

Ketchikan BEACH Water Quality Monitoring and Pathogen Detection

July 2017

Updated April 2018

Quality Assurance Project Plan



**Alaska Department of Environmental Conservation
Division of Water**

A. Project Management Elements

A.1 Title and Approvals

Title: Tier 2 Quality Assurance Project Plan for Water Quality Monitoring Sampling and Analysis Activities

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Ketchikan BEACH QAPP

28 June 2017

A. Project Management Elements

A.1 Title and Approvals

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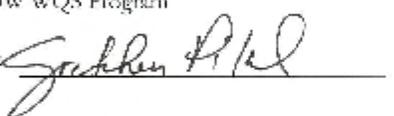
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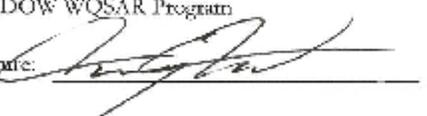
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A.2 Distribution List

This list includes the names and addresses of those who receive copies of the approved QAPP and subsequent revisions.

Table 1: Distribution List				
NAME	POSITION	AGENCY/ Company	DIVISION/BRANCH/SECTION	CONTACT INFORMATION
Gretchen Pikul	DEC Project Manager	DEC	Division of Water/ Water Quality Standards/Beach Grant	907-465-5023 gretchen.pikul@alaska.gov
Chandra McGee	DEC QA Officer (acting)	DEC	Division of Water/ WQSAR/QA	907-451-2140 chandra.mcgee@alaska.gov
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Nicole Forbes	KIC Lead Field Sampler	KIC	Environmental Specialist	907-228-9312 nforbes@kictribe.org
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A.3 Project Task/Organization

Duties and responsibilities of key individuals are listed below:

A.3.1 KIC Staff

- Project Manager/Project QA Officer** – Responsible for overall technical and contractual management of the project. If KIC staff have direct responsibility for sample collection and analysis of data results, the KIC Project Manager assume the responsibilities of the Lead Field Sampler/Project Manager.

Responsible to ensure all monitoring complies with the QAPP specified criteria. This is accomplished through routine technical assessments of the sample collection, analysis and data reporting process. Assessments may include, but are not limited to activities such as: on-site field audits, data audits, QA review of blind lab performance evaluation samples, and lab audits. These assessments are performed independent of overall project management.

- **Lead Field Sampler** – Responsible for sampling preparation, sample collection, sample preservation, transportation of samples to laboratory for analysis, receipt of data and transmittal of data to Project Manager. The individual will procure personal equipment of field personnel, coordinate with laboratories in planning sampling equipment needs, obtain supplies for and prepare daily sampling kits prior to departure for field location, travel to the field location, prepare necessary preservatives while in the field, perform site reconnaissance, collect site specific parameters, collect water samples, prepare samples for shipping, transport samples to laboratory, alert laboratory of successful sampling event, receive data from laboratory, verify sample result data is reliable and submit the data and all applicable QA/QC results to the DEC Project Manager.
- **Field Support Personnel** - Responsible for accompanying Lead Field Sampler into the field and supporting Lead Field Sampler during sampling. The individual will travel with the Lead Field Sampler to the field location, accompany the Lead Field Sampler to sampling sites, and support Lead Field Sampler in sampling tasks.
- **Laboratory Manager** – Responsible for the overall review and approval of contracted laboratory analytical work, responding to sample result inquiries and method specific details. Responsible for QA/QC of laboratory analysis as specified in the QAPP and reviews and verifies the validity of sample data results as specified in the QAPP and appropriate EPA approved analytical methods.

A.3.2 DEC Staff:

- **DEC Project Manager** – Responsible for overall technical and contractual management of the project. If DEC staff have direct responsibility for sample collection and analysis of data results, the DEC Project Manager/s assume the responsibilities of the Lead Field Sampler/Project Manager.
- **DEC Water Quality Assurance Officer (WQAO)** – Responsible for QA review and approval of plan and oversight of QA activities ensuring collected data meets project's stated data quality goals. If DEC staff have direct responsibility for sample collection and analysis of data results, the DEC WQAO assumes the responsibilities of the Project QA Officer.

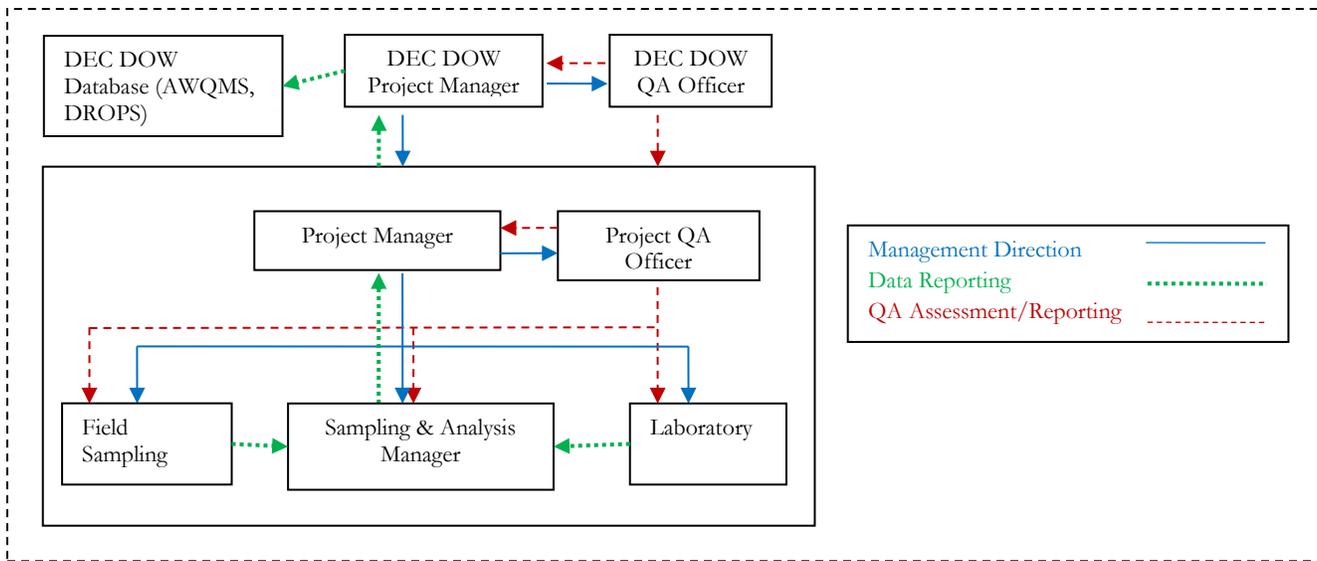


Figure 1: BEACH Project Organizational Structure

A.4 Problem Definition/Background and Project Objectives

A.4.1 Problem Definition

DEC identified the following beaches through a public nomination process; the Recreational Beach Survey is available at: <http://dec.alaska.gov/water/wqsar/wqs/beachprogram.htm>. The qualifying Ketchikan Beaches are listed below.^{1,2}

- Herring Cove (lat/long TBD)
- Mountain Point (lat/long TBD)
- Rotary Park Beach 55° 18' 31.50" N 131° 34' 39.34" W; 55.30875000, -131.57777778
- Seaport Beach 55° 18' 52.63" N 131° 35' 35.68" W; 55.31461944, -131.59333333
- Thomas Basin 55° 20' 28.49" N 131° 38' 30.45" W; 55.34124722, -131.64166667
- South Refuge Cove State Recreation Site 55° 24' 26.62" N 131° 45' 19.77" W; 55.40739444, -131.75555556
- Beach at Sunset Drive 55° 24' 45.40" N 131° 45' 54.19" W; 55.41261111, -131.76500000
- Beach at Shull Road 55° 26' 7.57" N 131° 47' 54.62" W; 55.43543611, -131.79861111
- South Point Higgins Beach 55° 26' 55.12" N 131° 49' 52.90" W; 55.44864444, -131.83138889
- Beacon Hill 55° 28' 20.21" N 131° 49' 22.98" W; 55.47228056, -131.82305556
- Knudson Cove 55° 28' 19.47" N 131° 47' 46.76" W; 55.47207500, -131.79638889

¹ One replicate of each analysis will be taken each at sampling event.

² Lat/long coordinates may be revised based on specific field sample location.

Based on the information provided by respondents, DEC ranked these beaches as Tier 1. Tier 1 includes high priority beaches that pose the greatest threat of human contact with contaminated waters during recreational use. Contact with waters containing fecal contamination increases the risk of becoming ill due to pathogens contained in feces.

A.4.2 Project Background

DEC has and continues to implement a Beach Grant monitoring model which partners with local interested organizations and the general public to monitor levels of fecal contamination and evaluate the potential risks associated with recreational beach use. While this model is effective in providing support to communities monitoring marine water quality adjacent to high use beaches, it has not been successful in monitoring all high priority, Tier 1, beaches in Alaska on a desirable basis. Data associated with monitoring efforts at these beaches are on file and can be obtained by contacting the Project Manager.

A.4.3 Project Objective(s)

The primary objective of this DEC BEACH Monitoring Program project is to sample identified beaches for fecal indicator organisms (fecal coliforms and enterococci bacteria) that signify the presence of fecal contamination. This information will be used to notify the public in the event an exceedance of allowable levels of indicator organisms in accordance to Alaska Water Quality Standards (WQS).

The secondary objective is to obtain a set of at least five samples per beach within a 30-day period. The geometric mean of these samples will then be used when reevaluating the ranking of these beaches as Tier 1. If the geometric mean of a beach meets WQS standards, it is possible the beach will be downgraded to a lower Tier. This would reduce the number of beaches categorized as high priority and, assuming no new beaches are nominated and ranked as high priority, increase the percentage of high priority beaches that can be monitored at a desirable frequency.

A.5 Project/Task Description and Schedule

A.5.1 Project Description

DEC/ KIC will collect water samples from eleven 11 Tier 1 beaches along the coast of Ketchikan. Samples will be analyzed in a DEC-approved laboratory for presence of fecal coliforms by SM 9222 D, and Enterococci by ASTM D6503. The goal of this project is to gather enough data to determine whether these beaches are meeting the water quality standards for fecal coliforms and enterococci based on single sample and/or geometric mean calculations. A list of DEC-approved microbiological laboratories is available at: <https://dec.alaska.gov/applications/eh/EHLabStatus/MicroReport/Index>.

