

2005 QAPP for Three Fresh Water Beach Bacteria TMDL Studies in New Hampshire: Sand Dam Village Pond, Mill Pond and Pawtuckaway State Park

1.0 Title and Signature Page

Document Title: Quality Assurance Project Plan for Three Fresh
Water Beach Bacteria TMDL Studies in New
Hampshire at Sand Dam Village Pond, Mill Pond
and Pawtuckaway State Park.

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3.0 Introduction

The Federal Clean Water Act requires states under section 303(d) to list waters impaired for recreation (fishing, swimming) and further requires states under section 305(b) to report on the status of those waters. States list impaired waters every two years in the Consolidated Assessment and Listing Methodology (CALM) submitted to the Environmental Protection Agency (EPA). EPA requires states to develop Total Maximum Daily Load (TMDL) studies on impaired waters for the pollutants causing impairment. NHDES gathers waters quality data through different programs to assess its water bodies and meet EPA requirements.

Three Freshwater Beaches that are currently listed as impaired on the 303(d) list for primary contact recreation due to bacteria contamination and require the development of a TMDL for *E. coli* bacteria have been chosen for Total Maximum Daily Load (TMDL) studies. The assessment units (AUs) associated with the three beaches are: Sand Dam Village Pond-Town Beach (NHIMP802010303-04-02), Mill Pond Town Beach (NHIMP700030204-05-02), Pawtuckaway Lake-Pawtuckaway State Park (NHLAK600030704-02-02). The three beaches were selected to represent a different suspected source of bacteria. The three suspected sources are waterfowl (Sand Dam Village Pond), agriculture (Mill Pond), and bather loads (Pawtuckaway State Park).

The NHDES Beach Program samples coastal and freshwater beaches for the presence of *E. coli* and Enterococci. These bacteria are indicator organisms that signify the potential occurrence of pathogenic bacteria. Pathogenic bacteria can cause illness when present in large amounts and ingested during recreational activities at public beaches. In accordance with the EPA, the state has set strict standards for acceptable levels of bacteria at its public beaches. The state standard at freshwater beaches for *E. coli* 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 standard at coastal beaches for Enterococci is 104 counts per 100 mL of water, or a geometric mean of 35 counts per 100 mL of water during a sixty day period. If the single sample criteria are not met, a bacteria advisory is posted.

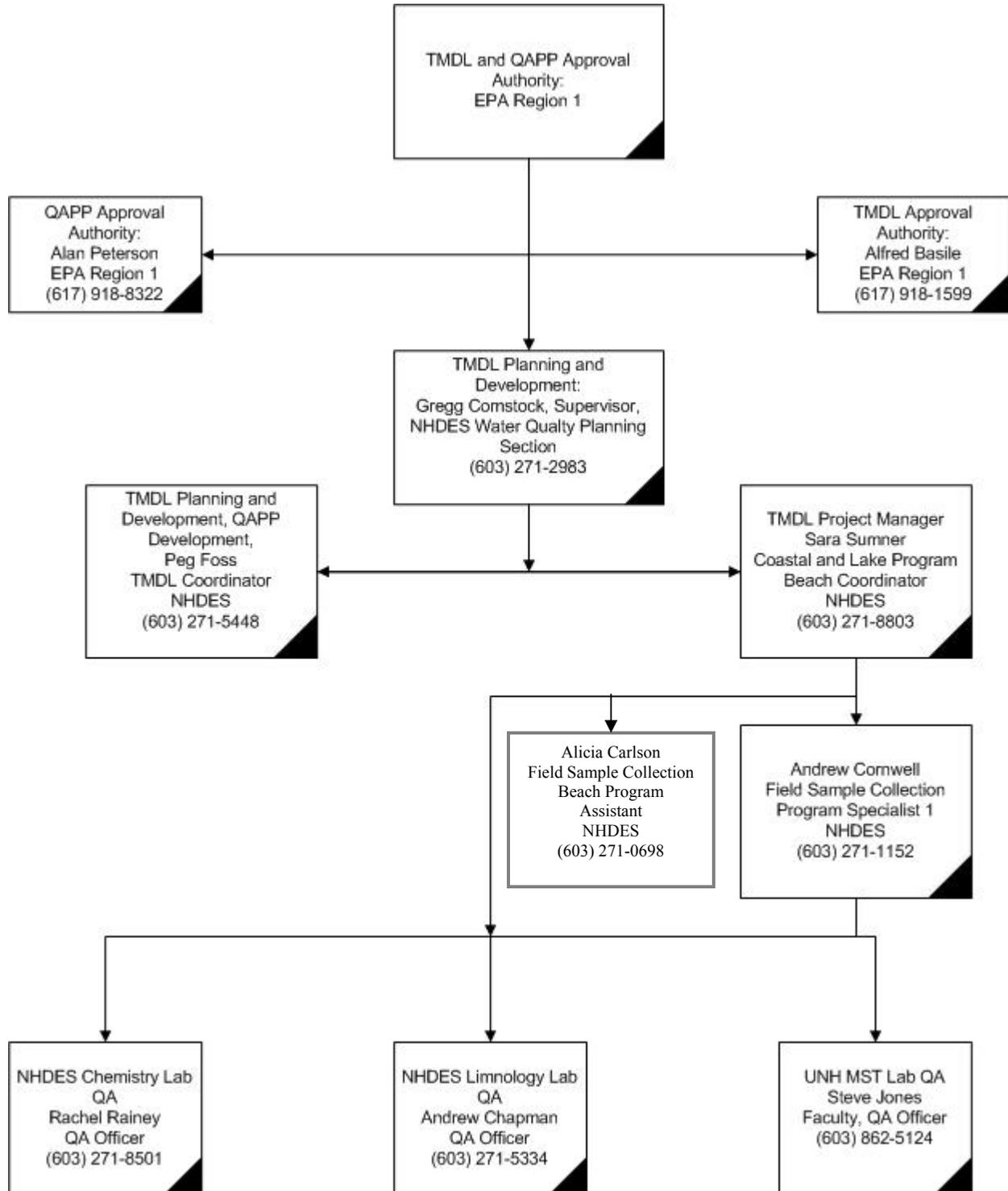
A public beach is listed as impaired when bacteria counts exceed state standards resulting in the posting of an advisory. Historical advisory posting data indicate that specific public beaches reflect chronic violations of *E. coli* water quality standards. To accurately identify the sources of *E. coli* to the beach areas, DES can employ the microbial source tracking (MST) technique ribotyping. This technique specifically identifies the sources of *E. coli* as human, waterfowl, domestic, or other animal.

