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THIRD FIVE-YEAR REVIEW REPORT FOR SULLIVAN'S LEDGE SUPERFUND SITE BRISTOL COUNTY, MASSACHUSETTS

Prepared by

U.S. Environmental Protection Agency
Region I
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LIST OF ACRONYMS AND ABBREVIATIONS

ACRONYM	DEFINITION
ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Ambient Water Quality Criteria
CAA	Clean Air Act
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CONB	City of New Bedford
CWA	Clean Water Act
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FS	Feasibility Study
GAC	Granular Activated Carbon
GER	Grant of Environmental Restrictions
GWTP	Ground Water Treatment Plant
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
LEL	Lower Explosive Limit
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU1	Operable Unit 1
OU2	Operable Unit 2
PAH	Polycyclic Aromatic Hydrocarbon

ACRONYM	DEFINITION
PCB	Polychlorinated Biphenyl
PMC	Project Management Committee (OU I Settling Defendants)
PCCP	Pre-stressed Concrete Cylinder Pipe
POTW	Publicly Owned Treatment Works
PRP	Potentially Responsible Party
RAC	Remedial Action Contract
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SDWA	Safe Drinking Water Act
SQCV	Sediment Quality Criteria Values
SVOC	Semivolatile Organic Compound
TBC	To Be Considered
TOC	Total Organic Carbon
TSCA	Toxic Substances Control Act
TTO	Total Toxic Organics
UV/OX	Ultraviolet/Oxidation
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

The Sullivan's Ledge Site, located in New Bedford, Massachusetts, consists of two operable units, Operable Unit 1 (OU1) and Operable Unit 2 (OU2). OU1 consists of a 12-acre historic disposal area and the adjacent Unnamed Stream. OU2 includes a 13-acre wooded wetland called Middle Marsh, and a 1.5 acre wetland area bordering the Unnamed Stream (400 feet upstream of the Middle Marsh) referred to as the "Adjacent Wetlands."

The selected remedy for Sullivan's Ledge OU1 included site preparation, soil excavation/treatment, sediment treatment, construction of an impermeable cap, diversion and lining of the Unnamed Stream, collection and treatment of on-site groundwater, wetlands restoration/enhancement, long-term environmental monitoring, institutional controls, and five-year reviews.

Three Explanations of Significant Differences (ESDs) have been issued for OU1. The first ESD revised the remedy so that soils in the disposal area would remain in place, untreated, and covered by the cap. Also, excavated soils and sediments from other areas of OU1 that exceeded cleanup standards would remain untreated and would be disposed of beneath the cap within the disposal area. The second ESD revised the remedy so that the stream channel would be permanently placed in an underground 72-inch pre-stressed concrete cylinder pipe (PCCP) and a new stream channel was created on the golf course and vegetation planted to recreate the habitat lost. Also, the ESD called for a slurry wall along a portion of the southern boundary and two recovery wells adjacent to the slurry wall. A third ESD incorporates ARARs related to landfill gas migration and describes the actions taken to comply with the ARARs.

The selected remedy for OU2 included site preparation, excavation of contaminated sediments and soils from portions of Middle Marsh and the Adjacent Wetland, dewatering of the excavated sediment/soils, disposal of the treated sediment/soils beneath the cap, wetlands restoration, institutional controls to prevent future residential use and non-recreational commercial use and to restrict access to Middle Marsh and the Adjacent Wetland, and long-term environmental monitoring.

This is the third five-year review for the site. The trigger for this statutory review is the signature date of the previous five-year review report on September 23, 2008. This review is required by statute as the selected remedies for OU1 and OU2 result in site contaminants being left on the site above levels that allow for unlimited use and unrestricted exposure.

This five-year review concludes that because the remedial actions at the Site are protective in the short-term, the Site is protective of human health and the environment in the short-term. However, in order to be protective in the long-term, the following actions need to be taken.

OU1

- Implement Institutional Controls;
- Monitor and correct landfill gas levels of concern and modify monitoring and extraction system as necessary;
- Replace bedrock monitoring well ECJ-2; and
- Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.

OU2

- Implement Institutional Controls and
- Monitor PCB concentrations in sediment for comparison to cleanup levels.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Sullivan's Ledge		
EPA ID: MAD980731343		
Region: 1	**State:** MA	**City/County:** New Bedford/Bristol

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:**
Author name (Federal or State Project Manager): David Lederer
Author affiliation: US EPA, Region I
Review period: 3/7/2013 – 9/30/2013
Date of site inspection: 5/16/2013 and 6/19/2013
Type of review: Statutory
Review number: 3
Triggering action date: 9/23/2008
Due date *(five years after triggering action date)*: 9/23/2013

Five-Year Review Summary Form (continued)

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): 1	Issue Category: Institutional Controls			
	Issue: Implement Institutional Controls.			
	Recommendation: Finalization of Institutional Controls.			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	EPA/State	EPA/State	2013
OU(s): 1	Issue Category: Monitoring			
	Issue: The landfill gas monitoring, collection, and extraction system may require modification to ensure it is meeting its objectives.			
	Recommendation: Monitoring of landfill gas will continue with objective to ensure gas is not migrating beyond the boundaries of the landfill. Monitoring points shall be capable of yielding representative air samples for analysis and consist of a sufficient number of wells properly located to detect the presence and migration of landfill gases. The sampling plan should be updated to reflect the most current monitoring procedures. Corrective actions to the monitoring, extraction, and collection system will be taken if necessary.			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	PRP	EPA/State	Quarterly basis
OU(s): 1	Issue Category: Operations and Maintenance			
	Issue: Bedrock groundwater compliance monitoring well ECJ-2 is damaged and needs replacement in order to assess compliance with cleanup levels for the active extraction system.			
	Recommendation: Replace multi-port bedrock groundwater monitoring well ECJ-2.			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	PRP	EPA/State	2013

OU(s): 1	Issue Category: Operations and Maintenance			
	Issue: Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.			
	Recommendation: Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	2013
OU(s): 2	**Issue Category: Institutional Controls**			
	Issue: Implement Institutional controls.			
	Recommendation: Finalization of Institutional Controls.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA/State	2013
OU(s): 2	**Issue Category: Monitoring**			
	Issue: Monitoring of sediments has indicated some PCB concentrations above the TOC normalized clean-up levels, while an equal number have been found below the cleanup levels. Further monitoring is warranted.			
	Recommendation: Continue to monitor and implement corrective actions if needed.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	2016

Protectiveness Statement(s)		
Operable Unit: 1	*Protectiveness Determination:* Short-term Protective	*Addendum Due Date (if applicable):*

Protectiveness Statement:
The remedy for OU1 is currently protective of human health and the environment because the construction of the remedy is complete, and operation and maintenance and monitoring of the remedy is being performed. However, in order for the remedy to be protective in the long-term, the following actions need to be taken:

- Implement Institutional Controls;
- Monitor and correct landfill gas levels of concern and modify monitoring and extraction system as necessary;
- Replace bedrock monitoring well ECJ-2; and
- Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.

Operable Unit: 2	*Protectiveness Determination:* Short-term Protective	*Addendum Due Date (if applicable):*

Protectiveness Statement:
The remedy for OU2 is currently protective of human health and the environment because the construction of the remedy is complete, and operation and maintenance and monitoring of the remedy is being performed. However, in order for the remedy to be protective in the long-term, the following actions need to be taken:

- Implement Institutional Controls and
- Monitor PCB concentrations in sediment for comparison to cleanup levels.

Sitewide Protectiveness Statement (if applicable)

Protectiveness Determination: Protective	*Addendum Due Date (if applicable):*

Protectiveness Statement:
Because the remedial actions at the Site are protective in the short-term, the Site is protective of human health and the environment in the short-term. However, in order for the remedy to be protective in the long-term, the following actions need to be taken:

OU1

- Implement Institutional Controls;
- Monitor and correct landfill gas levels of concern and modify monitoring and extraction system as necessary;
- Replace bedrock monitoring well ECJ-2; and
- Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.

OU2

- Implement Institutional Controls and
- Monitor PCB concentrations in sediment for comparison to cleanup levels.

SECTION 1.0
INTRODUCTION

This document is a comprehensive and interpretive report on the five-year review conducted for the Sullivan's Ledge Superfund Site (the site) in New Bedford, Massachusetts, for the U.S. Environmental Protection Agency's (EPA) Region I office.

The five-year review was conducted to determine whether the remedies for the site are protective of human health and the environment. The methods, findings, and conclusions of the review are documented in this five-year review report. In addition, this report identifies issues found during the review and recommendations to address them.

