NHDES Beach Program
Generic Quality Assurance Project Plan

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US EPA Project Manager: _____
Signature / Date
Matt Liebman, US EPA Region I

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Signature / Date
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A 3.0 Distribution List and Project Personnel Sign-off Sheet

A 3.1 Distribution List

Table 1 presents a list of people who will receive the approved QAPP, Sampling and Analysis Plans (Appendix E), and any amendments.

Table 1. QAPP Distribution List for the NHDES Beach Program

QAPP Recipient Name	Title	Organization	Telephone Number	Email
Sara Sumner	Beach Program Coordinator	NHDES	603-271-8803	ssumner@des.state.nh.us
Jody Connor	Limnology Center Director, Beach Program Manager	NHDES	603-271-3414	jconnor@des.state.nh.us
Beach Inspector	Seasonal Beach Inspector	NHDES		
Alicia Carlson	Beach Program Assistant	NHDES	603-271-0698	acarlson@des.state.nh.us
Environmental Tech (Vacant)	Environmental Tech	NHDES	N/A	N/A
Water Supply and Engineering Bureau	Seasonal Recreation Camp Inpsector(s)	NHDES	603-271-2542	rpelletier@des.state.nh.us
Andrew Cornwell	Program Specialist I	NHDES	603-271-1152	acornwell@des.state.nh.us
Rachel Rainey	NHDES Laboratory QA/QC Officer	NHDES Laboratory Services	603-271-2993	rrainey@des.state.nh.us
Mona Freese	NHDES Laboratory Microbiology Section	NHDES Laboratory Services	603-271-2992	mfreese@des.state.nh.us
Vincent Perelli	NHDES Quality Assurance Manager	NHDES	603-271-8989	vperelli@des.state.nh.us
Alan Peterson	US EPA Quality Assurance Officer	US EPA Region 1	617-918-8322	peterson.alan@epamail.epa.gov
Matt Liebman	US EPA Project Manager	US EPA Region 1	617-918-1626	liebman.matt@epamail.epa.gov

A 3.2 Project Personnel Sheet

Table 2 represents the project personnel for the NHDES Beach Program.

Table 2. Project Personnel Sheet for the NHDES Beach Program

Project Personnel	Title	Telephone Number Email address
Sara Sumner	NHDES Beach Program Coordinator	603-271-8803 ssumner@des.state.nh.us
Jody Connor	NHDES Limnology Center Director, Beach Program Manager	603-271-3414 jconnor@des.state.nh.us
Alicia Carlson	NHDES Beach Program	603-271-0698 acarlson@des.state.nh.us
Environmental Tech (Vacant)	Environmental Tech	N/A
Andrew Cornwell	NHDES Beach Program	603-271-1152 acornwell@des.state.nh.us
Recreation Camp Inspector(s)	Water Supply and Engineering Bureau Seasonal Camp Inspector	603-271-2542 bthoits@des.state.nh.us
Beach Inspector	Seasonal Beach Inspector	Varies per season
Deb Soule	NHDES Program Data Manager	603-271-8863 dsoule@des.state.nh.us
Andrew Chapman	NHDES Program QA/QC Officer	603-271-5334 achapman@des.state.nh.us
Rachel Rainey	NHDES Laboratory QA/QC Officer	603-271-2993 rrainey@des.state.nh.us
Mona Freese	NHDES Laboratory Microbiology Section	603-271-2992 mfreese@des.state.nh.us
Vincent Perelli	NHDES QA Manager	603-271-8989 vperelli@des.state.nh.us
Alan Peterson	US EPA Region 1 Quality Assurance Officer	617-918-8322 peterson.alan@epamail.epa.gov
Matt Liebman	US EPA Region 1 Project Manager	617-918-1626 liebman.matt@epamail.epa.gov

A 4.0 Project Organization

A 4.1 Project Organization Description

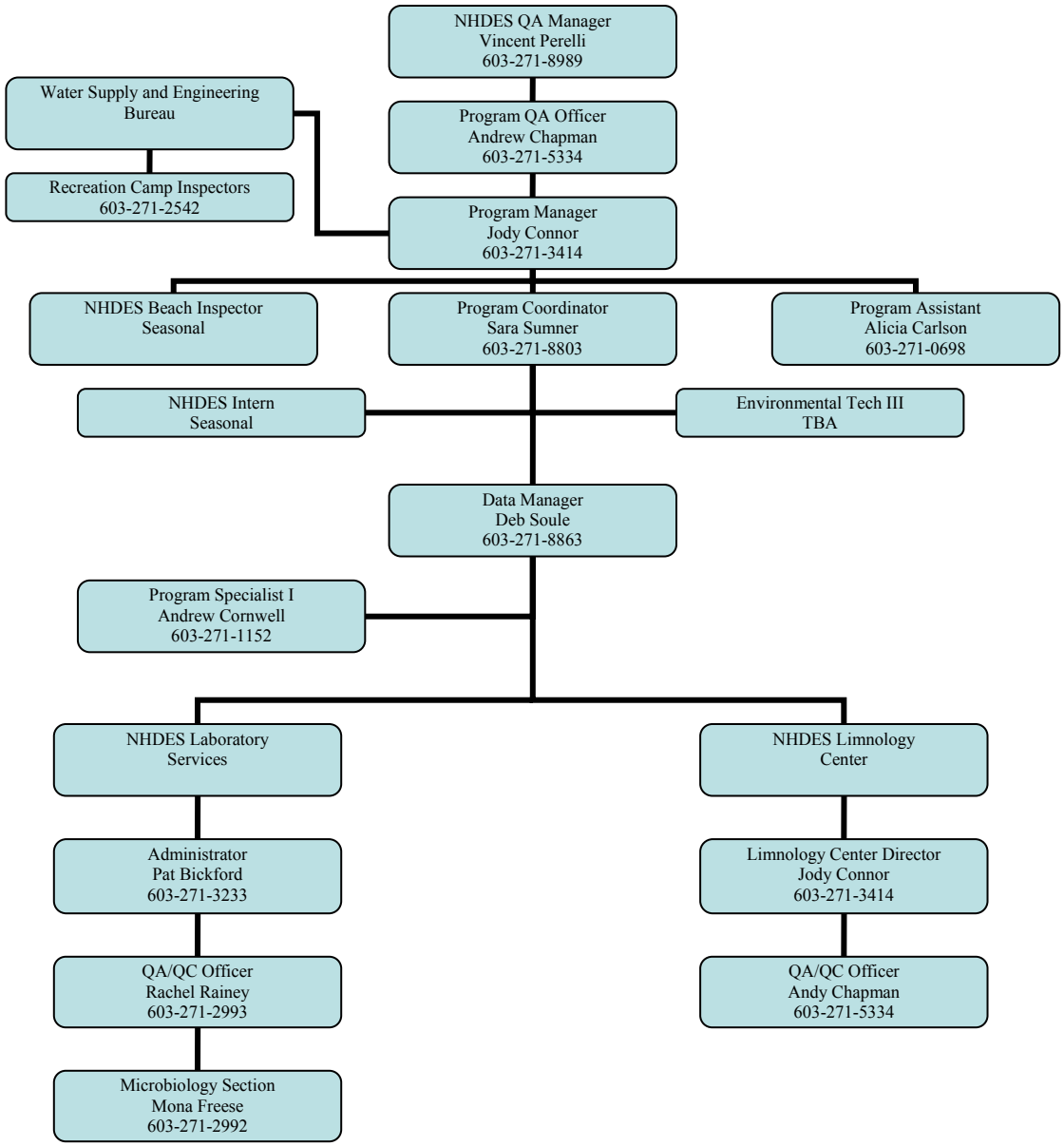
The New Hampshire Department of Environmental Services (NHDES) Public Beach Inspection Program, or Beach Program, will involve a number of key partners. Jody Connor, NHDES Beach Program Manager, is responsible for program implementation and management and issuing freshwater and coastal of beach advisories. Sara Sumner, NHDES Beach Program Coordinator (603-271-8803), is responsible for QAPP development, program coordination, inspection and sampling of coastal waters, issuing coastal beach advisories, and supervision and training of a program assistant and intern(s). The Water Supply and Engineering Bureau's Camp Inspectors are responsible for inspecting and sampling Juvenile Camps and their associated beaches. Other responsibilities of the NHDES Beach Program include website maintenance, investigation of non-point and point sources of pollution on the coast, conducting a tiered approach to monitoring, cataloguing all public beaches in the state, conducting public education and outreach, maintaining a public notification process and investigating new and improved methods for public notification, managing and analyzing water quality data for beach advisories, and investigating water quality complaints at public beaches.

A seasonal NHDES Public Beach Inspector is responsible for the inspection and sampling of freshwater beaches and issuance of freshwater beach advisories. A seasonal Beach Program intern works with the Beach Program Coordinator in inspecting and sampling coastal beaches. Alicia Carlson, Program Assistant, is responsible inspecting and sampling of coastal beaches and assists the Program Coordinator with various projects such as wet-weather monitoring, microbial source tracking, education and outreach, and website maintenance. An Environmental Tech III will be responsible for conducting Total Maximum Daily Load (TMDL) studies at impaired beaches as documented in the most recent version of New Hampshire's Consolidated Assessment and Listing Methodology (CALM). Andrew Cornwell, Program Specialist I, is responsible for data management and database organization and maintenance. The detailed responsibilities of each position are on file at NHDES. Any changes in project organization will be revised in the QAPP and submitted to EPA for approval by Jody Connor.

The NHDES Limnology Center is responsible for the identification of cyanobacteria scums and microcystin analyses. Upon identification, the Program Manager, Coordinator, Assistant, or Beach Inspector are responsible for issuing beach advisories. New Hampshire Health Officers and Beach Managers work with the NHDES Beach Program to post advisories of town beaches, and convey public health concerns to NHDES. NHDES Laboratory Services Unit (603-271-2997) is responsible for bacterial sample analysis. Rachel Rainey (603-271-2993) is responsible for NHDES Laboratory Services QA/QC. Mona Freese (603-271-2992) manages the Microbiology Section of the NHDES Laboratory Services Unit. Deb Soule, Program Data Manager (603-271-8863), is responsible for development and management of the beach database, and supervision of the Program Specialist I. Sara Sumner is responsible for the management of all beach data. Jody Connor is responsible for oversight and management of the Beach Program, Program Coordinator, Program Assistant, Beach Inspector, interns, and QAPP development. Jody Connor is also responsible for grant management and communication with US EPA. Andrew Chapman (603-271-5334) is the Program QA Officer for NHDES, and Vincent Perelli (603-271-8989) is the QA Manager for NHDES. Alan Peterson (617-918-8322) is the US EPA Quality Assurance Officer. Matt Liebman (617-918-1626) is the Project Manager for US EPA.

A 4.2 Project Organizational Chart

Figure 1. Organizational Chart for the NHDES Beach Program



A 4.3 Communication Pathways

Sara Sumner, under the supervision of Jody Connor, is the primary contact for all parties involved in inspecting, sampling and issuing advisories at coastal beaches. The Beach Inspector, under the supervision of Jody Connor and Sara Sumner is the primary contact for all parties involved in the inspection, sampling, and notification of advisories for all freshwater beaches. Jody Connor is the primary contact for all parties involved in inspecting, sampling and issuing advisories at recreation camp beaches. Alicia Carlson, under the supervision of Jody Connor and Sara Sumner assists the Program Coordinator in monitoring and sampling coastal beaches and various program related duties. The Beach Program Intern, under the supervision of Jody Connor and Sara Sumner, assists the Program Coordinator in monitoring and sampling coastal beaches. Recreation Camp Inspectors coordinate with the Beach Program in monitoring and sampling camp beaches. Sara Sumner, Alicia Carlson, the Beach Inspector, and intern, will report to Jody Connor if problems should arise in the field or laboratory. Jody Connor reviews beach advisories, resolves issues with beach owners, and coordinates with Sara Sumner and the Beach Inspector to issue advisories.

Sara Sumner and the Beach Inspector communicate with NHDES Laboratory Services if a problem should arise and consult with Mona Freese and Rachel Rainey. If a problem arises and neither Sara Sumner nor the Beach Inspector is available, Jody Connor is the primary contact and conveys the information to NH Health Officers or Beach Managers. QA/QC problems that arise are discussed with Andrew Chapman or Rachel Rainey and communicated to the EPA by Sara Sumner. Andrew Cornwell and Deb Soule are the contacts for data management and notify Sara Sumner or Jody Connor if problems arise with data management.

A 4.4 Personnel Responsibilities and Qualifications

Table 3 represents project personnel for the NHDES Beach Program.

Table 3. Personnel Responsibilities and Qualifications for the NHDES Beach Program

Name and Affiliation	Responsibilities	Education and Experience Qualifications
Jody Connor NHDES Limnology Center Director	Program Oversight	On file at NHDES
Sara Sumner NHDES Biology Section	Program Coordination	On file at NHDES
Alicia Carlson NHDES Biology Section	Program Assistance	On file at NHDES
Environmental Tech (Vacant)	TMDLs	N/A
Andrew Cornwell NHDES Watershed Management Bureau	Database Develpoment	On file at NHDES
Beach Inspector NHDES Limnology Center	Public Beach Inspector for all freshwater beaches	On file at NHDES
Water Supply and Engineering Bureau Camp Inspector(s)	Inspectors for recreation camp beaches	On file at NHDES
Andrew Chapman NHDES Biology Section	Oversees QA/QC of the Limnology Center and Beach Program	On file at NHDES
Mona Freese NHDES Laboratory Services	Oversees the Microbiology section of Laboratory Services.	On file at NHDES
Rachel Rainey NHDES Laboratory Services	Oversees laboratory QA/QC activities and identifies necessary corrective actions.	On file at NHDES
Deb Soule NHDES Watershed Management Bureau	Develops and manages the Beach database.	On file at NHDES
Alan Peterson US EPA, Region 1	US EPA Region 1 Quality Assurance Officer	On file at US EPA
Matt Liebman US EPA, Region 1	US EPA Region 1 Project Manager	On file at US EPA

A 5.0 Project (Program) Planning/Project Definition

A 5.1 Problem Definition/Background

Protecting and maintaining public health at freshwater and coastal beaches continues to be a goal of the New Hampshire Department of Environmental Services. The NHDES Beach Program has been monitoring and sampling beaches throughout the State since the early 1970's. The purpose of monitoring and sampling program is to protect the public from contracting waterborne diseases. Waterborne diseases, such as cholera, can pose serious threats to public health. The greatest threat is through the contamination of water from animal and human waste. Fecal material can house a variety of coliform bacteria, the most common being *Escherichia coli* (*E. coli*) and Enterococci. These bacteria are found in the intestines of warm-blooded animals, including humans. Since *E. coli* and Enterococci are present in fecal material, and are easily cultured within 24 hours, they are the two best indicators of fecal contamination in surface waters. Their presence in significant numbers statistically increases the potential for the presence of pathogenic organisms.

In order to protect the public from contracting diseases through recreational activities at public bathing areas, the NHDES inspects, samples, and issues advisories to public bathing beaches. In accordance with the EPA, the state has set strict standards for acceptable bacteria levels at public beaches. In accordance with RSA 485-A:8 (Appendix B), the state standard at freshwater beaches for *E.coli* in one sample is 88 counts per 100 mL of water, or no more than a geometric mean of 47 counts per 100 mL of water in 3 samples during a sixty day period. The state monitors coastal beaches for Enterococci, the preferred biological indicator for saltwater. The state standard for Enterococci in one sample is 104 counts per 100 mL of water, or no more than a geometric mean of 35 counts per 100 mL of water in 3 samples over a sixty day period. Beach advisories are posted when state standards are exceeded, and remain posted until retesting of the beach yields acceptable bacteria levels (Appendix A).

NHDES also recognizes the threat of toxic cyanobacteria (blue-green algae) to public health. Cyanobacteria are capable of producing toxins known to target the liver and central nervous system. They can also cause irritation to the skin and mucous membranes. High concentrations of cyanobacteria have caused fish-kills and the death of small animals, including domestic animals. The ingestion of cyanobacteria over a period of time can cause toxins to accumulate in the body with potential chronic effects to humans. Loss of liver function and subsequent organ failure are serious health threats. The NHDES Beach Program recognizes these threats, and has adopted an advisory for beaches where cyanobacteria scums are identified. Advisories are posted at public beaches when a visible cyanobacteria scum is present and cyanobacteria cell dominance is > 50% of the sample cell count. An advisory will remain in effect until further testing by NHDES reflects that cyanobacteria cell dominance is < 50% of the sample cell count and the beach area is safe for recreational activity. By posting advisories for cyanobacteria, NHDES is taking a proactive step in protecting and maintaining public health at its beaches.

A 6.0 Project (Program)/Task Description and Schedule

A 6.1 Project (Program) Overview

The purpose of the NHDES Beach Program is to protect and maintain public health at New Hampshire's public beaches. NHDES works cooperatively with town health officials, beach managers, lifeguards and private entities to ensure safe swim areas. The Program is administratively divided into the Coastal Beach Program and Freshwater Beach Program. Participation is voluntary, at the option of the beach owner, for the Freshwater Beach Program. Participation is mandatory for the Coastal Beach Program due to federal funding and associated grant requirements. The Water Supply and Engineering Bureau manages the Recreation Camp Inspection Program. Camp beaches are private and therefore not under the direction of the Beach Program. Recreation camps must pass annual inspections and obtain an operational license.

The beach season in New Hampshire begins with the release of public schools in mid-June and lasts until Labor Day. During the swim season, approximately 157 freshwater beaches are sampled on a monthly basis. Each beach is sampled once per month with 2 to 3 samples per beach averaging 314 to 471 samples per month. Approximately 15 coastal beaches are sampled on a weekly or bi-weekly basis during the swim season. Each beach requires 2 to 3 samples per beach averaging 30 to 45 samples per week. Approximately 70 recreation camp beaches are inspected once per season with one to two samples collected per beach averaging 70 to 140 samples per season. In addition to bacteria sampling, beaches are also inspected for the presence of lifeguards, sanitary facilities, and other potential pollution sources. Beach Inspectors will complete a Field Data Sheet (Appendix C) for each beach inspected. Monitoring/sampling technique is based on the Beach Program Standard Operating Procedures (SOPs) in Appendix A.

Bather loads are recorded at coastal beaches during the swim season. Lifeguards and/or beach managers collect bather load data on a daily/weekly basis according to the Beach Program's Standard Operating Procedures (Appendix A). Data are recorded on the Bather Load Data Sheet (Appendix C). Data collected are used to assess beach use, peak beach use times and days, percentage of users that are of the susceptible population (children/elderly), and correlation of bather loads and bacteria concentrations. DES will collect illness reports during the beach season. An illness report form (Appendix C) was developed and can be accessed on the DES Beach Program's website or by contacting the Beach Program. Illness reports will be completed by DES staff or the public. DES hopes to raise awareness of waterborne illnesses and data collected will be used to assess the outbreak of waterborne illnesses at New Hampshire's public beaches.

Advisories are posted at beaches if two of the three samples collected have bacteria levels above the state standard or if one of the samples collected exceeds the state standard by more than 70 counts. Procedures for posting a beach advisory are included in the NHDES Beach Program's Standard Operating Procedure for Beach Advisories (Appendix A). NHDES also analyzes algal scums at public beaches for potential toxic cyanobacteria (blue-green algae). If a cyanobacteria scum proves to be a dominant toxin producing cyanobacteria species an advisory will be posted at the beach area. Cyanobacteria sample collection and identification follows the NHDES Beach Program's SOP for Algal Collection/Identification (Appendix A). Algal scum samples positively identified as containing a dominant toxin producing species will be analyzed for Microcystin. Microcystin is a toxin produced by certain species of cyanobacteria common to New Hampshire waters. The analyses follow the draft SOP for Microcystin Sample Analysis (Appendix A).

Along with the monitoring/sampling of public beaches, the NHDES Beach Program will identify and catalogue all public beach areas in the state, based on the Beach Program SOPs (Appendix A). The goal of creating a catalogue of all public beaches in the State is to broaden the NHDES Beach Program to include those beaches not presently monitored/sampled by the NHDES Beach Program. The catalogue will allow the expansion of the freshwater monitoring and sampling program. NHDES will increase its monitoring/sampling program in the coastal area to include these beaches. The Beach Program will also work to promote public education and awareness by increasing its outreach through surveys, pamphlets, and fact sheets. These educational materials are dispersed to all town health officials, beach managers, lifeguards, and state parks.

A 6.2 Project (Program) Schedule/Sampling and Analysis Tasks

Project Schedule: Annual sampling of public beaches is performed on a seasonal basis due to the temperate climate experienced in New Hampshire. Therefore, the sampling season begins on June 15th and ends on Labor Day for all freshwater beaches. Sampling will begin 2 weeks prior to the start of the season for all coastal beaches (Appendix H: Tiered Monitoring Plan).

Sampling tasks: Bacteria sampling will be performed at coastal beaches on a weekly or bi-weekly basis during the swim season, on a monthly basis at freshwater beaches, and once per season at recreation camp beaches. Additional sampling will be performed if sample results yield bacteria counts above the state standards. Freshwater samples will be analyzed for *E. coli* while coastal samples will be analyzed for Enterococci. For beaches greater than 100 feet in length, three samples will be collected at each beach at left, center, and right locations in the swim area. The swim area is defined by a roped off area of the beach, or includes the whole beach area. If the beach area is less than 100 feet in length only two samples are taken one third of the distance from either end of the beach. If the beach area is located at a recreation camp, only one to two samples may be necessary to assess beach water quality. These samples are collected at the center of the beach area or at left and right stations. Beach areas located on a river, or flowing body of water, require samples be collected upstream of the beach area, in the center of the beach area, and downstream of the beach area. The purpose of collecting two or three samples per beach is to collectively represent the whole beach area instead of a single point on the beach. Water temperature is also measured at each site. Sampling methods are included in Appendix A in the NHDES Beach Program Standard Operating Procedures (SOPs). If visible cyanobacteria scums are present, a sample is collected according to the NHDES Beach Program SOPs for Algal Sample Collection/Identification (Appendix A).

Site maps are not included in this document for freshwater beaches. A map of coastal beaches is included in Appendix F. All coastal and freshwater beaches have GIS coverage and are located on the EPA Beach Watch Website (www.epa.gov/waterscience/beaches/index.html). Coastal beach coverage is also located on the Earth 911 website (www.beaches911.org) and the Oceana website (www.oceana.org/index.cfm?sectionID=25). Also, freshwater and coastal beach coverage is located on the DES Beach Program website (www.des.nh.gov/beaches).

Analysis tasks: Samples are analyzed for *E. coli* (freshwater) and Enterococci (saltwater). All analyses are conducted by the NHDES Laboratory Services Unit. The SOPs for bacteria sample analysis are on file at EPA. Identification of cyanobacteria is performed in the NHDES Limnology Center Laboratory. Refer to Appendix A for the SOP on algal identification. All algal samples positively identified as a toxin producing species will be analyzed for the presence of the toxin microcystin. Refer to Appendix A for the SOP for microcystin analysis. Temperature is collected at freshwater and coastal public beaches according to the Beach Program's SOPs for Temperature Collection in Appendix A. Temperature is not typically collected at recreation camp beaches.

Table 4 represents the analytical services performed and the personnel responsible for those services.

Table 4. Surface Water Analytical Services Table for NHDES Beach Program

Analyte	Laboratory Contact or Instrument and Person Responsible
LAB ANALYSIS	
E. coli Enterococci	NHDES Laboratory Services, Mona Freese, 603-271-2992
Cyanobacteria	Limnology Center Laboratory, Jody Connor, 603-271-3414
Microcystin	Limnology Center Laboratory, Jody Connor, 603-271-3414
FIELD ANALYSIS	
Temperature	Field Model

A 6.3 Project (Program) Schedule

Table 5 represents the schedule of the NHDES Beach Program.