A.5.2 Project Implementation Schedule

Table 2: Project Implementation Schedule				
Product	Measurement/ Parameter(s)	Sampling Site	Sampling Frequency	Time Frame
Field Sampling	Ambient air temperature, water temperature	All sites	See sample schedule based on tides	May 17- September 12, 2018
Lab Analysis	Fecal coliforms and Enterococci	All sites	Analyses within sample holding time requirements	May 17- September 12, 2018
Field Audit	Audit of field monitoring operations	All sites	< 30 days of project start-up	1/project

A.6 Data Quality Objectives and Criteria for Measurement Data**A.6.1 Data Quality Objectives (DQOs)**

Data Quality Objectives (DQOs, EPAQA/G4). DQOs are qualitative and quantitative statements derived from the DQO Process that:

- Determine ambient beach water concentrations of indicator organisms (fecal coliforms and enterococci) and compare these values to water quality standards regulatory limits for fecal coliform bacteria in marine waters.
- The data needed for this project is indicator organism concentrations. The ultimate goal of the project is to intensively monitor beaches that are currently considered Tier I to determine if there truly is a problem with fecal contamination. If so, beaches may be listed as impaired waters. If not, beaches will be down-tiered to a lower priority level. In order to accomplish the monitoring objectives, the appropriate type of data needed is defined by the WQS for bacteria (fecal coliform and enterococci). For WQS pollutants, compliance with the WQS is determined by specific measurement requirements. The measurement system is designed to produce water pollutant concentration data that are of the appropriate quantity and quality to assess compliance.

A.6.2 Measurement Quality Objectives (MQOs)

Measurement Quality Objectives (MQOs) are a subset of DQOs. MQOs are derived from the monitoring project's DQOs. MQOs are designed to evaluate and control various phases (sampling, preparation, and analysis) of the measurement process to ensure that total measurement uncertainty is within the range prescribed by the project's DQOs. MQOs define the acceptable quality (data validity) of field and laboratory data for the project. MQOs are defined in terms of the following data quality indicators:

- Detectability
- Precision
- Bias/Accuracy
- Completeness

- Representativeness
- Comparability

Detectability is the ability of the method to reliably measure a pollutant concentration above background. DEC DOW uses two components to define detectability: method detection limit (MDL) and practical quantification limit (PQL) or reporting limit (RL).

- The MDL 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 PQL or RL is the minimum value that can be reported with confidence (usually some multiple of the MDL).

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 DEC WQS and/or permitted pollutant level (for permitted facilities).

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

Precision is the degree of agreement among repeated measurements of the same parameter and provides information about the consistency of methods. Precision is expressed in terms of the relative percent difference (RPD) between two measurements (A and B).

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 lab samples. For paired and small data sets project precision is calculated using the following formula:

$$Precision = \frac{(A - B)}{((A + B)/2)} \times 100$$

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

$$RSD = 100 * (\text{standard deviation} / \text{mean})$$

Note: Precision assessed only when both paired values \geq :

- 5 times PQL (fecal coliforms SM 9222D)
- 2 times PQL (enterococci D-6503-99)
- 5 times PQL (fecal coliforms SM 9221 E (2) with A-1 media)

Bias (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 (DMRQA, blind Water Supply or Water Pollution PE samples from A2LA certified, etc.), Bias/Accuracy is usually assessed using the following formula:

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

Completeness is a measure of the percentage of valid samples collected and analyzed to yield sufficient information to make informed decisions with statistical confidence. As with representativeness, data completeness is determined during project development and specified in the QAPP. Project completeness is determined for each pollutant parameter using the following formula:

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

Where: T = Total number of expected sample measurements.

I = Number of invalid sample measured results.

NC = Number of sample measurements not produced (e.g., spilled sample, etc).

This project has a goal of 80% data completeness. Completeness will be assessed on an individual basis for every beach. For comparison with the geometric mean standard, ten individual sampling events are planned and a minimum of five unique and valid samples (per sample location) are required to assess compliance with the beach monitoring water quality indicator standards.

Representativeness is determined during project development and specified in the QAPP.

Representativeness assigns what parameters to sample for, where to sample, type of sample (grab, continuous, composite, etc.) and frequency of sample collection.

Comparability is a measure that shows how data can be compared to other data collected by using standardized methods of sampling and analysis.

Each sampling station is fixed and located by reference to a permanent landmark at each beach. The stations do not change throughout the sampling season, but may vary with tidal stage. Sampling is conducted in accordance with Alaska Beach Grant Program's Standard Operating Procedures. The SOP's are contained within the Sample Handbook available at:

<http://www.dec.state.ak.us/water/wqsar/wqs/beachprogram.htm>

Standardized EPA-approved analytical procedures methods are used by state certified microbiological laboratories. Fecal coliform bacteria colony forming units are enumerated using EPA Method 9222D. Enterococci colony forming units are enumerated using Standard Test Method D6503-99.

Table 3: Project Measurement Quality Objectives (MQOs)

Group	Analyte	Method	MDL	PQL	Alaska Water Quality Standards ³			Precision (RPD)	Accuracy
					Aquatic Life	Recreation Water	Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life		
	Temperature	In situ (electronic probe) EPA 170.1	NA	0.1°C	<20°C Migration routes < 15°C Spawning areas < 13°C Rearing areas < 15°C Egg /fry incubation < 13°C	<30°C	NA	±0.2°C	±0.2°C
Fecal Indicator Organisms	Fecal coliforms	SM 9222D, membrane filtration (MF)	1cfu/100mL	1cfu/100mL	NA	NA	Geometric Mean: 14 fc/100mL and not more than 10% samples may exceed 31 cfu/100mL	+/- 60%	NA
	Fecal Coliforms	SM9221 E (2) with A-1 media, MPN, marine growing waters method	2-1600 MPN/100mL	2-1600 MPN/100mL	NA	NA	14 fc/100mL and not more than 10% samples may exceed 43, 49 or 28 MPN cfu/100mL	+/- 60%	NA
	Enterococci	D6503-99 (Enterococci by Enterolert)	10cfu/100mL	10cfu/100mL	NA	Geometric Mean: 35 cfu/100mL Statistical Threshold Value: 130 cfu/100mL	NA	+/- 60%	NA
	Microbial Source Tracking	Polymerase Chain Reaction	NA	NA	NA	No human or human related sources	NA	NA	NA

³ 18 AAC 70 Water Quality Standards amended as of April 6, 2018.

A.7 Special Training Requirements/Certification

The DEC Project Managers currently serve as DEC DOW's BEACH Grant coordinator and have experience in administrating BEACH Grant Monitoring Program grants. The experience associated with their duties allows them to be effective in carrying out duties as Project Manager.

For BEACH monitoring projects, the entity is responsible to provide a knowledgeable and competent grant manager, project QA Officer and Lead Field Sampler.

For BEACH monitoring projects conducted by DEC staff, the Project QA Officer is the DEC DOW's Quality Assurance Officer. His training and experience allows him to successfully fulfill his duties as Project QA Officer.

Sub-contracted laboratories performing analytical work must have the requisite knowledge and skills in execution of the analytical methods being requested. Information on laboratory staff competence is usually provided in each lab's Quality Management (QMP) and/or Quality Assurance Plan (QAP). The laboratory to be used during the 2018 field season, R&M Engineering, Inc., is an Alaska Drinking Water certified microbiological laboratory. It is the responsibility of the contracted lab to maintain a current copy of the laboratory's QA Plan and attendant method specific SOPs on file with the Project Manager/ QA Project Manager and DEC DOW QA Officer during the duration of laboratory use.

DEC Project Manager: Gretchen Pikul

DEC QA Officer: Chandra McGee (acting)

KIC Project Manager/QA Officer: Tony Gallegos, KIC Cultural Resources Director

KIC Project Lead Field Sampler: Nicole Forbes, Environmental Specialist

KIC Field Support Personnel: TBA

Table 4: Training					
Specialized Training/Certification	Field Staff	Project Manager	Lab Staff	Lab Supervisor	Project QA Officer
Safety training	X	X	X	X	X
Water sampling techniques	X	X			X
Instrument calibration and QC activities for field measurements	X	X			X
Instrument calibration and QC activities for laboratory measurements			X	X	X
QA principles				X	X
Chain of Custody procedures for samples and data	X	X	X	X	X
Specific EPA Approved Field Measurement Method Training	X	X			X
DEC Microbiological Drinking Water Certification	Certification for microbiological analysis is limited to the individually certified analyst.				
Specific EPA Approved Lab Analytical Method Training			X	X	X

A.8 Documents and Records

The EPA's Marine Sanitary Survey will be used to record field and sanitary survey information (<https://www.epa.gov/beach-tech/beach-sanitary-surveys#marine>). A field logbook/field data sheets may also be used to store individual field information. Please see the Appendix for an example of logbook documents. The lead field sampler is responsible for ensuring that the all field data forms are correct.

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

- Pages will be numbered at the outset of the sampling season.
- Removal of any pages, even if illegible, will be prohibited.
- Entries will be made legibly with black (or dark) waterproof ink.
- 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.
- When field activity is complete, the logbook will be entered into the project file.

In addition to the preceding requirements, the person recording the information must initial and date each page of the field logbook. If more than one individual makes entries on the same page, each recorder must initial and date each entry. The bottom of the page must be signed and dated by the individual who makes the last entry. The field team and task leader, after reading the day's entries, also must sign and date the last page of each daily entry in the field logbook. Logbook 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. The type of information that may be included in the field logbook and/or field data forms includes the following:

- Names of all field staff
- A record of site health and safety meetings, updates, and related monitoring
- Station name and location
- Date and collection time of each sample
- Observations made during sample collection, including weather conditions, environmental conditions, complications, and other details associated with the sampling effort
- Sample description
- Any deviation from the sampling plan

Field log books and sample chain-of-custody forms will be completed for all samples and kept in the project file. Laboratory data results from the laboratories are recorded on laboratory data sheets, bench sheets and/or in laboratory logbooks for each sampling event. These records as well as control charts, logbook records of equipment maintenance records, calibration and quality control checks, such as preparation and use of standard solutions, inventory of supplies and consumables, check in of equipment, equipment parts and chemicals are kept on file at the laboratory.

