objectives for Measurement Data

A7.1 Data Precision, Accuracy and Measurement Range

The Project Team will train the volunteer monitors how to properly collect a water sample, collect basic water quality information at the site and the use of "chain-of-custody" for transport of samples to the lab. Each volunteer monitor will be provided with a copy of the *Volunteer Training Manual* and a simplified version of the sample collection Standard Operating Procedures (SOPs). Routine field checks will be conducted by the Project Team leads to verify the SOPs are being followed by each volunteer monitor. ARK staff will additionally maintain all lab records and results (e.g., bench sheets, log books, lab notes) and conduct monthly audits of lab procedures to ensure data quality and representativeness.

A7.2 Representativeness

A7.2.1 Selection of Sampling Sites

The volunteer monitors will be grouped into three different sample regions in the DC area – Potomac River, Anacostia River and Rock Creek. The list of samples sites can be found in Appendix A and a map is included in Figure 1. Based on the geographical position of the sample sites, the three different regions may help in a greater efficiency of delivering water samples in a timely manner to the lab for testing. The goal is to produce a quick turnaround of water samples to bacteria results.

A7.2.2 Sample Collection

Sample data shall be representative of the actual conditions or concentrations present in the stream at that point in time. Sample collection, preservation, and handling methods are factors that directly affect field sample representativeness. Monitors will collect water samples from the bank-side portion of the selected waterbody with an attempt to get as close to mid-stream as is possible while ensuring safe monitoring is practiced. Water samples will be collected using bottles appropriate for the parameter being measured. Sample bottles for turbidity will be rinsed three times, and swiped vertically through the water column, in order to collect a single sample that is representative of the conditions in the stream at that particular location and time. Bacterial samples will be collected by simple methodology but without any rinsing of sample bottles due to the presence of preservatives in designated bacterial sample bottles. During sample collection and analysis, monitors will follow prescribed methods and QA procedures to ensure representative data are collected. These techniques will ensure that the minimum standards of field representativeness are met.

A7.2.3 Volunteer Sample Site(s)

The number of sites each volunteer or group of volunteers will collect samples from, will be based on the number of volunteers available. Collectively, the Team organizations bring hundreds of already engaged citizen volunteers to the project. Additionally, each Team group has established relationships with established water sport clubs, outfitters, and marinas, whose members are out on the water almost daily during the season and who are very interested in learning about water quality and how to recreate safely on the water. Groups already interested in volunteer training include Friends of Kingman Island, Friends of Pope Branch, Capital Yacht Club, DC Sail, Community Boat House, Historic Anacostia Boating Association, Capital SUP, Washington Canoe Club, Thompson's Boat House, Audubon Naturalist Society, Rock Creek Conservancy, Friends of Dumbarton Oaks, Whitman Crew Boosters, and Friends of Kenilworth Aquatic Gardens. It is the goal of the Project Team and DOEE to ensure that volunteers from all DC wards are included in sampling efforts to include the widest and most diverse pool of volunteers possible.

A7.2.4 Sampling Timelines

All routine sampling will be collected on a Wednesday morning (Thursday alternate) collection schedule, excluding holidays, to allow for the most flexibility in sampling and to account for potential week-to-week weather conflicts (i.e., rain events). Volunteers will collect and deliver the sample from their respective station every week, either on a designated Wednesday or Thursday. Samples will be delivered to the Anacostia Riverkeeper Lab between the hours of 8:00AM – 12:00PM. In the case that a volunteer and the volunteer substitute are both unavailable for collection and delivery, the volunteer will inform the Team member covering that jurisdiction who will then be responsible for collecting the sample and delivering to the lab for testing and reporting. Samples must be turned into the lab within 6 hours of collection.

A "satellite" office will be made available to monitors in the Rock Creek and Potomac watersheds from 9:00 to 11:00AM each morning of sampling in order to facilitate sample drop-off and travel delays due to distance. ARK will organize and manage this satellite office with Team partners to ensure that it is staffed at all times.

The Team will add additional protocols into the plan accounting for transportation issues and other potential complications as part of the program development process.

A7.3 Comparability

It is important to analyze water samples with commonly accepted methods by Federal, State and Local officials. The water quality data collected will be analyzed using DOEE approved methods or other common methods for analyzing basic water quality data. The primary water quality parameter to be analyzed is *E. coli*; in which, the IDEXX Colilert Test kit will be used. The Colilert procedural manual can be found in Appendix B.

A7.4 Completeness

To provide a complete and accurate picture for citizens to assess if water contact in the three regions is safe, each volunteer monitor scheduled for the specified date must be able to collect a water sample weekly and deliver samples to the lab within the prescribed time frame. This allows for residents and visitors to DC to have consistent, up-to-date information on the quality of water in the regions, as well as provides DOEE with a full data set of water quality parameters related to bacteria for the entirety of the sampling period.

A8. Training Requirements

Sample collection volunteers will be provided with training and procedures for collecting water samples from tributaries, streams and rivers identified in the Site Selection Process as informed by the Recreational Use Survey. All training will be provided by the Training Team leaders (ARK, Rock Creek Conservancy, Alliance for the Bay, ANS) to ensure that efforts are in accordance with quality control measures and procedures formalized in the *Volunteer Training Manual*. All Training Team members will be provided with training materials to review at the beginning of each new project year.

The training manual will train each new volunteer and provide them with specific instructions on proper sampling techniques, sanitary handling practices, and chain of custody. Volunteers will work with Team staff onsite after training to ensure proper execution of sampling protocols. The *Volunteer Training Manual* will provide the volunteers with a map of their test location in relation to the larger watershed, an information sheet about the program, directions to the lab, written sample collection instructions, custody forms, links to the databases, and a prepared sample collection kit consisting of all items needed to successfully collect and deliver samples to the Anacostia Riverkeeper lab.

A8.1 Volunteer Water Quality Monitoring Training

Monitors will be required to attend a Water Quality Monitoring Training before they begin collecting water quality data for this project. ARK will provide the trainings on an as-needed basis during the project timeframe (April - September). At the Water Quality Monitoring training participants will learn how to:

- Clean, use, store, and maintain monitoring equipment
- Collect, store, and transport water samples for water quality analysis
- Analyze water samples
- Fill out and complete field data sheets and chain of custody forms accurately
- Follow quality assurance and quality control procedures
- Enter monitoring results into the project database

Participant performance will be evaluated at the training during the training activities. ARK/AFB/RCC/ANS will work closely with the participants during the hands-on training exercises to be sure that they achieve the goals of the exercises. It is expected that each participant will be able to collect and analyze water samples and enter the results into the project database after attending the Water Quality Monitoring Training.

Monitors will be given the equipment and supplies needed to begin monitoring at the conclusion of the Water Quality Monitoring Training. They will also receive copies of the training materials, which contain the information they learned at the training, *Volunteer Training Manual* and SOPs for collecting, recording, and entering their data, field data sheets, external QC forms, and references of how and where to access regional resources to supplement and reinforce what they learned at the training.

A9. Documentation and Records

A9.1 Field Data Sheets

Monitors will fill out and complete their field data sheet for every sampling event, as detailed in the Volunteer SOP Manual, Appendix C, and included in Appendix D. On the data sheet, monitors will record their name, date, time, and sample site location/name. They will also record weather conditions, their monitoring results, and the amount of time spent monitoring. If daily calibration of equipment is required for field parameter testing, this information will be recorded on the data sheet. The original data sheets will be submitted to Anacostia Riverkeeper and archived for at least seven years after the sampling date. The project will also maintain electronic (digital) records of the data within a project specific database.

A9.2 Lab QA/QC Forms

Anacostia Riverkeeper is the primary lab manager for this project and will maintain consistent records of lab checks, equipment calibration/maintenance, and data results. In-lab bench sheets will act to confirm and ensure proper incubator temperature and sample handling; log books will allow for a hard copy backup to all lab procedures and equipment handling; and equipment calibration and maintenance records will be kept to ensure all sampling equipment is in proper working order.

Anacostia Riverkeeper lab bench and lab sample sheets are included in Appendix D.

A9.3 Other Documentation and Records

As the Project Manager for this QAPP and recipient of the associated grant, Anacostia Riverkeeper, will submit quarterly reports to the DOEE. ARK will also be the primary holder of documents associated with this project. These may include lab log books, field notebooks, chain of custody forms and any other material that DOEE may need to assess this project.

Upon receiving all field sheets, chain of custodies, recreational use surveys, and other pertinent physical volunteers forms ARK will organize forms and keep on hand in ARK offices. Forms will be organized by month and watershed. Additionally, all volunteer forms from training (i.e., certification tests, surveys, etc) will be kept on hand at ARK offices. Finally, physical copies of the most up-to-date QAPP and *Volunteer Training Manual* will be kept on hand at the ARK lab.

Each member of the Project Team will also have access to the data and records for their use, with the approval of Anacostia Riverkeeper. Since the data will be used to educate the public on the safety of their local water access points, each member of the Project Team will be encouraged to share the data on their social media and with their members and partners, ensuring proper accreditation to DOEE as the funding agency for the project and ARK as the project manager. Reports will be submitted from each member organization of the Project Team as to where the data was shared and what reactions (if any) there are from the public. This information will be reported to the Project Manager on an informal basis through regular Project Team meetings.

Section B – Data Generation and Acquisition

B1. Volunteer Training Process

Volunteer trainings are necessary to provide consistent water collection, testing and handling techniques to have reliable data. The process for training volunteers under this QAPP is divided into two types of trainings, new volunteer training and annual re-certification training.

B1.1. New Volunteer Trainings

New volunteer trainings will be held at the beginning of the year's program and will be managed by the Project Team. Once volunteers are recruited, they will be invited to participate in a training class. Training will occur two to three times throughout the sampling period, however, if there is sufficient size of volunteers for additional trainings, then more may be conducted.

Process of New Volunteer Trainings:

- All volunteers will meet with the team leaders conducting the training at a convenient site;
- All volunteers will be given a copy of the *Volunteer Training Manual* and other necessary paperwork;
- Volunteers will be instructed based on the training plan of the team leader; which will include,
  a) Introduction to the project,
  b) Introduction of the team leaders and points of contact,
  c) Review of the project QAPP and the Volunteers SOP Manual,
  d) Introduction to the field test kits and how they are used,
  e) Demonstration of sample collection, testing and completing field worksheets and chain of custody forms,
  f) Volunteers will perform practice sampling,
  g) Team Leaders will discuss sample sites with volunteer(s),
  h) Volunteers will be provided with scheduling links in order to sign-up and schedule themselves for monitoring.
- Volunteers will be introduced to the Lab if interested

B1.2. Annual Certification Training

All returning volunteers are required to complete an annual re-certification training class online. This annual training class allows the Project Team to assess the adherence to the QAPP and Volunteer SOPs. Annual trainings also allow for opportunities to inspect and calibrate the field equipment. These annual trainings may also serve as a reporting mechanism on the progress of the project to the volunteers.

Process of Annual Recertification Trainings:

- All existing volunteers that have collected samples during the previous field season must complete the annual online training;
- Volunteers will review the project QAPP and Volunteer SOPs;
- Each Volunteer will be required to take a simple test for verification of knowledge on sampling practices and procedures.

B2. Sampling Standard Operating Procedures

A detailed outline of SOPs for water quality sampling in DC waters is summarized in the below sections and included in Appendices B and C.

B3. Sample Handling and Chain-of-Custody

Each volunteer will be trained in how to properly collect and handle water samples and data information sheets. It is important to have consistency with each volunteer or group of volunteers so that the measured data has the reliability for accurate information that will be portrayed to the public. Equally important, is the ability to compare sample results that will be used in addressing additional research questions.

Chain of custody forms along with field data sheets are necessary elements in validating the measured results to be as accurate as can be. Field data sheets will be filled out during each sampling event by the monitoring volunteer(s). The data sheets will include information such as date, time, site observations, and field water quality data from handheld monitoring equipment. The use of Chain-of-custody forms is necessary to show proper handling of the sample as it travels from collection point to the lab. When a sample is passed from one person to another, each individual will sign, date and note the time.

Samples will be collected each week on Wednesday morning (Thursday will be an alternate bad weather sampling day) by volunteers and delivered to the lab at Anacostia Riverkeeper. Delivery may either be in person by the volunteer or a member of the Project Team that collects the water samples from the volunteer locations. Samples will be delivered within a 6-hour time frame from collection to properly analyze the sample. Because bacterium is the primary water quality parameter, all samples must be kept on ice during transport. Detailed instructions on collecting and handling water samples can be found in the Volunteers SOPs (Appendix C).

B4. Lab Analytical Methodology

Anacostia Riverkeeper has an in-house lab with analytical equipment specific for the intent of this project. ARK will be using the IDEXX Colilert system to measure *E. coli* in each water sample. The Colilert system can return results within 24 hrs. The quick turnaround timeframe for results is necessary to allow the public to have water quality data as accurate as possible for the water access

locations and general conditions of the river. Detailed information on the IDEXX Colilert system can be found in Appendix B, Lab and Field Equipment Manuals/SOPs.

A nephelometric method will be used to measure in-lab turbidity for samples collected in the field. The LaMotte 2020we/wi uses light attenuation passing through a sample compared to lab standards to determine the turbidity of a sample in nephelometric units (NTUs). Lab turbidity samples will be run concurrently with bacterial samples so both results are available in a 24-hr time period. Detailed information on the LaMotte 2020we/wi system, sample preparation, and quality control can be found in Appendix B, Lab and Field Equipment Manuals/SOPs.

Temperature and pH parameters will be measured in-situ in the field so do not require lab analysis.

B5. Quality Control

The goal of this project is to produce timely and accurate water quality data that allows the public to assess the health and safety of the waters in the Anacostia River, Rock Creek and the Potomac River in the downtown DC area. It is important to have a high level of quality control so that the data presented to the public is not misrepresenting the “as close to” the true conditions of the rivers in the downtown DC area. The following sections of this QAPP outline the procedures that will be followed by the volunteers and lab to produce accurate and quality assured data. Detailed information for each section can be found in the Volunteers SOPs (Appendix C) and/or the Lab and Field Equipment Manuals/SOPs (Appendix B).

B5.1 Field QC Checks

B5.1.1 Equipment Calibration

All equipment used in sampling analysis throughout the project period will be calibrated per instrument SOPs and manufacturer recommendations. Field sampling equipment will be calibrated once at the beginning of each sampling season. Thermometers will be calibrated with a certified thermometer and pH strips arrive to ARK lab pre-certified from the supplier via their own QA/QC checks.

B5.1.2 Field Duplicates and Blanks

Field duplicates ensure that sampling procedures don’t contribute any contamination to samples during collection, maintaining sample integrity and fidelity. Field duplicates will be collected each week within each watershed and sampled concurrently or in-line with standard samples. One field duplicate will be collected from each watershed each week to ensure that duplicates are being collected for more than 10% of samples. An empty and sealed sample bottle will be provided randomly to volunteers when duplicate samples are required, and all volunteers will be trained on the use and sampling methodology behind field duplicates.

Blank samples will be collected during sampling to ensure sample preservation and quality. A field blank will be collected 10% of the time to ensure field sampling procedures and to assess potential sources of field contamination. Blanks will be randomly assigned to volunteers in each watershed each week. Volunteers will carry bacteria bottles into the field, unseal each bottle and expose it to air, and then recap and place in the cooler. Once delivered back to the lab, lab personnel will fill field blanks with DI water and run in-line with other bacterial samples. Blanks will be provided randomly to volunteers 10% of the time to carry into the field and then back to the lab, assessing any possible field or transportation sources of contamination.

B5.2 Laboratory QC Checks

All lab equipment and instrumentation used in the testing for this QAPP will follow all the manufacturer's requirements for Quality Control. There are two main lab equipment used in for this project, the IDEXX Colilert System and the LaMotte 2020we/wi turbidity meter.

Laboratory QC Checks for the IDEXX Colilert System involve a QA/QC check when a new batch of reagent is received in the lab and concurrently every week that samples are collected. IDEXX quality control protocols use a positive bacterial strain of *E. coli* (*Escherichia coli*), a positive coliform (*Klebsiella pneumoniae*), and a negative coliform (*Pseudomonas aeruginosa*) to ensure all sampling and lab procedures are not introducing any contamination into analysis as well as the reliability of the reagent.

The LaMotte 2020we/wi turbidity meter requires the use of blanks for each sample analysis and standards for development of the calibration curve when new reagent solution is used.

B5.2.1 Laboratory Equipment Calibration Procedures

Bacterial lab equipment does not require a dedicated calibration schedule as the test is visual and does not involve any electrical sensors. QC checks are performed on each shipment of bacterial reagents to the lab, as well as concurrently each week of sampling, to ensure quality and comparison between samples. Additionally, lab bench sheets are kept in-lab to ensure proper function and record of all lab equipment and procedures. IDEXX Colilert system QC checks can be found in Appendix B, Lab and Field Equipment Manuals/SOPs and Lab Bench sheets can be found in Appendix D, QA/QC Forms.

A certified thermometer will be kept inside the Binder Incubator to track the accuracy of the digital thermometer on the outside of the machine. The Incubation temperature must be kept consistent at 35°C for proper propagation of sample bacteria. A temperature fluctuation under/over 0.5°C is acceptable, any fluctuations above/below 0.5°C will be noted by the lab QA/QC manager. The incubator will be serviced by Anacostia Riverkeeper once each year before the start of sampling.

The in-lab turbidimeter will be calibrated according to the LaMotte 2020we/wi User’s Manual once a week, per each bulk sampling run, and tested every 10 samples to ensure accuracy. When samples

are collected and run over a two-day period the instrument will be calibrated each day before sample analysis and documented in a log book. Calibration standard vials are included with the instrument and first calibrated using a blank and then with standards of known NTU values to establish a calibration curve. This curve is then tested on a 0 NTU and 10 NTU sample once every 10 samples run to ensure the calibrations accuracy and address any drift that may have occurred. If lab personnel notice a difference >0.2 NTU in the 0 NTU calibration standard, or 10% of the 10 NTU standard, then the machine will be recalibrated and tested before any project samples are run. Full LaMotte 2020we/wi calibration procedures can be found in the Lab and Field Equipment Manuals/SOPs Appendix B.

All lab equipment maintenance, calibration, and operation will be recorded in daily lab bench sheets and the dedicated project lab logbook.

B5.3 Data Entry QC Checks

The data collected both in the field and the lab will be managed by ARK. Chain of Custody forms will be scanned digitally and hard copies kept in a designated file in ARK offices to keep consistent records and for project audits. Field data sheets will be turned into ARK each week after sampling is conducted. Field data sheets and recorded lab results will be reviewed by a supervisor at ARK and stored appropriately. Sheets will be scanned digitally and held in a database while hard copies will be kept in designated files in ARK offices. Each week the recorded data will also be uploaded to Water Reporter and the ARK website. The data collected will also be shared with Project Team members, DOEE, and CMC, allowing for three separate checks on data quality.

B6. Instrument/Equipment Testing, Inspection, and Maintenance

Monitors will inspect their equipment prior to each sampling event to ensure that all materials are clean and working properly as outlined in the Volunteers SOPs Appendix C. After testing, monitors will clean all equipment following the procedures also listed in the SOPs.

ARK will maintain lab equipment per manufacturer’s instructions and ensure all instruments are in proper working order going into the sampling period (April-September).

B6.1 Equipment Maintenance

Monitoring equipment and supplies are stored according to the manufacturer’s directions when not in use. Unless chemicals and reagents are discolored, fail standardization, or show other obvious signs of degradation or damage, they are considered valid until the printed date of expiration. Expired chemicals are to be disposed of properly in accordance with federal, state and local environmental control regulations. All monitoring equipment will be maintained according to the manufacturer's instructions.

B7. Instrument/Equipment Calibration and Frequency

All lab equipment and instrumentation used in the testing for this QAPP will follow all the manufacturer's requirements for calibration. There are two main lab equipment used in for this project, the IDEXX Colilert System and the LaMotte 2020we/wi turbidity meter.

The IDEXX Colilert System only requires a blank calibration when new reagent solution is used. No other calibration is required.

The LaMotte 2020we/wi turbidity meter requires a calibration curve to provide the most accurate reading. The Meter comes with a factory calibration curve. However, it is recommended to use approved calibration solutions when the suspected range of the sample will differ from previous sample analyses. Calibration must also be conducted if a dilution of the sample is required. The frequency calibration is variable and determined based on environmental conditions; however, at a minimum, calibration should be conducted 1 time/week.

Field equipment will be calibrated on a routine schedule according to the Volunteer SOP guidelines. Field testing has been limited to pH test trips and thermometers. Only the thermometers will have to be calibrated on a frequency that matches the training schedule or as indicated in the manufacturer's manual.

B8. Inspection and Acceptance Requirements for Supplies

Project Team Leads will obtain monitoring equipment and materials from reputable laboratory supply companies such as LaMotte, Micrology, HACH, Forestry Suppliers, Hanna, AquaPhoenix Scientific, VA Laboratory Supply, and Fisher Scientific. Monitoring equipment for this project will be chosen based on accuracy, precision, ease of use, cost, experience using, and/or recommendations from other monitoring program coordinators.

Project Team Leads will inspect purchased equipment and broken, or defective items will be sent back to the supplier. Equipment will be distributed to monitors at the Water Quality Monitoring Training or afterwards as needed. Monitors will check their supplies, including calibration solutions and reagents each month to be sure they have not expired and will return expired chemicals and defective equipment to designated Project Team Leader.

B9. Data Management

All project data will be recorded and managed by ARK and distributed weekly to the Project Team, DOEE, CMC, and Water Reporter. ARK is the designated organization for data management. Hard copies of project materials like chain of custody forms, field collection sheets, lab QC records, etc. will be kept in ARK offices and available for view per request from DOEE or the Project Team. Digital scans of project forms and data sheets will be kept in a database as backups by ARK. The Program

Manager of Anacostia Riverkeeper will act as data custodian for the sampling period and ensure that digital and hard copies of the following are kept secure and backed up separately: sampling sheets, chain of custody forms, lab bench sheets, lab log book, and data Excel sheets.