Table 5. Project (Program) Schedule Timeline for the NHDES Beach Program

Activity	Dates (MM/DD/YYYY)		Deliverable	Deliverable Due Date
	Anticipated Date(s) of Initiation	Anticipated Date(s) of Completion		
QAPP Preparation	04/2002	06/2003	QAPP Document	6/30/2003
Laboratory Analyses	Seasonally	Seasonally	Analysis Results	Daily
Monitoring/Sampling	June	September	Quantity of Beaches Monitored	Annually
Annual Report	N/A	N/A	Annual Program Report	Annually
Quarterly Report	N/A	N/A	Quarterly Progress Report	Quarterly

A 7.0 Project Quality Objectives and Measurement Performance Criteria

A 7.1 Quality Objectives and Measurement Performance Criteria

Table 6 summarizes the performance criteria for samples collected for this project.

Table 6. Measurement Performance Criteria for Surface Water Samples

Data Quality Indicators	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance
Precision-Field	RPD ≤ 75%	Duplicate Samples
Precision-Lab	RPD ≤ 100%	Lab Duplicates
Accuracy/Bias-Field	0 counts	Trip Blanks
Accuracy/Bias-Lab	100% positive identification	Colony Verification
Comparability	Deviation from SOPs Should Not Influence More Than 5% of the Data	Data Comparability Check
Sensitivity	Not Expected to be an Issue for This Project	N/A
Data Completeness	100% Samples Collected 90% Beaches Sampled	Data Completeness Check
Representativeness	3 Samples/Beach >100 ft. in Length 2 Samples/Beach <100 ft. in Length	Beach Program Field Data Sheet Completeness Check

Precision: Precision in the lab will be assessed using duplicate samples every tenth sample and values of the relative percent (RPD) difference of those samples. Refer to NHDES Laboratory Services SOP for Total Coliform by Membrane Filtration (Appendix A and on file at EPA). Refer to the NHDES Beach Program SOP for Bacteria Sampling (Appendix A). Precision in the field will be assessed using duplicate samples every tenth sample and values of the relative percent difference (RPD) of those samples:

$$RPD = \frac{|x_1 - x_2|}{\frac{x_1 + x_2}{2}} \times 100\%$$

where x_1 is the original sample concentration

x_2 is the duplicate sample concentration

RPDs ≤ 75% will be deemed acceptable for field duplicate samples.

RPDs ≤ 100% will be deemed acceptable for lab duplicate samples.

Field duplicate precision at coastal beaches is performed on each day of inspections for 10% of samples. Field duplicate precision at freshwater beaches is performed on two inspection days per week for 10% of samples. Field precision is not presently assessed at recreation camp beaches due to the additional costs involved.

Accuracy/Bias: Accuracy/Bias is measured in the laboratory by conducting verification of colonies. Verification procedures are included in the SOPs for the enumeration of *E. coli* in Appendix A. Verification of Enterococci is performed on a monthly basis. The verification process can be found in the SOP for Enterococci analyses. Changes to the QAPP are immediately communicated to EPA by the Beach Program Coordinator. Accuracy/Bias in the field is measured by collecting trip blanks. Trip blanks for coastal beaches are performed for each inspection day. Trip blanks for freshwater beaches are performed for two inspection days per week. Trip blanks are not presently collected during recreation camp beach inspections due to the additional costs involved.

Representativeness: Samples must be representative of the conditions present at the time of collection in order for beach advisories to be issued. Left, right, and center locations at beaches greater than 100 ft. in length are sampled in order to collectively represent the swim area as a whole and not just a single point on the beach. Left and right locations are sampled at beaches less than 100 ft. in length. Recreation camp beaches may require only one sample at the center station to be representative of the areas; otherwise two samples are collected at left and right stations. Conditions that may be pertinent to sample representativeness are recorded on the Beach Program Field Data Sheet (Appendix C). Algal samples are collected when surface scums are present to identify possible toxic conditions to the public.

Comparability: Comparability between samples is achieved through maintaining consistency with SOPs, sampling locations, sample holding times, and sampling methods. This allows current data to be compared with past data. Comparability is for the swim area as a whole by incorporating multiple samples and completing the Field Data Sheet. Comparability in the laboratory is maintained by analyses of samples using the same method of detection and maintaining consistency with SOPs.

Sensitivity: The historical data show that the methods used to detect the analyte(s) of concern are able to do so at the levels of interest for this program. Detectable ranges of the methods (as shown in the methods and SOPs) are adequate for the purpose of this program.

Quantitation Limits: The analytical method, analytical/achievable method detection limit, and the analytical/achievable laboratory quantitation limits for this program are shown below in Table 7.

Table 7. Surface Water Target Analytes and Reference Limits

Analyte	Analytical Method (See Appendix [A] for SOP Reference)	Project Action Level	Analytical/Achievable Method Detection Limit	Analytical/Achievable Laboratory Quantitation Limit
E. coli	*E. coli* Standard Method 9213D	88 cts/100 mL or Geometric Mean of 47 cts/100 mL per 3 Samples in 60 Days	0+ cts/100 mL (Depends on Dilution and Sample Volume)	0+ cts/100 mL (Depends on Dilution and Sample Volume)
Enterococci	Enterococci Standard Method 9230C (same as EPA Method 1600)	104 cts/100 mL or Geometric Mean of 35 cts/100 mL per 3 Samples in 60 Days	0+ cts/100 mL (Depends on Dilution and Sample Volume)	0+ cts/100 mL (Depends on Dilution and Sample Volume)
Potential Toxic Cyanobacteria	Microscopic Analysis	Observed Cyanobacterial Scums	N/A	Presence/Absence of Potential Toxic Cyanobacteria
Microcystin	Microcystin Analysis	N/A	≤ 0.5 – ≥ 3.0 ppb	≤ 0.5 – ≥ 3.0 ppb
Temperature	Collection of Water Temperature	N/A	-5°C - 50°C	-5°C - 50°C

Completeness: Completeness for this program is at least 90% for sample collection at public beaches. 90% of freshwater beaches are sampled once a month per summer and 90% of coastal beaches are sampled once a week during the summer. On a per beach basis, completeness is 100%. Completeness per beach must be 100% in order for data to be considered usable and advisories posted by the NHDES Beach Program.

A 8.0 Special Training/Certification

The Beach Program Coordinator trains the Program Assistant, Beach Inspector, and intern(s) in the sampling procedure (Table 8). Recreation camp inspectors are trained by the Water Supply and Engineering Bureau. All training follows the NHDES Beach Program SOPs for Bacteria Sampling and Algal Collection/Identification (Appendix A). Training provided by the Beach Program is documented on a training form (Appendix C), and kept in the Beach Program's Personnel Training files at NHDES.

Table 8. Special Personnel Training Requirements for the NHDES Beach Program

Project Function	Description of Training	Training Provided by	Training Provided to	Location of Training Records
Bacteria Sample Collection for Laboratory Analysis	Proper Techniques for Sample Collection and Preservation in the Field.	Sara Sumner and/or Beach Inspector	All Personnel Involved in Bacteria Sample Collection from Public Beaches.	Documentation will be Kept in the Beach Program's Personnel Training files.

A 9.0 Documents and Records

The most current approved version of the Generic Quality Assurance Project Plan (QAPP) for the NHDES Beach Program is electronically stored in the NHDES's database. A hard copy is retained in the Beach Program's files. Any changes to the QAPP are submitted to EPA for approval by the Beach Program Coordinator. Special projects, other than

routine monitoring/sampling of beaches stated in the Generic QAPP, such as storm sampling, may require a project specific QAPP to be developed, in which case the approval and process design for site specific plans, referred to as Sampling and Analysis Plans (SAPs) hereafter, is contained in Appendix E. All current and revised versions of the QAPP will be distributed to appropriate parties by the Beach Program Coordinator.

Hard copies of the SOPs, Beach Program field data sheets, advisory chain of communication forms, training documentation, bather load data sheets, illness reports, and sample results are stored indefinitely in the appropriate folder in the Beach Program's files. Results of sample analysis by Laboratory Services are stored in a bench book log and entered into the Oracle database. A new database built in Oracle stores all beach data. The database is exportable to STORET where all beach data resides before export to the EPA Beach Database (www.epa.gov/waterscience/beaches/data.html). The database is part of the Watershed Management Bureau's Environmental Monitoring Database. Algal scum data are stored as hard copies in the Beach Program's files and in the Limnology Center Laboratory's Bench Book for Microscopic Analysis and Taxonomic I.D, and electronically in the Beach database. Microcystin data are stored as hard copies in the Beach Program's files and in the Limnology Center Laboratory's Bench Books for Microscopic Analysis and Taxonomic I.D., and electronically in a spreadsheet format. A hard copy of posted beach advisories are kept in the Beach Program's files and are posted on the Beach Program's website (www.des.nh.gov/beaches) and Earth 911's website (www.beaches911.org) (coastal beaches only).

Special projects, publishings, postings, educational materials, reports, and other pertinent documents are stored as a hard copy in the Beach Program's files and electronically in the NHDES database. Appropriate references, citations and acknowledgements are included and distributed to those parties involved.

B 1.0 Sampling Process Design

The monitoring/sampling of freshwater and coastal beaches incorporates biological and physical information. All freshwater beaches are analyzed for *E. coli* in aqueous media. Coastal beaches are analyzed for Enterococci in aqueous media. There are 157 freshwater beaches sampled at least once per month during the mid-June through Labor Day sampling season. The volume of freshwater beaches allows for a once per month sampling schedule, however many freshwater beaches are sampled on a weekly or bi-weekly basis by beach managers or town health officers. On average, the NHDES Beach Inspector would have to visit 8 beaches per day per week to sample 157 beaches per month. Taking travel time into account, 7-8 beaches per day is feasible, but rarely can greater than 7-8 beaches per day be sampled, hence freshwater beaches are sampled once per month. Recreation camp beaches are sampled once during the sampling season. Juvenile camp inspectors are required to inspect not only beaches but all camp operations. Time restraint does not allow for multiple juvenile camp or beach inspections. Sixteen coastal beaches are sampled during the swim season. Eleven of the sixteen are sampled on a weekly basis, while the remaining five are sampled on a bi-weekly basis. The eleven coastal beaches sampled on a weekly basis are considered Tier I high priority beaches. The five beaches sampled bi-weekly are considered Tier II low priority beaches. All sixteen beaches have been evaluated according to the risk-based beach evaluations (Appendix H). Coastal beaches are sampled according to the Tiered Monitoring Plan (Appendix H). Beaches are evaluated on an annual basis and any change in Tier status is revised in the Tiered Monitoring Plan and QAPP and is submitted to EPA for approval.

Each beach requires the collection of three bacteria samples at left, right, and center locations representing the whole swim area. Samples are collected at knee depth where children are more likely to consume water, and bacteria tend to dissipate as distance from the shore increases. The collection of three samples at knee depth better represents bacteria concentrations at the beach. Beach areas less than 100 feet in length require two samples one at a third and one at two thirds the beach length. Recreation camp beaches may require one sample collected at the center station or two samples collected at left and right stations to represent the swim area. Each sample bottle is labeled appropriately with beach name, date, time, and sample site. The beach inspector records pertinent information on the Beach Program Field Data Sheet (Appendix C) while monitoring/sampling each beach. Information such as the presence or absence of sanitary facilities, lifeguards, and waterfowl is recorded. The beach manager, lifeguards, and the public are encouraged to voice their concerns while the beach inspector is present. Additional sampling at coastal beaches may be performed according to the Tiered Monitoring Plan (Appendix H).

Additional sampling is performed when a cyanobacteria scum is observed in the beach area. One sample of scum is collected and brought to the Limnology Center for microscopic identification. Samples are returned to the Limnology Center immediately for preservation and refrigeration. The identification of dominant toxin producing cyanobacteria populations requires the posting of a beach advisory and further analysis to confirm the presence of microcystin. Dominance is considered 50% or more of the cell count. Cell count is equivalent to a colony of cyanobacteria (most species are or can be colonial). An advisory will remain in effect until further testing by NHDES reflects that the beach area is safe for recreational activity.

E.coli and Enterococci samples are returned to NHDES Laboratory Services Unit within 6 hours where they are analyzed. *E. coli* results are reported within 24 hours and advisories are posted if bacteria concentrations exceed the state standards. Enterococci results are reported within 24 hours and advisories are posted if bacteria concentrations exceed the state standards. Refer to the Beach Program's Standard Operating Procedures for Bacteria Advisories (Appendix A). Advisories are issued if one sample exceeds the state standard by more than 70 counts, if two of three samples exceed the standard, or if all samples exceed the standard. If one sample exceeds the standard by less than 70 counts the beach is re-sampled and the situation is considered a safety response. The state standard for freshwater beaches is 88 counts per 100 mL, and 104 counts per 100 mL for coastal beaches. Or no more than a geometric mean of 47 counts per 100 mL of water in 3 samples during a sixty day period for freshwater beaches, and no more than a geometric mean of 35 counts per 100 mL of water in 3 samples over a sixty day period for coastal beaches. If bacteria counts do not meet these criteria, and an advisory is required, the Beach Program Coordinator, or the Beach Inspector consult with the Beach Program Manager and issue the advisory by contacting the town health officer or beach manager. Notification of an advisory requires the posting of a state approved sign and immediate re-sample. Re-sample collection is determined by the Beach Program Coordinator and includes the Program Coordinator, Program Assistant, Beach Inspector, Beach Program Intern, Recreation camp Inspector, town administration, health officer, or beach manager. Advisories remain posted until re-sample results are reported in 24 hours and are within state standards. All advisory postings and public notification procedures are detailed in Appendix A in the Beach Program's SOP for Beach Advisories and in Appendix G in the Beach Program's Public Notification and Risk Communication Plan.

B 2.0 Sampling Methods

B 2.1 Bacteria Sample Collection

In order to maintain uniform sample collection at all beaches, the Beach Program SOPs for Bacteria Sampling (Appendix A) are followed by all parties involved in the monitoring/sampling of beaches. Three samples per beach are collected, two if the beach area is less than 100 feet in length, one or two at camp beaches; additional samples are collected using the same protocol if conditions require so. Sterile 8 oz. screw cap containers are used for sample collection; sterilization protocol is included in NHDES Laboratory Services SOP for Bottle Washing in the Quality Systems Manual (on file at EPA). Sample volumes must be equal to or exceed 100 mL in order for sample analyses to be performed. Samples will be transported to NHDES Laboratory Services within proper holding times and proper preservation techniques will be initiated.

B 2.2 Bacteria Analyses

Analyses of *E. coli* and Enterococci are performed by the NHDES Laboratory Services Unit. Sample analysis follows the SOPs included in Appendix A.

B 2.3 Algal Collection/Identification

Algal samples are collected at beaches where potential cyanobacteria scums are observed on water surface or on the beach shoreline. Sample collection is a surface grab using an 8 oz. sterile screw cap container or another clean container. Samples are transported to the Limnology Center where they are preserved and refrigerated. The Beach Program SOPs for Algal Collection/Identification (Appendix A) are followed.

B 2.4 Water Analysis

Water temperature is measured in the field according to the Beach Program SOPs for Temperature Collection in Appendix A. Water temperature is not recorded at camp beaches.

B 2.5 Microcystin Analysis

Microcystin analyses are performed on all algal scum samples collected and positively identified as a toxin producing cyanobacteria species. Sample analysis follows the SOP included in Appendix A.

Table 9 summarizes sample requirements for the program.

Table 9. Sample Requirements

Analytical parameter	Collection Method	Sampling SOP	Sample Volume	Container Size and Type	Preservation Requirements	Max. Holding Time (Preparation and Analysis)
E. coli	Grab	Appendix A	100 mL	8 oz. sterile plastic bottle	Chilled to ≤ 10ºC	6 hours
Enterococci	Grab	Appendix A	100 mL	8 oz. sterile plastic bottle	Chilled to ≤ 10ºC	6 hours
Cyanobacteria	Grab	Appendix A	≤ 100mL	8 oz. sterile plastic bottle or other clean container	Refrigeration	24 hours
Microcystin	Grab	Appendix A	≥ 5 mL	8 oz. sterile plastic bottle or other clean container	Freeze	3 months
Temperature	Measured in-situ	Appendix A	N/A	N/A	N/A	N/A

B 3.0 Sample Handling and Custody

Bacteria sample collection is performed by the appropriate trained parties. Samples are transferred to a cooler with ice to initiate the preservation process immediately after sample collection. Samples are transported by vehicle to NHDES Laboratory Services Unit within 6 hours after collection (SOP for Bacteria Sampling Appendix A). Algal samples are transported to NHDES Limnology Center Laboratory immediately after sample collection (SOP for Algal Collection/Identification).

Custody of samples is relinquished by the individual to the Laboratory Services Unit or the Limnology Center Laboratory. Protocol for custody requirements can be obtained from the NHDES Laboratory Services Unit's Quality Systems Manual (on file at EPA), the NHDES Beach Program SOPs for Bacteria Sampling (Appendix A), and the NHDES Beach Program SOPs for Algal Collection/Identification (Appendix A). The sample custody and login sheet is included in Appendix C. Laboratory sample holding times are included in the SOPs for *E. coli* and Enterococci (on file at EPA).

B 4.0 Analytical Methods

Analyses for *E. coli* and Enterococci are performed by trained NHDES employees following the protocols for membrane filtration (on file at EPA). Algal identification follows the Beach Program SOPs for Algal Collection/Identification (Appendix A) and is performed by trained DES employees in the Limnology Center.

Microcystin analyses are performed by trained DES employees in the Limnology Center and follow the Beach Program SOPs for Microcystin Analysis.

B 5.0 Quality Control

Biological monitoring/sampling and analyses performed by the NHDES Laboratory Services Unit or the NHDES Limnology Center adhere to the QC guidelines listed in the NHDES Laboratory Services Unit's Quality Systems Manual (on file at EPA), the Watershed Management Bureau's Limnology Center Procedures and Protocols (Appendix A), the Beach Program SOPs for Bacteria Sampling (Appendix A), and the Beach Program SOPs for Algal Collection/Identification (Appendix A). Recreation **camp beach data are exempt from the quality control measures listed below.** Table 10 summarizes field QC procedures for the program.

Table 10. Field QC Samples and Frequency Table

Matrix	Analytical Parameter	Field QC	Data Quality Indicators	Acceptable Limits	Corrective Action	Person Responsible	Frequency
Surface Water	*E. coli*	Field Duplicates	Precision	RPD ≤ 75%	Address Field and Lab Operations and Precision	Beach Program Coordinator Sara Sumner	10% of Samples
Surface Water	Enterococci	Field Duplicates	Precision	RPD ≤ 75%	Address Field and Lab Operations and Precision	Beach Program Coordinator Sara Sumner	10% of Samples
Surface Water	*E. coli*	Trip Blanks	Accuracy/ Bias	0 counts	Retest and Address Lab D.I. Water and Bottle Sterilization	Beach Program Coordinator Sara Sumner	20% of Samples
Surface Water	Enterococci	Trip Blanks	Accuracy/ Bias	0 counts	Retest and Address Lab D.I. Water and Bottle Sterilization	Beach Program Coordinator Sara Sumner	20% of Samples

B 6.0 Instrument/Equipment Testing, Inspection, Maintenance

All equipment used in the analyses of bacteria samples are tested/inspected/or maintained according to the NHDES Laboratory Services Unit's Quality Systems Manual (on file at EPA). Inspection and maintenance of the thermometers is performed on a daily basis prior to sampling. Inspection and maintenance of the NHDES Limnology Center microscope is performed prior to sample identification.

B 7.0 Instrument/Equipment Calibration and Frequency

All instrument/equipment calibration in the NHDES Laboratory Services Unit is performed according to their Quality Systems Manual (on file at EPA). Thermometer calibration is performed by the Beach Program Coordinator or Program Assistant according to NHDES Laboratory Services Unit's SOP for Thermometer Calibration (Appendix A). Recalibration of the thermometers is done on an annual basis or more frequently as needed. Microscope calibration is

performed on a yearly basis according to the NHDES Limnology Center's SOP for Microscope Analysis Standard Procedures (Appendix A).

B 8.0 Inspection/Acceptance Requirements for Supplies and Consumables

All supplies and consumables used to perform laboratory analyses of bacteria samples are QC checked according to the NHDES Laboratory Services Unit's Quality Systems Manual (on file at EPA). All sample bottles are QC checked by NHDES Laboratory Services Unit, and the protocol is included in the Quality Systems Manual (on file at EPA). Trip blanks require the use of D.I. water obtained from the Microbiology Laboratory. Trip blanks are analyzed for the presence of bacteria according to the NHDES Laboratory Services Unit's Quality Systems Manual (on file at EPA). All supplies and consumables used to perform laboratory analyses of algal samples for microcystin are QC checked according to package instructions.

B 9.0 Non-direct Measurements

Data obtained from other NHDES Programs may be used in the cataloguing of all freshwater and coastal beaches. This could include site and tax maps, and lot by lot surveys conducted on the coast. Literature on cyanobacteria may be used to further develop the posting of beach advisories in the presence of cyanobacteria scums. Data obtained from other NHDES Programs may also be used for specific projects at the coast (not including regular monitoring/sampling of beaches stated in the Generic QAPP), which prior to implementation, a Sampling and Analysis Plan will be developed (Appendix E). Data obtained from other NHDES programs may also be used for evaluations of coastal beaches according to the Risk-Based Beach Evaluation and Classification Form (Appendix H).

B 10.0 Data Management

Field data sheets (Appendix C) are completed for each public and recreation camp beach sampled in the Beach or Recreation Camp Inspection Program. They are secured in clipboards in the field and are bound in year specific binders at NHDES. Field data sheets are stored for three years. Inspection data recorded on the field data sheets is stored electronically in the Beach Program's database. All inspection data is entered into the database on a weekly basis by the Beach Program Intern. Advisory chain of communication forms (Appendix A: Beach Program's SOP for Beach Advisories) are completed with each bacteria or cyanobacteria advisory issued. Advisory data is stored electronically in the Beach Program's database and hard copies are stored in the appropriate folder. Bather Load Data Sheets (Appendix C) are completed for coastal beaches and if possible are collected weekly or monthly. Bather Load data sheets are bound in three ring binders at NHDES and information recorded is stored electronically in the Beach Program's database. Bather load data is entered into the database on a weekly basis by the Beach Program Intern. Training documents for the NHDES Beach Program are stored as hard copies and are filed in the appropriate folder at NHDES. Illness reports are completed by the Beach Program or public and are filed in beach specific folders. The data is also stored electronically in the Beach Program's database. Analytical data generated from the Laboratory Services Division are filed in beach specific folders. Data are also stored electronically in the laboratory database. Laboratory QA/QC data is recorded in the bench book and is entered into the database.

Analytical data generated by Laboratory Services is exported nightly to the Beach Program module located in the Watershed Management Bureau's Environmental Monitoring Database. An error report is generated for data that fails to be exported. The Beach Program Coordinator consults with Data Management, corrects errors, and the data is re-exported or hand entered into the database. All analytical data is marked as reviewed upon import into the database. The Beach Program Coordinator will review the data to ensure compliance with this document and the data will then be marked as final. Required beach data is exportable to EPA via XML and STORET, historical beach data is made accessible through the database, and data are made accessible on the state web page. Algal samples are logged into the Limnology Center Login Database (SOPs Appendix D). Results of algal analyses are entered into the Limnology Center Login Database (SOPs Appendix D). Hardcopies of the results are filed in the appropriate beach folder.

C 1.0 Assessment and Response Actions

Field Sampling Technical Systems Audit (TSA) is performed by the program manager at the beginning of the sampling season. Corrective measures are taken immediately to address deviations or project deficiencies from the QAPP, SAPs, or SOPs when necessary by verbal communication. Revisions to the SAPs or SOPs are made if deemed necessary by the program coordinator. Sampling techniques are reevaluated using the training document for the Beach Program (Appendix C) and future sampling is monitored to ensure compliance is reached.