EPA Region I has conducted this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP). CERCLA §121(c) states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The NCP at Section 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The site consists of two operable units, OU1 and OU2. This five-year review addresses both operable units.

This is the third five-year review for the site. The trigger for this statutory review is the signature date of the previous five-year review report on September 23, 2008. This review is required by statute as the selected remedies for OU1 and OU2 result in site contaminants being left on the site above levels that allow for unlimited use and unrestricted exposure. This is most apparent with OU1 as contaminated soils have been left in place and a groundwater contaminant plume still exists. OU2 requires a statutory review because, although the site was cleaned up to levels that are protective of aquatic organisms, the remedy calls for institutional controls that restrict residential use of the site and thus disallow unlimited use. The OU2 ROD (Page 20) notes that if EPA had assumed that the future use would be residential, cleanup levels would be lower due to higher frequency of exposure. Thus, the ROD implies that contaminants could be left in place that are above levels that allow unlimited use and unrestricted exposure.

SECTION 2.0
SITE CHRONOLOGY

The chronology of the site, including all significant site events and dates is included in Table 1.

Table 1: Chronology of Site Events	
Event	**Date**
Quarrying operations conducted at the site	prior to 1846 through 1921
Land acquired by the City of New Bedford through tax title foreclosure	1935
Pits used for waste disposal	1930's through early 1970's
Fires in quarry pits lead to backfilling of one pit	early 1970's
Geotechnical borings by Massachusetts Department of Public Works indicate presence of capacitors in subsurface	1982
EPA conducted air monitoring program of the Greater New Bedford Area	1982
EPA installed groundwater monitoring wells around the site	1983
NPL Listing	September 21, 1984
OU1 Phase I Remedial Investigation report by NUS Corporation	September 1987
OU2 Final Remedial Investigation/Feasibility Study report by Ebasco Services Inc.	January 1989
ROD issued by EPA for OU1	June 29, 1989
OU2 Final Remedial Investigation - Additional Studies of Middle Marsh report by Metcalf & Eddy, Inc.	April 1991
OU2 Feasibility Study of Middle Marsh report by Metcalf & Eddy, Inc.	May 1991
ROD issued by EPA for OU2	September 27, 1991
Consent Decree for OU2 was lodged in U.S. District Court in Massachusetts	January 25, 1993
ESD issued by EPA, modifying the remedy so that treatment would no longer be required for OU1 soil and sediments to be covered by the OU1 landfill cap.	July 26, 1995
100% remedial design approved by EPA for OU1	June 1997

Table 1: Chronology of Site Events	
Event	**Date**
Start of on-site construction at Operable Unit 1	March 2, 1998
Start of on-site construction at Operable Unit 2	April 8, 1999
Start-up of the OU1 groundwater collection and treatment system	December 10, 1999
ESD issued by EPA substituting a slurry wall for the shallow collection trench along a section of the site boundary and culverting a section of the Unnamed Stream instead of a concrete lining	September 27, 2000
Final Remedial Construction Report, OU2 by URS Corporation and Certification of Remedial Construction Completion	August 13, 2001
Remedial Construction Report, OU1 by O'Brien & Gere Engineers, Inc. and Certification of Construction Completion	March 8, 2002
Approval of OU2 Construction Completion Report	January 23, 2003
Approval of OU1 Construction Completion Report	January 23, 2003
ESD issued by EPA adding Solid Waste regulations as an ARAR and requiring mitigation of a landfill gas migration issue	September 29, 2003
Completion of first five-year review	September 29, 2003
Start-up of the full-scale landfill gas extraction system	June 10, 2004
Fifth year of post-construction wetland monitoring	2006
Completion of second five-year review	September 23, 2008
First year of long-term wetland monitoring	2011

SECTION 3.0
BACKGROUND

3.1 PHYSICAL CHARACTERISTICS AND LAND AND RESOURCE USE

The Sullivan's Ledge Superfund Site is located in New Bedford, Massachusetts, Bristol County, near the intersection of Route 195 and Hathaway Road (see Figure 1, provided in Attachment 1 of this report). The Sullivan's Ledge Superfund Site consists of two operable units, OU1 and OU2.

OU1 consists of a 12-acre historic disposal area and the adjacent Unnamed Stream (see Figure 2, provided in Attachment 1 of this report). The Unnamed Stream flows from the site underneath Hathaway Road into OU2, which consists of the Middle Marsh and adjacent wetlands. The disposal area is bounded on the south by the highway interchange with Route 140 and I-195, on the east and west by commercial establishments, and on the north by Hathaway Road.

OU2 is located within the Whaling City Golf Course at New Bedford, just north of Hathaway Road. OU2 is bounded on the south by the southern banks of the tributary of the Unnamed Stream, on the north by the Apponogansett Swamp, and on the east and west by fairways of the golf course. OU2 includes a 13-acre wooded wetland called Middle Marsh, and a 1.5 acre wetland area bordering the Unnamed Stream (400 feet upstream of the Middle Marsh) referred to as the Adjacent Wetlands (see Figure 5, provided in Attachment 1 of this report).

Regional groundwater flow in the overburden, shallow bedrock, and deep bedrock is to the north. In the absence of the installed groundwater pump and treatment system, local groundwater flow in the overburden and shallow bedrock is from the southwest to the northeast corner of the former disposal area. Flow from the southwest corner of the site entered the quarry pits. A portion of the groundwater discharged out of the pits into the overburden and the Unnamed Stream and the remainder discharged into the bedrock. Prior to installation of the OU1 cap, most of the former disposal area was covered by a layer of fill which overlayed the bedrock and quarry pits. The thickness of the fill generally increased to the south and east across the property with the maximum observed thickness of 22.4 feet found in the southwest corner of the site. Shallow bedrock is highly fractured, with fracture planes varying in frequency and orientation, which means that the shallow bedrock exhibits the properties of a porous medium, with groundwater flowing in the direction of the hydraulic gradient. The deep bedrock contains fewer fractures than the shallow bedrock and the fractures follow a regional north/northwest lineament trend. Thus, contaminant migration in the deep bedrock is controlled by the orientation of the fractures.

3.2 HISTORY OF CONTAMINATION

The OU1 disposal area was originally operated as a granite quarry that supplied building stone to the New Bedford area. Quarry operations began in the 1800s and continued until 1921. During that time, as many as four separate quarry pits were in use on the property.

After serving as a local swimming hole, the city of New Bedford assumed ownership of the property in 1935 through a tax title foreclosure. The pits and adjacent areas were operated by

the City of New Bedford and used by local industry as a disposal site for wastes such as electrical transformers and capacitors, fuel oil, volatile liquids, old tires, glass, metal, steel tanks, smoke stack soot, and scrap rubber. The site also was used for disposal of other types of debris such as brush and trees, cobblestones, bricks, and demolition materials. The pits and adjacent areas are referred to throughout this report as the disposal area.

In the early 1970s, a major fire erupted on-site, primarily involving the mass of tires disposed of in the quarry pits. This fire was difficult to control due to the presence of the tires, and created a dense, black smoke. Due to concern regarding possible recurrence of such fires, an effort was undertaken to backfill the remainder of the smaller pit and to regrade the site, covering any exposed refuse. In early 1982, Massachusetts Department of Public Works, District 6, conducted test borings on-site in conjunction with a proposal for construction of a commuter parking lot, but recommended cancelling the project when borings indicated the presence of electrical capacitors.

EPA conducted an air monitoring program of the Greater New Bedford area in 1982 and installed groundwater monitoring wells around the site in 1983. Based in part on the results of these studies, the site was included in the National Priorities List (NPL) in September 1984.

3.3 INITIAL RESPONSE

In September 1984, EPA issued the owner and operator of the site, the City of New Bedford, an Administrative Order under Section 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). In compliance with this order, the City of New Bedford secured the disposal area by installing a perimeter fence and posting signs warning against unauthorized trespassing at the site.

On November 29, 1988, EPA notified parties who owned or operated the facility, generated wastes that were shipped to the facility, or transported wastes to the facility, of their potential liability with respect to the site.

A Remedial Investigation (RI) of the site was completed in two phases. The Phase I RI completed by NUS in September 1987 under subcontracts to EBASCO (EBASCO, 1987), provided the data necessary for site characterization. The draft final Phase II RI and Feasibility Study (FS) was completed in March of 1988 by E.C. Jordan under subcontract to EBASCO (EBASCO, 1989).

In June 1989, EPA concluded that additional studies of the Middle Marsh and adjacent wetland were needed and these areas were grouped into a second operable unit. The Remedial Investigation - Additional Studies of Middle Marsh report was completed in April 1991 by Metcalf & Eddy, Inc (M&E, 1991a). The Feasibility Study of Middle Marsh was completed by Metcalf & Eddy, Inc. on May 29, 1991 (M&E, 1991b).