Any procedural or equipment problems are recorded in the field notebooks. Any deviation from this Quality Assurance Project Plan will also be noted in the field notebooks. Data results will include information on field and/or laboratory QA/QC problems and corrective actions.

In addition to any written report, data collected for the project will be provided electronically in an AQWMS/STORET compatible format, as detailed in the following web address:

http://dec.alaska.gov/water/wqsar/awq_data_info.htm.

All records will be retained according to state records retention schedule.

Table 5: Project Documents and Records			
Categories	Record/Document Types	Location	Retention Time
Site Information	Site maps	With KIC	Five Years
	Site pictures	With KIC	Five Years
Environmental Data Operations	QA Project Plan	DEC	Five Years
	Field Method SOPs	With KIC	Five Years
	Field Notebooks	With KIC	Five Years
	Sample collection/measurement records	KIC and DEC	Five Years
	Sample Handling & Custody Records	KIC and DEC	Five Years
	Inspection/Maintenance Records	KIC and DEC	Five Years
Raw Data	Lab data (sample, QC and calibration) including data entry forms	KIC and DEC	Five Years
	Sanitary Survey Forms	KIC and DEC	Five Years
Data Reporting	Progress reports	N/A	Five Years
	Project data/summary reports	N/A	Five Years
	Lab analysis reports	DEC	Five Years
Data Management	Data quality assessments	DEC	Five Years
	Site audits	DEC	Five Years
	Lab audits	DEC	Five Years
	QA reports/corrective action reports	DEC	Five Years
	Corrective Action Response	DEC	Five Years

In addition to any written report, data collected for a project will be submitted electronically to DEC via a CD ROM or email ZIP file. All dates are to be formatted as “**MM-DD-YYYY**”.

B. Data Generation and Acquisition

B.1 Sampling Process Design (Experimental Design)

Beach water quality monitoring will be conducted at Tier I beaches designated by DEC, and sample locations should be chosen to represent the most likely pathogen exposure scenario for recreational beach users. Water samples will be analyzed to determine the population densities of microbes that indicate the presence of fecal contamination; microbes to be enumerated will be enterococci and fecal coliforms, with the results reported per 100 mL marine water.

Samples will be collected in accordance with the sampling SOP (Appendix A-1) at locations where primary contact recreation is likely to affect beach users. Sample collection information specific to this project is included in the Appendix A-1.

The sample will be collected in nearshore water 3 feet deep, approximately one foot below the water surface. Replicate samples for fecal coliform and enterococcus will be collected for each batch.

Enterococcus and fecal coliform population densities will be determined using the EPA or DEC approved protocols yielding the most rapid results. Those protocols were selected so decisions regarding issuance of beach advisories may be made without undue delay, minimizing the potential for public health risks associated with ongoing pathogen exposure.

Two sample containers will be collected at each sample site and time. One container will be delivered to the bacteria laboratory for analysis using Standard Methods 9222D and ASTM D6503-99. The second sample container will be priority overnight shipped to Source Molecular laboratory for potential MST analysis based on the bacteria results from the local laboratory. This sample will be filtered and frozen to hold until bacteria results are analyzed and MST tests are requested.

The DEC project manager will contact the MST laboratory (Source Molecular) immediately after receiving bacteria count results from the local lab to either 1) request MST analysis for samples exceeding criteria or, 2) to dispose the shipped samples if bacteria counts did not exceed. The MST laboratory will analyze for the presence/absence of human, gull and dog hosts and the relative amount (quantification) of bacteria each host is contributing if present through Bacteroidetes ID.

B.1.1 Define Monitoring Objectives(s) and Appropriate Data Quality Objectives

OBJECTIVE 1: Determine bacteria levels at eleven (11) Ketchikan beaches.

TASK 1: Ketchikan Indian Community (KIC) will conduct eighteen (18) weekly sampling events from mid-May to mid-September.

Start and end date: May 16, 2018 – September 13, 2018

Description: KIC will conduct eighteen (18) weekly sampling events from May 16 through September 13, 2018 in accordance with the DEC-approved Quality Assurance Project Plan and Sampling and Analysis Plan (QAPP/SAP) and BEACH Monitoring Handbook (these final documents are available to KIC).

The marine water samples will be analyzed for fecal coliform bacteria (SM 9222D) and enterococci (ASTM D6503-99). One (1) replicate sample for each analytical test per sampling event will be collected for quality assurance. The bacteria samples will be collected and submitted to the R&M Engineering-Ketchikan lab in Ketchikan for analytical testing.

Microbial source tracking (MST) tests to help determine fecal bacteria sources will be performed during the peak recreational use period (likely in August). MST hosts will include human, gull and dog markers to assess potential sources along the Ketchikan coast. The MST samples will be collected and shipped overnight to Source Molecular, Inc. lab in Miami FL, with the request to filter/freeze the samples. To capture a period of elevated fecal bacteria so that the host markers will be the most defined, the fecal coliform bacteria and enterococci results reported by R&M Engineering-Ketchikan, Inc. (local laboratory) will be assessed and if elevated, DEC will request MST tests to be conducted on those samples. If the

bacteria results are not elevated, then the process of collecting, shipping, and filter/freezing MST samples will be repeated. The MST sample selection goal is to select elevated bacteria samples to obtain the most robust host marker.

Eleven (11) locations will be sampled: Herring Cove, Mountain Point, Rotary Beach Park, Seaport Beach, Thomas Basin, south of South Refuge Cove State Recreation Site, beach off Sunset Drive, beach at Shull Road, South Point Higgins Beach, Beacon Hill, and Knudson Cove along with one (1) QA laboratory sample per analyte per sampling event (alternating between sampling locations). KIC will work with property owner(s) within Herring Cove monitoring location to secure permission to access land for sampling purposes. All eleven (11) will be sampled during one (1) event and will focus on the low tide cycle. A tentative sampling schedule with tidal cycles is attached in an excel spreadsheet.

Sample collection will target low tides to assess worst case bacteria scenarios. Specifically sampling collection will occur 3 hours prior to and during low tide at the outgoing tides (ebb tide), and during low tide up to 3 hours after in coming tides (flood tide). Sampling events will alternate site collection between these ebb and flood tide cycles in order to capture various tidal scenarios at each site location.

KIC field technicians will record observations listed in EPA's Marine Beach Sanitary Survey, such as wildlife presence, water clarity, and water and air temperature.

KIC will conduct the sampling events and ensure that proper sampling techniques are followed, chain-of-custody is correct, and samples are received and analyzed by the laboratory to meet the analytical holding time requirements. Samples will be delivered to the DEC-certified laboratory R&M Engineering-Ketchikan, Inc. in Ketchikan Alaska to meet the six (6) hour holding time for analysis.

Deliverables: The analytical data results, sanitary surveys, copies of the chain-of-custody forms, and site photos will be provided to the DEC Project Manager within 36 hours of the sampling event.

Permits: N/A

TASK 2: Bacteria laboratory will analyze marine water samples for fecal coliform bacteria and enterococci.

Start and end date: May 16, 2018 – September 13, 2018

Description: R&M Engineering-Ketchikan, Inc. laboratory will analyze marine water samples collected by KIC from the 11 monitoring sites for fecal coliform bacteria (SM 9222D) and enterococci (ASTM D6503-99). One (1) replicate sample for each analytical test per sampling event will be analyzed for quality assurance. A total of 216 samples will be analyzed for fecal coliform bacteria and enterococci from May 16 through September 13, 2018.

Deliverables: The analytical data results will be electronically reported to KIC and the DEC Project Manager within 36 hours of the sampling event.

TASK 3: MST laboratory will analyze marine water samples for human, dog and gull bacterioidetes.

Start and end date: August 1, 2018 – August 31, 2018

Description: Molecular Source Corp laboratory will analyze 12 marine water samples collected by KIC during the peak recreational use period (likely in August) from the 11 monitoring sites for MST tests. MST hosts will include absence/presence and quantification of human, dog and gull bacterioidetes. One (1) replicate sample will be analyzed for quality assurance. The MST samples will be collected and shipped overnight to MST laboratory in Miami FL, with the request to filter/freeze the samples. If the bacteria results are not elevated, then the process of collecting, shipping, and filter/freezing MST samples will be repeated. The MST sample selection goal is to select elevated bacteria samples to obtain the most robust host marker. A total of 12 samples will be analyzed for absence/presence and quantification of human, dog and gull bacterioidetes.

Deliverables: The analytical data results will be electronically reported to the DEC Project Manager at the completion of the laboratory tests.

OBJECTIVE 2: Manage project work, outreach, and reporting requirements.

TASK 4: DEC will manage project, participate in outreach, and complete reporting requirements.

Start and end date: March 1, 2018 – February 28, 2019

Description: update QAPP/SAP and Beach Handbook, develop project workplan, coordinate bacteria source sampling with other DEC programs, manage contracts, prepare and issue press releases, participate in outreach and meetings/calls, conduct QA site visit, compile and submit data to AWQMS and STORET databases, and prepare project report.

Deliverables: Updated QAPP/SAP and Beach Handbook, draft/final workplan, contract paperwork, draft/final press releases, outreach material and meeting/call summaries, QA site visit notes, draft/final data templates, draft/final project report.

TASK 5: KIC to coordinate and participate in communications and/or meetings with KIC tribal members, general public, City of Ketchikan and Ketchikan Gateway Borough, and other potential stakeholders to discuss monitoring project.

Deliverables: Meeting summary and list of participants.

B.1.2 Characterize the General Monitoring Location/s

In 2002 and 2003, an Alaska Beach Survey was conducted to collect information about recreational-use beaches in the state. The survey was designed to obtain information regarding the locations of recreational-use beaches, the types of recreational activities that occur there, and the levels and seasons of beach use. In addition, information regarding the types of pollution sources near these recreation areas was collected. The collected information was entered into a database and was used to rank beaches according to their relative potential pathogen-exposure risk to beach users. The results of this survey were used to create the Alaska Beach Database, which is updated as additional surveys are received.

