Combined work/quality assurance project plan (CWQAPP) Revision 1

for

Fecal Coliform Monitoring: 2002-2005

Massachusetts Water Resources Authority
Environmental Quality Department
Report ENQUAD ms-072

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COMBINED WORK/QUALITY ASSURANCE PROJECT PLAN

for

FECAL COLIFORM MONITORING 2002-2005
REVISION 1

Task 26

MWRA Harbor and Outfall Monitoring Project
Contract No. S366

Submitted to

Massachusetts Water Resources Authority
Environmental Quality Department
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October 2004
ms-072

COMBINED WORK/QUALITY ASSURANCE PROJECT PLAN

for

FECAL COLIFORM MONITORING 2002-2005

REVISION 1

TASK 26
MWRA HARBOR AND OUTFALL MONITORING PROJECT
CONTRACT NO. S366

CONCURRENCE AND APPROVALS

Ms. Ellen Baptiste-Carpenter Battelle Project Manager	Date
Dr. Carlton Hunt Battelle Technical Director	Date
Ms. Rosanna Buhl Battelle Project QA Officer	Date
Dr. Michael Mickelson MWRA Project Manager	Date
Ms. Kelly Coughlin MWRA Project Area Manager	Date
Ms. Wendy Leo MWRA EM & MS Manager	Date

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1.0 PROJECT NAME

MWRA Harbor and Outfall Monitoring Project
Task 26
Fecal Coliform Monitoring of Massachusetts Bay

2.0 PROJECT REQUESTED BY

Massachusetts Water Resources Authority
Environmental Quality Department

3.0 DATE OF REQUEST

November 7, 2001

4.0 DATE OF PROJECT INITIATION

November 7, 2001

5.0 PROJECT MANAGEMENT

Dr. Andrea Rex, MWRA Director of Environmental Quality Department
Dr. Michael Mickelson, MWRA Harbor and Outfall Monitoring Project Manager
Mr. Kenneth Keay, MWRA Harbor and Outfall Monitoring Deputy Project Manager
Ms. Kelly Coughlin, MWRA Project Area Manager
Ms. Ellen Baptiste-Carpenter, Battelle Project Manager for Harbor and Outfall Monitoring
Ms. Jeanine Boyle, Battelle Deputy Project Manager for Harbor and Outfall Monitoring
Dr. Carlton Hunt, Battelle Technical Director
Mr. Chris Gagnon, Battelle Field Manager
Ms. Deirdre Dahlen, Battelle Laboratory Manager

6.0 QUALITY ASSURANCE (QA) MANAGEMENT

Ms. Wendy Leo, MWRA EM & MS Manager
Ms. Rosanna Buhl, Battelle Project Quality Assurance Officer

7.0 PROJECT DESCRIPTION

7.1 Objective and Scope

The Massachusetts Water Resources Authority (MWRA) Harbor and Outfall Monitoring (HOM) Program requires that bacterial indicator data be collected in Massachusetts Bay. This activity provides MWRA and the Massachusetts Division of Marine Fisheries (DMF) with data required to comply with shellfish-growing water regulations, and to assure that the operation of the MWRA's outfall in Massachusetts Bay does not adversely affect shellfish-growing waters.

This work, conducted under Task 26 (Fecal Coliform Monitoring) of the HOM 4 project, provides assistance to the MWRA in evaluating fecal coliform and *Enterococcus* densities at specific locations in Massachusetts Bay. Battelle's assistance is limited to field operations in Massachusetts Bay through 2005 and data reporting through 2003. MWRA will conduct laboratory analyses and report the monitoring data to DMF. Through 2003, Battelle will receive final bacterial indicator data from MWRA and submit fecal coliform data reports, including field data, to MWRA semi-annually. After 2003, Battelle's work is limited to field operations on an on-call basis, and subsequent submittal of associated survey reports and water column profile data to MWRA.

7.2 Data Usage

The data will be used by the DMF to evaluate the water quality of the "conditional" classified shellfish-growing waters in areas of Massachusetts Bay potentially affected by operation of the outfall (conditional classification surveys), and to events such as a major storm or chlorination failure at the Deer Island Treatment Plant (adverse condition surveys).

7.3 Technical Approach

The technical requirements and schedule for Task 26 activities are listed in Tables 1 and 2.

Table 1. Technical Requirements for Fecal Coliform Monitoring.

Year	Activity	Conditional Classification Surveys	Adverse Condition Surveys
2002 - 2003	Schedule	Survey # / Week Number[1] PC0X1 / 5 PC02X / 9 PC0X3 / 14 PC0X4 / 17 PC0X5 / 20 PC0X6 / 25 PC0X7 / 30 PC0X8 / 34 PC0X9 / 39 PC0X0 / 43 PC0XA / 48 PC0XB / 51	As requested. Approximately 5 surveys per year.
	Stations	12 stations	12 stations
	Water column measurements	Hydrographic profiling See Libby *et al.* (2002)	Hydrographic profiling See Libby *et al.* (2002)

Year	Activity	Conditional Classification Surveys	Adverse Condition Surveys
	Water Samples and Gear	24 samples[2] per survey; Niskin bottles	24 samples[2] per survey; Niskin bottles
	Custody and Storage	Battelle bottle IDs (field only) MWRA LIMS sample IDs; Chilled	Battelle bottle IDs (field only) MWRA LIMS sample IDs; Chilled
	Whale Observations	Dec - May 15	Dec - May 15
2004-2005	Schedule	Survey # / Week Number[1] As requested.	As requested. Approximately 5 surveys per year.
	Stations	11 stations	11 stations
	Water column measurements	Hydrographic profiling See Libby *et al.* (2002)	Hydrographic profiling See Libby *et al.* (2002)
	Water Samples and Gear	22 samples[2] per survey; Niskin bottles	22 samples[2] per survey; Niskin bottles
	Custody and Storage	Battelle bottle IDs (field only) MWRA LIMS sample IDs; Chilled	Battelle bottle IDs (field only) MWRA LIMS sample IDs; Chilled
	Whale Observations	Dec - May 15	Dec - May 15

[1] Exact dates will be determined as the study progresses
[2] A maximum of 24 (2002-2003) or 22 (2004-2005) samples per survey, fewer samples will be collected when the water column is unstratified.

7.3.1 Field Surveys Program

In a Memorandum of Understanding (MOU), the MWRA and the DMF entered into a Monitoring and Notification Agreement [Appendix A (2002-2003) and B (2004-2005)]. The agreement describes the processes for monitoring fecal coliform in Boston Harbor and Massachusetts Bay. The agreement also details the circumstances under which an adverse condition may be declared and adverse condition stations must be sampled. Wording concerning pre-discharge and transect monitoring in the MOU does not apply to the HOM 4 program.

Conditional Classification and Adverse condition surveys are conducted at 12 stations in Massachusetts Bay (Figure 1) from 2002 – 2003, and 11 stations from 2004 - 2005. Adverse condition surveys are conducted at the request of MWRA (in consultation with DMF), in response to an event such as a major storm or chlorination failure at the Deer Island Treatment Plant.

7.3.1.1 Conditional Classification Surveys (Task 26.3)

Water column profiles of hydrographic and water quality data, and water samples for fecal coliform analysis will be obtained monthly at each of 12 conditional classification stations (Table 2; Figure1) for 2002 – 2003 and 11 stations for 2004 - 2005. Up to 1104 water samples will be collected during the

course of this program (12 stations per survey; two samples per station[11] x 48 surveys). If a pycnocline is not observed at a station, only the surface sample will be collected. No field duplicates are required for this monitoring effort. During field collection, both Battelle and MWRA COC forms will be completed (Section 13.2).

Hydrographic profiling of conductivity, temperature, sensor depth, and dissolved oxygen will be performed at each station (Table 2; Figure1) using Battelle's BOSS system. Salinity and density will be calculated in real-time from the conductivity, temperature, and depth data. Water depth (altitude above bottom), bathymetry, navigational position, and time also will be recorded by the NAVSAM system. Results will be directly input to Battelle's copy of the EM & MS database (see Section 15.2.1). Profiles will extend to at least 5 m above the bottom and closer if dissolved oxygen levels decrease markedly with depth.

Surface and subpycnocline water samples will be collected using Niskin bottles deployed with a Rosette system. Sample bottles will not be closed until the oxygen sensor has come to equilibrium to ensure sample data represent the collected water. Water samples will be stored chilled and delivered to the Deer Island Central Laboratory within 12 hours of collection.

Certified whale observers will be present on surveys conducted between December 1 and May 31. Whale observation results will be included in the survey report. Whale observations will be analyzed and the results included in the annual whale observation report prepared under Task 33.1 of the HOM 4 program.