Field Analytical TSA is performed by the program manager at the beginning of the sampling season. Corrective measures are taken immediately to address deviations or project deficiencies from the QAPP, SAPs, or SOPs when necessary by verbal communication. Revisions to the SAPs or SOPs are made if deemed necessary by the program coordinator. Future sampling is monitored to ensure compliance is reached.

The NHDES Laboratory Services Unit's Fixed Laboratory TSA is performed by the Laboratory Services QA/QC Officer. Corrective measures are taken immediately to address deviations or project deficiencies from the QAPP, SAPs, or SOPs. Replicates and critical range tables are checked with data to determine if sources of error exist. Data is entered into the computer weekly and cross-referenced with bench books for accuracy. Any deviations in results are addressed in both written and verbal formats, and future sampling is monitored to verify that compliance is reached.

Table 11 represents the project assessments that are performed by the NHDES Beach Program.

Table 11. Project Assessment Table

Assessment Type	Frequency	Person Responsible for Performing Assessment	Person Responsible for Responding to Assessment Findings	Person Responsible for Monitoring Effectiveness of Corrective Actions
Field Sampling Audit	Once Per Season	Sara Sumner, Beach Program Coordinator, NHDES	Sara Sumner, Beach Program Coordinator, NHDES	Sara Sumner, Beach Program Coordinator, NHDES
Field Analytical Assessment	Once Per Season	Sara Sumner, Beach Program Coordinator, NHDES	Sara Sumner, Beach Program Coordinator, NHDES	Sara Sumner, Beach Program Coordinator, NHDES
NHDES Laboratory Services Unit Fixed Lab Audit	Yearly	Rachel Rainey, Laboratory Services QA/QC Officer, NHDES	Rachel Rainey, Laboratory Services QA/QC Officer, NHDES	Rachel Rainey, Laboratory Services QA/QC Officer, NHDES

C 2.0 Reports To Management

The NHDES Beach Program produces an annual report on the quality of New Hampshire's public beaches. The Beach Program also produces quarterly reports to the EPA on the progress of the program in meeting the goals outlined in the Beaches Environmental Assessment and Coastal Health Act (BEACH) grant application. The NHDES also has developed a Measures Tracking and Reporting System (MTRS) database that allows management to track the progress of certain projects. This allows the Beach Program to update the progress of projects as tasks are completed.

D 1.0 Data Review, Verification, and Validation

The NHDES Beach Program Coordinator reviews all data generated. All data generated is accepted due to the impact, and potential health risk to the public. However, if the data do not meet the stated RPDs immediate re-sampling is performed. All data review, verification and validations results are stored in a spreadsheet format electronically and as a hardcopy in the subject specific folder in the Beach Program's files. Data is reviewed for:

1. Completeness: Omissions from logs, notebooks, field forms, and the database will not represent the true volume of samples collected and analyzed. If the data generated does not meet the 90% or 100% completeness requirement a meeting will be held with all staff responsible for sample collection, analyses, and the representative QA/QC officers. Incomplete field data may require re-sampling at the site(s). Incomplete laboratory data may call for reintroduction or re-analysis of the questionable sample, if feasible. Completeness is measured on a daily basis.

2. Consistency: The consistency of the program is reviewed on a weekly basis and upon identification of any discrepancies the program coordinator meets with all responsible staff and QA/QC officers to remediate the problems immediately. Consistency is measured at the end of the sampling season.

D 2.0 Verification and Validation Procedures

The Beach Program Coordinator reviews all data generated and evaluates QC requirements for usability in obtaining the stated objectives of the project by following the steps listed in Section D 1.0. Verification and validation of data generated from the NHDES Laboratory Services is compliant with their Quality Systems Manual (on file at EPA). Verification and validation of data generated from the NHDES Limnology Center is compliant with the Limnology Center Procedures and Protocols (Appendix D). All data review and verification and validations results are stored in a spreadsheet format electronically and as a hardcopy in the subject specific folder in the Beach Program's files.

D 3.0 Reconciliation with User Requirements

Data are generated based on the quality objectives defined in Section A 7.0 and verified according to Sections D 1.0 and D 2.0. Data usability should be 100% due to the public health risk of the analytes in question. If data usability is not 100% for a sample location, immediate re-sampling is conducted. Any limitations of the data are clearly defined for all users of the reports produced.

Appendix A

Beach Program
Standard Operating Procedures

A-1

Beach Program Standard Operating Procedures For Bacteria Sampling

STANDARD OPERATING PROCEDURE

FOR BACTERIA SAMPLING

Prepared by: _____ **Date:** _____
Program Coordinator

Reviewed by: _____ **Date:** _____
Program Manager

Approved by:_____ **Date:** _____
Quality Assurance Officer

N.H. DEPARTMENT OF ENVIRONMENTAL SERVICES
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PROCEDURES

1.0 Scope and Application

1.1 This Standard Operating Procedure encompasses all aqueous sample collection for bacteria at freshwater and coastal beaches by the NHDES Beach Program. It includes all samples collected at knee and surface depth.

2.0 Health and Safety Warnings

2.1 When sampling waters with known fecal contamination always wear disposable plastic gloves and utilize a sampling pole. Do not ingest or allow the water to come into contact with the skin. Always wash hands after sampling and do not touch hands to mouth or other exposed areas of the body before washing.

2.2 Ingestion of waters containing fecal contamination can cause health problems such as gastroenteritis, fever, vomiting, and diarrhea. Caution should be taken when recreating in areas where there may be a potential for fecal contamination.

3.0 Interferences

3.1 Interferences from bacteria sampling can include cross contamination and improper sample collection.

3.1.1 Cross Contamination

Avoid cross contamination by sampling with sterile bacteria bottles. Never touch the inside of the sample bottle cap or neck of the sample bottle, and always sample water that is flowing towards the body. Any bacteria that may be present on the body could contaminate the sample.

3.1.2 Improper Sample Collection

Improper sample collection can include rinsing of the sample bottle, disturbance of the substrate, sampling in a disturbed area, improper sample depth, and improper sample technique.

3.2 Always follow standard operating procedures for sample collection to avoid these errors.

4.0 Equipment and Supplies

4.1 The following supplies are needed for collection of bacteria samples:

- 8 oz. sterile plastic screw cap containers
- Sampling pole
- Cooler(s)
- Ice
- Clipboard, three ring binder, waterproof pen(s)
- Beach station list
- Station identification form
- Field data sheets, sample login and custody sheets
- Shoulder length polyethylene gloves
- Waterproof tape
- Thermometer
- Beach advisory signs
- Maps, directions, NH Atlas

4.2 Cyanobacteria collection supply list can be found in the NHDES Beach Program Standard Operating Procedures for Algal Collection and Identification.

5.0 Sample Collection – Preparation

1. Determine how many beaches will be sampled that day. Based on the number of beaches to be sampled, obtain sterile bacteria bottles from the NHDES Laboratory Services Unit. Each beach will require at least three sample bottles per beach.

2. Procure a large cooler form the Limnology Center and fill cooler to about 1/2 full with ice.

3. Obtain a sterile bacteria sample bottle from the laboratory. Label the bottle with date, time and Trip Blank. In the laboratory washroom, fill the bottle at least 2/3 of the way full with D.I. water being careful not to touch the inside of the bottle cap or neck of the bottle. Place the bottle in the ice filled cooler.

4. Review the equipment and supplies checklist to ensure all materials are present.

5. Once you have arrived at the sample location:

   - Introduce yourself to the beach management.
   - Observe beach and facility operation.
   - Provide necessary educational material.

6. If the beach area is less than 100 feet in length, only two samples are collected one third the distance from either end of the beach.

7. If sampling waters with known fecal contamination, always have disposable shoulder length gloves and a sampling pole available.

8. The beach area may require additional bacteria sampling. Obtain the extra sample bottle(s) and label them appropriately with date, time, location, and site.

9. Presence of a surface scum may require additional samples. Refer to the NHDES Beach Program's Standard Operating Procedures for Algal Collection/Identification.

10. Print out the pre-populated station identification forms from the Water Quality Database (WQD). Complete a station identification form for the beach and sampling points (if applicable). Fill out all shaded areas of the form.

11. Print out beach specific pre-populated inspection data sheets and sample log-in and custody sheets from the WQD.

6.0 Sample Collection - Method

1. Wade into the water to knee depth. Wait for the water to be clear of debris that may have been disrupted when walking into the water. Or sample away from the disturbed area.

2. Unscrew the bottle cap making sure not to touch the inside of the cap or neck with fingers or any other object.

3. Hold the cap in one hand, and with the other hand turn the bottle upside down so the opening is facing the water surface. Make sure you never touch the opening of the bottle neck.

4. With a downward thrust moving away from your body, dip the bottle at least a foot below the surface. Fill the bottle with one sweeping motion, and discard a few milliliters to allow some head (air) space.

5. Replace the cap carefully over the bottle and tighten.

6. Mark the site location, the name of the public beach, and the date and time the sample was collected. Make sure to always use a waterproof pen or Sharpie®.

7. Measure the water temperature according the Beach Program's SOPs for Temperature Collection.

8. If the swim area is located on a naturally flowing watercourse, such as a brook or river, samples should be collected upstream, at the public beach area, and downstream. In streams or rivers in which it is difficult to collect a sample at the desired depth, locate the deepest area with a moving current. Always collect sample moving against the current to reduce the chance of contamination.

9. If the there is known fecal contamination or if the area is difficult to access, use a sampling pole. Attach the sample bottle to the clamp, remove the bottle cap, and repeat step 4. Make sure to adjust the length of the pole to collect the sample as close to knee depth as possible.

7.0 Sample Handling and Preservation

7.1 After sample collection the process is as follows:

1. Place all samples in a cooler(s) with ice for preservation. Acceptable preservation temperature for *E. coli* and Enterococci is less than 10°C.

2. Return samples to the NHDES Laboratory Services Unit within 6 hours after sampling.

3. Place samples in order according to the time samples were collected on the bench in the log-in room of Laboratory Services. Complete the pre-populated login and custody sheet. If you have any questions ask the lab personnel to assist you.

4. Write the beach specific EPA number on the bottle label. The EPA numbers can be found on the Beach Station List.

5. Place the appropriate labels on the bottle caps. These labels inform lab personnel of analyses to be run.

6. Sample dilution is required for suspected sewage samples. Dilutions are X1, X10, or X100. Indicate the dilution factor by listing it on the label. Login sheets must also be labeled with the dilution factor(s) in the other/notes section.

7. Dilution is required for Enterococci trip blank samples. Indicate X1 on the label attached to the cap and indicate in the other/notes section on the login sheet.

8. Sign the custody sheet to relinquish the samples to the laboratory. The lab personnel must review and sign the custody sheet. **Always notify lab personnel when you drop samples off!**

8.0 Data and Records Management

8.1 All observations must be recorded on the Beach Program Field Data Sheet. This sheet must be filled out completely. The required observations are:

1. Beach name, town, station ID
2. Advisory, complaint, initial, or subsequent inspection
3. Beach inspector name, number of collected samples
4. Date, time, weather conditions, recent storm events
5. Presence or absence of toilet facilities
6. Type of toilet facility: bathhouse/bathroom, outhouse, portable
7. Presence or absence of lifeguards, swim ropes, rafts
8. Number of bathers (exact number if possible, otherwise estimate)
9. Water conditions (e.g. clarity, water level, water temperature, surface scums)
10. Waterfowl, wildlife, domestic animals
11. Culverts, storm drains, pipes
12. Complaints from lifeguards or bathers

8.2 All inspection data must be entered into the WQD Beach Module Inspections. Data is entered on a weekly basis by the Beach Program intern. Data entry follows the WQD Beach Module Training document.

8.3 Station identification forms must be filled out completely for each sampling station per beach. Required fields are as follows:

1.0 Project (program or project associated with the station a.k.a Beach)

2.0 Station ID

3.0 Station Type

4.0 Latitude, longitude

5.0 Correction of latitude or longitude if possible

6.0 GPS unit manufacturer, model

7.0 Method of location other than GPS

8.0 Datum

9.0 Quality Control and Quality Assurance

9.1 Duplicate samples are collected at a frequency of 10%. The relative percent difference (RPD) of the duplicate samples should be ≤ 75% respectively. If the RPD is exceeded, immediate re-sampling will be performed. All data generated will be accepted due to the impact, and potential health risk to the public.

9.2 Trip blanks are collected prior to each sampling trip using D.I. water. Trip blanks are performed twice per week for freshwater beaches and every trip for coastal beaches.

9.3 Inspection data entered into the WQD is QA/QC checked by Beach Program staff. Inspection data QA/QC cannot be performed by the person responsible for entering the data.

10.0 References

Water Sampling Protocol For *E. coli* Testing, Environmental Fact Sheet WD-BB-13, New Hampshire Department of Environmental Services, 1998.

A-2

Beach Program Standard Operating Procedures for Algal Collection/Identification

STANDARD OPERATING PROCEDURE

FOR ALGAE COLLECTION/IDENTIFICATION

Prepared by: _____ **Date:** _____
Program Coordinator

Reviewed by: _____ **Date:** _____
Program Manager

Approved by:_____ **Date:** _____
Quality Assurance Officer

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PROCEDURES

1.0 Scope and Application

1.1 The Standard Operating Procedure for Algal Collection/Identification incorporates aqueous sample collection for surface scums at freshwater, inter-tidal, and coastal beaches. It includes all samples collected at surface depth, and incorporates microscopic identification in the Limnology Center.

2.0 Health and Safety Warnings

2.1 Cyanobacteria (blue-green algae) are capable of producing neurotoxins and hepatotoxins which could be harmful to humans through water contact or ingestion. These toxins can damage the liver, kidneys, and central nervous system. Scientists have shown the toxins to cause fish kills and the death of fish, livestock, and domestic animals when ingested in large amounts.

2.2 Exposure to cyanobacteria through recreational contact at public bathing areas can cause acute and chronic health effects. Acute health effects occur through dermal exposure to cyanobacteria which can cause irritations to the skin and mucous membranes leading to rashes and inflammation upon contact. Chronic health effects such as liver and kidney failure may occur through the ingestion of cyanobacteria. The toxins can bio-accumulate over time resulting in chronic illnesses.

2.3 When sampling water with known cyanobacteria scums, do not aspirate or ingest the water.

3.0 Equipment and Supplies

3.1 The following supplies are necessary for the collection of surface scum samples:

- 8 oz. sterile plastic bottle or other clean container
- Waterproof tape, pens
- Field data sheet or complaint form, clipboard
- Station identification form
- Toxic cyanobacteria advisory posters
- Cooler with ice
- Lugols solution for preservation

3.2 The following equipment and supplies are necessary for identification of surface scum samples:

- Phase contrast, binocular compound microscope or equivalent compound microscope
- Microscope slide, cover slip
- Pen, algal identification sheet
- Pipette
- D.I. water
- Cyanobacteria keys/references/pictorials

4.0 Sample Collection – Preparation

1. Determine the number of potential beach inspections for the day. Obtain a clean 250 mL sample bottle (sterile bacteria bottles may be used) from the NHDES Limnology Center or the Laboratory Services Unit.
2. Obtain a cooler filled about ¼ depth with ice.
3. Review the equipment and supplies checklist to ensure all materials are present.
4. Once you have arrived at the sample location:
   - Introduce yourself to the beach management.
   - Make observations on the Beach Program field data sheet or complaint form.
   - Provide relevant educational material.
5. Complete a station identification form for the site where the sample was collected.

5.0 Sample Collection – Method

1. Inspect the beach area, shoreline, and swim area for the presence of surface scums. Note on field sheets the presence or absence of scums or other observations that may be relevant to the complaint.
2. Obtain one sample bottle and label with:
   a. Beach name
   b. Date and time

c. Sample location

d. Name of individual collecting sample

3. Open the bottle cap and dip into the water where the scum is present. Fill the bottle at least ¼ full with the sample. **Do not dip container into the sediment!**

6.0 Sample Handling and Preservation

6.1 After sample collection the process is as follows:

1. Place samples into the cooler.

2. Transport samples to NHDES Limnology Center immediately.

6.2 Process all samples as follows:

1. Uniformly mix sample and split contents into two separate containers. One sample is preserved by the addition of 2-3 drops of Lugols solution while the other sample is retained as a live sample.

2. Login samples into the Limnology Center Login System. Refer to the Limnology Center Sample Login SOP.

3. Log samples in under Beaches or Complaint and choose phytoplankton or microscopic ID as the parameter.

4. Affix the login label to the sample container and refrigerate all samples.

5. Immediately notify the Limnology Center Director and Beach Program Coordinator that a surface scum sample requires microscopic identification.

7.0 Sample Identification and Notification

7.1 Preparation for microscopic analyses is as follows:

1. Remove preserved and unpreserved sample from the Limnology Center refrigerator.

2. Obtain an algal identification sheet, slide and coverslip.

3. Invert the samples to assure sample homogeneity.

4. Take a small pipette and rinse with D.I. water a few times, discard waste into plankton waste bottle. Pipette a small amount of homogenous sample onto a specially designed Hausser Scientific microscope slide and carefully place coverslip over the sample.

5. Once the slide is placed on the microscope stage, scan the slide and check off identified algae on the algal identification sheet.

8.0 Data and Records Management

8.1 All field data sheets are filed in the beach specific folder and all completed complaint forms are filed with the Limnology Center in the appropriate complaint folder. Required observations for the sheets include:

1. Beach name, town, station ID
2. Beach Inspector name
3. Date, time, weather conditions
4. Presence of algal scum
5. Proximity of surface scum and dimensions of scum
6. Presence or absence of lifeguards
7. Estimate bather population
8. Water conditions (e.g. clarity, water level, water temperature)
9. Complaints from lifeguards or bathers

8.2 Station identification forms must be completed and must include the following:

1. Project (program or project associated with station a.k.a. Beach)
2. Station ID
3. Station Type
4. Latitude, Longitude
5. Correction of latitude and longitude if possible
6. GPS unit manufacturer, model
7. Method of location if other than GPS

8. Datum

8.3 Plankton identification data sheets are filed in the beach specific folder. Results of plankton identification are entered into the Limnology Center Login Database. Refer to the Limnology Center Login Data Entry SOPs.

8.4 The presence of cyanobacteria will be reported to the Limnology Center Director who will make a determination if a beach advisory is appropriate.

9.0 Calibration

9.1 The compound microscopes are calibrated using a Whipple grid and stage micrometer, as outlined in Standard Methods (20th Edition, p 10-11 through 10-13).

10.0 Quality Control and Quality Assurance

10.1 Sample collection and identification are consistent with the standard operating procedures outlined above and the Limnology Center Standard Operating Procedures and Protocols.

11.0 References

Microscope Analyses Standard Procedures, Limnology Center Laboratory Standard Operating Procedures and Protocols, New Hampshire Department of Environmental Services, 2001.

Data Entry Q.C., Rev. 1.0, Limnology Center Laboratory Manual, NHDES, April 2002.

Data Entry for Analysis and Q.C. Data, Rev. 1.0, Limnology Center Laboratory Manual, NHDES, April 2002.

Sample Login: Standard Operating Procedures, Section V, Rev. 1.0, Limnology Center Laboratory Manual, NHDES, April 2002.

A-3

Beach Program Standard Operating Procedures For Designated Beach Areas

STANDARD OPERATING PROCEDURE

FOR DESIGNATED BEACH IDENTIFICATION

Prepared by: _____ **Date:** _____
Program Coordinator

Reviewed by: _____ **Date:** _____
Program Manager

Approved by:_____ **Date:** _____
Quality Assurance Officer

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Procedures

1.0 Scope and Application

1.1 The NHDES Beach Program has drafted a new definition for a designated or public beach area: 'A public beach is an area on a river, lake, pond, or tidal water that is intended or used for bathing, swimming, or other primary water contact; operated for or by any municipality, governmental subdivision, public or private corporation, partnership, association, or educational institution, open to the public, members, guests, or students whether on a fee or free basis.'

1.2 The definition is to be applied statewide to develop catalogues of all coastal and inland beaches. In order to develop these catalogues a procedure for determining areas which comply with the above definition will be utilized.

2.0 Interferences

2.1 GPS interferences include cloud coverage, satellite availability, and object cover such as trees, buildings, or other large features.

3.0 Equipment and Supplies

3.1 The following equipment and supplies are needed in assessing designated beach areas:

- GPS Unit
- Pen/pencil
- Station ID Form
- Atlas
- Tax Maps
- Assessor's Records
- Beach Station List
- Clipboard

4.0 Assessment Method

4.1 Assessment Preparation

1. Compile a list of all public beaches previously identified in the state.

4.2 Assessment Method - Office

4.21 Using the list of public waterbodies, determine designated beach areas for each public waterbody, on or adjacent to that waterbody. The process is as follows:

1. Select a watershed, town(s), and/or waterbody(s) to assess.

2. Contact the town health official, select person, or agencies/programs to determine sites within the town used for swimming and other water contact purposes.

3. Obtain tax maps from the town and review lot information, ownership, land use etc. on or near the water body(s).

4. Send a letter to the owner and ask if their water frontage meets the definition of public beach. If the owner responds yes, enter the information in the database. Pertinent information may include beach name, owner, address, operator (if different from owner), and contact information.

4.3 Assessment Method – Field

4.31 This method requires a GPS unit. Follow the field method below.

1. Survey areas suspected of, or meeting the definition of public beach.

2. Use the GPS unit to obtain the latitudes and longitudes at each end of the beach area. Calculate the beach length from GPS points.

3. If you are unable to obtain GPS points from either end of the beach, determine beach length by following the Beach Length as a Function of Pace document found in the Beach Program files.

4. Complete a Station Identification Form.

5.0 Data and Records Management

5.1 All Station Identification Forms (Appendix A) are filed in the subject specific folder in the Beach Program Files. Required observations for the form include:

1. Beach name, town, EPA ID
2. Station ID
3. Station Type
4. Latitude, Longitude
5. Correction of latitude and longitude if possible
6. GPS unit manufacturer, model (if other than Beach Program GPS units)
7. Method of location if other than GPS
8. Direction to beach station
9. Description of beach station

5.2 All data obtained from GPS will be downloaded and stored electronically. Hardcopies of the information will be stored in subject specific folder in the Beach Program Files.

5.3 All beach specific data gathered in the field will be stored electronically and as hard copies in the subject specific folder in the Beach Program Files.

6.0 Quality Control and Quality Assurance

6.1 Dependent upon make and model of GPS unit used, post-processing could be done on-site or in the office. Refer to NHDES' Field Locating Handbook.

6.2 All positions are QA/QC checked against known sites. In the case of a suspected error in data, an error report is generated. Data is reviewed, checked against the error report and errors are corrected.

APPENDIX A

Station Identification Form

NH PUBLIC BEACH INSPECTION PROGRAM – STATION FORMS

Beach Name:_____ **Town:**_____ **EPA ID:**_____

Station Type:_____ **Date:** _____

Station Name:_____ **Station GPS'd?:**_____ **Location Method:**_____

Date Established:_____ **Latitude:**_____ **Longitude:**_____

Directions to the Beach/Station:

Station Description:

Station Name:_____ **Station GPS'd?:**_____ **Location Method:**_____

Date Established:_____ **Latitude:**_____ **Longitude:**_____

Directions to the Beach/Station:

Station Description:

Station Name:_____ **Station GPS'd?:**_____ **Location Method:**_____

Date Established:_____ **Latitude:**_____ **Longitude:**_____

Directions to the Beach/Station:

Station Description:

A-4

Beach Program Standard Operating Procedures For Beach Bathing Load Determination

STANDARD OPERATING PROCEDURE

FOR BATHER LOAD DETERMINATION

Prepared by: _____ Date: _____

Program Assistant

Reviewed by: _____ Date: _____

Program Coordinator

Reviewed by: _____ Date: _____

Program Manager

Approved by:_____ Date: _____

Quality Assurance Officer

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Procedures

1.0 Scope & Application

1.1. Dense bather loads are often suspected to impact bacteria levels at public bathing areas. To assess potential impacts, bathing load information is required.

1.2. This Standard Operating Procedure (SOP) is designed for beach managers and lifeguards to help determine daily bathing numbers during specific intervals. Information pertinent to bather loads shall be obtained by following the procedures.