3.4 BASIS FOR TAKING ACTION

Based on results of the Phase I and Phase II RIs, three source areas of contamination were identified for the site: the quarry pits, site soils, and PCB-contaminated sediments. The RIs also determined that contaminants from the quarry pits had contaminated on- and off-site groundwater and surface water in the Unnamed Stream.

The following summarizes the contamination at the site:

Soils. The Phase II RI and pre-design sampling confirmed semivolatile organic compound (SVOC) contamination within the disposal area and along the eastern site boundary. Polychlorinated biphenyls (PCBs) were also detected within the disposal area and along the eastern site boundary.

Sediment. PCBs were the only compound of concern in the sediments. PCB contamination was detected in sediments from the Unnamed Stream, Middle Marsh, golf course water hazards, and Apponagansett Swamp. PCB concentrations occurred at levels above the Sediment Quality Criteria Values (SQCVs) in each of the four habitats.

Groundwater. The majority of on-site groundwater contamination is caused by volatile organic compounds (VOCs); less significant levels of SVOCs and PCBs were also reported. VOCs were identified in the overburden groundwater, shallow bedrock groundwater (less than 100 feet), and deep bedrock groundwater (down to 200 feet below ground surface).

Surface Water. Relatively high concentrations of VOCs, SVOCs, and inorganics were reported in the Phase II RI at groundwater seeps located east and north of the disposal area. For several contaminants, the concentrations exceed the ambient water quality criteria (AWQC). Impacts to the Unnamed Stream, however, appeared minimal due to the effects of dilution by the large volume of water in the Unnamed Stream. There was no public health risk associated with surface water.

The human health risk assessment for OU1 estimated potential human health risks associated with exposure to contaminants of concern in surface soils, sediments, air, surface water, and groundwater. The risk assessment assumed that access to the site is restricted and the land is zoned as commercial, but considered a proposed future use of the site as a soccer field. PCBs and total PAHs contributed the majority of the total carcinogenic risk from direct contact with surface soils. Noncarcinogenic hazard from incidental ingestion of on-site soils by children was elevated due to the lead concentration in an on-site shallow soil sample. Though groundwater was not a current source of drinking water, carcinogenic risks and noncarcinogenic hazards from future ingestion of groundwater were estimated. Benzene, trichloroethene, vinyl chloride, and PCBs contributed over 99 percent of the total cancer risk. 1,1-Dichloroethene was the major contributor to the noncarcinogenic groundwater hazard at the site. Direct contact with contaminated sediments in the Unnamed Stream was the highest carcinogenic risk contributor from exposure to sediments. The ecological risk assessment indicated that a potential risk existed for aquatic organisms due to exposure to contaminants in surface water of the Unnamed Stream. It was noted that risk to aquatic organisms due to PCB exposure in water could not be accurately evaluated because the detection limit for PCBs (1.0 ug/l) was greater than the water quality criteria concentration (0.014 ug/l).

The human health risk assessment for OU2 concluded that human exposure to contaminants in Middle Marsh and the golf course/wetland area through current and future pathways would not result in significant increases in carcinogenic risk, and that there are no significant risks to human health posed by exposure to noncarcinogenic contaminants under the assumption that current and future site use would be as a golf course. The OU2 Record of Decision (ROD) notes that if EPA had assumed that the future use would be residential, cleanup levels would be

lower due to higher frequency of exposure. The OU2 ROD requires the use of institutional controls to prohibit residential use and restrict commercial use, thereby assuring the protectiveness of human health. The ecological risk assessment concluded that aquatic exposures and wetland/terrestrial exposures to PCB-contaminated sediments in portions of the Middle Marsh present an unacceptable risk to biota present in OU2. This is the primary basis of the OU2 remedial action.

SECTION 4.0
REMEDIAL ACTIONS

4.1 REMEDY SELECTION

This section outlines the selected remedies for OU1 and OU2.

4.1.1 Operable Unit 1

The EPA ROD for Sullivan's Ledge OU1 was issued on June 29, 1989. The remedial action objectives (RAOs) listed in the ROD are:

- Prevent or mitigate the continued release of hazardous substances to the Unnamed Stream, Middle Marsh, and Apponagansett Swamp;
- Reduce risks to human health associated with direct contact with and incidental ingestion of contaminants in the surface and subsurface soils;
- Reduce risks to animal and aquatic life associated with the contaminated surface soils and sediments;
- Reduce the volume, toxicity, or mobility of the hazardous contaminants;
- Maintain air quality at protective levels for on-site workers and nearby residents during site remediation;
- Reduce further migration of groundwater contamination from the quarry pits in the upper 150 feet of the bedrock groundwater flow system;
- Significantly reduce the mass of contaminants in groundwater located in and immediately adjacent to the quarry pits;
- Provide flushing of groundwater through the pits to encourage continued removal of contaminants at the site; and
- Minimize the threat posed to the environment from contaminant migration in the groundwater and surface water.

The selected remedy for OU1, as identified in the ROD, consisted of the following components. Items related to soil/sediment excavation, treatment, and placement are source control measures. Items related to groundwater collection/treatment are management of migration measures.

- Site Preparation;
- Soil Excavation/Treatment;
- Sediment Treatment;

- Construction of an Impermeable Cap;
- Diversion and Lining of the Unnamed Stream;
- Collection and Treatment of On-site Groundwater;
- Wetlands Restoration/Enhancement;
- Long-term Environmental Monitoring and Five-Year Reviews; and
- Institutional Controls.

As stated in the ROD, the EPA determined that contaminants have contaminated on- and off-site groundwater and surface water in the Unnamed Stream. Due to technical impractibility, Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) were not used as cleanup goals. Rather significant reduction of the contaminant mass and protection of surface water bodies were used as cleanup goals. A two part plan for the cleanup of on-site contaminated groundwater and seeps involved an active extraction system (bedrock extraction wells) and a passive collection system (shallow collection trench).

On July 26, 1995, EPA issued an ESD documenting changes to the remedial action specified in the OU1 ROD. The ROD called for excavation of soils within the disposal area down to the seasonal low water table, de-watering, solidification, and placement back within the disposal area under an impermeable cap. The revised remedy described in the ESD called for soils in the disposal area to remain in place, untreated, and covered by the cap. The ROD also called for soils and sediments from the Unnamed Stream, water hazards, and other areas of OU1 outside the disposal area that exceed cleanup standards to be excavated, treated, and disposed of under the impermeable cap within the disposal area. Under the revised remedy, excavated soils and sediments from these areas would remain untreated and would be disposed of under the impermeable cap within the disposal area.

Another ESD was issued by EPA on September 27, 2000, documenting additional changes to the remedial action specified in the OU1 ROD. The ROD described the concrete lining of about 750 feet of the Unnamed Stream in the portion parallel to the eastern boundary of the site. As described, the revised remedy included the permanent placement of the stream channel in an underground 72-inch PCCP, the creation of a new stream channel on the golf course, and the planting of vegetation to recreate the habitat lost. Under the ROD, passive groundwater collection along the eastern and northern boundary of the site consisted of an under drain pipe within a shallow trench. The ESD substituted this collection system with a slurry wall along a portion of the northern boundary and two recovery wells adjacent to the slurry wall.

A third ESD was issued by EPA on September 29, 2003. It incorporated methane gas collection into the remedy to comply with Massachusetts Solid Waste Management Regulations and to prevent the off-site migration of gas.

4.1.2 Operable Unit 2

The ROD for Sullivan's Ledge OU2 was issued by EPA on September 27, 1991. The remedial action objectives listed in the ROD are:

- Reduce exposure of aquatic organisms to PCB-contaminated pore water and sediments either through direct contact or diet-related bioaccumulation;
- Reduce exposure of terrestrial and wetland species to PCB-contaminated sediment/soils through direct contact or diet-related bio-accumulation;
- Prevent or reduce releases of PCBs to the Unnamed Stream and the Apponagansett Swamp; and
- Mitigate the impacts of remediation on wetlands.

The selected remedy, as identified in the ROD, consisted of the following components:

- Site preparation;
- Excavation of contaminated sediments and soils from portions of Middle Marsh and the Adjacent Wetland;
- Dewatering and stabilization of the excavated sediment/soils;
- Disposal of the stabilized sediment/soils beneath the cap constructed over portions of the disposal area of the site;
- Wetlands restoration;
- Institutional controls to prevent future residential use and restrict commercial use; and
- Long-term environmental monitoring.