4.0 Project Organization

This section identifies the Organizations and key personnel participating in the project and describes their specific roles, responsibilities and qualifications. This section also explains communication pathways.

Figure 1 depicts an organizational chart for this project. A description of each person's responsibilities associated with this project is provided in Section 5, Table 1 below. The Project Manager will be the primary contact for all parties involved in this study. If problems arise in the field, laboratory, or in any phase of the study, the Project Manager will be contacted and will determine the best course of action. If sampling design or sample collection procedures need to be modified, the Project Manager will submit modifications to EPA Region 1. If sample analysis procedures need to be modified, the Laboratory QA Officer will work with the Project Manager and then the Project Manager will submit modifications to EPA Region 1 for review and approval. If data assessment and reporting needs to be modified, the Project Manager will submit the modifications to EPA Region 1 for review and approval.

Figure 1
Organizational Chart



5.0 Project Definition

Freshwater Beach Bacteria TMDL

The TMDL studies will be conducted at three fresh water public beaches. These beaches are: Mill Pond Town Beach, East Washington; Pawtuckaway Lake State Park, Nottingham; and Sand Dam Village Pond Town Beach, Troy. Each beach experiences chronic bacteria exceedences during the summer months resulting in annual bacteria advisories. It is suspected that each beach is impaired by a different source of bacteria. The three suspected sources are waterfowl (Sand Dam Village Pond), agriculture (Mill Pond), and bather loads (Pawtuckaway State Park).

- **Waterfowl:** Feces of waterfowl, such as ducks and Canada Geese, can cause elevated bacterial levels at designated public beaches. Sand Dam Village Pond Town Beach (BCHTWBTRO) has had a resident geese problem during the swim season. Historical inspection and advisory data indicate that the presence of geese (and associated feces) in and along the beach area is the major source of elevated bacteria levels in the swim area
- **Agriculture:** Agricultural practices can be a non-point source of pollution to designated public beaches. Mill Pond Town Beach (BCHMPBWAS) experiences elevated bacteria levels suspected to be caused by agricultural facilities located upstream of the impoundment. Historical inspection and advisory data indicate that following rain events, *E. coli* concentrations exceed state bacteria standards.
- **Bather Loads:** Heavy bather load can be related to elevated bacteria levels at public beaches. Pawtuckaway Lake State Park (BCHPSPNOT) experiences large bather loads during the summer months.

Load Study Area

The total *E. coli* load per beach is based on a defined swim area. At most public beaches, bathers are not allowed to swim outside of the designated swim area. Due to this, the TMDL does not include *E. coli* concentrations that are directly outside of the designated swim area. Two to three samples collected at knee depth within the swim area yield the mean *E. coli* concentration for the beach.