Field sampling data will first be recorded by volunteers on the date and time of their monitoring on designated field collection sheets. All field and lab data will then be added to a shareable data table, separated by watershed, accessible to the Project Team upon ARK approval and DOEE to ensure the most up-to-date data is available to all parties. ARK team members will update this data table weekly with that week's results and additionally upload the results from that week to Water Reporter, and CMC.

C1. Assessment and Response Actions

The Project Team will use four categories of assessment to ensure the integrity of the data:

- Laboratory
- Training Program participation
- Field Sampling
- Validation and Reporting

C1.1 Laboratory Assessments

The internal audits used to evaluate the laboratory will examine:

- Sample blank
- Procedures
- Quality assurance
- Data reduction and reporting

The specific makeup of the audit team and procedures to conduct laboratory audits are contained in the individual laboratory project plans.

C1.2 Training Program Assessments

Training program assessments will be included in quarterly and annual reports to DOEE where relevant. Alliance for the Bay, Rock Creek Conservancy, and ANS will provide all training materials and notes to the project team and ARK will synthesize these into assessments that assess volunteer turnout, turnover, geography, and demographics. Assessments are important to assure the project team and DOEE that the project has a volunteer sampling roster of at least 45 participants and that volunteers accurately represent District communities in all areas of the city.

C1.3 Field Sampling Assessments

Field sampling assessments will be conducted throughout the project period to ensure volunteer collection methodology and quality of field data. Project Team members will conduct field audits quarterly on a random basis once per watershed (Anacostia, Potomac, Rock Creek). Team members will observe volunteer sample collection to ensure that volunteer samplers are following methods outlined in this QAPP and the SOPs (Appendix B). If any breach of methodology is observed during field audits the project team member conducting the audit will correct volunteers, ensure standard collection practices moving forward, and make note of any mistakes on that day's field sheet for data validation. ARK will review any field corrections made by project auditors weekly to determine whether the data is acceptable. Any corrections will be included in quarterly progress reports to DOEE.

C1.4 Validation and Reporting Assessments

Validation and reporting assessments will be conducted by the Project Leader (ARK) and the Grant Manager (DOEE) throughout the performance period.

All field and laboratory data are subject to verification and validation by ARK QC personnel (Program Manager and Project Coordinator). Data verification includes: weekly spot checks of incoming sampling and chain of custody forms, laboratory procedures, and data input. QC checks will be documented and initialed on established internal ARK QC forms to ensure the data for that week has been assessed and approved by qualified personnel.

QC checks and forms will be included in the quarterly and annual reports to DOEE as well as available upon request to the Project Team.

C2. Reports

The following documents will be provided to DOEE through quarterly reports and a final report submitted by ARK.

- Logbooks
- Field sheets and forms upon request
- Results from Quanti-Tray tests
- Photos of Quanti-Trays,
- Copies of data spreadsheets
- Mileage and travel record
- Supply receipts
- Staff time logs
- Chain of custody forms,
- Data/Progress Reports
- Project photographs

Section D – Data Validation and Usability

D1. Data Review, Validation, and Verification

Data review, validation, and verification will be completed on a weekly, quarterly, an annual basis by ARK, the Project Team, and DOEE. This promotes transparency throughout the period of performance and ensures the highest quality of data is available weekly to DC residents and visitors.

Weekly data review will be completed by the Project Team along the whole of the sampling chain from field to laboratory analysis. ARK, having control over data input, will have final review and verification of all data before it's submitted to DOEE, CMC, and Water Reporter.

Quarterly field spot checks will be conducted once in each watershed (Anacostia, Potomac, Rock Creek) by the project partners and included in quarterly reports to DOEE. Quarterly data validation documents submitted to DOEE will include: field spot check reports, ARK QC forms, and chain-of-custody or field collection sheets upon request.

Annual data review and validation will come in the form of an office audit by DOEE to ARK's office. Laboratory procedures and methods will be observed as well as data management and input.

Appendix A:

Final Sample Site List

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List of Monitoring Locations

Rock Creek

RC-1. Rock Creek at Juniper St NW Trailhead - Northernmost testing site sits close to the Rock Creek border with Montgomery County in one of the widest sections of Rock Creek. Hikers, dog-walkers, and even horse-riders routinely use the area to recreate and enjoy the Park.

RC-2. Pinehurst Branch (Rock Creek Tributary) - The 680-acre Pinehurst watershed encompasses residential neighborhoods in Chevy Chase, Maryland, and Chevy Chase, DC, as well as forested parkland. The stream can be accessed from Western Avenue; Beech Street; Aberfoyle Street; Oregon Avenue; trails in Rock Creek Park; and Beach Drive. Recreational activity includes walking, jogging, hiking, horseback riding, and dog walking along trails, which cross the stream in several places.

RC-3. Broad Branch (Rock Creek Tributary) - Broad Branch flows through the Chevy Chase and Forest Hills neighborhoods in Northwest DC. It can be accessed from Broad Branch Road. DOEE day-lighted and restored part of the stream and the site now has picnic tables. Nearby residents take pride in the day-lighting, and several are engaged in documenting amphibians at the newly restored stream for Frogwatch USA. This site is accessible from Van Ness-UDC and Tenleytown-AU metro stations.

RC-4. Soapstone Creek (Rock Creek Tributary) - The Soapstone Creek watershed encompasses neighborhoods in Northwest DC from Wisconsin Avenue to east of Connecticut Avenue. Trails through Soapstone Valley Park draw walkers, hikers, joggers, and dog walkers from the nearby apartment buildings, businesses, and UDC along Connecticut Avenue, as well as from the Forest Hills neighborhood. The park can be accessed from Windom Place, Albemarle Street, Audubon Terrace, and Broad Branch Road. It is a short walk from the Van Ness-UDC metro station. Foot trails in the park cross the stream on stepping-stones in several places. The Potomac Appalachian Trail Club routinely restores these stream crossings to keep the trails open. Five stormwater outfalls empty into Soapstone Creek, the largest of which is just south of Albemarle and 32nd Streets, NW. Dry weather flow from this outfall is frequently sudsy and has a foul sewage smell, indicating possible illegal sanitary connections to storm drains, perhaps from apartment buildings along Connecticut Avenue. Century-old sanitary sewers underlie Soapstone Creek. DC Water is working on plans to restore them.

RC-5. Melvin Hazen Run (Rock Creek Tributary) - The Melvin Hazen Run originates in springs in and around Hearst Recreational Park west of Reno Road, NW, then flows east through Melvin C. Hazen Park, and enters Rock Creek downstream of Tilden Street, NW. The watershed includes several large apartment buildings and single-family homes, as well as some embassies. Foot trails running along the stream and crossing it in twice are frequented by hikers and dog walkers. At the lower end, near the stream's confluence with Rock Creek, is a parking lot for Peirce Mill, a large picnic shelter, and an open space where games are played. It is a 14-minute walk to the Cleveland Park metro station. Although no sanitary sewers underlie Melvin Hazen Run, a few storm sewers empty into it. ANS has a benthic macroinvertebrate monitoring station 100 meters upstream of the confluence with Rock Creek. Since 2008, the ANS monitoring team has reported finding long thick filamentous green algae covering the streambed, a possible indication of excess nutrients from sanitary sewer leaks or illicit discharges.

RC-6. Rock Creek Just Below Piney Branch Confluence - This Mid-Creek testing site sits just below the confluence of Rock Creek and the Piney Branch tributary downstream from the largest Combined Sewer Overflow discharge into Rock Creek. The area is routinely used recreationally for hiking and biking and features dog-walkers at all times of the year.

RC-7. Normanstone Run (Rock Creek Tributary) - Normanstone Run meanders alongside Normanstone Drive, NW, and enters Rock Creek Park south of Edgevale Terrace. People and their dogs walk along the road and on trails in the

park. ANS has a benthic macroinvertebrate monitoring station at Normanstone Drive and 30th Street. Storm sewers convey runoff from the nearby Woodland-Normanstone neighborhood, as well as parts of Cleveland Park, Embassy Row, and Massachusetts Avenue Heights. During a dry spell in 2012, the team observed gray soapy water flowing from the culvert just upstream of their monitoring reach and smelled sewage. They reported their observations to the National Park Service and DC Water. It was determined that an overflow pipe at a sewage lift station at the Naval Observatory had been improperly connected to the storm sewer. There is the potential for *E. coli* impairment from other illegal sanitary connections to storm sewers and leaky sanitary sewers underlying the stream. There is residential street parking, and the site is a 12-minute walk from the Woodley Park-Zoo metro station.

RC-8. P Street Beach - The southernmost Rock Creek site sits directly adjacent to the Rock Creek hiker-biker trail and includes the only area of Rock Creek that is fishable per District of Columbia fishing regulations.

Potomac River

PR-1. Battery Kemble Creek/Fletcher's Run (Direct Potomac Tributary) - Battery Kemble Creek, also known as Maddox Branch, flows through Battery Kemble Park in the Palisades neighborhood of Northwest Washington. It enters the Potomac not far from Fletcher's Boathouse. Battery Kemble was a fortification defending Washington during the Civil War. It is now a feature of Fort Circle National Park. Not only is the park visited by historians, it is a very busy gathering spot for dogs and their owners. It is also popular for running, sledding, picnicking, and nature walks along the creek. Hikers take the streamside trail to connect to a trail in Wesley Heights and the C & O Canal Towpath.

PR-2. Fletchers Cove - Fletcher's Cove is a park and recreation area owned and managed by National Park Service, located at 4940 Canal Road, Washington, D.C. 20007, between Chain and Key Bridges, part of Chesapeake and Ohio Canal National Historical Park. It is situated along the C&O Canal Tow Path and attracts thousands of visitors annually by car, bicycle, and on foot. It is a popular destination for picnicking, angling and paddling. This site hosts a Tackle Shack, snack bar, and a concession that rents paddle boats, rowboats and canoes, kayaks and bicycles. Fletcher's Cove also receives upstream discharge from Battery Kemble Park, a popular dog walking area that may convey pet waste to the area.

PR-3. Foundry Branch (Direct Potomac Tributary) - Foundry Branch originates in the Tenleytown neighborhood of Northwest DC and flows through several Glover Archbold Park before entering the Potomac River in Georgetown. Adjoining neighborhoods include McLean Gardens, Cathedral Heights, Glover Park, Burleith, and Foxhall Village. Several side trails lead from neighborhood streets to the main trail that parallels the stream. The upper reaches of the stream are accessible from the Tenleytown-AU metro station. At any time of day, one encounters dog walkers, office workers on break, and neighborhood residents enjoying the trails. Their footprints can be seen at water's edge. Although some bridges cross the stream, in places crossings must be made on stepping-stones. The stream has exposed century-old sanitary sewer infrastructure in the streambed and adjacent to it. Asphalt and concrete patches show that sewer joints have been repaired more than once. DC Water is developing plans to rehabilitate these sewers. **Note:** Original site was moved ~50-100ft upstream to accommodate for dry drought conditions during summer and to ensure enough flow to sample each week.

PR-4. Washington Canoe Club - First opened in 1904, WCC's boathouse, is over a century old and is an iconic historic landmark serving as a base for its members to train for competition, paddle for recreation, and host community, educational and charitable groups. WCC is located just north of Key Bridge. With over 200 members, Washington Canoe Club is a community of volunteers dedicated to preserving, promoting, and engaging in paddlesports on the Potomac River in Washington, D.C. They will recruit volunteers for sampling and surveying.

PR-5. Thompson Boat Center - Thompson Boat Center is home to several high school and adult rowing clubs, and regularly hosts regattas for visiting clubs from other cities. It also offers rentals and lessons of kayaks, canoes, sculls,

stand up paddleboards. It is located at the mouth of Rock Creek and accesses waters directly affected by combined sewer overflows.

PR-6. Washington Tidal Basin - The Tidal Basin is a partially man-made reservoir between the Potomac River and the Washington Channel in Washington, D.C. It is part of West Potomac Park and is a focal point of the National Cherry Blossom Festival held each spring. Historically, it was actually a favored swimming hole up until the late 1940s when it was permanently closed due to chronic sewage contamination. Thousands of visitors and residents are able to rent paddleboats and recreate on the river and walk around the shoreline annually.

PR-7. Columbia Island – Columbia island is a natural formation on the west bank of the Potomac River spanning the distance between the Theodore Roosevelt bridge and the 14th Street bridge. It's been reworked and developed by humans since the creation of DC and is administered by the National Park Service. The island contains several pedestrian trails, parks, memorials, and one marina, so is a heavily trafficked and utilized riverside site along the Potomac that experiences a high frequency of boat and watersport traffic on a daily basis.

Anacostia River

AR-1. Floating Dock by National Arboretum - This floating dock is a documented swimming location and a frequent access point for paddle-craft who pull out and put back in here after resting or visiting the Arboretum. Its proximity to Kenilworth Park lends further merit to the site as that stretch of the seawall across from this dock is a favorite fishing site of the local community as well as a common put in site for paddle craft.

AR-2. Hickey Run (Anacostia Tributary) - Hickey Run flows through the grounds of the National Arboretum in Northeast Washington, DC, where it empties into the Anacostia River. Its upper reaches are now encased in storm sewers that serve residential, commercial, and industrial areas of Langdon, Arboretum, South Woodridge, West Fort Lincoln, South Brookland, Mt. Olivet, Brentwood, and Gateway. The watershed is outside the area of combined sewer overflow, yet 36% imperviousness in the watershed brings heavy stormwater runoff. The DOEE website states that "although the stream is cleaner than it has been in the past, Hickey Run is still very polluted by trash, bacteria, low oxygen levels, excess sediments, toxic chemicals and metals, making the stream harmful to humans and wildlife." DOEE is working to reduce stormwater runoff by educating homeowners and engaging them to participate in the RiverSmart Homes program. DOEE has also been working with the community to restore the Springhouse Run Tributary of Hickey Run. Residents engaged by DOEE's efforts, and members of the Friends of National Arboretum, could be a good source of volunteers for this site.

AR-3. Kingman Lake at Floating Dock - The floating dock on the south side of the boardwalk bridge between Heritage and Kingman Islands is a known swimming location and frequent put in and pull out point of paddle craft access.

AR-4. Anacostia Park Boat Ramp Dock - The boat ramp and dock here are a frequent fishing, paddle craft, and motor craft access point, including for Anacostia River Explorer tours and, most recently, the Family and Youth Casting Call.

AR-5. Yards Marina - The marina piers are a known swimming site, as well as a frequent fishing, motor craft, sail craft, and paddle craft access point, including for stand-up paddle boards. This site is also within several hundred yards of a common anchorage where frequent swimming is known to occur, and a current DOEE water quality monitoring station.

AR-6. Buzzard Point at the Henson Center – The Henson Center is a known swimming area, frequent motor craft and sail craft access point, with some paddle craft access.

AR-7. Washington Channel - Washington Channel is a huge point of access for motor craft, sail craft, and paddle craft, and a known swimming site. With the recent opening of The Wharf, significantly more frequent water contact is expected here.

Sample Site Identification Number and GPS Coordinates

Station ID	Site Name	Latitude	Longitude
RC-1	Rock Creek at Juniper St	38.98315	-77.04068
RC-2	Pinehurst Branch	38.97634	-77.05221
RC-3	Broad Branch	38.95748	-77.06218
RC-4	Soapstone Creek	38.9466	-77.05575
RC-5	Melvin Hazen Run	38.93831	-77.05258
RC-6	Rock Creek below Piney Branch	38.93337	-77.05024
RC-7	Normanstone Run	38.92176	-77.06027
RC-8	P Street Branch	38.90885	-77.05065
PR-1	Battery Kemble Creek	38.92586	-77.09509
PR-2	Fletcher’s Boat House	38.91868	-77.10311
PR-3	Foundry Branch	38.91583	-77.08306
PR-4	Washington Canoe Club	38.90431	-77.07193
PR-5	Thompson Boat Center	38.90008	-77.05842
PR-6	Tidal Basin	38.88495	-77.0355

PR-7	Columbia Island	38.87637	-77.04671
AR-1	National Arboretum	38.91162	-76.95459
AR-2	Hickey Run	38.90975	-76.96182
AR-3	Kingman Lake	38.89394	-76.96554
AR-4	Anacostia Park	38.87994	-76.97087
AR-5	Yards Marina	38.87278	-77.00064
AR-6	Buzzard Point	38.86535	-77.01015
AR-7	Washington Channel	38.87738	-77.02462

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Appendix B:

Lab and Field
Equipment Manuals/SOPs

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Water Quality Parameters

- Parameters Tested in the Field
  a) pH testing will be conducted by using test strips
  b) Air and water temperature will be measured by pocket thermometers
- Parameters Tested in the Lab
  a) Turbidity will be tested by LaMotte 2020WE EPA Portable Turbidity Meter
  b) *E. coli* will be tested by the IDEXX Colilert system

Field Test Equipment SOPs

Procedures for testing field parameters are found in Appendix C

Lab Test Equipment Manuals: Following pages

For Sales & Service Contact
geotech
2650 E. 40th Ave. • Denver, CO 80205
Phone 303-320-4764 • Fax 303-322-7242
1-800-833-7958
www.geotechenv.com

LaMotte

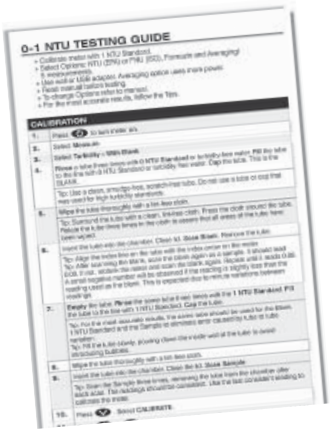
2020we/wi TURBIDIMETER

1970-EPA
1970-ISO

GENERAL INFORMATION


2020we/wi QUICK START GUIDE

Refer to the Quick Start Guide for simplified Calibration and Analysis procedures.


0-1 NTU TESTING GUIDE

Refer to the Testing Guide for detailed Calibration and Analysis procedures for improving the accuracy of low range turbidity measurements.

INTRODUCTION

■ TURBIDITY

What is Turbidity?

Turbidity is an aggregate property of the solution, which is water in most cases. Turbidity is not specific to the types of particles in the water. The particles could be suspended or colloidal matter, and they can be inorganic, organic or biological. At high concentrations, turbidity is perceived as cloudiness, haze or an absence of clarity in the water. Turbidity is an optical property that results when light passing through a liquid sample is scattered. The scattering of light results in a change in the direction of the light passing through the liquid. This is most often caused when the light strikes particles in solution and is scattered backward, sideways and forward. If the turbidity is low, much of the light will continue in the original direction. Light scattered by the particles allows the particle to be ”seen” or detected in solution just as sunlight allows dust particles in the air to be seen.

In the past 10 years, turbidity has become more than just a measure of water clarity. Because of the emergence of pathogens such as Cryptosporidium and Giardia, turbidity now holds the key to assuring proper water filtration. In 1998, the EPA published the IESWTR (interim enhanced surface water treatment rule) mandating turbidities in combined filter effluent to read at or below 0.3 NTU. By doing so, the EPA hoped to achieve a 2 log (99%) removal of Cryptosporidium. There is presently consideration to lower this to 0.1 NTU. The trend has been to check the calibration of on-line turbidimeters with hand-held field units. The optical design and low detection limit of the 2020we/wi allows very accurate readings for such calibrations.

The meter also allows the user to choose the units of measure for expressing turbidity. While nephelometric turbidity unit (NTU) has been the standard for years, FNU (formazin nephelometric unit) and FAU (formazin attenuation unit) are now being used in ISO 7027 units. American Society of Brewing Chemists (ASBC) units and European Brewery Convention (EBC) units allow the brewing industry to check process waters.

How is Turbidity Measured?

Turbidity is measured by detecting and quantifying the scattering of light in water (solution). Turbidity can be measured in many ways. There are visual methods and instrumental methods. Visual methods are more suitable for samples with high turbidity. Instrumental methods can be used on samples with both high and low levels of turbidity.

Two visual methods are the Secchi Disk method and the Jackson Candle method. The Secchi Disk method is often used in natural waters. A black and white Secchi Disk is lowered into the water until it can no longer be seen. It is then raised until it can be seen again. The average of these two distances is known as the “Secchi Depth”. The Jackson Candle method uses a long glass tube over a standard candle. Water is added or removed from the tube until the candle flame becomes

indistinct. The depth of the water measured with a calibrated scale is reported as Jackson Turbidity Units (JTU). The lowest turbidity that can be determined with this method is about 25 NTU. There are two common methods for instruments to measure turbidity. Instruments can measure the attenuation of a light beam passing through a sample and they can measure the scattered light from a light beam passing through a sample. In the attenuation method, the intensity of a light beam passing through a turbid sample is compared with the intensity passing through a turbidity-free sample at 180° from the light source. This method is good for highly turbid samples. The most common instrument for measuring scattered light in a water sample is a nephelometer. A nephelometer measures light scattered at 90° to the light beam. Light scattered at other angles may also be measured, but the 90° angle defines a nephelometric measurement. The light source for nephelometric measurements can be one of two types to meet EPA or ISO specifications. The EPA specifies a tungsten lamp with a color temperature of 2,200–3,000 K. The units of measurement for the EPA method are nephelometric turbidity units (NTU). The ISO specifies a light emitting diode (LED) with a wavelength of 860 ± 30 nm and a spectral bandwidth less than or equal to 60 nm. The units of measurement for the ISO method are formazin nephelometric units (FNU). The 2020we meets the EPA specification and the 2020wi meets the ISO specification. The nephelometric method is most useful for low turbidity.

The 2020we/wi is a nephelometer that is capable of measuring turbidity by both the attenuation method and the nephelometric method. It uses a detector placed at 180° to the light source for high turbidity samples. It uses a detector placed at 90° to the light source for the nephelometric method for low turbidity samples. The 2020we/wi has a signal averaging option to improve the stability of readings on low turbidity samples.