4.2 REMEDY IMPLEMENTATION

This section summarizes the implementation of the remedial actions specified in the RODs for OU1 and OU2.

4.2.1 Operable Unit 1

The settling defendants for OU1 formed the Sullivan's Ledge Site Group led by a project management committee (PMC) and hired a design engineering firm, O'Brien & Gere Engineers, Inc. (OBG), to implement the EPA OU1 Statement of Work. In June 1997, EPA approved the 100% design, initiating the time track for remedial action. The PMC contracted with Harding Lawson and Associates, Inc. (HLA) to implement the remedial actions. On-site construction activities for OU1 were initiated in March 1998 with Phase I mobilization.

Implementation of the remedial action for OU1 is discussed below, by component, as identified in the ROD. The information below is based primarily on the Remedial Construction Report (OBG, 2002d) for OU1.

Site Preparation

Site preparation work that was conducted included the installation of fencing and gates, clearing of vegetative material and debris and placement on the disposal area, placement of drums of soil and personal protective equipment and various construction debris on the disposal area, demolition of the former car wash located adjacent to the site and placement of the resulting debris on the disposal area, grading of the site to remove high points, abandonment of monitoring wells in the disposal area, proof rolling (or ensuring there are no unstable areas) of the site, and placement of a 12-inch ordinary borrow interim cover on the portion of the site not scheduled for capping until a later phase.

Soil Excavation

Soil excavation was conducted in several areas of the site. The approximate total volume of material removed from each area is provided as follows:

- Unnamed Stream bed and southern tributary soil and sediments - 950 cubic yards plus 50 cubic yards of rock
- East bank soils (south of car wash) - 140 cubic yards
- Soils east of stream channel - 910 cubic yards
- East bank soils (north of car wash) - 40 cubic yards

In each area, post-excavation confirmation samples were collected and compared to the clean-up criteria for soils of 10 ppm PCBs. When necessary, additional excavation was performed until confirmation sampling indicated that the clean-up criteria had been met. The excavated materials were placed in areas within the limits of the cap system in accordance with construction specifications.

Diversion and Lining of the Unnamed Stream

This component of the remedy involved lining the Unnamed Stream east of the disposal area with a 72-inch PCCP. The 72-inch PCCP was installed during Phase I of the remedial action.

Collection and Treatment of On-Site Groundwater

This component of the remedy involved the construction of the active groundwater collection system, the passive groundwater collection system, the slurry wall, and the groundwater treatment plant.

The active groundwater collection system was installed during Phase I of the remedial action and consisted of the installation of three bedrock recovery wells, conversion of three existing bedrock wells to recovery wells, installation of two high density polyethylene (HDPE) piping access vaults, installation of HDPE piping from each bedrock recovery well to a manifold in the groundwater treatment plant, and installation of pumps and controls in each of the six bedrock

recovery wells.

The passive groundwater collection system was installed during Phase I of the remedial action and consisted of approximately 660 feet of shallow collection trench (12-inch diameter HDPE perforated collection pipe surrounded by crushed stone backfill), HDPE manholes, a pump station, a valve vault, and associated double-walled piping.

A slurry wall was constructed along the northern limits of the landfill cap. The slurry wall was installed to a depth of 20 to 25 feet and a width of 6 to 30 feet. Two recovery wells (called "Interim Wells") with pumps, controls, and associated piping were installed adjacent to the slurry wall.

The groundwater treatment plant was constructed during Phase I of the remedial action. The start-up period and initial operations occurred from December 10, 1999 through October 19, 2000.

Construction of an Impermeable Cap

This component of the remedy involved the following activities:

- installation of the geogrids along the former quarry limits;
- construction of the gas venting system including placement of granular material, installation of gas vent risers and horizontal gas collection pipe, and installation of 22 gas monitoring wells around the perimeter of the landfill cap system;
- installation of the geosythetic clay liner;
- installation of the flexible membrane (LLDPE) cover;
- installation of the synthetic drainage layer;
- placement of the barrier protection material;
- placement of topsoil;
- excavation and construction of the sedimentation basin;
- augmentation of the Hathaway Road culvert;
- construction of run-on/run-off controls including berms, lined swales, and culverts;
- construction of access roads; and
- installation of site security measures including fencing and gates.

Wetlands Restoration/Enhancement

The restoration of affected wetlands in OU1 was conducted concurrently with OU2 wetlands restoration. HLA subcontracted certain wetland restoration tasks (vegetation plantings, invasive control, monitoring, reporting) for both OUs to New England Environmental (NEE) of Amherst, Massachusetts.

Sediment Treatment

Sediment excavation was performed within a tributary of the Unnamed Stream (Tributary #2), and two golf course hazards (Ponds A and B). Post-excavation confirmation samples were

collected and compared to the clean-up criteria of 20 µg PCBs/gram carbon. A total of approximately 7,590 cubic yards of sediment was excavated from these areas. Excavated sediments were transferred to the treatment pad, stabilization agents (lime kiln dust and sand) were added and mixed using an excavator, and then the material was spread out and moisture conditioned (treated with admixtures to dry the sediment and improve usability as fill). A total of approximately 9,340 cubic yards of stabilized sediment was placed within the limits of the cap system.

The Sullivan's Ledge Superfund Site, Operable Unit 1, Remedial Construction Report was completed in March 2002 by OBG (OBG, 2002d). This report included a Certification of Completion of Construction, signed on March 8, 2002. This report was approved by EPA on January 23, 2003, which triggered the start of the O&M period.

Institutional Controls

- To date, the institutional controls identified in the OU1 ROD have not been implemented. These include: ordinances and zoning restrictions to prevent the use of groundwater for drinking water; and
- deed restrictions regulating land use at the site

EPA, the Commonwealth of Massachusetts, and the PRPs have drafted and agreed upon a Grant of Environmental Restrictions (GER) for the institutional controls for the site. The current draft document will have language to address a potential solar project on the site. A letter to EPA from the New Bedford City Solicitors office indicates the city will be prepared to file the GER within ninety (90) days' of its approval by the MassDEP. The remedy is protective in the short-term without the GER in place because exposures to hazardous constituents remain under control due to completion of construction at the Site and continued operation and maintenance activities.

Active Landfill Gas Extraction System

Active methane gas removal was not part of the remedy specified in the ROD for OU1. However, landfill gas monitoring conducted in 2001 and 2002, in accordance with the Post-Construction Environmental Monitoring Plan (OBG, 1996b), indicated that several gas monitoring wells had methane concentrations that exceeded 25% of the lower explosive limit (LEL) for methane. On-site landfill gas vents were also monitored and methane was found to be present. Methane was not detected in explosive gas screenings of subsurface structures and buildings, on and adjacent to the site. Soil gas surveys were performed in spring and summer 2002, indicating that methane was present at greater than 25% LEL both east and west of the landfill but was not detected in any adjacent buildings or structures screened.

A Corrective Action Alternative Analysis was performed to mitigate the migration of explosive gases from the landfill which exceeded the concentrations specified in 310 CMR 19.132(4)(g) and (h). The corrective action chosen was active gas control concurrent with data collection to evaluate the effectiveness in removing landfill gas and reducing off-site migration of landfill gases above 25% LEL. On November 15, 2002 a revised Corrective Action Design was submitted for approval on behalf of the Settling Parties by OBG. The PMC proposed to install a pilot gas extraction system consisting of a trailer mounted 8 horsepower blower with knockout

tank and gauges to record stack discharge velocity and temperature. The pilot system was run initially for a three month period, and then continued to operate until early 2004 when it was dismantled to allow for installation of the full scale system as described below.

OBG, on behalf of the OU1 PMC, submitted a conceptual design for the full scale landfill gas collection system dated May 8, 2003. The design was based on the results of the pilot system. The design included collection from the east, west, and north sides of the landfill via a 200 GPM blower and subsequent release to the atmosphere.

Installation of the full scale landfill gas collection system was conducted during the beginning of 2004. The full scale landfill gas collection system became operational on June 10, 2004.

4.2.2 Operable Unit 2

On January 25, 1993, EPA gave notice that the Consent Decree (CD) for OU2 had been lodged in United States District Court in Massachusetts. The Consent Decree was entered into by AVX Corporation (AVX) as the lead Settling Party, the City of New Bedford, the OU1 Settling Parties, EPA, and the Massachusetts Department of Environmental Protection (MassDEP). AVX Corporation hired a design engineering firm, Dames & Moore (now known as URS Corporation) to implement the EPA Statement of Work.

The remedial action at OU2 was conducted between 1998 and 2001. The OU2 Settling Parties contracted with HLA to implement the RA.

