

Kenai River Water Quality Monitoring Quality Assurance Project Plan (QAPP)

Multi-Agency Baseline

V. 2. Updated April 2012

V.3. Updated May 2023



Original Version Prepared by:

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Al. Title and Approval Page

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A3. Acronyms

- ADEC – Alaska Department of Environmental Conservation
- ADEC DOW – ADEC Division of Water
- ADEC WQS – ADEC Water Quality Standards
- AWQMS – Ambient Water Quality Monitoring System
- BTEX – Benzene, Toluene, Ethylbenzene, Xylene
- COC – Chain of Custody
- CWA – Clean Water Act
- DL – Detection Limit
- EPA – Environmental Protection Agency
- EPA WQP – EPA Water Quality Portal
- EPA WQX – EPA Water Quality Exchange
- IDL – Instrument Detection Limit
- KWF – Kenai Watershed Forum
- LCS – Laboratory Control Sample
- LFB – Laboratory Fortified Blank
- LOQ – Level of Quantitation
- MS – Matrix Spike
- MSD – Matrix Spike Duplicate
- MQO – Measurement Quality Objective
- ND – Non-detect
- NMFS – National Marine Fisheries Service
- QAPP – Quality Assurance Project Plan
- QA/QC – Quality Assurance / Quality Check
- RL – Reporting Limit
- RPD – Relative Percent Difference
- SOP – Standard Operating Procedure
- TSS – Total Suspended Solids
- USGS – United States Geological Survey

Acknowledgements

This document was originally developed by the Kenai Watershed Forum and was modeled and adapted, with permission, from Quality Assurance Project Plans (QAPP) produced by the Cook Inletkeeper of Homer, Alaska. Portions of the Cook Inletkeeper QAPP were adapted from similar plans developed by The Friends of Casco Bay (Maine) and Texas Watch. The United States Environmental Protection Agency (EPA), the Alaska Department of Environmental Conservation (ADEC), the United States Geological Survey (USGS), and the National Marine Fisheries Service / Auke Bay Laboratory (NMFS / ABL) also provided guidance and cooperation in helping both the Cook Inlet Keeper and the Kenai Watershed Forum develop and refine their QAPP. Some sections are also adapted from the 2021 ADEC Watershed Health and Data Analysis Project QAPP.

A4. Distribution List

Signees (Project Manager, Project QA Officer, ADEC Project Manager and ADEC QA Officer) shall receive a copy of the QAPP and subsequent revisions. Official copies of this QAPP and any subsequent revisions will be extended to individuals on the Distribution List.

NAME	POSITION	AGENCY	CONTACT INFORMATION
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Copies of this Quality Assurance Project Plan will be made available online at <https://www.kenaiwatershed.org/science-in-action/research-information/water-quality/>. Interested parties may request a digital copy from KWF, or purchase a copy for the cost of production and shipping by writing the Kenai Watershed Forum, 44129 Sterling Highway, Soldotna, AK 99669, or calling (907) 260-5449, or emailing hydrology@kenaiwatershed.org.

A4. Project / Task Organization

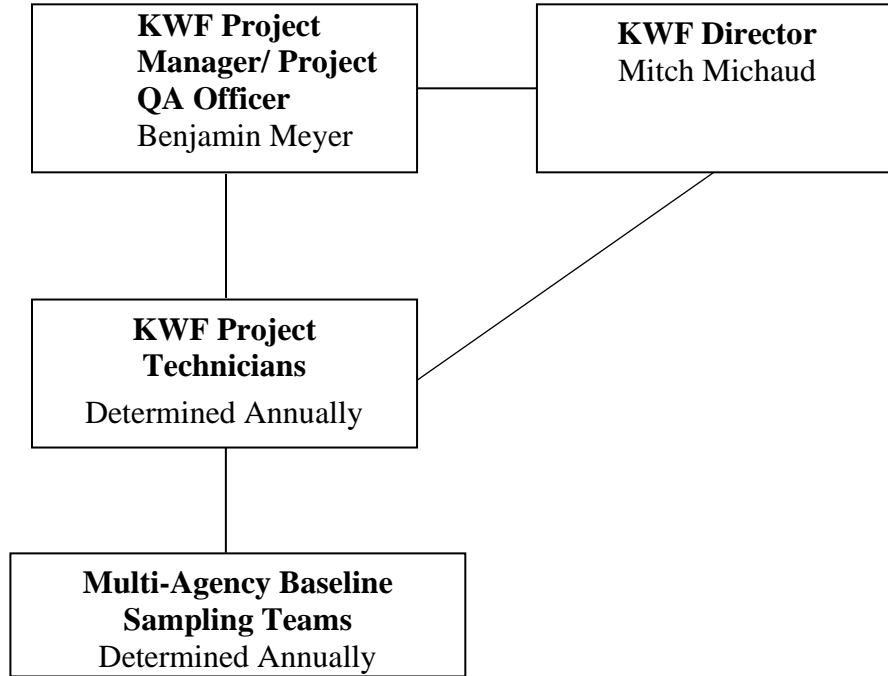


Figure 1. Project management organization

Key Contacts and Responsibilities

Mitch Michaud – Kenai Watershed Forum – Executive Director – Oversees all employees and operations at Kenai Watershed Forum.

Benjamin Meyer - Kenai Watershed Forum - Project Manager- Oversees the water quality monitoring efforts and projects conducted by the Kenai Watershed Forum. Provides and/or ensures adequate training is completed for each of the team members conducting water quality monitoring throughout the project. Has completed training in each of the monitoring elements outlined in the plan. Project Quality Assurance Officer - Supervises and trains water quality monitors. They are trained in Agency Baseline Sampling protocols. They are responsible for overall supervision of quality assurance and data entry.

Justin Nelson - SGS Environmental Laboratory Services (SGS) - Subcontractor for Kenai River Water Quality Assessment element of the project. Oversees all analyses to be performed at SGS. This contract will be used to ensure proper sampling and analysis of water for 22 Kenai River Watershed sites to determine the water quality within the Kenai River Watershed.

John Essert - City of Soldotna Wastewater Treatment Plant operator plays a significant

role in the Kenai River Water Quality Assessment. Will work cooperatively with the Project QA Officer and will perform a variety of water quality analysis for the Kenai Watershed Forum.

Technical Advisory Committee - The technical advisory committee will review results obtained from the monitoring effort on an annual basis. The committee may at any time ask for additional information on any aspect of the project. If monitoring data raises a particular concern, the advisory committee will be asked to suggest and review any changes to the monitoring plan. KWF will not be bound to implement any changes, but will give serious consideration to their input and will follow the committee's wishes if feasible.

Field Monitoring Staff - Monitoring staff collect samples for the Kenai River Watershed Monitoring program. Monitoring staff are or have been provided by the following Agencies/Organizations:

- Alaska Department of Fish and Game
- Alaska Department of Natural Resources
- Alaska Department of Environmental Conservation
- Cook Inlet Aquaculture Association
- City of Kenai
- City of Soldotna
- Kenai Peninsula Borough
- Kenaitze Indian Tribe
- KWF and any volunteers under direct supervision of KWF monitoring staff
- Kenai Soil and Water Conservation District
- Salamatof Tribe
- Tyonek Tribal Conservation District
- U.S. Fish and Wildlife Service
- U.S. Forest Service

Project managers are outlined in Figure 1, and annual, biannual, and five-year responsibilities are outlined in Table 1.

Table 1. Annual, biannual, and five-year project logistics tasks and responsible parties

Frequency	Month	Responsible Party	Responsible Person	Task	Page
Annual	February	Technical Advisory Committee	Committee Members	Review annual results from previous year	10
Annual	March	Kenai Watershed Forum	Project Manager / Project QA Officer	Uplift previous year's data that passed QA review to the EPA Water Quality Exchange	39, 40
Annual	March	Kenai Watershed Forum	Project Manager / Project QA Officer	Review previous year's data for five-year trends in the context of regulatory values	40
Annual	December	Kenai Watershed Forum	Project Manager / Project QA Officer	Produce a data trends and QA summary report; submit to the KWF Executive Director	32, 42
Semiannual	January	Kenai Watershed Forum	Project Manager / Project QA Officer	Submit data to the ADEC Integrated Report call for data.	39
Semiannual	March	Technical Advisory Committee	Committee Members	Review QAPP, address QA issues, and overall project design	42
Semiannual	March/May	Kenai Watershed Forum	Project Manager	Confirm sampling teams	29
Semiannual	April/May	Kenai Watershed Forum	Project Manager	Transfer field samples to laboratories	30
Semiannual	July/August	Kenai Watershed Forum	Project Manager	Receive data from laboratories	40
Semiannual	March/May	Kenai Watershed Forum	Project Manager / Project QA Officer	Confirm laboratory schedules and capabilities	29
Five years	-	Kenai Watershed Forum	Project Manager / Project QA Officer	Produce comprehensive data review, contingent on funding	42

A5. Problem Definition/Background and Project Objectives

The Kenai Watershed Forum's (KWF) water quality program is designed to document the existing and changing conditions of water quality within the Kenai River Watershed by developing and maintaining baseline information. It is the intent of the program to first identify and then address a wide range of activities that may contribute to nonpoint source pollution in the Kenai River Watershed. The baseline water-quality monitoring program is consistent with the recommendation 4.5.10.2.2 in the ***Kenai River Comprehensive Management Plan***, which today is overseen by the Kenai River Special management Area (KRSMA) Advisory Board (AKDNR 1997). This recommendation was developed for Alaska State Parks and the ***Upper Kenai River Cooperative Plan*** (USFWS 1997) as a partnership between Alaska State Parks, U.S. Fish and Wildlife Service and the U.S. Forest Service, Chugach National Forest. Since the project's inception in 2000, agencies represented by the KRSMA Advisory Board have provided financial and personnel support to carry out fieldwork and laboratory analyses.

The State of Alaska conducts ambient water quality monitoring only in select areas due to the high operating costs to maintain such a system over a large undeveloped area. Historically, on the Kenai Peninsula there have been several water quality analyses conducted by state agencies in the early 1990's (Litchfield and Kyle 1992; ADEC 2022b, 2022a). Although these studies indicated that measured water quality parameters were within state and federal compliance standards, *impacts of development and recreational use were evident*. Litchfield and Kyle (1992) analyzed water quality at 17 sites located between the outlet of Kenai Lake and Cook Inlet, and recommended the continued sampling of critical water quality parameters (fecal coliform, hydrocarbon, metals, and nutrients) for the purpose of monitoring future impacts on the Kenai River. They selected representative sites with the suggestion that they be monitored at least twice a year. It was also suggested that more intensive sampling be conducted in the Lower Kenai River, where concentrations of water quality contaminants were the highest priority and of greatest concern.

The baseline-monitoring program is needed to link water quality trends to an understanding of the natural and human factors that affect the water quality. The program is also necessary since many of the enforceable parameters rely on background or natural conditions. Without long-term data collection, it is impossible to know what the appropriate standards of enforcement are. This program must be integrated among many agencies that have differing objectives and must be long-term. The unique hydrologic features of the Kenai River, such as its glacier origin and two large lake systems, require an investigation that is designed to assess the whole of the watershed. The monitoring program must also be consistent with standard sampling and analysis protocols. The monitoring program addresses these needs and implements methods to monitor changes to the Kenai River as the local population and recreational use increase. For more detailed information on historical results, see the two previous Kenai River Water Quality Assessments published by Kenai Watershed Forum (Guerron Orejuela 2016; McCard 2007).

It should be noted that the temporal structure of this sampling program has not intended to represent water quality conditions of a full calendar year. Rather, the intention is to capture a snapshot of two annual conditions:

1. Prior to a period of higher potential for impact from human activities (boating activity, impervious surface runoff, etc.) in early summer; and
2. At the peak of human activity on/near the river in mid-summer.

A6. Project / Task Description

There are three project elements of the Kenai River Watershed Forum's Water Quality Monitoring Program described in this QAPP:

- A) Agency Baseline Monitoring Partnership
- B) Collection of specified interval data with programmable Electronic Instruments
- C) Stream Temperature Monitoring

Continuous monitoring of intrinsic parameters with electronic instruments was conducted by KWF in 2008 through 2012 on the lower Kenai River, which was summarized in a technical report by KWF (Martin et al. 2011). These activities are not currently active, but QA/QC methods are included here in Appendix H for future reference.

Water temperature monitoring was conducted in tributaries of the Kenai River by Cook Inletkeeper (CIK) 2008 through 2012, and continues in a selected subset of these streams today, led by KWF. Monitoring results were synthesized (Mauger 2013) and later applied in peer-reviewed research (Mauger et al. 2017). Currently active stream temperature monitoring will continue indefinitely as funding permits. (See further details on stream temperature monitoring under “Task C” of this section, and Appendix H for field form).

In 2018, a zinc and copper monitoring project was added to the KWF Water Quality Monitoring Program. This Alaska Clean Waters Action (ACWA) grant funded project was designed to monitor copper and zinc levels in key locations on the Kenai River and its tributaries. This element was added in response to an observed increase in zinc and copper levels between 2014 and 2016 (Sires 2017b, 2017a; Guerron Orejuela 2016). A final report on this project was completed in 2021 (Meyer 2021). ADEC conducted a subsequent monitoring effort focused on dissolved metals in the main stem Kenai River in 2021-2022, which highlighted the value of incorporating additional sample QA/QC metrics to ensure accuracy (Apsens and Petitt 2022).

Task A) Agency Monitoring Partnership to conduct baseline monitoring for Nutrients, Dissolved Metals, Hydrocarbons, and Fecal Coliforms (Referred to as Agency Baseline hereafter)

Narrative Task Description

Work with the Kenai River Special Management Area Advisory Board and the agencies represented on that board to conduct sampling with the help of a professional environmental contractor¹.

Objectives:

- Develop a baseline data set to include, at a minimum, dissolved metals, hydrocarbons, and fecal coliforms
- Work with the City of Soldotna to supplement this data with parameters that Soldotna’s wastewater treatment plant can analyze. (i.e. – total suspended solids, pH, fecal coliforms, turbidity and specific conductance, etc.)
- Near concurrent sample collection at 22 sites located on the Kenai River main stem and tributaries throughout the Kenai River Watershed using federal, state and local agency personnel (See Table 8 for a narrative description of the 22 sample sites)
- Attain high quality data by collecting samples in a manner that minimizes potential sample contamination and by using a professional lab certified by ADEC for drinking water analysis
- Sample each of the 22 sites at least 2 times per year as financial resources allow.

Data Collection

- Surface water quality parameters include; total metals (Cu, Fe, Hardness, and Zn), dissolved metals, petroleum hydrocarbons, fecal coliform, turbidity, specific conductance, temperature,

¹ Kenai Watershed Forum has been this contractor from 2000 – present.

nutrients

- Physical parameters include; weather conditions, boat traffic, and water temperature.

Schedule

- Data collection will occur in spring (April/May) and summer (July/August)

Task B) Collection of specified interval data with programmable Electronic Instruments

Narrative Task Description

Maintain and deploy as needed instruments capable of recording time series of water quality parameters, e.g. water quality sondes. Work with partners to identify projects where such monitoring is beneficial. Continuous monitoring with sondes is not currently part of the baseline water quality monitoring project, but will be conducted opportunistically as future needs are identified by stakeholders represented in the KRSMA advisory board and the project technical advisory committee.

Objectives

- Maintain a collection of 8-10 water quality sondes capable of recording continuous parameters
- Work with agencies, NGOs, and citizens to identify locations where continuous monitoring of water quality parameters may be valuable. E.g.; invasive species treatments; developing areas, impacted water bodies.