Table 6: Site Location and Rationale			
Site ID	Latitude	Longitude	Site Description
KB-HerringCove	TBD	TBD	Herring Cove Beach
KB-MtnPoint	TBD	TBD	Mountain Point Beach
KB-Rotary	55° 18' 31.50" N	-131° 34' 39.34" W	Rotary Beach Park Beach
KB-Seaport	55° 18' 52.63" N	-131° 35' 35.68" W	Seaport Beach
KB-ThomasBasin	55° 20' 28.49" N	-131° 38' 30.45" W	Thomas Basin Harbor
KB-RefugeCove	55° 24' 26.62" N	-131° 45' 19.77" W	South Refuge Cove State Recreation Site
KB-Sunset	55° 24' 45.40" N	-131° 45' 54.19" W	Beach of Sunset Drive
KB-Shull	55° 26' 7.57" N	-131° 47' 54.62" W	Beach at Shull Road
KB-SPHiggins	55° 26' 55.12" N	-131° 49' 52.90" W	South Point Higgins Beach
KB-BeaconHill	55° 28' 20.21" N	-131° 49' 22.98" W	Beacon Hill
KB-KnudsonCove	55° 28' 19.47" N	-131° 47' 46.76" W	Knudson Cove
Note: GIS Maps of sampling locations (large scale as well as site specific) are to be located in the Appendix as part of the sampling plan.			

B.1.3 Identify the Site-Specific Sample Collection Location/s, Parameters to be Measured and Frequencies of Collection

Specific sampling sites will not be known until field reconnaissance has been performed. It is likely that sampling will occur at the point of greatest ease of public access. It will be assumed that the greatest use will occur at the point of greatest ease of public access.

An area within short walking distance of the public access point will most likely be sampled at each beach. The sites depicted in the topographic maps found in Appendix B.4 are tentative.

The following table details parameters to be taken at each site, the sampling frequency, and the sampling dates.

Table 7: Site-Specific Sample Parameters to be Measured and Collection Frequency			
Measurement/ Parameter(s)	Sampling Site	Sampling Frequency	Sampling Dates
Grab: Fecal Coliforms, Enterococci In situ ambient air temperature, water temperature	All sample locations	Weekly	May-September 2018

B.2 Sampling Method Requirements

Specific sampling methods are detailed in the Sampling SOP, included in the Appendix of this QAPP.

B.2.1 Sample Types

Samples will be listed as “grab” on the Chain-of- Custody and in field data sheets.

B.2.2 Sample Containers and Equipment

The following general guidelines are listed to provide consistency among the samples collected from Alaskan beaches:

- Collect one sample for each recreational-use area. A sample will consist of one sample container filled with water from one location. The container will be analyzed to determine fecal coliform population densities and enterococcus populations.
- Wear hip-waders, elbow-length gloves and a life vest during sampling.
- Collect samples in areas of greatest use by recreational users, where water is about 3 feet deep, at about knee-depth or one foot below the surface.
- Collect a field replicate sample with a minimum of one replicate per analytical test per sampling day. A field replicate consists of one additional sample container filled with water at the same location where the primary water sample set was collected.
- All sample bottles will be pre-cleaned and sterilized, and will not require rinsing with sample.
- Remove the sample container cap carefully, avoid touching the inside of the cap or the lip of the sampling container, and face into the waves or the current to avoid sample container contamination.
- Minimize sediment or debris in the sample; this may require waiting for sediment to settle after wading out to the sample collection location. If sediment or debris are present throughout the sample area, note this fact on the Beach Sampling Data Sheet.
- Grasping the open sampling container at the bottom with one hand, plunge the bottle mouth downward into the water to avoid introducing any surface scum. Position the mouth of the bottle into the current while standing downstream of the sample bottle. Tip the bottle upward to allow air to exit and the bottle to fill, and remove the bottle from the water. Pour out a small portion of the sample from the bottle to allow airspace of about 1 inch for proper mixing before analysis. Replace the cap on the bottle and assure it is tightly closed. Label the sample bottle with sample identifier, date, and time.
- List samples as “grab” on the laboratory’s chain of custody (COC) form. Note on the COC form that the laboratory needs to send the bacterial data to three recipients: to the local beach monitor, to the DEC Project Manager, and to the DEC QA Officer.

- Place samples into a cooler containing frozen blue ice to maintain a chilled temperature below 10° C. The cooler should be pre-chilled before sampling begins to ensure that samples are kept cold from the time of sampling until they are analyzed. A temperature blank must be included in each cooler.
- Measure and record water temperature to 0.1°C at the time of sample collection. A note of the temperature of the cooler contents will be made upon arrival at the laboratory.

The sample container, preservation, and holding time requirements are tabulated below:

Table 8: Preservation and Holding Times for the Analysis of Samples					
Analyte	Matrix	Container	Necessary Volume	Preservation and Filtration	Maximum Holding Time
Temperature	Surface Water	N/A, direct measurement	N/A, Direct Measurement	N/A, direct measurement	N/A, direct measurement
Fecal Coliform	Surface Water	G, PA	100 mL	Cool <10°C; do not freeze, 0.0008% Na ₂ S ₂ O ₃	6 hours (field) 2 hrs lab prep (note: time not additive)
Enterococci	Surface Water	G, PA	100 mL	Cool <10°C; do not freeze, 0.0008% Na ₂ S ₂ O ₃	6 hours (field) 2 hrs lab prep (note: time not additive)
MST	Surface Water	PC	500 mL	Cool <10°C; do not freeze, unpreserved	48 hours
Notes: G = glass, PA = autoclavable plastic PC = polycarbonate					

B.2.3 Sampling Methods

Sampling Standard Operating Procedures (SSOP) are located within the Sample Handbook available at: <http://www.dec.state.ak.us/water/wqsar/wqs/beachprogram.htm>. A copy of the SSOP is located in the appendix.

Beach Grab Samples – Sample bottles will be filled sequentially, normally being filled to the shoulder of the bottle, leaving a small space for expansion and mixing. The laboratory will provide sampling instructions with the sample bottles.

B.3 Sample Handling and Custody Requirements

B.3.1 Sampling Procedures

See Section B.2 of this QAPP – Sampling Method Requirements SOP.

B.3.2 Sample Custody Procedures

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 signed and dated friable evidence tape 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 evidence tape or cutting the lock.

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. KIC should provide a copy of the contracted lab COC at the end of this QAPP (Appendix A-2).

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).

B.3.3 Shipping Requirements

Packaging, marking, labeling, and shipping of samples will comply with all regulations promulgated by the U. S. Department of Transportation in 49 CFR 171-177. Staff should receive the necessary training for shipping samples or consult with the contracted laboratory for shipping instructions.

Samples will be individually packaged in sealed plastic bags. The sealed plastic bags will be placed into a bag-lined cooler with ice sealed in plastic bags or "blue-ice" to maintain a temperature of less than four degrees C. A temperature blank, 250 or 500 mL in size, will be placed in the cooler. Temperature will be measured prior to shipment and 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 last sampling site.

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 beach to laboratory within the specified hold time. For those projects without laboratories in their communities, samples will be packaged at the sampling site, driven by car to the nearest airport, picked up by a courier, and then delivered to the laboratory. Other projects will deliver samples directly to the contracted laboratory.

Table 9: Sample Transport Chain Information						
Business Type	Name	Address	Hours	Contact Information	Transport Leg	Estimated Transit Time
Deliver directly to laboratory	R&M Engineering, Inc.	7180 Revilla Road, Suite 300 Ketchikan AK 99901	8:00 am – 4:00 pm	(907) 225-7917	Motor Vehicle	30 minutes
Ship FedEx	Source Molecular Corporation (MST samples only)	4985 SW 74 th Court, Miami, FL 33155		(786) 220-0379	FedEx overnight	24 hours

B.4 Analytical Methods and Requirements

Water quality analytical methods that will be used throughout this project are outlined below. All analysis methods used for this program are EPA-approved. The contracted laboratory will be a currently DEC Drinking Water -certified laboratory, though the lab will be using methods specified for water/wastewater analysis. The contracted laboratory's current Quality Assurance Plan will be on file with DEC Division of Water Quality Assurance Office detailing their quality assurance procedures. Laboratory turnaround time is 20 business days. Any issues regarding analytical data quality will be resolved by the DEC project manager in consultation with any or all of the following: DEC QA Officer, sampling staff and the laboratory project manager.

B.4.1 Sampling Parameters

Temperature will be reported in °C, and will be measured using a YSI 650 MDS multiprobe meter or an equivalent meter (minimum resolution of 0.1 degree C or better). The thermometer will have current NIST traceable certification.

Fecal Coliform Standard Method 9222D will be used to determine the fecal coliform concentration in surface water. Filter sample through a membrane filter. Place membrane on mFC agar containing aniline blue as indicator. Incubate at 44.5°C for 22-24 h. Colonies that are various shades of blue are positive for fecal coliforms. The blue color indicates the capability to ferment lactose to acid.

Enterococci ASTM Method D6503-99 will be used to determine the most probable number enterococci concentration in surface water. Add reagent to the sample, pour into Quanti-Tray® or Quanti-Tray® /2000, seal in Quanti-Tray® Sealer and incubated for 24 hours at 41°C. Count fluorescent wells and refer to most probable number table.

Fecal Coliform Standard Method 9221A SM9221 E (2) with A-1 media, MPN, marine growing waters method. This method describes multiple-tube fermentation procedures [also called the most probable number (MPN) procedure] for the detection and enumeration of fecal coliform bacteria in biosolids. These

methods use culture-specific media and elevated temperature to isolate and enumerate fecal coliform organisms.

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. Reference the Project's MQO Table 3(section A.6.2) of this QAPP for list of parameters of concern, approved analytical methods, method-specific detection and reporting limits, accuracy and precision values applicable to this project. 40 CFR, Part 136.6 lists other regulated pollutant parameters not listed in the MQO Table 3(section A.6.2).

An expedited reporting turnaround time after sampling will be required for laboratory microbiological analyses to obtain results quickly for decision-making purposes. As pathogen exposure remains a risk to beach users during the period between sample analysis and reporting sample results, a short reporting time is recommended; a period of 36 hours following sample submission should be used for reporting results to the QAO, the BPM, and local community point of contact.

Microbial Source Tracking Detection of the fecal associated Human, and other selected host species, gene biomarker by real-time quantitative Polymerase Chain Reaction (qPCR) DNA analytical technology. Each submitted water sample was filtered through 0.45 micron membrane filters. Each filter was placed in a separate, sterile 2ml disposable tube containing a unique mix of beads and lysis buffer. The sample was homogenized for 1 min and the DNA extracted using the Generite DNA-EZ ST1 extraction kit (GeneRite, NJ), as per manufacturer's protocol.