Activities associated with soil/sediment removal were conducted from April 1999 through September 2000. The calculated volume of soil, sediment, and debris wastes that were removed from Middle Marsh and the adjacent wetland was 25,485 cubic yards. Activities associated with the stabilization of soil/sediment and placement in the disposal area were conducted from June 1999 through June 2000. Activities associated with wetlands restoration were conducted from July 1999 through September 2000.

The Final Remedial Construction Report, Sullivan's Ledge Superfund Site, Second Operable Unit was completed on August 13, 2001 by URS Corporation. The report included a Certification of Remedial Construction Completion, signed on August 13, 2001. This report was approved by EPA on January 23, 2003, which triggered the start of the O&M period.

To date, land use restrictions identified in the OU2 ROD have not been fully implemented. The ROD called for zoning ordinances and/or deed restrictions to ensure that future uses of Middle Marsh and the Adjacent Wetland are limited to existing recreation and conservation purposes, and to prohibit residential and restrict commercial uses.

EPA, the Commonwealth of Massachusetts, and the PRPs have drafted and agreed upon a GER reflecting the above mentioned restrictions. The current draft document will have language added to address a potential solar project on the site. The draft document is in its final review and will be issued soon. A letter to EPA from the New Bedford City Solicitors office indicates the city will be prepared to file the GER within ninety (90) days' of its approval by the MassDEP. The remedy is protective in the short-term without the GER in place because exposures to hazardous constituents remain under control due to completion of construction at the Site and continued operation and maintenance activities.

- Quarterly monitoring of the perimeter gas monitoring wells and other locations for explosive gases and annual monitoring for hydrogen sulfide (results provided in quarterly or semi-annual monitoring reports); and

- Monitoring of representative perimeter gas monitoring wells for VOCs using SUMMA canisters.

Groundwater compliance monitoring was conducted quarterly through 2008 and then reduced to semi-annually beginning with the March 2009 monitoring round.

The Wetlands Restoration Plan specifies that wetlands monitoring be performed annually for the first three years after completion of the initial restoration, during the fifth year, and once every following five years. Monitoring activities include stream flow and elevation monitoring, groundwater elevation monitoring, and evaluation of percent cover of the restored and created wetlands. To date, annual wetland monitoring reports have been submitted for monitoring conducted in 2001 through 2006 and 2011 (NEE, 2002; NEE, 2003; NEE, 2004; OU1 & OU2, 2005; OU1 & OU2, 2006; OU1 & OU2, 2007; and CONB, 2012). The wetland monitoring reports address both OU1 and OU2.

A Ground Water Treatment Plant (GWTP) Operation and Maintenance Manual, finalized by OBG in August 2000, specifies the following O&M activities:

- Quarterly inspections of the GWTP to determine the total volume of remedial waste water treated since the previous inspection, average flow rate of the system, total volume of non-aqueous phase oil or hazardous materials recovered since the previous inspection, and whether any maintenance activities are necessary;

- Routine monitoring of effluent for various parameters; and

- Routine monitoring of the air discharge from the GAC canister in service with the tank venting system for benzene, trichlorethylene, and vinyl chloride using colorimetric tubes and follow-up laboratory analyses.

The manual also describes recommended maintenance activities that should be performed on the GWTP process equipment. Monthly reports documenting the effluent monitoring and other operating data are submitted by the City of New Bedford.

4.3.1.2 Summary of OU1 O&M Issues and Operational Modifications

The OU1 remedy has generally performed as designed since construction completion. During this review period, the groundwater treatment plant underwent a modification to replace the ultraviolet/oxidation (UVOX) system with an air stripper and liquid-phase granular activated carbon (GAC) system, which is further described below. Also, O&M issues/problems that have occurred in relation to the landfill cap, landfill gas extraction system, groundwater monitoring wells, and groundwater collection system over this review period are summarized below. Additional O&M issues are discussed in other sections of this report.

GWTP Modification. The OU1 PMC and City of New Bedford elected with EPA's support to

replace the existing ultraviolet/oxidation (UVOX) system, which treats VOCs in extracted groundwater, with an air stripper and liquid-phase activated carbon (GAC) system. The OU1 ROD had contemplated the use of air stripping with GAC if the UVOX system was determined to be ineffective or significantly more costly. A Draft Groundwater Treatment Plant Modification Design Report (Lightship, 2010) was prepared on behalf of the OU1 PMC in March 2010 and was approved by EPA on May 27, 2010. Installation and initial startup of the new treatment train occurred in November 2010. Initial problems with clogging by iron floc, which limited the flow through the GAC, have been addressed to some extent by routine cleaning of the tanks and piping, which the plants operators indicate has become a standard maintenance activity. The air stripper requires frequent cleaning to prevent blockages which affect the removal efficiency of the air stripper. Air stripper cleaning has also become a standard maintenance activity.

Landfill Cap Settlement. In 2011, settlement was observed on a portion of the landfill cap. In order to evaluate the significance of the settlement and whether any actions were necessary, the OU1 PMC had the landfill cap surveyed and the results were evaluated. It was determined that some settlement in that portion of the cap was anticipated during the cap design and geogrids were placed in that specific area to help prevent damage to the cap liner from the anticipated settlement. Further, ponding did not appear to be a concern because sufficient slope was present. It was determined that no action was needed.

Landfill Gas Extraction System. Since the initial startup of the full scale landfill gas collection system in 2004, some modifications have occurred to the system to address the accumulation of water/condensate in the lower leg of the collection system and to apply additional vacuum to the eastern portion of the landfill cap. In 2009, gas monitoring wells GM-19 and GM-20 were directly connected via piping to the lower leg of the collection system to improve landfill gas removal. Gas monitoring wells GM-17 and GM-18 has previously been connected. In 2006, a pneumatic valve was installed near the blower system and is operated on a timer, such that the valve is open for 60 minutes and closed for 120 minutes. When the valve is closed, vacuum is applied only to the lower leg of the piping, producing a higher vacuum which helps remove water or condensate from the piping and also provides a higher vacuum to the direct connection points in the eastern portion of the cap. When the valve is open, vacuum is applied to both the upper and lower legs.

Groundwater Monitoring Wells. Two multi-level Westbay monitoring wells (ECJ-2 and ECJ-4) have become damaged within the past 5 years. Well ECJ-2 experienced a failure in mid-2009, apparently due to damage or deterioration of the packing ring which caused the sample ports to no longer be sealed off from each other. Well ECJ-4 experienced a similar failure in mid-2010. The OU1 Settling Parties intend to replace well ECJ-2 with a similar multi-level Westbay well that will have sampling ports at 4 depth zones that target shallow, mid, and deep bedrock, instead of the original 5 depth zones. It is anticipated that installation of the replacement well will occur in the summer of 2013. Well ECJ-2 is a Point of Compliance well that is used to assess compliance with the cleanup goal for the active collection system. Both monitoring wells were part of the routine compliance monitoring program prior to failure. There are no plans to replace well ECJ-4 since it is not a point of compliance.

Groundwater Collection System. On frequent occasions within the past 5 years, one or more of the six bedrock extraction wells has had downtime due to problems with the pumps that require repair or replacement. This is an ongoing maintenance issue that is addressed as

needed.

4.3.1.3 OU1 O&M Costs

Due to agreements between the OU1 Settling Parties and the City of New Bedford, O&M costs are paid separately by both groups. The table below summarizes these costs.

Table 2: Annual Approximate System Operations/O&M Costs for Operable Unit 1

Type of Cost and Time Period	Total Cost
Groundwater Treatment Plant O&M Costs:	
July 1, 2008 – June 30, 2009	$489,141
July 1, 2009 – June 30, 2010	$341,410
July 1, 2010 – June 30, 2011	$344,732
July 1, 2011 – June 30, 2012	$337,879
Monitoring, Engineering, Capital Improvement, Administrative, and Legal Costs:	
January 1, 2008 – December 31, 2008	$317,430
January 1, 2009 – December 31, 2009	$376,760
January 1, 2010 – December 31, 2010	$289,430
January 1, 2011 – December 31, 2011	$363,860
January 1, 2012 – December 31, 2012	$287,100

4.3.2 Operable Unit 2

4.3.2.1 OU2 O&M Activities

Post-construction environmental monitoring and post-construction and long-term wetlands monitoring activities are currently being performed in accordance with the Final Operation and Maintenance Plan for the Second Operable Unit, dated January 13, 1999. The O&M period officially began on January 23, 2003 (the date of approval of the Construction Completion Report). However, some O&M activities did occur prior to that date to maintain the integrity of the restored wetlands. The following post-construction environmental monitoring activities are required to be conducted once per year during the first three years, in year five, and then once every five years:

- Collection of four surface water samples from reaches of the Unnamed Stream and analysis for pH and PCBs;
- Collection of four sediment samples from the reaches of the Unnamed Stream, within the area of OU2 impacted by remedial action construction and analysis for PCBs and

total organic carbon (TOC); and

- Collection of two wetland sediment/soil samples from the adjacent wetland and four sediment/soil samples from the Middle Marsh and analysis for PCBs.