Data Collection

- Parameters monitored by sondes include pH, turbidity, conductivity, temperature, and dissolved oxygen
- Sondes will be subject to pre and post deployment calibrations and checks for all parameters

Schedule

- Fieldwork will be executed based on funding opportunities and local need
- Sondes will be returned to the manufacturer for bench calibration as needed depending on annual usage

See Appendix H for further details on Hydrolab Calibration

Task C) Stream Temperature Monitoring

Narrative Task Description

Maintain stream temperature monitoring sites in perpetuity at six sites in the lower Kenai River and Kasilof River areas, and at other sites as needed by new projects

Objectives

- Perform site visits at the six long-term stream temperature monitoring sites a minimum of twice annually
 - Moose River
 - Funny River

- Soldotna Creek
 - Slikok Creek
 - Beaver Creek
 - Crooked Creek
- Apply the highest available standards for field site management and data curation (as outlined in Mauger et al. (2015))

Data Collection

- Record year-round continuous time series of water temperature using programmed electronic instruments

Schedule

- Site visits to locations with water temperature loggers will be visited a minimum of biannually, typically once in early summer (May/June) and once in Fall (September/ October)

See Appendix G and Mauger et al. (2015) for further details on stream temperature monitoring methods in southcentral Alaska. Standard operating procedure for water temperature data QA/QC, management, and storage are detailed in the AKTEMP Water Temperature Database user Guide at <https://aktemp.uaa.alaska.edu/> from the University of Alaska Anchorage's Alaska Center for Conservation Sciences (ACCS 2023).

A7. Quality Objectives and Criteria for Measurement of Data

Data Quality Objectives (DQOs) for this program have been established to ensure that the data meets its overall objectives as described in A6, above – establishing a basic water quality inventory and detecting significant changes and trends. Table 2 through Table 6 show objectives for detectability, precision and accuracy for each parameter tested by all possible methods used by the Agency Baseline. DQOs are also included for automated multiprobes. In each case the sampling matrix is the water body of interest. Table 6 shows the objectives for the Stream Temperature monitoring. Objectives for precision, accuracy, representativeness, comparability, and completeness are also summarized in the following tables. Project DQOs may be revised in the future if funding becomes available for additional training and equipment or if the project manager determines that different objectives would be more effective in meeting program objectives. Any changes in DQOs will be submitted to USEPA for approval and reviewed by ADEC and the Technical Advisory Committee before implementation.

Table 2. Data Quality Objectives for Electronic Instruments

PARAMETER	METHOD/RANGE	UNITS	SENSITIVITY	PRECISION	ACCURACY
pH	SM H ⁺ B-2000, Hydrolab pH probe on Minisonde 0-14	Standard pH units	0.01 units	±0.2 units	±0.2 units
Turbidity	ISO 7027, Self Cleaning Turbidity Hydrolab Minisonde 5 0-3000 NTU	Nephelometric Turbidity Units (NTU)	0.1 0-400 NTU 1.0 400-3000 NTU	±5 NTU	±5% 0-100 NTU ±5% 100-400 NTU +5% 400-3000 NTU
Turbidity (Soldotna Lab)	EPA 180.1 Rev 2.0, Hach 2100 P 0-1000 NTU	Nephelometric Turbidity Units	0.010-9.99 NTU 0.1 10-100 NTU 1 100-1000 NTU	±5 NTU	±5% 0-500 NTU ±5% 500-1000 NTU
Water Temperature	SM 2550 B-2000, YSI Model 30, 55, and 95 -5 to 95, -5 to +45, and -5 to +45	Degrees Celsius (C)	0.1, 0.2, and 0.1	±0.1, ±0.2, and ±0.2	±0.1, ±0.2, and ±0.2 C
Conductance	EPA 120.1, Hydrolab probe on Minesonde 0-100 mS/cm	Micro-Siemens/cm (µS/cm) (converted to 25 C)	4 digits	±0.001 units	2% full Scale
Dissolved Oxygen	SM 4500 O C-2000, Micro Winkler Titration 0 to 20 mg/L	Milligrams per liter (mg/L)	0.1 mg/L	±0.9 mg/L	±0.3 mg/L
Dissolved Oxygen (Winkler used for calibration)	ASTM D888-09 (A), Hydrolab LDO probe on Minisonde 0 to 50 mg/L	Milligrams per liter (mg/L)	0.01 mg/L	NA	±0.2 mg/L

Table 3. Data Quality Objectives for Hydrocarbons Collected for Agency Baseline (Supplied by SGS)

PARAMETER	METHOD / RANGE	Sensitivity (DL)	LOQ	OVERALL PROJECT PRECISION ²	ACCURACY
Gasoline Range Organics (GRO)	AK101 by GCFID: 25-1,000,000,000	3.0 µg/L	5x DL	20%	Calibration: ±25% Recovery: 60-120%
Diesel Range Organics (DRO)	AK102 by GCFID: 50-1,000,000	0.0065 mg/L	0.11 mg/L	20%	Calibration: ±25% Recovery: ±25%
Residual Range Organics (RRO)	AK103 by GCFID: 500-1,000,000	0.22 mg/L	0.54 mg/L	20%	Calibration: 75-105% Recovery: 60-120%
Benzene	EPA 602 by GC/PID: 1-1,000,000,000	0.074 µg/L	1.0 µg/L	20%	Calibration: ±15% Recovery: ±30%
Ethylbenzene	EPA 602 by GC/PID: 1-1,000,000,000	0.088 µg/L	1.0 µg/L	20%	Calibration: ±15% Recovery: ±30%
Toluene	EPA 602 by GC/PID: 1-1,000,000,000	0.078 µg/L	1.0 µg/L	20%	Calibration: ±15% Recovery: ±30%
m,p-Xylene (total)	EPA 602 by GC/PID: 1-1,000,000,000	0.20 µg/L	2.0 µg/L	20%	Calibration: ±15% Recovery: ±30%
o-Xylene	EPA 602 by GC/PID: 1-1,000,000,000	0.20 µg/L	1.0 µg/L	20%	Calibration: ±15% Recovery: ±30%
Xylenes (total)	EPA 602 by GC/PID: 1-1,000,000,000	0.82 µg/L	3.0 µg/L	20%	Calibration: ±15% Recovery: ±30%

DL; detection limit

GCFID, gas chromatograph flame ionization detector

GCPID, gas chromatograph photo ionization detector

LOQ, limit of quantitation¹

² To use measurements for RPD calculations: one or both of the measurements must be above the parameters limit of quantitation (LOQ) and/or reporting limit (RL), and one or both of the measurements must be at least two times the LOQ.

Table 3. Continued

PARAMETER	METHOD / RANGE	Sensitivity (DL)	LOQ	OVERALL PROJECT PRECISION ³	ACCURACY
Bromofluorobenzene (surrogate)	EPA 602 by GCPID	0.12 µg/L	0.50 µg/L	20%	Calibration: ±15% Recovery: ±30%
Benzene	EPA 624	0.12 µg/L	0.40 µg/L	20%	±20.5%
Ethylbenzene	EPA 624	0.31 µg/L	1.0 µg/L	20%	±21%
Toluene	EPA 624	0.31 µg/L	1.0 µg/L	20%	±20.5%
m,p-Xylene (total)	EPA 624	0.620 µg/L	2.0 µg/L	20%	±20.5%
o-Xylene	EPA 624	0.31 µg/L	1.0 µg/L	20%	±22%
1,2-Dichloroethane-D4 (surrogate)	EPA 624				±18.5%
4-Bromofluorobenzene (surrogate)	EPA 624				±14.4%
Toluene D-8 (surrogate)	EPA 624				±11.5%

³To use measurements for RPD calculations: one or both of the measurements must be above the parameters limit of quantitation (LOQ) and/or reporting limit (RL), and one or both of the measurements must be at least two times the LOQ.

Table 4. Data Quality Objectives for Metals Collected for Agency Baseline (Supplied by SGS Laboratories, Anchorage, AK; and ALS Laboratories, Kelso, WA)

PARAMETER	METHOD	SENSITIVITY (DL)	LOQ	OVERALL PROJECT PRECISION ⁴	ACCURACY
Hardness	Calculated from Ca, total and Mg, total as CaCO ₃ + MgCO ₃				
Calcium, total	EPA 200.7	0.9 µg/L	4.0 mg/L	≤ 20 RPD	85 – 115 %LCS
Iron, total	EPA 200.7	3.0 µg/L	8.0 mg/L	≤ 20 RPD	85 – 115 %LCS
Magnesium, total	EPA 200.7	0.3 µg/L	2.0 mg/L	≤ 20 RPD	85 – 115 %LCS
Arsenic, dissolved	EPA 200.8	1.5 µg/L	5.0 µg/L	≤ 20 RPD	±15 % LFB
Cadmium, dissolved	EPA 200.8	0.15 µg/L	0.50 µg/L	≤ 20 RPD	±15 % LFB
Chromium, dissolved	EPA 200.8	0.78 µg/L	2.0 µg/L	≤ 20 RPD	±15 % LFB
Copper, dissolved	EPA 200.8	0.031µg/L	1.0 µg/L	≤ 20 RPD	±15 % LFB
Lead, dissolved	EPA 200.8	0.06 µg/L	0.2 µg/L	≤ 20 RPD	±15 % LFB
Zinc, dissolved	EPA 200.8	3.1 µg/L	10.0 µg/L	≤ 20 RPD	±15 % LFB

DL, detection limit
 LOQ, limit of quantitation
 LCS, laboratory control sample
 LFB, laboratory fortified blank
 mg/L, milligrams per liter (ppm)

µg/L, micrograms per liter (ppb)
 RPD, relative percent difference

⁴To use measurements for RPD calculations: one or both of the measurements must be above the parameters limit of quantitation (LOQ) and/or reporting limit (RL), and one or both of the measurements must be at least two times the LOQ.

Table 5. Data Quality Objectives for Nutrients, Fecal Coliform, and Total Suspended Solids (Supplied by Analytica Group F.C., and SGS)

PARAMETER	METHOD	SENSITIVITY (DL)	LOQ	OVERALL PROJECT PRECISION⁵	ACCURACY
Phosphorous, total	SM21 4500-P-B,E	0.01 mg/L	0.02 mg/L	≤ 25 RPD	±25 % LFB
Nitrates (NO ₂ + NO ₃)	SM21 4500-NO3-F	0.05 mg/L	0.20 mg/L	≤ 25 RPD	±10 % LCS
Suspended solids, total	SM21-2540-+D	0.31 mg/L	1.0 mg/L	≤5 RPD	±25 %
Fecal coliform	SM 9222D-1997 – membrane filtration	1.0 cfu/100 ml	1.0 cfu/100 ml	**	**

DL, detection limit

LOQ, limit of quantitation

mg/L, milligrams per liter (ppm)

cfu/100 ml, colony forming units per 100 milliliters

RPD, relative percent difference

LFB, laboratory fortified blank

LCS, laboratory control sample

* depends on dilution: filter 100 ml, <1/0; filter 50 ml, <2

** control checks of sterility, temperature

⁵ To use measurements for RPD calculations: one or both of the measurements must be above the parameters limit of quantitation (LOQ) and/or reporting limit (RL), and one or both of the measurements must be at least two times the LOQ.

Table 6. Data Quality Objectives for Stream Temperature Monitoring (From Cook Inletkeeper)

PARAMETER	METHOD	RESOLUTION/LIMIT (°C)	EXPECTED RANGE(°C)	ACCURACY	PRECISION	COMPLETENESS
AIR TEMPERATURE	SM 2550 B-2000, HOBO TIDBIT V2	0.16	-5 TO 37	± 0.2°C	±0.4C	90%
WATER TEMPERATURE	HOBO WATER TEMP PROV2	0.02	0 TO 50	±0.2 @ 0 TO 50°C	±0.4C	90%

Detectability is the ability of the method to reliably measure a pollutant concentration above background. ADEC DOW uses two components to define detectability: detection limit (DL) and limit of quantitation (LOQ) or reporting limit (RL).

- The DL is the minimum value which the instrument can discern above background but no certainty to the accuracy of the measured value. For field measurements the manufacturer's listed instrument detection limit (IDL) can be used.
- The LOQ or RL is the minimum value that can be reported with confidence (usually some multiple of the DL).

Note: The measurement method of choice should at a minimum have a practical quantification limit or reporting limit 3 times more sensitive than the respective ADEC WQS and/or permitted pollutant level (for permitted facilities).

Sample data measured below the DL is reported as ND or non-detect. Sample data measured \geq DL but \leq LOQ or RL is reported as estimated data. Sample data measured above the LOQ or RL is reported as reliable data unless otherwise qualified per the specific sample analysis.

Precision

Precision is the degree of agreement among repeated measurements of the same characteristic, or parameter, and gives information about the consistency of methods. It applies to analytical lab techniques and field replicates. Precision is expressed in terms of the relative percent difference (RPD) between two measurements (A and B). To use measurements for RPD calculations: one or both of the measurements must be above the parameters limit of quantitation (LOQ) and/or reporting limit (RL), and one or both of the measurements must be at least two times the LOQ.

For field measurements, precision is assessed by measuring replicate (paired) samples at the same locations and as soon as possible to limit temporal variance in sample results. Field and laboratory precision is measured by collecting blind (to the laboratory) field replicate or duplicate samples. For paired and small data sets project precision is calculated using the following formula:

$$RPD = \frac{A - B * 100}{\frac{(A + B)}{2}}$$

For larger sets of paired precision data sets (e.g. overall project precision) or multiple replicate precision data, use the following formula:

$$RSD = 100 * \frac{\text{Standard Deviation}}{\text{Mean}}$$

Replicate samples will be taken as described in section B5. Goals for precision are described for each element of the monitoring effort in Tables 1 through 5.

Accuracy

Accuracy is a measure of confidence that describes how close a measurement is to its “true” value. Methods to determine and assess accuracy of field and laboratory measurements include, instrument calibrations, various types of QC checks (e.g., sample split measurements, sample spike recoveries, matrix spike duplicates, continuing calibration verification checks, internal standards, sample blank measurements (field and lab blanks), external standards), performance audit samples (Discharge Monitoring Report Quality Assurance reports, blind Water Supply or Water Pollution Performance Evaluation samples from American Association for Laboratory Accreditation certified, etc). Accuracy is usually assessed using the following formula:

$$Accuracy = 100 * \frac{\text{Measured Value}}{\text{True Value}}$$

Representativeness

Representativeness is the extent to which measurements represent the true environmental condition. Representativeness will not be routinely monitored throughout the project, but is incorporated when necessary, in interpreting the data. It is obvious that water flowing past a given location on land or in the water column, particularly in the Kenai River, is constantly changing in response to dynamic inflow, tidal cycle, weather, etc. Regular periodic collection of data from any given location can help develop a better understanding of the variance associated with time series measurements of selected environmental variables. Representativeness for any given location, area, and region within the Kenai River Watershed will be more defined as historical water data is collected and compared at each site over time.

Comparability

Comparability is the degree to which data can be compared directly to similar studies. Using standardized sampling, analytical methods and units of reporting with comparable sensitivity helps ensure comparability. The Kenai Watershed Forum has selected testing methods that are EPA-approved and/or currently being employed by other water quality monitoring programs throughout the country. All monitors are trained to follow the same standard protocol for each parameter within the respective monitoring elements described in this document. As the program expands, site selection will favor locations where previous water quality monitoring has taken place. Efforts will be made to duplicate the effort of past studies where possible.

Completeness

Completeness is the comparison between the amounts of usable data collected versus the amount of data called for in the sampling plan. Completeness is measured as the percentage of total samples collected and analyzed as a whole and for individual parameters and sites as compared to the goals

set out by the project design. We can measure completeness by two mechanisms: 1) the primary number of samples collected divided by the useable number of samples submitted to ADEC with a goal of 85% completeness and, 2) a secondary completeness measured by the planned number of samples divided by the useable samples with a goal of 60%.

$$T = 100\% * \frac{T - (I + NC)}{\text{Completeness}}$$

Where T = Total number of expected measurements

I = Number of invalid results

NC = Number of results not produced (e.g., spilled sample, etc.) or rejected during data validation.

Qualifiers

Qualifiers refer data points with additional information about a particular analytical condition. This information is useful for a condition handler to determine what corrective actions to take. In this project, the qualifiers applied will be from those outlined by SGS Laboratories America, which are provided as part of a standard annual results report (Table 7).