[1] If two depths are required for each station on each survey.

Table 2. Conditional Classification/Adverse Condition Sampling Stations[1]

Year	Station	Latitude	Longitude	Depth (m)
2002-2003	N02	42° 25.65' N	70° 49.31' W	39
	N09	42° 20.39' N	70° 47.48' W	35
	N16	42° 23.64' N	70° 45.20' W	42
	N20	42° 22.90' N	70° 49.03' W	31
	F10	42° 14.54' N	70° 38.24' W	33
	F13	42° 16.10' N	70° 44.10' W	25
	F14	42° 18.00' N	70° 48.50' W	19
	F17	42° 20.75' N	70° 34.23' W	76
	F18	42° 26.53' N	70° 53.30' W	25
	F22	42° 28.79' N	70° 37.06' W	79
	F24	42° 22.50' N	70° 53.75' W	21
	F25	42° 19.30' N	70° 52.58' W	15
2004-2005	N04	42° 26.64' N	70° 44.22' W	50
	N07	42° 21.36' N	70° 42.36' W	50
	N02	42° 25.65' N	70° 49.31' W	39
	N09	42° 20.39' N	70° 47.48' W	35
	N16	42° 23.64' N	70° 45.20' W	42
	N20	42° 22.90' N	70° 49.03' W	31
	F13	42° 16.10' N	70° 44.10' W	25
	F14	42° 18.00' N	70° 48.50' W	19
	F18	42° 26.53' N	70° 53.30' W	25
	F24	42° 22.50' N	70° 53.75' W	21
	F25	42° 19.30' N	70° 52.58' W	15

[1] The monitoring agreement was updated for 2004-05 (MWRA/DMF Memorandum of Understanding, dated 10/30/2003); locations F10, F17, and F22 were dropped, stations N04 and N07 were added.

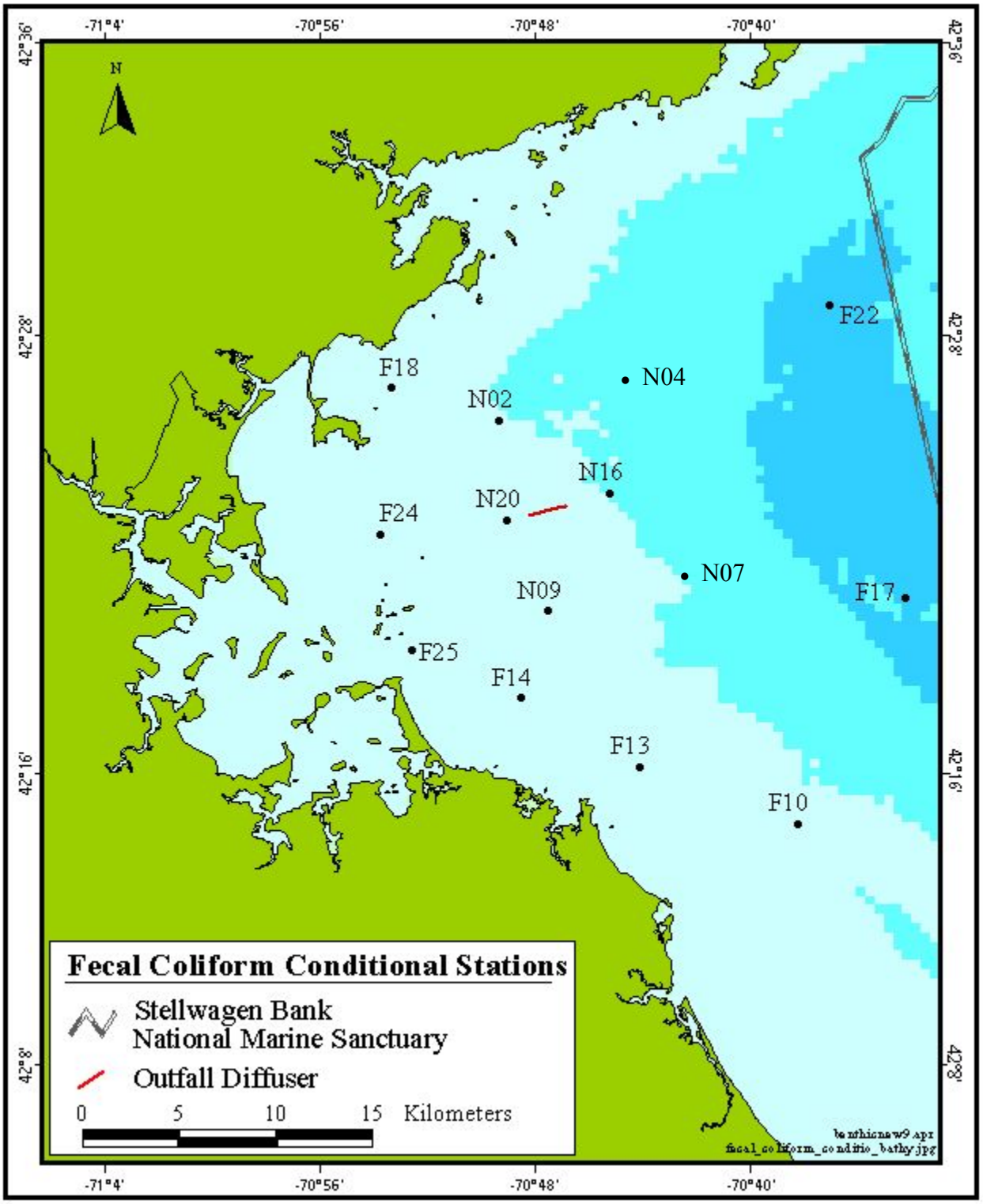

Figure 1. Fecal Coliform Conditional Classifications and Adverse Condition Sampling.

[*In 2004, N04 and N07 were added, and F10, F17, and F22 were removed.]*

7.3.1.2 Adverse Condition Surveys (Task 26.4)

Criteria for mounting an adverse condition survey are in outlined Appendices A and B. The adverse condition survey plan (Appendix C) will be implemented as weather conditions allow. A rapid-response field team has been designated. This team will be responsible for mobilizing and completing the adverse condition survey in the event of chlorination failure or other conditions that might adversely affect the treatment plant's ability to provide adequate treatment and disinfection of effluent at the Deer Island Plant. The Field Manager will oversee the survey team and will be responsible for all communications with MWRA.

MWRA may request approximately 5 adverse condition surveys per year at the discretion of DMF. Up to 120 water samples (12 stations (Figure 1) per survey, two samples per station, 5 surveys) may be collected for fecal coliform analysis by MWRA. As in Conditional Classification surveys, if no pycnocline is observed only the surface sample will be collected. During field collection, both Battelle and MWRA COC forms will be completed (Section 13.2).

Survey activities will include hydrographic profiling and water samples collection, performed as described in Section 7.3.1.1. MWRA will provide a set of bottles for the rapid response teams. These bottles will be stored on Battelle's research vessel at all times. An additional set will be maintained at Battelle as a backup. Water samples will be stored chilled and delivered to the Deer Island Central Laboratory within 12 hours of collection.

Certified whale observers will be on stand-by status for all surveys conducted between December 1 and May 31. Whale observation results will be included in the survey report and annual whale observation report prepared under Task 33.1 of the HOM 4 program.

7.3.2 Laboratory Program for Survey Tasks

The MWRA central laboratory will analyze samples for fecal coliform abundance according to the methodology approved by the Massachusetts Division of Marine Fisheries. Samples will be tested for *Enterococcus* abundance according to MWRA's Standard Operating Procedure (MWRA, 1996).

8.0 PROJECT FISCAL INFORMATION

The Fecal Coliform Monitoring activities described in the CWQAPP are being conducted under the Harbor and Outfall Monitoring contract (Contract No. S366) between Battelle and MWRA.

9.0 SCHEDULE OF ACTIVITIES AND DELIVERABLES

The schedule of surveys is given in Table 1. The schedule of deliverables is below (Table 3).

Table 3. Schedule of Deliverables.