The 2020we/wi has two different turbidity calibrations, formazin and Japan Standard. The formazin calibration is the EPA and ISO approved method of calibrating nephelometers. This calibration can be used with user prepared formazin standards or commercially purchased formazin standards. LaMotte Company approved AMCO™ standards labeled for use with the 2020we/wi can also be used with the formazin calibration. Stablcal® standards below 50 NTU should not be used to calibrate the 2020we/wi.

The Japan Standard calibration is a calibration for a Japanese Water Works standard. It is based on Japanese formulated polystyrene turbidity standards. This calibration should only be used to meet Japanese Water Works requirements. The Japanese polystyrene standards can only be purchased in Japan. Formazin, AMCO and Stablcal® standards cannot be used with this calibration.

Taking Turbidity Water Samples

Clean plastic or glass containers may be used for turbidity samples. Ideally, samples should be tested soon after collection and at the same temperature as when collected.

■ SAMPLE DILUTION TECHNIQUES

If a test result is out of the range of the meter, it must be diluted. The test should then be repeated on the diluted sample. The following table gives quick reference guidelines for dilutions of various proportions.

Amount of Sample	Deionized Water to Bring Final Volume to 10 mL	Multiplication Factor
10 mL	0 mL	1
5 mL	5 mL	2
2.5 mL	7.5 mL	4
1 mL	9 mL	10
0.5 mL	9.5 mL	20

All dilutions are based on a final volume of 10 mL, so several dilutions will require small volumes of the water sample. Graduated pipets should be used for all dilutions. If volumetric glassware is not available, dilutions can be made with the colorimeter tube. Fill the tube to the 10 mL line with the sample and then transfer it to another container. Add 10 mL volumes of deionized water to the container and mix. Transfer 10 mL of the diluted sample to the colorimeter tube and follow the test procedure. Repeat the dilution and testing procedures until the result falls within the range of the calibration. Multiply the test result by the dilution factor. For example, if 10 mL of the sample water is diluted with three 10 mL volumes of deionized water, the dilution factor is four. The test result of the diluted sample should be multiplied by four.

OPTIONS & SET UP

■ FACTORY DEFAULT SETTINGS

Settings that have user options have been set at the factory to default settings.

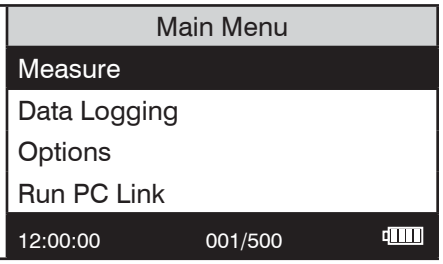
The factory default settings are:

Averaging	Disabled
Turbidity Units	NTU
Turbidity Calibration	Formazin
Date Format	MM-DD-YYYY
Power Save	5 minutes
Backlight	10 seconds
Language	English

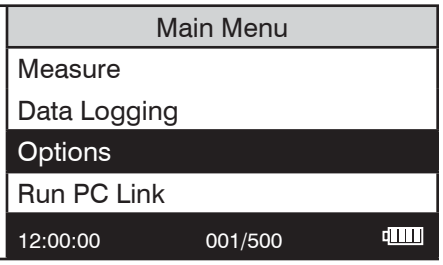
■ AVERAGING

The averaging option allows the user to average multiple readings. This option will improve the accuracy of samples with readings that may tend to drift with time. When the two, five or ten measurement option has been selected the final average is displayed. The averaging option is available only for turbidity. The default setting is disabled. To change the setting:

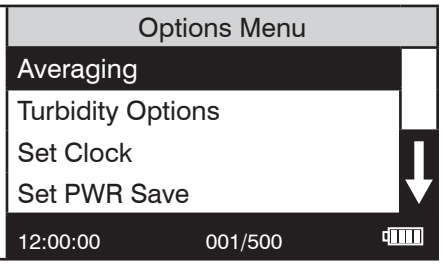
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



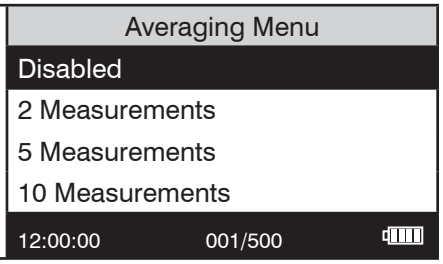
2. Press ▼ to scroll to **Options**.



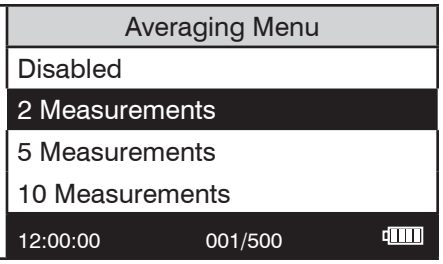
3. Press ENTER to select **Options**.



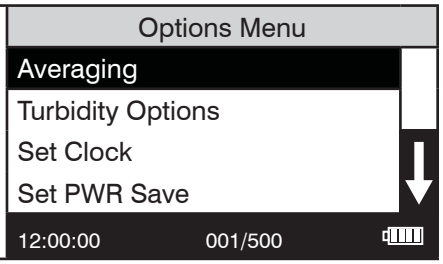
4. Press ENTER to select **Averaging**.



5. Press ▲ or ▼ to scroll to the desired option.



6. Press ENTER to save the selection. The screen will display **Storing...** for about 1 second and return to the **Options Menu**.



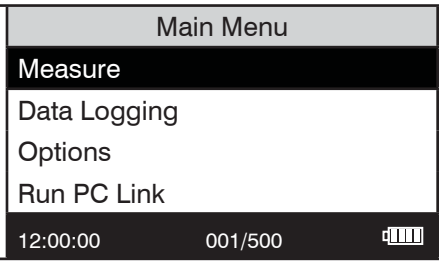
NOTE: When the **Averaging** option is enabled, more time will be required to display a reading and more power will be used.

■ TURBIDITY OPTIONS

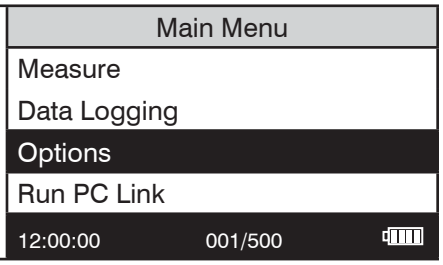
The default units are NTU and the default calibration curve is formazin. To change the settings:

Selecting Turbidity Units

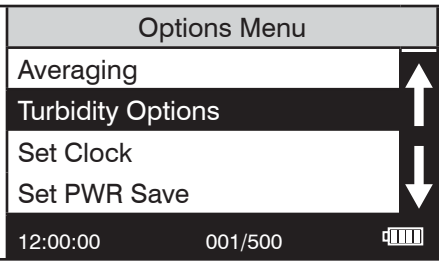
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



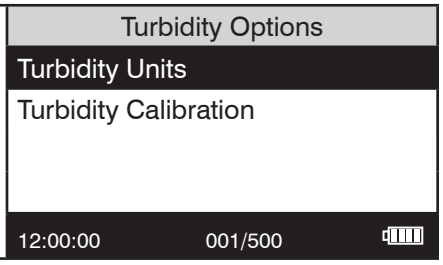
2. Press ▼ to scroll to **Options**.

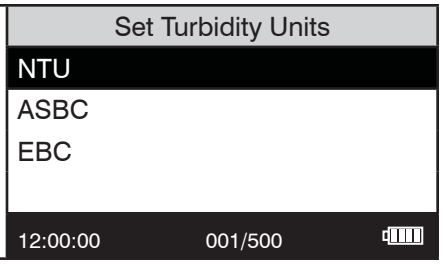


3. Press ENTER to select **Options**. Press ▼ to scroll to **Turbidity Options**.

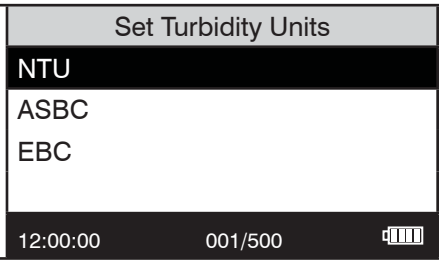


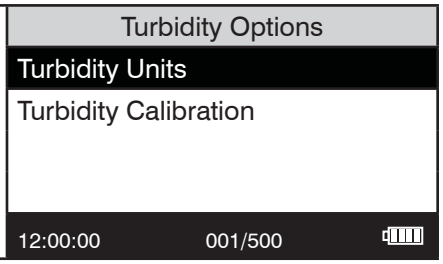
4. Press ENTER to select **Turbidity Options**.



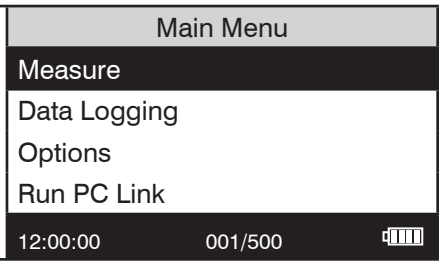
5. Press ENTER to select **Turbidity Units**.	

Available units are:
NTU (Nephelometric Turbidity Units)(2020we only)
FNU (Formazin Nephelometric Units) (2020wi only)
ASBC (American Society of Brewing Chemists)
EBC (European Brewery Convention)
NOTE: The meter will automatically switch to the attenuation mode above approximately 600 NTU or FNU. Measurements will be made with the 180° detector as indicated by AU or FAU on the display.

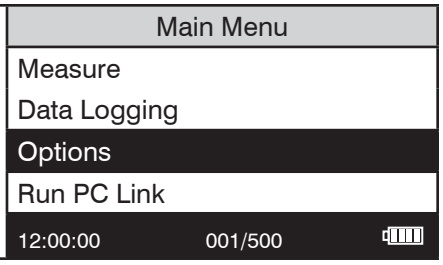
6. Press ^ or v to scroll to the desired units.	

7. Press ENTER to save the selection. The screen will display **Storing...** for about 1 second and return to the **Turbidity Options** menu. Press EXIT to return to a previous menu.	

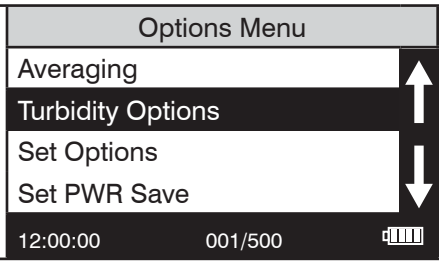
Selecting a Turbidity Calibration Curve

1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.	

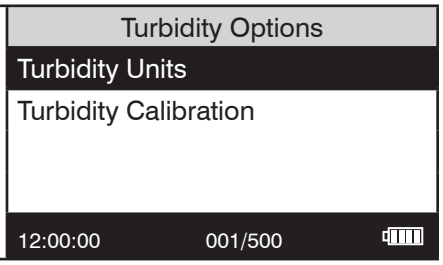
2. Press ▼ to scroll to **Options**.



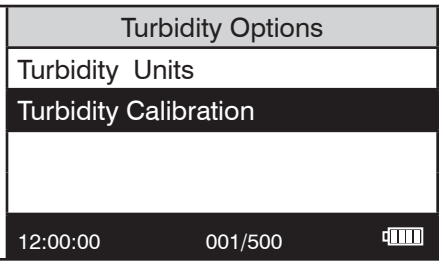
3. Press ENTER to select **Options**. Press ▼ to scroll to **Turbidity Options**.



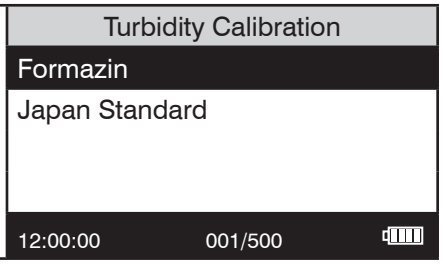
4. Press ENTER to select **Turbidity Options**.



5. Press ▼ to scroll to **Turbidity Calibration**.



6. Press ENTER to select **Turbidity Calibration**.



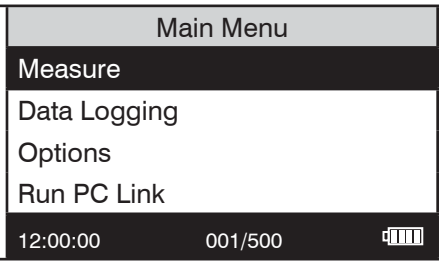
7. Scroll to the desired calibration option. Select a calibration option based on the composition of the standards that will be used to calibrate the meter.	Turbidity Calibration Formazin Japan Standard 12:00:00 001/500

NOTE: Stablcal® standards below 50 NTU should not be used to calibrate the 2020we/wi. The diluent has a different refractive index than traditional formazin standards and will affect the results.

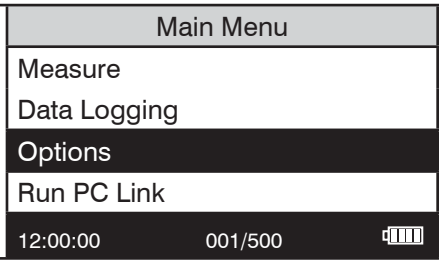
8. Press ENTER to save the selection. The screen will display **Storing...** for about 1 second and return to the **Turbidity Options** menu. Press EXIT to return to a previous menu.	Turbidity Options Turbidity Units Turbidity Calibration 12:00:00 001/500

■ SETTING THE CLOCK

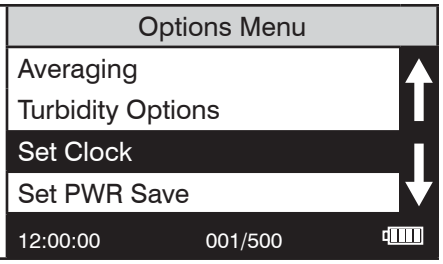
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



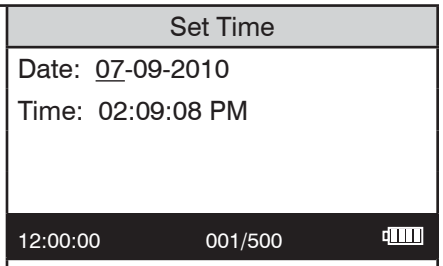
2. Press ▼ to scroll to **Options**.



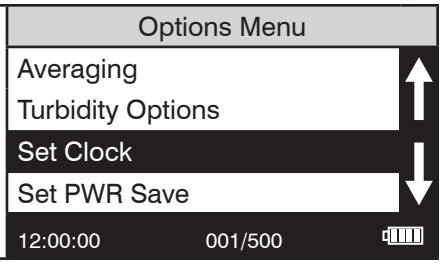
3. Press ENTER to select **Options**. Press ▼ to scroll to **Set Clock**.



4. Press ENTER to select **Set Clock**. The date is displayed as month-day-year. The time is displayed as hours:minutes:seconds AM/PM. Press ▲ or ▼ to the appropriate character and press ENTER to select. The cursor will move to the next character. Set all characters in the same manner. This is a scrolling menu.



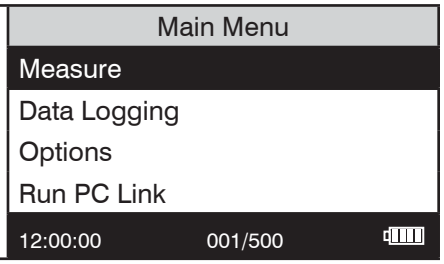
5. Press ENTER to select the final character. The time and date will be saved and the screen will return to the **Options Menu**.



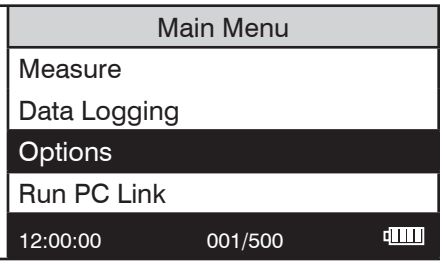
■ SETTING POWER SAVE

The power saving Auto Shutoff feature will turn the meter off when a button has not been pushed for a set amount of time. The default setting is disabled. To change the setting:

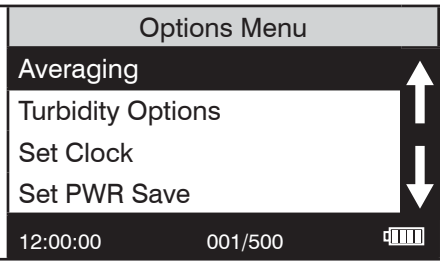
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



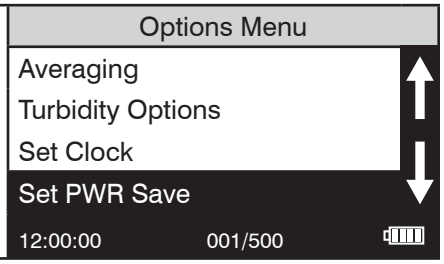
2. Press ▼ to scroll to **Options**.



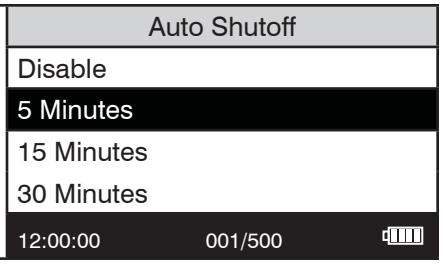
3. Press ENTER to select **Options**.



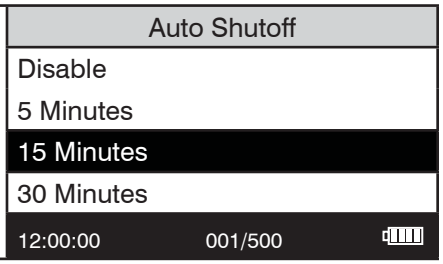
4. Press ▼ to scroll to **Set PWR Save.**



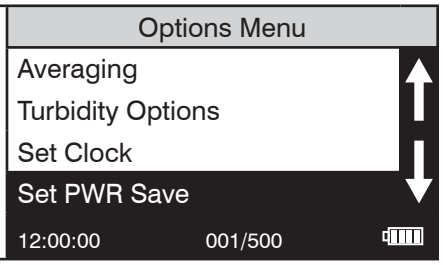
5. Press ENTER to select **PWR Save**.



6. Press ▼ ▼ to scroll to desired setting.



7. Press ENTER to save the selection. The screen will display **Storing...** for about 1 second and return to the **Options Menu**.



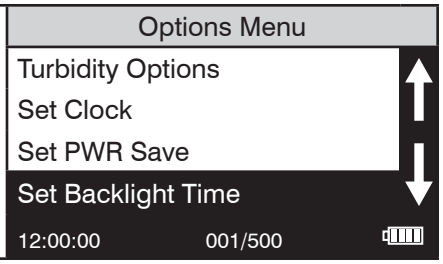
■ SETTING THE BACKLIGHT TIME

The backlight illuminates the display for enhanced viewing. If Button Control is chosen the backlight button on the key pad will act as an on/off switch and the backlight will remain on or off when the meter is being used. When one of the other settings – 10, 20 or 30 seconds – is chosen, the display will be illuminated for the specified amount of time after any button is pressed. As a precaution, the backlight will not illuminate during turbidity measurements to avoid interference from stray light.

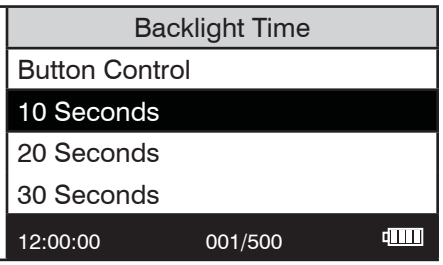
NOTE: The backlight feature uses a significant amount of power. The longer the backlight is on, the more frequently the battery will have to be charged if the USB/Wall Charger is not being used.

1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.	Main Menu Measure Data Logging Options Run PC Link 12:00:00 001/500
2. Press ▼ to scroll to **Options**.	Main Menu Measure Data Logging Options Run PC Link 12:00:00 001/500
3. Press ENTER to select **Options**.	Options Menu Averaging Turbidity Options Set Clock Set PWR Save 12:00:00 001/500

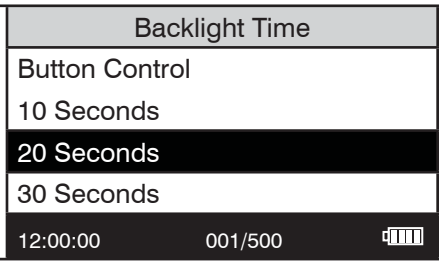
4. Press ▼ to scroll to **Set Backlight Time.**



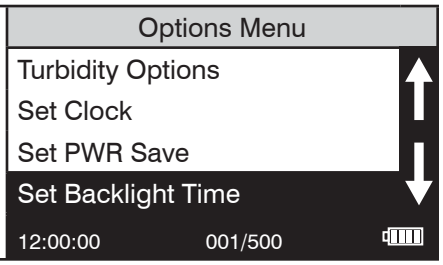
5. Press ENTER to select **Set Backlight Time.**



6. Press ▼ ▼ to scroll to desired setting.



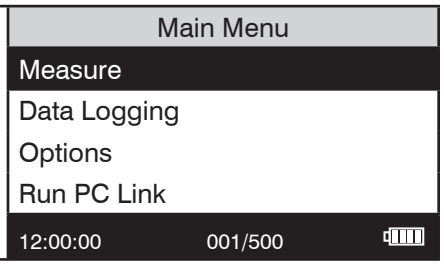
7. Press ENTER to save the selection. The screen will display **Storing...** for about 1 second and return to the **Options Menu**.



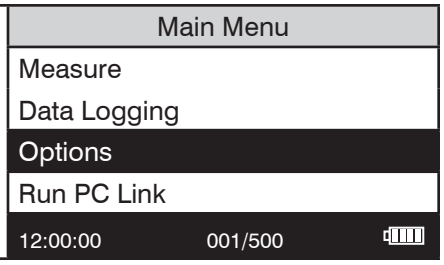
■ FACTORY RESET

Performing a Factory Reset will restore the factory default settings. All user-level calibrated settings will be lost.