Table 7. Data Qualifiers (from SGS North America)

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCCV/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
DF	Analytical Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	Detection Limit (i.e., maximum method detection limit)
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LLQC/LLIQC	Low Level Quantitation Check
LOD Limit of Detection	(i.e., 1/2 of the LOQ)
LOQ Limit of Quantitation	(i.e., reporting or practical quantitation limit)
LT	Less Than
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected
RPD	Relative Percent Difference
TNTC	Too Numerous To Count
U	Indicates the analyte was analyzed for but not detected

A8. Training Requirements

Training workshops are held for all monitors from the various agencies on how to collect water samples and secure them for transportation to the drop-off location. Training sessions occur the day preceding each sampling event (See Appendix B, Agency Baseline Monitoring Procedures). Monitors are also instructed on how to complete the Agency Baseline Field Data Sheet (Appendix C) to provide added information on sample conditions at the site. Training is performed by SGS staff and/or the KWF QA Officer. The KWF QA Officer will conduct an audit of 10% of the agency monitors to ensure they are following proper sampling procedures and data sheets are completed correctly. Both the KWF QA Officer and SGS staff will be available to aid by cell phone during the sampling period. The ADEC QA Officer may be available to provide support through pre and post sampling consultation. When samples are brought to the receiving location, we will review their sampling procedure and data collection to ensure completeness and accuracy. A standard chain of custody (COC) form supplied by SGS is used to track the samples from the field to the lab. All training workshops are documented by the KWF QA Officer and stored in digital and hardcopy versions at the KWF office for no less than 10 years.

A9. Documentation and Records

The field logbook will be a 3-ring binder containing individual field forms and chain-of-custody forms. Please see Appendix C and Appendix D for examples of these documents.

All field activities and observations will be noted during fieldwork. The descriptions will be clearly written with enough detail so that participants can reconstruct events later if necessary. Field logs and data sheets will describe any changes that occur at the site, in particular, personnel and responsibilities or deviations from the QAPP as well as the reasons for the changes. Requirements for entries will include the following:

Entries will be made legibly with black (or dark) waterproof ink.

- Corrections will be made by drawing a single line through the original entry allowing the original entry to be read. The corrected entry will be written alongside the original.
- Corrections will be initialed and dated and may require a footnote for explanation.
- Unbiased, accurate language will be used.
- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made should be noted, as well as the time of the observation itself). Each consecutive day's first entry will be made on a new, blank page.
- The date and time will appear on each page.
- Names of person(s) conducting the monitoring will be recorded on each data sheet.

All data gathered in the field will be recorded on site at the time sampling occurs using the Agency Baseline Field Data Sheet (Appendix C). This form is then returned to the drop-off location, along with the water samples collected in the field, where the Project QA Officer and the Project Manager check the data as described in sections B9 & B10 of this plan. The Project Manager enters data into a computer database after the Project QA officer has approved them for entry. Original copies of all data sheets are kept on file at the Kenai Watershed Forum office indefinitely.

Results for parameters analyzed at the Soldotna Wastewater Treatment Plant on the sampling event

day will be recorded on the Agency Baseline Lab Test Results form (Appendix E). SGS will provide results from their analyses on their data sheets. Sample analytical results will include all method, SOP and QAPP required quality control sample results including their acceptance criteria limits in order for project staff and ADEC to perform tertiary data validation/verification of analytical results. All data will be entered into the KWF database which is accessible in-house.

Hard copies of all data sheets will be kept at the KWF office for 10 years and at SGS lab for 5 years.

B1. Sampling Process Design

In order to obtain useful baseline inventory and monitoring information as described in Section A5 (Problem Definition/Background), it is critical to select sampling sites that are representative of the various hydrologic, geographic, biologic, land use, and other conditions within the watershed. Because of the variability and distribution of human population densities in the Kenai River Watershed, site selection should ensure a balance between more impacted and less impacted areas. Finally, to maintain agency involvement, it is important to select monitoring sites in which agency monitors can work and fund the project within the area that is managed by their particular agency

Applying the above criteria, the Kenai Watershed Forum has established 22 sites along the Kenai River and several of its tributaries. Sites were also selected based on a previous water-quality monitoring project performed by the Alaska Department of Fish and Game in 1990.

Each site is given a name and identified by river mile and a location description, as well as by its latitude, longitude and elevation as determined using USGS 1:63,360 scale topographical maps and on-site GPS readings. See Table 8 for Agency Baseline sampling locations. Site selection for future monitoring within the basin will be based on similar factors.

As described in Section A6 (Project Objectives/Task Description), testing parameters are selected based on their usefulness in inventorying water quality and projecting the general "health" of the water bodies in question.

Surface water grab samples will be taken at all 22 stations during July/August when the river is heavily used and is at high flow and then again during April/May breakup when the river is at low flow. Agencies that have received training and are supplying staff to conduct monitoring are outlined in Section A4 ("Key Contacts and Responsibilities") of this document.

The 22 sampling stations where water samples will be taken were selected by first incorporating the 17 sites used during the ADF&G 1990/91 Water Quality study with the addition of four additional sites in the estuary portion of the river and Juneau Creek. The selected sites with GPS coordinates are listed in Table 8.

Table 8. Sampling Locations for Agency Baseline Monitoring

KENAI RIVER STATIONS	RIVER MILE	LATITUDE	LONGITUDE
City of Kenai Boat Dock	1.5	60.543680	-151.222940
Cunningham Park	6.5	60.540810	-151.182780
Upstream of Beaver Creek Mouth	10.1	60.539279	-151.142263
The Pillars Park	12.5	60.533743	-151.099258
Poacher's Cove	18	60.502005	-151.106973
Soldotna Bridge	21	60.476634	-151.082099
Swiftwater Park	23	60.480338	-151.030847
Morgan's Landing	31	60.498284	-150.863121
Bing's Landing	40	60.515441	-150.702069
Upstream of Dow Island	43	60.489844	-150.636905
Skilak Lake Outflow	50	60.467517	-150.507789
Jim's Landing	70	60.481392	-150.115020
Kenai Lake Bridge	82	60.49200	-149.81087
TRIBUTARY STATIONS			
"No Name" Creek	0	60.550888	-151.268417
Beaver Creek	10	60.548029	-151.143240
Slikok Creek	19	60.482318	-151.127053
Soldotna Creek	22	60.483364	-151.057656
Funny River	30	60.489963	-150.860982
Moose River	36	60.536870	-150.754724
Killey River	44	60.481518	-150.632498
Russian River	74	60.484622	-149.993955
Juneau Creek	79.5	60.489	-149.877

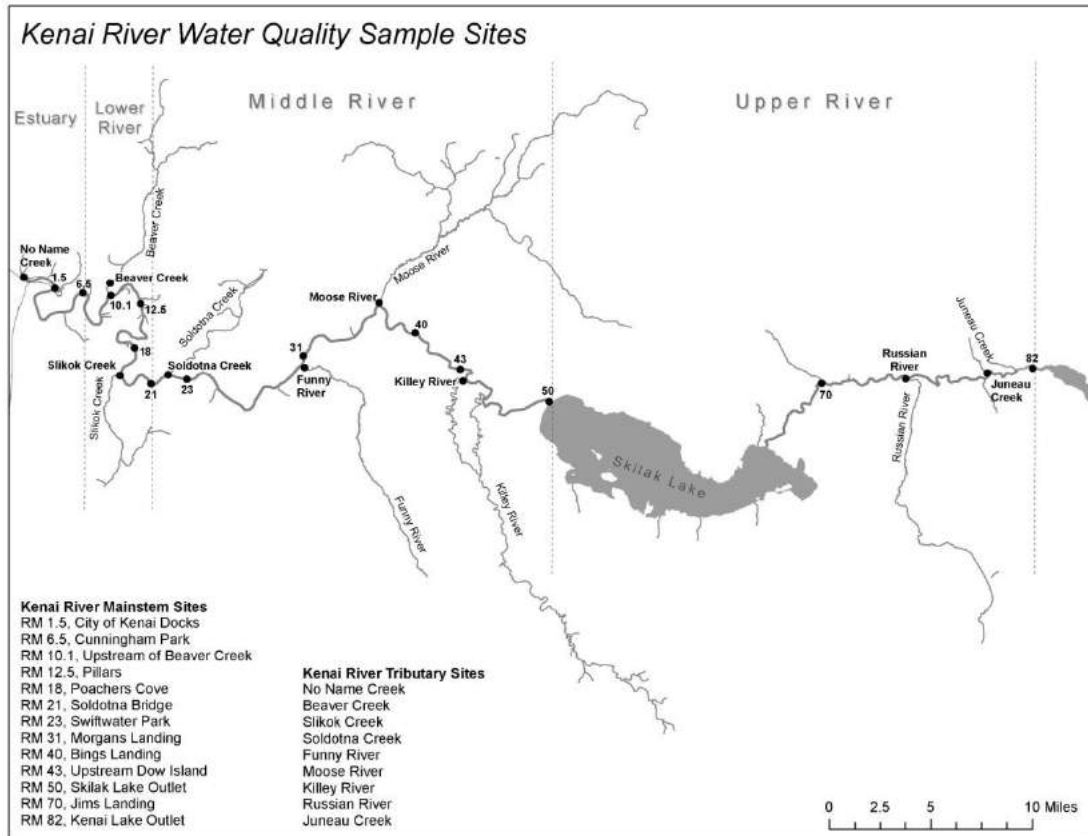


Figure 2. Map of the multi-agency baseline sample locations and the Kenai River watershed.

The City of Soldotna Wastewater Treatment Plant has the capability and equipment to test the following parameters and will do so as time allows and staff are available and willing to donate time:

- Total Suspended Solids
- Fecal Coliform

SGS Anchorage will be under contract for a more intensive analysis of water quality parameters including:

- Hydrocarbons
- Trace Metals
- Total Phosphorous
- Nitrates

As needed, Tauriainen Engineering & Testing will be under contract for analysis of water quality parameters including:

- Fecal Coliform (when the City of Soldotna cannot provide this analysis)

Agency representatives receive training on sampling techniques directly from the SGS and the KWF Quality Assurance Officer on the day prior to sampling. Each team receiving training will be assigned from 1 to 5 sites to collect multiple water samples. Total suspended solids samples will be taken directly to the City of Soldotna Wastewater Treatment for analysis within the capacity of the Soldotna Wastewater treatment plant. Remaining samples will be sent to SGS or Tauriainen for the

more specific analysis as described above.

B2. Sampling Methods Requirements

The Project QA Officer is responsible for making sure written instructions are provided to each of the monitoring teams during the training that occurs on the day prior to sampling. Sample containers with unique sample numbers will be provided to the sampling teams. These containers are to be filled following the aforementioned instruction sheet. Collection techniques will be demonstrated and monitors will be able to practice sampling under the supervision of the project QA Officer on the day prior to collection. Agency Baseline Monitoring Procedures are included in Appendix B.

Monitors will face upstream while collecting water samples, wear clean gloves, and ensure that they are not downstream of any boats or other river obstacles that may be adding concentrated products into the water column. Monitors will employ “Clean Hands – Dirty Hands” technique when handling sample vessels and equipment (EPA 1996b) (see Appendix B for detailed protocol). Monitors will remove the bottle lid carefully, making sure not to touch the inside of the bottle cap or bottle rim. Never place bottle caps in pockets, or on surfaces. Monitors will do their best to minimize the amount of time that bottles are open before sample collection. Monitors will take water samples by inverting the bottles to six inches below water line then turning the bottle upright to collect the sample at that water level. Samples collected in the main stem of the Kenai River, unless otherwise noted on the data collection sheet for safety reasons, will be collected at least 10 feet away from the riverbank. Samples from a tributary stream will be collected upstream of the mixing zone with the Kenai River. The GPS coordinates of the actual sample collection location will be recorded by each monitor.

Each sample bottle will be labeled with a unique sample number, sample site name, analysis to be performed, date and time, and initials of the person collecting the sample. SGS will provide and prepare all uncontaminated testing sample bottles for each. See Section B3, Sampling Handling and Custody Requirements, for details on how the samples will be prepared and handled for transport.

The recommended time for sampling is morning so that samples can be analyzed in the early afternoon at the Soldotna Wastewater Treatment Plant and prepared for travel and subsequent analysis at the SGS in Anchorage. At the sampling stations located in the tidal areas of the Kenai River, samples will be taken during outgoing tide to obtain river water rather than tidally influenced salt water.

Table 9. Preservation and Holding Times for Sample Analysis

Analyte	Matrix	Container	Necessary Volume	Preservation and Filtration	Holding Time
BTEX	Water	VOA amber vials w/septa	3x40mL vials	HCl to pH < 2; 0-≤6°C, do not freeze; no headspace	14 days
Phosphorus, total	Water	HDPE	125ml	H ₂ SO ₄ to pH < 2; 0-6°C, do not freeze	28 days
-Nitrates (NO₂ + NO₃)	DW/W	HDPE	60 ml	H ₂ SO ₄ to pH < 2; chill recommended	28 days
Fecal Coliform	Water	PA	125 ml	<ul style="list-style-type: none"> • 1 ml of 10% sodium thiosulfate, • ≤10°C, do not freeze 	<6 hours sample collection to sample incubation.
TSS	Water	P, FP, G		<ul style="list-style-type: none"> • Cool ≤6°C • do not freeze 	7 days
Dissolved Metals	Water	HDPE	250 ml	<ul style="list-style-type: none"> • lab filtration w/0.45 μm filter within 14 days of collection followed by • HNO₃ to pH<2 in lab 	6 months
Total Metals	Water	HDPE	250 ml	HNO ₃ to pH<2 at time of collection	6 months
Turbidity	Water	P, FP, G	250 ml	<ul style="list-style-type: none"> •Cool ≤6°C •do not freeze 	48 hours

PA, P, FP, PA is any sterilizable (autoclavable) plastic, “P” is polyethylene, “FP” is fluoropolymer, “G” is glass, HDPE is “high-density polyethylene”, VOA is “volatile organic analysis”

B3. Sample Handling and Custody Requirements

In-situ field measurements

- Field sampling crews will use handheld electronic instruments to measure conductivity, pH, temperature, and turbidity on site.

Sample transport from field to office

- Samples will be labeled (see Figure 3) and logged on the Agency Baseline Field Data Sheet (Appendix C).
- Sample collection vessels will be stored in double plastic bags, grouped by field site. Sample vessels will be handled only by gloved hands, per description of the “Clean Hands / Dirty Hands” methodology (see Field Sampling SOP in Appendix B).
- In the field, samples will be collected and stored in insulated ice chests containing freezable gel packs to hold samples at 4 degrees C (plus or minus 2 degrees C) until delivered to the lab. Temperature in transit will be monitored with a temperature blank with an objective of maintaining 4 degrees centigrade plus or minus 2 degrees centigrade. Once collected, samples are the responsibility of the monitors, and will stay in their possession until delivered to the drop-off location.
- Once samples have been delivered to the drop-off location, the Soldotna Wastewater

Treatment Plant lab technicians analyze samples for total suspended solids, and fecal coliform bacteria.

- A portion of the samples will also be prepared for travel to SGS for further analysis. Samples will be repacked in insulated ice chests and kept in chilled condition with freezable ice packs. Temperature in transit will be monitoring with a temperature blank with an objective of maintaining 4 degrees centigrade plus or minus 2 degrees centigrade.
- An SGS Chain of Custody Form will be used to record all transport and storage information.
- Each sample bottle will be labeled with a unique sample number, sample site name, analysis to be performed, date and time, and initials of the person collecting the sample.

KENAI WATERSHED FORUM Phone (907) 260-5449	
Field Information:	
Type of Sample: _____	Sample Number _____
Site #: _____	Location: _____
Sample ____ of ____	
Preservation Method: _____	Gear: _____ Date: _____
____ / ____ / ____	
Time: _____ AM PM	Monitor Name: _____
Phone: _____	Monitor Signature: _____
Lab Information:	
Date: ____ / ____ / ____	Time: _____ AM PM Phone: _____

Analyst: _____	Signature: _____

Figure 3. Sample Container Label

Sample transport from office to laboratory

Samples and sample containers will be maintained in a secure environment from the time the bottles leave the laboratory until the samples are received at the laboratory. The laboratories will maintain custody of bottles and samples using their normal custody procedures.