Year	Deliverable	Due Dates According to Survey Type	
		Conditional Classification	Adverse Condition
2002 - 2003	Survey Plan	2 weeks prior to survey	Generic survey plan (Appendix C)
	Surveys	Monthly	As requested
	Survey Report, including plots	4 weeks after each survey	4 weeks after each survey

Year	Deliverable	Due Dates According to Survey Type	
		Conditional Classification	**Adverse Condition**
	Data Reports and Exports	Jan-Jun surveys: August 15th same year Jul-Dec surveys: February 15th following year	
2004-2005	Survey Plan	Generic survey plan (Appendix C)	Generic survey plan (Appendix C)
	Surveys	As requested	As requested
	Survey Report, including plots	4 weeks after each survey	4 weeks after each survey
	Data Exports	4 weeks after each survey (hydrographic data only)	

10.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Figure 2 presents the Project Management structure for the Fecal Coliform Monitoring surveys. This structure represents the major tasks necessary to conduct the activities in the CWQAPP. Each element of the task has been assigned a separate subaccount with budget and milestones, and these accounts will be used to track costs against progress. Battelle's Program Management Plan describes the management policies that will be applied to all HOM 4 activities.

Dr. Andrea Rex is the MWRA Director of Environmental Quality Department. Dr. Michael Mickelson is the MWRA Project Manager. Ms. Kelly Coughlin is the MWRA Fecal Coliform Project Area Manager. They will be informed of all matters pertaining to work described in this CWQAPP. Mr. Ken Keay is the MWRA Deputy Project Manager and will serve as a back up to Dr. Mickelson. Ms. Wendy Leo is MWRA's EM & MS database manager. Ms. Nicole Parilla O'Neill is the MWRA Central Laboratory Supervisor responsible for Fecal Coliform and *Enterococcus* laboratory analysis Ms. O'Neill was replaced by Ms. Laura Ducott in 2004.

Ms. Ellen Baptiste-Carpenter is the Battelle Project Manager. She is responsible for ensuring that products and services are delivered in a timely and cost-effective manner that meets MWRA's expectation, and for the overall performance of this project. Ms. Baptiste-Carpenter is also Battelle's Database Manager for this project. Dr. Carlton Hunt is the Battelle Technical Director and is responsible for ensuring that data collection and interpretation are scientifically defensible, and for responding to technical challenges as they arise. Ms. Jeanine Boyle is Battelle's Deputy Project Manager. The Battelle Quality Assurance Officer for the project is Ms. Rosanna Buhl. For this task, Ms. Buhl is responsible for reviewing all survey reports prepared by Battelle and the 2002-2003 data reports for completeness and adherence to the CWQAPP. Mr. Chris Gagnon is the Battelle Field Manager, responsible for the overall field program as well as day-to-day activities. Ms. Deirdre Dahlen is in charge of data reports for this task.

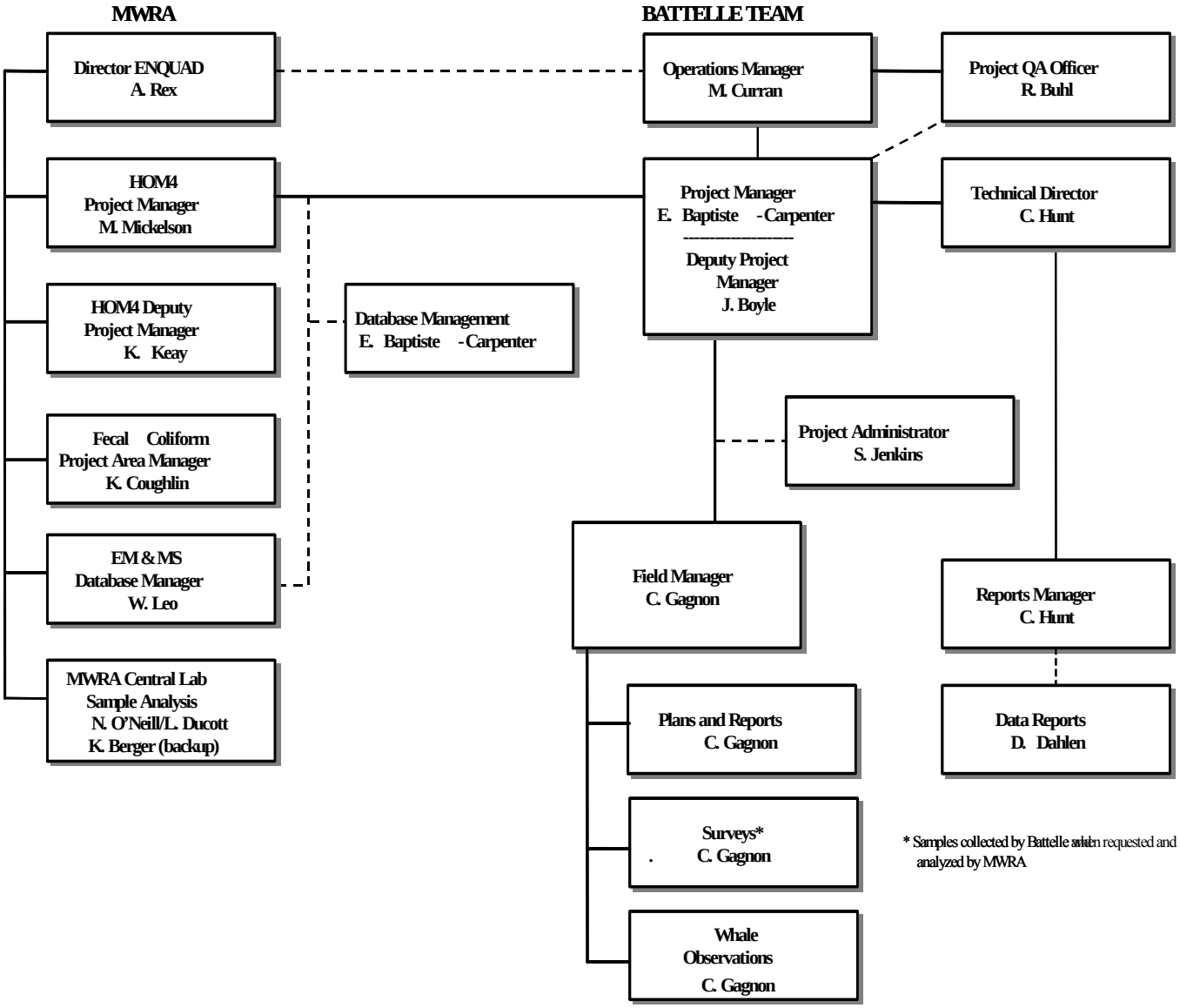

Figure 2. Fecal Coliform Study Area Organization

[*N. O'Neill was replaced by L. Ducott in 2004*]

11.0 DATA QUALITY REQUIREMENTS AND ASSESSMENTS

The HOM 4 Quality Management Plan (Battelle 2002) defines the quality system policies that will be applied to all HOM 4 activities. To ensure that all data generated during the conduct of surveys, analyses, and reporting are of the highest quality, data will be examined in terms precision, accuracy, completeness, comparability, and representativeness. The application of these measures of data quality is described below.

Accuracy – the extent of agreement between the measured value and the true value
Precision – the extent of agreement among independent, similar, or related measurements
Completeness – measure of the amount of data acquired relative to the amount of data required to fulfill the objectives and statistical criteria for the intended use of the data
Comparability – the extent to which data from one study can be compared directly to similar studies
Representativeness – the extent to which sample locations and measurements represent true systems

11.1 Navigational and Hydrographic Data

Data quality requirements and assessments for navigational and hydrographic data are detailed in the Water Column Monitoring CWQAPP (Albro *et al*. 2002, Libby *et al.*, 2002).

11.2 Water Sampling

11.2.1 Precision and Accuracy

Precision and accuracy of water sampling procedures are not directly quantified, but are ensured by the collection procedures. The sampling objective is to obtain uncontaminated samples representative of their location. Procedures will follow standard methods that can achieve this objective. All samples will be handled and stored according to the procedures described in Section 12.

11.2.2 Completeness

In the event of sample loss or equipment malfunction, the Chief Scientist will determine the need for appropriate corrective action (*e.g*., resampling). The corrective action taken by the Chief Scientist will be recorded in the survey notebook. The goal is to collect 100% of the samples, however, a loss of 10% of the fecal coliform data for the entire program is not expected to compromise the objectives of the program.

11.2.3 Comparability

Hydrographic profiling data will be comparable to measurements from those collected for water column surveys, Albro *et al*. 2002, Libby *et al.* 2002. Fecal coliform and *Enterococcus* results will be comparable to results collected during fecal coliform surveys previous years.

11.2.4 Representativeness

The representativeness of the planned station locations and frequency of sampling is defined by the sample collection plan. Water samples will be collected, handled, and transported using procedures (see Section 12 below) that will ensure that resulting data represent the sample material collected. To ensure that sample data represent the collected water, Niskin bottles used for fecal coliform collection will not be closed until the oxygen sensor has come to equilibrium.