2.0 Equipment and Supplies

2.1. The following supplies are necessary for collection of data:

1. Bather Load Data Sheet (Appendix A)
2. Clipboard
3. Waterproof pen
4. Watch/clock

3.0 Data Collection-Preparation

1. Obtain multiple copies of the Bather Load Data Sheet from the Beach Program staff.
2. Secure data sheets to a clipboard. Always keep a waterproof pen attached to the clipboard.

4.0 Data Collection-Method

1. It is recommended that bather load be recorded each day during the week. If not possible, go to #2.
2. At a minimum, record bather load on one to three days each week. It is recommended that bather loads are recorded during peak use days (weekends and holidays). If not possible, go to #3.

3. If bather loads cannot be recorded on a daily or weekly basis it is recommended that bather loads are recorded during peak use days (weekends and holidays).

5.0 Data Collection-Field

1. Each week fill out the appropriate information on the field sheet regarding beach name, town, and start date ("weekly start date").

2. For beaches with more than one lifeguard station, record the specific stretch of beach the data sheet corresponds with. Have a data sheet available at each lifeguard station.

3. Record the date the data are collected in the first column.

4. Record the number of people in the water every two hours. We suggest recording bather loads at four different times each day. Suggested tally times are 10:00 am, 12:00 pm, 2:00 pm, and 4:00 pm. If there are more than 50 bathers, estimate to the nearest 10 people.

5. Record the weather conditions daily.

6. Make any comments regarding bathers in the appropriate column of the data sheet. Comment on such items as the number of children in the water, the number of animals on the beach, or any other information you feel is important or may contribute to increased bacteria levels.

7. Record the first initial and last name of the data collector.

8. Store the data sheets in a safe location. The Beach Program staff will collect the data sheets weekly during monitoring/inspection visits. Note: data sheets from freshwater beaches may not be collected on a weekly basis. Please retain data sheets until a Beach Program staff member can retrieve them.

6.0 Data and Records Management

6.1. All observations must be recorded on the Bather Load Data Sheet. Required observations include:

1. Beach name

2. Town

3. Start Date

4. Date/time

5. # of bathers in water

6. Initials

6.2. Upon completion of the swim season, data will be handled as follows:

9. The DES Beach Program Coordinator will compile all data sheets in three ring binders at the DES headquarters.

10. The Program Coordinator will review the data to determine the average number of bathers using the beach throughout the summer. The data will also be used to determine maximum bather load during peak recreation hours.

7.3 Bather load data will be stored in the Water Quality Database's Beach Module. Data will be entered on a weekly or as needed basis during the summer. Data entry will follow the procedure listed in the Beach Module Training Document.

7.0 Quality Assurance and Quality Control

7.1 All data entered into the WQD is QA/QC checked by Beach Program staff. QA/QC cannot be performed by the person responsible for entering the data. QA/QC may be performed by Beach Program staff or other trained staff.

APPENDIX A

Bather Load Data Sheet

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Beach Program
Bather Load Data Sheet

Beach Name _____ **Town** _____

Beach Stretch (if applicable)_____ **Weekly Start Date** _____

This form is provided to help determine how many people are using the water at our public beaches. For more detailed instructions, refer to the Standard Operating Procedure for Bather Load Determination.

Date	Time	# of Bathers in the Water	Weather	Comments	Name (First In., Last)

A-5

Beach Program Standard Operating Procedures For Microcystin Analysis

STANDARD OPERATING PROCEDURE

FOR MICROCYSTIN SAMPLE ANALYSIS

Prepared by: _____ **Date:** _____
Program Assistant

Reviewed by: _____ **Date:** _____
Program Coordinator

Reviewed by: _____ **Date:** _____
Program Manager

Approved by:_____ **Date:** _____
Quality Assurance Officer

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Procedures

1.0 Scope and Application

1.1. This Standard Operating Procedure (SOP) incorporates all aqueous samples collected for surface scums at freshwater beaches by the NHDES Beach Program. It includes all samples positively identified as toxin producing cyanobacteria.

2.0 Health and Safety Warnings

2.1. Species of cyanobacteria produce toxins (cyanotoxins) that are known to cause both acute and chronic health effects in humans. The toxins can cause acute health effects such as skin and mucous membrane irritations upon water contact. Chronic health effects such as liver, kidney, and central nervous system damage can be caused by the ingestion of large amount of the toxins over an extended period of time.

2.2. The toxin of concern is Microcystin. Produced by more than one cyanobacteria species, Microcystin is a hepatotoxin that targets the liver, causing cirrhosis and tumor growth. The most common is Microcystin-LR. The toxins are released into the water upon cell death or lysis. All contact and ingestion of waters containing Microcystin producing cyanobacteria should be avoided.

2.3. When performing analyses for Microcystin, do not ingest Microcystin standards or cyanobacteria samples; if skin contact occurs rinse with water.

3.0 Interferences

3.1. Interferences in these analyses can occur from cross contamination.

1. Avoid cross-contamination by using new syringes and associated filters for each sample. When dispensing samples into test tubes use clean pipettes. Rinse graduated cylinders and cuvettes thoroughly with D.I. water between uses.

4.0 Equipment and Supplies

4.1. Store Microcystin test kit in refrigerator when not in use. Use all contents before the expiration date on the outside of the kit.

4.2. The following equipment and supplies are needed for Microcystin analyses:

- 10 mL disposable syringes
- 0.2 µm filter
- 5 mL plastic sample vials
- Test tube rack

- Permanent fine tip marker
- Tape
- Disposable plastic pipettes (provided in test kit)
- 5 mL sample test tubes (provided in test kit)
- 4.5 mL brown glass standard vials
- Timer or stopwatch
- 0.5 mL transfer pipette
- 1.0, 5.0, or 10.0 mL transfer pipette
- Pipette aid
- D.I water
- Wash bottles for D.I. water
- Waste container
- Safety goggles
- Disposable gloves
- Microcystin Assay Diluent (provided in test kit)
- Microcystin Substrate (provided in test kit)
- Microcystin Enzyme Conjugate (provided in test kit)
- 0.25 ppb Microcystin standard (prepared using 0.5 ppb standard)
- 0.5 ppb Microcystin standard (provided in test kit)
- 1.5 ppb Microcystin standard (prepared using 3.0 ppb standard)
- 3.0 ppb Microcystin standard (provided in test kit)
- Microcystin Stop Solution (provided in test kit)
- Perkin-Elmer Lambda 2 spectrophotometer
- 20 mm path length cuvettes

5.0 Sample Preparation

5.1. All samples must be logged in using the Limnology Center's Log-in database. Refer to the SOP for Sample Log-in (NHDES Limnology Center Laboratory Manual, Section V: Daily Procedures, page 26).

5.2. All cyanobacteria samples used in this analysis must have been positively identified as potential Microcystin producing cyanobacteria. These toxin producing cyanobacteria include Anabaena, Microcystis, Aphanizomenon, and Oscillatoria. Samples containing unknown cyanobacteria species may also be analyzed if concern exists that the unknown species could produce Microcystin.

5.3. Once a microscopic analysis determines that a scum contains greater than 50% concentration of potential Microcystin producing organisms, the following steps are performed:

1. Place unpreserved samples in the Limnology Center freezer. Indicate on the sample log-in label that the sample is being prepared for a toxicity test.

2. Indicate in the Microscopic Identification and Analysis bench book that the sample will be analyzed for toxins.

3. All samples prepared for Microcystin analysis must undergo three freeze/thaw cycles. Indicate on the sample label the number of times the sample has been frozen/thawed. *The same individual should keep track of the freeze/thaw cycles of the samples to avoid any discrepancies.*

5.4. Microcystin samples should not be stored longer than three months.

6.0 Sample Analysis – Preparation

6.1. Preparation of the samples is as follows:

1. Remove all processed samples from the freezer. Allow samples to come to room temperature.

2. Remove the Microcystin test kit from the refrigerator. Allow all sample reagents and test tubes to come to room temperature.

3. Label and prepare one 5 mL plastic sample vial per sample.

4. Thoroughly shake sample before drawing a 1 mL volume into the syringe. Remove air bubbles by pointing the syringe tip upwards and flushing air out of the syringe until some fluids are dispelled from the tip.

5. Attach 0.2 µm filter to the syringe. Filter enough sample into the 5 mL sample vial so two drops of the sample can be dispensed to a test tube.

6.2. Preparation of the standards is as follows:

1. Obtain a 0.5 mL transfer pipette and pipette aid.

2. Obtain two clean 4.5 mL brown glass standard vials.

3. Label the vials as 0.25 ppb and 1.5 ppb standards.

4. Fill a clean beaker with D.I. water.

5. Draw 0.5 mL of D.I. water into the pipette (ensuring the bottom of the meniscus is in line with the pipette mark). Transfer D.I. water to one of the 0.25 ppb or 1.5 ppb standard vials. Repeat step for other standard vial.

6. Remove all liquid from the pipette using the blow out button on the pipette aid.

7. Draw 0.5 mL of 0.5 ppb standard into the pipette (ensuring the bottom of the meniscus is in line with the pipette mark). Transfer the standard into the vial labeled 0.25 ppb.

8. Repeat step 7 using the 3.0 ppb standard to prepare the 1.5 ppb standard.

6.3. Prepare a control sample using D.I. water. *Do not filter D.I. water or standards!*

7.0 Sample Analysis – Method

7.1. Test Kit Analysis

All test kit components should be at room temperature. Organize all standards, samples (including the control sample) and reagents so that steps 2 and 3 can be performed within three minutes.

1. Label all test tubes with the appropriate standard or sample name and arrange in the test tube rack.

2. Rapidly add 5 drops of Microcystin Assay Diluent to each tube.

3. Using the disposable sample pipettes provided, immediately add two drops of control sample, standards, and lake water samples to their corresponding tubes.

4. Mix the contents of the tubes by moving the test tube holder in a circular motion for 20-30 seconds.

5. Set timer for 5 minutes and incubate tubes at room temperature.

6. Add 5 drops of Microcystin Enzyme Conjugate to each tube. Mix the contents of the tubes for 20-30 seconds as in step 4 above.

7. Set timer for 20 minutes and incubate tubes at room temperature.

8. Add 10 drops of Substrate to each tube. Mix contents of the tubes for 20-30 seconds as in step 4 above.

9. Set timer for 10 minutes and incubate tubes *in the dark* at room temperature.

Note: If a blue color does not develop in the 0.5 ppb calibration tube after incubation, the assay is invalid and should be repeated.

10. Use goggles and gloves for the next steps.

11. Obtain a 1.0, 5.0, or 10.0 mL pipette with 0.1 mL increments. Draw up the Stop Solution into the pipette. Pipette 0.7 mL of the Stop Solution into each tube. ***Stop Solution is 1.0 N Hydrochloric acid. Handle with care!***

12. Mix tubes thoroughly as in step 4 above.

7.2. Spectrophotometer Analysis

Read samples on the Perkin-Elmer Lambda 2 spectrophotometer within 30 minutes of the addition of the stop solution. Refer to Appendix A-5-1 for the parameter settings of the spectrophotometer. The process is as follows.

1. Turn spectrophotometer power on (button on top right rear).

2. Turn printer power on (button on right side rear).

3. Allow spectrophotometer to warm up approximately 5 minutes.

4. Dilute all standards and samples to 5 mL in order to fill the cuvettes. Using a 5 mL graduated cylinder, carefully pour the sample from the tube into the graduated cylinder. Dilute with D.I. water to the 5 mL mark.

5. Press the METHOD button of the spectrophotometer.

6. Screen appears:

```
SELECT METHOD >   <
```

7. Type 1 and press ENTER.

8. Screen appears:

```
METHOD 1 CONC1/MAN
<-->/PARAM/START
```

9. Press START.

10. The program is set to start at Sample #1 for each run.

11. Screen appears:

```
STD     1              [0.25]
PRESS START
```

12. Remove 20 mm cuvettes from drawer below spectrophotometer. Empty and rinse "blank" cuvette with small volume of D.I. water.

13. Fill "blank" cuvette with control sample, gently stopper and place in rear cuvette holder of spectrophotometer. ENSURE THAT CUVETTE SURFACES ARE FREE FROM MOISTURE AND FINGERPRINTS BEFORE PLACING IN SPECTROPHOTOMETER. USE KIMWIPE TO REMOVE MOISTURE AND FINGERPRINTS FROM CUVETTES.

14. Rinse sample cuvette with small volume of D.I. water. Fill to volume with 0.25 ppb Microcystin standard and place in forward cuvette holder in spectrophotometer.

15. Shut sample bay door and press START. Spectrophotometer will read absorbance of standards. It will prompt for each standard concentration in the following order: 0.25, 0.50, 1.5, and 3.0. Printer will print absorbance of each standard when completed. The printer will plot a standard curve of absorbance versus concentration.

16. Screen will appear:

```
METH 1 SAMPLE #1
PRESS START
```

17. Remove forward sample cuvette, empty and rinse with small volume of D.I. water.

18. Fill to volume with sample, place in cuvette holder and shut compartment door. Press START. The sample concentration will appear on the screen, and absorbance and concentration will print.

19. When analysis is complete, screen will read:

```
METH 1 SAMPLE #
PRESS START
```

20. **REPEAT STEPS 17 AND 18 FOR NEXT SAMPLE OR PRESS STOP TO INITIATE SHUT-DOWN PROCEDURE.**

21. Remove cuvettes from spectrophotometer, empty and rinse with D.I. water. Fill with D.I. water for storage.

22. Return clean cuvettes to case and store in drawer below spectrophotometer.

23. Remove paper from printer.

24. Shut spectrophotometer and printer OFF.

25. COVER INSTRUMENTS.

8.0 Quality Control and Quality Assurance

8.1 Duplicate samples are run at a frequency of 10%. The relative percent difference (RPD) of the duplicate samples should be ≤25% respectively. All data generated will be accepted due to the impact, and potential health risk to the public.

8.2 Blanks are analyzed at the beginning of each run of samples.

9.0 References

Microcystin Tube Kit, Envirologix Inc., Catalog No. ET 022, Revision Date 11-15-01.

NHDES Limnology Center Laboratory Manual, Section V: Daily Procedures, page 26, Revision Date 4-22-02.

APPENDIX A

Spectrophotometer Parameters for Microcystin Analysis

These settings are programmed into the Perkin-Elmer Lambda 2, based on guidance from Enviro-Logix (manufacturer of Microcystin Tube Kit) and other methods run by the Limnology Center.

1. Mode: ABS
2. Wavelength: 450 nm
3. # of Standards: 4
4. Concentration Units: C (a general unit; our concentration of ug/L was not available as a choice)
5. Standard concentrations:
   a. Std. 1= 0.25 C
   b. Std. 2= 0.5 C
   c. Std. 3= 1.5 C
   d. Std. 4= 3.0 C
6. Standards: Yes (this indicates that standards must be used at the start of each run, since the absorbance values will change)
7. Curve fit: Linear
8. Factor: 1
9. Divisor: 1
10. Response: 2 sec.
11. Lamp: VIS
12. Back correction: No
13. Samples/batch: 0
14. First sample #: 1
15. Cycles: 1
16. Cycle-Time: 0.01 min.
17. Print Data: Yes
18. Plot Standards: Yes
19. Print Standards: Yes
20. Auto Method: Yes
21. Operator ID: 0000
22. Sample ID: 0000

PLEASE NOTE: There is a parameter for VALUE of the standards. This value is replaced each time the standards are analyzed, so it is not necessary to change this value.

A-6

Beach Program Standard Operating Procedures For Water Temperature

STANDARD OPERATING PROCEDURE FOR THE COLLECTION OF WATER TEMPERATURE

Prepared by: _____ **Date:** _____
Program Coordinator

Reviewed by: _____ **Date:** _____
Program Manager

Approved by:_____ **Date:** _____
Quality Assurance Officer

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Appendix A: Laboratory Services Unit SOP for Thermometer Calibration.....4

Procedures

1.0 Scope and Application

1.1 This Standard Operating Procedure encompasses data collected from aqueous media at all freshwater, inter-tidal, and coastal beaches by the NHDES Beach Program.

2.0 Equipment and Supplies

- Thermometer
- Field Data Sheet
- Clipboard
- Waterproof pen

3.0 Instrument Calibration and Standardization

3.1 Thermometer calibration follows NHDES Laboratory Services Unit Standard Operating Procedures for Thermometer Calibration (Appendix A-6-1).

3.2 Thermometers are calibrated at 4°C and 30°C respectively.

4.0 Data Collection

1.0 Wade into the water to knee depth (60 cm). Submerse the temperature probe two inches (~5 cm) below the water's surface.

2.0 Allow temperature reading to stabilize (about 30 seconds). Look squarely at the thermometer face; record reading in the temperature column on the field data sheet.

3.0 Proceed with bacteria sample collection.

5.0 Data and Records Management

5.1 All data collected shall be recorded on the Beach Program Field Data Sheet.

5.2 Data will be stored in three ring binders and in the Beach Program Database.

6.0 Quality Control and Quality Assurance

6.1 Thermometer calibration will occur on an annual basis or more frequently if needed.

APPENDIX A

Laboratory Services Unit
Standard Operating Procedures
For
Thermometer Calibration

DES Laboratory Services Unit
Standard Operating Procedures for Thermometer Calibration

A. THERMOMETERS

The laboratory's thermometers are calibrated against an NIST traceable thermometer on a yearly basis for glass-liquid thermometers and quarterly for dial thermometers. The NIST thermometers are sent to the manufacturer or a service company for recalibration and re-certification every three years. The calibration records are kept in a bound record book. The working thermometers all have identification tags showing the thermometer name and serial number, date of calibration, and correction, if any.

1. Calibration check is performed as follows:

Calibration System: ERTCO Thermometer Calibration System, Model TCS 200-35
Solvent Bath: 50% Propylene Glycol + 50% tap water
Temperature Range: -30 to 100^{0}C
NIST Traceable thermometers: Serial #1977, -1 to 201 ^{0}C, scale divisions 0.2 ^{0}C
Serial #1157, -1 to 101 ^{0}C, scale divisions 0.1 ^{0}C
Serial #F96-146, -36 to 54 ^{0}C, scale divisions 0.2 ^{0}C

Calibration System Operation and Correction Determination:

a. a. Turn on power by pressing ON button. Wait for self-test to conclude.
b. b. Select operating temperature by first pressing SET, then use the number pad to enter the temperature. Digits on the display will move to the left. Enter a zero to advance past the decimal point.
c. c. When the display shows the desired temperature, again press SET to lock it in. The calibration bath will then heat or cool to reach the set temperature. The FLUID read-out tells you the temperature of the bath. Always use the temperature on the NIST traceable thermometer for calibration.
d. d. Insert NIST and test thermometers into the entry ports of the calibration system. Make sure the bulbs are properly immersed.
e. e. After the thermometers have reached stable readings, begin recording comparative readings. Take an initial reading, an intermediate reading after 10 minutes, and a final reading after another 10 minutes. Record all readings in the thermometer calibration bench book. Make corrections to the test thermometers based on their final readings compared to the NIST final reading. Prepare identification tags as described above and place on each thermometer. When no correction is needed, the tag lists "-0-".

To turn off calibration system, press the OFF button

A-7

Beach Program Standard Operating Procedures for Risk-Based Beach Evaluations

STANDARD OPERATING PROCEDURE FOR RISK-BASED BEACH EVALUATIONS

Prepared by: _____ **Date:** _____
Program Assistant

Reviewed by: _____ **Date:** _____
Program Coordinator

Reviewed by: _____ **Date:** _____
Program Manager

Approved by:_____ **Date:** _____
Quality Assurance Officer

N.H. DEPARTMENT OF ENVIRONMENTAL SERVICES
BEACH PROGRAM

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Procedures

1.0 Scope and Application

1.1. The Beach Program uses a risk-based ranking system to evaluate and classify the designated coastal beaches. The system was developed to rank the sampling priority at each beach, as either Tier I (high priority) or Tier II (low priority); this ranking will determine sampling frequency of each beach.

1.2. This Standard Operating Procedure (SOP) provides the Beach Program staff with guidance for completing risk-based beach evaluations.

2.0 Equipment and Supplies

2.1. The following supplies are necessary for collection of data:

1. Pencil/pen
2. Definitions (Appendix A)
3. Beach Evaluation and Classification Checklist (Appendix B)
4. DES water quality data and reports (provided by Coastal Program, Shellfish Program, Beach Program, Clean Vessel Act Program, NPDES, and 305(b) and 303(d) reports.
5. Data from the University of New Hampshire (UNH) and the National Oceanic and Atmospheric Administration (NOAA).
6. Recreational water surveys for Towns, Beach Managers and Medical Facilities.

3.0 Data Collection-Preparation

1. Obtain a copy of the Beach Evaluation and Classification Checklist for each beach to be evaluated.
2. Obtain copies of data and reports specific to each criterion and beach.

4.0 Data Collection-Method

4.1. Cover Page Checklist

1. Complete the form on the cover page as completely as possible. Access previous years' Beach Inspection data for the checklists pertaining to toilet facilities and other general information.

4.2. For each criterion in each of the three sections (Beach History, Microbial Pathogen Sources, and Beach Use), place a check next to the appropriate level of significance. The points will be awarded as follows:

1. Inconclusive: 0 point
2. Low Priority: 2 points
3. High Priority: 3 points
4. Shaded areas: 4 points

4.3. Refer to Appendix A for definitions used in the Risk-Based Beach Evaluation and Classification Form.

4.4. Risk-Based Beach Evaluation Classification Form should be completed as follows:

1. Beach History
   a. Access previous years' Beach Inspection data to determine each criterion's significance. Access information from other DES Programs, UNH, NOAA, or from municipal records if information cannot be found in the inspection data.
   b. Tally the number of checks for each level of significance and place the total points in the final row.
2. Microbial Pathogen Sources
   a. Access the Shellfish Program Sanitary Survey reports, NPDES, Port Authority, CVA, NOAA, and town information to determine each criterion's significance.
   b. Tally the number of checks for each level of significance and place the total points in the final row.
3. Beach Use
   a. Access Beach Program files and beach survey results to determine each criterion's significance.
   b. Tally the number of checks for each level of significance and place the total points in the final row.

4.5. Preliminary classifications of the beaches are determined as follows:

1. Tally the total number of checks for each level of significance and place in the respective row of the table.
2. Tally the total number of points for the preliminary classification.

3. Determine the preliminary classification.

    a. The Tier II classification range is 0 to 39 points.

    b. The Tier I classification range is 40 to 78 points.

4.6. Final considerations for beaches are determined as follows:

1. The criterion "beach importance to the local economy" will be determined by surveying the towns and/or beach managers.

2. The criterion "beach importance to public" will be initially ranked according to historical beach inspection data and knowledge of beach use. Upon collecting comments the criterion will be changed to reflect the general public opinion.

3. Tally the number of points for each level of significance and place the total points in the final row.

4. Based on beach specific information gathered determine if significant risk factors exist that should receive greater consideration. If so, explain and rank the consideration on a scale of one to five. One being the least significant and five the greatest.

5. Determine the final classification based on the preliminary classification plus the addition of the total points from the final classification and considerations.

    a. The Final Tier II classification range is 0 to 43 points.

    b. The Final Tier I classification range is 44 to 89 points.

5.0 Data and Records Management

5.1. Upon completion of evaluations, the Program Coordinator will generate a sampling schedule based on the number of beaches ranked as either Tier I or Tier II. The schedule will follow the Beach Program Tiered Monitoring Plan.

5.2. The Beach Program Coordinator will compile the risk-based beach evaluation forms, data, and reports in beach specific folders at DES headquarters.

5.3. The Beach Program Coordinator will store evaluation results electronically in beach specific spreadsheets.

APPENDIX A

Definitions for Risk-Based Beach Evaluations

The following terms, found within the Beach Evaluation and Classification Checklist, demand greater clarification.