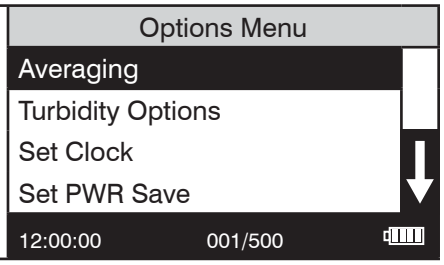
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



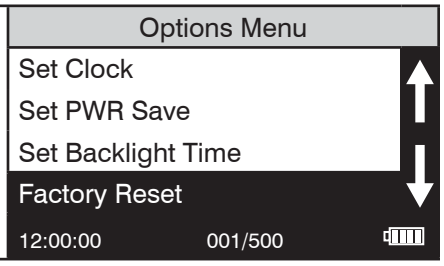
2. Press ▼ to scroll to **Options**.



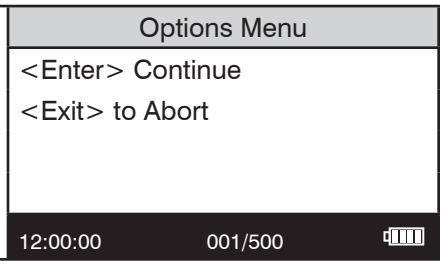
3. Press ENTER to select **Options**.



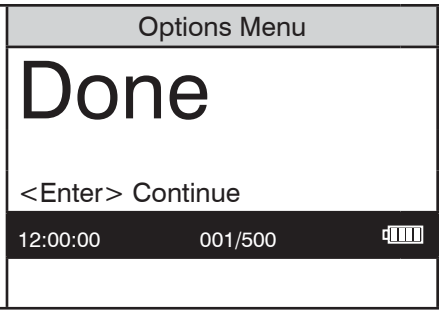
4. Press ▼ to scroll to **Factory Reset.**



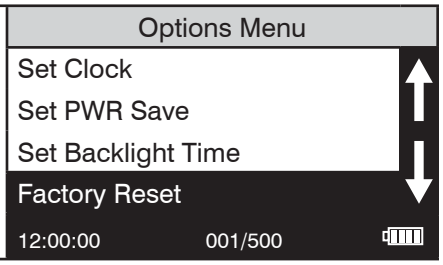
5. Press ENTER to select to **Factory Reset.**



6. Press ENTER to complete the Factory Reset. The screen will momentarily display **Writing**. The screen will display **Done** and return to the **Options Menu.** To retain the current user level calibration settings, press EXIT to abort the Factory Reset.



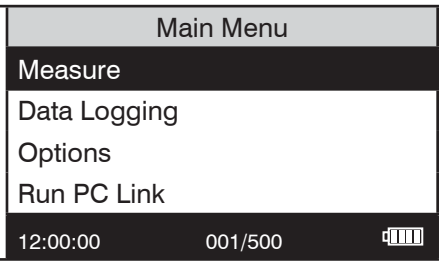
7. Press ENTER to return to the **Options Menu.**



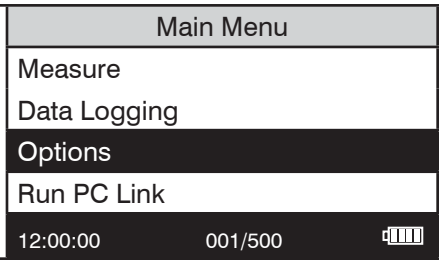
■ SELECTING A LANGUAGE

There are seven languages available in the 2020we/wi: English, Spanish, French, Portuguese, Italian, Chinese, and Japanese (Kana).

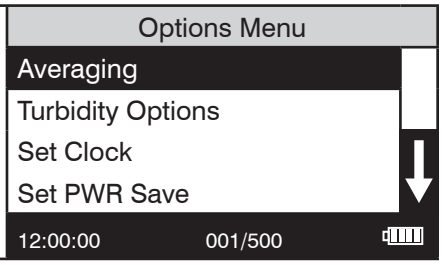
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



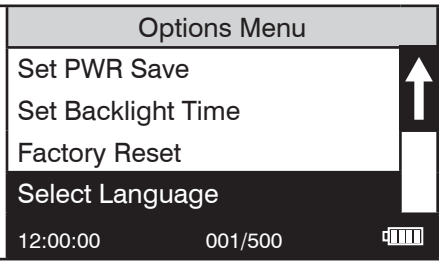
2. Press ▼ to scroll to **Options**.



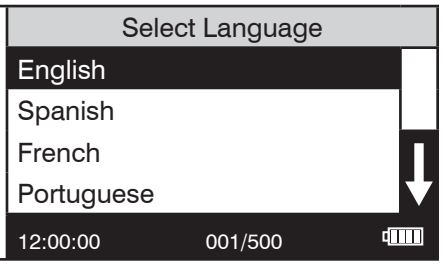
3. Press ENTER to select **Options**.



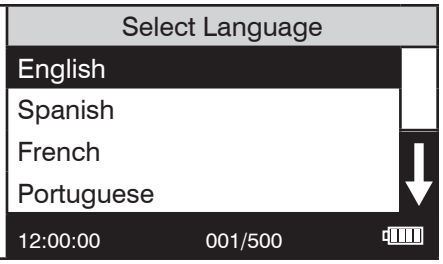
4. Press ▼ to scroll to **Select Language.**



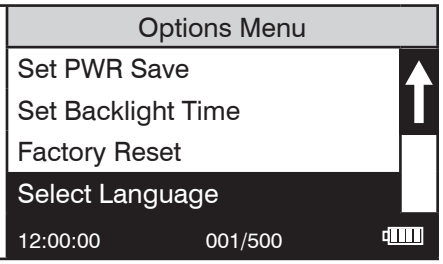
5. Press ENTER to select to **Select Language**.



6. Press ▲ or ▼ to scroll to desired language.



7. Press ENTER to select desired language. The screen will momentarily display, **Storing...**for about 1 second and return tot the **Options Menu**.



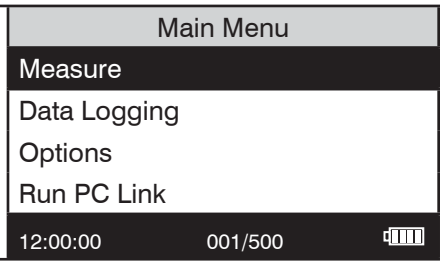
NOTE: If the meter unintentionally switches to another language, use the procedure above to reset the meter to the desired language. For example, to reset the meter to English:

1. Turn the meter on.
2. Press down arrow twice. Press ENTER.
3. Press down arrow seven times. Press ENTER.
4. Press ENTER.

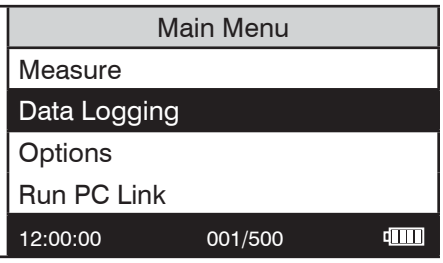
DATA LOGGING

The default setting for the data logger is enabled. The meter will log the last 500 data points. The counter in the center bottom of the display will show how many data points have been logged.

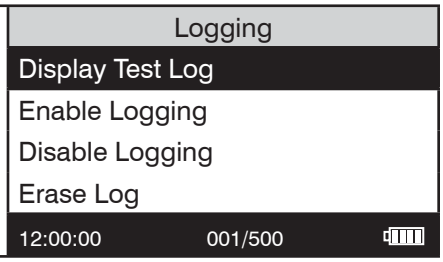
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



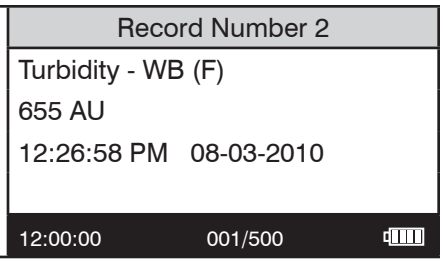
2. Press ▼ to scroll to **Data Logging**.



3. Press ENTER to select **Data Logging**.



4. Press ENTER to display the last data point and the time that it was logged.



5. Press ^ or v to scroll through the data points in the log.	Record Number 1 Turbidity - WB (F) 95.4 NTU 12:26:44 PM 08-03-2010 12:00:00 001/500

6. Press EXIT to return to the **Logging** menu. Press ^ or v to scroll to disable the logging options or erase the log. Press ENTER to select the option. The screen will display **Storing...** for about 1 second and return to the **Logging Menu**.	Logging Display Test Log Enable Logging Disable Logging Erase Log 12:00:00 001/500

CALIBRATION & ANALYSIS

■ CALIBRATION

Turbidity Standards

Only use AMCO or formazin standards with the 2020we/wi. StablCal® standards below 50 NTU should not be used to calibrate the 2020we/wi. The diluent used in the StablCal® standards has a different refractive index than traditional formazin standards and will affect the results. The concentration of the calibration standard should be similar to the expected concentration of sample that will be tested. The following standards are available from LaMotte Company:

1480 0 NTU Standard, 60 mL (EPA or ISO)

1450 1 NTU Standard, 60 mL (EPA)

1453 1 NTU Standard, 60 mL (ISO)

1451 10 NTU Standard, 60 mL (EPA)

1454 10 NTU Standard, 60 mL (ISO)

1452 100 NTU Standard, 60 mL (EPA)

1455 100 NTU Standard, 60 mL (ISO)

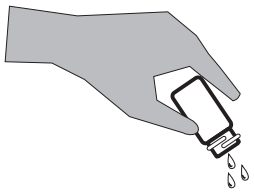
Turbidity Calibration Procedure

The default units are NTU and the default calibration curve is formazin as indicated by (F) in the Menu bar. For the most accurate results, a user calibration should be performed. The Japan Standard calibration mode, as indicated by (J) in the Menu bar, should be used only with Japanese Polystyrene Standards (0-100 NTU). To change the settings see the Set Up Instructions on page 9.

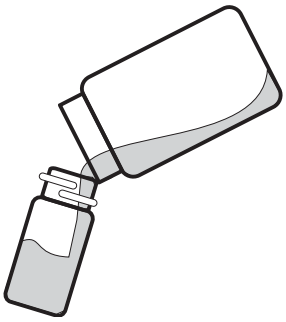
For the most accurate results, perform a calibration over the smallest range possible. Use a calibration standard that, along with the blank, brackets the range of samples that will be tested. For example, if the samples that are to be tested are expected to be below 1 NTU, more accurate results will be obtained by calibration with a blank and a 1 NTU standard as opposed to a blank and a 100 NTU standard.

It is recommended that the meter be calibrated daily.

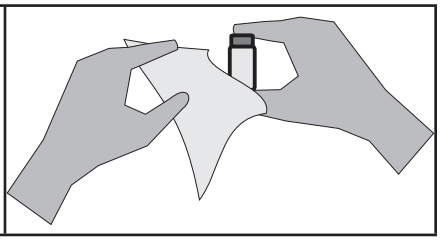
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.	Main Menu Measure Data Logging Options Run PC Link 12:00:00 001/500

2. Press ENTER to select **Measure**.	Measure Menu Turbidity - No Blank Turbidity - With Blank 12:00:00 001/500
3. Press ▼ to scroll to **Turbidity - With Blank**.	Measure Menu Turbidity - No Blank Turbidity - With Blank 12:00:00 001/500
4. Press ENTER to select **Turbidity - With Blank.**	Turbidity WB (F) Scan Blank Scan Sample 12:00:00 001/500
5. Rinse a clean tube (0290) three times with the blank. If samples are expected to read below 1 NTU the meter should be blanked with a 0 NTU Primary Standard or prepared turbidity-free (<0.1 NTU) water. For the most accurate results, use the same tube for the blank and the sample.	

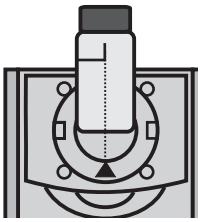
6. Fill the tube to the fill line with the blank. Pour the blank down the inside of the tube to avoid creating bubbles. Cap the tube.



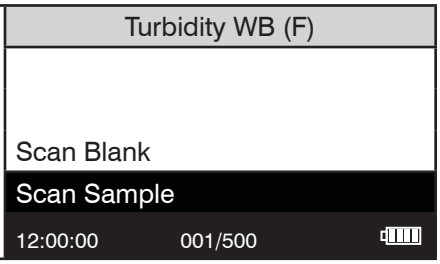
7. Wipe the tube thoroughly with a lint-free cloth.



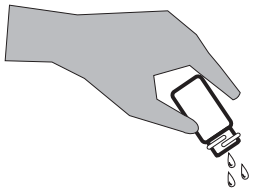
8. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.



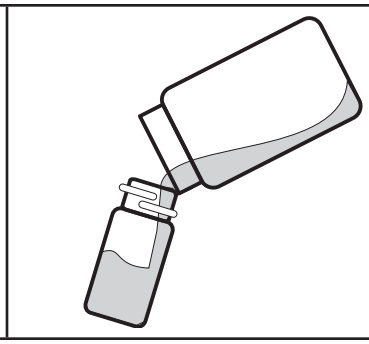
9. Press ENTER to scan the blank. The screen will display **Blank Done** for about 1 second and then return to the **Turbidity - With Blank Menu**.



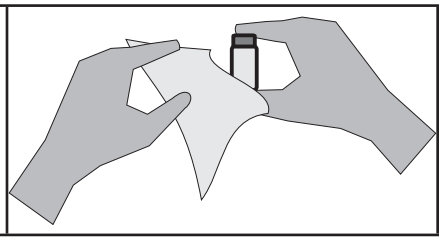
10. Rinse a clean tube (0290), or the same tube, three times with the standard.



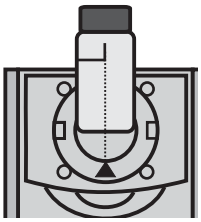
11. Fill the tube to the fill line with the standard. Pour the standard down the inside of the tube to avoid creating bubbles. Cap the tube.



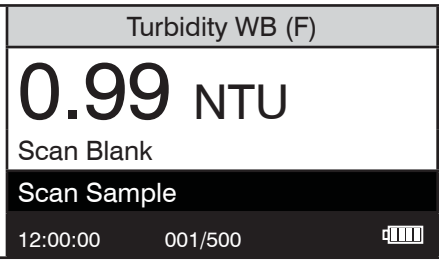
12. Wipe the tube thoroughly with a lint-free cloth.



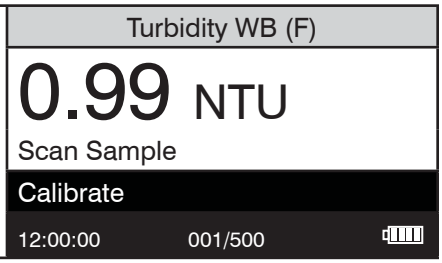
13. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.



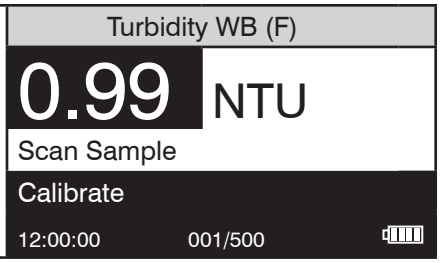
14. Press ENTER to scan the standard. The screen will display **Reading** for about 1 second. The result will appear on the screen.



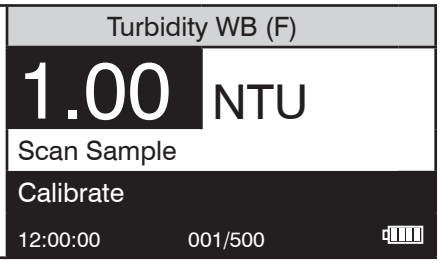
15. Press ▼ to scroll to **Calibrate**.



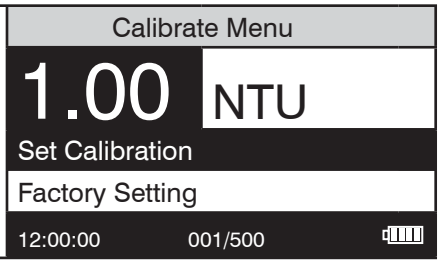
16. Press ENTER to select **Calibrate**. A reverse font (dark background with light characters) will appear to indicate that the reading can be adjusted.



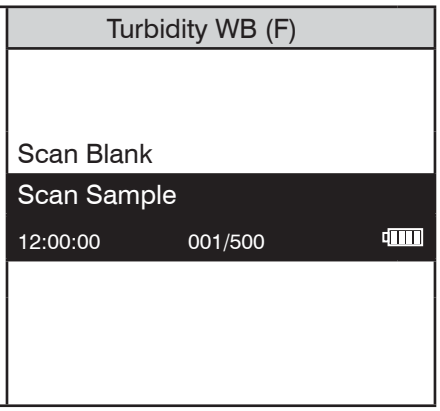
17. Press ^ or v to scroll to the concentration of the standard, 1.00 in the example. Note: The allowable adjustment is ±10%.



18. Press ENTER to select **Caibrate**. Two menu choices will be offered, **Set Calibration** and **Factory Setting**.



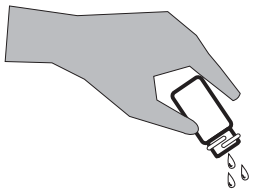
19. Press ENTER to select **Set Calibration** and save the calibration. Press ^ or v to scroll and select **Factory Setting** to revert to the factory calibration. The meter will momentarily display **Storing...** and return to the **Turbidity -Without Blank** menu. The calibration has now been saved and the meter can be used for testing.



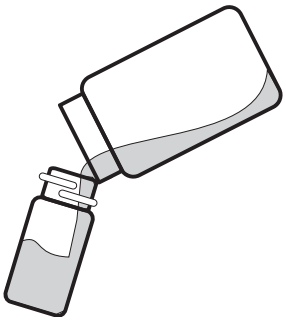
NOTE: For the greatest accuracy during the calibration procedure, be sure that after the meter is blanked and the blank is scanned as a sample, the reading is 0.00. If not, reblank the meter and scan the blank again until it reads 0.00. When scanning the calibration standards as the sample, scan the calibration standard three times removing the tube from the chamber after each scan. The readings should be consistent. Use the last consistent reading to calibrate the meter. If the readings are not consistent, avoid using an aberrant reading to calibrate the meter.

■ ANALYSIS WITHOUT BLANKING PROCEDURE

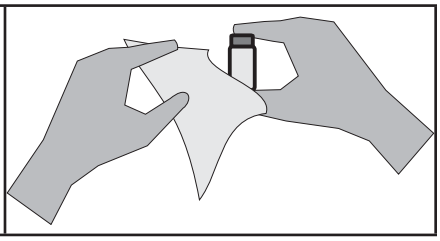
To obtain the most accurate results the meter should be blanked before measuring a sample. The blanking step is not as critical for samples above 10 NTU. The meter should always be blanked before reading samples below 10 NTU.

1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.	Main Menu Measure Data Logging Options Run PC Link 12:00:00 001/500
2. Press ENTER to select **Measure**.	Measure Menu Turbidity - No Blank Turbidity - With Blank 12:00:00 001/500
3. Press ENTER to select **Turbidity - No Blank**.	Turbidity NB (F) Scan Blank Scan Sample 12:00:00 001/500
4. Rinse a clean tube (0290) three times with the sample.	

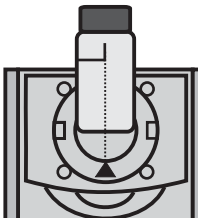
5. Fill the tube to the fill line with the sample. Pour the sample down the inside of the tube to avoid creating bubbles. Cap the tube.



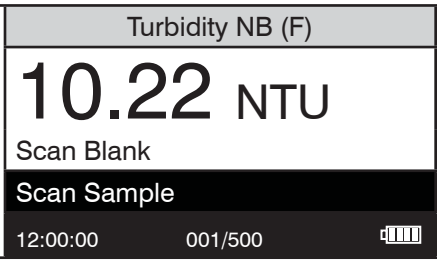
6. Wipe the tube thoroughly with a lint-free cloth.



7. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.



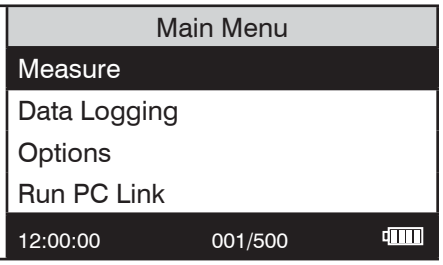
8. Press ENTER to select **Scan Sample**. The screen will display **Reading** for about 1 second. The result will appear on the screen.



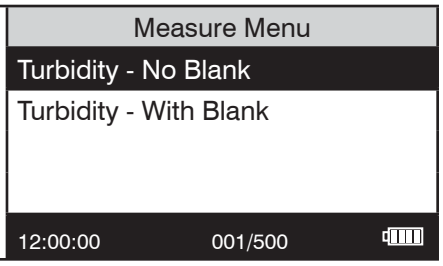
■ ANALYSIS WITH BLANKING PROCEDURE

To obtain the most accurate results the meter should be blanked before measuring a sample. The blanking step is not as critical for samples above 10 NTU. The meter should always be blanked before reading samples below 10 NTU.

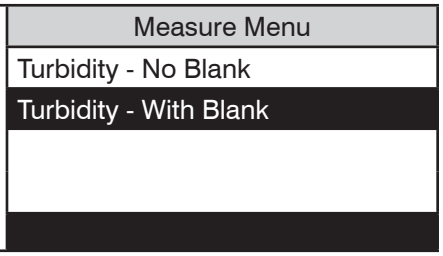
1. Press and briefly hold ⏻ to turn the meter on. The LaMotte logo screen will appear for about 3 seconds and the **Main Menu** will appear.



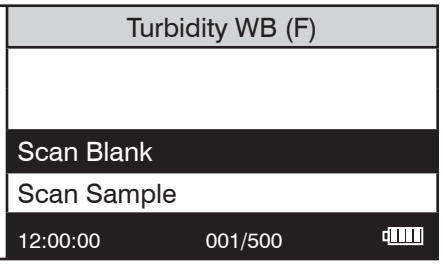
2. Press ENTER to select **Measure**.