The O&M Plan also specifies that post-construction wetland monitoring be conducted annually, for a period of at least five years. Long-term wetland monitoring will then be conducted to ensure the long-term effectiveness of the wetland restoration program. Wetlands monitoring activities include monitoring of hummocks, wetlands hydrology, soil development, and biological attributes including survival rates of planted trees and shrubs, tree growth, vegetative diversity, plant community, and presence of the Mystic Valley Amphipod.

Annual O&M reports are required to be submitted to EPA. To date, seven annual wetland monitoring reports have been submitted (NEE, 2002; NEE, 2003; NEE, 2004; OU1 & OU2, 2005; OU1 & OU2, 2006; OU1 & OU2, 2007; and CONB, 2012). The first six annual O&M reports documented wetland monitoring activities for both OU1 and OU2, as well as environmental monitoring for OU2. The most recent wetland monitoring report (CONB, 2012) documented the first year of long-term wetland monitoring which occurred during 2011. In 2013, EPA conducted environmental monitoring, including surface water and sediment sampling, to meet the requirements for OU2.

The next wetlands and environmental monitoring event is scheduled for 2016.

4.3.2.2 OU2 O&M Costs

O&M costs incurred by the City of New Bedford Department of Environmental Stewardship over the period from 2008 through 2012 are estimated at $6,774. These costs include wetland O&M and monitoring activities for both OU1 and OU2. Activities included two beetle releases in 2008 and 2009 for control of invasive purple loosestrife, periodic monitoring and inspection/on-site meetings with EPA, and effort for the 2011 long-term wetland monitoring event.

SECTION 5.0
FIVE-YEAR REVIEW PROCESS

This section describes the activities performed during the five-year review process and provides a summary of findings.

5.1 COMMUNITY NOTIFICATION AND INVOLVEMENT

On May 9, 2013, EPA issued a press release announcing that EPA was beginning five-year reviews of 16 Superfund sites across New England, including Sullivan's Ledge. A similar press release will be issued by EPA once the five-year reviews are complete. On May 11, 2013, an article was published in the Standard Times announcing that five-year reviews were being conducted at Sullivan's Ledge and another nearby Superfund site.

Interviews were conducted with parties involved in O&M and monitoring of the remedy, including the City of New Bedford Water Superintendent, City of New Bedford Conservation Agent, and a representative of the OU1 Project Management Committee. A summary of responses to questions posed to PRPs and City personnel is provided in Section 5.5.

5.2 DOCUMENT REVIEW

This five-year review consisted of a review of relevant documents for both OUs including the remedial investigation reports, RODs, remedial construction reports, and O&M and monitoring plans and reports. See Attachment 2 for a list of documents that were reviewed.

5.3 DATA REVIEW

5.3.1 Operable Unit 1

5.3.1.1 Groundwater Treatment Plant Effluent Monitoring

Effluent from the GWTP is discharged to the City of New Bedford publicly-owned treatment works (POTW). The New Bedford POTW has established discharge criteria that must be met by the GWTP for discharge to the municipal sewer system. Treatment plant effluent sample analyses were evaluated to determine if pretreatment discharge limitations were met. PCB samples have been typically collected on a weekly basis and although there have been a small number of exceedances of the discharge limit within the past 5 years, no PCBs have been detected in samples collected during 2012 and the first quarter of 2013. Where there were effluent exceedances in past years, they were typically attributed to temporary operational problems or maintenance within the treatment plant. There have been fewer effluent exceedances since the modifications to the GWTP, which occurred in late 2010. Samples have typically been collected for VOCs, metals, and cyanide on a monthly or bi-weekly basis and review of data over the past 5 years has not indicated any exceedances of the discharge limits for Total Toxic Organics (TTO), metals, and cyanide. Semivolatile organics (SVOCs) and pesticides have been analyzed on a less frequent basis. SVOCs were last analyzed for in January 2011 and no SVOCs were detected. Pesticides were last analyzed for in August 2012 and no pesticides were detected. Table A3-1 (located in Attachment 3) provides a comparison of recent effluent data from April 2013 to the pretreatment discharge limitations.

5.3.1.2 Groundwater Monitoring

Monitoring is being conducted while the groundwater treatment plant is operating until the groundwater clean-up standards are achieved in accordance with the requirements of the CD with the OU1 Settling Parties. Once performance standards are met, performance monitoring will be conducted for a period of three years, in order to evaluate whether achievement of the cleanup standards is sustained. After performance monitoring, long-term monitoring will be conducted (OBG, 1996b).

The Post-Closure Environmental Monitoring Plan (PCEMP) (OBG, 1996b) describes compliance monitoring requirements for both the active extraction system and the passive collection system. With regard to the active extraction system, the plan specifies that bedrock and Westbay monitoring wells be sampled on a quarterly basis and that overburden monitoring wells be sampled on a quarterly basis for the first four quarters and annually thereafter. Since the PCEMP was developed, certain modifications and reductions have been made to the sampling program with EPA's approval. Most recently, the frequency of groundwater monitoring was reduced from quarterly to semi-annually beginning with the March 2009 monitoring round. Water level measurements continue to be conducted on a quarterly basis.

The current sampling program includes a March sampling event and a more comprehensive September (annual) sampling event. The March events include the sampling of the recovery system components (bedrock extraction wells and shallow collection trench), eight conventional monitoring wells and multiple zones in two Westbay monitoring wells. The September events include the sampling of the recovery system components, 21 conventional monitoring wells, and multiple ports in 4 Westbay monitoring wells.

To date, a Post-Construction Baseline Groundwater Sampling Event report (OBG, 2000a) followed by quarterly groundwater monitoring reports through 2008, and semi-annual groundwater reports from 2009 through 2013 have been submitted. The Fall/Winter monitoring reports (Winter monitoring reports prior to 2009) are annual reports that provide additional discussion of historical data and data trends.

Active Collection System

The active collection system has been delivering contaminated groundwater to the treatment plant since startup in 1999. The bedrock cleanup goal identified in the ROD for the active collection system is the significant reduction in the mass of the bedrock contamination. Two criteria are used to evaluate this goal: (1) a concentration range of 1 to 10 ppm (1,000 to 10,000 ppb) of total VOCs; and/or (2) an asymptotic curve using groundwater monitoring data indicating that significant concentration reductions are no longer being achieved. Several bedrock monitoring wells serve as points of compliance and were established in the PCEMP. A summary of total VOC data for the points of compliance from 1999 through 2012 is presented in Table A3-2 (located in Attachment 3) and summarized below. Total VOC concentrations are based on totals provided in the Fall and Winter 2012 Monitoring Event report (OBG, 2013).

Point of compliance wells ECJ-1, GCA-1, MW-13, and MW-17 are located within the former disposal area on the downgradient side. In general, total VOC concentrations in most zones of Westbay monitoring well ECJ-1 and wells GCA-1, MW-13, and MW-17 have decreased since plant startup. Total VOC concentrations in ECJ-1(267), in the deep bedrock zone have

generally been higher over than past 5 years compared to the previous 9 years, but are consistently well below 1,000 ppb. Total VOC concentrations in ECJ-1(122) and ECJ-1(148) have fluctuated and periodically exceed 1,000 ppb, but have not exceeded 10,000 ppb since 2006. Similarly, total VOC concentrations in ECJ-1(37), ECJ-1(62), and ECJ-1(72) continue to fluctuate, but concentrations in ECJ-1(37) have not exceeded 1,000 ppb since 1999 and concentrations in ECJ-1(62) and ECJ-1(72) have not exceeded 1,000 ppb since 2008. Total VOC concentrations in well GCA-1 have been consistently between 100 and 300 ppb since 2003. Total VOC concentrations in wells MW-13 and MW-17 have shown concentrations below 10 ppb since 2002, with one exception. The total VOC concentration in well MW-13 in the fall of 2010 was 699 ppb (significantly higher than typical levels) and appears to be anomalous.