- **Actual threat or source:** an existing structure or conduit that contributes or transports contaminants to a beach area, thus causing negative health impacts to humans.
- **Potential threat or source:** an existing structure or conduit that may contribute or transport contaminants to a beach area but sufficient data has not been collected to assess impacts on water quality.
- **CSO:** Combined Sewer Overflow
- **TMDL:** Total Maximum Daily Load
- **WWTF:** Waste Water Treatment Facility

APPENDIX B

Beach Evaluation and Classification Checklist

NHDES

Coastal Beach Evaluation and Classification Checklist

Beach Name:_____ **Town:**_____

Latitude: _____ **Longitude:** _____

Date of Evaluation:_____ **County:**_____

Responsible Authority:_____

Contact Person: _____

Address:_____

Phone:_____ **Fax:**_____ **Email:**_____

Beach Area (Physical Description)

- ☐ Sandy
- ☐ Rocky
- ☐ Other _____

Area Development

- ☐ Residential
- ☐ Commercial
- ☐ Industrial
- ☐ Other _____

Toilet Facility

- ☐ Present
- ☐ Absent

Holding Type

- ☐ Portable toilet
- ☐ Septic system
- ☐ Holding tank
- ☐ Sewer

Condition

- ☐ Excellent
- ☐ Good
- ☐ Fair
- ☐ Poor

Distance to Surface Water
(for septic systems only)

- ☐ <50 feet
- ☐ 50 to 100 feet
- ☐ >100 feet

Name:_____ **Title:**_____

Agency:_____

Address:_____

Signature:_____ **Date:**_____

Risk Based Beach Evaluation and Classification Form

Criterion	Significance					
	Inconclusive 0 points	**X**	**Low Priority 2 points**	**X**	**High Priority 3 points (unless otherwise noted)**	**X**
Beach History Rank the significance of historical data by checking the appropriate column.						
Reported health issues	No reports or Data not available		≤ 2 reports		3 or more reports per year	
Historical exceedance of bacteria standards in previous 10 years	No exceedances or Data not available		1-5 exceedances		> 5 exceedances **(4 points)**	
Historical cyanobacteria advisories	No advisories or Data not available		< 2 advisories issued		3 or more advisories issued	
Mean time for public notification	Data not available/not applicable		< 24 hours		≥ 24	
Mean number of days beach affected by advisory during bathing season	Data not available/not applicable		≤ 2 days		> 2 days	
Mean high water temperature during swim season	Data not available		< 60˚F		≥ 60˚F	
Wildlife present on beach during inspections	None present or Data not available		Present at < 50% of inspections		Present at ≥ 50% of inspections	
Beach History total points by category			*Total Low Priority points*		*Total High Priority points*	
TOTAL BEACH HISTORY POINTS						

Criterion	Significance					
	Inconclusive 0 points	**X**	**Low Priority 2 points**	**X**	**High Priority 3 points (unless otherwise noted)**	**X**
Microbial Pathogen Sources Rank the significance of possible microbial pathogen sources by checking the appropriate column.						
Average annual rainfall	Data not available		< 25 inches		≥ 25 inches	
Number of significant (> 3 inches) rainfall events in the past year	None or Data not available		1 event		2 or more events **(4 points)**	
Data available from monitoring rainfall vs. bacteria counts	No risk or Data not available		Low detected risks		Moderate or high detected risks	
Source of fecal contamination within 1 mile of beach	None or Data not available		1 or more potential sources		1 or more actual sources **(4 points)**	
Point sources: industrial waste within 1 mile of beach	No sources or Data not available		1 or more Potential sources		1 or more Actual sources **(4 points)**	
Number of CSOs within 5 miles of beach	None or Data not available		≤ 2		> 2	
Proximity of WWTF discharge to beach	None or Data not available		≥ 5 miles		< 5 miles	
Estimated number of septic systems within 1 miles of beach	None or Data not available		< 25		≥ 25	
Do town ordinances allow domestic animals on this beach during bathing season?	Data not available		No		Yes	
Marina with boat pumpout facilities within 1 mile of beach	No marina		Marina with pumpout facility		Marina without pumpout facility	

Presence of boat mooring sites within 1 mile of beach	None or Data not available		< 10 moorings present		≥ 10 moorings present **(4 points)**	
Proximity to waterbody that requires a TMDL study for bacteria in the watershed of beach	None or Data not available		> 2 miles		≤ 2 miles **(4 points)**	
Microbial Pathogen Sources total points by category			*Total Low Priority points*		*Total High Priority points*	
TOTAL MICROBIAL PATHOGEN SOURCES POINTS						

Criterion	Significance					
	Inconclusive 0 points	**X**	**Low Priority 2 points**	**X**	**High Priority 3 points (unless otherwise noted)**	**X**
Beach Use Rank the significance of beach use by checking the appropriate column.						
Mean number of days in bathing season	Data not available		< 50		≥ 50	
Mean percentage of beach goers that enter the water	Data not available		< 25%		≥ 25% **(4 points)**	
Mean number of bathers during peak recreation days (weekends/ holidays) per 50 feet of beach	Data not available		< 50		≥ 50 **(4 points)**	
Beach Use total points by category			*Total Low Priority points*		*Total High Priority points*	
TOTAL POINTS FOR BEACH USE						

Classification

Preliminary Values

Once the Beach Evaluation and Classification Checklist is complete, tally the number of checks for each table (Beach History, Microbial Pathogen Sources, Beach Use) and record the total points in the appropriate column below.

Level of Significance	Total Points
Beach History	
Microbial Pathogen Sources	
Beach Use	
FINAL TOTAL	

Preliminary Classification:

Circle One:	Low (Tier II) (0-39 points)	High (Tier I) (40-78 points)

This is the preliminary classification of the beach. To make a final classification fill out the Final Criteria table on the following page and total the checks for that table.

Final Criterion	Significance					
	Inconclusive (0 point)	**X**	**Low Priority (2 points)**	**X**	**High Priority (3 points)**	**X**
Final Considerations Rank the significance of the considerations by checking the appropriate column						
Beach importance to the local economy	N/A or not known		Not important to economy		Highly important to economy	
Results of public comment/concerns about this beach	N/A or not assessed		Beach not considered a popular area for tourists or local residents		Beach is considered a highly popular area for tourists or local residents	
Considerations total:						

Compare total number of points from above with the Preliminary Classification.

Are there other factors at this beach that need to receive greater considerations?

☐ Yes ☐ No ☐ Unknown

If yes, please provide significant factors: _____

_____

If yes, rank the significance on a scale of 1-5, one being the least significant or important to the beach; five being the most significant or important to the beach.

Circle one: 1 2 3 4 5

Add the points to the final considerations above.

Final Classification

Classification Phase	Points
Preliminary Classification	
Final Consideration	
FINAL POINTS	

Circle one: **Tier II** (0 to 43 points) **Tier I** (44 to 89 points)

Final Classification Category: _____

A-8

Beach Program Standard Operating Procedure for Beach Advisories

STANDARD OPERATING PROCEDURE

FOR BEACH ADVISORIES

Prepared by: _____ **Date:** _____
Program Coordinator

Reviewed by: _____ **Date:** _____
Program Manager

Approved by:_____ **Date:** _____
Quality Assurance Officer

N.H. DEPARTMENT OF ENVIRONMENTAL SERVICES
BEACH PROGRAM

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PROCEDURES

1.0 Purpose and Applicability

1.1 The purpose of this standard operating procedure is to develop consistency in the public beach advisory notification and posting process. The issuance and posting of a beach advisory requires a coordinated effort between the state, towns, and local beach managers. Through this effort the Beach Program will enhance public notification to better protect the public from contracting a water-borne disease.

1.2 Public beaches where water quality standards for primary recreation are exceeded require public notification that the water may not be suitable for recreation.

2.0 Definitions

2.1 The following are definitions applicable to the public beach advisory notification and posting process:

- Issue: The act of notifying the proper beach contact of a water quality violation that requires an advisory.
- Advisory: A report (sign) that provides information about beach water quality.
- Posting: The act of attaching the advisory to an object at beach access area.
- Primary Contact: The main contact person for a beach (could also be the advisory contact).
- Advisory Contact: The person notified of a beach advisory (could also be the primary contact).
- Secondary Contact: The person notified of a beach advisory if the primary or advisory contacts are unavailable.

3.0 Personnel Qualifications/Responsibilities

3.1 The following DES personnel may be responsible for issuing a beach advisory:

- DES Limnology Center Director
- DES Beach Program Coordinator

- DES Freshwater Beach Inspector

3.2 The following personnel may be responsible for posting a beach advisory:

- DES Beach Program Coordinator
- DES Beach Program Assistant
- DES Freshwater Beach Inspector
- Town Health Officer
- Beach Owner/Manager
- Advisory Contact (if different from health officer or beach owner/manager) (This information was provided to the Beach Program from towns and/or beach managers)

3.3 The following personnel may be responsible for taking bacteria or cyanobacteria samples:

- DES Beach Program Coordinator
- DES Beach Program Assistant
- DES Freshwater Beach Inspector
- Beach Program Intern
- Town Health Officer
- Beach Owner/Manager
- Advisory Contact (if different from health officer or beach owner/manager) (This information was provided to the Beach Program from towns and/or beach managers)

4.0 Procedure

4.1 Bacteria results for public beach water samples are obtained from the DES Laboratory Services Unit on a daily basis. The results may be received in report, electronic, or verbal format.

4.2 Cyanobacteria samples are received via beach inspection or complaint.

4.3 The following describes the issuance, notification, and posting procedures for bacteria advisories.

1. Review report results for exceedances of state water quality standards (88cts/100mL *E. coli* and 104cts/100mL Enterococci). Exceedances may also be communicated by laboratory personnel prior to report review.

2. Notify the Limnology Center Director, Beach Program Coordinator, or Freshwater Beach Inspector of any exceedances.

3. Obtain an Advisory Chain of Communication (Appendix A) form and record pertinent information.

4. Access the Beach Database Contacts. Find the primary and advisory contact associated with the beach.

5. Immediately contact both parties (if different) by phone and/or email. If you cannot get in touch with the primary or advisory contact, call the secondary contact. If no contact is available, leave messages and keep trying until you reach someone.

6. Notify the contact(s) of the bacteria exceedance(s) at the public beach. Verbally communicate the sample results and inform the contact(s) that hard copies of the results are being mailed or can be faxed.

7. Record pertinent information of the Advisory Chain of Communication Form.

8. Inform the contact(s) that a bacteria advisory is being issued for the public beach. Briefly describe the content and means of the bacteria advisory.

9. If the contact(s) has a DES Beach Program Bacteria Advisory sign, instruct the individual to post the sign at visible access points to the beach area and/or lifeguard stands. If the contact(s) does not have a sign, fax the sign and instruct them to copy the sign on a bright yellow piece of paper. Or, bring the sign to the beach and post.

10. If the primary, advisory, or secondary contacts cannot be reached to issue the advisory on that day, Beach Program personnel must go to the beach to post the advisory.

4.4 The following describes the issuance, notification, and posting procedures for cyanobacteria advisories.

1. Analyze cyanobacteria scum samples to identify a dominant toxin producing cyanobacteria species.

2. Notify the Limnology Center Director or Beach Program Coordinator of the toxin producing cyanobacteria scum.

3. Obtain an Advisory Chain of Communication Form (Appendix A) and record pertinent information.

4. Access the Beach Database Contacts. Find the primary and advisory contact associated with the beach.

5. Immediately contact both parties (if different) by phone and/or email. If you cannot get in touch with the primary or advisory contact, call the secondary contact. If no contact is available, leave messages and keep trying until you reach someone.

6. Record pertinent information on the Advisory Chain of Communication Form.

7. Notify the contact(s) that there is a toxin producing cyanobacteria scum at the beach. Verbally communicate the species identified and provide information on cyanobacteria.

8. Inform the contact(s) that a cyanobacteria advisory is being issued for the public beach. Briefly describe the content and means of the cyanobacteria advisory.

9. If the contact(s) has a DES Beach Program Cyanobacteria Advisory sign, instruct the individual to post the sign at visible access points to the beach area and/or lifeguard stands. Or, bring the sign to the beach and post.

10. If the primary, advisory, or secondary contacts cannot be reached to issue the advisory on that day, Beach Program personnel must go to the beach to post the advisory.

4.5 Coastal beach advisories must be updated on the Earth 911 website. Refer to..\..\Website\Earth 911\Data Entry Instructions.doc for instructions on how to update the website.

4.6 Coastal and freshwater beach advisories must be updated on the DES Beach Program web page. The Beach Program Coordinator or Program Assistant is responsible for updating current beach advisories.

4.7 A Beach Advisory Chain of Communication Form must be completed for each advisory issued.

4.8 Along with the issuance and posting of a bacteria advisory, immediate re-sampling of the beach occurs within 24 hours. Sampling must follow the

Beach Program's Standard Operating Procedures (SOPs) for Bacteria Sampling.

4.9 Along with the issuance and posting of a cyanobacteria advisory, re-sampling should occur periodically until the scum has dissipated. Sampling must follow the Beach Program's SOPs for Algal Collection/Identification.

4.10 The following describes the re-sample and advisory removal procedure for bacteria and cyanobacteria advisories:

1. Re-sampling should occur immediately (within 24 hours) after notification of bacteria standard exceedances. Or, periodically until the cyanobacteria scum dissipates.

2. If Program personnel are available to re-sample the beach they should do so.

3. Record the data of re-sample on the Beach Advisory Chain of Communication Form.

4. If Program personnel are unavailable to re-sample the beach, discuss with the contact(s) if they can re-sample and transport the samples to the DES Laboratory.

5. Provide the contact(s) with the Beach Program's SOP for Bacteria Sampling or Cyanobacteria sample collection (email) or verbally communicate the sampling protocol if they are unaware of the procedure.

6. After the bacteria re-samples are analyzed by the lab (within 24 hours), check sample results for continued exceedance of standards.

7. Analyze cyanobacteria re-samples in the Limnology Center.

8. If bacteria sample results continue to exceed state standards, or if a dominant toxin producing cyanobacteria species still exists, notify the beach contact(s) that the beach advisory needs to remain posted.

9. Re-sample the beach immediately (Follow procedure above).

10. If bacteria sample results are below state standards or a toxin producing cyanobacteria species is not dominant, notify the beach contact(s) that the beach advisory may be removed. If the beach

contacts are unavailable the beach advisory may be removed by Program personnel.

11. Complete the associated Advisory Chain of Communication Form and store in appropriate folder.

4.11 Coastal beach advisory removal must be updated on the Earth 911 website. Follow instructions referenced above.

4.12 Coastal and freshwater beach advisory removal must be updated on the DES Beach Program web page. The DES Beach Program Coordinator or the DES Beach Program Assistant will be responsible for maintaining the Beach Advisory web page.

4.13 The Beach Advisory Chain of Communication Form must be completed when the advisory is removed.

5.0 Criteria

5.1 According to RSA 485 A:8, the State standard at freshwater beaches for *E. coli* in one sample is no more than 88 counts/100 mL of water, or no more than a geometric mean of 47 counts/100 mL of water in 3 samples over a sixty day period. The State standard at coastal beaches for Enterococci in one sample is 104 counts/100 mL of water, or no more than a geometric mean of 35 counts/100 mL of water in 3 samples over a sixty day period.

5.1.1 DES posts beach advisories when one sample (there are two to three samples collected per beach) exceeds the State standards by greater than 70 counts or when two samples (collected on the same day) exceed the standards.

5.2 According to the Generic Beach Program Quality Assurance Project Plan (QAPP), cyanobacteria advisories are posted when a dominant toxin producing cyanobacteria population is identified. Dominance is considered 50% or more of the cell count.

6.0 Data and Records Management

6.1 All data generated from the Laboratory Services unit is stored as hard copies in beach specific folders, and electronically in the Laboratory's database and the Environmental Monitoring Database's (EMD) Beach Module.

6.2 Advisory Chain of Communication forms are stored as hard copies in the Beach Programs files, and electronically in the Beach Program's files, and the EMD's Beach Module.

7.0 Quality Assurance and Quality Control

7.1 Quality assurance and quality control measures for the analysis of bacteria samples follow the steps outlined in the Laboratory Services Unit's Quality Systems Manual. The procedures followed are Enterococci Standard Method 9230C and *E. coli* Standard Method 9213D.

7.2 All data generated from the Laboratory Services Unit is validated according to their Standard Operating Procedure for Data Validation and Verification.

8.0 References

State of New Hampshire, Revised Statutes Annotated, *Title L Water Management and Protection, Chapter 485-A Water Pollution and Waste Disposal,*1998.

NHDES Beach Program, *Earth 911 Data Entry Instructions,*2003.

NHDES Beach Program Standard Operating Procedures, *Bacteria Sampling,* 2003.

NHDES Laboratory Services Unit Standard Operating Procedure, *Data Validation and Verification,* 2003.

APPENDIX A

Advisory Chain of Communication Form

Beach Advisory Chain of Communication Form

Beach Name:_____ **Town:**_____

Sample Results:_____

Date Sample Results Received:_____

Results Received By:_____

Course of Action:_____

Contact Name:_____ **Phone:**_____

Email:_____ **Fax:**_____

Date Called:_____ **By:**_____

Notes:

Date Emailed:_____ **By:**_____

Notes:

Date Advisory Posted:_____ **By:**_____

Notes:

Date Re-sampled:_____ **By:**_____

Notes:

Date Website Posted:_____ **By:**_____

Date Advisory Removed:_____ **By:**_____

A-9

E.coli Standard Method 9213D

==========

Approved by:

_____	_____	_____
Laboratory Director	Section Supervisor	QA Officer

==========

REFERENCES:

1. Test Methods for Escherichia coli and Enterococci In Water By The Membrane Filter Procedure, EPA 600/4-85/076, Environmental Monitoring and Support Lab, Cincinnati, OH 45268.

2. .Standard Methods for Examination of Water and Wastewater, American Public Health Association, 19th Edition, 1995, Method 9213D.3, p 9-28.

3. State of Maine Procedure for Escherichia coli by mTEC, Augusta, ME.

SAMPLING METHODOLOGY

1. Preservative: Storage at 2-4°C, 10% sodium thiosulfate if needed to inactivate chlorine.

2. Holding time: 8 hours after sampling for NPDES and other compliance samples, will accept samples up to 30 hours old for other types of monitoring.

3. Required volume: Minimum of 100 mL is best, we do accept smaller amounts if unable to get more

4. Container type: 8 oz. sterile screw cap plastic containers or 450 mL sterile sample jugs, or chlorinated samples in 4 oz. plastic bottles with sodium thiosulfate added before sterilization.

SUMMARY:

Escherichia coli (E. coli) is a member of the fecal coliform group and it is a good indicator of fecal contamination in water. This method analyzes water for the presence of E. coli. Results are obtained in 24 hours. The media is mTEC and the confirmation is a 20 minute Urease Test.

A. APPARATUS AND MATERIALS:

1. Autoclave

2. Vacuum Pump

3. Filter System - Funnels, Manifolds, Waste Vessel

4. UV Light Box

5. Petri Dishes, 50 x 9 mm

6. Filter Membranes 0.45 □m pore, 0.47 mm diameter

7. Buffered water in 2 liter jugs - Section 10.36g for prep.

8. Pipettes for Dilution - Disposable sterile 1 and 10 mL.

9. pH meter with flat surface probe.

10. Hot Plate (Stirrer)

11. Incubators at 35.0^{o}C and 44.5^{o}C

12. Burner and forceps.

13. Sterile absorbent petri dish pads to fit 50 x 9 mm dishes.

14. Light microscope.

15. Minipet for dispensing media.

B. MEDIA AND REAGENTS:

1. mTEC media:

a. To prepare 500 mL (100 plates):

1) 22.65 g mTEC Agar media dissolved into 500 mL of DI water.

2) Heat with stirrer on hot plate to dissolve completely.

3) Sterilize in autoclave for 15 minutes at 121°C and 15 psi.

4) Dispense 4-5 mL of hot media into sterile 50x9 mm petri plates.

b. Store in refrigerator at 1-5°C in plastic bag in closed box for up to 3 months.

c. Check one plate for pH - 7.3+/-0.2. Record results in media log.

d. A positive, negative and sterility check should be done for each batch. Positive is E. coli, negative is Ps. aeruginosa. Incubate controls as you would a sample plate. Record results in media log.

2. Urea substrate:

a. To prepare 100 mL:

1) Add 2.0 g of Urea and 0.01 g of Phenol Red to 100 mL DI water.

2) Stir on magnetic stirrer until dissolved. Phenol Red dissolves slowly.

b. Test pH - it should be between 3.0 and 4.0 Record pH in media log.

c. The substrate should be straw colored.

d. Label with pH, initials, and lot number (date of prep.). Record date removed from freezer.

e Store in the refrigerator for up to one week. It may be frozen for up to 6 months. Thaw and store in refrigerator for up to one week.

C. ANALYSIS:

1. Filtration procedure: See 10.43b Sec. G Total Coliform by Membrane Filtration.

2. UsemMTEC in place of m-Endo.

3. Incubate plates at 35.0 +/- 0.5^{o}C for 2 hours. Put in incubator at 44.5 +/- 0.2^{o}C for 22 +/- 2 hours.

4. Check plates for growth and record the negative plates in the log book. Suspected E. coli colonies will be yellow to yellow-brown. Plates with suspected E. coli colonies should be lined up on the bench for confirmation.

5. Remove the cover and place a sterile absorbent pad in the cover.

6. Add 1.5 to 2 mL of Urea substrate to the pad and aseptically transfer the membrane to.the pad. Make sure the membrane is placed without any air bubbles.

7. Wait 15-20 minutes and look for yellow to yellow-brown colonies. These are the E. coli colonies. Negative colonies will be purple or gray.

8. Use a microscope and light source to read the plates.

D. CALCULATIONS:

1. The ideal range for counting is 20-80 colonies.

2. Samples may need to be diluted to stay within counting range.

3. Record the results and do the necessary calculation for diluted samples.

counts x dilution factor = counts/100 mL

4. If no sample results are within the 20-80 ideal counting range use the following formula:

(Σ colonies / Σ volumes used for all dilutions) x 100 = counts /100 mL

E. QUALITY CONTROL:

1. See Section 10.43b Total Coliform by Membrane Filtration - L. QUALITY CONTROL.

2. Plates should be autoclaved in biohazard bags for at least 65 mins. after use.

3. Buffered rinse water blanks are run at the beginning and end of each filtering run. Resamples are requested if blanks are contaminated.

4. Duplicates are run at least every 10 samples.

A-10

Enterococci Standard Method 9230C

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Approved by:

_____	_____	_____
Laboratory Director	Section Supervisor	QA Officer

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REFERENCES:

1. State of Maine procedure for Enterococci, Augusta, ME.

2. Test Methods for Escherichia coli and Enterococci In Water By The Membrane Filter Procedure, EPA 600/4-85/076, Environmental Monitoring and Support Lab, Cincinnati, OH 45268.

3. Standard Methods for Examination of Water and Wastewater, American Public Health Association. 19th Edition, 1995, Method 9230C. 2 and 3, p, 9-72 and 9-73.

SUMMARY:

Enterococci are a group of bacteria that are found in the waste of warm-blooded animals including man. The group includes Enterococcus faecalis, Enterococcus faecium, Enterococcus avium and Enterococcus gallinarum. Enterococci are considered good indicators of fecal contamination in marine and fresh water bathing beaches.

This procedure is intended for the analysis of fresh, marine, and wastewater for enterococci. The result of the membrane filter test is obtained in 48 hours and is confirmed by an Esculin Iron Agar test that takes 20 minutes.

SAMPLING METHODOLOGY

1. Preservative: Storage at less than 10°C, 10% sodium thiosulfate if needed to inactivate chlorine.

2. Holding time: 8 hours after sampling (6 hours maximum holding time for effluent waters).

3. Required volume: Minimum of 100 mL is best, we do accept smaller amounts if unable to get more

4. Container type: 8 oz. sterile screw cap plastic containers or 450 mL sterile sample jugs, or chlorinated samples in 4 oz. plastic bottles with sodium thiosulfate added before sterilization.