Amplifications to detect the target gene biomarker were run on an Applied Biosystems StepOnePlus real-time thermal cycler (Applied Biosystems, Foster City, CA) in a final reaction volume of 20ul containing sample extract, forward primer, reverse primer, probe and an optimized buffer. The following thermal cycling parameters were used: 95°C for 10 min and 40 cycles of 95°C for 15 s and 60°C for 1 min. All assays were run in duplicate.

For quality control purposes, a positive control consisting of horse fecal DNA and a negative control consisting of PCR-grade water, were run alongside the sample(s) to ensure a properly functioning reaction and reveal any false negatives or false positives. The accumulation of PCR product is detected and graphed in an amplification plot. If the fecal indicator organism is absent in the sample, this accumulation is not detected and the sample is considered negative. If accumulation of PCR product is detected, the sample is considered positive.

B.5 Quality Control Requirements

Table 10 lists the percent of field and laboratory replicates to be used for quality control (See section A.6.2 for discussion on calculation of precision and accuracy). The precision of field and laboratory measures will be calculated using the equation in section A.6.2. Data measurements that do not meet the limits described in A.6.2 may or may not be used in the final report depending on degree to which limits are not met.

However, the report will clearly flag any and all data of questionable value along with a brief description of the problem and any justification why data should be considered for use.

Blind field sample replicates will be collected at a count of one sample per analyte per sampling event (alternating between sampling locations). Since all 11 locations cannot be sampled during one event and meet the tidal cycle, two consecutive day sampling events will occur to collect all 11 locations. Each sampling event requires one sample per analyte, resulting in two samples per analyte per sampling round. They will be analyzed for enterococci and fecal coliform (both methods, SM 9222 D and SM 9221 E with A1 media) population densities. The purpose of the blind field sample replicates is to assess sampling and laboratory precision and overall method variability for each BEACH monitoring project.

For laboratory analyses, contract laboratories will submit quality control results along with sample analytical results. Laboratory Quality Control will include duplicates, holding times, sample temperatures upon receipt of sample at lab and blanks. Laboratory precision criteria should be within BEACH MQO criteria provided in Section A.6.

B.5.1 Field Quality Control (QC)

Measures Quality control activities in the field will include adherence to documented procedures and the comprehensive documentation of sample collection information included in the field notebooks. 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.

Quality Control measures in the field include but are not limited to:

- Proper cleaning of sample containers and sampling equipment.
- Maintenance, cleaning and calibration of field equipment/ kits per the manufacturers and/or laboratory's specifications, and field Standard Operating Procedures (SOPs).
- Chemical reagents and standard reference materials are used prior to expiration dates.
- Proper field sample collection and analysis techniques.
- Correct sample labeling and data entry.
- Proper sample handling and shipping/transport techniques.
- Field replicate measurements at a minimum of one sample for each analyte per sampling event.

Analytical methods used on the project have been approved and documented by EPA, Standard Methods, or ASTM. These methods will be used as project-specific protocols to document and guide analytical procedures. Adherence to these documented procedures will ensure that analytical results are properly obtained and reported.

Table 10: Field Quality Control Samples				
Field Quality Control Sample	Measurement Parameter/s	Frequency		QC Acceptance Criteria Limits
		Frequency of Occurrence	Total # of QC Type Samples	
Temperature blank	fecal coliforms, enterococci, fecal coliforms (marine waters growing method)	1/ Cooler		Rec'd at lab $\leq 10^{\circ}\text{C}$
Project samples (QC samples, blanks, samples)		All		Analyzed within holding times
Field replicates		1 per analyte/per batch		$\leq \pm 60$ RPD

B.5.2 Laboratory Quality Control (QC) Measures

Laboratories detail QC procedures used in their laboratory Quality Assurance Plan and method specific SOPs. Quality Control in laboratories 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).
- Specific QC activities prescribed in the project's QAPP.
- Laboratory data verification and validation prior to sending data results to DEC.

Contracted and sub-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 sub-contracted laboratory to resolve the issue and take appropriate corrective action/s.

B.6 Instrument/Equipment Testing, Inspection and Maintenance Requirements

Contracted and sub-contracted laboratories will follow the testing, inspection and maintenance procedures required by EPA Clean Water Act approved methods and as stated in the respective laboratory's QAP and SOPs.

B.7 Instrument Calibration and Frequency

Field instruments shall be calibrated where appropriate prior to using the instruments. If equipment and/or kits require calibration immediately prior to the sampling event, the calibration date will be recorded in the operator's field logbook or field data sheets. When field instruments require only periodic calibration, the record of this calibration should be kept with the instrument. The project manager will delegate a field

project team member to ensure that instruments are calibrated correctly and appropriate documents recorded and retained.

Thermometers will be calibrated annually against a currently certified NIST traceable thermometer at a minimum of two (2) temperatures that bracket temperatures expected in the field (e.g., 0°C and 20°C). The NIST traceable thermometer must be certified over the expected field measurement range and should have greater accuracy and measurement resolution than the field thermometer.

Contracted and sub-contracted laboratories will follow the calibration procedures found in its QAP and the laboratory's Standard Operating Procedures (SOPs). Specific calibration procedures for regulated pollutants will be in agreement with the respective "EPA Approved" Clean Water Act Pollutant methods of analysis. Field and/or Laboratory calibration records will be made available to DEC upon request.

B.8 Inspection/Acceptance of Supplies and Consumables

All reagents, calibration standards, and kit chemicals are to be inspected to ensure that expiration dates have not been exceeded prior to use in the monitoring project.

Pre-cleaned sample containers will be obtained from the lab with the appropriate preservation method included. Coolers, gel ice, temperature blanks, and chain-of-custody forms will be provided by the contract laboratory prior to field mobilization. Qualified staff will check all field equipment and supplies to ensure that their technical specifications have been met before use. Any deviations during inspection procedures will be remedied by the project manager and recorded in the field notebook. If re-sampling becomes necessary, replacements will be made.

No standards, solutions, buffers, or other chemical additives will be used if the expiration date has passed. It is the responsibility of the sampling manager or his/her designee to keep appropriate records, such as logbook entries or checklists, to verify the inspection/acceptance of supplies and consumables, and restock these supplies and consumables when necessary.

Contracted and sub-contracted laboratories will follow procedures in their laboratory's QAP and SOPs for inspection/acceptance of supplies and consumables.

B.9 Data Acquisition Requirements (Non-Direct Measurements)

Topographic non-direct measurements (e.g., maps, charts) will be conducted using USGS derived materials. All geographical materials will be listed according to their source, year, and scale. GPS information will be documented by including collection device make and model number, geographic coordinate system, degree of accuracy (minimum of three satellite signals), and calibration information. GIS information will include GIS software program and model, source information, and geographic coordinate system.

B.10 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, and
- 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.

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 (e.g., laptops, data acquisition systems), laboratory analysis, data validation/verification, QA assessments and reporting of data of known quality to the respective DEC Division of Water Program Office. It also includes/discusses the control mechanism for detecting and correcting errors. Please include a flow chart (see example at end of section) as well as a detailed narrative of the monitoring project's data management process.

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

- The field samplers are responsible 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 supervisor.
- Laboratories are responsible to comply 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 are reported to the sampling coordinator/supervisor/project supervisor.
- Secondary reviewers (sampling coordinator/supervisor/project supervisor) are responsible for the QC the review, verification and validation of field and laboratory data and data reformatting as appropriate for reporting to AWQMS/STORET, 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.
- DEC DOW project manager and QA Officer AQS data entry staff conducts a final review (tertiary review) and submits the validated data to AWQMS/STORET.

An example Data Management Flow Chart (Figure 2) provides a visual summary description of the data flow/management process for environmental data collected in support of DEC's Division of Water decision making processes. Please revise as appropriate for the monitoring project.

Daily field records (a combination of field and core logbooks data sheets) will make up the main documentation for field activities. As soon after collection as possible, field notes, data sheets, core logs,

and chain-of-custody forms will be scanned to create an electronic record. Field data will be hand-entered into the database. One-hundred percent of the transferred data will be verified based on hard copy records. Electronic QA checks to identify anomalous values will also be conducted following entry.

Data obtained during sampling activities will be entered into field notebooks.

The following is a list of data information that will be kept and submitted to DEC:

- Field equipment and chemicals maintenance, cleaning and calibration records;
- Field notebooks;
- Sample Data Sheets;
- Photographs of sampling stations and events;
- Chain-of-Custody forms;
- Laboratory equipment maintenance, cleaning and calibration records;
- Laboratory bench sheets, control charts, and SOPs;
- Records of QA/QC problems and corrective actions (field and/or laboratory);
- Laboratory data QC records;
- Records of data review sheets;
- Replicate, performance evaluation records and other QA/QC control records (field and laboratory); and
- Data review, verification and validation records.

Data handling equipment will include computer software applications Microsoft Excel and Access. Data will be entered by the DEC project manager into a database in a form compatible with requirements of the statewide database entry into AWQMS. Requirements for data entry can be found at http://dec.alaska.gov/water/wqsar/awq_data_info.htm#2.

Sample Numbering

All samples will be assigned a unique identification code based on a sample designation scheme designed to suit the needs of the field personnel, data management, and data users. Sample identifiers will consist of two components separated by dashes. The first component is used to identify the area to which the sample originated, for example: KB = Ketchikan Beach.

Laboratory Data

The contract laboratory will submit data in electronic format to DEC. Written documentation will be used to clarify how field replicates and laboratory duplicates and QA/QC samples were recorded in the data metatables and to provide explanations of other issues that may arise. The data management task will include keeping accurate records of field and laboratory QA/QC samples so that project managers and technical staff who use the data will have appropriate documentation. Data management files will be stored on a secure computer or on a removable hard drive that can be secured. All records will be retained by the contract laboratory for five years.

Data Storage and Retention

Data management files will be stored on a secure computer or on a removable hard drive that can be secured. Laboratory Records will be retained by the contract laboratory for a minimum of five years. Project records will be retained by the lead organization conducting the monitoring operations for a minimum of five years, preferably longer. Site location and retention period for the stored data will be specified in each QAPP.