12.0 SAMPLING AND ANALYTICAL PROCEDURES

The method for collection of samples is identical for each of the two subtasks covered under Task 26. Each sample collected will receive a unique sample number assigned by the MWRA's Laboratory Information System (LIMS). Specific sample collection information will relate the sample to the collection site and will indicate the collection date and time.

12.1 Navigation, Hydrographic Profile, and Water Sampling

Refer to the Water Column CWQAPP (Albro *et al*. 2002, Libby *et al., 2002*) for a complete description of navigation, hydrographic profiling, and water sampling procedures. Station logs used for this task are the same logs used for the water column sampling.

It is expected that Adverse Condition surveys will occasionally be requested during extreme weather events or times when Battelle's survey vessel/equipment is scheduled for work elsewhere. This may require the use of an alternative vessel. To support sample collections from such vessels, a fully integrated, NAVSAM compatible, hand-deployed CTD and water collection system has been developed as a backup. The use of this portable equipment will allow an Adverse Condition survey to be conducted from an alternative vessel on short notice.

12.2 Onboard Sample Processing

Methods for shipboard processing will be identical for each of the two subtasks described under Task 26. Pre-sterilized sample bottles will be provided to the Battelle sampling team by MWRA prior to departure for each survey. The shipboard technician will transfer the sample from the Niskin bottle to the sample bottle using care to avoid contamination from his/her own bacteria (saliva, hands) or cross contamination from other samples. It is important that the inside surfaces of the sample bottle and cap remain uncontaminated. To minimize contamination, the technician will refrain from talking during the sample transfer. The sample volume will be at least 250 mL.

The sample bottles will be labeled and stored in coolers at <10° C. A thermometer in a water-filled bottle (temperature blank) will be kept in each cooler containing samples. Verification of storage conditions will be documented on the custody forms upon arrival to the Central Laboratory facility. In situ temperature and salinity measurements for each sample will be transcribed from the CTD data onto the MWRA COC form (Figure 3) prior to sample transfer. Transfer to the laboratory must occur within 12 hours. Arrangements must be made by the Battelle chief scientist prior to the survey to have samples received at the lab immediately upon survey completion.

12.3 Laboratory Procedures

Samples will be processed according to MWRA Central Laboratory Standard Operating Procedures. Laboratory methodologies are detailed in MWRA (1996) and MWRA (1998).

The MWRA Central Laboratory data sheet will be used for documentation.

13.0 SAMPLE CUSTODY

13.1 Custody of Electronic Data

Field custody of electronic data will be the responsibility of the survey chief scientist. The field custody of the electronic data consists of creating floppy disk or compact disk backups of all electronic data

generated each day. The label on the backup media will include a survey ID, date, name of person creating the backup files, and a disk number. The data will be transferred to Battelle's EM & MS database upon completion of the survey. The Field Manager or his designee maintains the disks until the annual archive cycle. HOM 4 discs are saved for six years from the time of collection.

MWRA's Central Laboratory will maintain custody of electronic files of all data generated at that laboratory until an independent QC audit has been completed. Once the data have been marked "approved" in the MWRA's LIMS system, the data will be downloaded into MWRA's EM & MS database. The laboratory results will be sent to Ms. Baptiste-Carpenter as an Oracle export file for loading into Battelle's copy of the EM & MS.

13.2 Custody of Water Samples

During field collection, both Battelle and MWRA COC forms will be completed (Figures 3 and 4). Labels with the MWRA LIMS IDs (provided by Deer Island Central Laboratory prior to the survey) will be affixed to the sample containers. Labels generated by the NAVSAM program will be affixed to the MWRA COC form as well as the Battelle Station Log, thereby creating a link between the MWRA and Battelle (NAVSAM) IDs. In addition to attaching the label, the survey Chief Scientist is responsible for recording the temperature and salinity at the surface and subpycnocline water sample depths from each station onto the MWRA custody form. If the subpycnocline sample is not collected, "N/S" will be noted on the MWRA Chain-of-Custody form and the MWRA supplied label will be discarded. The BOSS operator will also delete the sample ID from the Battelle Chain-of-Custody form.

The Chief Scientist will retain custody of samples during the survey. He is responsible for verifying each sample ID vs. the custody forms generated by NAVSAM prior to delivering the samples to the MWRA Central Laboratory. At the Central Laboratory dock, the MWRA Sample Custodian will examine the samples versus the COC forms, verify that sample-specific information has been recorded on the COC, and ensure and that sample integrity is not compromised. The MWRA custodian will then sign and keep the original COC forms and fax copies of them to the Battelle sample custodian within 24 hours of receipt. Original COC's will be sent to the Battelle Laboratory Manager with the data file (2002-2003). For 2004-2005 surveys, the original custody forms will be filed in the Central Laboratory, and photocopies sent to the Battelle Field Manager. The Laboratory Manager (Battelle or MWRA) will maintain all original custody forms with the data package.

The MWRA sample custodian will log the samples into the laboratory tracking system and issue copies of the COC's to the MWRA Fecal Coliform Project Area Manager (Kelly Coughlin). MWRA sample IDs will be used to track the samples through the laboratory.

14.0 CALIBRATION PROCEDURES AND PREVENTIVE MAINTENANCE

14.1 Hydrographic Profiling Equipment

Details of the calibration procedures and preventative maintenance for the hydrographic profiling equipment associated with the BOSS system can be found in the Water Column Monitoring CWQAPP (Albro *et al*. 2002, Libby *et al* 2002). The hand-deployed profiling and sample collection system consists of an OS-200 CTD, Wetlabs C-Star 25 cm Transmissometer, and a Seabird Model 13 Dissolved Oxygen Sensor. All sensors are returned to the manufacturer annually for calibration. The chief scientist and NAVSAM operator are responsible for insuring calibration settings for sensors used on a survey are correct in the data acquisition software. All instruments are inspected before and after each survey for signs of wear or erosion.

14.2 Navigation Equipment

Details of the calibration procedures and preventative maintenance for the navigation equipment can be found in the Water Column Monitoring CWQAPP (Albro *et al*. 2002, Libby *et al.* 2002).

14.3 Laboratory Equipment

The calibration procedures and acceptance criteria for laboratory equipment are detailed in the MWRA Central Laboratory SOP's (MWRA, 1996 and 1998).

MWRA CHAIN OF CUSTODY
FOR
MISCELLANEOUS SAMPLES

SAMPLE LOC.	SAMPLE ID	DATE COLLECTED	TIME	SAMPLE LOCATION DESCRIPTION	PLANT	TYPE / TESTS	/ PRESERVATIVE	/ BOTTLE
						G C CG GS/ FCOLSWMFL	/	/ P G S
						G C CG GS/ ECOCAGMFL	/	/ P G S
						G C CG GS/ FCOLSWMFL	/	/ P G S
						G C CG GS/ ECOCAGMFL	/	/ P G S
						G C CG GS/ FCOLSWMFL	/	/ P G S
						G C CG GS/ ECOCAGMFL	/	/ P G S
						G C CG GS/ FCOLSWMFL	/	/ P G S
						G C CG GS/ ECOCAGMFL	/	/ P G S
						G C CG GS/ FCOLSWMFL	/	/ P G S
						G C CG GS/ ECOCAGMFL	/	/ P G S
						G C CG GS/ FCOLSWMFL	/	/ P G S
						G C CG GS/ ECOCAGMFL	/	/ P G S
						G C CG GS/ FCOLSWMFL	/	/ P G S
						G C CG GS/ ECOCAGMFL	/	/ P G S
						G C CG GS/ FCOLSWMFL	/	/ P G S
						G C CG GS/ ECOCAGMFL	/	/ P G S
						G C CG GS/ FCOLSWMFL	/	/ P G S
						G C CG GS/ ECOCAGMFL	/	/ P G S
						G C CG GS/ FCOLSWMFL	/	/ P G S
						G C CG GS/ ECOCAGMFL	/	/ P G S
						G C CG GS/ FCOLSWMFL	/	/ P G S
						G C CG GS/ ECOCAGMFL	/	/ P G S

COMMENTS: ______________________________

SAMPLED BY: ____________________ DATE: ____________

RELINQUISHED TO: ____________________ DATE: ____________

RECEIVED BY: ____________________ DATE: ____________ (AT LAB)

Figure 3. MWRA Chain of Custody Form

MWRA Harbor and Outfall Monitoring Program
Contract No. S366
Chain-of-Custody Form

Today's Date : 1/31/02 9:19:13 AM

Chain-of-Custody # : PC021-FE-0001
Survey ID : PC021
Analysis ID : FE
Analysis Description : Fecal coliform

Laboratory : Mass. Water Resource Admin., ENQUAD
Charlestown Navy Yard
100 First Avenue
Boston MA 02129
Lisa Wong
617-539-4331 (Phone) (Fax)