A. HEALTH AND SAFETY

Anyone following this method must be trained in the correct handling of the materials, and performance of the techniques necessary. Individuals must be familiar with the appropriate material safety data sheets (MSDS). Refer to DES Lab Safety SOP Sec 09.01 for specific details as well as General Microbiology Instructions 10.36a.

B. APPARATUS AND MATERIALS:

1. Autoclave

2. Vacuum pump

3. Filter System - Funnels, Manifolds, Waste Vessel

4. UV light box

5. Petri dishes

6. Filter membranes 0.45 m pore, 0.47 mm diameter.

7. Buffered water in 2 liter and 0.5 L plastic jugs - Section 10.36q.

8. Pipettes for dilution - Disposable sterile 1 mL and 10 mL.

9. pH meter.

10. Hot plate (Stirrer)

11. Incubator at 41°C +/- 0.5.

12. Burner and Forceps

13. Microscope

14. Minipet

C. MEDIA

1. mE MEDIA:

a. To prepare 500 mL (Approximately 100 plates)

mE Agar Media	35.6 g
DI Water	500 mL
Nalidixic Acid	0.12 g
Triphenyl Tetrazolium Chloride (TTC)	0.075 g or 7.5 mL of a 1% solution

Note: TTC is a poisonous substance. Use gloves when handling.

b. Dissolve the mE Media in 500 mL of DI water.

c. Heat with stirrer on hot plate to dissolve completely.

d. Sterilize in the autoclave at 121°C, 15 psi for 15 minutes.

e. Mix Nalidixic Acid in 2.5 mL of DI water and add 0.1 mL of 0.2N NaOH to dissolve it and add to media.

f. Add TTC directly to media. Swirl to mix.

g. Dispense 4-5 mL with sterile minipet pipettor into 50x9 mm Petri dishes.

h. When media cools, store plates in plastic containers in refrigerator. Mark with lot number, expiration date and initials. Store for up to 1 month.

i. Record in micro. Media Log Book.

j. Use one plate for pH and one for sterility. The positive control used is Enterococcus faecalis and the negative is E. coli. Incubate positive, negative and sterility as you would a sample plate. pH should be 7.1 +/- 0.2. Record results in micro. Media Log Book

2. Esculin Iron Agar (EIA)

a. To Prepare 100 mL (approx. 20 plates):

EIA Agar	1.65 g
DI Water	100 mL

b. Add EIA Agar to DI water. Heat and stir until dissolved.

c. Autoclave covered at 121 C for 15 minutes.

d. While hot dispense 4-5 mL into 50x9 mm petri dishes and store as in mE Media (up to 1 month).

e. Enterococcus positive and negative controls and sterility are the same as mE mMedia. Set up membrane filter plates with E. faecalis and E. coli on mE and incubate controls at 41.0+/-0.5°C for at least 18 hours. Use these controls to test EIA media. Place filter on EIA and look for black spots after 20 minutes at 41.0+/-0.5°C.

f. pH = 7.1 +/- 0.2.

3. Purchased mEI media

D. ANALYSIS:

1. Filtration Procedure: See 10.43b Total Coliform by Membrane Filtration G.

2. Use the mE or mEI media in place of m-Endo and the temperature for incubation is 41.0+/-0.5^{o}C.

3. Incubate the mE plates for 48+/- 3 hours. Incubate the mEI plates for 24+/- 2 hours

4. Confirmation for mE:

   a. Check mE plates for growth. Those without growth can be recorded and discarded.

   b. The membranes with growth must be transferred aseptically to the EIA Agar and incubated at 41.0+/-0.5^{o}C for 20 minutes. It is not necessary to invert the plate for this confirmation step.

   c. Count and record the number of colonies on the agar with blackish brown spots directly underneath them on the filter. These are the enterococci colonies. You can roll back the filter to count the spots.

   d. Report any abnormalities that may interfere with the counts.

5. No EIA confirmation step for mEI plates.

   a. Count colonies with blue halos regardless of colony color.

6. Verification for mE or mEI:

   a. Verify positives once per month during the sampling period.

   b. Choose ten enterococci colonies – with blue halos for MEI or black on EIA.

   c. Inoculate brain heart infusion broth (BHIB) and agar slant (BHIA) for each colony. Incubate BHIB at 35+/-0.5 ^{o}C for 24 hours and BHIA slant for 48 hours.

   d. From BHIB at 24 hours, inoculate:

      1) bile esculin azide agar (BEA) and incubate at 35.0+/-0.5 ^{o}C for 48 hours,
      2) BHIB and incubate at 45+/- 0.5 ^{o}C for 48hours,
      3) BHIB with 6.5% NaCl and incubate at 35+/-0.5 ^{o}C for 48hours.

   e. From BHIA slant at 48hours, do a gram stain.

7. Verification Results:

   a. BEA – black is positive

b. BHIB 45.0 ^{o}C – growth is positive

c. BHIB w/ NaCl - growth is positive

d. Gram stain – gram positive cocci

If all conditions are met, you have enterococci.

8. Samples may need to be diluted if counts are suspected to be high or there is too much debris to read the plate.

E. CALCULATIONS:

1. The ideal counting range is 20-60 colonies. Report the dilution that gives the best counting range.

2. Multiply the filter count of confirmed colonies by the dilution factor and report the results as counts /100 mL.

3. If there are acceptable counts on replicate plates, carry counts independently to the final reporting units, then calculate the mean of those counts to obtain the final reportable value.

4. If more than one dilution of a sample falls in the acceptable count range, independently carry counts to the final reporting units then average for the final reportable value

5. If no sample results are within the 20-60 ideal counting range use the following formula:

(Σ colonies / Σ volumes used for all dilutions) x 100 = counts /100 mL

Round result to the same number of significant figures as the smallest filter count.

6. If the total 100 mL sample volume was filtered in two or four separate volumes (ie two 50 mL filtrations/four 25 mL filtrations) due to high sediment content, the counts from all two/four plates should be added together to obtain the final count/100 mL.

Example: two 50 mL volumes filtered

50 colonies on one plate
<u>+ 60 colonies on the other plate</u>

110 colonies total for the 100 mL volume.

7. All results are to be reviewed by the department supervisor or designee before data is released from the lab.

8. The data is to be reviewed and compared to the results in the log book by the dept. supervisor or designee to ensure correct entry of data. Any discrepancies are to be reported immediately to the dept. supervisor for corrective action

F QUALITY CONTROL:

1. See Section 10.43b Total Coliform by Membrane Filtration L. QUALITY CONTROL.

2. Autoclave all plates and other contaminated materials for 65 minutes.

3. Blanks - Sterile buffered rinse water is processed as a sample once every 10 samples and at the beginning and end of every sample run to ensure sterility of rinse water, funnels, and filters. If blanks are contaminated resamples are requested

4. Duplicates are run at least every 10 samples.

G. POLLUTION PREVENTION AND WASTE MANAGEMENT

The NH DES Laboratory tries to reduce or eliminate sources of pollution from analytical activities as much as possible. Hazardous wastes from sample analysis are stored in properly marked containers and disposed according to state and federal regulation. Staff are trained in the proper handling and management of waste as it relates to one's work area. Biological wastes are disposed of according to Sec 10.36a General Microbiology Instructions, part B. Disposal of Contaminated Materials.

A-11

Total Coliform By Membrane Filtration

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Approved by:

_____ _____ _____

Laboratory Director Section Supervisor QA Officer

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REFERENCES:

1. Standard Methods For The Examination of Water and Wastewater, American Public Health Association, 18th edition, 1992, p 9-54 to 9-58.

2. Microbiological Methods For Monitoring The Environment, Environmental Monitoring and Support Laboratory, Office of Research & Development, U.S.E.P.A., Cincinnati, 1978, 108-115, 124-132, 135-139.

3. Water Microbiology, Laboratory and Field Procedures, Millipore Corp; Bedford, MA, 1986, 1-32.

A. BACKGROUND INFORMATION:

Total coliform organisms are defined as any gram negative, non-spore forming, aerobic or facultative anaerobic bacilli able to ferment lactose with the production of acid and gas at 35°C (+/-0.5) within 24 to 48 hours. The coliform group includes four genera: Escherichia, Enterobacter, Klebsiella and Citrobacter. Coliforms are widely distributed in nature, all except Escherichia can be found as free-living saphrophytes in the environment, and all can be of intestinal origin. Coliform organisms are almost always present in water containing enteric pathogens. As coliforms are easy to isolate, are present in larger numbers and usually survive longer in an aquatic environment than enteric pathogens they are a useful indicator of fecal contamination and the possible presence of enteric bacteria, viruses and parasites. Organisms that cause typhoid fever, dysentery, cholera, giardiasis, hepatitis and other waterborne illnesses are difficult to isolate and identify from a water sample. It is therefore important to utilize an indicator organism, such as coliforms, to rapidly determine the possible presence of these pathogens and the sanitary quality of the water. Total coliform is the best available primary indicator of bacteriological quality for potable water distribution systems, public water supplies, and shellfish waters.

B. PRINCIPLE:

An appropriate volume of sample water, or its dilution, is passed through a membrane filter composed of cellulose esters of known pore size. The filter is then placed on the appropriate media. In the single stage procedure, place the filter directly onto mEndo agar. In the two-step enrichment procedure, place the filter onto a lauryl tryptose saturated pad for 1.5 to 2 hours and then place the filter onto mEndo agar. Incubate the plates at 35°C for 24 hours ±2 hours. Any bacteria trapped on the filter surface grow and produce distinct colonies visible macroscopically and/or microscopically. Coliforms ferment lactose present in the mEndo medium producing an acid aldehyde complex which in turn combines with the basic fuschin dye resulting in a green-gold metallic sheen. Sheen colonies are counted under low magnification and confirmed as total coliforms using appropriate media. The number of total coliforms is reported per 100 mL of original sample.

C. USE:

Membrane filtration is used to test water for total coliform.

D. SAMPLE REQUIREMENTS:

1. Preservative: storage at less than 10°C / sodium thiosulfate for chlorinated samples.

2. Holding Time: 30 hours from time of collection for drinking water or 8 hours from time of collection for effluent. Pool samples should be processed within 8 hours but will be accepted up to 30 hours.

3. Required Volume: minimum of 100 mL, there should be sufficient air space in the container to allow for adequate mixing.

4. Container:

a. Sterile 450 mL jugs with screw caps.

b. Sterile 4 oz bottles preserved with sodium thiosulfate.

E. HEALTH AND SAFETY

Anyone following this method must be trained in the correct handling of the materials, and performance of the techniques necessary. Individuals must be familiar with the appropriate material safety data sheets (MSDS). Refer to DES Lab Safety SOP Sec 09.01 for specific details as well as General Microbiology Instructions 10.36a. The following safety procedures are especially important:

1. All plates are placed in appropriate biohazard bags to be autoclaved before disposal.

2. All pipets, plastic inoculating loops and needles, wooden applicator sticks and swabs are to be immersed in a bleach solution for disinfection and then placed in biohazard bags to be autoclaved before disposal.

3. All fermentation tubes are to be autoclaved prior to disposal.

F. EQUIPMENT & MATERIALS:

1. Incubator, 35 C+/-0.5. Thermometer should be checked against an NIST certified thermometer.

2. Binocular microscope with a magnification of 10 to 25 x and a daylight type fluorescent lamp angled to give maximum sheen appearance.

3. Hand Tally.

4. Vacuum pump and filter flask, with appropriate tubing.

Note: a safety trap flask should be placed between the filter flask and the vacuum pump.

5. Filter manifolds.

6. Funnels.

7. UV light boxes for funnel sterilization

8. Forceps with smooth tips.

9. Bunsen burner.

10. Sterile, disposable TD bacteriological or Mohr pipets of appropriate size (1.1 mL and 10 mL).

11. Sterile, disposable petri dishes with tight fitting lids, 50x9 mm.

12. Dilution bottles, marked at 99 mL volume, with screw caps.

13. Sterile prepackaged membrane filters, white, grid marked, 47 mm in diameter with 0.45 m +/- 0.02 m pore size.

14. Disposable, sterile wooden applicator sticks, plastic loops, or sterilized swabs.

15. Ethanol, 95%, for plate prep. Use reagent alcohol for flaming forceps.

16. Disinfectant, a 10% solution of bleach.

17. Sterile absorbent petri pads.

G. MEDIA:

1. m-Endo Agar plates - see procedure #10.36n.

2. Lauryl Tryptose Broth, 10 mL tubes - see procedure #10.36k.

3. Brilliant Green Bile Broth, 2%, 10 mL tubes - see procedure #10.36f.

4. Sterile buffered rinse water - see procedure #10.36q.

5. Sterile buffered dilution water in dilution bottles, 99 mL+/-2 mL, see procedure #10.36q.

6. EC-MUG broth, 10 mL tubes. See procedure 10_36g.

H. FILTRATION PROCEDURE:

1. Place autoclaved filter funnels in the UV cabinet and expose to UV light for at least 2 minutes before and after use.

2. Wipe bench top with disinfectant.

3. Remove the appropriate number of media plates from the walk-in cooler.

4. Remove a bottle of sterile, buffered rinse water from the walk-in cooler.

5. Open a 0.45 m filter packet and expose about one half of the filter by folding back the wrappings. At no time during this step should the filter be contaminated by touch, if this occurs discard the filter and open a fresh one.

6. Sterilize forceps by dipping the tips in reagent alcohol and flaming them with a Bunsen burner. Allow flame to extinguish.

7. Using sterilized forceps, remove the membrane filter from its wrapping by gently grasping the edge of the filter, and place on the porous plate of the filter manifold.

8. Place the sterilized, magnetic funnel over the filter.

9. Repeat steps 5-8 for each sample to be done.

10. Place sample bottles in front of the filter manifolds, one sample per station.

11. Place media plates in front of each station, label the bottom of the plate with appropriate sample number. Use mEndo plates for drinking water and use the 2-step enrichment procedure for effluent samples, as follows:

a. Using sterile forceps, place a sterile absorbent pad in a sterile petri dish.

b. Pipet 1.8-2.0 mL of lauryl tryptose broth onto the pad to saturate it. Pour off excess broth.

Note: at the beginning and end of each filtering series a buffered rinse water blank is run. Label that plate: BUF H2O, time of filtration analyst initials and date.

12. Shake sample bottle vigorously about 25 times to thoroughly mix.

13. Pour sample into the funnel until the 100 mL mark is reached.

14. When all samples are poured, turn on vacuum pump. Turn the stopcock below each of the funnels so that it is at a 90 degree angle to the bench.

15. Allow the sample to be drawn through the filter membrane and into the waste flask.

Note: be sure the waste flask is emptied often.

16. Once the entire sample has been filtered, rinse the funnels with three rinses of 20-30 mL of sterile Buffered Rinse Water.

17. Allow funnels to drain completely.

18. Turn stopcock below each funnel so that it is horizontal to the bench to prevent back flow from the pump.

19. Turn off vacuum pump.

20. Place funnels in UV cabinet and expose to UV light for at least two to three minutes to achieve sterilization.

21. Flame forceps and aseptically remove filter from the porous plate, and place grid side up on the agar. Reseat the membrane if air bubbles are trapped under it. Invert mEndo plates and incubate upside down at 35+/-0.5 ^{o}C for 24.

a. For lauryl enrichment plates: Place filter onto a sterile absorbent pad that has been moistened with 1.5 to 2 mL of lauryl tryptose broth. Incubate without inverting for 1.5 to 2 hours at 35+/- 0.5 ^{o}C. Then transfer the

filter onto mEndo medium. Reseat filter if bubbles are observed. Invert the plate now and continue incubation to completion at 24 hours +/-2 hours at 35+/- 0.5 °C.

22. Dilutions of any samples are to be prepared with sterile buffered water and sterile pipets. Add sterile, buffered rinse water to funnel before doing dilutions of 10 mL or less.

I. COUNTING PROCEDURE:

1. Remove plates from the incubation after 24+/- 2 hours at 35°C +/- 0.5 Fill in appropriate data in membrane filter log book.

2. Using a binocular, wide-field dissecting scope, focus scope and light source to give maximum sheen discernment (magnification of 10-25 x).

3. Remove the cover and count all the colonies on the membrane filter which exhibit a green metallic sheen and record that number in the log book as TC

4. Colonies that lack sheen will vary in size and color and may appear as colorless, pink, white or red. Record these non-coliform colonies if they are greater than 200.

5. Growth on the plates should not exceed 200 colonies of all types. The optimum counting range for total coliform is 20-80 colonies per plate, due to possible adverse effects of colony crowding on sheen development and to assure statistically valid data these minimum/maximum level indicator organisms should be adhered to.

6. If a sample has confluent growth (colonies that are not discrete and run together, or a blanket of growth) a resample should be obtained and run diluted to achieve an accurate count.

J. VERIFICATION OF TOTAL COLIFORMS:

NOTE: EC_MUG is inoculated at the same time to check specifically for E. coli.

1. Plates with suspected total coliforms should be swabbed and the swab used to inoculate lauryl tryptose broth (LTB), EC-MUG, and brilliant green bile (BGB) broths. Inoculate BGB tubes last to avoid possible toxic effects from carry-over.

2. Incubate LTB and BGB at 35.0°C +/- 0.5 and EC-MUG in a water bath at 44.5°C +/- 0.2.

3. Examine LTB and BGB tubes for the production of gas at the end of the 24 hour incubation period, indicated by the presence of bubbles or an air space in the inverted collection tube. Examine EC-MUG for fluorescence.

4. Lauryl tryptose and BGB tubes having no gas production should be re-incubated at 35.0°C +/- 0.5 for an additional 24+/- 2 hours. EC-MUG tubes are incubated for 24 hours only.

5. If only the LTB tubes have displayed gas production at the end of 24-48 hours the BGB tubes should be reinoculated from the Lauryl Tryptose tubes and reincubated at 35+/- 0.5°C for an additional 24-48 hours.

6. The reactions of the Lauryl Tryptose tubes should be recorded under presumptive test as (+) for gas production and (-) for no gas production.

7. The reactions of the brilliant green bile broth tubes should be recorded under confirmed test as (+) for gas production and (-) for no gas production.

8. Record results of EC-MUG as fluorescence = E. coli. Growth and gas with no fluorescence can be considered positive for fecal coliform.

9. Results cannot be released until the confirmed test has been completed.

10. Calculation of final results - multiply the actual TC filter count by the dilution factor (when applicable).

a. If no sample results are within the 20-80 ideal counting range use the following formula:

$$(\Sigma \text{ colonies} / \Sigma \text{ volumes used for all dilutions}) \times 100 = \text{counts} / 100 \text{ mL}$$

Round to the number of significant figures in the original plate count.

EXCEPTION- Verify up to 5 separate colonies when doing effluents that require actual total coliform counts.

K. DATA HANDLING

1. Privates:

Plates with non-coliform bacteria counts of greater than 200 will be reported in the log and computer as >200 NC. Total coliform counts will be recorded in logbook and verified. They will be entered in the computer as either present or absent for total coliform and E. coli.

2. Communities:

Samples are recorded as either present or absent for total and E. coli. If a sample has >200 non-coliforms and 0 totals a new sample is requested to be done by an alternate method such as the MMO-MUG analysis.

3. Reviewing data

a. Data are reviewed and compared to the results in the logbook to ensure accurate data entry. Any discrepancies are to be reported immediately to the department supervisor for corrective action.

b. All data entries on private letters are to be reviewed and compared to the results in the logbook by the department supervisor or designee to ensure correct entry of data. Any discrepancies are to be reported immediately to the dept. supervisor for corrective action.

L. LIMITATIONS:

1. High turbidity caused by suspended solids or algae may prevent filtration. Smaller replicate volumes of the sample may be filtered if bacteria counts are known to be high.

2. Samples of high turbidity and low bacteria counts are not applicable to the membrane filtration method. A multiple tube fermentation (MTF) technique is the method of choice in this case.

3. Community and non-community drinking water samples must be analyzed within 30 hours of collection.

M. QUALITY CONTROL:

1. Media- See media preparation procedures, all Q.C. results are recorded in the media log.

2. Blanks- Sterile buffered rinse water is processed as a sample at the beginning and end of every sample run, to insure sterility of rinse water, funnels, media and filters. If blanks are contaminated, resamples are requested.

3. Precision: one sample is run in duplicate every 10 samples when adequate sample volumes allow.

4. Accuracy:

a. New analysts should be tested until they can duplicate the count of other analysis within 10% on the same membrane filter.

b. Analysts should be able to duplicate their own counts on the same membrane within 5%.

c. On a monthly basis analysts should repeat each others counts or their own within 10% and 5% respectively. This data should be recorded in the Misc. Q.C. log under comparative counts.

5. Equipment:

a. In addition to exposing the funnels to U.V. light for two (2) minutes before and after filtration, the funnels are washed and autoclaved daily to ensure cleanliness and sterility.

1) Wash in dishwasher

2) Autoclave 15 minutes at 121°C (15 psi pressure) on dry cycle.

b. Autoclaves - see procedure #10.36a.

c. Incubators - see procedure #10.36a.

N. POLLUTION PREVENTION AND WASTE MANAGEMENT

The NH DES Laboratory tries to reduce or eliminate sources of pollution from analytical activities as much as possible. Hazardous wastes from sample analysis are stored in properly marked containers and disposed according to state and federal regulation. Staff are trained in the proper handling and management of waste as it relates to one's work area. Biological wastes are disposed of according to Sec 10.36a General Microbiology Instructions, part B. Disposal of Contaminated Materials

Appendix B

State of New Hampshire
Revised Statutes

TITLE L
WATER MANAGEMENT AND PROTECTION

CHAPTER 485-A
WATER POLLUTION AND WASTE DISPOSAL

Classification of Waters

Section 485-A:8

485-A:8 Standards for Classification of Surface Waters of the State. – It shall be the overall goal that all surface waters attain and maintain specified standards of water quality to achieve the purposes of the legislative classification. For purposes of classification there shall be 2 classes or grades of surface waters as follows:

I. Class A waters shall be of the highest quality and shall contain not more than either a geometric mean based on at least 3 samples obtained over a 60-day period of 47 Escherichia coli per 100 milliliters, or greater than 153 Escherichia coli per 100 milliliters in any one sample; and for designated beach areas shall contain not more than a geometric mean based on at least 3 samples obtained over a 60-day period of 47 Escherichia coli per 100 milliliters, or 88 Escherichia coli per 100 milliliters in any one sample; unless naturally occurring. There shall be no discharge of any sewage or wastes into waters of this classification. The waters of this classification shall be considered as being potentially acceptable for water supply uses after adequate treatment.

II. Class B waters shall be of the second highest quality and shall have no objectionable physical characteristics, shall contain a dissolved oxygen content of at least 75 percent of saturation, and shall contain not more than either a geometric mean based on at least 3 samples obtained over a 60-day period of 126 Escherichia coli per 100 milliliters, or greater than 406 Escherichia coli per 100 milliliters in any one sample; and for designated beach areas shall contain not more than a geometric mean based on at least 3 samples obtained over a 60-day period of 47 Escherichia coli per 100 milliliters, or 88 Escherichia coli per 100 milliliters in any one sample; unless naturally occurring. There shall be no disposal of sewage or waste into said waters except those which have received adequate treatment to prevent the lowering of the biological, physical, chemical or bacteriological characteristics below those given above, nor shall such disposal of sewage or waste be inimical to aquatic life or to the maintenance of aquatic life in said receiving waters. The pH range for said waters shall be 6.5 to 8.0 except when due to natural causes. Any stream temperature increase associated with the discharge of treated sewage, waste or cooling water, water diversions, or releases shall not be such as to appreciably interfere with the uses assigned to this class. The waters of this classification shall be considered as being acceptable for fishing, swimming and other recreational purposes and, after adequate treatment, for use as water supplies. Where it is demonstrated to the satisfaction of the department that the class B criteria cannot reasonably be met in certain surface waters at all times as a result of combined sewer overflow events, temporary partial use areas shall be established by rules adopted under RSA 485-A:6, XI-c, which meet, as a minimum, the standards specified in paragraph III.