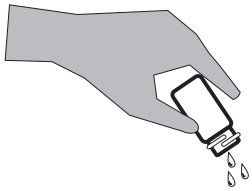
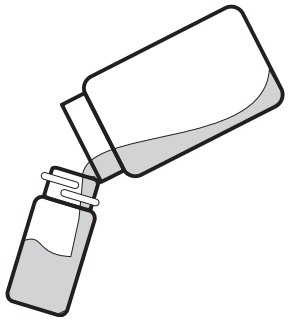
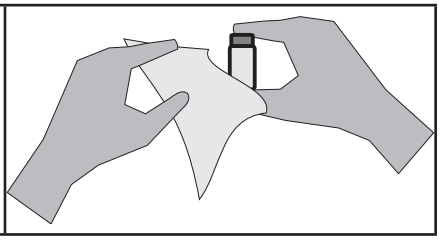
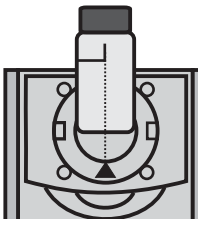


3. Press ⌄ to scroll to **Turbidity - With Blank**.

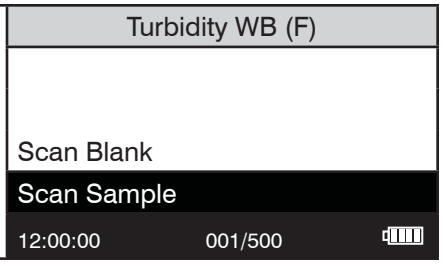


4. Press ENTER to select **Turbidity - With Blank**.

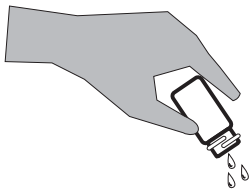


5. Rinse a clean tube (0290) three times with the blank. If samples are expected to read below 1 NTU the meter should be blanked with a 0 NTU Primary Standard or prepared turbidity-free (<0.1 NTU) water. For the most accurate results, use the same tube for the blank and the sample.	
6. Fill the tube to the fill line with the blank. Pour the blank down the inside of the tube to avoid creating bubbles. Cap the tube.	
7. Wipe the tube thoroughly with a lint-free cloth.	
8. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.	

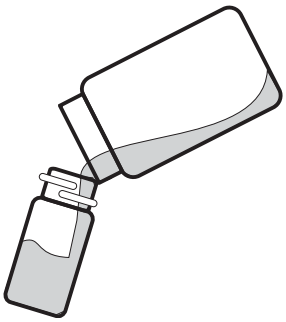
9. Press ENTER to scan the blank. The screen will display **Blank Done** for about 1 second and then return to the **Turbidity - With Blank** menu.



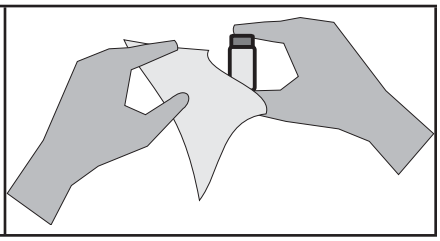
10. Rinse a clean tube (0290), or the same tube, three times with the sample.



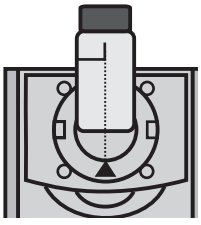
11. Fill the tube to the fill line with the standard. Pour the standard down the inside of the tube to avoid creating bubbles. Cap the tube.



12. Wipe the tube thoroughly with a lint-free cloth.



13. Open the meter lid. Insert the tube into the chamber. Align the index line on the tube with the index arrow on the meter. Close the lid.



14. Press ENTER to scan the standard. The screen will display **Reading** for about 1 second. The result will appear on the screen.	Turbidity WB (F) 0.99 NTU Scan Blank Scan Sample 12:00:00 001/500

NOTE: The meter will remember the last scanned blank reading. It is not necessary to scan a blank each time the test is performed. To use the previous blank reading, instead of scanning a new one, scroll to Scan Sample and proceed. For the most accurate results, the meter should be blanked before each test and the same tube should be used for the blank and the reacted sample.

■ DILUTION PROCEDURES

If a sample is encountered that is more than 4000 NTU, a careful dilution with 0 NTU or very low turbidity water will bring the sample into an acceptable range. However, there is no guarantee that halving the concentration will exactly halve the NTU value. Particulates often react in an unpredictable manner when diluted.

Turbidity-Free Water

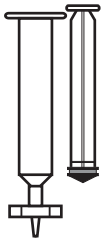
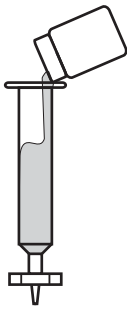
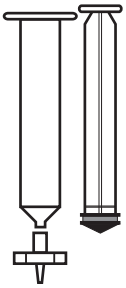
The definition of low turbidity and turbidity-free water has changed as filter technology has changed and nephelometric instruments have become more sensitive. At one time turbidity-free water was defined as water that had passed through a 0.6 micron filter. Now 0.1 micron filters are available and higher purity water is possible. Water that has been passed through a 0.1 micron filter could be considered particle free and therefore turbidity free, 0 NTU water. Turbidity is caused by scattered light. Therefore, low turbidity water is water without any particles that scatter a measurable amount of light. But water that passed through a 0.1 micron filter may still have detectable light scatter with modern instruments. This light scattering can be the result of dissolved molecules or sub-micron sized particles that can not be filtered out of the water. Because there may still be a small amount of scattered light from dissolved molecules, high purity water is often called low turbidity water and assigned a value of 0.01 or 0.02 NTU. However, because this water is used as a baseline to compare to sample water, the difference between the sample and the low turbidity or turbidity-free water will be the same whether it is called 0.00 NTU or 0.02 NTU. For design simplicity the 2020we/wi uses the term turbidity-free water and the value of 0.00 NTU.

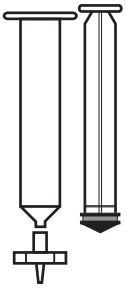
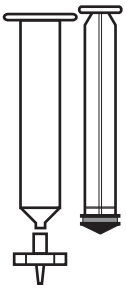
■ PREPARATION OF TURBIDITY-FREE WATER

A 0 NTU Standard (Code 1480) is included with the meter. An accessory package (Code 4185) is available for preparing turbidity-free water for blanking the meter and dilution of high turbidity samples.

The preparation of turbidity-free water requires careful technique.

Introduction of foreign matter will affect the turbidity reading. A filtering device with a special membrane filter is used to prepare turbidity-free water. The filter, filter holder and syringe must be conditioned by forcing at least two syringes full of deionized water through the filtering apparatus to remove foreign matter. The first and second rinses should be discarded. Turbidity-free water as prepared with the following procedure may be stored in the dark at room temperature in a clean glass bottle with a screw cap and used as required. The storage container should be rinsed thoroughly with filtered deionized water before filling. The water should be periodically inspected for foreign matter in bright light.

1. Remove the plunger from the syringe (0943). Attach the filter to the bottom of the syringe.	
2. Pour approximately 50 mL of deionized water into the barrel of the syringe. Insert the plunger. Exert pressure on the plunger to slowly force the water through the filter. Collect water in the clean storage container. Rinse walls of the container then discard this rinse water.	
3. Remove the filter from the syringe. Remove the plunger from the barrel. (This step is required to prevent rupturing the filter by the vacuum that would be created when the plunger is removed.)	

4. Replace the filter and repeat step 2 for a second rinse of the syringe and storage container.	
5. Remove the filter from the syringe. Remove the plunger from the barrel. Replace the filter and fill the syringe with approximately 50 mL of deionized water. Filter the water into the storage container and save this turbidity-free water.	
6. Repeat Step 5 until the desired amount of turbidity-free water has been collected.	

TESTING TIPS

1. Samples should be collected in a clean glass or polyethylene container.
2. Samples should be analyzed as soon as possible after collection.
3. Gently mix sample by inverting before taking a reading but avoid introducing air bubbles.
4. For the most precise results, follow the recommended procedure for wiping a filled tube before placing it in the meter chamber. Invert tube very slowly and gently three times to mix the sample. Surround the tube with a clean, lint-free cloth. Press the cloth around the tube. Rotate the tube in the cloth three times to assure that all areas of the tube have been wiped.
5. Discard tubes that have significant scratches and imperfections in the light pass zones. (Central zone between bottom and fill line).
6. When reading very low turbidity samples, do not use tubes or caps that have been used previously with high turbidity samples.
7. Use the averaging option for low level measurements of turbidity.

8. The meter should be placed on a surface that is free from vibrations. Vibrations can cause high readings.
9. Turbidity readings will be affected by electric fields around motors.
10. Carbon in the sample will absorb light and cause low readings.
11. Excessive color in a sample will absorb light and cause low readings. The user should verify if a certain level of color will cause a significant error at the level of turbidity being tested.
12. Observe shelf life recommendations for turbidity standards.
13. Do not use silicone oil on tubes when testing turbidity with the 2020we/wi.
14. When testing at low concentrations use the same tube for the blank and the sample.
15. Always insert tube into the meter chamber with the same amount of pressure and to the same depth.
16. Occasionally clean the chamber with a damp lint-free wipe, followed by a Windex® dampened wipe. A clean chamber and tubes are essential for reliable results.
17. For the greatest accuracy during the calibration procedure, be sure that after the meter is blanked and the blank is scanned as a sample, the reading is 0.00. If not, reblank the meter and scan the blank again until it reads 0.00. When scanning the calibration standards as the sample, scan the calibration standard three times removing the tube from the chamber after each scan. The readings should be consistent. Use the last consistent reading to calibrate the meter. If the readings are not consistent, avoid using an aberrant reading to calibrate the meter.
18. Calibrate the meter daily.
19. Calibrate the meter with a 1.0 NTU Standard if samples are expected to be 1.0 NTU or less. Calibrate the meter with a 10.0 NTU Standard if samples are expected to be 1.0 NTU or greater.

TROUBLESHOOTING GUIDE

■ TROUBLESHOOTING

PROBLEM	*REASON*	*SOLUTION*
“Blank?”	Sample is reading lower than the blank.	With samples of very low concentration reblank or record as zero. On samples of higher concentration reblank and read again.
Flashing	Low battery. Readings are reliable.	Charge battery or use USB wall/computer charger.
“Low Battery”	Battery voltage is very low. Readings are not reliable.	Charge battery or use USB wall/computer charger.
“Shut Down Low Batt” Shut Down	Battery is too low to operate the unit.	Charge battery or use USB wall/computer charger.
“Over range”	Sample is outside of acceptable range.	Dilute sample and test again.
“Error1”	High readings with 90° and 180° detectors.	Dilute sample by at least 50% and retest.
Lost in meter menus	Reset to factory default settings.	Follow Procedure on page 9 or page 26.
Unusually large negative or positive readings when performing calibration	Incorrect standards used to calibrate meter.	Use fresh 0.0 standard in clean tube. Reset meter to factory default settings. Recalibrate meter.

■ STRAY LIGHT

The accuracy of readings on the 2020we/wi should not be affected by stray light. Make sure that the sample compartment lid is always fully closed when taking readings. The backlight will interfere with turbidity readings. The meter will temporarily disable the backlight while turbidity measurements are being taken.

GENERAL OPERATING INFORMATION

■ OVERVIEW

The 2020we/wi is a portable, microprocessor controlled, direct reading nephelometer. Turbidity is measured directly by either EPA Method 180.1 or ISO Method 7027. It has a graphical liquid crystal display and 6 button keypad. These allow the user to select options from the menu driven software, to directly read test results or to review stored results of previous tests in the data logger. The menus can be displayed in seven different languages.

The 2020we/wi uses a state of the art, multi-detector optical configuration that assures long term stability of calibrations, high precision and accuracy and low detection limits. All readings are determined by sophisticated digital signal processing algorithms, minimizing fluctuations in readings and enabling rapid, repeatable measurements. The microprocessor and optics enable a dynamic range and auto-ranging over several ranges. Energy efficient LED light sources are used for ISO turbidity. EPA turbidity uses a tungsten filament light source that meets or exceeds EPA specifications and is designed for a uniform light spot image and stable output.

A USB computer/wall charger or Lithium battery powers the 2020we/wi.

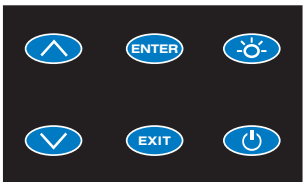
A USB port on the back of the meter allows an interface of the meter with a Windows-based computer for real-time data acquisition and data storage using a PC. The 2020we/wi may be interfaced with any Windows-based computer by using the LaMotte SMARTLink 3 Program.

GENERAL OPERATING INFORMATION

The operation of the 2020we/wi is controlled by the menu driven software and user interface. A menu is a list of choices. This allows a selection of various tasks for the 2020we/wi to perform, such as, scan blank and scan sample. The keypad is used to make menu selections that are viewed on the display.

■ The Keypad

	This button will scroll up through a list of menu selections.
	The button is used to select choices in a menu viewed in the display.
	This button controls the backlight on the display.
	This button will scroll down through a list of menu selections.
	This button exits to the previous menu.
	This button turns the meter on or off.

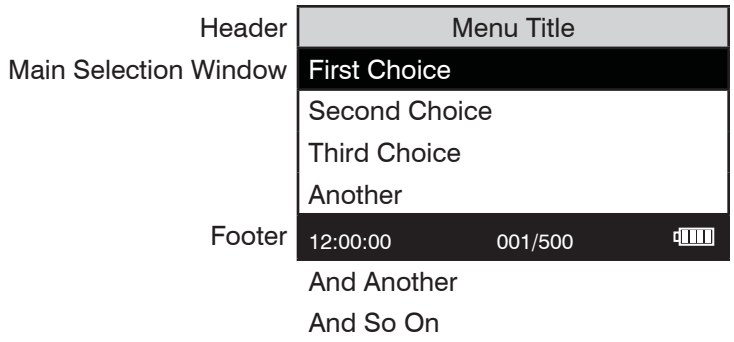


■ THE DISPLAY & MENUS

The display allows menu selections to be viewed and selected. These selections instruct the 2020we/wi to perform specific tasks. The menus are viewed in the display using two general formats that are followed from one menu to the next. Each menu is a list of choices or selections.

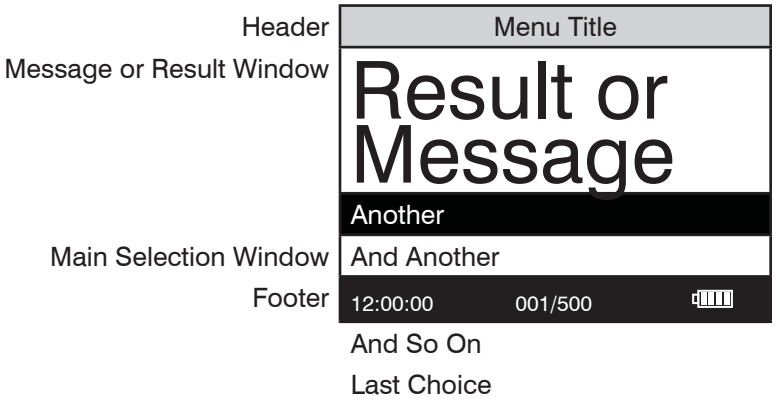
The display has a header line at the top and a footer line at the bottom. The header displays the title of the current menu. The footer line displays the time and the date, the data logger status and the battery status. The menu selection window is in the middle of the display between the header and the footer.

The menu selection window displays information in two general formats. In the first format only menu selections are displayed. Up to 4 lines of menu selections may be displayed. If more selections are available they can be viewed by pressing the arrow buttons to scroll the other menu selections into the menu selection window. Think of the menu selections as a vertical list in the display that moves up or down each time an arrow button  is pressed. Some menus in the 2020we/wi are looping menus. The top and bottom menu choices are connected in a loop. Scrolling down past the bottom of the menu will lead to the top of the menu. Scrolling up past the top of the menu will lead to the bottom of the menu.



A black bar will indicate the menu choice. As the menu is scrolled through, the black bar will highlight different menu choices. Pressing the ENTER button will select the menu choice that is indicated by the black bar.

In the second format the menu choice window takes advantage of the graphical capabilities of the display. Large format graphic information, such as test results or error messages or the LaMotte logo is displayed. The top two lines of the display are used to display information in a large, easy to read format. The menus work in the same way as previously described but two lines of the menu are visible at the bottom of the display.



As described previously, the EXIT button allows an exit or escape from the current menu and a return to the previous menu. This allows a rapid exit from an inner menu to the main menu by repeatedly pushing the EXIT button. Pushing ⏻ at any time will turn the 2020we/wi off.

The display may show the following messages:

	Battery Status
	More choices are available and can be viewed by scrolling up and/or down through the display.
Header	Identifies the current menu and information on units and reagent systems if applicable.
Footer	In the data logging mode the number of the data point is displayed and the total number of data points in the memory will be shown. The footer also shows current time and battery status

■ NEGATIVE RESULTS

There are always small variations in readings with analytical instruments. Often these variations can be observed by taking multiple readings of the same sample. These variations will fall above and below an average reading. Repeated readings on a 0.00 sample might give readings above and below 0.00. Therefore, negative readings are possible and expected on samples with concentrations at or near zero. This does not mean there is a negative concentration in the sample. It means the sample reading was less than the blank reading. Small negative readings can indicate that the sample was at or near the detection limit. This is a normal variation that results in a negative reading. A large negative reading, however, is not normal and indicates a problem. Some instruments are designed to display negative readings as zero. In this type of instrument, if the meter displayed zero when the result was actually a large negative number there would be no indication that a problem existed. For this reason, the 2020we/wi displays negative numbers for turbidity.

■ TUBES

The 2020we/wi uses one type of tube (Code 0290). There is no need for a special turbidity tube.

The handling of the tubes is of utmost importance. Tubes must be clean and free from lint, fingerprints, dried spills and significant scratches, especially the central zone between the bottom and the sample line.

Scratches, fingerprints and water droplets on the tube can cause stray light interference leading to inaccurate results when measuring turbidity. Scratches and abrasions will affect the accuracy of the readings. Tubes that have been scratched in the light zone through excessive use should be discarded and replaced with new ones.

Tubes should always be washed on the inside and outside with mild detergent prior to use to remove dirt or fingerprints. The tubes should be

allowed to air-dry in an inverted position to prevent dust from entering the tubes. Dry tubes should be stored with the caps on to prevent contamination.

After a tube has been filled and capped, it should be held by the cap and the outside surface should be wiped with a clean, lint-free absorbent cloth until it is dry and smudge-free. Handling the tube only by the cap will avoid problems from fingerprints. Always set the clean tube aside on a clean surface that will not contaminate the tube. It is imperative that the tubes and light chamber be clean and dry. The outside of the tubes should be dried with a clean, lint-free cloth or disposable wipe before they are placed in the meter chamber.

Tubes should be emptied and cleaned as soon as possible after reading a sample to prevent deposition of particulates on the inside of the tubes. When highly accurate results are required, reduce error by designating tubes to be used only for very low turbidity and very high turbidity testing.

Variability in the geometry of the glassware and technique is the predominate cause of variability in results. Slight variations in wall thickness and the diameter of the tubes may lead to slight variations in the test results. To eliminate this error the tubes should be placed in the chamber with the same orientation each time.

COMPUTER CONNECTION

■ PC LINK

The 2020we/wi may be interfaced with any Windows-based computer by using the LaMotte SMARTLink 3 Program and USB Cable. The program will store test information and results in a database.

■ OUTPUT

USB

■ COMPUTER CONNECTION

USB Type A, USB mini B, Order Cable Code 1720.

BATTERY OPERATION

The 2020we/wi may be operated on battery power or using a computer/AC wall adapter. If using the meter as a bench top unit, use the AC wall adapter if possible to extend the battery life. The meter will remain on when the USB adapter is used.

The battery icon will show no bars and flash when the unit first turns on. Then the indicator will indicate the battery status by showing 0, 1, 2, 3 or 4 bars.

It will take 5 hours to fully change a low battery. The battery icon will flash when the battery is charging. The battery icon will show four bars and stop flashing when it is fully charged. The charging circuit will automatically switch to a float charge when the battery is fully charged. The charger may remain connected. Some computers will NOT supply

power to their USB ports during standby operation. The wall charger will charge the unit continuously.

The battery icon will show no bars and continuously flash if the battery is getting low but the unit will still operate normally. A “Low Battery” message on the status bar of the display will replace the time when the battery voltage is too low for proper operation and accuracy may be degraded. A “Shutdown Low Batt” message on the display will appear for a few seconds before the power is switched off when the battery is too low to operate the unit.

To extend the battery life:

- Shut down the unit with the power switch when not taking measurements or use the power save option to have the unit automatically turn off after 5 minutes.
- Store the unit in a cool dry place.
- Fully charge the battery before storing the unit for extended periods of time.
- Limit backlight use. The unit consumes 3X normal power with the backlight on. Set the backlight time option to 10 seconds, or select “Button Control” and keep the backlight off.

MAINTENANCE

■ CLEANING

Clean the exterior housing with a damp, lint-free cloth. Do not allow water to enter the light chamber or any other parts of the meter. To clean the light chamber and optics area, point a can of compressed air into the light chamber and blow the pressurized air into the light chamber. Use a cotton swab dampened with Windex® window cleaner to gently swab the interior of the chamber. Do not use alcohol; it will leave a thin residue over the optics when dry.

■ REPAIRS

Should it be necessary to return the meter for repair or servicing, pack the meter carefully in a suitable container with adequate packing material. A return authorization number must be obtained from LaMotte Company by calling 800-344-3100 (US only) or 410-778-3100, faxing 410-778-6394, or emailing tech@lamotte.com. Often a problem can be resolved over the phone or by email. If a return of the meter is necessary, attach a letter with the return authorization number, meter serial number, a brief description of problem and contact information including phone and FAX numbers to the shipping carton. This information will enable the service department to make the required repairs more efficiently.