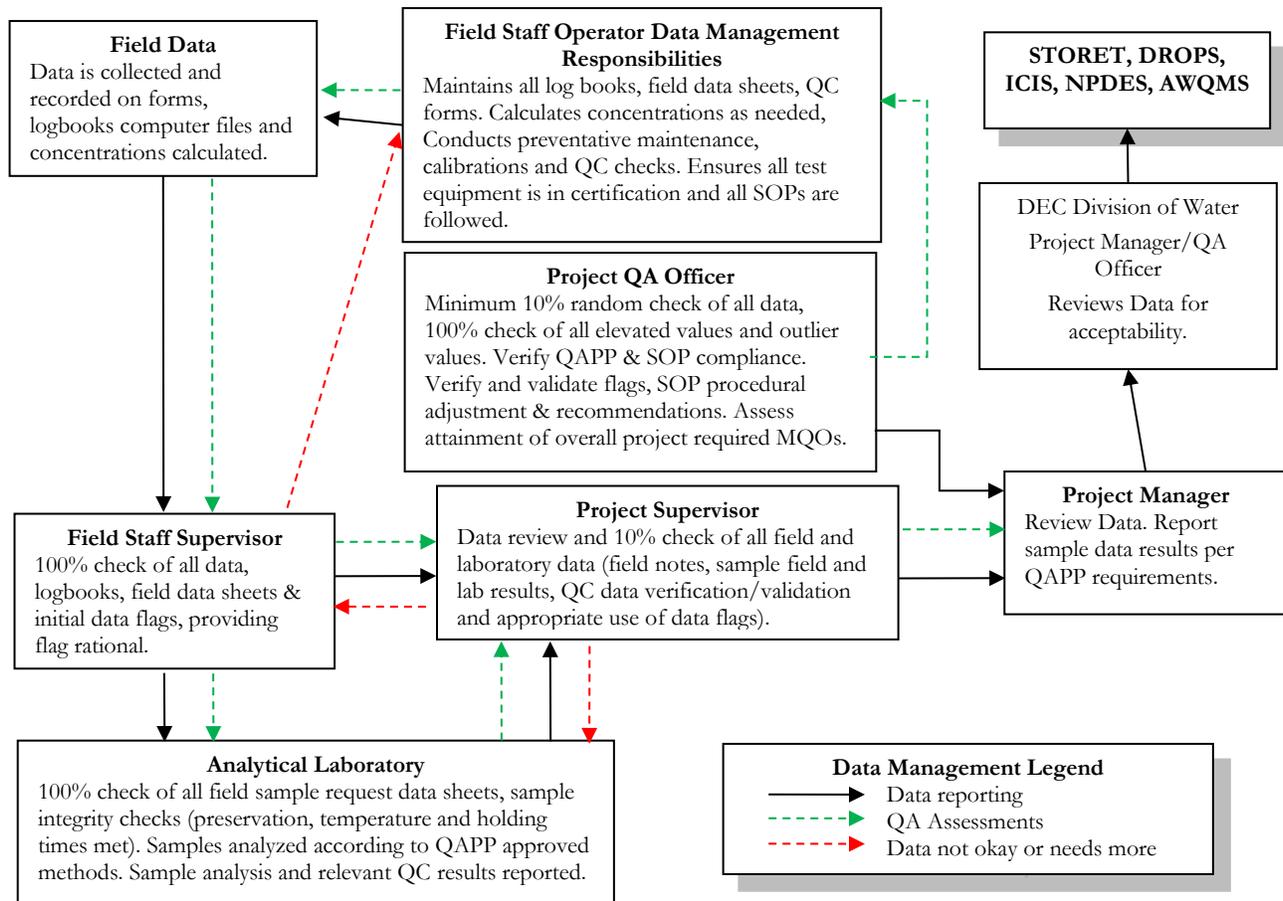


Figure 2: Data Management Flow Chart

C. Assessment and Oversight

C.1 Assessments and Response Actions

Assessments are independent evaluations of the monitoring project that are performed by the Project’s QA Officer or his/her designee. Assessments may include (but are not limited to) any of the following: on-site field surveillance, on-site laboratory audits, performance evaluation samples, blind sample duplicates/replicates (precision samples), field split samples, data quality audits, data reviews. The number and types of assessments are dependent upon the monitoring project’s intended data uses.

C.1.1 Lab Assessments to be performed under the BEACH Monitoring Program

Blind 3rd party lab performance evaluation (PE samples also called Performance Test, PT samples) for microbial analytes/methods of interest. PT water/wastewater sample participation is at a frequency of 1/year from a NELAC certified vendor (<http://www.nelac-institute.org>). Microbiological samples must be analyzed by a current DEC EH Drinking Water certified lab (<http://dec.alaska.gov/applications/eh/EHLabStatus/MicroReport/Index>) for the methods of interest. For those microbiological methods not covered under the DEC EH Lab DW certification program, the microbiological lab will enroll in an approved PT study for the microbiological method of interest (see above link for approved NELAC PT vendors). Laboratory 3rd party microbiological PT samples results will be submitted directly to the DEC Water QA Officer and the Monitoring Project's QA Officer.

- Note 1: It is the responsibility of the laboratory to enroll itself in these blind PT studies with the results mailed/emailed directly to the DEC DOW Water Quality Assurance Office and the Monitoring Project's QA Officer. Routine laboratory performance in the blind PT sample studies will be used to assess overall laboratory data quality as well as monitoring project data quality.
- Note 2: It is the responsibility of the Project Manager and project QA Officer to ensure the selected laboratory is self-enrolled in a NELAC certified PT water/wastewater study at a frequency of 1/year.

C.1.2 On-Site assessments to be performed under the BEACH Monitoring Program

- One on-site field audit/BEACH monitoring operation (contractor) of sample collection procedures (each pollutant/method). Audit evaluates whether procedures used for sample collection, preservation, shipping and hold times and sample receipt at lab are in compliance with QAPP requirements.

C.1.3 Project Data Assessments

- Audits of Monitoring Data for reproducibility of results from recalculation/reconstruction of field/lab data.
- Calculation of monitoring project's overall achieved precision, accuracy and data completeness compared to QAPP defined precision, accuracy and data completeness goals. Method specific precision, accuracy and data completeness criteria is specified in the Project MQO Table 3 of section A.6.2.
- End of monitoring project QA summary report. Describes whether project data quality objectives and measurement quality objectives were obtained. Identifies whether exceedances of Alaska's Water Quality Standards were measured, water quality monitoring problems encountered and corrective actions that were taken.

C.2 Revisions to QAPP

Annually the QAPP will be reviewed and revised as needed. Minor revisions may be made without formal comment. Such minor revisions may include changes to identified project staff, QAPP distribution list and/or minor editorial changes.

Revisions to the QAPP that affect stated monitoring Data Quality Objectives, Method Quality Objectives, method specific data validation “critical” criteria and/or inclusion of new monitoring methods must solicit input/ and pre-approval by DEC DOW QA Officer/DEC Project Management before being implemented.

C.3 QA Reports to Management

Use the following table to describe assessment types, frequency, content, responsible individual/s, and distribution of assessment reports to management and other recipients and actions to be taken.

QA Report Type	Contents	Presentation Method	Report Issued by	Reporting Frequency	
				As Required	Year
On-site Field Inspection Audit Report	Description of audit results, audit methods and standards/equipment used and any recommendations	Written text and tables, charts, graphs displaying results	Project QA Officer/auditor	✓	1/BEACH contract project
3 rd Party PT (e.g., DMRQA) Audit Report	Description of audit results, methods of analysis and any recommendations	Written text and charts, graphs displaying results	Project QA Officer/auditor	✓	1/year
Corrective Action Recommendation	Description of problem(s); recommended action(s) required; time frame for feedback on resolution of problem(s)	Written text/table	QA Officer/auditor	✓	
Response to Corrective Action Report	Description of problem(s), description/date corrective action(s) implemented and/or scheduled to be implemented	Written text/table	Project Manager overseeing sampling and analysis	✓	
Data Quality Audit	Independent review and recalculation of sample collection/analysis (including calculations, etc) to determine sample result. Summary of data audit results; findings; and any recommendations	Written text and charts, graphs displaying results	Project QA Officer	✓	
Quality Assurance Report to Management	Project executive summary: data completeness, precision, bias/accuracy	Written text and charts, graphs displaying results	Project QA Officer	✓	✓

D. Data Validation and Usability

D.1 Data Review, Verification and Validation Requirements

The purpose of this section is to define the criteria that will be used to review and validate—that is, accept, reject or qualify data in an objective and consistent manner. It is a way to decide the degree to which each data item has met its quality specifications as described in Element B above.

D.1.1 Data Validation means determining if data satisfy QAPP-defined user requirements; that is, that the data refer back to the overall data quality objectives. Data validation is an analyte and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set to ensure that the reported data values meet the quality goals of the environmental data operations (method specific data validation criteria).

D.1.2 Data Verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements.

D.1.3 Data Review is the process that evaluates the overall data package to ensure procedures were followed and that reported data is reasonable and consistent with associated QA/QC results.

D.2 Verification and Validation Methods

D.2.1 Validation Methods

Data validation determines whether the data sets meet the requirements of the project-specific intended use as described in the QAPP. That is, were the data results of the right type, quality, and quantity to support their intended use? Data validation also attempts to give reasons for sampling and analysis anomalies, and the effect that these anomalies have on the overall value of the data.

All data generated shall be validated in accordance with the QA/QC requirements specified in the methods and the technical specification outlined in this QAPP. Raw field data will be maintained by the Program staff who collect it. Raw laboratory data shall be maintained by the laboratory. The laboratory may archive the analytical data into their laboratory data management system. All data will be kept a minimum of 3 years.

The summary of all laboratory analytical results will be reported to the Project supervisor/manager staff. Data validation will be performed by the laboratory for all analyses prior to the release of data. All laboratory data will be validated according to the laboratory's QAP and SOPs and as specified in the Monitoring Project's QAPP. The rationale for any anomalies in the QA/QC of the laboratory data will be provided to the Project Manager with the data results. Completed Chain-of-Custody or Transmission forms (if required) will be sent back from the laboratory to the Project Manager.

Data will be qualified as necessary. Sampling may need to be repeated. Unacceptable data (i.e., data that do not meet the QA measurement criteria of precision, accuracy, representativeness, comparability and completeness) will not be used or if used, the problems with the data will be clearly defined, flagged appropriately and data use clearly delimited and justified. Any actions taken to correct QA/QC problems in sampling, sample handling, and analysis must be noted. Under the direction of the project manager, project staff will document any and all QA/QC problems and QA/QC corrective actions taken.