6.0 Project Task Description

Table 1. Personnel Responsibilities and Qualifications

Name and Affiliation	Responsibilities	Qualifications
Alfred Basile EPA Region 1	Responsible for issuing final Approval of TMDL	On File at EPA
Alfred Basile EPA Region 1	Responsible for Reviewing TMDL for Completeness	On File at EPA
Alan Peterson EPA Region 1	Responsible for Review and approval of QAPP	On File at EPA
Gregg Comstock NHDES	Water Quality Planning Section Supervisor in overall charge of all work associated with TMDL development	On File at NHDES
Peg Foss NHDES	TMDL Coordinator in charge of TMDL development including project planning and development including QAPP preparation	On File at NHDES
Sara Sumner NHDES	Project Manager in charge of planning and development of this TMDL, organization and coordination of all field and lab activities, supervision of field sampling staff and overall project oversight	On File at NHDES
Alicia Carlson NHDES	Program Assistant in charge of assisting in all field activities when necessary.	On File at NHDES
Andrew Cornwell NHDES	Responsible for sample collection and handling	On File at NHDES
Rachel Rainey NHDES	NHDES Chemistry Laboratory QA/QC Officer	On File at NHDES
Steve Jones UNH	UNH Faculty, Supervisor of MST Laboratory	On File at UNH

7.0 Sampling Design

Water samples will be collected from the three beaches in the designated swimming areas during wet and dry weather conditions. Dry weather sampling is equal to < .25 inches of wet fall in the previous 24 hours. Beach dry weather sampling will occur once per week during the swim season. The swim season is twelve weeks long and two to three samples will be collected per beach. Dry weather sampling will yield residual *E. coli* concentrations (in the absence of bathers), loading from bathers, and non-point source loads. The actual number of bathers will be counted during each sampling event. This will estimate the maximum bather load capacity for each beach. Sampling in the absence of bathers will estimate the residual *E. coli* concentration and dry weather non-point source loads. Wet weather beach sampling will occur four times over the course of the swim season, weather permitting. Wet weather is equal to > .25 inches of wet fall in the previous 24 hours. Precipitation will be measured using rain gauges stationed at each beach. Two to three samples will be collected per beach. Wet weather sampling will estimate the non-point source *E. coli* loading to the beach.

Load Calculation Methods

The major sources of bacterial (*E. coli*) loading to beach areas are assumed to be residual bacteria, bather loads, and non-point sources. The TMDL is equal to the load allocation (LA) + waste load allocation (WLA) + margin of safety (MOS); or $TMDL = LA + WLA + MOS$. For this TMDL the $WLA = 0$ since all sources of bacteria are non-point sources. Therefore, the $TMDL = LA + MOS$. The MOS will be 5% for this TMDL. The TMDL will be calculated for the single sample and geometric mean *E. coli* criteria as follows:

- Single sample criteria = 88 cts/100 mL; TMDL is $88 = 83 + 5$
- Geometric mean criteria = 47 cts/100 mL; TMDL is $47 = 44 + 3$

Microbial source tracking (MST) techniques will be used to identify the specific source species of *E. coli* at the beach. MST will identify the *E. coli* sources as human, waterfowl, or other animal (agriculture, deer, etc...). MST samples will be collected during four dry and four wet weather events. One sample per beach will be collected for each event. Using MST, the allocation of loading to a specific source is possible. A local source species library will be developed for the beach area where appropriate. A source species DNA library currently exists and can be applied statewide, however, to increase the likelihood of matching an *E. coli* isolate with a library source, a local source species DNA library is beneficial. Scat samples from various local source species will be collected and compared with *E. coli* isolates from the

beach area. All beach bacteria and scat samples will be transported to the University of New Hampshire's Jackson Estuarine Laboratory for bacterial indicator and ribotyping analyses. Using MST, *E. coli* loading can be allocated to specific source species. *E. coli* percent reductions per source to meet state standards can be calculated and efforts to reduce or eliminate the sources can be implemented.

Load Reduction Methods

Load reductions are based on the single sample maximum and geometric mean water quality criteria for designated beach areas. The percent reduction will be the difference between the TMDL and the beach load. Single sample (SS) and geometric mean (GM) percent reductions will be based upon the maximum *E. coli* loading allocated per source. Example (SS): maximum bather *E. coli* load allocation = 550 cts/100 mL; TMDL = $550 - 83 / 550 = 85\%$. The same can be applied for the geometric mean.