■ METER DISPOSAL

Waste Electrical and Electronic Equipment (WEEE)

Natural resources were used in the production of this equipment. This equipment may contain materials that are hazardous to health and the environment. To avoid harm to the environment and natural resources, the use of appropriate take-back systems is recommended. The crossed out wheeled bin symbol on the meter encourages the use of these systems when disposing of this equipment.

Take-back systems will allow the materials to be reused or recycled in a way that will not harm the environment. For more information on approved collection, reuse, and recycling systems contact local or regional waste administration or recycling services.

GENERAL INFORMATION

■ PACKAGING AND DELIVERY

Experienced packaging personnel at LaMotte Company assure adequate protection against normal hazards encountered in transportation of shipments.

After the product leaves LaMotte Company, all responsibility for safe delivery is assured by the transportation company. Damage claims must be filed immediately with the transportation company to receive compensation for damaged goods.

■ GENERAL PRECAUTIONS

READ THE INSTRUCTION MANUAL BEFORE ATTEMPTING TO SET UP OR OPERATE THE METER. Failure to do so could result in personal injury or damage to the meter. The meter should not be used or stored in a wet or corrosive environment. Care should be taken to prevent water from wet tubes from entering the meter chamber.

NEVER PUT WET TUBES IN THE METER.

■ SAFETY PRECAUTIONS

Read the label on all reagent containers. Some labels include precautionary notices and first aid information. Certain reagents are considered potential health hazards and are designated with a * in the instruction manual. To view or print a Material Safety Data Sheet (MSDS) for these reagents go to www.lamotte.com. To obtain a printed copy, contact LaMotte by e-mail, phone or FAX. Additional information for all LaMotte reagents is available in the United States, Canada, Puerto Rico, and the US Virgin Islands from Chem-Tel by calling 1-800-255-3924. For other areas, call 813-248-0585 collect to contact Chem-Tel's International access number. Each reagent can be identified by the four-digit number listed on the upper left corner of the reagent label, in the contents list and in the test procedures.

■ LIMITS OF LIABILITY

Under no circumstances shall LaMotte Company be liable for loss of life, property, profits, or other damages incurred through the use or misuse of their products.

■ SPECIFICATIONS - 2020we/wi

Instrument Type:	Nephelometer
Standard:	EPA 180.1, 2020we; ISO7027, 2020wi
Units of Measure:	NTU (Nephelometric Turbidity Units) (2020we only) FNU (Formazin Nephelometric Units) (2020wi only) ASBC (American Society of Brewing Chemists) EBC (European Brewery Convention)
Range:	0-4000 NTU, 0-4000 FNU, 0-10,500 ASBC, 0-150 EBC
Range Selection:	Automatic
Resolution: (display)	0.01 NTU, 0–10.99 NTU Range 0.1 NTU, 11.0–109.9 NTU Range 1 NTU, 110–4000 NTU Range
Accuracy:	From 0-2.5 NTU the accuracy is ±0.05 NTU. From 2.5-100 NTU the accuracy is ±2%. Above 100 NTU the accuracy is ±3%.
Detection Limit:	0.05 NTU
Light Source:	Tungsten lamp 2300°C ±50 °C, 2020we; IR LED 850 nm ±10 nm, spectral bandwidth 50 nm, 2020wi
Detector	Photodiode, centered at 90°, maximum peak 400-600 nm, TC-3000we Photodiode, centered at 90°, TC-3000wi
Response Time:	<2 seconds
Signal Averaging:	Yes
Sample Chamber:	Accepts 25 mm flat-bottomed test tubes
Sample:	10 mL in capped tube
Display:	Graphic Liquid Crystal Display
Software:	*Auto Shut-off:* 5, 10, 30 min, disabled *Calibration:* Field adjustable, 2-points *Data Logging:* 500 points
Languages:	English, Spanish, French, Portuguese, Italian, Chinese, Janpanese (Kana)
Temperature:	Operation: 0–50 °C; Storage: -40–60 °C

Operation Humidity Range:	0–90 % RH, non-condensing
Auto Shut-off:	5, 10, 30 min, disabled
Waterproof:	IP67
Power Source†:	USB computer/wall charger or Lithiun ion rechargeable battery 2200 mAH, 3.7V
Battery Life:	~380 tests (backlight on) to 1000 tests (backlight off) (with signal averaging disabled)
Dimensions:	(W x L x H) 8.84 x 19.05 x 6.35 cm; 3.5 x 7.5 x 2.2 inches
Weight:	362 g, 13 oz (meter only)
USB Interface	mini B

†CE Mark: The device complies to the product specifications for the Low Voltage Directive.

■ STATISTICAL & TECHNICAL DEFINITIONS RELATED TO PRODUCT SPECIFICATIONS

Method Detection Limit (MDL): "The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte."[1] Note that, "As Dr. William Horwitz once stated, 'In almost all cases when dealing with a limit of detection or limit of determination, the primary purpose of determining that limit is to stay away from it.'"[2]

Accuracy: Accuracy is the nearness of a measurement to the accepted or true value.[3] The accuracy can be expressed as a range, about the true value, in which a measurement occurs (i.e. ±0.5 ppm). It can also be expressed as the % recovery of a known amount of analyte in a determination of the analyte (i.e. 103.5 %).

Resolution: Resolution is the smallest discernible difference between any two measurements that can be made.[4] For meters this is usually how many decimal places are displayed. (i.e. 0.01). Note that the resolution many change with concentration or range. In some cases the resolution may be less than the smallest interval, if it is possible to make a reading that falls between calibration marks. A word of caution, that resolution has very little relationship to accuracy or precision. The resolution will always be less than the accuracy or precision but it is not a statistical measure of how well a method of analysis works. The resolution can be very, very good and the accuracy and precision can be very bad! This is not a useful measure of the performance of a test method.

Repeatability: Repeatability is the within-run precision.[5] A run is a

single data set, from set up to clean up. Generally, one run occurs on one day. However, for meter calibrations, a single calibration is considered a single run or data set, even though it may take 2 or 3 days.

Reproducibility: Reproducibility is the between-run precision.[6]

Detection Limit (DL): The detection limit (DL) for the 2020we/wi is defined as the minimum value or concentration that can be determined by the meter, which is greater than zero, independent of matrix, glassware, and other sample handling sources of error. It is the detection limit for the optical system of the meter.

[1] CFR 40, part 136, appendix B

[2] Statistics in Analytical Chemistry: Part 7 – A Review, D. Coleman and L Vanatta, American Laboratory, Sept 2003, P. 31.

[3] Skoog, D.A., West, D. M., *Fundamental of Analytical Chemistry*, 2nd ed., Holt Rinehart and Winston, Inc, 1969, p. 26.

[4] Statistics in Analytical Chemistry: Part 7 – A Review, D. Coleman and L Vanatta, American Laboratory, Sept 2003, P. 34.

[5] Jeffery G. H., Basset J., Mendham J., Denney R. C., *Vogel's Textbook of Quantitative Chemical Analysis*, 5th ed., Longman Scientific & Technical, 1989, p. 130.

[6] Jeffery G. H., Basset J., Mendham J., Denney R. C., *Vogel's Textbook of Quantitative Chemical Analysis*, 5th ed., Longman Scientific & Technical, 1989, p. 130

■ CONTENTS & ACCESSORIES

	2020we Kit EPA Version Code 1970-EPA	2020wi Kit ISO Version Code 1970-ISO
Contents	*Code*	*Code*
0 NTU Standard, 60 mL	1480	1480
1 NTU Standard, 60 mL	1450	1453
10 NTU Standard, 60 mL	1451	1454
Water Sample Bottle, 60 mL	0688	0688
Tubes, 4	—	—
Cable, USB, 3 ft.	1720	1720
USB Wall Plug	1721	1721

Accessories	
Code	*Description*
1452	100 NTU Standard, 60 mL (EPA)
1455	100 NTU Standard, 60 mL (ISO)
0290-6	Tubes, Code 0290, Set of 6
4185	Turbidity-Free Water Kit
2-2097	Filters, 0.1 micron, Pack of 50
1901-CD	SMARTLink 3 Software

■ EPA COMPLIANCE

The 2020we meter meets or exceeds EPA design specifications for NPDWR and NPDES turbidity monitoring programs as specified by the USEPA method 180.1.

■ ISO Compliance

This 2020wi meter meets or exceeds ISO design criteria for quantitative methods of turbidity using optical turbidimeters as specified by ISO 7027.

■ CE COMPLIANCE

The 2020we and 2020wi meters have been independently tested and have earned the European CE Mark of compliance for electromagnetic compatibility and safety. To view certificates of compliance, go to the LaMotte website at www.lamotte.com.

NOTE: The device complies to the product specifications for the Low Voltage Directive.

■ WARRANTY

LaMotte Company warrants this instrument to be free of defects in parts and workmanship for 2 years from the date of shipment. If it should become necessary to return the instrument for service during or beyond the warranty period, contact our Technical Service Department at 1-800-344-3100 for a return authorization number or visit www.lamotte.com for troubleshooting help. The sender is responsible for shipping charges, freight, insurance and proper packaging to prevent damage in transit. This warranty does not apply to defects resulting from action of the user such as misuse, improper wiring, operation outside of specification, improper maintenance or repair, or unauthorized modification. LaMotte Company specifically disclaims any implied warranties or merchantability or fitness for a specific purpose and will not be liable for any direct, indirect, incidental or consequential damages. LaMotte Company's total liability is limited to repair or replacement of the product. The warranty set forth above is inclusive and no other warranty, whether written or oral, is expressed or implied.

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www.lamotte.com

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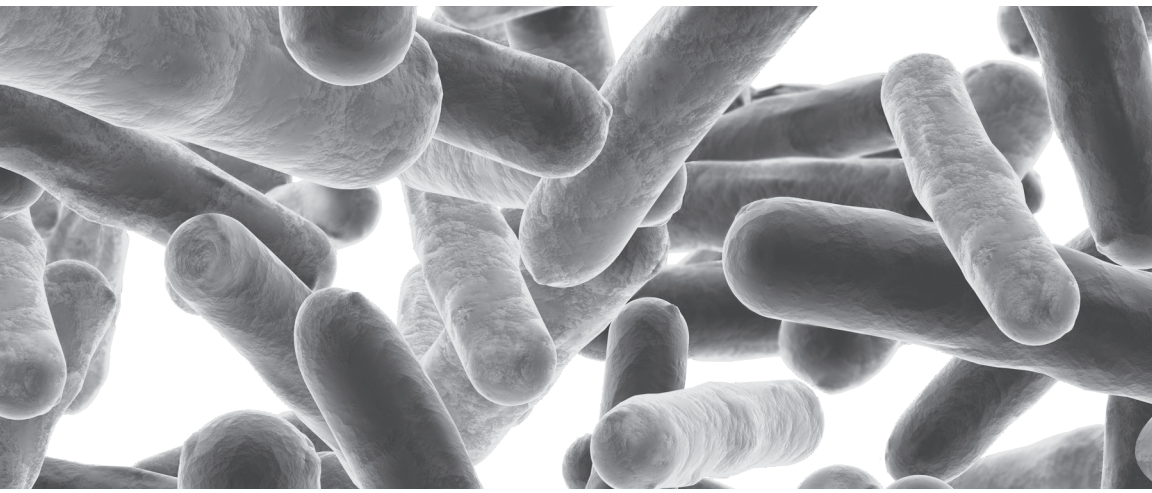
Colilert*



06-12999-08

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IDEXX Laboratories, Inc., One IDEXX Drive, Westbrook, Maine 04092 USA

idexx.com/water

Colilert* Test Kit

Introduction

Colilert* simultaneously detects total coliforms and *E. coli* in water. It is based on IDEXX's proprietary Defined Substrate Technology*. When total coliforms metabolize Colilert's DST* nutrient-indicator, ONPG, the sample turns yellow. When *E. coli* metabolize Colilert's DST* nutrient-indicator, MUG, the sample also fluoresces. Colilert can simultaneously detect these bacteria at 1 cfu/100 mL within 24 hours even with as many as 2 million heterotrophic bacteria per 100 mL present.

Storage

Store at 2–30°C away from light.

Presence/Absence (P/A) Procedure

1. Add contents of one pack to a 100 mL sample in a sterile, transparent, nonfluorescing vessel.
2. Cap vessel and shake.
3. Incubate at 35±0.5°C for 24 hours.
4. Read results according to Result Interpretation table below.

Quanti-Tray* Enumeration Procedure

1. Add contents of one pack to a 100 mL water sample in a sterile vessel.
2. Cap vessel and shake until dissolved.
3. Pour sample/reagent mixture into a Quanti-Tray* or Quanti-Tray*/2000 and seal in an IDEXX Quanti-Tray* Sealer.
4. Place the sealed tray in a 35±0.5°C incubator for 24 hours.
5. Read results according to the Result Interpretation table below. Count the number of positive wells and refer to the MPN table provided with the trays to obtain a Most Probable Number.

Result Interpretation

Appearance	Result
Less yellow than the comparator[1]	Negative for total coliforms and *E. coli*
Yellow equal to or greater than the comparator	Positive for total coliforms
Yellow and fluorescence equal to or greater than the comparator	Positive for *E. coli*

- Look for fluorescence with a 6-watt, 365-nm UV light within 5 inches of the sample in a dark environment. Face light away from your eyes and towards the sample.
- Colilert results are to be read after 24 hours of incubation.
- However, if the results are ambiguous to the analyst based on the initial reading, incubate up to an additional four hours (but not to exceed 28 hours total) to allow the color and/or fluorescence to intensify.
- Positives for both total coliforms and *E. coli* observed before 24 hours and negatives observed after 28 hours are also valid.
- In addition, laboratories may incubate samples for additional time (up to 28 hours total) for their convenience.

Procedural Notes

- This insert may not reflect your local regulations. For compliance testing, be sure to follow appropriate regulatory procedures. For example, samples run in other countries are incubated at 36±2°C for 24–28 hours.
- Colilert can be run in any multiple tube format. *Standard Methods for the Examination of Water and Wastewater*[2] MPN tables should be used to find Most Probable Numbers (MPNs).
- If a water sample has some background color, compare inoculated Colilert sample to a control blank of the same water sample.
- If sample dilutions are made, multiply the MPN value by the dilution factor to obtain the proper quantitative result.
- Use only sterile, nonbuffered, oxidant-free water for dilutions.
- Colilert is a primary water test. Colilert performance characteristics do not apply to samples altered by any pre-enrichment or concentration.
- In samples with excessive chlorine, a blue flash may be seen when adding Colilert. If this is seen, consider sample invalid and discontinue testing.
- Aseptic technique should always be followed when using Colilert. Dispose of in accordance with Good Laboratory Practices.

Quality Control Procedures

1. One of the following quality control procedures is recommended for each lot of Colilert:
   A. IDEXX-QC Coliform and *E.coli* [3]: *Escherichia coli*, *Klebsiella variicola*‡, and *Pseudomonas aeruginosa*
   B. Quanti-Cult*[4]: *Escherichia coli, Klebsiella pneumoniae* and *Pseudomonas aeruginosa*.
   C. Fill three sterile vessels with 100 mL of sterile nonbuffered oxidant-free water and inoculate with a sterile loop of ATCC[5] strains, *Escherichia coli* ATCC 25922/WDCM 00013 or ATCC 11775/WDCM 00090, *Klebsiella variicola*‡ ATCC 31488/ WDCM 00206 and *Pseudomonas aeruginosa* ATCC 10145/WDCM 00024 or ATCC 27853.
2. Follow the P/A Procedure or Quanti-Tray Enumeration Procedure above.
3. Results should match the Result Interpretation table above.

NOTE: IDEXX internal quality control testing is performed in accordance with ISO 11133:2014. Quality Control Certificates are available at idexx.com/water.

1. IDEXX P/A Comparator, catalog #WP104; Quanti-Tray Comparator #WQTC, or Quanti-Tray/2000 Comparator #WQT2KC
2. Eaton, AD, Clesceri, LS, Greenberg, AE, Rice, EN. *Standard Methods for the Examination of Water and Wastewater*. American Public Health Association, 2005. Washington, DC.
3. IDEXX-QC Coliform and *E. coli*—IDEXX Catalog #UN3373-WQC-TCEC
4. Quanti-Cult cultures—IDEXX catalog # WKIT-1001
5. American Type Culture Collection 1-800-638-6597 atcc.org

‡. *Klebsiella pneumoniae* (ATCC 31488/WDCM 00206) has been renamed to *Klebsiella variicola*.

Kit d'analyse Colilert*

Introduction

Colilert* permet la détection simultanée des coliformes totaux et *E. coli* dans l'eau. Ce test est basé sur la technologie propriétaire Defined Substrate Technology* (DST*) d'IDEXX. Lorsque les coliformes totaux métabolisent ONPG, le substrat chromogène-indicateur de Colilert, le prélèvement vire au jaune. Lorsque l'échantillon est positif, le réactif MUG contenu dans Colilert est métabolisé par les *E. coli* et génère une fluorescence. Colilert peut détecter simultanément ces bactéries à 1 cfu/100 ml en 24 heures, même en présence de bactéries hétérotrophes d'une concentration de 2 millions par 100 ml.

Conditions de Conservation

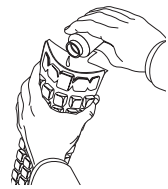
Conserver entre 2–30°C à l'abri de la lumière.

Procédure de Présence/Absence (P/A)

1. Ajouter le contenu d'un sachet dans un prélèvement de 100 ml placé dans un récipient stérile, transparent et non fluorescent.
2. Fermer le récipient et agiter.
3. Incuber à 35±0,5°C pendant les 24 heures qui suivent.
4. Interpréter les résultats en se référant au tableau d'interprétation des résultats ci-dessous.

Quanti-Tray* Procédure de numération

1. Ajouter le contenu d'un sachet dans un prélèvement de 100 ml d'eau placé dans un récipient stérile.
2. Fermer le récipient et agiter jusqu'à dissolution.
3. Verser le mélange prélèvement/réactif dans un Quanti-Tray* ou un Quanti-Tray*/2000 et fermer hermétiquement dans un IDEXX Quanti-Tray* Sealer.
4. Placer le plateau hermétiquement fermé dans un incubateur à 35±0,5°C pendant 24 heures.
5. Interpréter les résultats en se référant au tableau d'interprétation des résultats ci-dessous. Compter le nombre de puits positifs et se référer au tableau MPN fourni avec les plateaux pour obtenir le Chiffre le plus probable (MPN).



Interprétation des Résultats

Aspect	Résultat
Moins jaune que le comparateur[1]	Négatif pour les coliformes totaux et *E. coli*
Aussi jaune ou plus jaune que le comparateur	Positif pour les coliformes totaux
Couleur jaune et fluorescence égales ou supérieures au comparateur	Positif pour *E. coli*

- Évaluer la fluorescence avec une ampoule UV de 6 watts et 365 nm placée à 13 cm du prélèvement dans l'obscurité. Orienter la lumière vers le prélèvement, dans la direction opposée à celle des yeux de l'opérateur.
- Les résultats du test Colilert doivent être lus après 24 heures d'incubation.
- Toutefois, si les résultats de la première lecture sont ambigus pour l'analyste, incuber jusqu'à quatre heures supplémentaires (sans dépasser 28 heures au total) pour laisser la couleur et/ou la fluorescence s'intensifier.
- Les résultats positifs en coliformes et *E. coli* observés avant 24 heures et les résultats négatifs observés après 28 heures sont également valables.
- En outre, les laboratoires peuvent incuber des échantillons pendant une durée plus longue (jusqu'à 28 heures en tout) par souci de commodité.

Remarques Concernant la Procédure

- Cette notice peut différer des réglementations en vigueur dans votre pays. Pour tout test de conformité, suivre les procédures réglementaires appropriées. Par exemple, l'incubation des échantillons dans certains pays est réalisée à 36±2°C pendant 24 à 28 heures.
- Colilert peut être effectué en format de tubes multiples. Utiliser des méthodes standards et les tableaux MPN pour le contrôle des eaux et eaux usées[2] afin de déterminer les Chiffres les Plus Probables (MPN).
- Si un prélèvement d'eau présente une couleur de fond, comparer le prélèvement inoculé avec Colilert à un contrôle neutre du même prélèvement d'eau.
- Si les prélèvements sont dilués, multiplier la valeur MPN par le facteur de dilution pour obtenir le résultat quantitatif correct.
- Utiliser uniquement de l'eau stérile, non tamponnée et sans oxydant pour les dilutions.
- Colilert est avant tout un test pour eau. Les caractéristiques de performance de Colilert ne s'appliquent pas aux prélèvements altérés par tout enrichissement préalable ou toute concentration.
- Avec les prélèvements présentant un excédent de chlore, il peut se produire une rapide lueur bleuâtre lors de l'ajout de Colilert. Si tel est le cas, le prélèvement n'est pas valide et il faut cesser le test.
- Utiliser systématiquement des techniques aseptiques dans l'emploi de Colilert. Mettre au rebut conformément aux Bonnes pratiques de laboratoire.

Procédures de contrôle de qualité

1. L'une des procédures de contrôle qualité suivantes est recommandée pour chaque lot de Colilert:
   A. IDEXX-QC[3] pour les Coliformes et *E.coli*: *Escherichia coli*, *Klebsiella variicola*‡ et *Pseudomonas aeruginosa*.
   B. Quanti-Cult*[4] *Escherichia coli*, *Klebsiella pneumoniae* et *Pseudomonas aeruginosa*.
   C. Remplir trois récipients stériles avec 100 ml d'eau stérile, non tamponnée et sans oxydant puis inoculer les récipients avec une anse stérile avec des souches ATCC[5], *Escherichia coli* ATCC 25922/ WDCM 00013 ou ATCC 11775/ WDCM 00090, *Klebsiella variicola*‡ ATCC 31488/ WDCM 00206 et *Pseudomonas aeruginosa* ATCC 10145/ WDCM 00024 ou ATCC 27853.
2. Suivre la procédure P/A ou la procédure de numération Quanti-Tray ci-dessus.
3. Les résultats doivent correspondre aux résultats du tableau d'interprétation ci-dessus.