Bottle ID :	Bottle ID :	Sampling Date :	Station ID :	Ck 1	Ck 2	Ck 3	Ck 4
	PC02101AFE1	1/29/02 9:16:07 AM	F10				
	PC02101BFE1	1/29/02 9:17:40 AM	F10				
	PC021024FE1	1/29/02 9:45:50 AM	F13				
	PC021025FE1	1/29/02 9:47:10 AM	F13				
	PC02102BFE1	1/29/02 10:34:23 AM	F17				
	PC02102CFE1	1/29/02 10:36:19 AM	F17				
	PC021041FE1	1/29/02 11:50:38 AM	F22				
	PC021042FE1	1/29/02 11:53:11 AM	F22				

Shipping Condition - Room Temperature: _____ Cold(ice): _____ Frozen(dry ice): _____
Received Condition - Room Temperature: _____ Cold(ice): _____ Frozen(dry ice): _____

Relinquished By / Date / Time / Company / Transport-Airbill #	Received By / Date / Time / Company

Page 1 of 1

Figure 4. Battelle Chain of Custody Form

15.0 DOCUMENTATION, DATA REDUCTION, AND REPORTING

15.1 Data Recording

All field data will be initially recorded either (1) electronically onto computer storage media from BOSS or other laboratory systems or (2) manually into survey logbooks on established data forms. All notes will be written in black ink. Corrections to hand-entered data will be initialed, dated, and justified. Corrections to electronically captured data (*e.g.*, electronic "spikes") will be documented on a hard-copy plot of the data. Completed data forms or other types of hand-entered data will be signed and dated by the individual entering the data. Direct-entry and electronic data entries will indicate the person collecting or entering the data. Station logs associated with field custody and tracking will be kept in survey notebook for each survey. These notebooks will be held in the custody of the Deputy Program Manager after the survey report is complete.

15.2 Data Reduction

15.2.1 Hydrographic and Navigation Data

The hydrographic data generated during the survey will consist of rapidly sampled, high-resolution measurements of conductivity, temperature, depth, DO, altitude above bottom, and bathymetry. The BOSS data-acquisition software assigns a unique data filename to each vertical profile made during the survey. All data will be electronically logged with date, time, and concurrent vessel-position data. Battelle's NAVSAM™ software will be used to convert the raw engineering data into concentration units using factory or laboratory calibration coefficients. The converted hydrocast data (conductivity, temperature, depth of sensors, dissolved oxygen) will be plotted in high resolution, parameter versus depth graphic form for visual inspection of data representativeness. NAVSAM™ will create a Microsoft Access database file consisting of two tables. One table will contain the downcast data that will exclude the ship upward motions and be averaged to 0.5-m depth bins, and the second table will include the upcast data corresponding to the average of the data between the top and bottom of the Niskin bottle at each sampling depth. The database file will serve as an export file to the EM & MS database. The NAVSAM station data will be linked to the MWRA SAMPLE_ID for data entry. It is the responsibility of the Chief Scientist and the NAVSAM operator to verify the accuracy of the NAVSAM file, adding comments and deleting non-sampling events, each survey day.

For 2002 - 2003 fecal coliform surveys, the station location/depth and sample ID information provided by the MWRA Central Lab is matched up with the corresponding NAVSAM ID using Depth_Class_Code and station ID. When the samples are analyzed at MWRA and the data export is sent back to Battelle to be loaded, the sample ID and the bottle ID are the same (MWRA sample ID). Using the prepared cross table, the MWRA sample IDs are updated to Battelle NAVSAM IDs, leaving the bottle IDs intact. This allows the database to carry both the MWRA (Bottle_ID) and the Battelle ID (from NAVSAM) for each sample. Data custody and data reduction for the hand-deployed system are the same as for the full BOSS system described above. For 2004 – 2005 surveys, sample data will be generated by the MWRA Central Laboratory's LIMS system using MWRA Sample IDs. Battelle sample and bottle IDs generated in the field by the NAVSAM system will not be stored by MWRA.

15.3 Reporting Data to be Loaded into the Database

Fecal coliform samples will be identified using SAMPLE_Ids, which are the LIMS sample numbers provided by the MWRA's Central Lab.

All field and laboratory data will be submitted to Battelle in electronic format for the 2002 – 2003 survey data reports. The field data will be available for data loading directly off the ship. The MWRA Central

Laboratory will use the Multiple Tube Fermentation method using A-1 medium (LIMS code FCOLSWMTF) for fecal coliform, and the membrane filtration method (EPA Method 1600, 24 hour incubation, LIMS code EC24AQMFL) for *Enterococcus*. For 2002 – 2003 surveys, the MWRA Fecal Coliform Project Area Manager will forward fecal coliform and *Enterococcus* results to Battelle within two weeks of sample receipt. Battelle downloads the ANALYTICAL_RESULTS table into the EM & MS database. Battelle will generate EVENT, STATION, SAMPLE, PROFILE SAMPLE_DEPTH_CLASS, SAMPLE_PURPOSE_LOOKUP, and ORDERED_DEPTH_CLASS records for this study. Details can be found in the Battelle SOP MWRA 002, Loading and Reporting Fecal Coliform Data. For 2004 – 2005 surveys, the MWRA Fecal Coliform Project Area Manager will be responsible for generating the above tables and loading records into EM & MS directly from the MWRA Central Laboratory LIMS database. Exports of survey and *in situ* data collected during Battelle fecal coliform surveys will be submitted to MWRA electronically within one month of the survey, and subsequently matched to MWRA sample records and loaded into EM & MS.

15.3.1 Navigation and Sample Collection Data

Details can be found in the Water Column Monitoring CWQAPP (Albro *et al*. 2002, Libby *et al.* 2002).

15.3.2 Hydrographic Data

Details can be found in the Water Column Monitoring CWQAPP (Albro *et al*., 2002, Libby *et al.*, 2002).

15.4 Loading Analytical Data into the Harbor Studies Database

For 2002 – 2003 survey data, data submissions from the laboratory will be received from MWRA as Oracle export files and imported into EM & MS using STUDY_IDs (Table 4). The submissions are logged in upon receipt and a copy is maintained on file under the login id. The MWRA check script will be run on the database as a batch job each night. Any issues will be sent to the data manager and MWRA via email so that MWRA can make any necessary changes as a result of quality control checks before the data export. For 2004 – 2005 surveys, analytical data will be loaded directly into EM & MS from the Central Laboratory's LIMS database by MWRA.

Table 4. Table of Database STUDY_IDs.

DMF_COND	Conditional classification surveys
DMF_ADV	Adverse conditions surveys

15.5 Reporting Data to MWRA

The data contained in each hard copy data report are submitted to MWRA as a database export. The supporting documentation files are included with the data submission. Data deliverables will be combined only with permission from MWRA.

16.0 DATA VALIDATION

The MWRA will be responsible for conducting data validations of data generated in their laboratory. As an additional data validation step, the MWRA Fecal Coliform Project Area Manager will review all data for technical reasonableness.

Table 5. Database Codes.

Field Name	Code	Description
ANAL_LAB_ID	DIL	MWRA Central Lab
METH_CODE	EC24AQMFL	*Enterococcus* EPA Method 1600, 24 hour incubation time using membrane filtration
METH_CODE	FCOLSWMTF	Multiple tube fermentation for fecal coliform, holding time 6-30 hours
UNIT_CODE	#/100 ml	Number of bacteria per 100 mL
UNIT_CODE	MPN/100 ml	Most probable number per 100 milliliters
INSTR_CODE	MICR	Microscope
INSTR_CODE	EYE	Visual inspection
PARAM_CODE	ECOC	Enumeration of *Enterococcus*
PARAM_CODE	FCOL	Enumeration of Fecal Coliform
VAL_QUAL	A	Value above maximum detection limit, *e.g.*, too numerous to count or beyond range of instrument
VAL_QUAL	As	Value above maximum detection limit and suspect/invalid, not fit for use
VAL_QUAL	T	Holding time exceeded
VAL_QUAL	a	Not detected - value reported as negative or null
VAL_QUAL	aT	Not detected - value reported as negative or null, and holding time exceeded
VAL_QUAL	aq	Not detected - value reported as negative or null. May be invalid, under investigation (Do not use).
VAL_QUAL	as	Not detected - value reported as negative or null, and not fit for use
VAL_QUAL	asT	Not detected - value reported as negative or null, not fit for use, and holding time exceeded
VAL_QUAL	e	Results not reported, value given is NULL. Explanation in COMMENTS field
VAL_QUAL	eq	Not reported, may be invalid, under investigation (Do not use).
VAL_QUAL	f	Value reported is below method detection limit

17.0 PERFORMANCE AND SYSTEM AUDITS

The Battelle QA Officer for the Harbor and Outfall Monitoring Project is Ms. Rosanna Buhl. She will conduct at least one systems audit to ensure that Task 26 activities carried out by Battelle are in accordance with this CWQAPP. The result of this audit will be reported to management as described in the project's Quality Management Plan. In addition, survey and data reports will be reviewed for accuracy and completeness.