Samples must be in the sampler’s possession or in a cooler sealed with a signed and dated custody seal on opposing sides of the cooler. When the cooler is sealed, the method of securing the samples must be such that tampering with samples or bottles is not possible. The cooler must be secured so that the lid cannot be removed without breaking the custody seal.

Transfer of samples will be accomplished using the laboratory’s Chain-of-Custody (COC) form. When samples are transferred between personnel, such transfer will be indicated on the COC form with signature, date, and time of transfer. The COC will remain with the samples, sealed inside the cooler, until received by the laboratory.

If custody is broken at any time during sample transfer, a note must be made on the COC form accompanying the sample. Upon receipt at the laboratory, the laboratory sample custodian will make note if a breach of custody has occurred (for example, if a custody seal has broken during transport).

Shipping Requirements

Packaging, marking, labeling, and shipping of samples will comply with the contracted laboratory shipping instructions. Staff should receive the necessary training for shipping samples or consult with the contracted laboratory for details.

Samples collected in plastic bottles will be double-bagged and placed in the cooler with sufficient padding (e.g., bubble wrap, cardboard, etc.) to limit movement of the bottles in the cooler during transport. The plastic sample bottles will be placed into a bag-lined cooler with ice sealed in plastic bags or gel-ice/blue-ice to maintain a temperature of less than $4\pm 2^{\circ}\text{C}$. A temperature blank, 250 or 500 mL in size, will be placed in the cooler. Temperature will be measured upon receipt at the lab. The chain of custody (COC) form will be placed in a plastic bag within the cooler. The cooler will be taped closed securely using packing tape at the drop-off location.

The six-hour holding time limitation for the bacteria samples must be met. To accomplish this, this project will use a combination of transportation to get the samples from waterbodies to laboratory within the specified hold time. Water chemistry samples will be delivered to contracted laboratories within 48 hours to meet the hold times.

B4. Analytical Methods Requirements

Monitoring shall be conducted in accordance with EPA-approved analytical procedures and in compliance with 40 CFR Part 136, *Guidelines Establishing Test Procedures for Analysis of Pollutants* (EPA 1996a). Documentation of methods used, along with precision and accuracy and detectability information is provided in Table 2 through Table 5. For each sample collected, the method used is recorded in the data.

Under direction of the Project Manager, project staff will ensure that all equipment and sampling kits used in the field and laboratories use EPA Clean Water Act (CWA) approved methods. The project's QA officer will verify that only EPA CWA approved methods (or in specific incidences ADEC DOW pre-approved methods) are used.

Soldotna Wastewater Treatment Lab will analyze samples for Total Suspended Solids, as well as for Fecal Coliforms when resources allow. SGS will perform laboratory analysis of water quality beyond the capacity of the Soldotna Wastewater Treatment Plant. Their Quality Management Plan is on file with Kenai Watershed Forum, and available upon request from either KWF or the Soldotna Wastewater Treatment Plant.

B5. Quality Control Requirements

Quality Control (QC) is the overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the monitoring project's data quality objectives. This information is summarized in Table 10.

B.5.1 Field Quality Control (QC) Measures

QC measures in the field include but are not limited to:

- Adherence to documented procedures and the comprehensive documentation of sample collection information included in the field data sheets.
- A rigidly enforced chain-of-custody program will ensure sample integrity and identification. The chain-of-custody procedure documents the handling of each sample from the time the sample was collected to the arrival of the sample at the laboratory.

- Proper cleaning of sample transport containers (coolers) and sampling equipment.
- Maintenance, cleaning and calibration of field equipment/kits per the manufacturer's and/or laboratory's specification, and field SOPs.
- Chemical reagents and standard reference materials used prior to expiration dates.
- Ensuring that field sample collection containers seals remain unbroken until sampling is conducted.
- Correct sample labeling and data entry.
- Proper sample handling and shipping/transport techniques.
- Field replicate samples (blind to the laboratory). A minimum of 10% of the field samples will be duplicated with a replicate sample. Two replicate samples will be collected during the spring Monitoring event and again during the summer Monitoring event. The replicate samples will be randomly rotated among the 7 teams of monitors.
- Field replicate measurements. At least 10% of the instrument multi-day deployments are duplicated using two instruments side by side. Comparison of the two data sets is to be reported in an annual summary to demonstrate comparability.
- Field blank measurements. A minimum of two field blank samples for dissolved and total metals will be assigned by random rotation to two separate sites for each sample event. The sample will be collected by pouring ultrapure distilled water provided by SGS Laboratories directly into the sample vessel. At minimum, the field blank will be analyzed for total Cu and Zn, and dissolved Cu, Zn, As, Cd, Cr, and Pb (see Table 12).
 - Field blanks will be assigned only to sites below River Mile 30. The rationale is that field blanks are currently intended to measure the influence of field collection procedures as a potential source of sampling contamination for dissolved metals. Dissolved metals samples are collected only at sites including at and downstream of River Mile 30.

Table 10 (page 1 of 2). Field Quality Control Samples. Table contains information for Hydrolabs and stream temperature monitoring for general reference.

Field Quality Control Sample	Measurement Parameter	Frequency of Occurrence	QC Acceptance Criteria Limits
Trip Blank	BTEX	1/cooler/shipment	≤ BTEX DL (see Table 2)
Field Blank	Total Cu, Zn; Dissolved Cu, Zn, As, Cd, Cr, Pb	2 per sample event (i.e., spring/summer), random rotation	
^a Field Replicate (Blind to Lab)	DRO, GRO, RRO, Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene, Ca _{total} , Fe _{total} , Mg _{total} , AS _{dissolved} , Cd _{dissolved} , Cr _{dissolved} , Cu _{dissolved} , Pb _{dissolved} , Zn _{dissolved} , P _{total} , NO ₂ + NO ₃ ,	10%	See Section A7, Table 3 through Table 5 for analyte-specific precision criteria. (See section B.5.1 for operational details).
Field Replicate Measurement	Hydrolab (pH, Turbidity, Water Temperature, Specific Conductance, DO)	2/each hydrolab deployment (beginning and end) and at least 10% sample data collected	See Section A7, Table 2 for analyte-specific precision criteria
Field Replicate Measurement (Stream Temperature Monitoring)	Air and Water Temperature	2/each deployment (beginning and end of ice-free season)	See Mauger et al. (2015)
Calibration Verification Check Standards	Hydrolab (pH, Turbidity, Specific Conductance, DO)	1/deployment after stream retrieval	See Table 2 analyte-specific accuracy criteria
Temperature Blank	BTEX, Phosphorous (Total), NO ₃ +NO ₂ , TSS, Turbidity	1/cooler/shipment	≤ 6°C
	Fecal Coliforms		≤ 10°C
Trip Blank	BTEX	1/cooler/shipment	≤ BTEX DL (see Table 2)

^a Two replicate samples will be collected during the summer Monitoring event. The replicate samples will be rotated among the 7 teams of monitors.

^b One field blank collection for total and dissolved metals will be randomly assigned to two sites per sampling event for sites at and below River Mile 30.

Table 10. (page 2 of 3). Field/Laboratory Quality Control Samples

Field/Lab Quality Control Sample	Measurement Parameter	Frequency of Occurrence	QC Acceptance Criteria Limits
Lab blank	DRO, GRO, RRO, Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene, Ca _{total} , Fe _{total} , Mg _{total} , As _{dissolved} , Cd _{dissolved} , Cr _{dissolved} , Cu _{dissolved} , Pb _{dissolved} , Zn _{dissolved} , P _{total} , NO ₂ + NO ₃ , TSS, Turbidity, Fecal Coliforms		≤ DL (See Section A7, Table 3 through Table 5 for analyte-specific precision criteria)
Lab Fortified Blank	DRO, GRO, RRO,		Calibration: ±25%
	Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene		Calibration: ±15%
	Ca _{total} , Fe _{total} , Mg _{total}		Calibration: ±15%
	As _{dissolved} , Cd _{dissolved} , Cr _{dissolved} , Cu _{dissolved} , Pb _{dissolved} , Zn _{dissolved} ,		Calibration: ±15%
	P _{total}		Calibration: ±15%
	NO ₂ + NO ₃		Calibration: ±15%
Lab Calibration Standard (LCS) and Continuing Lab Calibration Standard (CCS)	DRO, GRO, RRO		Calibration: ±25%
	Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene,		Calibration: ±15%
	Ca _{total} , Fe _{total} , Mg _{total}		Calibration: ±15%
	As _{dissolved} , Cd _{dissolved} , Cr _{dissolved} , Cu _{dissolved} , Pb _{dissolved} , Zn _{dissolved}		Calibration: ±15%
	P _{total}		Calibration: ±15%
	NO ₂ + NO ₃		Calibration: ±15%
	Turbidity		Calibration: ±15%

Table 10. (page 3 of 3). Field/Laboratory Quality Control Samples

Field/Lab Quality Control Sample	Measurement Parameter	Frequency of Occurrence	QC Acceptance Criteria Limits
Matrix Spike	DRO, GRO, RRO, Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene, Ca _{total} , Fe _{total} , Mg _{total} , As _{dissolved} , Cd _{dissolved} , Cr _{dissolved} , Cu _{dissolved} , Pb _{dissolved} , Zn _{dissolved} , P _{total} , NO ₂ + NO ₃ ,		Calibration: ±15%
Matrix Spike Duplicate	DRO, GRO, RRO, Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene, Ca _{total} , Fe _{total} , Mg _{total} , As _{dissolved} , Cd _{dissolved} , Cr _{dissolved} , Cu _{dissolved} , Pb _{dissolved} , Zn _{dissolved} , P _{total} , NO ₂ + NO ₃ ,		Calibration: ±15%
Lab Duplicate Sample	DRO, GRO, RRO, Benzene, Ethylbenzene, m,p-Xylene, o-xylene, Toluene, Ca _{total} , Fe _{total} , Mg _{total} , As _{dissolved} , Cd _{dissolved} , Cr _{dissolved} , Cu _{dissolved} , Pb _{dissolved} , Zn _{dissolved} , P _{total} , NO ₂ + NO ₃ , Turbidity, TSS		Calibration: ±15%
External QC Check Standard	Turbidity,		Calibration: ±15%
	TSS		Calibration: ±15%
Internal Standard/Surrogate Standard	BTEX		Calibration: ±15%
	As _{dissolved} , Cd _{dissolved} , Cr _{dissolved} , Cu _{dissolved} , Pb _{dissolved} , Zn _{dissolved}		Calibration: ±15%

If analytical sample results exceed state water quality criteria for a parameter (or multiple parameters), KWF will do the following:

- For the semiannual water quality monitoring events in April and July, KWF will collect another sample as soon as possible to confirm the original findings if funding is available. Ideally, samples would be collected at the original sample location and one above and below the original location.
- Flag the data, validate it, notify ADEC as soon as feasible and summarize it in the annual data report.
- Flag the data, validate it, and share the information with the technical advisory committee to help determine where and what to sample for in the future.
- Prior to the public release of any data, KWF will inform ADEC of KWF’s intention to report the data. KWF will work closely with the ADEC project manager to ensure an accurate and consistent message will be delivered. Prior to final release, KWF will also notify partner organizations involved with fieldwork, sample analysis, and data management to ensure consistent messaging.

B6. Instrument / Equipment Testing, Inspection and Maintenance

Training is conducted by the KWF Program Manager with support from the KWF QA Officer and/or SGS staff. The trainers describe the proper handling and maintenance of sample bottles and, once the water samples were taken, how to handle the samples while in transit to the drop off point. The only field analysis performed by monitors is in-situ temperature. Proper equipment handling and maintenance is also emphasized when each monitor picks up his/her sample kit assembled by SGS. Monitors are asked to contact the Project QA Officer immediately upon receipt if any sample bottles, caps, labeling material, data sheets, etc. are not included in the kit.

All equipment, and kits are checked upon receipt by the Project QA Officer to ensure that all equipment is in working order and the kit was complete. Before each sampling event, Monitors are asked to inspect all kits for completeness. Kits are also inspected when Monitors bring them in with water samples to the drop-off location. SGS will provide extra sampling bottles in case some are missing in the kits or in case of breakage.

B7. Instrument Calibration Procedures

Field instruments will be calibrated or verified within calibration tolerances prior to using the instruments. Calibrations will be in accordance with the respective EPA Clean Water Act (CWA) approved method against standards of known traceability and within stated certification (expiration) dates. Calibrations, etc. will be documented as previously described.

Contracted and sub-contracted laboratories will follow the calibration procedures found in its QAP and the laboratory's SOPs. Specific calibration procedures for regulated pollutants will be in agreement with the respective EPA Approved CWA method of analysis. Field and/or laboratory calibration records will be made available to partner agencies upon request.

Standard Calibration Procedures for Hydrolab Minisonde MS 5 are included as Appendix H to this document.

Note: YSI meters are calibrated to the manual specifications for each model listed. YSI meters are only used to collect temperature data. The YSI Temperature Meter QA form is found in Appendix I.

B8. Inspection and Acceptance Requirements for Supplies

Monitoring supplies are provided by SGS. The lead contact at SGS has the responsibility of ordering equipment and supplies. All sample containers, tubing, filters, etc. provided by SGS will be certified clean for the analyses of interest. The KWF team will take note of the information on the certificate of analysis that accompanies sample containers to ensure that they meet the specifications and guidance for contaminant-free sample containers for the analyses of interest. The project QA Officer has the responsibility to ensure that adequate supplies are available and being used at the time of sampling.

B9. Data Acquisition Requirements for Non-Direct Measurements

Weather data downloaded or purchased through the National Oceanic and Atmospheric Administration (NOAA) web site (<http://www.nci.noaa.gov>) also will be used and assumed accurate. Stream discharge data may be obtained from the U.S. Geological Survey (USGS) (<https://maps.waterdata.usgs.gov/mapper/>) and will be assumed to be accurate.

B10. Data Management

The success of a monitoring project relies on data and their interpretation. It is critical that data be available to users and that these data are:

- Of known quality
- Reliable
- Aggregated in a manner consistent with their prime use
- Accessible to a variety of users

Quality Assurance/Quality Control (QA/QC) of data management begins with the raw data and ends with a defensible report, preferably through the computerized messaging of raw data. See Figure 4 for details.

Data management encompasses and traces the path of the data from their generation to their final use or storage [e.g., from field measurements and sample collection/recording through transfer of data to computers (laptops, data acquisition systems, etc.), laboratory analysis, data validation/verification, QA assessments and reporting of data of known quality to the Project Manager and partner agencies upon request. Data management also includes/discusses the control mechanism for detecting and correcting errors.

Various people are responsible for separate or discrete parts of the data management process:

- The sampling team is responsible for field measurements/sample collection and recording of data and subsequent shipment of samples to laboratories for analyses. They assemble data files, which includes raw data, calibration information and certificates, QC checks (routine checks), data flags, sampler comments and metadata where available. These files are assembled and forwarded for secondary data review by the sampling manager or supervisor.
- Laboratories are responsible for complying with the data quality objectives specified in the QAPP and as specified in the laboratory QAP and method specific SOPs. Validated sample laboratory data results with respective analytical method QA/QC results and acceptance criteria are reported to the sampling manager or project supervisor.
- Secondary reviewers (sampling coordinator/supervisor/project supervisor) are responsible for QA/QC review, verification and validation of field and laboratory data and data reformatting as appropriate for reporting to the EPA Water Quality Exchange, AWQMS (if subscribed), and reporting validated data to the project manager.
- The project QA officer is responsible for performing routine independent reviews of data to ensure the monitoring projects data quality objectives are being met. Findings and recommended corrective actions (as appropriate) are reported directly to project management.
- The project manager is responsible for final data certification
- Prior to upload to the EPA Water Quality Exchange, a final tertiary review is conducted by a third party, such as the ADEC DOW Water Quality Nonpoint Source Regional Staff/WQAO or another party as recommended by ADEC and technical review board members.
- ADEC staff will perform a biannual assessment of water quality that has been uploaded to the EPA Water Quality Exchange in the context of regulatory limits as part of their Integrated Assessment report.