REMARQUE: les tests de contrôle qualité internes d'IDEXX sont effectués conformément à la norme ISO 11133:2014. Les certificats de contrôle qualité sont disponible à l'adresse idexx.fr/water.

1. Comparateur P/A IDEXX, réf. n° WP104 ; Comparateur Quanti-Tray n° WQTC ou Quanti-Tray/2000 Comparateur n° WQT2KC
2. Eaton, AD, Clesceri, LS, Greenberg, AE, Rice, EN. *Standard Methods for the Examination of Water and Wastewater* (Méthodes traditionnelles d'analyses de l'eau et des eaux usées), American Public Health Association, 2005. Washington, DC.
3. Coliforme et *E. coli* d'IDEXX-QC - Catalogue IDEXX n° UN3373-WQC-TCEC
4. Cultures Quanti-Cult - IDEXX réf. n° WKIT-1001
5. American Type Culture Collection 1-800-638-6597 atcc.org

‡. *Klebsiella pneumoniae* (ATCC 31488 / WDCM 00206) a été renommé *Klebsiella variicola*.

Kit di analisi Colilert*

Introduzione

Colilert* rileva simultaneamente i coliformi totali e l'*E. coli* nell'acqua. Si basa su una tecnologia di substrato definito (DST* o Defined Substrate Technology) di cui IDEXX* e' proprietaria del brevetto. Quando i coliformi totali metabolizzano l'indicatore di nutrienti del Colilert, ONPG, il campione diventa giallo. Quando l'*E.coli* metabolizza il nutriente-indicatore MUG, il campione presenta anche fluorescenza. Il Colilert è in grado di rilevare simultaneamente questi batteri in concentrazioni di 1 cfu/100 ml entro 24 ore anche se sono presenti addirittura 2 milioni di batteri eterotrofici per 100 ml.

Conservazione

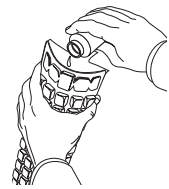
Conservare a 2–30°C lontano dalla luce.

Procedura Relativa a Presenza/Assenza (P/A)

1. Unire il contenuto di un pacchetto ad un campione da 100 ml in un a provetta sterile, trasparente e non fluorescente.
2. Incappucciare la provetta ed agitarla.
3. Incubare a 35±0,5°C per 24 ore.
4. Leggere i risultati secondo la tabella di Interpretazione dei risultati qui sotto.

Procedura di Enumerazione Quanti-Tray*

1. Unire il contenuto di un pacchetto ad un campione di acqua da 100 ml in una provetta sterile.
2. Chiudere la provetta e agitarla fino a dissoluzione.
3. Versare la miscela campione/reagente in un vassoietto Quanti-Tray* o Quanti-Tray*/2000 e sigillarlo in un IDEXX Quanti-Tray* Sealer.
4. Mettere il vassoietto sigillato in un'incubatrice a 35°C±0,5°C per 24 ore.
5. Leggere i risultati secondo la tabella di Interpretazione dei risultati qui sotto. Contare il numero di pozzetti positivi e consultare la tabella MPN fornita insieme ai vassoietti per ottenere il numero più probabile.



Interpretazione dei Risultati

Aspetto	Risultato
Meno giallo rispetto al colore di confronto[1]	Negativo per coliformi totali ed *E. coli*
Giallo uguale o più intenso rispetto al colore di confronto	Positivo per coliformi totali
Giallo e fluorescenza uguali o più intensi rispetto al colore di confronto	Positivo per *E. coli*

- Individuare la fluorescenza con una luce a raggi ultravioletti da 6 watt, 365 nm, entro circa 13 cm dal campione, in ambiente buio. Dirigere la luce verso il campione, in direzione opposta ai propri occhi.
- I risultati di Colilert devono essere letti dopo 24 ore di incubazione.
- Tuttavia, se i risultati sono ambigui per l'analista sulla base della lettura iniziale, incubare fino a quattro ore in più (non superando tuttavia 28 ore in totale) in modo da consentire l'intensificarsi del colore e/o della fluorescenza.
- Sono validi anche i positivi sia per i coliformi totali sia per *E. coli* osservati prima di 24 ore e i negativi osservati dopo 28 ore.
- Inoltre, i laboratori possono incubare i campioni per un periodo aggiuntivo (fino a 28 ore in totale) per loro comodità.

Note Sulla Procedura

- Questo inserto informativo potrebbe non riflettere le normative locali. Per i test sulla conformità, assicurarsi di seguire le procedure normative corrispondenti. Ad esempio, i campioni trattati in altri Paesi vengono incubati a 36±2°C per 24–28 ore.
- Il Colilert si può eseguire in qualsiasi formato a provetta multipla. I metodi standard per l'esame delle tabelle MPN dell'acqua e delle acque di scarico[2] vanno usati per ottenere i Numeri Più Probabili (MPN).
- Se un campione di acqua dovesse presentare della colorazione di sfondo, confrontare il campione Colilert inoculato con controllo vuoto dello stesso campione di acqua.
- Se il prodotto viene diluito, moltiplicare il valore MPN per il fattore di diluizione per ottenere la quantità giusta.
- Per le diluizioni usare solo acqua sterile, non tamponata, priva di ossidanti.
- Il Colilert è un test primario per l'acqua. Le caratteristiche di prestazione del Colilert non sono applicabili a campioni alterati da qualsiasi pre-arricchimento o da concentrazione.
- In campioni con cloro eccessivo, quando si aggiunge il Colilert si potrebbe vedere un lampo azzurro. In questo caso, considerare il campione non valido e interrompere l'analisi.
- Quando si usa il Colilert va sempre seguita la tecnica asettica. Eliminare secondo le buone pratiche di laboratorio.

Procedure di Controllo della Qualità

1. Per ciascun lotto di Colilert si consiglia una delle seguenti procedure di controllo della qualità:
   A. Coliformi ed *E.coli*[3] IDEXX-QC: *Escherichia coli*, *Klebsiella variicola*‡ e *Pseudomonas aeruginosa*.
   B. Quanti-Cult*[4] *Escherichia coli*, *Klebsiella pneumoniae* e *Pseudomonas aeruginosa*.
   C. Riempire tre contenitori sterili con 100 ml di acqua sterile non tamponata e senza ossidanti e inoculare con un'ansa sterile di ceppi ATCC[5], *Escherichia coli* ATCC 25922/ WDCM 00013 o ATCC 11775/ WDCM 00090, *Klebsiella variicola*‡ ATCC 31488/ WDCM 00206 e *Pseudomonas aeruginosa* ATCC 10145/ WDCM 00024 o ATCC 27853.
2. Seguire la procedura P/A o la procedura di enumerazione Quanti-Tray descritte sopra.
3. I risultati devono corrispondere a quelli della tabella di Interpretazione dei risultati indicata sopra.

NOTA: i test di controllo di qualità interni IDEXX sono condotti in conformità con ISO 11133:2014. I certificati di controllo qualità sono disponibili sul sito idexx.it/water.

1. Comparatore P/A IDEXX, codice di catalogo WP104; Comparatore Quanti-Tray N. WQTC o Quanti-Tray/2000 Comparatore N. WQT2KC
2. Eaton, AD, Clesceri, LS, Greenberg, AE, Rice, EN. *Standard Methods for the Examination of Water and Wastewater*. American Public Health Association, 2005. Washington, DC.
3. Coliformi ed *E.coli* IDEXX-QC - Catalogo IDEXX N. UN3373-WQC-TCEC
4. Colture Quanti-Cult N. di catalogo IDEXX WKIT-1001
5. American Type Culture Collection 1-800-638-6597

‡. *Klebsiella pneumoniae* (ATCC 31488 / WDCM 00206) è stato rinominato in *Klebsiella variicola*

Colilert* Testkit

Einführung

Colilert* ist zum gleichzeitigen Nachweis von Gesamtcoliformen und *E. coli* im Wasser bestimmt. Es basiert auf der gesetzlich geschützten Defined Substrate Technology* (DST*) von IDEXX. Wenn die Gesamtcoliformen den Nährstoff-Indikator ONPG von Colilert metabolisieren, verfärbt sich die Probe gelb. Wenn *E. coli* den Nährstoffindikator MUG verstoffwechselt, fluoresziert die Probe. Colilert kann diese Bakterien gleichzeitig im Bereich von 1 CFU/100 ml innerhalb von 24 Stunden nachweisen, selbst wenn 2 Mio. heterotrophe Bakterien pro 100 ml vorhanden sind.

Lagerung

Bei 2–30°C und nicht im Licht lagern.

Presence/Absence (P/A) Test

1. Den Inhalt einer Packung zu einer 100 ml Probe in einem sterilen, transparenten, nicht fluoreszierenden Gefäß hinzugeben.
2. Das Gefäß verschließen und schütteln.
3. Für den verbleibenden 24-Stunden-Zeitraum bei 35±0,5°C inkubieren.
4. Die Ergebnisse gemäß der nachstehenden Ergebnisauswerte-Tabelle ablesen.

Quanti-Tray* Auszähl-Methode

1. Den Inhalt einer Packung zu einer 100 ml Wasserprobe in einem sterilen Gefäß hinzugeben.
2. Das Gefäß verschließen und so lange schütteln, bis der Inhalt aufgelöst ist.
3. Die aus Probe und Reagenz bestehende Mischung in ein Quanti-Tray oder Quanti-Tray/2000 gießen und in einem IDEXX Quanti-Tray Sealer fest verschließen.
4. Das verschlossene Tray 24 Stunden in einen Inkubator im Temperaturbereich von 35±0,5°C inkubieren.
5. Die Ergebnisse anhand der nachstehenden Ergebnisauswerte-Tabelle ablesen. Die Anzahl der positiven Vertiefungen zählen und die wahrscheinlichste Zahl (MPN; Most Probable Number) anhand der MPN-Tabelle, die den Trays beiliegt, ermitteln.

Ergebnisauswertung

Aussehen der Probe	Mögliche Ergebnisse
Geringere Gelbfärbung als der Comparator[1]	Negativ für Gesamtcoliforme und *E. coli*
Gleiche oder stärkere Gelbfärbung als der Comparator	Positiv für Gesamtcoliforme
Gelbfärbung und Fluoreszenz gleich oder stärker als die des Comparators	Positiv für *E. coli*

- Prüfung auf Fluoreszenz mit einer 6-Watt, 365 nm UV-Lampe aus einem Abstand von 13 cm in einer dunklen Umgebung. Dabei die Lampe nur auf die Probe, nicht auf die Augen, richten.
- Colilert-Ergebnisse sollten nach einer Inkubationszeit von 24 Stunden abgelesen werden.
- Wenn die Ergebnisse jedoch nach der ersten Ablesung nicht eindeutig sind, nochmals bis zu vier Stunden (insgesamt jedoch nicht länger als 28 Stunden) inkubieren, um die Intensivierung der Farbe und/oder Fluoreszenz zu ermöglichen.
- Positive Ergebnisse für Gesamtcoliforme und *E. coli*, die vor Ablauf von 24 Stunden und negative Ergebnisse, die nach Ablauf von 28 Stunden beobachtet werden, sind ebenfalls gültig.
- Darüber hinaus können Labors die Proben aus praktischen Gründen auch länger (insgesamt bis zu 28 Stunden) inkubieren.

Verfahrenshinweise

- Diese Packungsbeilage entspricht unter Umständen nicht Ihren örtlichen Bestimmungen. Bei Konformitätsprüfungen unbedingt die entsprechenden aufsichtsbehördlichen Verfahren anwenden. In anderen Ländern werden zum Beispiel zu untersuchende Proben 24–28 Stunden bei 36±2°C inkubiert.
- Das Colilert Verfahren kann in jedem Multiple-Tube-Format durchgeführt werden. Zur Ermittlung der MPNs (wahrscheinlichste Zahlen) sollten MPN-Tabellen für Standardverfahren zur Untersuchung von Wasser und Abwasser[2] verwendet werden.
- Wenn eine Wasserprobe etwas Hintergrundfarbe aufweist, ist die inokulierte Colilert Probe mit einer Kontrollprobe derselben Wasserprobe zu vergleichen.
- Bei Probenverdünnungen den MPN-Wert mit dem Verdünnungsfaktor multiplizieren, um das korrekte quantitative Ergebnis zu erhalten.
- Nur steriles, nicht gepuffertes, keine Oxidantien enthaltendes Wasser zur Verdünnung verwenden.
- Colilert ist ein primärer Wassertest. Die Leistungsmerkmale von Colilert gelten nicht für Proben, die durch Voranreicherung oder Konzentration modifiziert wurden.
- In Proben mit übermäßigem Chlorgehalt wird bei der Zugabe von Colilert u.U. ein blaues Aufleuchten beobachtet. In diesem Fall ist die Probe als ungültig zu betrachten und der Test abzubrechen.
- Bei der Verwendung von Colilert ist ein aseptisches Vorgehen vorgeschrieben. Entsorgung gemäß Standard-Laborpraktiken.

Qualitätskontrollverfahren

1. Eines der folgenden Qualitätskontrollverfahren wird für jede Colilert-Charge empfohlen:
   A. IDEXX-QC Coliforme okund *E.coli* [3]: *Escherichia coli*, *Klebsiella variicola*‡ und *Pseudomonas aeruginosa*.
   B. Quanti-Cult*[4] *Escherichia coli*, *Klebsiella pneumoniae* und *Pseudomonas aeruginosa*.
   C. Drei sterile Gefäße mit 100 ml sterilem, ungepuffertem, oxidansfreiem Wasser füllen und mit einer sterilen Öse ATCC[5]-Stämme, *Escherichia coli* ATCC 25922/ WDCM 00013 oder ATCC 11775/ WDCM 00090, *Klebsiella variicola*‡ ATCC 31488/ WDCM 00206 und *Pseudomonas aeruginosa* ATCC 10145/ WDCM 00024 oder ATCC 27853 inokulieren.
2. Das oben beschriebene P/A-Verfahren oder das Quanti-Tray Auszählverfahren befolgen.
3. Die Ergebnisse sollten mit der Ergebnisauswerte-Tabelle oben übereinstimmen.

HINWEIS: Die internen Qualitätskontrollprüfungen von IDEXX werden im Einklang mit ISO 11133:2014 durchgeführt. Qualitätskontrollzertifikate sind unter idexx.de/water erhältlich.

1. IDEXX P/A Comparator, Best.-Nr. WP104; Quanti-Tray Comparator WQTC oder Quanti-Tray/2000 Comparator WQT2KC
2. Eaton, AD, Clesceri, LS, Greenberg, AE, Rice, EN. *Standard Methods for the Examination of Water and Wastewater* (Standardverfahren für die Wasser- und Abwasseruntersuchung). American Public Health Association, 2005. Washington, DC, USA.
3. IDEXX-QC Coliform und *E.-coli* - IDEXX Bestellnr. UN3373-WQC-TCEC
4. Quanti-Cult Kulturen - IDEXX Best.-Nr. WKIT-1001
5. American Type Culture Collection 1-800-638-6597

‡. *Klebsiella pneumoniae* (ATCC 31488 / WDCM 00206) wurde *Klebsiella variicola* umbenannt

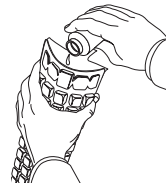
Kit de análisis Colilert*

Introducción
Colilert* detecta simultáneamente los coliformes totales y *E. coli* en el agua. Se basa en Defined Substrate Technology* (Tecnología de substrato definido [DST*]), patentada por IDEXX. Cuando los coliformes totales metabolizan el indicador ONPG de nutrientes de Colilert, la muestra toma una coloración amarilla. Cuando *E. coli* metaboliza el indicador MUG de nutrientes de Colilert, la muestra además fluoresce. Colilert puede detectar simultáneamente estas bacterias a una concentración de 1 ufc/100 ml dentro de las 24 horas, hasta en presencia de 2 millones de bacterias heterotróficas por cada 100 ml.

Almacenamiento
Almacenar a temperatura de 2–30°C, alejado de la luz.

Procedimiento de Presencia/Ausencia (P/A)
1. Añadir el contenido de una dosis a una muestra de 100 ml en un recipiente estéril transparente, no fluorescente.
2. Tapar y agitar el recipiente.
3. Incubar a 35±0,5°C durante 24 horas.
4. Leer los resultados de acuerdo con el cuadro de interpretación de resultados, más abajo.

Procedimiento de Enumeración Quanti-Tray*
1. Añadir el contenido de un paquete a una muestra de 100 ml de agua, en un recipiente estéril.
2. Tapar y agitar el recipiente hasta disolver.
3. Verter la mezcla de muestra/reactivo en una Quanti-Tray* o una Quanti-Tray*/2000 y sellar en un IDEXX Quanti-Tray* Sealer.
4. Colocar la bandeja sellada en una incubadora a 35±0,5°C durante 24 horas.
5. Leer los resultados de acuerdo con el cuadro de interpretación de resultados, más abajo. Contar el número de pocillos positivos y referirse al cuadro NMP proporcionado con las bandejas para obtener el número más probable.



Interpretación de resultados

Aspecto	Resultado
Menos amarillo que el comparador[1]	Negativo para coliformes totales y *E. coli*
Amarillo igual o mayor que el del comparador	Positivo para coliformes totales
Amarillo y fluorescencia iguales o mayores que los del comparador	Positivo para *E. coli*

- Buscar fluorescencia usando una luz UV de 6 vatios, 365 nm a distancia de unas 5 pulgadas (13 cm) de la muestra, en un entorno oscuro. Apuntar el haz de luz en dirección contraria a los ojos y hacia la muestra.
- Los resultados de Colilert se deben leer a las 24 horas de incubación.
- Es possible prolonger el tiempo de lectura 4 horas mas, hasta las 28 horas, para que en raro pero posible caso de duda el color o la fluorescencia se intensifiquen.
- Los resultados positivos para coliformes totales y *E. coli* antes de las 24 horas y negativos tras 28 horas también son válidos.
- Asimismo, los laboratorios pueden incubar muestras (hasta 28 horas en total) si lo desean, para mayor comodidad.

Notas sobre el procedimiento
- Este prospecto tal vez no refleje sus reglamentaciones locales. Para probar el cumplimiento, asegurarse de seguir los procedimientos reglamentarios apropiados. Por ejemplo, las muestras realizadas en otros países se incuban a 36±2°C durante 24 a 28 horas.
- Colilert puede procesarse en cualquier formato de múltiples tubos. Deben usarse los Standard Methods for Examination of Water y las tablas NMP de aguas residuales[2] para encontrar los números más probables (NMP).
- Si la muestra de agua tiene un cierto color de fondo, comparar la muestra inoculada de Colilert con un blanco testigo de la misma muestra de agua.
- Si se hacen diluciones de muestra, multiplicar el valor NMP por el factor de dilución para obtener el resultado cuantitativo apropiado.
- Usar solamente agua estéril, no tamponada, libre de oxidantes, para efectuar las diluciones.
- Colilert es una prueba primordialmente del agua. Las características de rendimiento de Colilert no se aplican a muestras alteradas por enriquecimiento o concentración previos.
- En el caso de muestras con un exceso de cloro, tal vez se observe un destello azul al añadir Colilert. Si se observa, considerar que la muestra no es válida y suspender la prueba.
- Siempre debe utilizarse una técnica aséptica cuando se use Colilert. Desechar en cumplimiento con las Buenas Prácticas de Laboratorio.

Procedimientos de control de calidad
1. Se recomienda uno de los siguientes procedimientos de control de calidad para cada lote de Colilert:
   A. IDEXX-QC Coliform and *E.coli*[3]: *Escherichia coli*, *Klebsiella variicola*‡ y *Pseudomonas aeruginosa*.
   B. Quanti-Cult*[4] *Escherichia coli*, *Klebsiella pneumoniae* y *Pseudomonas aeruginosa*.
   C. Llene tres recipientes estériles con 100 ml de agua estéril, libre de oxidantes, no tamponada e inocule con un asa estéril de cepas ATCC[5], *Escherichia coli* ATCC 25922/ WDCM 00013 o ATCC 11775/ WDCM 00090, *Klebsiella variicola*‡ ATCC 31488/ WDCM 00206 y *Pseudomonas aeruginosa* ATCC 10145/ WDCM 00024 o ATCC 27853.
2. Seguir el procedimiento P/A o el procedimiento de enumeración Quanti-Tray mencionado anteriormente.
3. Los resultados deben corresponder a los del Cuadro de Interpretación de resultados, más arriba.

NOTA: Las pruebas de control de calidad interna de IDEXX se realizan según ISO 11133:2014. Los certificados de control de calidad se encuentran disponibles en idexx.es/water.