Audits of the sample analysis and data collection procedures at the MWRA Central Laboratory will be the responsibility of MWRA personnel. The laboratory is fully responsible for the QA of the data it submits. Data submissions that will not load into the database for any reason will be returned to the submitting lab.

18.0 CORRECTIVE ACTION

All technical personnel share responsibility for identifying and resolving problems encountered in the routine performance of their duties. Ms. Ellen Baptiste-Carpenter, Battelle's Project Manager, will be accountable to MWRA and to Battelle management for overall conduct of the Harbor and Outfall Monitoring Project, including the schedule, costs, and technical performance. She is responsible for identifying and resolving problems that (1) have not been addressed timely or successfully at a lower level, (2) influence multiple components of the project, (3) necessitate changes in this CWQAPP, or (4) require consultation with Battelle management or with MWRA.

Issues that affect schedule, cost, or performance of Task 26 will be reported to the Battelle Project Manager. They will be responsible for evaluating the overall impact of the problem on the project and for discussing corrective actions with the MWRA Project Manager.

Problems identified by the QA Officer will be reported and corrected as described in Section 17.0 and the Quality Management Plan.

Technical and scientific issues will be reported to the Battelle Technical Director, Dr. Carlton Hunt. Dr. Hunt has overall responsibility for the technical activities of this project. He is responsible for ensuring that data are technically sound and defensible, and for advising senior scientists on all data interpretation and synthesis activities.

19.0 REPORTS

19.1 Survey Plans

Survey plans have been developed using the standard template for survey plans described in Albro *et al*. (2002), Libby *et al.* (2002), and Battelle SOP #6-043, Contents of Survey Plans. The plans describe survey dates, vessel, and personnel information along with specific sample collection instructions, method deviations from the CWQAPP, and the planned chronology of survey events.

19.2 Survey Reports

Survey reports will include survey dates, vessel, personnel, methods, operations, and deviations from the survey plan or CWQAPP. In addition, all survey reports will include a description of any problems encountered, corrective actions, and recommendations. A table of samples collected versus samples planned, a table summarizing Battelle and MWRA ID numbers (if Battelle performs the field work or collects *in situ* data using NAVSAM^{TM}) and a table describing the date, time, and location of each sampling event will also be included. Each report will note any whale observations, whether noted by a dedicated observer or incidental. In addition, all survey reports for Task 26 will include plotted results of the *in situ* hydrographic measurements (temperature, salinity and DO) from each station. Note that while not contract deliverables, when the full BOSS system is employed and fluorescence and beam attenuation data are collected, those data will also be plotted and included in the survey report as well.

19.3 Data Reports (2002 – 2003 only)

Fecal Coliform data reports will include data tables of the samples collected and reported, the qualifier codes used in the data report, and the fecal coliform and *Enterococcus* data. Data quality considerations will also be noted. QC plots are defined for applicable parameters in the Water Column CWQAPP.

Data reports will be submitted by August 15 for samples collected in January-June, and February 15 for samples collected in July-December. Data will be exported to MWRA concurrent with data report submissions. An example report is included in Battelle's project-specific SOP MWRA 002.

Beginning in 2004, Battelle will no longer submit data reports but submit hydrographic measurements electronically to MWRA for inclusion into the EM & MS database.

20.0 REFERENCES

Albro CS, Trulli HK, Boyle JD, Sauchuk S, Oviatt CA, Keller A, Zimmerman C, Turner J, Borkman D, Tucker J. 2002. Combined Work/Quality Assurance Plan for Baseline Water Quality Monitoring: 1998-2001 Revision 1. Boston: Massachusetts Water Resources Authority. Report ENQUAD ms-48. 123 p

Battelle. 2002. Project Management Plan for Professional Services on Harbor and Outfall Monitoring Project (Contract 366). Massachusetts Water Resources Authority Environmental Quality Department, Boston, MA 29 pp + apps.

Libby PS, Boyle JD, Oviatt CA, Keller A, Zimmerman C, Turner J, Borkman D, Tucker J. 2002. Combined Work/Quality Assurance Plan for Baseline Water Quality Monitoring: 2002-2006. Boston: Massachusetts Water Resources Authority. Report ENQUAD ms-074.

MWRA. 1996. Massachusetts Water Resources Authority Central Laboratory Standard Operating Procedure 10-IND-MFL-04. *Enterococcus* – Receiving Water Samples. (Reference: Standard Methods 18th Edition, Method 9230C)

MWRA. 1998. Massachusetts Water Resources Authority Central Laboratory Standard Operating Procedure 10-IND-A1M-01. Fecal Coliform by Multiple Tube Fermentation (A-1 Medium Method) AOAC Method 978.23 (16th Ed.)

APPENDIX A

MONITORING AND NOTIFICATION AGREEMENT BETWEEN DMF AND MWRA (through 2003)

Notification Procedures

Whereas the Massachusetts Water Resources Authority (MWRA) operates and maintains the Deer Island Sewage Treatment Plant and the associated collection system and whereas there exists the potential of an adverse change in these pollution sources, the MWRA agrees to notify the Massachusetts Division of Marine Fisheries in the event of the following:

1. Discharge under the following conditions:
   Deer Island Treatment Plant
   Any discharge at the outfall (T01) in violation of the NPDES permit limits for fecal coliform;

2. Discharge from any of the following outfalls or areas:
   Deer Island Treatment Plant
   Emergency outfalls 001, 002, 004, or 005;
   Nut Island Headworks
   Emergency outfalls 101, 102, 103, 104 or the Nut Island Spillway;
   Combined Sewer Overflows Permitted to MWRA
   Any dry weather activations;
   Sanitary Sewer Overflows
   Any overflow or bypasses through MWRA's sewage collection system that impact or have a reasonable potential to impact receiving waters in the vicinity of shellfish growing areas;
   Sludge Pelletizing Plant
   Any major spill that impacts or has a reasonable potential to impact receiving waters.

3. Foreseeable events that have the potential to affect the performance of the treatment facilities and/or sewage collection system to the extent that shellfish growing areas may be adversely impacted.

Notifications for incidents listed above will include the following available information where applicable:

a. Start and stop times
b. Estimated volume of discharge
c. Status of disinfection
d. Cause of discharge
e. Analytical data (fecal coliform counts)

DMF will be notified by phone at (617) 727-3036 between 7:00 AM and 4:00 PM Monday through Friday as soon as possible for any of the above events. If an event occurs or data becomes available after 4:00 PM, notification should be made the following business day. MWRA will make a reasonable attempt to notify DMF after 4:00 PM on weekdays and on weekends by leaving a message on the answering machine at (508) 465-5947. Analytical data, including chlorine residual and coliform counts, will be reported as soon as they become available.

DMF will be included in the distribution list for Deer Island Sewage Treatment Plant Discharge Reports, Operations Summary Reports, and Activation Notification Letters.

Monitoring

MWRA agrees to provide field sampling and laboratory services to assist DMF in the classification of shellfish growing areas in the vicinity of the outfall. MWRA will follow a mutually agreed upon monitoring plan (Attachment A) in partnership with DMF to provide analytical data both prior to and following the discharge at the outfall (T01). The monitoring plan will follow DMF protocols for fecal coliform sampling and analysis. MWRA and DMF agree that the monitoring plan may be changed under mutual agreement as relevant data becomes available, and that these changes will be documented in writing and included in the Monitoring agreement. MWRA also agrees to provide laboratory services to document improvements to shellfish growing areas previously impacted by MWRA discharges.

Receiving Water Quality

MWRA acknowledges that, subject to the approval of the Massachusetts Department of Environmental Protection and the United States Environmental Protection Agency, DMF may direct MWRA to modify its treatment processes to ensure that the effluent from the Deer Island Wastewater Treatment Plant will meet all state water quality standards for fecal coliform and total chlorine residual upon discharge to the receiving water at the new outfall location.