Point of compliance wells located within the former disposal area on the upgradient side include ECJ-3, MW-2, and MW-24. Total VOC concentrations in each zone of Westbay well ECJ-3 have generally been low and have been below 10 ppb since 2005. Total VOC concentrations in well MW-24 appeared to decrease following plant startup through the Winter 2004 round and have since shown an increasing trend, with concentrations ranging between 4,000 and 10,000 ppb over the past five years. Since MW-24 is located within the former disposal area, the apparent increasing trend does not indicate an off-site source or other concern. Total VOC concentrations in well MW-2 generally decreased through the spring 2006 round and have since shown a slight increasing trend, with concentrations ranging between 200 and 1,400 ppb over the past five years.

Point of compliance wells ECJ-2, MW-4, MW-5, and MW-6 are located outside of the former disposal area. As discussed elsewhere, Westbay well ECJ-2 experienced damage in mid-2009 and although some monitoring data has been collected since then, it is not considered reliable and therefore not presented or discussed in this data review. Prior to mid-2009, monitoring data has shown that total VOC concentrations in each zone of ECJ-2 have generally decreased significantly since plant startup. Total VOC concentrations in ECJ-2(117) decreased following plant startup but have appeared to increase since the winter 2005 round. Both ECJ-2(117) and ECJ-2(152) showed spikes in total VOC concentration over 10,000 ppb during the year prior to well failure. Total VOC concentrations in well MW-4 have appeared to fluctuate with no overall trend and concentrations have ranged between 800 and 2,500 ppb over the past 5 years. Total VOC concentrations in well MW-5 have been very low (less than 10 ppb) relative to other point of compliance wells since plant startup with no apparent increasing or decreasing trend. Total VOC concentrations in well MW-6 have decreased significantly since plant startup but have remained relatively steady over the past few years of monitoring.

For the most part, concentrations of total VOCs have decreased significantly since treatment plant startup conditions in 1999. However, continuation of the compliance monitoring set forth in the ROD in accordance with the PCEMP should continue. Special attention to any wells exhibiting increasing concentrations in total VOCs is warranted as data continues to be collected. Westbay well ECJ-2 should be repaired as soon as possible so that monitoring can continue at that point of compliance.

Passive Collection System

The objective of the passive collection system is to prevent degradation of the Unnamed Stream by collecting shallow contaminated groundwater. Cleanup levels are to be determined based on AWQC and the designated uses of the receiving waters. Compliance is measured at the

influent to the treatment plant. Quarterly groundwater monitoring includes collection of groundwater from the passive collection system for chemical analysis. In addition to the quarterly monitoring, the City of New Bedford has generally been sampling the collection trench groundwater for PCBs on a weekly to biweekly basis since March 2005 and at other frequencies prior to that time. To date, specific cleanup levels have not been defined for the passive collection system; however, cleanup levels will need to be determined in the future to assess compliance and determine whether continued operation of the passive collection system is warranted.

During the recent September 2012 monitoring round, groundwater from the shallow collection trench was analyzed for VOCs, PCBs, and metals and a summary of detected analytes is provided as Table A3-3 in Attachment 3. In general, levels of VOCs, PCBs, and metals have remained relatively consistent since treatment plant startup. SVOCs were last sampled in December 2008 and none were detected.

The passive collection system continues to collect shallow contaminated groundwater. Flow from the collection system is providing essential additional flow to the treatment plant to ensure continuous/semi-continuous operation. During dry weather periods and the resultant lower than expected flow rate from the passive collection system vault, the treatment plant has been operating intermittently.

5.3.1.3 Sediment Monitoring

Bi-annual sediment sampling was performed in September 2009 and September 2011 and additional supplemental sediment sampling was performed in June 2010. In 2009 and 2011, sediment samples were collected from the Unnamed Stream just upstream of Pond A, OU1 diversion swale, sedimentation basin, the Unnamed Stream just downstream of the Hathaway Road culvert, and from upstream of the former disposal area at the OU1 cap swale. Sediment samples were analyzed for PCBs, PAHs, TOC, metals, and percent solids. During the 2009 and 2011 sampling events, an additional sediment sample was collected from within a culvert pipe at the headwall just north of Hathaway Road and analyzed for PCBs, PAHs, and metals.

In 2009, two sediment samples exceeded the sediment target level of 20 ug PCB/g carbon, including the sediment sample from the sedimentation basin (45.16 ug PCB/g carbon) and the sediment sample from the Unnamed Stream just upstream of Pond A (50.48 ug PCB/g carbon). All other sediment samples from September 2009 showed concentrations below the sediment target level (OBG, 2010a). In order to further assess the 2009 sediment target level exceedances, these two locations were resampled in 2010. Ten samples were collected in the vicinity of each of these locations and analyzed for TOC, while one of the samples was also analyzed for PCBs. In addition both TOC and PCBs were analyzed on composites of 6 samples at each of the two locations. The normalized PCB concentrations for the composite samples were 0.96 ug PCB/g carbon and 0.53 ug PCB/g carbon for the sediment samples from the Unnamed Stream upstream of Pond A and the sedimentation basin, respectively, and were below the sediment target level.

In September 2011, all sediment samples showed normalized PCB concentrations below the sediment target level (OBG, 2012a).

During each of the 2009 and 2011 sediment sampling events, PAHs were detected at all sample

locations including the location upstream of the former disposal area at the OU1 cap swale. Concentrations of PAHs were generally highest in the sediment sample collected from just downstream of the Hathaway Road culvert. OBG has attributed the higher concentrations at this location to runoff from Hathaway Road. Similarly, several metals were detected in all sediment samples including the upstream samples from the OU1 cap swale. While the downstream metals concentrations were generally higher than the upstream metals concentrations, there do not appear to be any sharp upward trends between monitoring events. Also, the highest metals concentrations were not consistently detected at one sample location (OBG, 2010a and 2012a).

5.3.1.4 Surface Water Monitoring

Bi-annual surface water sampling was performed in September 2009 and September 2011. Surface water samples were generally collected from the Unnamed Stream, OU1 diversion swale, sedimentation basin, downstream of the Hathaway Road culvert, and OU1 cap swale (upstream location). The surface water samples were analyzed for VOCs, PAHs, PCBs, metals, and pH.

Generally, surface water data showed similar results for each of the two sampling events. PCBs were not detected in any surface water samples. Very low concentrations of VOCs, primarily chlorinated VOCs and benzene, were detected at multiple downstream locations with no increasing trends. Metals concentrations were generally similar between the two monitoring events. PAHs were not detected during the 2009 event but were detected in 2011 at the sampling locations just downstream of the Hathaway Road culvert and within the sedimentation basin (OBG, 2010a and 2012a).

5.3.1.5 Landfill Gas Monitoring

As described above, a full scale active landfill gas collection system has been operating since June 2004. Landfill gas monitoring is conducted on a quarterly basis in accordance with the Surface Water, Sediment, and Landfill Gas Monitoring Field Sampling Plan. During each event, the landfill gas monitoring wells along the perimeter of the landfill cap, the discharge stack of the gas extraction system, and ambient air in the vicinity of the gas extraction unit are screened for VOCs, methane, carbon dioxide, oxygen, and hydrogen sulfide. See Figure **4**, provided in Attachment 1, for the locations of the landfill gas monitoring wells and discharge stack. Ambient air, along the fence line and within catch basins at the gas station (formerly Rosie's Restaurant) located next to the former disposal area, is also screened for landfill gases.

During the recent December 2012 monitoring event, VOCs and hydrogen sulfide were not detected in any of the gas monitoring wells. Methane was detected in four of the landfill gas monitoring wells located on the eastern side of the landfill cap at concentrations ranging from 2% to 29% of the lower explosive limit (LEL). The methane concentration at well GM-18 at 29% of the LEL is not in compliance with the Massachusetts Solid Waste regulations since methane was present at the property boundary above 25% LEL. As frequently occurs, one landfill gas monitoring well on the southern perimeter of the landfill cap was not monitored because the area around the wells was submerged with water. Methane was detected at the discharge stack of the landfill gas extraction system at a concentration greater than 100% of the LEL. As is typical of previous monitoring events, no methane, hydrogen sulfide, or VOCs were detected in ambient air around the gas extraction system or around the gas station. Indoor air was not

monitored at the adjacent gas station during the Winter 2012 event or previous events; methane was not detected in ambient air along the fence line or within catch basins on the gas station property (OBG, 2013).