8.0 Site Sampling Maps

Figure 2

Mill Pond Town Beach East Washington, NH

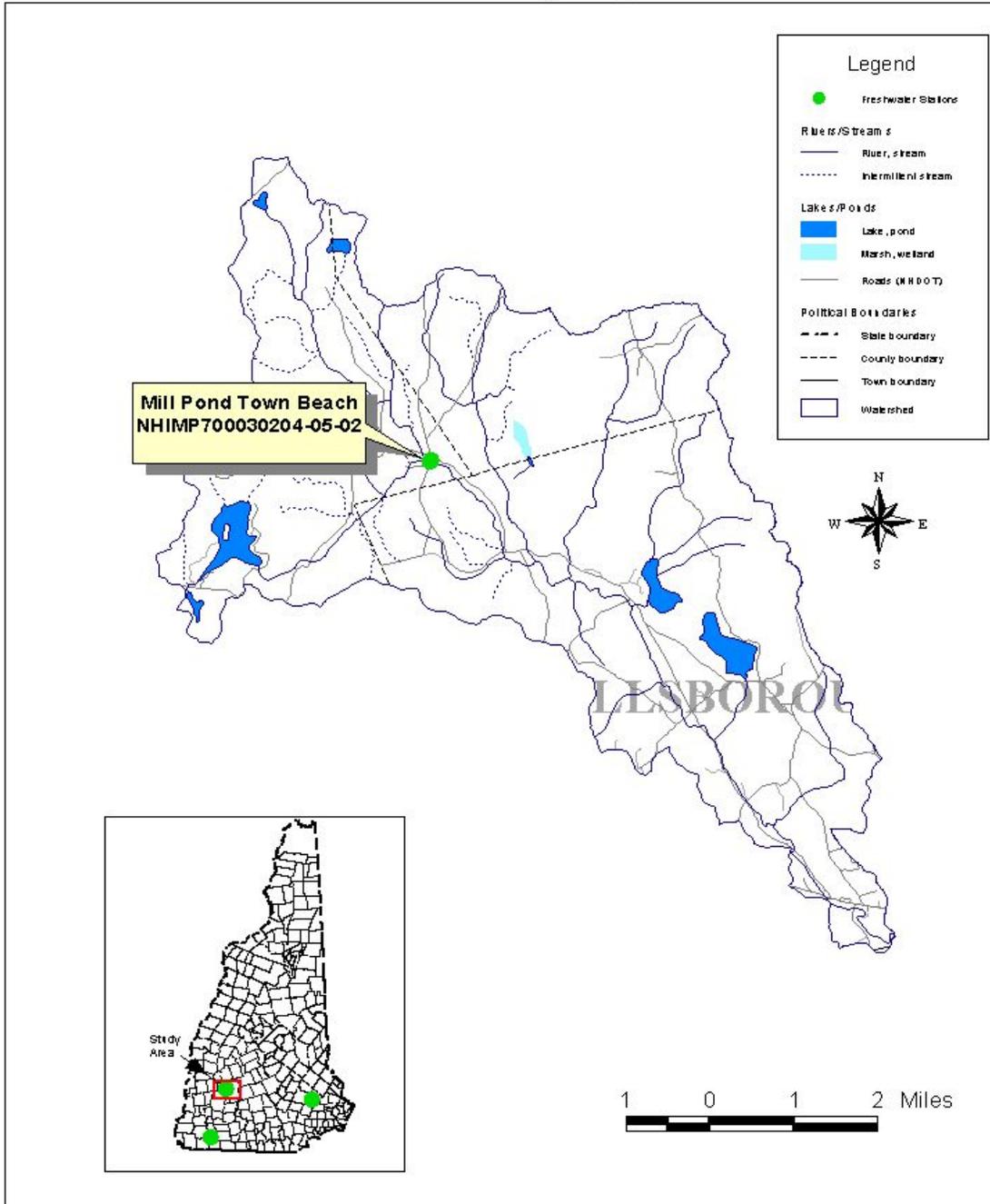


Figure 2.a.