Attachment A

Fecal Coliform Monitoring Plan

The monitoring plan shall have the following components:

Pre-discharge monitoring to establish a baseline to compare to post-discharge levels (this component completed in 2001)

In 1999 and 2000, MWRA collected and analyzed samples for fecal coliform along four transects from the T01 outfall shoreward to Devereaux Beach, Nahant, Hull, and Cohasset Harbor. (In all, six transect surveys were conducted during 1999 and 2000). Samples were collected from the surface and from the water below the pycnocline during periods of stratification. All samples were processed at MWRA's Central Laboratory according to United States Food and Drug Administrations (FDA) approved methods for shellfish growing waters. Following the commencement of the discharge of wastewater from the T01 outfall in Massachusetts Bay, MWRA conducted four transect monitoring surveys in late 2000 and 2001. The monitoring stations for the transect surveys are listed in Table 1.

Post-discharge monitoring for Conditional Zone Classification

MWRA will collect and analyze samples for fecal coliform from twelve locations for conditional zone classification. Samples will be collected from the surface and from the water below the pycnocline during periods of stratification. All samples will be processed at MWRA's Central Laboratory according to FDA approved methods for shellfish growing waters. The monitoring stations for the conditional zone classification surveys are listed in Table 2.

Post-discharge monitoring during adverse conditions

MWRA will collect and analyze samples for fecal coliform from the same twelve conditional zone classification locations listed below during and/or immediately following adverse conditions. Adverse conditions are events that have a reasonable potential to cause MWRA to discharge wastewater with high levels of bacteria including extremely high flows due to heavy rain, treatment plant failures, and unforeseen events. Criteria that determine what constitutes adverse conditions appear in Attachment B. Given that these criteria are met, it is anticipated that MWRA will conduct approximately five adverse conditions surveys per year. The sampling and analytical procedures for the adverse condition surveys are the same as the procedures for the conditional zone classification surveys.

Table 1. Transect Monitoring Stations

Station ID[1]	Latitude	Longitude	Station Description
GC1	42-22.56	70-47.88	#1-COHASSET TRANSECT
GC2	42-22.08	70-47.76	#2-COHASSET TRANSECT
GC3	42-21.06	70-47.64	#3-COHASSET TRANSECT
GC4	42-20.10	70-47.52	#4-COHASSET TRANSECT
GC5	42-19.14	70-47.34	#5-COHASSET TRANSECT
GC6	42-17.10	70-47.04	#6-COHASSET TRANSECT
GD1	42-23.52	70-48.48	#1-DEVERAEUX TRANSECT
GD2	42-24.00	70-48.66	#2-DEVERAEUX TRANSECT
GD3	42-24.96	70-49.08	#3-DEVERAEUX TRANSECT
GD4	42-26.88	70-49.86	#4-DEVERAEUX TRANSECT
GH1	42-22.44	70-48.78	#1-HULL TRANSECT
GH2	42-21.84	70-49.26	#2-HULL TRANSECT
GH3	42-20.64	70-50.34	#3-HULL TRANSECT
GH4	42-18.42	70-51.48	#4-HULL TRANSECT
GN1	42-23.28	70-49.02	#1-NAHANT TRANSECT
GN2	42-23.46	70-49.62	#2-NAHANT TRANSECT
GN3	42-24.42	70-52.02	#3-NAHANT TRANSECT
N16	42-23.64	70-45.20	OUTFALL DIFFUSER #1
N20	42-22.90	70-49.03	OUTFALL DIFFUSER #55

[1] Station IDs are followed by an "S" or a "P" to represent surface sample or sub-pycnocline sample respectively.

Table 2. Conditional Zone Classification/Adverse Conditions Monitoring Stations

Station ID[2]	Latitude	Longitude	Station Description
F10	42-14.45	70-38.24	NE OF SCITUATE HARBOR
F13	42-16.10	70-44.10	ENE OF COHASSET HARBOR
F14	42-18.00	70-48.50	ENE OF NANTASKET BEACH (~3NM)
F17	42-20.75	70-34.23	ENE OF NANTASKET BEACH (~4.2NM)
F18	42-26.53	70-53.30	NAHANT BAY S. OF LITTLES PT (1.5 NM)
F22	42-28.79	70-37.06	UPPER MB SSE OF EASTERN PT (~6.5NM)
F24	42-22.50	70-53.75	INNER MB, NE OF DI
F25	42-19.30	70-52.58	INNER MB, NE OF NANTASKET BEACH
N02	42-25.65	70-49.31	E. OF DI, S. OF SALEM SND
N09	42-20.39	70-47.48	E. OF DI, S. OF SALEM SND
N16	42-23.64	70-45.20	OUTFALL DIFFUSER #1
N20	42-22.90	70-49.03	OUTFALL DIFFUSER #55

[1] Station locations were selected from far field and near field monitoring locations currently monitored by MWRA under its Outfall Monitoring Plan. The station IDs are followed by an "S" or a "P" to represent surface sample or sub-pycnocline sample respectively.

Attachment B

Criteria for Adverse Conditions Monitoring

Adverse conditions monitoring will occur under conditions that may result in elevated pathogen levels in Massachusetts Bay, as described in Attachment A. This attachment establishes the criteria that will trigger an adverse monitoring survey. These triggers may be modified once baseline information regarding operation of the new outfall is established. Adverse conditions monitoring will not commence until after the new outfall is online.

An adverse conditions survey will be triggered by: 1) A reduction in secondary treatment, when the effluent consists of 60% secondary treated flows or less for more than six hours; or 2) Complete loss of chlorination for more than six hours.

- Once it is determined that operational upset/high flow conditions qualify for adverse conditions monitoring, the survey should take place between 10 and 30 hours following the trigger, weather and logistics permitting. If an operational upset is prolonged, DMF, in consultation with MWRA, may decide to extend this time window.

- Every effort shall be made to sample all conditional monitoring stations in a survey; if a survey is abbreviated or cancelled because of weather conditions or equipment problems, the survey should be completed as soon as possible. Locations closest to the outfall have the highest priority of any of the monitoring stations.

- When secondary treatment is reduced as defined above, one of MWRA's Massachusetts Bay virus surveys should be rescheduled to coincide as closely as possible with the reduction, should the reduction last for more than one week.

- If adverse conditions persist, MWRA (in consultation with DMF) should make an effort to conduct more than one survey over the course of the event.

APPENDIX B

MONITORING AND NOTIFICATION AGREEMENT BETWEEN DMF AND MWRA (2004 - 2005)

Notification Procedures

Whereas the Massachusetts Water Resources Authority (MWRA) operates and maintains the Deer Island Sewage Treatment Plant and the associated collection system and whereas there exists the potential of an adverse change in these pollution sources, the MWRA agrees to notify the Massachusetts Division of Marine Fisheries in the event of the following:

1. Discharge under the following conditions:
   Deer Island Treatment Plant
   Any discharge at the outfall (T01) in violation of the NPDES permit limits for fecal coliform;

2. Discharge from any of the following outfalls or areas:
   Deer Island Treatment Plant
   Emergency outfalls 001, 002, 004, or 005;
   Nut Island Headworks
   Emergency outfalls 101, 102, 103, or the Nut Island Spillway;
   Combined Sewer Overflows Permitted to MWRA
   Any dry weather activations;
   Sanitary Sewer Overflows
   Any overflow or bypasses through MWRA's sewage collection system that impact or have a reasonable potential to impact receiving waters in the vicinity of shellfish growing areas;
   Sludge Pelletizing Plant
   Any major spill that impacts or has a reasonable potential to impact receiving waters.

3. Foreseeable events that have the potential to affect the performance of the treatment facilities and/or sewage collection system to the extent that shellfish growing areas may be adversely impacted.

Notifications for incidents listed above will include the following available information where applicable:

a) Start and stop times
b) Estimated volume of discharge
c) Status of disinfection
d) Cause of discharge
e) Analytical data (fecal coliform counts)

DMF will be notified by phone at (617) 727-3036 between 7:00 AM and 4:00 PM Monday through Friday as soon as possible for any of the above events. If an event occurs or data becomes available after 4:00 PM, notification should be made the following business day. MWRA will make a reasonable attempt to notify DMF after 4:00 PM on weekdays and on weekends by leaving a message on the answering machine at (508) 465-5947. Analytical data,

including chlorine residual and coliform counts, will be reported as soon as they become available.

DMF will be included in the distribution list for Deer Island Sewage Treatment Plant Discharge Reports, Operations Summary Reports, and Activation Notification Letters.

Monitoring

MWRA agrees to provide field sampling and laboratory services to assist DMF in the classification of shellfish growing areas in the vicinity of the outfall. MWRA will follow a mutually agreed upon monitoring plan (Attachment A) in partnership with DMF to provide analytical data. The monitoring plan will follow DMF protocols for fecal coliform sampling and analysis. MWRA and DMF agree that the monitoring plan may be changed under mutual agreement as relevant data becomes available, and that these changes will be documented in writing and included in a revised Notification and Monitoring Agreement. MWRA also agrees to provide Boston Harbor monitoring results upon request to document improvements to shellfish growing areas previously impacted by MWRA discharges.