III. The waters in temporary partial use areas established under paragraph II shall be free from slick, odors, turbidity, sludge deposits, and surface-floating solids of unreasonable kind or quantity, shall contain not less than 5 parts per million of dissolved oxygen; shall have a hydrogen ion concentration within the range of pH 6.0 to 9.0 except when due to natural causes; and shall be free from chemicals and other materials and conditions inimical to aquatic life or the maintenance of aquatic life. These criteria shall apply during combined sewer overflow discharges and up to 3 days following cessation of said discharge. At all other times the standards and uses specified in paragraph II shall apply.

IV. Notwithstanding anything contained in this chapter, the department in submitting classifications relating

to interstate waters to the New England Interstate Water Pollution Control Commission for review and approval, as provided for under the terms of Article V of the compact whereby the interstate commission was created by RSA 484, shall submit such classifications in accordance with the standards of water quality as currently adopted by said interstate water pollution control commission provided, however, that the standards for any classification thus submitted for review and approval shall not be less than, nor exceed the standards of the classification duly adopted by the General Court as provided for in RSA 485-A:9 or 10.

V. Tidal waters utilized for swimming purposes shall contain not more than either a geometric mean based on at least 3 samples obtained over a 60-day period of 35 enterococci per 100 milliliters, or 104 enterococci per 100 milliliters in any one sample, unless naturally occurring. Those tidal waters used for growing or taking of shellfish for human consumption shall, in addition to the foregoing requirements, be in accordance with the criteria recommended under the National Shellfish Program Manual of Operation, United States Department of Food and Drug Administration.

VI. Notwithstanding anything contained in this chapter, the commissioner shall have the authority to adopt such stream classification criteria as may be issued from time to time by the federal Environmental Protection Agency or its successor agency insofar as said criteria may relate to the water uses specified in RSA 485-A:8, I and II, provided, however, that the criteria thus issued shall not result in standards that are less than nor exceed the standards of the classification duly enacted by the general court as provided for in RSA 485-A:9 or 485-A:10.

VII. All tests and sampling for the purposes of examination of waters shall be performed and carried out in a reasonable manner and whenever practicable, in accordance with the commonly accepted scientific method as selected by the department. The waters in each classification shall satisfy all the provisions of all lower classifications. The minimum treatment for the lowest classification shall be as follows:

(a) For sewage, secondary treatment and disinfection as necessary to comply with water quality standards.

(b) For industrial wastes and combined sewer overflows, such treatment as the department shall determine. Appeal from any such determination shall be in the manner provided for in RSA 21-O:14.

VIII. In prescribing minimum treatment provisions for thermal wastes discharged to interstate waters, the department shall adhere to the water quality requirements and recommendations of the New Hampshire fish and game department, the New England Interstate Water Pollution Control Commission, or the United States Environmental Protection Agency, whichever requirements and recommendations provide the most effective level of thermal pollution control.

IX. Subject to the provisions of RSA 485-A:13, I(a), the fish and game department may use rotenone or similar compounds in the conduct of its program to reclaim the public waters of the state for game fishing.

Source. 1989, 339:1. 1991, 371:3-5. 1996, 228:77, 106, 110. 1998, 63:1, eff. July 11, 1998.

Appendix C

Field Data Sheets
Training Document
Sample Log-in and Custody Sheets

C-1

Field Data Sheets

Coastal Beach Program Field Data Sheet

Beach Name:_____ **Town:**_____
Station ID:_____ **EPA ID:**_____
Date:_____ **Time:**_____ **Weather:**_____
Inspector:_____ **Number of Samples Taken:**_____
Type of Inspection: Advisory Complaint Initial Subsequent

Water Conditions

Clear:____ **Turbid:**_____ **Colored:**_____ **Other:**_____
Comments:

Tide: High Low **Water Temp:**_____
Algae: Yes No **Sample Collected:** Yes No
Comments:

Facilities

Present: Yes No **Comments:**

Type: Flush Portable Privy Bathhouse

Bathing Area

Lifeguard(s): Yes No **Lifeguard Comments:**

Number of Bathers:_____ **Bathing Area General Comments:**

Miscellaneous

Animal Presence: Domestic Waterfowl Other None
Comments:

Recent Storm Events: Yes No **Point Sources:** Yes No
Comments: **Comments:**

General Comments: **Complaints:**

Freshwater Beach Program Field Data Sheet

Beach Name:_____ **Town:**_____
Station ID:_____ **EPA ID:**_____
Date:_____ **Time:**_____ **Weather:**_____
Inspector:_____ **Number of Samples Taken:**_____
Type of Inspection: Advisory Complaint Initial Subsequent

Water Conditions

Clear:_____ **Turbid:**_____ **Colored:**_____ **Other:**_____
Comments:

Water Level: Low Average High N/A **Water Temp:**_____
Algae: Yes No **Sample Collected:** Yes No
Comments:

Facilities

Present: Yes No **Comments:**

Type: Flush Portable Privy Bathhouse

Bathing Area

Lifeguard(s): Yes No **Lifeguard Comments:**

Rafts(s): Yes No **Ropes:** Yes No
Number of Bathers:_____ **Bathing Area General Comments:**

Miscellaneous

Animal Presence: Domestic Waterfowl Other None
Comments:

Recent Storm Events: Yes No **Point Sources:** Yes No
Comments: **Comments:**

General Comments: **Complaints:**

C-2

Training Document

BEACH PROGRAM TRAINING FORM

To be conducted by the Beach Program Coordinator on at least three occasions, and until all tasks are successfully completed prior to independent sampling
(sheet to be filed by the Beach Coordinator in QA/QC files)

Name:_____ Title:_____

DES Staff:_____

Date:_____ Time:_____

Training Site:_____ Town:_____

SAMPLING ISSUE	ASSESSMENT RATING		COMMENTS
	Needs Improvement	Good	
I. Preparation For Sampling			
1. Proper Equipment Pack-up			
Sterile bacteria bottles			
Cooler with ice			
Waterproof pen(s), sharpie			
Thermometer *checked last QA/QC to make sure up to date*			
Bottles for algal collection *lugols solution*			
Waterproof tape			
Shoulder length polyethylene gloves			
Sampling pole			
2. Number of Bottles for "Routine" Sampling Event			
Identify number of beaches to be sampled			
Pack 2 to 3 sample bottles per beach for bacteria collection			
Pack 1 sample bottle per beach for algal collection			
Extra sample bottles in case of contamination or pollution sources			
3. Proper Paperwork			
Field Data Sheets – 1 per beach, *clipboard*			
Complaint forms			
Illness report forms			
Bather Load Data Sheets			
Three ring binder with Beach Program			

SOPs and QAPP			
Advisory Posters – for bacteria and algae			
Fact sheets			
Log-in Forms			
Beach Coordinator/Beach Inspector business cards			
Directions			
NH Atlas			
II. Sample Collection			
1. Trip Blanks			
Sterile bacteria bottle is filled with D.I water *obtained from Laboratory Services washroom*			
Bottle is labeled properly *trip blank, date, time*			
Inside of bottle cap or neck was not touched			
One blank is taken per beach inspector per day before start of sampling			
Blank is stored on ice until sample log-in			
2.. Bacteria Sample Collection			
Bottles labeled correctly – *sample site, station, date, time*			
Water temperature is measured using the thermometer			
Shoulder length gloves are worn if sampling areas with potential sewage contamination			
Sampling pole is used if sampling areas with potential sewage contamination			
Bottle cap removed just prior to collection			
Inside of bottle cap or neck was not touched			
Sample bottle was not rinsed			
Care taken to ensure no cross-contamination of the sample – *sample area undisturbed, sample motion away from body, water flow towards body*			
Proper sampling technique was followed – *a u-shaped motion at least 1 foot below water surface*			
Samples collected at knee depth			
Samples collected at left, right, and center sites or left and right sites where the beach is less than 100 ft. long			
If beach is located on a river or flowing waterbody samples are collected upstream of beach, at the beach, and downstream of			

the beach			
If known or suspected sewage contamination at beach samples are collected using a sampling pole *as described in Beach Program SOP for Bacteria Sampling*			
Samples immediately put on ice			
3. Field Duplicates			
Duplicate samples collected for 10% of samples			
Bottles labeled correctly *sample site, station duplicate, date, time*			
Duplicate sample obtained immediately after original *both sample bottles brought to sample station*			
Bottle cap removed just prior to sample collection			
Inside of bottle cap or neck was not touched			
Sample bottle was not rinsed			
Care taken to ensure no cross-contamination of the sample – *sample area undisturbed, sample motion away from body, water flow towards body*			
Proper sampling technique was followed – *a u-shaped motion at least 1 foot below water surface*			
Sample collected at knee depth *same as original*			
Sample immediately put on ice			
4. Algal Collection			
Sample bottles labeled with site, location, date, time			
Station form completed *station ID created, station description, directions to station, and if possible GPS coordinates*			
Samples collected in a grab motion			
Samples immediately put on ice			
Samples split and one preserved with Lugols solution			
III. Paperwork			
1. Proper Paperwork Completed/Distributed			
Introduce yourself to beach manager, lifeguards, and public			
Collect bather load data sheets from coastal beach managers/lifeguards			
Inpsect beach facilities – *are they present, what condition are they in*			

Inspect the bathing area			
Comment on water conditions			
Identify if algal scum is present			
All sections of the field data sheet are filled out completely			
Beach managers, lifeguards, and the public are asked to comment on beach conditions			
Complaint forms are filled out if necessary			
Beach Advisories are posted if necessary *advisory posters are distributed to proper management*			
Fact sheets are distributed if necessary			
IV. Sample Handling/Custody			
1. Sample Log-in			
Samples are returned to the Laboratory within proper holding times and on ice			
Samples are placed in order according to time sampled on the lab bench			
Sample log-in and custody sheet is filled out completely			
Place the appropriate labels on the bottle caps			
Indicate whether samples need to be diluted by writing on the label and in the other/notes section on the log-in sheet - *X1, X10,or X100,*			
Relinquish samples to the laboratory – *custody section is signed*			
Notify laboratory personnel that samples are relinquished – *lab personnel must review log-in sheet and sign*			
V. Corrective Actions			
Did the Beach Program Coordinator notify the Beach Inspector or intern that methods need improvement? Yes____ No____			
Did the Beach Program Coordinator re-train the in the area(s) where improvement was needed? Yes____ No____			

Signature (Intern):_____ Signature (Coordinator):_____
Date:_____ Date:_____

C-3

Sample Log-in
And Custody Sheet

NH DES LABORATORY SERVICES LOGIN AND CUSTODY SHEET

(Laboratory Policy: Samples not meeting method requirements will be analyzed at the discretion of the NH DES Laboratory.)

Program / Client ID: , ❒ In-House, ❒ OSA, ❒ Pool, ❒ Special, X Swim, ❒ VLAP, ❒ Other:_____ EPA # / Project #:_____

System Name:_____ Site / Town:_____ Contact:_____

Comments:_____ Collected By & Phone# _____

Samples Preserved by: ❒Ice ❒Blue Pack ❒Other_____

Sample Location /ID	Date/Time Sampled	# of Containers			*Enterococci*													Other / Notes	Lab ID # (For Lab Use Only)
			A Q																
			A Q																
			A Q																
			A Q																
			A Q																
			A Q																
			A Q																

Relinquished By_____Date and Time_____Received By_____

Relinquished By_____Date and Time_____Received By_____

Relinquished By_____Date and Time_____ **Received For Laboratory By_____**

Matrix: A= Air S= Soil AQ= Aqueous (Ground Water, Surface Water, Drinking Water, Waste Water) ❒ Other: _____

Page _____ of _____ Data Reviewed By_____ Date_____

C-4

Illness Report Form

N.H. Department of Environmental Services
Beach Program

Illness Report

Please fill out this form only if you, your child, or a family member became sick from swimming at a public bathing area. Please fill out the form as completely as possible.

Name: **Date:**
Address (Optional):

Telephone #:
E-mail (Optional):

Gender (circle one)**:** Male Female

Age (circle one)**:** 0-2 yrs 3-6 yrs 7-12 yrs 13-18 yrs 19-30 yrs

31-50 yrs 51-65 yrs 66-80 yrs Over 80

Public bathing area where illness was contracted (list beach name, lake/pond/ocean beach name, and town):

What type of contact was made with the water? (circle one)
1. Full body contact over the head
2. Full body contact up to the neck
3. Partial body contact up to the waist
4. Partial body contact up to the knees

Did the illness require a doctor's visit? If so, did the doctor diagnose the illness as being caused by a water-borne pathogen?

Did you inform the doctor that you recently participated in water-contact activities at a beach area?

Type of Illness (circle illness type as diagnosed by the doctor or list illness symptoms):

Gastroenteritis	Swimmer's Itch	Eye Infection
Skin Irritation/Infection	Giardiasis	Cryptosporidiosis

Illness Symptoms:

How long did the illness last?

Were there other bathers in the water at the specific beach? If so, how many would you estimate?

Did anyone else in your group exhibit similar symptoms?

Did you notice any of the following while recreating at the public bathing area? (circle all that apply)

1. Foul odors
2. Waterfowl (ducks, geese, gulls) on or near beach
3. Domestic animals (dogs) on beach
4. Scum on water's surface
5. Cloudy/turbid water
6. Public facilities
7. Trash

Did you observe anything else that you feel may have contributed to an illness?

Thank you for taking the time to complete this form. Your response is greatly appreciated and will aide the Beach Program in tracking swimmer related illnesses throughout the state. Please fax (603-271-7894) or mail (address below) the completed form to the Beach Program. If you have any comments or questions please feel free to contact the Beach Program.

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Appendix D

Limnology Center
Standard Operating Procedures

D-1

Sample Login
Standard Operating Procedures

D. LogIn of Samples: Standard Operating Procedure

1. Introduction

Once a sample is brought in from the field, it needs to be logged into the computer. At this point, a label is also created to put on the sample container indicating what tests need to be completed, where the sample is from, etc.

2. Computer Login of Samples

a. Double click on **Limno Login** icon shown above.
b. Click the **Login Sample** button.
c. The **Limnology Center Login** screen should appear on your computer. ***If you have any questions concerning this screen, press the F1 button on the keyboard and a help screen will appear. If you still have questions please contact the Limnology Center QA/QC Officer.***
d. The **Sample ID** is pre-set according to the last sample entered so there is no need to touch this section.
e. Select the **Program** drop-down list and choose the field you are logging in.
f. If the sample is from a pool or spa you must enter a **Pool ID.**
g. Enter the **Town** the sample was taken in and then **Lake/River/Site**. A drop-down list generally appears in the latter column to choose the **Lake/River/Site**.
h. Enter **Station** where sample was taken. There is a drop-down screen available and a depth should also be entered. In the case of pool samples deep, shallow, or spa should be entered in this field.
i. Enter **Date-time** that sample was collected. (Example; mm/dd/yy 10:30am)
j. The **Logged_in** section automatically fills in with the date and time that the sample is logged in.
k. Enter your initials in the **Recd-by** field.
l. In the **Relinquished** field, enter who took or delivered the sample.
m. Check to be sure that the correct parameters are selected under **Selected Parameters** and if more parameters are needed, they can be chosen from the **Available Parameters** section**.** To choose an additional parameter, click on the one you want to add and click the single forward arrow. Be sure that it appears under the **Selected Parameters.**
n. If the next sample is from the same **Program**, **Town**, and **Lake/River/Site** you can simply click the **Carry On** arrow located on the right of the screen and all the information will go to the next record where you can change the **Station** information.
o. If the next sample is from a different **Program**, **Town**, and **Lake/River/Site,** click the arrow above the **Carry On** arrow and a fresh screen appears for the next sample.
p. The labels will print automatically after you move to a new login. Check to be sure they printed correctly.
q. When completely finished login, click the **STOP** located at the bottom right of the

screen. This brings you back to the **DES Limnology Center Sample Login** screen. Clck **STOP** again to end.

D-2

Computer Procedures
Data Management
Standard Operating Procedures

STANDARD OPERATING PROCEDURES
LOGIN SYSTEM DATA ENTRY FOR ANALYSIS DATA AND QC DATA

A. Bench book data review

1. Bench book entries should be checked for completeness and legibility before being entered into the LogIn system.
2. Bench book entries that are not complete or legible should not be entered into the LogIn system. However, if the analyst's initials are legible, every attempt should be made to contact the analyst responsible for the incomplete/illegible data so that any/all discrepancies can be resolved.
3. If bench book entries are complete and legible, proceed with the steps in Section B.

B. LogIn System Data and QC Data Entry

1. Double click on **Limno LogIn** icon.
2. Click the **Enter Results** button.
3. The **Results Data Entry by Bench Log** screen should appear on your computer. ***If you have any questions concerning this screen, press the F1 button on the keyboard and a help screen will appear. If you still have questions please contact the Limnology Center QA/QC Officer.***
4. Select the appropriate parameter from the **Parameter** drop-down list.
5. Select the appropriate meter from the **Meter** drop down list.
6. Enter your first and last initials in the **Entered By** field.
7. Click the **Jump** button and enter the unique identifier portion of your id number in the Jump pop-up screen. For example, for 2001-999, you would enter 999.
8. If the sample data requires a qualifier, you would enter the qualifier for the result in **Qualifier** field. For example, an apparent color reading of <5 would require you enter LT for less than. Other qualifiers include GT (greater than) and EQ (equal to).
9. Enter the sample result in the **Result** field.
10. If the sample has corresponding QC data, click the **Add QC** button and proceed with step 11. If the sample does not have corresponding QC data, either click on the **Next Record (►)** button to enter the data for the next record for your current parameter and meter, or **Clear** to enter data for a different parameter/meter. If you are finished entering data simply click the **Stop** button and you will be returned to the main Limno LogIn screen.
11. Verify that you are entering the QC data for the correct sample and click the **OK** button.
12. Enter the QC data and click the **OK** button.
13. A pop-up screen will ask you to verify the data you have entered. If it is correct click **YES** and proceed to step 14. If the data is not correct click **NO** and renter

the QC data by clicking the **Add QC** button and proceeding with step 11.

14. Click **OK** on the QC data entry pop-up screen and either click on the **Next Record** (►) button to enter the data for the next record for that parameter, or **Clear** to enter data for a different parameter/meter. If you are finished entering data simply click the Stop button and you will be returned to the main Limno LogIn screen.

****Warning Box****
When entering results, sometimes a warning box appears that questions the result entered. Double check to make sure that the number typed in is indeed correct, change if necessary, and continue the data entry process.

STANDARD OPERATING PROCEDURES
DATA ENTRY QC

A. Summary Reports

The data entry summary reports must be run on a weekly basis. It is the responsibility of the Limnology Center QA/QC Officer or his/her designee to run the summary reports.

1. Double click on **Limno LogIn** icon.
1. Click on **Summary Reports.**
2. Click on **Bench Book**.
3. The date is automatically set to print the prior weeks data; change the date if necessary.
4. Be sure that **By Week** and **Print** circles are filled in and then click **OK.**
5. **Weekly Bench Book Results** will print at the computer station's default printer.

B. LogIn System Data Check

1. Once the **Weekly Bench Book Results** are printed out, they need to be double checked against the results in the actual bench books.
2. Make sure you have the sheet that corresponds to the correct bench book; check the **Sample ID**'s, **Results**, and **QC Results** against those in the bench book.
3. If the results match, ***in red pen***, put a check mark next to the result in the bench book and on the sheet.
4. If the results on the sheet do not match those in the bench book, make a note on the sheet.
5. Sign and date the bottom of each sheet.
6. Return the sheets to the Limnology Center QA/QC Officer and explain any notes you had to make on the sheets.

C. Limnology Center QA/QC Officer Changes and Deletions

The Limnology QA/QC Officer is responsible for addressing any data omissions, duplicate data entries, or erroneous data entries. When the QA/QC Officer makes any changes to the data presented in the weekly summary report, he/she must note the change on the corresponding parameter page, and date and initial the note. Once the Limnology Center QA/QC Officer has reviewed the data reports and made any/all the necessary corrections, he/she can proceed to Section D.

D. QA/QC Officer Data Verification

Completion of the following steps verifies that the data has been reviewed and has been entered correctly, and allows the data to be used for reporting purposes.

1. Click on **Admin.-QC Menu**.
2. Select appropriate administrator from drop down box.
3. Enter administrator password and click **OK**.
4. Click on **QC Status Update**.
5. Once the Results QC Review screen has been opened, check the start date- it must be the same as your report start date*. Also check the **Get Results By** box; **By Week** should be checked.

***Note:** The date the report was printed is on the bottom of each page, not the report start date.

6. Select a parameter, and the appropriate mete if necessary, from the drop down box.
7. Click on **Get Results**. Verify that the data in the computer table is the same as the corrected Weekly Report data. If not, return to Section C to resolve the discrepancy.
8. Click on the Double Box button. The boxes in the Review Column should now contain a check mark.
9. Sign and date the reviewed report. The reviewed report should be kept on file until the end of the calendar year. At that time it should be stored with its corresponding bench book data. This joint data folder must be kept on file for a minimum of five years.
10. Return to Step 5 if more reports need to be reviewed, or click on the **Stop** button to exit the screen.

Appendix E

Sampling and Analysis Plan

Sampling and Analysis Plan

Sampling and Analysis Plans (SAPs) will be prepared by the Program Coordinator, reviewed and approved by the Program Manager prior to field work, and a copy retained in the Beach Program files (referenced from Section A-9). A copy of the approved plan will be sent to the DES Quality Assurance Manager. The Program Coordinator is responsible for communicating the SAP and other QA/QC requirements to other field sampling staff that may be working on the project.