Figure 3

Pawtuckaway Lake State Park Beach Nottingham, NH

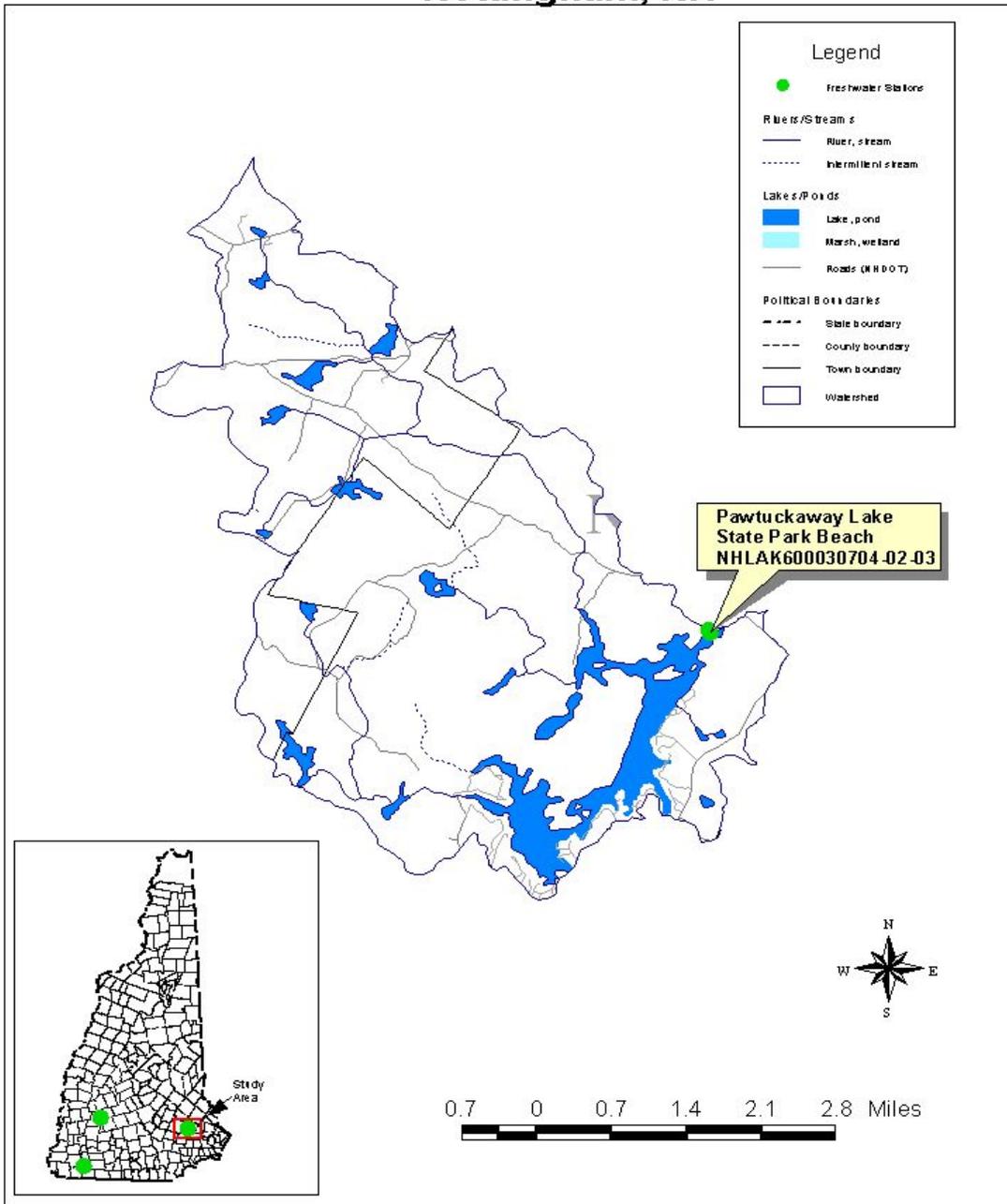


Figure 3.a.