The Project Manager/monitoring supervisor or his/her designee is responsible for reviewing field log notebooks and field data sheets for accuracy and completeness within 48 hours of each sample collection

activity, if possible. Sample results provided by the laboratory, will be verified and validated by the laboratory QA Officer prior to issuing the laboratory report, and will become part of the permanent file for the monitoring project. The Project Manager or his/her designee will compare the sample information in the field log notebooks and/or data field sheets with the laboratory analytical results to ensure that no transcription errors have occurred, and to verify project QC criteria have been met (e.g., samples preserved and sample hold times met as required by QAPP and method, relative percent difference (RPD) results for blind sample replicates).

The Project QA Officer or his/her designee will calculate the Relative Percent Difference (RPD) between field replicate samples.

Laboratories calculate and report the RPD and percent analyte recovery of analytical duplicate samples.

RPD's greater than the project requirements will be noted. The Project Manager, along with supervisors and/or the Project QA Officer, if necessary, will decide if any QA/QC corrective action will be taken if the precision, accuracy (bias) and data completeness values exceed the project's MQO goals.

Estimated Quantitation Limits

The estimated quantitation limits (EQLs) are the lowest concentration that can be reliably achieved within specified limits of precision and accuracy for field and lab measurement methods. Estimated quantitation limits should be equal to or below the reporting limit (RL) but above the method detection limit (MDL). These method and analyte specific limits are provided in the MQO Table 3 (section A.6.2).

D.2.2 Verification Methods

The primary goal of verification is to document that applicable method, procedural and contractual requirements were met in field sampling and laboratory analysis. Verification checks to see if the data were complete, if sampling and analysis matched QAPP requirements, and if Standard Operating Procedures (SOPs) were followed.

Verification of data is the responsibility of the Project QA Officer. The Project QA Officer should verify at least 10% of generated project data.

D.3 Reconciliation with User Requirements

The Project Manager and the Project QA Officer will review and validate data against the Project's defined MQOs prior to final reporting stages. If there are any problems with quality sampling and analysis, these issues will be addressed immediately and methods will be modified to ensure that data quality objectives are being met. Modifications to monitoring will require notification to DEC and subsequent edits to the approved QAPP.

Only data that have been validated and qualified, as necessary, shall be provided to DEC Division of Water and entered into the applicable database (STORET, AWQMS, ICI-NPDES, DROPS).

E. Decision Criteria

Beach Advisories, Closures or other emergency actions may only be taken by municipalities in conjunction with the Department of Environmental Conservation.

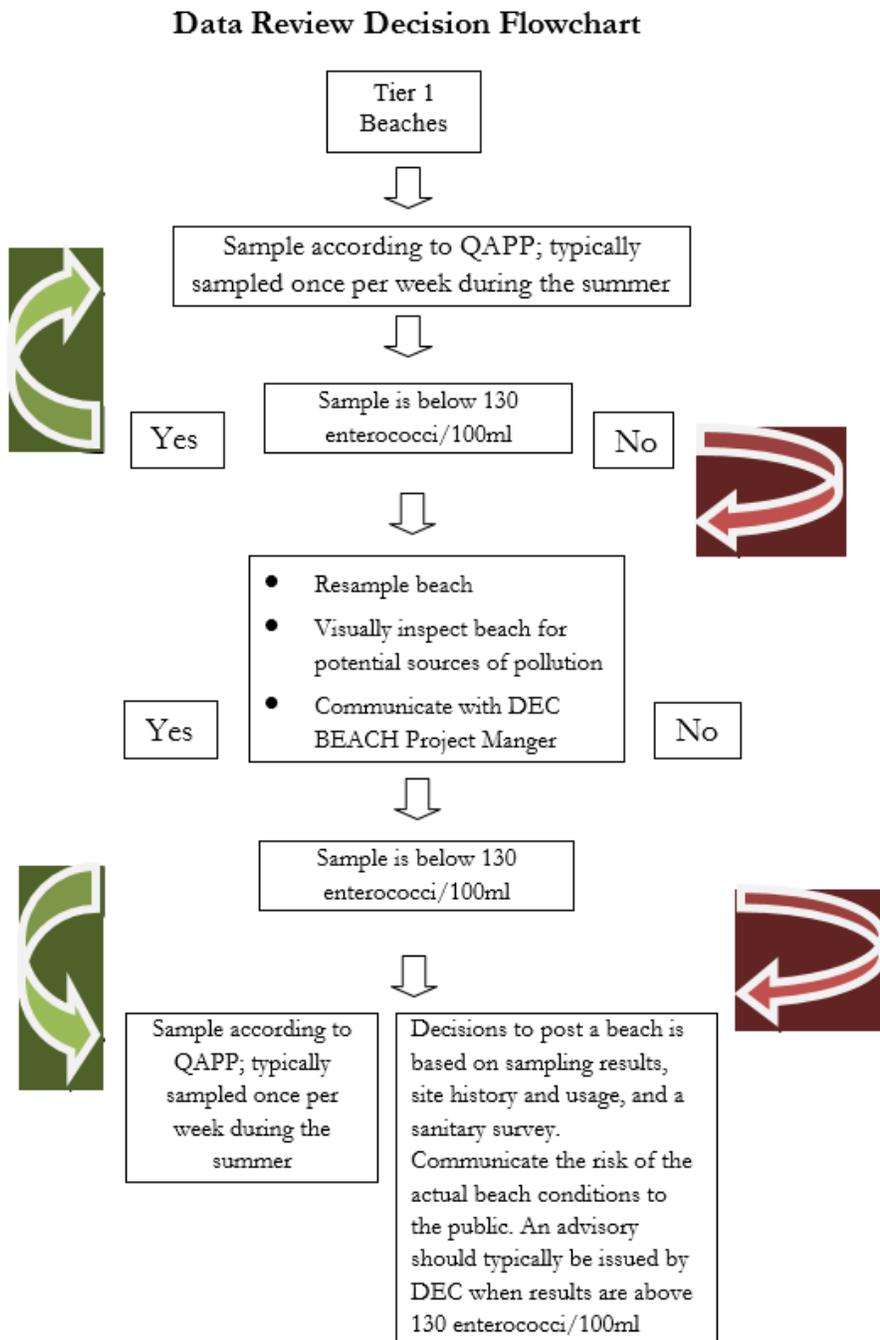
The BEACH Program's decision criteria are based on EPA's ambient water quality criteria (EPA, 1986) for two reasons:

Enterococci have a better correlation between indicator levels and illness rates than fecal coliform.

Alaska's marine Bacteria Indicator Water Quality Standards protect for the consumption of shellfish. Protection from human illness due to primary marine water contact. Closing a beach or advising against water contact based on a not more than 10% of the samples may exceed 31 fecal coliform colonies/100mL and having a geometric mean of samples may not exceed 14 fecal coliform colonies/100mL [18AAC70(14)(D) harvesting for consumption of raw mollusks or other raw aquatic life] could result in excessive advisories. A financial hardship on local communities could result from unnecessary and excessive postings. Public confidence in the Beach Program could also drop resulting in a human health hazard due to future postings being ignored.

Management decisions for public health and safety at recreational beaches should be based on specific data (e.g., activities, sanitary surveys) including identification of possible impacts from pollution sources. To make the necessary decision, data must be indicative of water quality conditions to adequately assess sanitary conditions of the beach. Due to inherent uncertainty involved with sampling and analytical determination of bacteria levels, decisions will be made when there is no reason to doubt the accuracy of the sample.

Figure 3: Data Review Decision Flowchart



Appendix A-1: Water Sampling Collection Protocols

A.1 Water Sample Collection

Water sampling involves wading into the water adjacent to a beach commonly used for water recreation to collect water from below the surface into sample jars. The sample should be collected in the general recreational beach area, or near locations expected to be influenced by fecal contamination (e.g., adjacent to sewage lagoons, near small boat harbors, etc.). The BEACH Manager will complete sampling after the following steps have been accomplished:

- Each sample jar is filled with water.
- Each sample jar is labeled.
- Each sample jar is placed in a cooler kept chilled with artificial ice.
- The Beach Sampling Data Sheet is filled out.
- A chain-of-custody form is filled out.
- The cooler is transported to the laboratory responsible for determining fecal coliform and enterococcus populations.
- A copy of the Beach sampling Data Sheet is sent to DEC BEACH Manager.

Detailed directions for collecting good water samples, shipping the samples to the laboratory, and providing beach assessment information to the DEC are given in the following subsections.

A.2 Sample Collection Method

A good water sample is collected by avoiding cross-contamination, which can happen when the sampler inadvertently contaminates the sample. To reduce the potential for cross-contamination the sampler must follow a standard sample-collection method. Step-by-step sample-collection instructions are provided below:

1. Request a sample kit from the laboratory. The kit should include:
 - A cooler.
 - The appropriate sample containers for marine water-quality sampling (enterococcus and fecal coliform bacteria).
 - Artificial ice to keep the cooler chilled to the appropriate temperature.
 - Temperature blank.
 - Chain-of custody form.
 - Custody seals.
 - Sample jar labels.
 - An extra set of Sample bottles.
 - An extra set of sample bottles for a duplicate sample.
 - Shipping labels.

- Packing material.
2. **Call the laboratory prior to sampling** to make sure there will be someone at the laboratory to receive and process the samples within 6 hours of sampling.
 3. **If necessary, consult flight schedules** to make sure there will be a flight that can get the samples to the laboratory within 6 hours of sampling.
 4. Write the beach sampling location on the bottle label and Beach Sampling Data Sheet.
 5. Put on clean waders, gloves and life vest. Wade into the water to a depth of approximately 3 feet. Try to avoid kicking up sediment or wait until any sediment that has been kicked up settles. Stand downstream of the water current and wait for sediment to clear.
 6. Remove the bottle cap just before collecting the sample. Protect the cap from contamination. Do not touch the inside of the bottle, or the inside of the cap.
 7. Open the sampling bottle and hold onto the base with one hand. Plunge the top of the bottle downward into the water. Avoid introducing surface scum. Point the mouth of the bottle into the current. Hold the bottle about 1 foot below the water surface and tip it slightly upward to allow air to exit and the bottle to fill.
 8. Remove the bottle from the water. Pour out a little water to leave airspace at the top of the jar. Fill one 100-mL bottle at each sampling location.
 9. Tightly close each bottle.