The SAPs will reference its parent Generic QAPP. Deviations from and stipulations not addressed in the Generic QAPP will be incorporated into the SAPs. These will include site information, rationale, project description and schedule, analysis, and reporting. Additional information will be considered and added when applicable. Also, the Program Coordinator will be responsible to locate or produce procedures for any deviations and stipulations, in particular, sampling and testing required for a project that is not described in the Generic QAPP, in which case the Program Manager will review and approve. An example of possible information per deviation and/or stipulations is as follows:

Site Information

Site map
Sample location map
Personnel identification and organization

Rationale

Problem Definition
Historic Data
Matrix of Concern

Project Description and Schedule

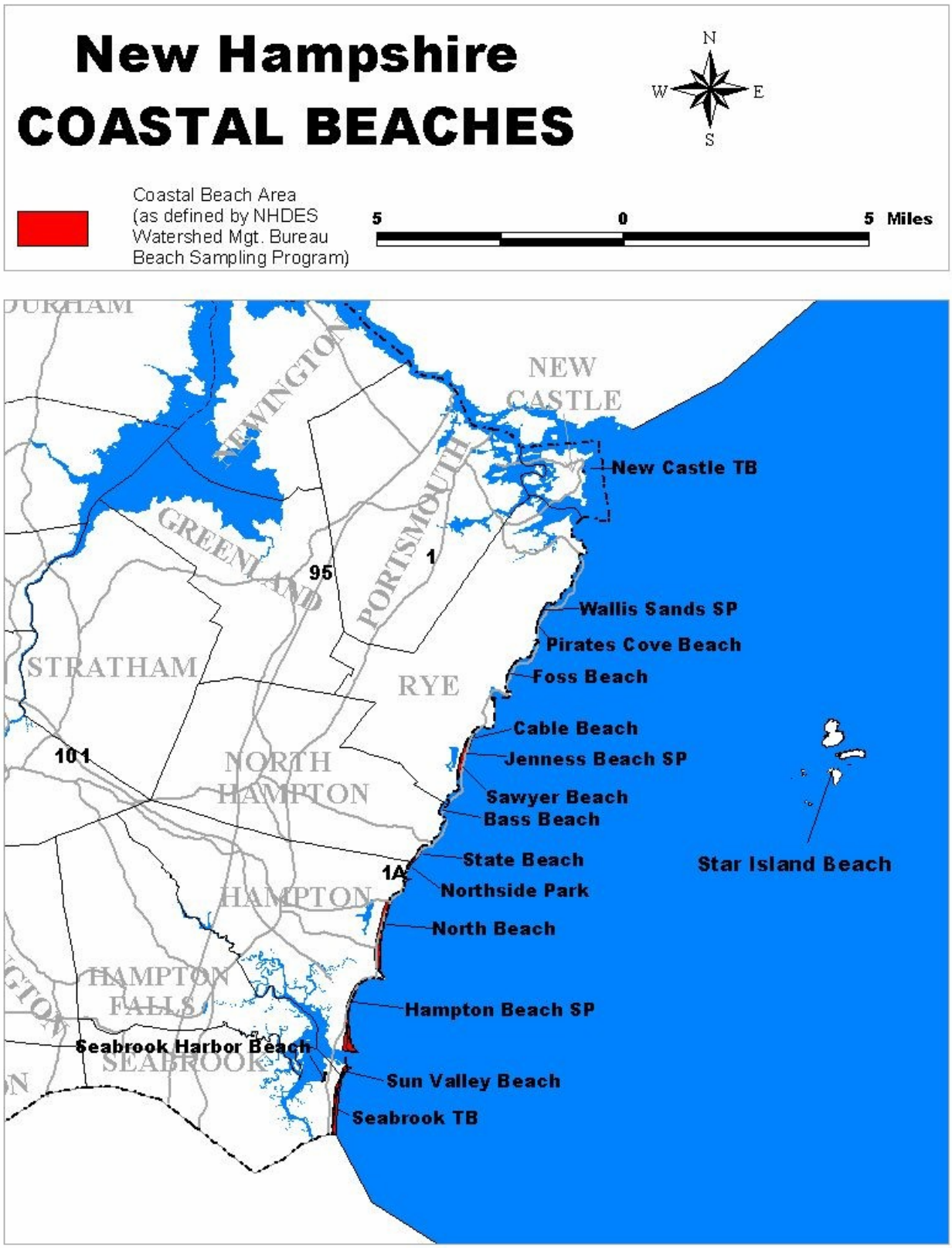
Sampling Design (sampling location, Sampling and Analysis Method/SOP requirements
Sampling Procedures and Requirements
Data Analysis

Reporting

To whom results and discussion are reported

Appendix F

Coastal Beach Map


New Hampshire
COASTAL BEACHES
N
W
E
S
Coastal Beach Area
(as defined by NHDES
Watershed Mgt. Bureau
Beach Sampling Program)
5
0
5 Miles
NEW CASTLE
NEWINGTON
PORTSMOUTH
GREENLAND
STRATHAM
RYE
NORTH HAMPTON
HAMPTON
HAMPTON FALLS
SEABROOK
95
1
101
1A
New Castle TB
Wallis Sands SP
Pirates Cove Beach
Foss Beach
Cable Beach
Jenness Beach SP
Sawyer Beach
Bass Beach
State Beach
Northside Park
North Beach
Hampton Beach SP
Seabrook Harbor Beach
Sun Valley Beach
Seabrook TB
Star Island Beach

Appendix G

Public Notification
And
Risk Communication Plan

Public Notification and Risk Communication Plan

Notification of local government, municipalities, public, and EPA

1.0 Problem Definition/Assessment

The New Hampshire Department of Environmental Services' (NHDES) recognizes the public health threats associated with recreating in waters containing pathogenic organisms. As a result of this threat to public health, NHDES operates a Public Beach Inspection Program (Beach Program) during the swim season (mid-June to Labor Day). Beach inspectors monitor the water quality of all public beaches by collecting bacteria samples and inspecting the toilet facilities.

In accordance with Environmental Protection Agency (EPA) guidelines, New Hampshire uses indicator organisms to predict the presence of pathogenic organisms is surface waters of the state. Pathogenic organisms are those that cause waterborne diseases and result in illnesses to the water user.

NHDES has followed the EPA recommendations published in the *Ambient Water Quality Criteria for Bacteria-1986* that incorporate a bacterial standard for freshwater and coastal waters. The New Hampshire standard for public freshwater beaches is 88 counts of *E. coli* /100 mL in a single sample or a geometric mean of 47 counts/100 mL of at least 3 samples over a 60 day-period. The state standard at public coastal beaches is 104 counts of Enterococci /100 mL in a single sample or a geometric mean of 35 counts/100 mL of at least 3 samples over a 60-day period.

The program goals include increased public awareness and a higher level of public protection against pathogenic organisms. This can be achieved by communicating public health threats in a quick, effective manner.

1.1 Audience

New Hampshire coastal beaches are popular sites for out-of-town visitors. The majority of our coastal beaches attract tourists from the New England states, other areas of the country, and even from other countries. Some coastal beaches, while supporting use by out-of-town visitors, are great congregational areas for the towns' residents. New Hampshire's coastal beaches are also popular gathering places for families, local college students, field trips, festivals, and much more.

The state's freshwater beaches attract a variety of beach users as well. Some beaches are open only to town residents while others are used by residents, tourists, local schools, and summer camps.

The popularity of New Hampshire's beaches makes the protection of public health a main goal of the Beach Program. When sample analyses reveal an exceedance of water quality standards, public health may be compromised. A quick response to the public is necessary to warn swimmers of the potential health risks.

The first step in developing an effective notification plan is to determine the target audience. Therefore, the Beach Program will need to identify the most appropriate means of communicating with the variety of beach users when samples exceed water quality standards at their respective beaches. Public notification to the target audience and the most appropriate means of communication are key elements to protect public health.

2.0 Types of Notification

The Beach Program has established a process that details the factors used to determine a beach advisory. In addition to a DES beach advisory, local governments may issue beach closures. A beach closure may restrict all activities at that particular beach.

2.1 Beach Advisories

An advisory is a recommendation to the public to avoid water contact activities in areas where bacteria results exceed the state's water quality standards or when a potential toxic cyanobacteria scum is present. A beach advisory allows the public to recreate at the beach, but advises them to stay out of the water. Currently the Beach Program displays two types of advisories:

1. A *bacterial water quality advisory* notifies the public that bacteria levels exceeded state water quality standards during routine monitoring/inspections of beach areas.

2. A *cyanobacteria water quality advisory* notifies the public of the potential presence of a toxic cyanobacterial scum in the bathing area.

3.0 When to Notify

A beach advisory will be issued by the Beach Program when:

1. Enterococci levels exceed the state standard of 104 counts per 100 milliliters (mL) of water in at least one sample, or when enterococci levels exceed the geometric mean of 35 counts per 100 mL based on at least 3 samples obtained over a 60-day period. (NHDES collects two to three samples per beach per inspection depending on beach length.) Immediate re-sampling will occur for all situations listed above.

2. *E. coli* levels exceed the state standard of 88 counts per 100 mL of water in at least one sample, or when *E. coli* levels exceed the geometric mean of 47 counts per 100 mL based on at least 3 samples obtained over a 60-day period. Immediate re-sampling will occur for all situations stated above.

3. A dominant, potential toxin-producing cyanobacterial scum is present at the bathing area. Dominance is considered 50% or more of the cell count. A cell count is equivalent to a colony of cyanobacterial (most are colonial). Re-sampling will occur until dominance of the alga is determined to be less than 50% of the cell count.

4.0 How to Notify

The Program Manager, Coordinator, or Beach Inspector, will be responsible for issuing beach advisories. The Beach Program will also utilize other methods of public notification, such as a press release to a local newspaper or radio station, a posting on the Beach Program website, or a message on the Beach Program hotline.

Advisories are immediately issued upon published results from NHDES Laboratory Services. Once standards are exceeded, Beach Program personnel will contact the local health official, beach manager, or

town administrator. Advisories are posted by the health official, beach manager, or Beach Program personnel. Posting will occur at all access points to the beach. Town health officials, beach managers, or Beach Program staff will notify all lifeguards of the advisory.

4.1 Signs

The Beach Program has developed official signs that are required to be posted during a beach advisory. A second sign is also available to post at coastal beaches notifying the public that the beach is open for public swimming. A third sign is available for freshwater beaches warining the public that a potential cyanobacteria scum is present. A fourth sign is available to post at beaches or access points notifying the public that the area is not monitored on a routine basis by the Beach Program.

Reproductions of these signs are located in Appendix G-1.

4.2 Press Releases

The Beach Program will create a template for press releases relating to beach advisories. These press releases will be issued immediately following notification of the appropriate beach contact. The information in the press release will include the reason for the advisory, the area affected, and the anticipated duration of the advisory. Contact information for the local beach representative and the DES Beach Program will also be included.

The press releases will be sent to local newspapers and radio stations. Press releases that are issued by DES are posted on the DES website at http://www.des.state.nh.us/press.htm.

4.3 Web Site

A DES beach advisory webpage will be available for the 2003 season. The page will include information about the reason for the advisory, the area affected, and the anticipated advisory duration. Beach Program contact information will also be available on the webpage.

The Beach Program participates in the Earth 911 beach quality website: http://newhampshire.earth911.org/waterquality/index.html. The Beach Program provides information and data to the website on a regular basis during the summer months. Advisory information is posted on the website as soon as it is received. Note: Earth 911 is currently used only for coastal beaches.

4.4 Technical Reports

The Beach Program produces an annual report listing all the beach advisories issued during the year. The report includes the beach name, number of advisories issued, duration of the advisories, and whether the advisories were due to excessive bacteria or the presence of cyanobacteria.

5.0 Notification Removal

Beach Program personnel will resample the beach until the bacteria concentration falls within the state's water quality standards. Once samples reflect data within the state standard for public beaches the advisory is removed either by the state or local officials.

If the advisory was issued due to the presence of cyanobacteria, the bathing area will be resampled until the cyanobacteria species is less than 50% of the total cell count.

Public notification of advisory "removal" will be made through contact with the beach manager or local town official. The Beach Program and Earth 911 websites will be updated to indicate the advisory has been removed.

6.0 Evaluation of Notification Process

Beach Program personnel will conduct evaluations to determine whether the notification process is effective. The Beach Program may conduct surveys with the public to determine which source of information (i.e., signs, hotline, press releases, website) was most successful in public notification.

Beach Program personnel, along with local beach managers and town officials, will assess the effectiveness of the communication methods used in the notification process.

The results of the surveys and interviews will be compiled and used to assess the effectiveness of the notification process.

7.0 Notification Report Submission and Delegation

The local government will be authorized by DES to post and remove signs at beaches during and after an advisory. If the local government determines that a beach closure is most appropriate, the town official or beach manager will be responsible for reporting this decision to the Beach Program Coordinator.

The NHDES Beach Program will be responsible for annual reporting of data, including the notification data, to the Environmental Protection Agency. Monitoring data (stations and analytical results) will be reported to EPA through STORET. Beach specific information and advisory information will be sent to EPA via XML to the EPA's PRAWN database.

G-1

Beach Program Signs

NOTICE

THIS BEACH AREA MAY NOT BE SUITABLE FOR SWIMMING DUE TO

HIGH LEVELS OF BACTERIA

Per Commissioner
NH Department of Environmental Services

Please:

- Do not drink the water or let children drink the water!
- Do not wade or swim in the water!

Exposure to pathogenic organisms may cause various symptoms, including nausea, vomiting, diarrhea, fever, general malaise or skin rashes.

For more information contact:
NHDES
Biology Section
PO Box 95, 6 Hazen Drive
Concord, NH 03302-0095
603-271-3503

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

NOTICE

THIS BEACH AREA MAY NOT BE SUITABLE FOR SWIMMING DUE TO HIGH LEVELS OF

POTENTIALLY TOXIC BLUE-GREEN ALGAE

Per Commissioner
NH Department of Environmental Services

Please:

- Do not wade or swim in water containing visible blue-green or greenish scums!
- Do not drink the water or let children drink the water!
- Do not let pets or livestock into the water!

Exposure to blue-green algal scums may cause various symptoms, including nausea, vomiting, diarrhea, mild fever and general malaise. Anyone who comes in contact with an algal scum should rinse off with freshwater.

For more information contact:
NHDES
Biology Section
PO Box 95, 6 Hazen Drive
Concord, NH 03302-0095
603-271-3503 or 603-271-3414

New Hampshire Department of Environmental Services

OPEN

THIS BEACH IS OPEN FOR SWIMMING AND RECREATION
AND
MEETS STATE STANDARDS FOR ACCEPTABLE BACTERIA LEVELS

IF INTERESTED IN LEARNING MORE ABOUT WATER QUALITY AT PUBLIC BEACHES PLEASE CONTACT:

NHDES
PO BOX 95, 6 HAZEN DR
CONCORD, NH 03302-0095
603-271-8803 or 603-271-3414
email: sammarco@des.state.nh.us
acomment@des.state.nh.us
web address: www.des.state.nh.us/
www.epa.gov/waterscience/beaches/data.html

IF INTERESTED IN LEARNING OF CURRENT BEACH ADVISORIES AND CONDITIONS CONTACT NHDES OR:

EARTH 911 @
www.newhampshire.earth911.org/waterquality/index.asp

NHDES

NOT MONITORED

THIS BEACH IS NOT MONITORED ON A ROUTINE BASIS

INFORMATION IS UNAVAILABLE TO ASSESS CURRENT BACTERIA LEVELS

FOR ADDITIONAL INFORMATION ON WATER QUALITY AT PUBLIC BEACHES CONTACT:

NHDES
PO BOX 95, HAZEN DR
CONCORD, NH 03302-0095
603-271-8803 or 603-271-3414
email: ssumner@des.state.nh.us
jconnor@des.state.nh.us
web address: www.des.state.nh.us/
www.epa.gov/waterscience/beaches/data.html

CURRENT BEACH ADVISORIES AND CONDITIONS CAN BE OBTAINED FROM NHDES OR:

EARTH 911@
www.newhampshire.earth911. org/waterquality/index.asp

NHDES

Appendix H

Tiered Monitoring Plan

NHDES Beach Program

Tiered Monitoring Plan

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Purpose

The New Hampshire Department of Environmental Services (DES) Beach Program has been monitoring water quality at public beaches for over twenty years. The Beach Program monitors coastal and freshwater beaches during its swim season from June through Labor Day. DES recognizes the threat of contracting water-borne diseases at public beaches and makes protecting public health its' main priority. Protection of public health requires the identification of designated beach areas, evaluation of risks associated with a beach area, and the development of a sampling design specific for each beach.

The Beach Program's definition of a designated beach area is as follows: 'A public beach is an area on a river, lake, pond, or tidal water that is intended or used for bathing, swimming, or other primary water contact; operated for or by any municipality, governmental subdivision, public or private corporation, partnership, association, or educational institution, open to the public, members, guests, or students whether on a fee or free basis.

Sampling Design

Coastal designated beach areas will be considered primary contact recreation areas as defined by the New Hampshire 2002 305(b)/303(d) Consolidated Assessment and Listing Methodology (CALM). Coastal areas identified as secondary contact recreation areas as defined by the CALM (Appendix A), are not subject to routine monitoring by the Beach Program and will not be evaluated, or assigned a Tier ranking. Refer to Appendix A for a list of coastal recreational waters and primary/secondary contact recreation areas.

Coastal waters throughout the state are surveyed to identify beach areas which comply with the above definition. Risk-based beach evaluations are performed for each designated beach area identified along the coast. Beaches will be evaluated using specific criteria for available information, pollution threats, sanitary survey information, exposure conditions, and monitoring data. Each beach will then be ranked and placed into a Tier I or Tier II category. Tier I beaches will be high priority beaches, while Tier II beaches will be of lower priority. Refer to Table 3 for a list of designated beaches and their corresponding Tiers.

The minimum sampling requirements for Tier I and II beaches are described in Table 1. Staffing to meet sampling requirements is consistent with the Generic Beach Program Quality Assurance Project Plan (QAPP) section A 4.0 Project Organization. Staff training abides by section A 8.0 Special Training/Certification of the QAPP.

Signs will be displayed at the beach area indicating the status of the beach (refer to Table 2). Beaches meeting the minimum sampling requirements for their assigned Tier will display a sign which indicates the beach is *Open* for swimming and recreation and meets state standard for acceptable bacteria levels. Beaches that do not meet the Tier designation for minimum sampling requirements will display a sign indicating the beach area is *Not Monitored* and bacteria levels are not sampled routinely by the NHDES Beach Program. Beaches that do not meet state standards for acceptable bacteria levels, and/or a toxic cyanobacterial scum is present will display signs indicating the beach is under *Advisory*.

Quality Control

Quality assurance and quality control elements are consistent with sections A 7.0, A 7.1, B 4.0, and B 5.0 of the Beach Program QAPP.

Data Management

Data management elements are consistent with sections B 9.0, B 10.0, D 1.0, D 2.0, and D 3.0 of the Beach Program QAPP.

Program Assessment

Program assessment elements are consistent with sections C 1.0, and C 2.0 of the Beach Program QAPP.

Table 1: Tiered Sampling Design for New Hampshire Public Beaches

		Tier I	Tier II
A. Minimum Sampling Frequency		At least two weeks before start of sampling season and to the last day of sampling season. June 1st through September 7th. Minimum sampling frequency from June 15th through September 7th is 1 sample per station per week.	At least two weeks before the start of the sampling season and to the last day of the sampling season. June 1st through September 7th. Minimum sampling frequency from June 15th through September 7th is 1 sample per station two times per month.
B. Designated Sample Location		a. Beach length ≥ 100 ft. requires 3 samples per beach at left, center and right locations. b. Beach length < 100 ft. requires 2 samples per beach 1/3 of the distance from either end of the beach. c. Beach located on flowing body of water requires 3 samples per beach upstream, center, and downstream of the beach.	a. Beach length ≥ 100 ft. requires 2 samples per beach 1/3 of the distance from either end of the beach. b. Beach length < 100 ft. requires 1 sample per beach at the center of the beach. c. Beach located on a flowing body of water requires 1 sample per beach at the center of the beach.
C. Sample Depth		Knee Depth	Knee Depth
D. Triggers for Additional Sampling	**a. Water quality violation and re-opening after advisory**	Re-sampling and public notification.	Re-sampling and public notification.
	b. Bather load	High bather load during peak use triggers additional round of samples.	N/A
	c. Sewage spill or pollution event	Requires additional sampling.	Requires additional sampling
	d. Point sources such as culverts, drainage pipes, or CSOs	DES recommends that additional samples be collected after rain events.	Same

	e. Surface scums	DES protocol requires scum samples be collected and analyzed for the presence of toxic cyanobacteria.	Same
	f. Waterfowl	DES recommends additional samples if waterfowl congregate on the beach or in the designated beach area.	Same
	i. Marinas	DES recommends additional samples be collected at beaches that are potentially impacted by marinas.	Same

Table 2: New Hampshire Beach Use Categories

Beach Status	Color Code	Explanation
Open Open to the public for recreation		Meets the minimum sampling requirements and currently meets state standards for acceptable bacteria levels.
Not Monitored		Beach does not meet minimum sampling requirements.
Beach Advisory Water Quality		Beach may not be suitable for swimming or other water contact activities due to high levels of bacteria.
Beach Advisory Cyanobacteria		Beach may not be suitable for swimming or other water contact activities due to high levels toxic cyanobacteria.

Table 3: Coastal Designated Beaches and Tier Status

Beach Name	Water Body	Tier
Seabrook Beach	Atlantic Ocean	I
Seabrook Harbor	Hampton/Seabrook Harbor	I
Hampton Beach State Park	Atlantic Ocean	I
Sun Valley Beach	Atlantic Ocean	II
North Beach	Atlantic Ocean	I
Northside Park	Atlantic Ocean	II
North Hampton State Beach	Atlantic Ocean	I
Bass Beach	Atlantic Ocean	II
Sawyer Beach	Atlantic Ocean	I
Jenness Beach State Park	Atlantic Ocean	I
Cable Beach	Atlantic Ocean	I
Foss Beach	Atlantic Ocean	II
Pirates Cove Beach	Atlantic Ocean	I
Wallis Sands State Park	Atlantic Ocean	I
New Castle Town Beach	Little Harbor	I
Star Island	Atlantic Ocean	II

Appendix A

Coastal Recreational Waters
And
Primary/Secondary Contact Recreation Areas

New Hampshire Department of Environmental Services Beach Program

Coastal Recreational Waters and Primary/Secondary Contact Areas

The following represents coastal recreational waters and primary/secondary contact areas for the State of New Hampshire. The Environmental Protection Agency's Clean Water Act (CWA) section 502(12), as amended by the BEACH Act, defines coastal recreational waters as: "the Great Lakes and marine coastal waters (including coastal estuaries) that are designated under section 303 © by a state or tribe for use for swimming, bathing, surfing, or similar water contact activities. Coastal recreation waters do not include either inland waters or waters upstream of the mouth of a river or stream having an unimpaired natural connection with the open sea" (US EPA, 2002). The DES Beach Program has identified coastal recreational waters consistent with the above definition. Table 1 represents a list of coastal recreational waters for the State of New Hampshire.

Table 1. Coastal Recreational Waters

Atlantic Ocean (Atlantic Coast/Gulf of Maine)
Hampton/Seabrook Harbor
Rye Harbor
Little Harbor
Portsmouth Harbor
Little Bay
Great Bay

The Beach Program is required to identify beaches or similar points of access along coastal recreational waters used for swimming or similar water-contact activities. Coastal designated beach areas were identified as primary contact recreation areas (Table 2) while coastal access points were identified as secondary contact recreation areas (Table 3). The New Hampshire 2002 305(b)/303(d) Consolidated Assessment and Listing Methodology (CALM) defines primary and secondary contact recreation areas. Refer to Table 4 for definitions.

Table 2. Primary Contact Recreation Areas

Beach Name	Town	Waterbody
Bass Beach	Rye	Atlantic Ocean
Cable Beach	Rye	Atlantic Ocean
Foss Beach	Rye	Atlantic Ocean
Hampton Beach State Park	Hampton	Atlantic Ocean
Sun Valley Beach	Hampton	Atlantic Ocean
Jenness Beach State Park	Rye	Atlantic Ocean
New Castle Town Beach	New Castle	Portsmouth Harbor
North Beach	Hampton	Atlantic Ocean
Northside Park	Hampton	Atlantic Ocean
Pirates Cove Beach	Rye	Atlantic Ocean
Sawyer Beach	Rye	Atlantic Ocean
Seabrook Town Beach	Seabrook	Atlantic Ocean
Seabrook Harbor Beach	Seabrook	Hampton/Seabrook Harbor
Star Island Beach	Rye	Atlantic Ocean
State Beach (North Hampton State Beach)	North Hampton	Atlantic Ocean
Wallis Sands State Park	Rye	Atlantic Ocean

Table 3. Secondary Contact Recreation Areas

Name	Town	Waterbody
North Hampton Access	Hampton	Atlantic Ocean
Odiorne Access	Rye	Little Harbor
Odiorne Park Boat Launch	Rye	Little Harbor
New Castle Access	New Castle	Portsmouth Harbor
Goat Island Access	New Castle	Little Harbor
Sun Valley Access	Hampton	Hampton River
Rye Harbor Access	Rye	Rye Harbor

Table 4: New Hampshire Designated Use Definitions for Recreational Waters

Designated Use	DES Definition	Applicability
Primary Contact Recreation (i.e. swimming)	Waters suitable for recreational uses that require or are likely to result in full body contact and/or incidental ingestion of water	All surface waters
Secondary Contact Recreation	Waters that support recreational uses that involve minor contact with the water.	All surface waters

From the New Hampshire 2002 Consolidated Assessment and Listing Methodology

References

Comstock, G. 2003. *2002 Section 305(b) and 303(d) Consolidated Assessment and Listing Methodology and Comprehensive Monitoring Strategy*. State of New Hampshire Department of Environmental Services. Concord, NH.

USEPA. 2002. *National Beach Guidance and Required Performance Criteria for Grants.* EPA-823-B-02-004. U.S. Environmental Protection Agency, Washington, DC.