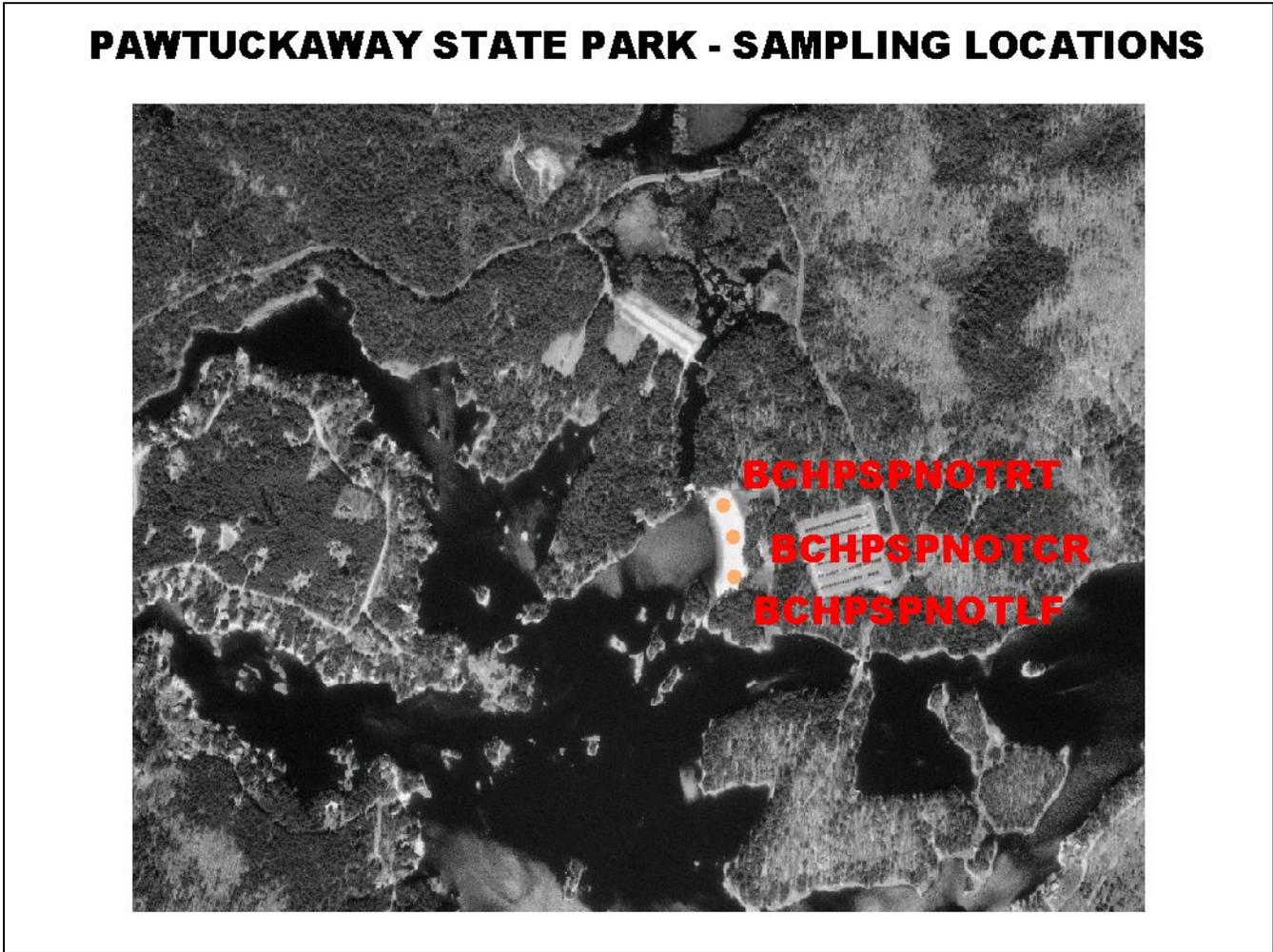


Figure 4

Village Pond Sand Dam Beach Troy, NH

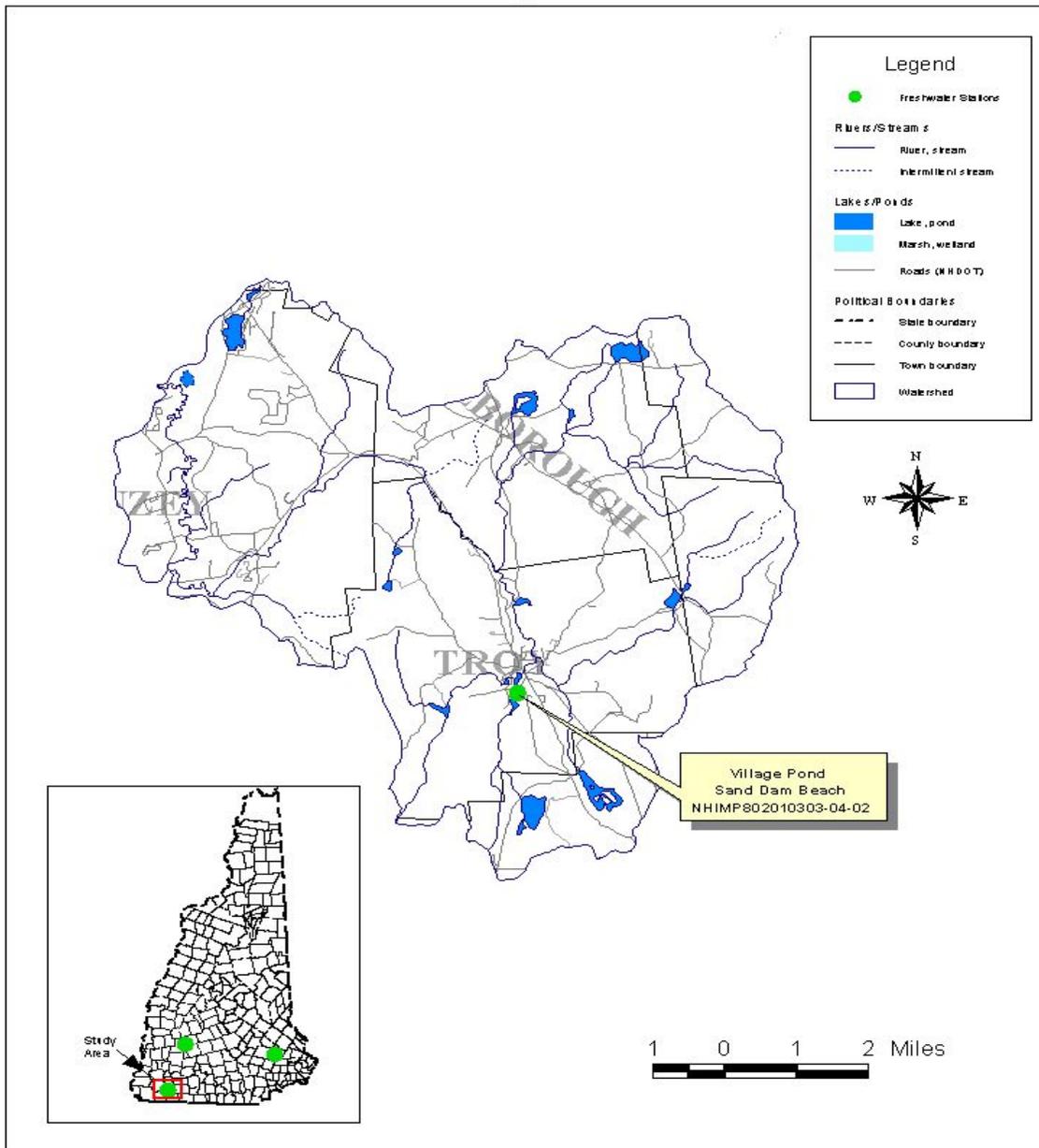


Figure 4.a.