B10.1 Data Storage and Retention

Data management files will be stored as described below and in Section A9, Documents and Records. Laboratory records must be retained by the contract laboratory for a minimum of five years.

All data are reviewed by the Project QA Officer and the Project Manager before data are accepted. Data will be converted into a customized template in Microsoft Excel compatible with the data upload procedure being applied (e.g. the EPA Water Quality Exchange or the Ambient Water Quality Management System (AWQMS)). Data will be reviewed to determine if water quality problems exist and any values exceed water quality standards. Data files are backed up on KWF server, which in turn is backed up at a remote location by the IT service provider North Tech Group (<https://northtechgroup.com/>). See Figure 4 for the data management flowchart.

Kenai Watershed Forum Agency Baseline Water Quality Project Data Management Flowchart

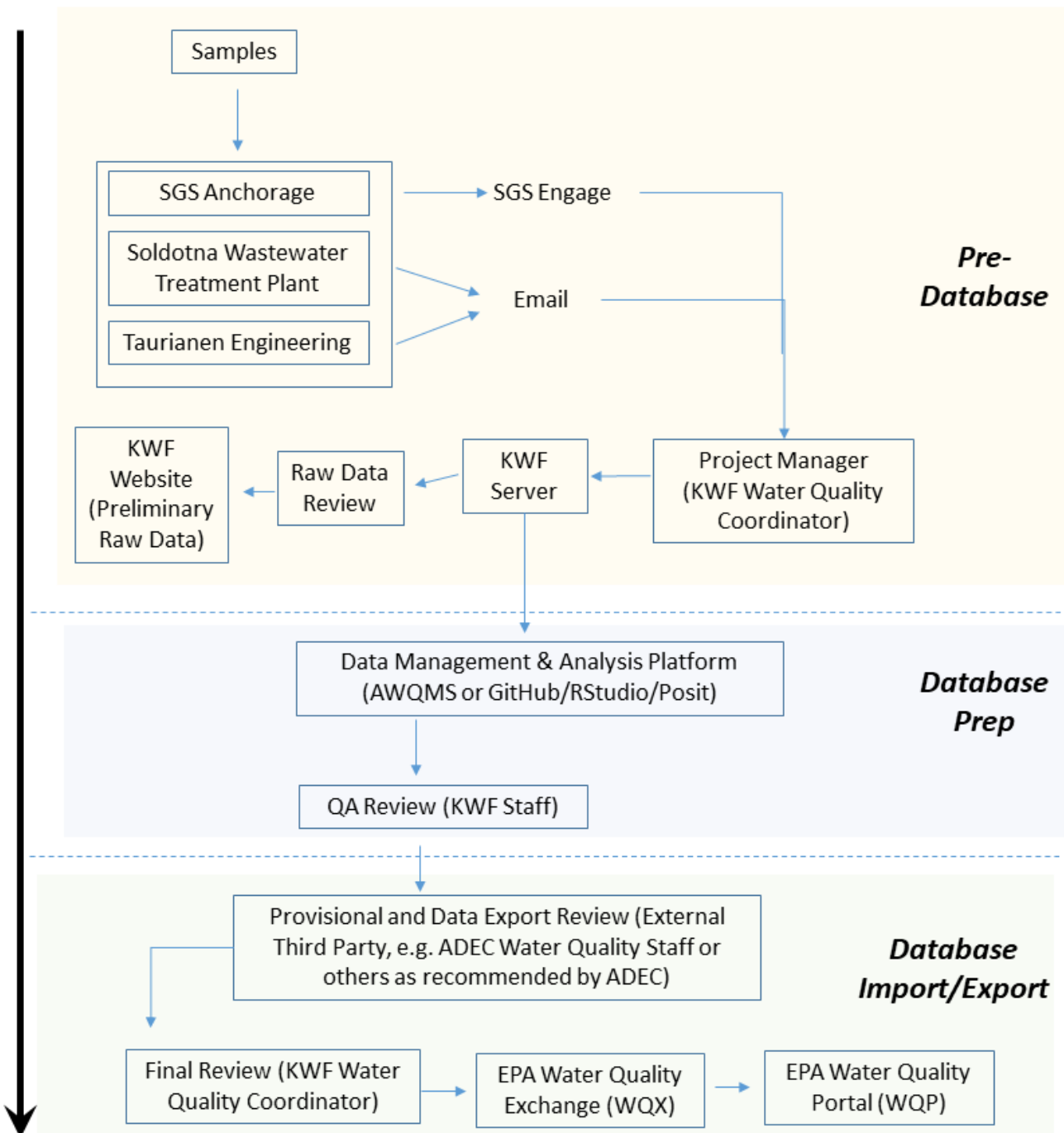


Figure 4. Data management and evaluation flowchart for Kenai River Agency Baseline Water Quality Monitoring Project.

CI. Assessments and Response Actions

Assessments are independent (of management) evaluations of the monitoring project that are performed by the Project's QA Officer or his/her designee. For this project assessments include the following:

Field Assessments (each pollutant)

- Precision (replicate) sample measurements. Precision criteria are specified in Section A7, Table 2 through Table 6.
- On-site observation of field monitoring operations. Surveillance - The project QA Officer will spot check monitoring teams at two sampling locations (10%) to observe sample collection. If sampling technique problems are observed, corrective action will be taken immediately to resolve the problem. Observations of problems and corrective actions will be included in a corrective action report (reporting errors observed and actions taken to correct errors).

Field samples collected for subsequent laboratory analysis (each pollutant)

- Blind replicate samples for each pollutant to be measured. Precision criteria are specified in Section A7, Table 2 through Table 6.
- Matrix spike duplicates (MSD) (assesses total measurement bias for project – both precision and accuracy). Frequency of MSDs is usually specified by the analytical method. Accuracy and precision of criteria for each pollutant and analytical method are specified in the project's Measurement Quality Objectives (MQO) tables, see section A7.
- Matrix spike (MS) assess project accuracy are specified in the project's MQO tables, see section A7.

On-Site Assessments

- Inspection of field monitoring operations for compliance with QAPP requirements - The QA Officer will spot check monitoring teams at two sampling locations (10%) to observe sample collection. If sampling technique problems are observed, corrective action will be taken immediately to resolve the problem. Observations of problems and corrective actions will be included in a corrective action report (reporting errors observed and actions taken to correct errors).
- Audit of project field measurement data results.

Project Data Assessments

- QA review (verification and validation) of Monitoring Data. Recommended QA coverage is 100% QA for data entered by hand. A 10% QA is recommended for data copy/pasted or downloaded from a database. Data that receives manual QA review will be recorded as such in the spreadsheet being reviewed. The reviewer will record their initials and the date in a column adjacent to each row that has been manually reviewed. If the records are being

checked against a paper copy, the reviewer will note their initials and the date in the lower right corner of the paper sheet once complete in the following format: “QA1: AB 10/30/2022.”

- Calculation of monitoring project’s overall achieved precision, accuracy and data completeness compared to QAPP defined precision, accuracy and data completeness goals.

As described in Section B10, all data are reviewed by the Project QA Officer and the Project Manager before data are accepted and submitted to a database. If problems are discovered with data quality or management, it is the responsibility of both the Project Manager and the Project QA Officer to address them in a timely manner, which may include a corrective action report.

Procedures for inspection, acceptance, calibration and maintenance of equipment and supplies are described in detail in Sections B6, B7, and B8. If problems with data quality are traceable to equipment failure, inspection, calibration and maintenance will be scheduled more frequently.

The Technical Advisory Committee (Appendix A) will review this QAPP and the overall project design bi-annually and may suggest procedural refinements or additional testing procedures. This may include new parameters to be measured or changes to procedures currently in use. Any such changes will be subject to EPA and ADEC approval. The project is open to EPA or ADEC system audits at their discretion.

Data that has been validated and appears not to meet state water quality standards will be flagged and pointed-out both to ADEC and EPA as well as members of the Kenai River Special Management Area Board.

C2. QA Reports to Management

Annually a QA summary report and field report will be produced and submitted to the KWF Project Manager, ADEC DOW Nonpoint Source Regional Staff, Technical Review Committee, and participating partner agencies. QA summary report to include the following:

- A written summary stating whether the project-specific data quality objectives (and specifically project Measurement Quality Objectives were met, specified in section A7 of each QAPP). If not, what parameters failed, what data was affected and what corrective actions were taken to return the monitoring network to pre-approved project data quality objectives.
- Precision assessments and Precision Table listing for each analyte—
 - All field replicate sample pairs (even if sample values are qualified).
 - Sample collection date of respective field replicate sample pairs.
 - Calculated individual precision of each paired field replicate where both values \geq analyte specific limit of quantitation/reporting limit (LOQ or RL). Use algorithm in section A7

- Calculated overall precision project precision where both values \geq analyte specific LOQ or RL. Use algorithm in section A7.
- QAPP specified Precision Measurement Quality Objective (MQO)
- Accuracy (Assessment-- Accuracy Table listing for each analyte measured where sample spike recoveries are required by analytical method and project specific QAPP) the following:
 - Sample spiked and unspiked results
 - Date of analysis of sample and spiked sample
 - Percent (%) sample spike recovery
 - Sample unspiked and spike duplicate results
 - Date of analysis of dup sample and dup spiked sample
 - % sample spike duplicate recovery
 - Sample spiked duplicate RPD
 - QAPP specified Accuracy MQO

Note: Accuracy for spiked sample results is determined by calculation percent (%) spike recovery from sample spikes and duplicate sample spikes using the following algorithm:

$$\% \text{ spike recovery} = (\text{spike concentration} - \text{sample conc.}) / \text{spike conc.} \times 100$$

- Data Completeness Assessment—Data Completeness Table listing each analyte measured the following:
 - Number of samples scheduled to be collected/analyzed as specified in the QAPP.
 - Number of samples collected/analyzed and reported as valid data.
 - QAPP required Data Completeness requirement.
- Any deviations from the sampling plan with explanation

A comprehensive report will be produced every 5 years, contingent on available funding. An open data report will be produced within one year of data collection. The open data reports will be available online through a link at <http://www.kenaiwatershed.org>. The KWF Program Manager is responsible for report production and distribution. Summaries of all reports, highlighting the assessment results, and project status will be made available to the local public through the Kenai River Center and Kenai Watershed Forum web centers and at the local public libraries.

D1. Data Review, Validation, and Verification Requirements

The Project Manager and the Quality Assurance Officer will conduct data review and validation. This process for data review is described under Sections B10 and A7. Data that are obtained using equipment that has been stored and calibrated correctly and that meets the accuracy, precision and QC limits will be used. Data that does not meet the accuracy, precision and QC limits may be used if justification is reasonable, data is qualified with data use limitations applied and with ADEC project manager/ADEC Water QA Officer concurrence.

D2. Validation and Verification Methods

Project QA Officer and Project Manager will conduct data validation and verification. Project QA Officer and Project Manager review data and flag, but not delete, any values which fall outside of the expected range for each parameter. Errors in data entry will be corrected and inconsistencies will be flagged for further review.

The Project QA Officer is responsible for ensuring that maintenance and calibration records show all monitoring equipment in use to be in compliance with the requirements of this QAPP (see Sections B6, B7, & B8). If data quality questions cannot be adequately resolved, data will not be entered into any database without being flagged as questionable. The Project QA Officer will arrange for corrective measures (i.e. monitor re-training, equipment re-calibration, etc.).

Laboratory Quality Control (QC) Measures

Laboratory QC includes the following:

- Laboratory instrumentation calibrated with the analytical procedure.
- Laboratory instrumentation maintained in accordance with the instrument manufacturer's specifications, the laboratory's QAP and Standard Operating Procedures (SOPs).
- Matrix spike/matrix spike duplicates, sample duplicates, calibration verification checks, surrogate standards, external standards, etc. per the laboratory's QAP and SOPs.
- Specific QC activities prescribed in the project's QAPP.
- Laboratory data verification and validation prior to sending data results to ADEC and/or permitted facility.

Contracted laboratories will provide analytical results after verification and validation by the laboratory QA Officer. The laboratory must provide all relevant QC information with its summary of data results so that the project manager and project QA officer can perform field data verification and validation and review the laboratory reports. The Project Manager reviews these data to ensure that the required QC measurement criteria have been met. If a QC concern is identified in the review process, the Project Manager and Project QA Officer will seek additional information from the contracted laboratory to resolve the issue/s and take appropriate corrective action.

D3. Reconciliation with Data Quality Objectives

The Project QA Officer and/or the Project Manager will compare the results and associated variability, accuracy, precision, and completeness with project objectives. If data quality indicators do not meet program specifications (see Table 2 through Table 6) data will be flagged as 'Rejected' and not be uplifted to the EPA Water Quality Exchange. The cause of failure will be evaluated and documented in the data QA report. If the cause is found to be equipment failure,

calibration and maintenance procedures will be reassessed and improved. In some cases, accuracy project criteria may be modified with prior approval by ADEC project management and ADEC Water QA Officer. In this case the justification for modification, problems associated with collecting and analyzing data, as well as potential solutions will be reported to ADEC. If failure to meet program specifications is found to be unrelated to equipment, methods, or monitor error, specifications may be revised. Revisions to this QAPP will be submitted to the designated state ADEC and federal EPA, Region 10 Quality Assurance Officers for approval.

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**Appendix A: Technical
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Appendix B: Fieldwork Sampling SOP



“Research, Restoration, Education”

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KENAI RIVER BASELINE WATER QUALITY MONITORING
SAMPLE COLLECTION PROCEDURES

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A. FIELDWORK PREPARATION

a. Six weeks prior to sampling date

- The water quality coordinator will contact you by email. Please RSVP as soon as possible if you are participating.

b. One week prior to sampling date

- Confirm plans with your fieldwork partners and supervisor.
 1. Know meeting time and place.
- Review current sampling protocol (this document).
- Ask the Water Quality Coordinator if you have questions (see top of this form for contact info).

c. One day prior to sampling date

- At least one team member will pick up water quality sampling equipment from the Water Quality Coordinator. Your confirmation email will describe pick-up time and location.
- Keep **ice packs** for the sample cooler frozen until the morning of sampling, put reminder note in car.

B. GENERAL SAMPLING PROTOCOL

- **Once you're at the site, there are some important things to do BEFORE opening the cooler.**
 - **At the site, make a judgment call as to whether the site is representative**
 - Is the river bottom stirred up?
 - Is there something atypical, like a moose carcass just upstream?
 - Are other boats nearby?
 - If site at the coordinates are not representative, either wait until conditions return to normal or slightly modify location.
 - Leave cell phones turned on for project communications
 - **Choose a collection location**
 - Samples collected in the main stem of the river should be collected at least ten feet from the riverbank.
 - Samples collected from tributaries should be collected upstream of the mixing zone with the main stem.
 - **Collect Site information**
 - i. Use pre-printed Rite-in-the-Rain field forms to record data with a pencil
 - ii. Record GPS coordinates on paper at each sampling location
 - 1. *You can use the Google Maps app on your smart phone to get coordinates even when out of cell reception. Ask the Water Quality Coordinator if you have questions how to do it.*
 - iii. Collect a photograph at each location with a person holding a sign indicating the sampling location.
 - iv. Deploy water and air thermometers, take readings before you leave the site
 - v. Collect samples only from the assigned creek or river for your group

C. PREPARING FOR SAMPLE COLLECTION

Once you've established that your sampling location is ready...

1. **Prepare to use "Clean Hands / Dirty Hands" technique**
 - a. **NEW:** Designate one person as "Clean Hands" who will only handle sample bottles, and one person as "Dirty Hands" who will perform all other steps. The water quality coordinator will provide training and explanation on clean hands / dirty hands technique on sample kit pick-up day. See Appendix A for further detail.
2. **Prepare sample labels**
 - a. Write on bottle label stickers **prior** to applying them to the bottles, and apply them to the bottles **before** they are wet. (Labels are waterproof).