Collect one replicate for each analyte per sampling event. To collect a replicate sample, you must first have requested extra jars from the laboratory. Repeat Steps 2 through 9 at the same location.

10. Complete bottle labels and attach them to each sample jar. Labels should be clean, waterproof, non-smearing, and large enough for all the information. Information on the label should include:
 - Sample identifier (e.g., “city-date-sample” = “KET-051707-01”)
 - Sample location (e.g., beach name, KB-Rotary)
 - Sampling date and time
 - Name of sampler
11. Wash your hands and arms with soap and water or waterless antimicrobial cleanser, or disinfectant lotion to reduce exposure to potentially harmful bacteria or microorganisms.

A.3 Sample Handling

Sample handling involves packing the samples in a cooler and shipping them to the laboratory. After sample collection is complete the samples must be handled with care so that they arrive to the laboratory in good condition. Step-by-step sample handling instructions are provided below:

1. Place the sample(s) in a pre-chilled cooler containing artificial ice to maintain a temperature from 1° to 10°C. Ask the laboratory ahead of time how much ice will be needed. **Do not allow the**

samples to freeze. Samples must remain below 10°C until receipt by qualified staff at the laboratory, otherwise samples are determined invalid so ensure sufficient cold artificial ice is added.

2. Place enough packing material inside the cooler to protect the sample jars from breaking during transport to the laboratory.
3. Complete the chain-of-custody form. Put the form in a plastic bag and tape it to the inside of the cooler lid.
 - Write a note in the “Special Instructions” box requesting that the laboratory results be sent without delay (within 36 hours of sampling) to three people: the DEC BEACH Project Manager, the DEC BEACH Quality Assurance Officer, and you.
4. Fill out two custody seals and attach one to the front and one to the back of the cooler to span the lid seam. You want them to tear when the cooler is opened.
5. Securely tape the cooler shut prior to shipment. Attach shipping labels that identify the shipping destination and say: “keep cool,” “do not freeze,” and “fragile.”
6. Ship the samples to DEC-certified laboratory R&M Engineering-Ketchikan, Inc. (907) 225-7917.

Remember that samples have to be collected, shipped and received by the laboratory in 6 hours.

Samples that exceed the 6-hour holding time will not be analyzed. If necessary, consult flight schedules, and call the laboratory prior to sampling to make sure there will be a flight that can get the samples to the laboratory within 6 hours of sampling, and that there will be someone at the laboratory to receive the samples.

The MST laboratory bottle will be filled following the same procedures as above. The collected MST bacteria sample will be standard overnight shipped in a cooler at 4°C or less to the MST laboratory. A COC form will be filled out and included in the sealed cooler for shipping.

Appendix B: Supporting Documentation

Appendix B.1: Beach Sampling Field Forms

BEACH Monitoring Handbook, Rev 1

July 5, 2011

BEACH SAMPLING FIELD FORM

Name of Beach _____ Date _____

Nearest Town _____

Describe Sampling Location (Note location on map and attach) _____

Latitude N _____ Longitude _____

SAMPLES

Sample(s) ID: _____ Time: _____

Replicate ID: _____ Time: _____

Field Blank ID: _____ Time: _____

Weather Conditions:

- Sunny & Clear
- Cloudy / Overcast
- Other (describe): _____
- Rain
- Fog
- Water Temperature: _____ °C
- Air Temperature: _____ °F _____ °C
- Wind Speed (approx): _____ Mph
- Wind Direction: _____ On Shore Off Shore
- Precipitation in the last 24 hours: _____ in

Tidal Conditions:

- Low Tide
- High Tide
- Ebbing
- Flooding
- Tide** **Height** **Time**
- Low: _____ ft m _____ (am/pm)
- High: _____ ft m _____ (am/pm)

Condition of the beach:

	Debris (Describe)	Vegetation (% Coverage):
On shore		
In water		

Activity on the Beach

- Adults: _____ Dogs: _____
- Children: _____
- Other (describe): _____

Type of Activity

- Swimmers
- Walkers
- Fishermen
- Boaters
- Other (describe): _____

Condition of the Water

- Clear
- Cloudy & Murky
- Oily Film
- Other (describe): _____

Potential Sources of Pollution

- Water Fowl (approx #): _____
- Boats (approx #): _____
- Other (describe): _____
- Sanitary Facilities (describe): _____
- Sewage odor/presence (describe): _____
- Presence of stormwater pipes or other flow across the beach (describe): _____

Additional comments, noteworthy unusual conditions:

Sampler Name (Printed)

Signature



MARINE BEACH ROUTINE ON-SITE SANITARY SURVEY METHODS

PART I – GENERAL BEACH CONDITIONS

Air Temperature: Liquid-in-glass thermometer Electronic thermometer Weather report from local airport
 Weather report from local weather station Other (describe): _____

Wind Speed and Direction:
 Wind vane for direction Wind sock for direction and speed Anemometer for wind speed
 Aerovane for wind direction and speed Weather report from local airport Weather report from local weather station
 Other (describe): _____
 Distance from station: _____ (ft / mi)

Weather Conditions: Visual observations Other (describe): _____

Rainfall: Rain gauge Weather report Other (describe): _____

Distance from station or gauge: _____ (ft / mi)

Longshore Current Speed: Stick with fishing reel with water balloon on end Ball and tether
 Other (describe): _____

Wave Height: Visual examination of wave height Graduated stick and ranging pole
 Other (describe): _____

Tidal Phase: Visual examination Weather report (source: _____) Other (describe): _____

Rip Currents: Visual examination Weather report (source: _____) Other (describe): _____

PART II – WATER QUALITY

Water Temperature: Multiprobe Electronic meter Graduated thermometer Report from local radio station
 Report from NOAA weatherband radio Other (describe): _____

Turbidity: Simple visual observation Visual test kit Titrimetric test kit Nephelometer/Turbidimeter
 Other (describe): _____

Salinity: Multiprobe Salinity meter Conductivity meter Other (describe): _____

DO: DO meter Multiprobe Other (describe): _____

PART III – BATHER LOAD

Numbers of People Participating in Various Activities: Counting by surveyor Counting by lifeguards Photos
 Turnstiles Other (describe): _____



MARINE BEACH ROUTINE ON-SITE SANITARY SURVEY METHODS (continued)

PART IV – POTENTIAL POLLUTION SOURCES

Sources of Discharge:

(a) Source identification: Visual observation WWTP Notification/Report Other (describe): _____

(b) Flow/velocity or Volume measured: Mechanical flow meter Electric flow meter USGS Gauging Station WWTP Notification/Report
 Orange (float) and stopwatch Other (describe): _____

Tide Pools: _____ Describe how size was estimated: _____

Floating Present: Visual observation Cleanup event results Other (describe): _____

Amount and Type of Beach Debris/Litter on Beach: Visual observation Cleanup event results
 Other (describe): _____

Harmful Algal Bloom: Visual observation Other (describe or list source): _____

Algae in Nearshore Water and Beach:

(a) Amount and Color: Visual observation Other (describe): _____

(b) Identification: Field guide or internet site for taxonomic identification (describe): _____
 Other (describe): _____

Presence of Wildlife and Domestic Animals: Counting using hand-held counter, and if necessary, binoculars
 Other (describe): _____

Dead birds:
(a) Number: Visual observation Other (describe): _____

(b) Identification: Field guide or internet site for taxonomic identification (describe): _____
 Other (describe): _____

Dead fish:
(a) Number: Visual observation Other (describe): _____

(b) Identification: Field guide or internet site for taxonomic identification (describe): _____
 Other (describe): _____

B.2: Chain of Custody Form



R&M ENGINEERING-KETCHIKAN, INC.
355 Carlanna Lake Road, Ketchikan AK 99901
phone 907-2257917 / fax 907-225-3441

Chain of Custody	
Report Attention: <u>Nicole Forbes</u>	Phone Number: <u>907-465-5023</u>
Company Name: <u>DEC. Div of Water</u>	Fax Number:
Address: <u>410 Willoughby Avenue</u>	Sampler Name (Print): <u>Nicole Forbes</u>
City, State, Zip: <u>Juneau, AK 99811</u>	Sampler Signature: <u>Nicole Forbes</u>

Sample Information					
Sample Location	Sample Matrix (waste, drinking, storm)	Date	Time	Grab/Comp	Analysis Requested
<u>KB-KNUCKSON</u>	<u>marine</u>	<u>7/31/17</u>	<u>10:52am</u>	<u>grab</u>	<u>FC SM 9222D</u>
<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>ENTERO D0503-99</u>
<u>KB-Beacon</u>	<u>"</u>	<u>"</u>	<u>11:12am</u>	<u>"</u>	<u>FC</u>
<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>ENTERO</u>
<u>KB-SP Higgins</u>	<u>"</u>	<u>"</u>	<u>11:37am</u>	<u>"</u>	<u>FC</u>
<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>ENTERO</u>
<u>KB-Shull</u>	<u>"</u>	<u>"</u>	<u>11:55am</u>	<u>"</u>	<u>FC</u>
<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>ENTERO</u>
<u>KB-Sunset</u>	<u>"</u>	<u>"</u>	<u>12:13pm</u>	<u>"</u>	<u>FC</u>
<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>ENTERO</u>

Wastewater samples are accepted Mon-Thurs 8:00-3:00 and must be received within 6 hours of collection. If more than 2 hours elapses between collection and receipt, the samples must be refrigerated or stored in a cooler with blue ice. If bottle contains preservative, take caution not to overfill; otherwise, simply fill bottles with representative sample, leaving a 1-inch air space for laboratory homogenization. It's important that this form is properly completed by the sampler, if you have questions feel free to contact the lab.

<u>KB-settlers</u>	<u>"</u>	<u>"</u>	<u>12:30pm</u>	<u>"</u>	<u>FC</u>
<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>"</u>	<u>ENTERO</u>

FIELD NOTES:
FC @ 1750
ENTERO @ 1830

Tracking Information					
Relinquished By:	Date	Time	Received By:	Date	Time
<u>Nicole Forbes</u>	<u>7/31/17</u>	<u>6:10 pm</u>	<u>[Signature]</u>	<u>7/31/17</u>	<u>1410</u>

B.4: Sampling Location Maps

Two new sampling locations to be determined: Mountain Point and Herring Cove