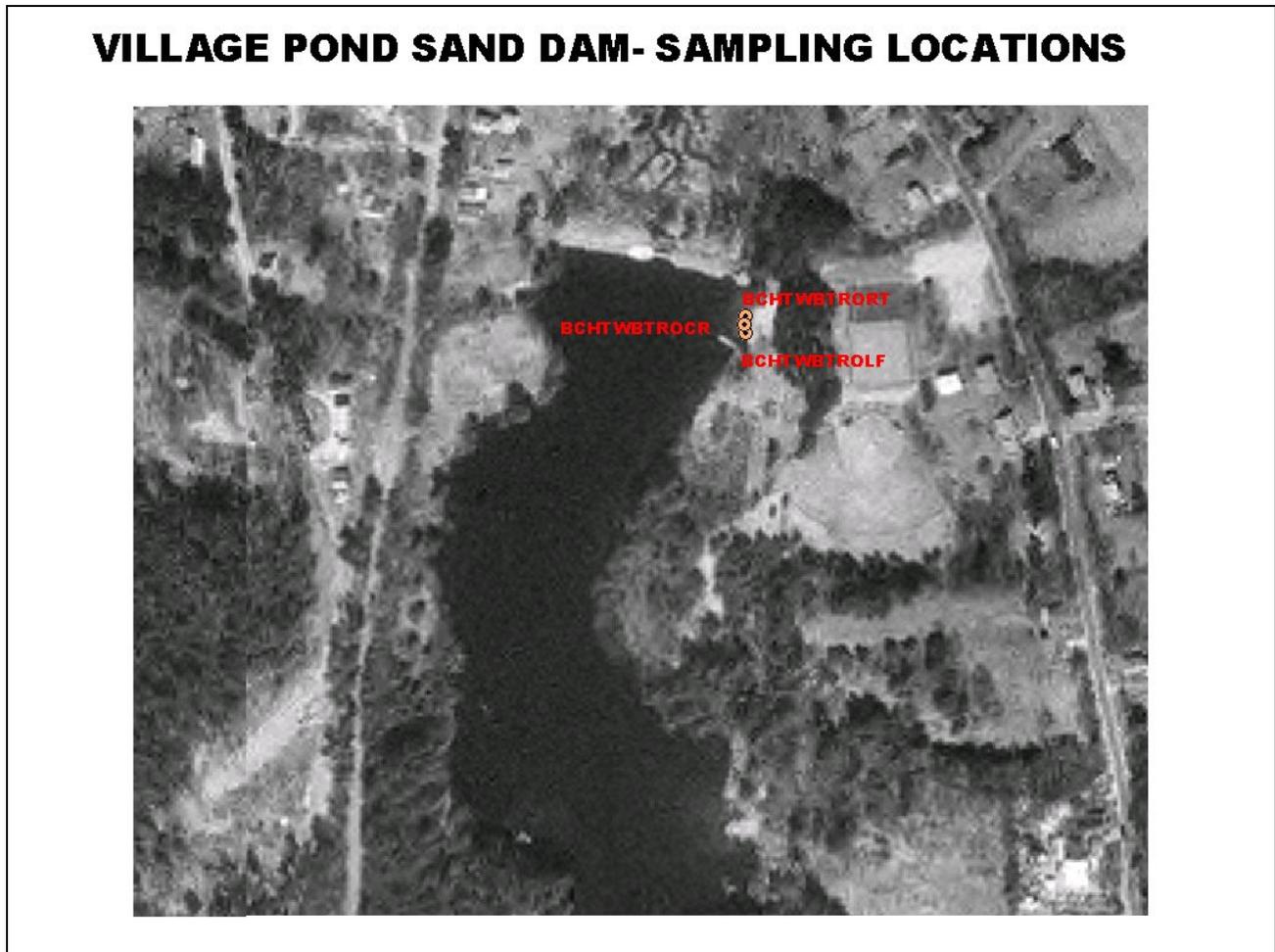


Table 2. Beach Sampling Site Locations Table

EPA ID	Beach Name	Station ID	Station Name	Latitude	Longitude
NH257154	Mill Pond Town Beach	BCHMPBWASCR	Mill Pond TB - Center	43 11 25.2	72 1 8.2
NH257154	Mill Pond Town Beach	BCHMPBWASLF	Mill Pond TB - Left	43 11 25.1	72 1 8.3
NH257154	Mill Pond Town Beach	BCHMPBWASRT	Mill Pond TB - Right	43 11 25.3	72 1 8.1
NH260388	Pawtuckaway State Park Beach	BCHPSPNOTCR	Pawtuckaway SP - Center	43 5 5.5	71 9 17.7
NH260388	Pawtuckaway State Park Beach	BCHPSPNOTLF	Pawtuckaway SP - Left	43 5 3	71 9 17.7
NH260388	Pawtuckaway State Park Beach	BCHPSPNOTRT	Pawtuckaway SP - Right	43 5 7.5	71 9 18.6
NH260388	Pawtuckaway State Park Beach	BCHPSPNOTWET	Pawtuckaway SP – Wetland Draininage		
NH774329	Village Pond Sand Dam	BCHTWBTROCR	Village Pond Sand Dam TG-Center	42 49 9.85	72 10 59.51
NH774329	Village Pond Sand Dam	BCHTWBTROLF	Village Pond Sand Dam TG-Left	42 49 9.7	72 10 59.5
NH774329	Village Pond Sand Dam	BCHTWBTRORT	Village Pond Sand Dam TG-Right	42 49 10	72 10 59.5

9.0 Sampling and Analytical Summary Table

Table 2 describes the ambient beach sampling design for the project. Table 3 describes the MST sample design for this project. Table 4 describes sample requirements for both the DES Laboratory Services and the UNH Jackson Estuarine Laboratory (JEL). Table 5 describes field quality control requirements for ambient beach bacteria sampling.

Table 3. Freshwater Beach TMDL Ambient Dry and Wet Weather Sample Design

Station	Total # Dry Weather Sample Events	Total # Wet Weather Sample Events	# Samples per Event	Total # Samples
Pawtuckaway Lake State Park Beach	12	4	3	48
Sand Dam Village Pond Beach	12	4	3	48
Mill Pond Town Beach Beach	12	4	3	48

Table 4. Freshwater Beach TMDL Microbial Source Tracking Sample Design

Station	Total # Sample Events	# Samples per Event	Total # Samples	# Isolates per Sample	Total # Isolates
Pawtuckaway Lake State Park Beach	8	1	8	5	40
Sand Dam Village Pond Beach	8	1	8	5	40
Mill Pond Town Beach Beach	8	1	8	5	40
Scat Sampling				30	

Table 5. Sample Requirements

Analytical Parameter	Matrix	Collection Method	Sample Container and Type	Sample Preservation	Holding Time	Laboratory
<i>E. coli</i>	Surface water	Grab	8 oz. sterile plastic bottle	Chilled to < 10°C	6 hours	DES