1. IDEXX, Comparador P/A, Nº de catálogo WP104; Comparador Quanti-Tray Nº WQTC o Quanti-Tray/2000 Comparador Nº WQT2KC
2. Eaton, AD, Clesceri, LS, Greenberg, AE, Rice, EN. *Standard Methods for the Examination of Water & Wastewater*, (Métodos estándares para el análisis del agua y las aguas residuales). American Public Health Association, (Asociación Americana de Salud Pública), 2005. Washington, D. C.
3. IDEXX-QC Coliform and *E.coli* — IDEXX Catalog #UN3373-WQC-TCEC
4. Cultivos Quanti-Cult— Nº de catálogo IDEXX WKIT-1001
5. American Type Culture Collection 1-800-638-6597

‡. *Klebsiella pneumoniae* (ATCC 31488 / 00206 WDCM) se ha renombrado como *Klebsiella variicola*

Colilert* (コリラート) 検査キット

はじめに

Colilert*はIDEXXが知的財産権を持つDefined Substrate Technology* (DST*) (特定酵素基質法)を用いて、水中の大腸菌群と大腸菌を同時に検出します。大腸菌群が、コリラートに含まれる栄養指標のONPGを代謝することにより、検水は黄色に変色します。さらに、大腸菌がもう1つの栄養指標であるMUGを代謝すると、検水は蛍光を呈します。コリラートは、100mL当たり最大200万個の従属栄養細菌の存在下においても、24時間以内に1cfu/100mLの感度で対象細菌を検出する ことができます。

保管

直射日光を避け、2～30℃で保管してください。

定性検査手順手順

1. スナップパック1つの中身を、滅菌済みの透明な蛍光を発しない容器に入った100mLの検水に加えてください。
2. 容器の蓋を締め、振ってください。
3. 36±1℃で、24時間培養してください。
4. 以下の結果判定表に従って、結果判定してください。

Quanti-Tray*定量検査手順

1. スナップパック1つの中身を、滅菌済み容器に入った100mLの検水に加えてください。
2. 容器の蓋を閉め溶けるまで静かに振ってください。
3. Quanti-Tray/2000に検水/コリラート混合液を注ぎ、シーラーで密封してください。
4. 密封されたトレイを36±1℃で24時間培養してください。
5. 以下の結果判定表に従って、結果を判定してください。陽性ウェルの数を数え、専用MPN表を参照して、最確数を求めてください。

結果判定

培養液の状態	結果
比色管*より薄い黄色[1]	大腸菌群および大腸菌陰性
比色管*と同等か、またはそれより濃い黄色	大腸菌群陽性
比色管*と同等か、またはそれより濃い黄色および蛍光	大腸菌陽性

- 暗所で6W・365nmのUVランプから13cm以内に検水を置き、判定してください。光は目に向けないようにし、検水に向けてください。
- コリラートの結果は培養開始から24時間後に判定してください。
- 但し、初回の判定において結果があいまいな場合には、さらに最長4時間（総時間数が28時間を超えないように）培養を継続し、再判定を行ってください。
- 24 時間以内で大腸菌群および大腸菌が共に陽性となった場合、または 28 時間以降も共に陰性であった場合、これらの判定は有効です。
- また、検査の便宜上、検水の培養時間を延長 (総培養時間28時間まで) することも可能です。

操作上の注意

- 本説明書の内容は該当する地域の法律・条例に適合していない場合があります。法律・条例に準拠した検査を行うために、必ず適切な規制手順に従ってください。例えば、他の国で検査を行う際は、36±2°Cで24～28時間培養する必要があります。
- コリラートは、5本法などの最確数法でも実施できます。最確数は最確数表(MPN表)を使用して求めてください。
- 検水に何らかの着色がある場合、同じ検水を用いたブランクと比較してください。
- 検水を希釈した場合、MPN値に希釈倍数を掛けて、適切な定量結果を求めてください。
- 希釈には、緩衝液や酸化物質の入っていない、滅菌された水だけを使用してください。
- コリラートは、水の一次検査です。コリラートの性能特性として、増菌培地で培養または濃縮によって変質した検水に使用できません。
- 塩素を過剰に含む検水では、コリラートを加えると、青色を呈することがあります。この場合、検査は無効ですので検査を中止してください。
- コリラートを使用する際は、常に無菌操作を行ってください。結果判定後の検水と容器は GLPに従って、廃棄してください。

品質管理手順

1. コリラートを使用する場合、ロット毎に次の品質管理手順のいずれかを行うことをお薦めします。
   A. IDEXX-QC大腸菌群および大腸菌[3]：大腸菌、*Klebsiella variicola*‡、*Pseudomonas aeruginosa*（緑膿菌）
   B. Quanti-Cult*[4]: *Escherichia coli*（大腸菌）、*Klebsiella pneumoniae*（肺炎桿菌）、*Pseudomonas aeruginosa*（緑膿菌）
   C. 滅菌容器3本に、それぞれ緩衝剤や酸化剤の入っていない滅菌水100 mLを入れ、大腸菌ATCC 25922/WDCM 00013またはATCC 11775/WDCM 00090、*Klebsiella variicola*‡ ATCC 31488/WDCM 00206、および *Pseudomonas aeruginosa* ATCC 10145/ WDCM 00024または27853 ATCC[5]菌株を、滅菌ループを用いて接種してください 。
2. 上記の定性検査手順またはQuanti-Tray定量検査手順に従ってください。
3. 結果が上の結果判定表と一致することを確認してください。

注: IDEXXの社内品質管理検査は、ISO 11133:2014に準拠して行われます。成績証明証 (品質管理認証) は idexx.co.jp/waterにて利用可能です。

1. IDEXX P/A 比色管, カタログ # WP104、または Quanti-Tray/2000比色トレイ#WQT2KC
2. Eaton, AD, Clesceri, LS, Greenberg, AE, Rice, EN. *Standard Methods for the Examination of Water and Wastewater*. American Public Health Association, 2005. Washington, DC.
3. IDEXX-QC大腸菌群および大腸菌- IDEXX カタログ番号UN3373-WQC-TCEC
4. Quanti-Cult—IDEXX カタログ # WKIT-1001
5. American Type Culture Collection 1-800-638-6597

‡. *Klebsiella pneumoniae* (ATCC 31488/WDCM 00206) は*Klebsiella variicola*へと菌種名の変更が行われました。

IDEXX Water Quality Control Laboratory is accredited to ISO/IEC 17025:2005

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Appendix C:

Volunteer SOPs

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Volunteer
Standard Operating Procedures

Table of Contents

1 Before You Begin

1.1 Safety, Equipment List, and Volunteer Responsibilities

1.1.1 Safety – General Precautions

a) Always perform water-monitoring activities under the guidance of an adult or with a partner when possible.

b) Read all instructions to familiarize yourself with the test procedure before you begin. Note any precautions in the instructions.

c) Use caution when collecting water samples from the shoreline to prevent slips, fall, or extended contact with water.

1.1.2 Field Equipment Maintenance and Cleanliness

a) Keep your thermometer clean after each use and store in a protective case/location when not in use.

b) Keep the pH test strip container as clean as possible. If test strips are discolored, DO NOT use.

c) Keep turbidity bottles free of dirt or contamination which can alter results of testing.

1.1.3 Lab Equipment Maintenance and Cleanliness

d) Keep the incubator on a steady and level base with easy access and clearance for both the door to open and the back fan to vent with more than 6” of space.

e) Keep bacterial sample bottle in a dry location with consistent temperature before use and discard in designated lab disposal receptacle after use.

f) All lab equipment, standards, and reagents will be kept and maintained according to manufacturer instructions to ensure quality.

g) All bacterial lab equipment will be cleaned and disinfected with ethanol before and after each analysis.

1.2 Monitor Responsibilities

Ensure that you have attended a yearly volunteer training session if you are a new volunteer. Training sessions are provided annually by Anacostia Riverkeeper staff and project partners to certify all volunteers for the project and the collection of environmental data.

Maintain the monitoring schedule for your site(s) each week. Sample collection must be performed every Wednesday or Thursday morning. If you are unable to collect a water sample from your site, find an alternate person and/or contact one of the Watershed Coordinators. Samples must be transported to the lab within 6 hours of collection.

Properly mark your sample bottles before the site visit and update each bottle with the appropriate information and label.

Maintain a clean cooler that will be used to transport water samples stored on ice from the field to the lab.

Record your test results: Record data on a data collection form provided. Always record the test results as you go along. Keep a copy of the data collected for your records and to provide a backup copy should the original be lost, whether that be a picture or results written in a notebook.

Provide comments as necessary: The "Comments/Notes" section can be used to record general observations about the site especially changes due to erosion, recent notable weather, and any problems you had with the sampling procedures.

Provide data sheets and chain of custody forms to Team Supervisors when you deliver your sampling cooler weekly. Ensure that upon delivery of your samples the sampling cooler contains necessary samples (duplicates and field blanks if necessary), chain of custody sheet, and sampling sheet.

Stay certified: Complete the project recertification process each year if you are a returning volunteer. You can also attend any training session to refresh yourself of the concepts and procedures between re-certifications.

2 QA/QC Procedures

2.1 Certification and Re-certification

2.1.1 Certification

Monitors can become certified at their initial training session by demonstrating a mastery of the sampling procedures and complete understanding of the quality assurance protocols used during data collection to be assessed by a Project Team member or Certified Trainer. Monitors must also pass a test that assesses the monitor's understanding of QA/QC procedures outlined in this SOP and the project QAPP with a score of 80%.

Monitors that attend an initial training and are unable to pass the requirements to become certified at the end of the training will be encouraged to continue practicing their monitoring procedures. Un-certified monitors are encouraged to assist certified monitors in the field until they have become comfortable with the procedures and QA/QC protocols. Un-certified monitors are allowed to retake the certification test and demonstrate proper sampling and analysis technique up to three times in order to become a certified monitor.

When a monitor achieves certification, they may be assigned a site and begin to collect Tier II data and submit it to the project database.

2.1.2 Re-certification

The Project Team and Certified Monitors will host online recertification sessions annually for monitors that have passed the initial training and wish to maintain their certification. Recertification sessions are conducted in a fashion that is similar to an online module. Monitors are checked to assure that: they remain proficient in methodology and understanding of basic water quality parameters; their equipment is operational and properly calibrated/verified; and they have an adequate supply of viable chemicals, procedures, equipment verification/check, and updated information about monitoring. Monitors will be provided will all pertinent information online and take a final recertification test to officially be recertified. Materials will include an informational video, program materials, and small quizzes.

2.2 Pre-monitoring checks

2.2.1 Equipment Check

Prior to going out into the field, monitors should check their equipment for cleanliness, breakage, discoloring or any other expiration. If a monitor finds that their equipment is damaged and will affect the quality of the data they collect, they will not collect data that day and mark the reason on their data sheet and then inform their Project Team Leader as soon as possible. The monitor should contact their Project Team member to get the equipment repaired or replaced prior to the next scheduled sample.

2.2.2 Calibration

Thermometers that are verified should be re-verified every year. Thermometers will be verified each year before the start of the sampling season (May-September).

Lab turbidimeter will be calibrated before each sampling run by trained ARK staff. Should full sampling occur over two days then the turbidimeter will be calibrated by lab personnel each day before sampling. The turbidimeter calibration will be tested every 10 samples to ensure no drift has occurred in calibration. If measured 0NTU and 10NTU standards show a drift >0.2 NTU then the machine will be recalibrated and tested again.

IDEXX bacterial methodology requires minimal calibration. The Binder incubator will be serviced once each year to ensure proper function. Each new batch of IDEXX reagent will be tested before use to check its viability. A dedicated certified thermometer will be placed in the Binder incubator to ensure consistent temperature with the external digital readout.

2.3 Field QC

2.3.1 Duplicates

Monitors collecting samples for Tier II laboratory analysis will perform duplicate samples at least 10% of the time. Duplicates consist of immersing sample containers side by side in the water at the same time. This ensures that the samples are representative of the current water conditions and taken from identical locations.

3 Field Monitoring Procedures

3.1 Field Sampling Procedures

3.1.1 Best Practices

a) Use of protective gloves. Gloves serve a dual purpose: 1) protecting the sample collector from potential exposure to sample constituents and 2) minimizing accidental contamination of samples by the collector. Wearing protective gloves at all times while sampling is recommended. Latex or nitrile gloves may be used for common sampling conditions.

b) Safety always comes first. All sampling should be conducted with the proper equipment and least amount of danger to field personnel.

c) Permission must be obtained from landowners before entering private property.

d) Care should be taken not to disturb the bottom when sampling. When nearing a stream, always sample in an upstream direction on the bank.

e) Surface water should always be collected facing upstream and from a safe location on the bank to ensure volunteer safety.

f) Samples should be collected in the main flow representative of the stream you are monitoring (for small streams, this is usually mid-channel) just below the water surface, about 0.3 meters (0.5 to 1 foot) deep.

g) Whenever possible, collect field measurements directly from the sample site, not from bucket. If the field parameters need to be measured in the bucket, collect water quality samples (bacteria and turbidity) first before measuring water temperature and testing for pH.

h) In situations where the sample site is a boat ramp or other hard surface access, it is best to avoid collecting a sample in waters above the hard surface. These are usually warmer waters and may provide inaccurate bacteria data.

i) When there are obvious standing pools of water during low or no flow conditions, do not collect samples or field measurements. Make a note of this on the data sheet.

j) When collecting bacterial samples:

   i. DO NOT rinse the bacteria sample bottle before collecting the sample (decanting to 100mL line is acceptable).
   ii. Be careful not to insert fingers into the mouth of the container or on the interior of the cap.

3.1.2 Streambank and Instream Sampling

All water samples will be collected from a streambank as to limit the amount of sediment disturbance and for volunteer safety.

When sampling from the streambank, care should be taken to sample from an area that will most closely represent the entire stream. Typically, this will be the area of the greatest flow in the stream and away from stagnant pools or eddies.

Step	Bacteria Samples
1.	Walk upstream to the sample location. Be sure any sediment or debris disturbed from your movement in the streambed is not present where you will collect the sample.
2.	Submerge the container; neck first into the water. The mouth of the bottle should be completely below the water surface approximately 6-12 inches.
3.	Invert the bottle so the neck is upright and pointing into the water flow.
4.	Move the bottle forward away from the body for at least six inches.
5.	Return the filled container quickly to the surface. Pour any excess water and cap.

3.1.3 Dock or Bridge Sampling

1. Sample in the center of main flow from or as close as you can get on the dock or bridge. If sampling from a bridge sample from the safest side of the bridge and where contamination is least likely to occur. Typically, sampling on the upstream side of the bridge or dock is less likely to be contaminated.

2. During rainy periods, avoid sampling where storm water runoff from the bridge can affect sample.

3. Obtain field parameters (pH, temperature) first before lowering a sample bucket.

4. When lowering the sample bucket, allow it to fill ¼ the way full and retrieve. Swirl the contents and dump the rinse away from the sample location to avoid kicking up sediment.

5. Repeat step 4 two more times and on the final time fill ½ to ¾ the way full.

6. Retrieve the bucket and collect the samples in the following order.

    1. Bacteria
        - Open the bottle without touching the inner wall of the bottle or lid.
        - Invert the bottle by holding to the main body of the bottle and lower into the bucket 3-6 inches.
        - Fill the bottle in a ‘U’ from the side of the bucket closest to you to the opposite end.
        - At the end, bottle opening should be facing up and remove from the bucket.
        - Pour off any excess water and cap with the lid.

7. In situations where field parameters must be obtained from the bucket, all water samples must be collected prior to testing for water temperature and pH in the bucket.

3.2 Air Temperature Measurement

Equipment: armored, digital thermistor

Temperature is reported in degrees Celsius (ºC). Always measure air temperature before water temperature.

Method:

1. Standing on the streambank hold the thermometer over the water to obtain the best measurement.

2. Wait 3-5 minutes to allow the thermometer to equilibrate.

3. Record air temperature to the nearest 0.5 ºC for the armored thermometer on the Field Sampling Sheet in the designated location.

3.3 Recording General Observations

Record weather and general observations on the datasheet.

3.4 Water Temperature Measurement

Equipment: armored, digital thermistor, or probe

Temperature is reported in degrees Celsius (ºC). Always measure air temperature before water temperature.

Method:

Surface Sampling:

1. Place your probe or thermometer 0.3 m beneath the surface of the water
2. Wait for the probe or thermometer to stabilize
3. Record your reading

Sample with bucket:

1. Hang thermometer in the bucket
2. Wait for the probe or thermometer to stabilize
3. Record your reading

3.5 pH Test Strips

Method:

1. Remove one test strip from the container (close cap) and insert into the water at your sampling spot and allow water to react with the color strip (may take a few minutes)

2. Let color develop.

3. Compare color of test strip to the color chart on the pH test strip container.

4. Record measurement on field sheet. Repeat if collecting a replicate.

3.6 Turbidity Sample

1. Label the top of the turbidity container and unscrew the cap

2. Collect the sample as close to midstream as possible, however if sampling from the bank be sure not to disturb any bottom sediments

3. Be sure to sample upstream of any disturbed sediments

4. Collect another water sample using the methods identified in this document, additionally rinsing the bottle three times before collecting the sample on the fourth time.

5. Cap and label the sample bottle. (Site name/#, date, time, initials)

4 Lab sample collection preparation and handling

4.1 Bacteria Samples

Collecting on stream bank:

1. Get as close to the stream bank as possible with minimal disturbance of bottom sediments;

2. Take a few steps upstream with care not to disturb the sediment;

3. Un-cap the pre-labeled bottle

4. Using a U motion dip the bottle into the water down and away from yourself allowing the bottle to fill to the shoulder

5. After samples are taken, immediately place the sample on ice up to the shoulders of the bottle. The lid should not be immersed under the ice, in case ice water leaks into the sample bottle, diluting the concentration of the sample.

4.2 Sample container handling and preservation

Proper sample containers and sample preservation are essential to sample integrity. Samples not preserved properly may be rejected by the laboratory.

a) Sample containers should be inspected and any torn, punctured or cracked sample containers discarded.

b) After collecting the sample, make sure the lids are secured tightly to prevent contamination from water seepage in or out of the container.

c) Sample containers and coolers should be stored with the tops securely fastened. Containers with loose fasteners should be replaced or taped to prevent loss of sample containers during transport.

d) In the field, unless specified otherwise, all samples should be placed in an ice filled cooler immediately after collection. To ensure samples do not exceed the 4°C holding temperature, sample containers shall be placed upright and if possible, covered with ice in such a manner that the container openings are above the level of ice.

e) Glass sample containers should be packed in bubble wrap or other waterproof protective materials to minimize accidental breakage.

4.3 Sample Bottle Identification

Each sample container must include a label with the following information.

a) Station ID or description

b) Date and time of sample collection

c) Analyte sampled for

d) Collector's initials

Samples will not be analyzed if this information is missing. If more than one container is needed for a parameter (such as a duplicate sample), each container collected for that parameter must have a label with identical information in addition to an indication of 1 of 3, 2 of 3, 3 of 3, etc., as required. Duplicate samples should be designated as "Station ID – Dup".

Please remember to fill out the labels on the bottle with a waterproof pen before taking the samples.

It is essential that the actual sampling site match the labeling information. Always check the labeling information against the actual site. Samples not labeled properly may be rejected by the laboratory.

4.4 Transport of Samples

After collecting the samples at the site:

1. Place the bottles in the cooler filled with ice. Coolers should have enough ice to come up to the necks of the sample bottles.

2. Place any chain of custody forms in the Ziploc bag taped to the inner lid of the cooler.

3. Transport the cooler with samples to the designated drop off point or laboratory within 6 hours of collection.

5 Cleanup and Storage of Water Monitoring Equipment

a) Rinse the thermometer in tap water and store upright.

a) Ensure pH test strips are secure in the container and are kept in a clean, dry place between sampling event

Appendix D:

QA/QC Forms

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Volunteer Monitors Field Sheet

Volunteer Water Quality Monitoring in District of Columbia Waters

SITE NAME:	
SITE ID:	**RECORDER:**
DATE (mm/dd/yyyy)**:**	**TIME** (hhmm)**:**
MONITOR:	**MONITOR:**
MONITOR:	**MONITOR:**

OBSERVATIONS / WEATHER

Water Surface (circle one): Calm / Ripple / Waves / White Caps / N/A

Stream Flow Rate (circle one): High / Normal / Low / Stagnant

Weather Type (circle one): Sunny / Overcast / Partly Cloudy / Fog/Haze / Drizzle / Rain / Intermittent Rain

Water Color (circle one): Normal / Abnormal _____(color description)

Other observations (circle): Oil slick / SAV / Dead fish / Erosion / Foam / Odor / Debris

Field Parameter Measurements

Parameter	Measurement 1	Measurement 2
Air Temperature (°C)		**N/A**
Water Temperature (°C)		**N/A**
pH test strip		

Field Samples for Lab

Action	Yes	No
Bacteria sample collected?		
Bacteria sample bottle labeled? (site name, date, time)		
Turbidity sample collected?		
Turbidity sample labeled? (site name, date, time)		
Sample bottles placed in cooler?		
Fill out Chain of Custody form?		
Duplicate Collected?		

Notes:

ARK Internal Use Only		
Tide/Stream height (m):	**Rainfall (24hrs): inches**	**Duplicate (Y/N):**
UV Index:	**Rainfall (48hrs): inches**	**QC Check:**

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DEPARTMENT OF ENERGY & ENVIRONMENT

GOVERNMENT OF THE DISTRICT OF COLUMBIA
MURIEL BOWSER, MAYOR

Chain of Custody Record
Volunteer Water Quality Monitoring in DC Waters
Project/Grant#: RFA-2018-WQD-VWQM

Field Samplers (print name)	Signature	Anacostia Riverkeeper	For Internal Use	
		515 M ST SE, Suite 218 Washington DC, 20003 (202)-863-0158	Cooler temp (°C):	
			QC Check:	
			Scanned:	

Sample ID	Date	Time	Analysis (Bac/Turb)	Sample Type (N/DUP)	Remarks

Time and Date	Relinquished By	Received By	Comments

District Rivers' Recreational Use Survey

Site ID:_____ Date:_____ Start time:_____ End time:_____

Observers:_____

Activity	Description (if needed)	# of participants total
Swimming - indicate if seen from: Dock, boat, or shore		
Swim event (20+ people)		
Wading (waist deep or higher)		
Water play by children		
SCUBA/Snorkeling		
Power boat		
Tubing		
Water skiing		
Wake boarding		
Jet skiing		
Kayaking		
Stand up paddle boarding		
Pedal boarding		
Canoeing		
Rowing/sculling		
Paddle boating/swan boat		
Sailing		
Fishing		
Contact with wet dogs after playing in water		
Contact with water while hiking/crossing streams		
Other water contact activity (include a description)		

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Incubator Recording Sheet:

Incubator Turn On		**Place in Incubator**				**Remove from Incubator**			
Time and Date	Initials	Time and Date	Sample ID	Temp (°C)	Initials	Time and Date	Sample ID	Temp (°C)	Initials

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Colilert E. Coli Analysis Lab Sheet

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Lab Name: **Date:**

Lab Analysis: **QA/QC Supervisor:**

Sample	Analysis Start Time	Dilution	Incubation Start Time & Temp (C)	Incubation End Time & Temp (C)	UV Reader	# of large fluorescent wells	# of small fluorescent wells	E. Coli MPN

FD = field duplicate; LD = Lab duplicate