- b. Other sample label notes
 - i. Complete the fields on the bottle labels for **TIME and INITIALS**.
 - ii. **INITIALS** should be those of the team leader **only**.
 - iii. Use the **IDENTICAL TIME** for all sample containers at a site⁶.
 - iv. Sites are designated with Kenai River main stem River Mile (RM) and site name.
 - 1. Duplicate samples are indicated by using the abbreviation DUP, as in “RM 10 – Site name - DUP.”
 - 2. If necessary, write additional information with a black sharpie on plastic HDPE bottles.
 - 3. **Do NOT use sharpies on the hydrocarbon (BTEX) samples vials, they will contaminate the sample.**

3. Other General Sampling Notes

- a. Put on new clean gloves if you suspect contamination at any point in sampling process.
- b. In general always, ensure that the inside of the bottle caps are not contaminated:
 - i. Do not put bottle caps in your pocket.
 - ii. Do not touch inside of cap or bottle.
- c. Employ “Clean Hands / Dirty Hands” technique throughout sampling process. The water quality coordinator will provide a demonstration on cooler pick-up day. See Appendix A of this document for more details.

When sample collection is complete at all sites, return to sample drop-off location in Soldotna as quickly as feasible.

- Some samples cannot be analyzed if they exceed a holding period, thus timely delivery is important!!!
- If your route to the next sampling site passes by the sample drop-off location, please drop them off even if you are not yet done for the day.
- Thank you!!!

D. SAMPLE COLLECTION PROCEDURES BY SAMPLE TYPE

Fecal coliform *is a bacteria that exists naturally in the wild that is found in feces of warm-blooded animals. It can reach elevated levels when animals concentrate, like gulls flocking to carcasses, or from human sources, such as a leaking septic tank.*



- 1. **Collect the “Fecal Coliform” sample.**
 - i. The fecal coliform bottle is 100 ml clear plastic bottle with white powder (sodium thiosulfate-fixing agent) and may have a *labeled paper seal over the lid*. The lid may be labeled “FC.”

⁶ Duplicate samples at the same site are considered separate sampling events, and each set of duplicate samples will have a unique time associated with it.

- ii. Break the seal, either plastic or paper
- iii. **Record sampling time and crew leader initials on the label and apply to bottle.**
- iv. Carefully open the container, keeping the lid in one hand and the bottle in the other hand.
 - 1. ***Do not touch the inside of the bottle or lid.***
- v. Always collect samples facing upstream with the flow of the river coming at you.
- vi. Fill the sample bottle with one smooth motion to just over the 100 ml mark. It is necessary to leave some room in the bottle because it will have to be inverted 25 X in the lab.
- vii. **Place sealed bottle in cooler with ice.**

Dissolved metals *refers to substances such as zinc, copper, lead, arsenic, and others that exist in a soluble (dissolved) form in water. These elements exist naturally in the environment in rocks and soils, and also have anthropogenic sources such as runoff from roads and agriculture, industrial processes, and fuel combustion.*



Not all sites collect **dissolved** metals samples. Check your kit packing list to see if your sites do.

- **NEW CHANGES TO DISSOLVED METALS COLLECTION:**
 - **No filtration in the field is required for any samples. The dissolved metals sample will be filtered in the lab. No syringes or filters are provided.**
 - **See note on Field Blank collection below if your site has been randomly assigned a Field Blank**

1. Collect the “Dissolved Metals” sample (if applicable)

- i. ***Please note, only sites including and downstream of RM 30 will sample for dissolved metals.***
- ii. ***Proceed to Step 3 if no dissolved metals sample is to be collected.***
 - i. The unfiltered total metals sample collection bottle is a 125 ml plastic bottle with no sticker (denoting no preservatives)
 - ii. **Record sampling time and crew leader initials on the label and apply to bottle.**
 - iii. Do not rinse this bottle.
 - iv. Fill the TSS bottle (1 L plastic bottle) using a slow sweeping motion at a depth of six inches.
 - v. Remove the cap of the dissolved metals bottle. Fill this bottle to the shoulder with sample water from the 1 L TSS bottle, then replace the caps on both bottles.

- vi. Place dissolved metals bottle in cooler with ice.
- vii. If your site has been randomly assigned a field blank, see page 7, “Field Blanks” for further details (only applies to sites at and downstream of Morgan’s landing).

Hydrocarbons (BTEX) are substances found in petroleum products, such as fuel for boats and vehicles. These substances can enter the water from several sources including older or improperly maintained boat engines, fuel leaks from homes or vehicles, and products such as paints and plastics. BTEX stands for benzene, toluene, ethylbenzene, and xylene.



Hydrocarbon samples are collected in Summer only, not Spring, and not all sites collect these samples. Check to see if your kit does. This is our most detail-oriented type of sample collection, so proceed carefully.

- i. **Please note, only RM 1.5, 6.5, 40 and 43 sites will be sampled for BTEX and only during summer (not spring) sampling events!**
- ii. **Proceed to Step 4 if no BTEX sample is to be collected**
- iii. The BTEX sample vials are three 40 ml brown glass vials preserved with hydrochloric acid (HCl)
- iv. **Record sampling time, crew leader initials, and vial sequence (# of 3) on the label and apply to the vials lengthwise.**
- v. Do not rinse these vials.
- vi. **Fill the 1 L TSS bottle with sample water:**
 - a. Face upstream with the flow of the river coming at you.
 - b. Remove the lid, turn the bottle upside down, go to a depth of 6”, and allow the bottle to fill, remove the bottle from the water, and discard a small amount so that the fluid level reaches the shoulder of the bottle.
 - c. Carefully **fill all three** 40 ml vials until a mound of water (meniscus) is formed on top of the vial.
 - i. *Do not overflow the vials excessively as they contain Hydrochloric Acid (HCl) as a preservative.*
- vii. Cap the vials and place in cooler with ice.
- viii. **Special notes concerning the collection of BTEX samples.**
 - a. **For BTEX-Volatile Organics Compounds (VOC)- it is critically important to NOT have any air bubbles (or headspace) in the vials after sampling.**
 - b. Sampling Teams using a boat
 - i. Have a designated driver and only the driver handles gas can and drives the motor.

- ii. Boat driver does not handle BTEX Bottles.
- c. All teams
 - i. If you filled up a vehicle with gas the day of sampling, do not handle the BTEX vials.
 - ii. Avoid handling or contact with all chemicals and/or solvents.

Total metals *includes all the metals within a water sample, including BOTH dissolved metals AND non-soluble (particulate) metals. These elements, including zinc, copper, lead, arsenic, and others exist naturally in the environment in rocks and soils, and also have anthropogenic sources such as runoff from roads and agriculture, industrial processes, and fuel combustion.*



- **NEW CHANGES TO TOTAL METALS COLLECTION:**
 - **See note on Field Blank collection below if your site has been randomly assigned a Total Metals Field Blank**

1. Collect the “Total Metals” sample

- viii. The total metals sample collection bottle is a 125 ml plastic bottle with a red sticker (denoting HNO₃; Nitric acid)
- ix. **Record sampling time and crew leader initials on the label and apply to bottle.**
- x. Do not rinse this bottle.
- xi. Remove the cap, fill the bottle to the shoulder with sample water from the TSS bottle, and replace the cap.
- xii. Place bottle in cooler with ice.

Nitrogen and phosphorus *are essential for plant and animal growth and nourishment, but the overabundance in water can cause adverse health and ecological effects. Although nitrogen and phosphorus are abundant naturally in the environment, they are also introduced through sewage and fertilizers.*



1. Collect the Nitrate+Nitrite/Total Phosphorus sample

- i. The Nitrate+Nitrite/Total Phosphorus bottle is a 250 ml plastic bottle, with a yellow sticker (denoting H₂SO₄, sulfuric acid)
- ii. **Record sampling time and crew leader initials on the label and apply to bottle.**
- iii. Remove the cap, fill the bottle to the shoulder with sample water from the TSS bottle, and replace the cap.

Total Suspended Solids, or TSS, stands for total suspended solids, and refers to waterborne particles that exceed 2 microns in size. TSS commonly consists of items like clay, gravel, sand, silt, and vegetation. TSS can increase due to erosion, algae growth, and sediment disruption. TSS levels can affect dissolved oxygen content, which affects aquatic life like fish.



Collect the “TSS”-Total Suspended Solids

- i. The Total Suspended Solids bottle is a 1 L plastic bottle
- ii. **Record sampling time and crew leader initials on the label and apply to bottle.**
- iii. Fill the TSS bottle with the same methods outlined in the “Dissolved Metals” Section.
- iv. Cap the bottle and place bottle in cooler with ice.

Field Blanks – Field blanks are samples of clean water provided by the laboratory that are collected and handled in the same way as normal water quality samples. Field blanks are collected in order to help assess the influence that the field sampling process may have on water quality measurements.

To collect a field blank, use the same, normal method described for the parameter (dissolved metals or total metals). However rather than river water, your source of water will ultra-pure distilled water provided by the laboratory. A bottle of ultra-pure distilled water will be provided by the laboratory, and the water quality coordinator will provide training on this collection procedure.

Appendix B1: “Clean Hands, Dirty Hands” Sampling Technique

What is ‘Clean Hands, Dirty Hands’ (CHDH)?

The Clean Hands Dirty Hands sampling technique of EPA-1669 was developed for low level mercury testing but is often applied to trace metals sampling. This method minimizes potential sample contamination by designating one person to be ‘clean hands’ (CH) and another as ‘Dirty Hands’ (DH). DH handles all sampling equipment and CH handles all sample bottles.

Field Application

Clean Hands – The person designated as Clean Hands (CH) will handle the actual sample bottles. CH will fill and label the bottles. CH is responsible for keeping hands clean during sampling events, and changing gloves if contamination occurs and in between sampling locations. CH is responsible for communicating with other crew members to open coolers, handle sampling equipment, etc., as CH should not be handling any sampling items except for the sample bottles themselves.

Field Sampling Crew – The field sampling crew will be Dirty Hands (DH). DH will open/close the cooler, handle the sealed (in Ziplock) bag of sample bottles, handle the water collection bottle, and record data.

Boat Crew – The boat operator will be in contact with motor oil, galvanized metals, etc. and therefore should not be handling the actual sample bottles. The boat operator will be responsible for maintaining the boat in position for sampling and safely transporting the crew from one site to the next. The boat operator may help with data recording and other tasks as needed that do not involve directly handling sample bottles.

Required Preparation

- Practice makes perfect – The field sampling team will practice sample collection using the CHDH technique. At least one practice sample collection will be demonstrated on sample cooler pickup day, and the other on fieldwork day prior to the first sample collection.
- Pre-sampling preparation – Bottles will be carefully handled with gloved hands, labeled, and placed into double layer Ziplock bags. DO NOT open bottles before actual sample collection.
- Supplies – The Project Manager will make sure that the field team has enough nitrile gloves, Ziplocks and other tools required to complete field work.

Sunscreen, jewelry, and galvanized metals

- Many cosmetic products including sunscreen contain zinc. It’s important to protect you skin against UV, however if you wear sunscreen DO NOT touch your face during active sampling. If you do, change gloves, and start over. Alternatively, wear physical sun protection such as a sun hat, face mask/gaiter, long sleeved shirt, etc.
- Avoid wearing jewelry on your hands and/or wrists. Earrings and necklaces are fine, just avoid touching them during active sampling. If you touch metal jewelry, even if it’s not zinc based, change your gloves immediately.
- Galvanized metals are metals coated in zinc oxides. No one actively collecting samples should touch galvanized surfaces during active sample collection. If samplers accidentally touch galvanized metal they should stop, remove the contaminated gloves, and replace contaminated gloves with clean cloves.

Adapted from Appendix F in Apsens, S., and Petitt, J. 2022. Kenai River, Alaska Field Report 2021. Alaska Department of Environmental Conservation.

Appendix C: Kenai River Watershed Water Quality Monitoring Field Data Form

	Low Tide			River			Air temp.	Weather	Boat traffic	Photos	Water Temp	GPS coord	
Date	Time	Agency	Initials	Mile	Location	Location of sample	Fahrenheit	S/R/C	L/M/H	Y/N	Centigrade	Latitude Longitude	Comments

Take all samples upstream from your position in the river

sunny low yes
 rainy med no
 cloudy high

YSI: Handheld Thermometer Serial Number _____

Team Members:

Samples Submitted By: _____ Date: _____ Time: _____

Samples Received By: _____ Date: _____ Time: _____

Notes: On sampling day measure water temperature with YSI digital thermometer.
 Turn in samples at drop-off point as notified by project coordinator.
 River Mile is the location on the main stem of the Kenai River or where the tributary enters the Kenai River

**Appendix D: Kenai River Watershed Water Quality Monitoring Chain of Custody Forms
Soldotna Wastewater Treatment Plant**

Client	Kenai Watershed Forum				Page ___ of ___ 2			
Contact								
Project Name	Kenai River Baseline Water Quality Monitoring							
Phone								
Email	hydrology@kenaiwatershed.org							
SAMPLE ID	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	MATRIX	CONTAINER QUANTITY	CONTAINER / SIZE	ANALYSIS	PRESERVATIVE	NOTES
RM 0 - No Name Creek			water	1	1 L HDPE	TSS	None	
RM 1.5 - Kenai City Dock			water	1	1 L HDPE	TSS	None	
RM 6.5 - Cunningham Park			water	1	1 L HDPE	TSS	None	
RM 10 - Beaver Creek			water	1	1 L HDPE	TSS	None	
RM 10.1 - Kenai River			water	1	1 L HDPE	TSS	None	
RM 12.5 - Pillars			water	1	1 L HDPE	TSS	None	
RM 18 - Poachers Cove			water	1	1 L HDPE	TSS	None	
RM 19 - Slikok Creek			water	1	1 L HDPE	TSS	None	
RM 21 - Soldotna Bridge			water	1	1 L HDPE	TSS	None	
RM 22 - Soldotna Creek			water	1	1 L HDPE	TSS	None	
RM 23 - Swiftwater Park			water	1	1 L HDPE	TSS	None	
RM 30 - Funny River			water	1	1 L HDPE	TSS	None	
RM 31 - Morgan's Landing			water	1	1 L HDPE	TSS	None	
RM 36 - Moose River			water	1	1 L HDPE	TSS	None	
RM 40 - Bing's Landing			water	1	1 L HDPE	TSS	None	
RM 43 - Upstream of Dow Island			water	1	1 L HDPE	TSS	None	
RM 44 - Mouth of Killey River			water	1	1 L HDPE	TSS	None	
RM 50 - Skilak Lake Outflow			water	1	1 L HDPE	TSS	None	
RM ___ - _____-DUP			water	1	1 L HDPE	TSS	None	
RM ___ - _____-DUP			water	1	1 L HDPE	TSS	None	
Relinquished by:		Received by:						
Relinquishment date:		Received date:						
Relinquishment time:		Received time:						
Notes: Please send electronic data delivery file, and signed Chain of Custody to hydrology@kenaiwatershed.org . Thank you!								



Appendix D: Kenai River Watershed Water Quality Monitoring Chain of Custody Forms
Tauriainen Engineering and Testing (page 1 of 2)



PLEASE READ INSTRUCTIONS ON BACK
 PRINT ALL INFORMATION
Test Requires Advance Notice
Please Call Prior to Bringing in Sample

FECAL COLIFORM BACTERIA DRINKING WATER ANALYSIS BY MEMBRANE FILTER

Client Name Kenai Watershed Forum
Mailing Address 44129 Sterling Hwy
Soldotna, AK 99669

Lab Use Only
Lab Number _____

Phone (907) 262 - 5449
Email/Fax hydrology@kenaiwatershed.org

Sample Information: Residential Water System PWSID _____ Other Surface Water

Legal Description:/Building: _____

Sample Location: (bathroom, kitchen, etc) _____

Sampled: Date: 7/26/2022 Time: _____ By: _____

Sample Type: Routine Special Purpose Water Quality Monitoring
 Check Sample (For previous unsatisfactory sample with lab number _____)

Disinfection: Untreated Treated (chlorine, UV, etc.) _____

Relinquished: Date: _____ Time: _____ By: _____

Received: Date _____ Time: _____ By: _____ Paid: _____

Condition: Satisfactory Rejected Comments: _____

This report is for the exclusive use of the party to whom it is addressed.
 By submitting a sample for testing to Tauriainen Engineering & Testing, Inc. (TET) the Client agrees to the terms and conditions on reverse.