<i>E. coli</i>	Surface water	Grab	8 oz. sterile plastic bottle	Chilled to < 10°C	6 hours	JEL
<i>E. coli</i>	Fecal material	Grab	Sterilized Whirl-Pak®	Chilled to < 10°C	6 hours	JEL
Ribotyping	Isolates from a plate	Tryptic soy agar	RiboPrinter sample carrier	- 80°C	Indefinite	JEL
Water Temperature	Surface water	In-situ	N/A	N/A	N/A	N/A

Table 6. Field Quality Control Samples and Frequency Table

Analytical Parameter	Matrix	Field QC	DQ Indicator	Acceptable Limits	Method Reference	Corrective Action	Frequency
<i>E. coli</i>	Surface Water	Field duplicate	Precision	RPD ≤ 75%	Appendix A (Beach Program QAPP)	Address field operations and precision	10% of samples
<i>E. coli</i>	Surface Water	Trip blanks	Accuracy/ Bias	0 counts	Appendix A (Beach Program QAPP)	Retest and address lab D.I. water and bottle sterilization	One per trip

10.0 Reports

The Draft TMDL report will describe the bacterial and ribotyping results for each location under dry and wet weather conditions. The ribotyping results will identify the specific fecal bacterial sources and the percent dominance reported for each site based on the local source species DNA libraries and the statewide source species DNA library. The report will also include the TMDL calculation for each beach. The draft report will be submitted to EPA for review and approval. The results will be forwarded to the Water Quality Planning section for TMDL implementation. Restoration strategies will also depend on the principal source(s) for each contaminated site. All results will also be reported to other State Agencies and local governments and stakeholder groups.

11.0 Method and SOP Reference Table

Appendix A contains the Generic QAPP for the NHDES Beach Program sampling and analysis, approved by EPA on May 7, 2003. Appendix B contains the QAPP for the MST sampling and analysis, approved by EPA on October 1, 2004. NHDES will follow the guidelines set forth in these QAPP's for this study. The methods and SOP's described in both of these QAPP's will be used in this study. Both QAPP's include the analytical laboratories' SOP's that describe the sensitivity, precision bias of all analytical methods utilized for this project.

Appendix A

Generic Beach QAPP

May 7, 2003

Revision 5: February 17, 2005

Appendix B

Microbial Source Tracking (MST) QAPP

October 1, 2004