Receiving Water Quality

MWRA acknowledges that, subject to the approval of the Massachusetts Department of Environmental Protection and the United States Environmental Protection Agency, DMF may direct MWRA to modify its treatment processes to ensure that the effluent from the new Deer Island Wastewater Treatment Plant will meet all state water quality standards for fecal coliform and total chlorine residual upon discharge to the receiving water at the new outfall location.

Attachment A

Fecal Coliform Monitoring Plan

The monitoring plan shall have the following two components:

1) Monitoring for Conditional Zone Classification
MWRA will collect and analyze samples for fecal coliform from eleven locations for conditional zone classification. Samples will be collected from the surface and from the water below the pycnocline during periods of stratification. All samples will be processed at MWRA's Central Laboratory according to FDA approved methods for shellfish growing waters. Samples will be collected monthly. The monitoring stations for the conditional zone classification surveys are listed in Table 1.

2) Monitoring during adverse conditions
MWRA will collect and analyze samples for fecal coliform from the eleven conditional zone classification locations as quickly as possible following adverse conditions. Adverse conditions are events that have a reasonable potential to cause MWRA to discharge wastewater with high levels of bacteria including extremely high flows due to heavy rain, treatment plant failures, and unforeseen events. Criteria that determine what constitutes adverse conditions appear in Attachment B. Given that these criteria are met, it is anticipated that MWRA will conduct approximately five adverse conditions surveys per year. The sampling and analytical procedures for the adverse condition surveys are the same as the procedures for the conditional zone classification surveys. A map of the locations appears in Figure 1.

Table 1. Conditional Zone Classification/Adverse Conditions Monitoring Stations

Station ID[1]	Latitude	Longitude	Station Description
F13	42-16.10	70-44.10	ENE OF COHASSET HARBOR
F14	42-18.00	70-48.50	ENE OF NANTASKET BEACH (~3NM)
F18	42-26.53	70-53.30	NAHANT BAY S. OF LITTLES PT (1.5 NM)
F24	42-22.50	70-53.75	INNER MB, NE OF DEER IS.
F25	42-19.30	70-52.58	INNER MB, NE OF NANTASKET BEACH
N02	42-25.65	70-49.31	E. OF DI, S. OF SALEM SOUND
N09	42-20.39	70-47.48	E. OF DI, S. OF SALEM SOUND
N16	42-23.64	70-45.20	OUTFALL DIFFUSER #1
N20	42-22.90	70-49.03	OUTFALL DIFFUSER #55
N04	42-26.64	70-44.22	NORTHEASTERN CORNER OF NEARFIELD
N07	42-21.36	70-42.36	SOUTHEASTERN CORNER OF NEARFIELD

[1] Station locations were selected from farfield and nearfield monitoring locations currently monitored by MWRA under its Outfall Monitoring Plan. The station IDs are followed by an "S" or a "P" to represent surface sample or sub-pycnocline sample respectively.

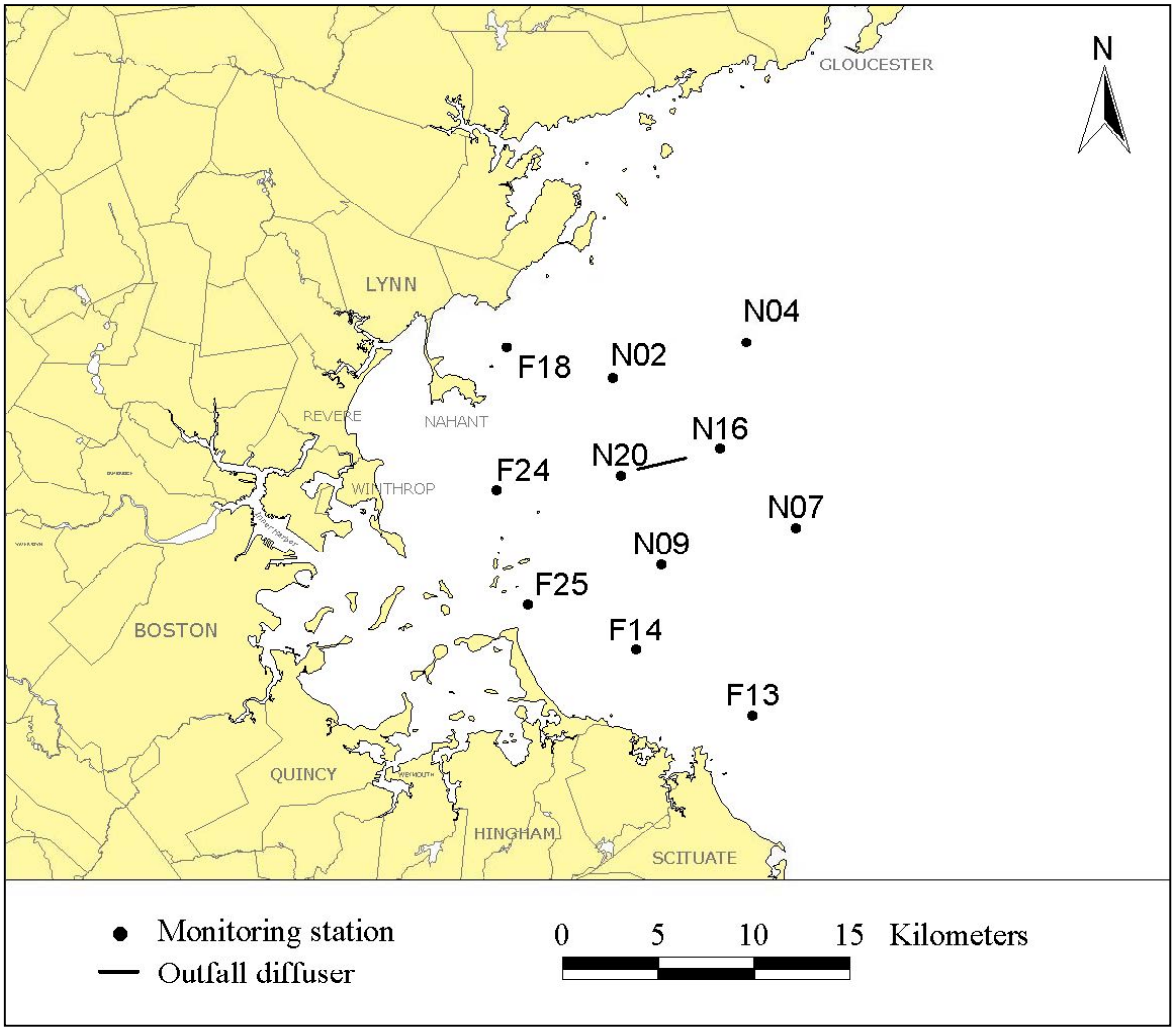

Figure 1. Map of Conditional Zone Classification/Adverse Condition monitoring stations

Attachment B

Criteria for Adverse Conditions Monitoring

Adverse conditions monitoring will occur under conditions that may result in elevated pathogen levels in Massachusetts Bay, as described in Attachment A. This attachment establishes the criteria that will trigger an adverse monitoring survey.

An adverse conditions survey will be triggered by either 1) a reduction in secondary treatment, when the effluent consists of 60% secondary treated flows or less for more than six hours; or 2) complete loss of chlorination for more than six hours. In the event of another type of operational upset that may result in elevated pathogen levels in Massachusetts Bay, MWRA will consult with DMF to determine if an adverse conditions survey is warranted.

- Once it is determined that operational upset/high flow conditions qualify for adverse conditions monitoring, the survey should take place between 10 and 30 hours following the trigger, weather and logistics permitting. If an operational upset is prolonged, DMF, in consultation with MWRA, may decide to extend this time window.

- Every effort shall be made to sample all conditional monitoring stations in a survey; if a survey is abbreviated or cancelled because of weather conditions or equipment problems, the survey should be completed as soon as possible. Locations closest to the outfall have the highest priority of any of the monitoring stations.

- If adverse conditions persist, MWRA (in consultation with DMF) should make an effort to conduct more than one survey over the course of the event.

APPENDIX C (available upon request)

ADVERSE CONDITION/CONDITIONAL CLASSIFICATION SURVEY PLAN

Massachusetts Water Resources Authority
Charlestown Navy Yard
100 First Avenue
Boston, MA 02129
(617) 242-6000
http://www.mwra.state.ma.us