↓ **To be filled out by Lab** ↓

Date Test Started: _____ Time Test Started: _____ Analyst: _____

TEST RESULTS (SM 9222D) **Date** **Time** **Analyst**

Direct Count: _____ Colonies/100ml
 Negative for Fecal Coliform
 Positive for Fecal Coliform - # Colonies _____
 Satisfactory Unsatisfactory

Comments: _____

DIRECTIONS FOR SAMPLE COLLECTION

Appendix D: Kenai River Watershed Water Quality Monitoring Chain of Custody Forms Tauriainen Engineering and Testing (page 2 of 2)

SAMPLE DROP-OFF MUST BE SCHEDULED IN ADVANCE WITH LAB

1. Tauriainen Engineering & Testing cannot accept samples collected in your own container for this analysis. Before collecting a sample for bacteriological analysis, you must first obtain a **LAB SUPPLIED STERILE SAMPLE BOTTLE**.
2. **Remove Aerator/Screen** from spigot if applicable. Recommend sampling to be from a fixed faucet. (Non-swivel)
3. Apply flame or bleach to spigot to sterilize before sampling.
4. **Use Cold Water.** Run cold water for 3 minutes.
5. **Verify Paper Seal** is intact.
6. This is a sterile procedure. **Do Not Touch Inside Container or Lid.**
7. **Do Not Rinse Bottle.** Powder inside is an important part of the test.
8. Remove lid and **Fill to at least the 100 ml line** without over flowing bottle.
(See diagram at right) **Samples with less than 100 mls of water WILL BE REJECTED.**
9. **Replace Lid. Write name, sample date, time and location on lid label.**
10. **Keep Sample Cold** and deliver to laboratory as soon as possible after collection.
11. **Samples more than 6 hours old WILL be rejected.**
12. **Water samples accepted: Monday through Wednesday - 8:00 am to 5:00 pm** Samples arriving after 3:00 will not be analyzed until the following day. **Thursday - 8:00 am to 3:00 pm**



No sample will be accepted after 3:00 on Thursday, except by special arrangement.

TERMS AND CONDITIONS

By submitting a sample for testing or using a report from Tauriainen Engineering & Testing, Inc. (TET), Client agrees to following terms and conditions:

SCOPE OF SERVICES TET performs testing services on samples submitted to or collected by TET using environmental testing industry accepted protocols, practices and standards and as requested by Client. TET provides a written report of analytical results. Results are delivered by mail or e-mail, or with special arrangements verbally, or by fax. This report is for the exclusive use of the party to whom it is addressed.

DUTIES OF CUSTOMER Samples delivered to TET must be accompanied by written disclosure of any hazardous substances known or suspected by Client. Samples suspected of containing a hazardous substance must be packaged, labeled, transported and delivered in accordance with applicable laws. TET reserves absolute right to refuse delivery or revoke acceptance of any sample which in the sole judgement of TET is of unsuitable volume, arrives in a leaking or damaged container, or may pose risk in handling, transport or processing or for any other reason, whether or not due to presence in sample of hazardous substance and whether or not disclosed to TET by Client.

PAYMENT Payment is due at the time of sample submittal, unless otherwise agreed in writing. Client agrees to pay all expenses incurred by TET, including attorney fees and court costs, to collect any past due amounts.

LIMITED WARRANTY TET will perform services with care and skill ordinarily exercised by members of the profession practicing in the area under similar conditions and limitations. TET's sole obligation hereunder shall be to re-perform services which are materially deficient without charge, so long as such deficiencies are reported in writing to TET within 30 days after discovery thereof, but in no event later than one year from performance of services by TET. TET services are limited in scope and subject to expected measurement variability and possible interferences in the measurement process caused by the sample matrix. TET makes no warranty that tested sample is representative of source from which sample was taken or that any particular analysis can be performed on a particular sample. TET may utilize subcontractors.

TET MAKES NO EXPRESS OR IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE ON TET SERVICES. IN NO EVENT SHALL TET BE LIABLE FOR ANY INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES. NOR

SHALL TET BE LIABLE IN ANY EVENT, INCLUDING ITS OBLIGATION TO RE-PERFORM, FOR ANY LOSSES, DAMAGES OR CLAIMS IN EXCESS OF AMOUNT PAID TO TET FOR SERVICES HEREUNDER.

CONFIDENTIALITY TET will keep Client documents and information confidential and will not disclose such information to third parties (except required reports to ADEC for public water systems) without Client permission except in response to legal process after giving copy of such process to Client.

RECORDS/SAMPLE RETENTION TET will retain copies of data and reports for 5 years, after which such documents will be disposed of. If Client requests additional copies of reports or data during retention period, an additional charge will apply for preparation and delivery of such reports.

All non-hazardous samples will be disposed of after TET completes its services unless otherwise agreed in writing. Samples known or suspected to contain hazardous substances or determined by TET to be incompatible with existing waste streams shall remain the property of Client and may be returned to Client at Client's expense. Alternatively, Client may request in writing, pay, and assume responsibility for TET to have contaminated materials transported to a disposal site in compliance with applicable laws. TET would be acting as bailee and would not assume title to contaminated materials.

FORCE MAJEURE TET shall have no liability for nonperformance caused in whole or in part by causes beyond our reasonable control, including but not limited to Acts of God, civil unrest and war, equipment failures, acts of authorities, or delays in transportation, mail or delivery services.

DISPUTE RESOLUTION These Terms and Conditions shall override conflicting provisions contained in Client purchase order or other standard form documents and may be amended only by written agreement of TET. Client and TET agree that all disputes between them arising out of or relating to this Agreement shall be submitted to non-binding mediation unless mutually agreed otherwise. This agreement shall be interpreted under the laws of Alaska. Rev7/13/20

Appendix E: Agency Baseline Lab Test Results

DATE: _____

River Mile	Location	Temperature	Conductivity us/cm	pH	Turbidity NTU	Turbidity Check NTU	
0	No Name Creek						
1.5	Kenai Dock						
6.5	Cunningham Park						
10	Beaver Creek						
10.1	Kenai River						
12.5	Pillars						
18	Poachers Cove						
21	Soldotna Bridge						
23	Swiftwater Park						
19	Slikok Creek						
22	Soldotna Creek						
30	Funny River						
31	Morgan's Landing						
36	Moose River						
40	Bing's Landing						
43	Upstream Dow Island						
44	Mouth of Killey River						
50	Skilak Lake Outflow						
70	Jim's Landing						
74	Russian River						
79.5	Juneau Creek						
82	Kenai Lake Bridge						
DUP							
DUP							

ANALYSIS PERFORMED BY :

Appendix G: Stream Temperature Monitoring Field Data Sheet

Stream Information

Stream Name: _____

Field Crew: _____

Partner Organization: _____

Site Description/Directions: _____

Water Logger Information

Logger Type: _____ Serial #: _____

Date placed in stream: _____ Time placed in stream: _____

Instantaneous water temperature: _____ Time of measurement: _____

Air Logger Information

Logger Type _____ Serial #: _____

Date placed in riparian zone: _____ Time placed in riparian zone: _____

Instantaneous air temperature: _____ Time of measurement: _____

Site/Reach Information

Habitat type of water logger placement: (circle) riffle pool run other

Tethering/deployment method: (circle) rebar bank-secured cable sandbag other

Verified site is well mixed using: (circle) Hand-held thermometer Probe: _____

Channel depth (m) at logger _____ Channel width (m) at logger _____

Extent to which vegetation shades the logger: (circle) 0% 20% 40% 60% 80% 100%

Channel flow status: (circle) bank full 90-75% of channel filled 75-50% filled <50% filled

GPS Coordinates: _____ N _____ W

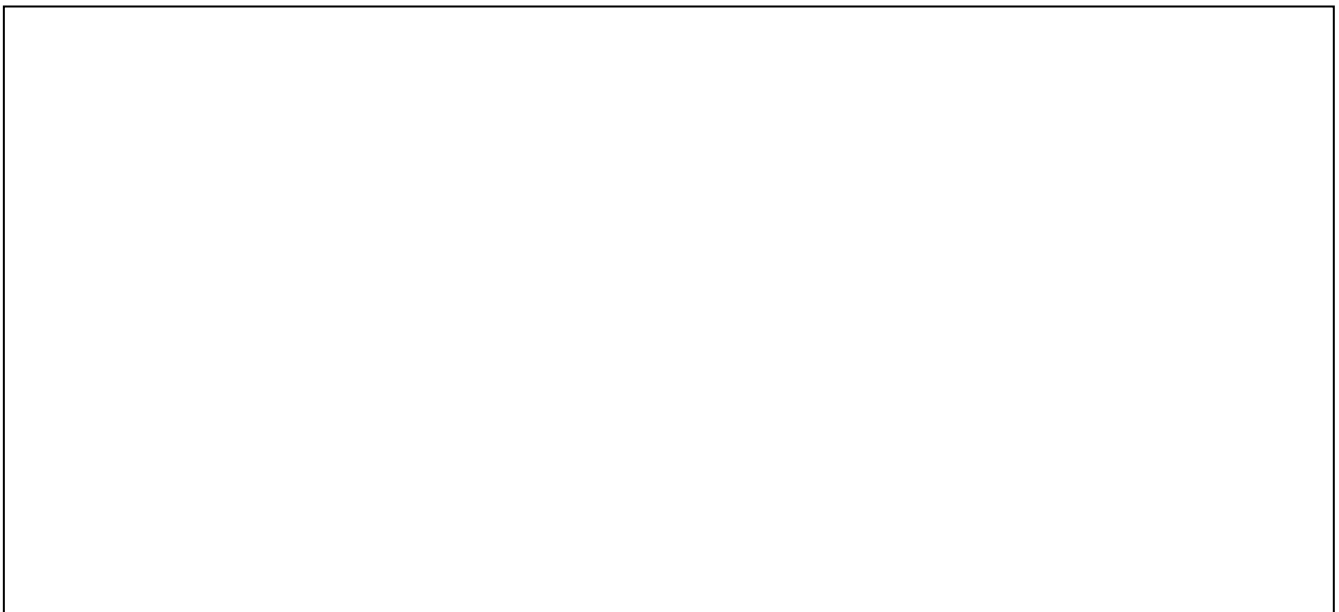
Elevation (m) _____

Photo Documentation

Photos taken on which camera?: _____ # of photos taken: _____

Description of photos:

Detailed sketch of site should include stream aspect, landmarks like large boulders or other markers to help locate the loggers, trails or other access points.



Other Comments and Observations:

For additional detail and standardized methods on water temperature QA/QC, data management, and data storage, see Mauger et al. 2015 and visit the AKTEMP Water Temperature Database from the University of Alaska Anchorage’s Alaska Center for Conservation Science at <https://aktemp.uaa.alaska.edu/>

Appendix H: Standard Calibration Procedure for Hydrolab Minisonde MS 5

(updated June 2021)

Hydrolab Calibration

All calibration readings and solution usage should be recorded in the Hydrolab QA physical folder as well as the individual instrument's physical folder. Time and temperature must be taken for every measurement (calibrations and checks). Follow these instructions in order.

Connecting to Hydrolab:

1. Open HYDRAS3 LT program
2. Remove black tip casing at the top of the Hydrolab and attach cable to it by lining up the single black dot on the cable and the largest prong on the Hydrolab. Secure firmly. Attach COM port to the laptop.
3. Click "Re-scan for Sondes". In the top box titled "Connected Sondes" the serial number for the Hydrolab should appear. Highlight and click "Operate Sonde"
4. Make sure that the "Clock" setting is set to the accurate time a day. If not, click on "Set clock to PC time" to correct.
5. Select "Calibration" on the top of the window.

Conductivity:

1. Select tab labeled "SpCond ($\mu\text{S}/\text{cm}$)"
2. Remove the clear protective cap
3. Gently remove the turbidity wiper using a small allen wrench.
4. Rinse sensors with DI water in a spray bottle. Dry off with a KIMTECH wipe. Finish drying process by using a small air blower to remove drops stuck in between sensors. This is particularly important when performing conductivity calibration because it can dilute the test solution resulting in inaccurate readings.
5. Set standard to "0" and click calibrate with the sensor exposed to the air. Record temperature on data sheet. This creates a baseline of zero for calibration.
6. Attach solution labeled "100 $\mu\text{S}/\text{cm}$ " to the Hydrolab and change SpCond standard on the laptop to "100". Invert Hydrolab **slowly** so the solution does not touch the pH sensor. The pH sensor is the second shortest probe in the Hydrolab and the conductivity sensor is the shortest. Touching the pH solution to the sensor will skew data and result in having to replace the solution and restart.
7. The reading should be less than 10% off of the calibration standard. If not, dispose of solution in conductivity waste receptacle, clean sensor and restart procedure. If reading is within 10%, click on "Calibrate" and record temperature.
8. Remove 100 $\mu\text{S}/\text{cm}$ solution and clean sensor with DI spray bottle, KIMTECH wipes, and air blower again.
9. Attach solution labeled "1500 $\mu\text{S}/\text{cm}$ " to the Hydrolab and change SpCond Standard on the laptop to 1500. Invert Hydrolab **slowly** so the solution does not touch the pH sensor. The pH sensor is the second shortest probe in the Hydrolab and the conductivity sensor is the shortest. Touching the pH solution to the sensor will skew data and result in having to replace the solution and restart.
10. The reading should be less than 10% off of the calibration standard. If not, dispose of solution in conductivity waste receptacle, clean sensor and restart procedure. If reading is within 10%, click on "Calibrate" and record temperature.
11. Remove 1500 $\mu\text{S}/\text{cm}$ solution and clean sensor with DI water, KIMTECH wipes, and air blower.

Appendix H (continued)

General Notes:

Conductivity is very sensitive. Be patient with this calibration as it takes the longest and is the one that is most likely to be repeated. Meticulous drying can help increase the accuracy of readings. If repeated 3 times with a fresh solution each time and readings are still unsuccessful, then it may be a problem with the Hydrolab sensor and get in touch with Hach Industries Customer Service.

pH

1. Click on the tab labeled "pH (Units)" on the top of the window.
2. Attach the solution labeled "7.00 pH" to the clean Hydrolab sensors.
3. Invert the Hydrolab and let sit/settle for ~5 minutes.
4. Make sure that "Standard" line reads "7.00" on the laptop. If reading is greater than 10% off the standard then replace the solution, clean the sensor and repeat the trial.
5. When reading is within the accepted range click "Calibrate".
6. Clean sensor with DI water, KIMTECH wipes, and air blower.

Turbidity

1. Click on the tab labeled "Turbidity (NTU)" at the top of the window.
2. Put on gloves!
3. Attach wiper to the bottom of the sensor. Make sure that the single ridge (the part that looks like a windshield wiper) is on the sensor side and make sure that the screw is flush with the flat side of the fixed piece (DO NOT OVERTIGHTEN!). The wiper should sit approximately 180 degrees opposite of the sensor window. If this step is done incorrectly your NTU readings will be very high because the sensor window will be partially blocked.
4. Change the "Turbidity Point" value to "1" and the "Turbidity standard" value to "0".
5. Perform an air test with no solution or cap on the sensor and the sensor pointing upwards. The NTU value for this should be between 0 and 1. Click "Calibrate".
6. Change the "Turbidity Point" value to "2" and the "Turbidity standard" value to "100".
7. Place 100 NTU solution on a stir plate on medium setting for 2-5 minutes until the solution seems evenly dispersed. Attach the 100 NTU solution to the Hydrolab while keeping it on the stir plate to continue the dispersal of the sediment.
8. Reading should be within 10% of desired standard value. If so, click "Calibrate". If not, allow to stir on a lower setting for 5-10 minutes attached to Hydrolab and try reading again. If still outside of range, replace the solution and repeat.
9. Remove 100 NTU solution and clean with DI water, KIMTECH wipes, and air blower.
10. Place 20 NTU solution on stir plate for 2-5 minutes to evenly disperse particulates. Attach to Hydrolab while still on stir plate and let it continue to stir. This is a check reading, there is no need to calibrate or change any of the values, you are just checking to make sure the NTU reading is within the acceptable range of 20 NTU.
11. Remove 20 NTU solution and repeat Step 10 with 40 NTU solution to perform a second value check.
12. Clean sensors with DI water, KIMTECH wipes, and air blower.

Appendix H (continued)

Potential Problems: Turbidity can be a pain to calibrate and issues can arise for a number of reasons.

- a. If readings are odd the first step is to get fresh solution, rinse and dry instrument and try again (up to three times) then move on to the other possible solutions if there is still a problem
- b. Is the wiper blade on correctly?
- c. Is the cap filled high enough to cover the sensor?
- d. Is it possible the stock solution wasn't mixed correctly and the bottle is now bad? Are there air bubbles in the solution?
- e. Is the magnet stirring at a constant rate? This one I've noticed can really cause the readings not to settle. If the magnet doesn't settle down, turn off for a while and come back later.
- f. Is the magnet stirring fast enough (if not turbidity slowly drops and particles settle out)
- g. If none of these seem wrong try to calibrate again with all new solutions.

LDO

1. Click on the lab labeled "LDO% (Sat)" at the top of the window.
2. Search for mmHg pressure at the nearest airport sensor (ours is Kenai Municipal Airport). The reading they will give you will most likely be in inches from the "Altimeter" column on the NOAA website. You will need to convert this to mmHg. (Ex. 29.94 inches = 760.476 mmHg). Enter this value into the "Enter BP mmHg" line on the page.
3. Grab the vial labeled "DI H2O". Shake it lightly 15-20 times.
4. Attach this to the Hydrolab and gently invert. Unscrew the black cap that is now at the top of the vial (originally the black cap that is at the bottom of the vial prior to being inverted). Flip it upside down and rest it gently on the open vial.
5. Allow current value to stabilize and click "Calibrate".
6. Screw cap back on and unscrew vial from the Hydrolab.

General Calibration Tips

1. Don't rush, let readings settle
2. Always change solution first if a reading is odd
3. Avoid touching sensors as much as possible (it is better to wear gloves for the whole calibration)
4. If a calibration isn't working try more cleaning and thorough drying sessions between standards
5. If batteries are less than 50% reading can become odd

Programming

To create a program file:

1. Select: Files>Delete
2. Check to see how many files are already on the instrument, four is the max, three or less are necessary to create a new file
3. Delete a file only after checking to make sure it has been downloaded
4. To delete simply type in the file number and hit ENTER, "Y" for yes, ENTER

Appendix H (continued)

5. Go to: Files>Create and fill in the following:
 - a. File Name – whatever you want
 - b. Start date – MMDDYY
 - c. Start time – HHMMSS
 - d. Finish date – MMDDYY
 - e. Finish time – HHMMSS
 - i. 14 days is max, 10 is ideal
 - f. Sample frequency – 001500 is typical for turbidity
 - g. Sensor warm-up - 000030, fills in the next criteria as 000030 too
 - h. Disable audio –“Y” ENTER
6. Go to: Files>Status and check to make sure file you created is there, verify start/end dates and times
7. Unplug instrument
8. Put in 8 new batteries, should beep if done correctly
9. Plug instrument back in
10. Record the battery % and voltage of the first reading, should be 100% and 13 + volts

Data Download

1. Connect to Hydrolab
2. Select: Files>Transfer>Sensors Off>Spreadsheet Importable>X Modem 1K
3. Highlight just the file name (not date and time)
4. Hit Ctrl+C (Copy)
5. Type the file number (1,2,3 or 4) and hit ENTER
6. From grey bar select “Transfer”
7. Click “receive file”
8. A transfer box should pop up
 - a. Browse to “Desktop”
 - b. Select “1K X Modem”
 - c. Receive
 - d. Under File Name hit Ctrl+V (Paste)
9. On the desktop select file and change name to .csv to make it an excel file
10. Open the file and check to see if the data look good, make a quick graph
11. Log the number of data lines and file name in the Hydrolab QA folder
12. Move file to correct folder

Instrument Retrieval

1. Clean sensor off as much as possible in the river, remove guard and attach plastic cap
2. In lab scrub sensor gently with a toothbrush and dish soap
3. Rinse with water and dry with AccuWipe
4. Download data immediately
5. Within 24 hr check calibration using calibration techniques above, unless redeploying with 48 hours do not calibrate, just check

Sensor Reset –When all else fails and the sensor will not calibrate

1. Select: Login>Level 3, Enter “Hydrolab” as the password, ENTER
2. Select: Setup>System>Reset>Sensor, select the correct sensor and correct units

Appendix H (continued)

3. For Turbidity: Select Setup>Parameter>Turbidity>Calibrate>4 pt to get the four point calibration

Other Useful Knowledge

Ctrl+R refreshes screen

Appendix I: YSI Temperature Meter QA

DATE: _____ TIME: _____

CONDUCTED BY: _____

METER NUMBER	MODEL NUMBER	TEMPERATURE

Appendix K: Laboratory Certificates of Analysis

Laboratory certificates of analysis are available from the project manager at hydrology@kenaiwatershed.org. The certificates are also available for download online at https://bit.ly/kwf_lab_certs.

Appendix L: Data Evaluation Checklist

Kenai Watershed Forum developed its data evaluation checklist based on the template provided from the Alaska Department of Environmental Conservation. KWF is translating this template to a spreadsheet format. Both documents are available to download online at https://bit.ly/kwf_wqx_evaluation_checklist.



44129 Sterling Hwy, Soldotna, AK 99669 | Phone (907) 260 – 5449 | www.kenaiwatershed.org

Working together for healthy watersheds on the Kenai Peninsula

April 1, 2024

Katherine Brown
Tribal Trust and Assistance Branch
Regional Administrator's Division (TTAB-122)
1200 6th Avenue, Suite 155
Seattle, WA 98101

Email: brown.katherine@epa.gov

Dear Ms. Brown,

Kenai Watershed Forum coordinates the efforts of a cooperative water quality monitoring program focused on the Kenai River in south central Alaska. We are providing this technical memo to inform the EPA Region 10 office of several minor revisions to the project's current Quality Assurance Project Plan (QAPP version 3.0). The changes include the following items:

- Updating personnel names on the distribution list and technical advisory committee
- Including use of new models of hand-held water probes to collect intrinsic water quality parameter observations:
 - YSI ProQuatro (pH, temperature, conductivity, dissolved oxygen)
 - Hach 2100P (turbidity)
- Describing where, when, and how opportunistic observations of the five parameters listed above may be collected, using the new hand-held probes. ("Opportunistic," to mean occurring on dates outside of solely the two standard spring & summer dates currently described in the QAPP)

No changes to data quality objectives or sample locations are included in this technical memo.

We have documented these proposed changes within this technical memo and will publish it as an addendum to the full QAPP document posted on www.kenaiwatershed.org. When a future opportunity occurs to conduct a formal revision of the QAPP, we will incorporate these changes in to the proposed document edits.

Thank you for your time and assistance. Sincerely,

A handwritten signature in black ink, appearing to read "Ben Meyer".

Benjamin Meyer
Kenai Watershed Forum, Environmental Scientist
ben@kenaiwatershed.org
(907) 232-0280



April 2024

Revisions to “Kenai River Water Quality Monitoring Quality Assurance Project Plan (QAPP), Multi-Agency Baseline, v3,” available at the web address in the footnote¹.

1.) Updating personnel names on the distribution list and technical advisory committee (arrow indicates change)

- Page 7, “A4. Distribution List”
 - Mitch Michaud → Trent Dodson
 - Moses Jordan → Alana Shaw (alana.shaw@kenaitze.org)
 - Yvonne Weber → Vacant
 - Amber Bethe → Amber Crawford (amber.crawford@alaska.gov)
- Page 8, “KWF Director”
 - Mitch Michaud → Trent Dodson
- Page 46, “Appendix A: Technical Advisory Committee”
 - Sara Apsens
 - → Change in job title & agency
 - → Habitat Branch – Fish and Wildlife Biologist, Kenai Fish and Wildlife Conservation Office, 43655 Kalifornsky Beach Road, Soldotna, AK 99669
 - Jack Blackwell
 - → Retired, remove from list

2.) Use of new models of hand-held water probes to collect intrinsic water quality parameter observations (pH, temperature, conductivity, dissolved oxygen, and turbidity)

Kenai Watershed Forum will include use of two new portable field instruments, 1.) the hand held probe YSI ProQuatro, and 2) the Hach 2100P portable turbidimeter. They will be used at existing sites year-round as resources and site conditions permit.

- Page 13, “Schedule”
 - Add additional bullet point:
 - “Opportunistic data collection of intrinsic water quality parameters will occur at established sites throughout the year, including pH, turbidity, water temperature, specific conductivity, and dissolved oxygen.”

¹ <https://www.kenaiwatershed.org/news-media/qapp-revisions-completed-2023/>

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- Page 16, “Table 2. Data Quality Objectives for Electronic Instruments”
 - See the revised version of table 2 below for updated information in implementing the new instruments, a) YSI ProQuatro for pH, conductivity, dissolved oxygen, and temperature, and 2.) The Hach 2100P for turbidity

Table 2. Data Quality Objectives for Electronic Instruments^{2,3}

PARAMETER	EPA METHOD	RANGE	UNITS	SENSITIVITY	PRECISION ⁴	ACCURACY
pH	4500-H+ B-2000, pH probe on YSI ProQuatro	0 – 14	Standard pH units	0.01	0.01 units	± 0.2 units
Turbidity	2130 B ~ Nephelometric Method, Hach 2100Pportable turbidimeter	0 – 1000 NTU	Nephelometric Turbidity Units (NTU)	0.01	0.01 NTU or 1% of reading, whichever is greater	± 2%
Water Temperature	2550 B-2000, temperature probe on YSI models ProQuatro, 30, 55, and 95	-10°C – 60°C	Degrees Celsius (°C)	0.1, 0.1, 0.2, and 0.1	0.1°C	± 0.2°C
Conductance	120.1, conductivity probe on YSI ProQuatro	0 – 1000 uS/cm	Micro-siemens/cm (uS/cm) (converted to 25 C)	4 digits	No stated accuracy spec	± 0.5% of reading or 0.001 mS/uS. w.i.g.
Dissolved Oxygen	ASTM D888—09 (C), dissolved oxygen probe on YSI ProQuatro	0 to 20 mg/L	Milligrams per liter (mg/L)	0.1 mg/L	0.1% air saturation	0 to 20 mg/L: ± 2% of reading or 0.2 mg/L, w.i.g. 20 to 50 mg/L: ± 6% of reading (0.01 mg/L)

² <https://www.ysi.com/File%20Library/Documents/News%20Briefs/NB13-0116-01-EPA-Approved-Methods.pdf>

³ <https://www.manualslib.com/manual/1279581/Hach-2100p.html>

⁴ Instrument’s value in user manual for “resolution”



- Page 33, “Table 10, Field Quality Control Samples”
 - Field Replicate Measurement (4th row)
 - Add content to the “Measurement Parameter” box:
 - “YSI ProQuatro (pH, DO, Specific Conductance, temperature), Hach 2100P (turbidity)”
 - Replace content of “Frequency of Occurrence” box:
 - “For hydrolabs, 2/each deployment (beginning and end) and at least 10% sample data collected. For YSI ProQuatro, 2/each per site visit within five minutes of each other.”
 - Calibration Verification Checks (6th row)
 - Add “or YSI ProQuatro” next to “Hydrolab”
 - Replace content of “Measurement Parameter” box:
 - Hydrolab (pH, Turbidity, Specific Conductance, DO), YSI ProQuatro (pH, Specific Conductance, DO), and Hach 2100P (Turbidity)
- Page 35, “Table 10, Field Quality Control Samples”
 - External QC check standard, turbidity (2nd to last row)
 - Frequency of occurrence box:
 - Minimum every 3 months (Hach 2008)
- Page 36, “B7. Instrument Calibration Procedures”
 - Add new sentence at end of 3rd paragraph:
 - “Standard calibration procedures for the YSI ProQuatro are outlined in the YSI “ProQuatro User Manual” # 606962-01 (YSI 2020), and for the Hach 2100P in “Portable Turbidimeter Model 2100P Instrument and Procedure Manual (# 46500-88) (Hach 2008). Both manuals are available to download as PDF documents in links in the bibliography.”
 - Replace paragraph beginning with, “Note: YSI meters...”
 - “Note: YSI meters are calibrated to the manual specifications for each model listed. YSI ProQuatro meters are used to measure pH, dissolved oxygen, specific conductance, and temperature. Any other models of YSI meter are used for water temperature only. The YSI meter QA form is found in Appendix I”
- Page 74, add Appendix M
 - Portable field meter calibration records form
- Page 75, add Appendix N
 - Portable field meter observation records form



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3.) Opportunistic observations of intrinsic water quality parameters, using the new hand-held instruments

- In version 3 of the QAPP, five water quality parameters are collected using hand-held instruments at all twenty-two field sites twice annually, once in spring and once in summer, simultaneously when grab samples are collected.
- To characterize baseline conditions more thoroughly at these established sites, we will use portable field instruments to gather data at additional dates throughout the year as labor resources allow.
- We will use the **YSI ProQuatro** to measure in-situ conditions for pH, temperature, conductivity, and dissolved oxygen
 - All measurements for these parameters will be recorded in-situ on the field form provided in this technical memo (Appendix N).
- We will use the **Hach 2100P** portable turbidimeter to measure turbidity.
 - Measurements will be recorded preferably on-site, and data recorded on the field form provided in this technical memo (Appendix N).
 - When it is not possible to use the turbidimeter in-situ, samples will be collected and transported to the Kenai Watershed Forum office using methods identical to those described for total suspended solids (TSS) (Appendix B of QAPP)
 - After transport, prior to transferring samples to the 20 mL glass vials used for the Hach 2100P photometer, samples in the 1L HDPE bottles will be re-homogenized according to methods described for preparing Hach turbidity standards (Hach 2008) (each collection bottle will be receive a series of gentle inversions).
- All individuals using the portable field instruments described above will receive a standardized training from the project manager or project quality assurance officer (page 8).

References

Hach Company. 2008. Hach Portable Turbidimeter Model 2100P Instrument and Procedure Manual, 8th edition. <https://paperpile.com/app/p/2dd08e85-52b7-0733-8f74-e0128f7a72b1>

YSI Company. 2020. ProQuatro User Manual. Xylem. <https://www.ysi.com/File%20Library/Documents/Manuals/606962-ProQuatro-User-Manual-English.pdf>



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Appendix N: Field Form for YSI Meter and Portable Turbidimeter Observations

Kenai Watershed Forum
 Portable Water Quality Meter
 Field Form

Version 1.0 Updated 4/2/2024

Section A - Sample Event								
Site Arrival Date				Site Depart Date				
Site Arrival Time				Site Depart Time				
Site Name				Latitude				
Crew				Longitude				
Section B - Portable Meter Measurements								
Model	Instru-ment ID	Collection Time (HH:MM)	Observation Time* (HH:MM)	Parameter	Value	Unit	Notes	Rep-licate
YSI ProQuatro		N/A		pH				1
				Conductivity				
				DO				
				Temperature				
Hach 2100P**				Turbidity				
YSI ProQuatro		N/A		pH				2
				Conductivity				
				DO				
				Temperature				
Hach 2100P**				Turbidity				
Section C - Site Photos								
Camera ID	Photo ID		Photo Notes					
Section E - General Notes								
General Notes								
<p><i>*Note: for turbidity, collection time refers to when the water sample is collected. Observation time refers to when data is recorded from the meter. Only turbidity measurements will have values for both times.</i></p> <p><i>**2024 Kenai Baseline field crews will not carry the Hach 2100P Instrument in the field</i></p>								
				QC1				
				For Office Use	Data Entry			
Side A				QC2				

For questions contact
hydrology@kenaiwatershed.org
www.kenaiwatershed.org