Methane has typically been detected in one or more landfill gas monitoring wells at levels above 25% LEL. The following list summarizes the locations of these elevated methane levels for the past 8 monitoring rounds (2011 and 2012) as documented in the semi-annual monitoring reports (OBG, 2011, 2012a, 2012b, 2013):

Monitoring Date	Monitoring Wells Containing Methane at >25% LEL
March 2011	GM-2R, GM-3R, GM-5, GM-8, GM-10, GM-12
June 2011	None
September 2011	GM-17
December 2011	GM-17
March 2012	GM-2R, GM-3R, GM-16, GM-18
June 2012	GM-17
September 2012	GM-2R
December 2012	GM-18

As shown on Figure 4, gas monitoring well GM-2R through GM-12 are located closest to the southern (upper) leg of the gas collection header and GM-16 through GM-20 are located along the eastern property boundary near the northern (lower) leg of the gas collection header.

As discussed in Section 4.3.1.2, the landfill gas extraction system currently alternates between two modes of operation. For 60 minutes, vacuum is applied to both the upper and lower legs of the collection piping and then for 120 minutes, vacuum is applied only to the lower leg of the piping. For the majority of recent monitoring events, the mode of operation during which wells were monitored was not noted although greater attention was paid to this during the most recent monitoring round. While the elevated methane readings along the eastern property boundary are typical of previous years, the periodic elevated methane readings in wells GM-2R and GM-3R are not typical of the previous five-year review period. The periodic elevated methane readings in well GM-2R and GM-3R, in particular, call into question whether the current system operation is adequate to continuously control landfill gas levels at the property boundary in that area, since vacuum is no longer continuously applied to the upper leg of the collection piping. Further, the current monitoring procedure should be documented in the sampling plan to establish clarity and consistency with respect to when measurements are collected.

Between 2005 and 2009, gas monitoring wells GM-17, GM-18, GM-19, and GM-20 were piped directly to the lower leg of the gas collection system in an effort to improve landfill gas removal. Since these wells are now connected to the system, they are no longer appropriate as monitoring locations for assessing compliance with Massachusetts Solid Waste regulations at the property boundary. The reason for this is that when the system is in operation, landfill gas is drawn to these directly connected wells and it is expected that they would contain methane. Compliance should be determined using points which are not connected to the system and therefore, additional soil gas monitoring points should be installed just beyond directly connected monitoring wells. Once an appropriate perimeter monitoring network is in place, the monitoring data should be evaluated for compliance with the requirement that methane levels be maintained below 25% LEL at the property boundary.

5.3.1.6 Wetlands Monitoring

The biological and physical goals for wetland restoration in OU1 areas were modified to align with the goals established for the OU2 area. Therefore, monitoring for OU1 and OU2 areas was combined and the data was presented in single annual reports. A summary of the data review is provided in OU2 section below.

5.3.2 Operable Unit 2

5.3.2.1 Sediment and Soil Monitoring

Since the previous five-year review, sediment/wetland soil sampling was performed in June 2013 by EPA in order to meet monitoring requirements for OU2. Sediment samples were collected from four locations within the unnamed stream, within the area of OU2 impacted by the remedial action construction. At each unnamed stream location, four individual samples were collected and analyzed for TOC and then the sample with the TOC concentration closest to average was analyzed for PCBs. Normalized total PCB concentrations ranged from nondetect to 64 ug PCBs/g carbon. Two out of four sediment samples from the unnamed stream exceeded the sediment target level of 20 ug PCBs/g carbon, with PCB concentrations of 64 ug PCBs/g carbon (at 0.82% TOC) at location SDPC-2 and 32 ug PCBs/g carbon (at 2.58% TOC) at location SDPC-4. Compared to the previous monitoring round in 2006, location SDPC-2 had a lower unadjusted PCB concentration and a much lower TOC concentration in 2013 and location SDPC-4 had a higher unadjusted PCB concentration and a higher TOC concentration in 2013. Continued monitoring of sediments in the unnamed stream should be conducted to evaluate the protectiveness of the remedy and in particular to assess whether the PCB result for location SDPC-4 is indicative of greater impacts to the unnamed stream at that location.

Wetland soil samples were collected from four locations within non-aquatic plot areas in the Middle Marsh and two locations within the adjacent wetlands and analyzed for PCBs. PCBs were not detected in wetland soil samples from the adjacent wetlands. PCBs were detected at concentrations ranging from 0.12 to 0.93 mg/kg in the four Middle Marsh samples. All detected PCB concentrations were well below the 15 mg/kg total PCBs cleanup level.

Sediment and wetland soil results are provided in Attachment 3.

5.3.2.2 Surface Water Monitoring

Since the previous five-year review, surface water samples were collected in June 2013 by EPA from four locations within the unnamed stream and analyzed for PCBs and pH. PCBs were not detected above the detection limit in any of the samples collected.

Surface water results are provided in Attachment 3.

5.3.2.3 Wetlands Monitoring

Data has been submitted for wetland monitoring that occurred in 2011. Monitoring was conducted in the fall of 2011 by personnel from the City of New Bedford Department of Environmental Stewardship (CONB, 2012).

The data were collected and compared to the various biological and physical indicators that were established prior to remediation to monitor the progress towards reaching the goal of wetland restoration. The first two columns of the following table identify the goals that were established and described in the O&M Plan for OU2 (Dames & Moore, 1999) and subsequently adopted by OU1. Comments regarding the trajectory towards meeting these goals are provided in the third column. Refer to Figure 5, provided in Attachment 1, for the locations of the OU1 and OU2 wetland and stream restoration areas.

Wetland Attributes	Goals	Comments
	Biological Indicators	
Survival Rates of Planted Trees and Shrubs	At least 80% of the original number of plantings of each species should be viable five years after planting. The 80% may be comprised of both plantings and volunteers of the species.	At least 80% of the original number of plantings of each species do not appear to be viable five years after planting in some areas of the site, including the OU1 Mitigation Area West and the OU2 Middle Marsh northwestern and southeastern corners. In these areas, prevalence of extended surface saturation and/or abundant phragmites has likely decreased survival of planted woody species and favored herbaceous species. These observations are similar to those documented by 2005 data. In other areas, this attribute appears to be met.
Tree Growth	Mean tree height and diameter (dbh) for planted trees should increase at least 20% from the original planting height and dbh every 5-year interval.	Documentation that this criterion has been met is not complete, because height and dbh of all planted tree species was not well documented at the time of planting, or during the 2005 inspection. However, the 2011 data do document this data for current conditions,

Wetland Attributes	Goals	Comments
		and will provide a basis of comparison for the next five year event. Overall the data suggest that the intent of this goal is being met for most areas because a woody canopy layer has become well established, with the exception of the extreme northwestern and southeastern corners.
Vegetative Diversity	Demonstrate an ever increasing trend up from the 15 woody and 10 herbaceous planted species, by providing at least one additional woody and one additional herbaceous non-invasive wetland species every 5 years.	Addition of new plant species has slowed over the last five years, however the 2011 Wetland Monitoring Report (CONB, 2012) documents that there are many species present throughout both the OU1 and OU2 areas.
Plant Community	(a) Herbaceous, shrub, and woody relative cover at the end of the second growing season must achieve an overall 75% areal coverage of wetland plant species. (Also a Performance Standard) (b) To ensure the area continues to meet the federal wetland definition, greater than 50% of the dominant plants, exclusive of invasive species, should be wetland species.	Wetland species appear to cover at least 75% of the restored wetland areas in all plots but one. The one plot that was identified as not currently dominated by wetland species based on the 2011 data is OU1-STRM-1; this plot included unidentified herbs that were conservatively classified as upland. As a result, the herbaceous layer was classified as dominated by upland species. However, shrub and tree layers are dominated by wetland species and hydric soil indicators are present, suggesting that the herb layer will continue to accumulate additional wetland species. In addition, most of the plots met the criteria of greater than 50% dominance by non-invasive wetland plants. Although still

Wetland Attributes	Goals	Comments
		present at the site, invasive species are becoming less prevalent. In 2011, six of the plots included greater than 50% dominance by invasive wetland species, compared to 10 plots in 2005, which demonstrates a trend toward reduction in dominance by invasive species.
Mystic Valley Amphipod	The Mystic Valley Amphipod (MVA) must occur within areas of the Second Operable Unit by the end of the third year after wetland construction. (Also a Performance Standard)	The MVA was observed in the OU2 MM in 2003. No confirmation sampling has been performed to indicate the maintenance of this species in the wetlands; however, site conditions have remained stable over the 10-year period since the initial sampling.
Physical Indicators		
Hummocks	Maintain greater than 25% mean areal coverage of hummocks in the sampling plots.	All six of the Middle Marsh plots were assessed for hummock coverage in 2011. For four of the six plots, the percent of hummocks was established at greater than 25%. Two of the plots, OU2-MM2 and OU2-MM 3, had only 15% hummock coverage and were observed to be in low, flat areas. OU2-MM3 is in an area documented as very wet prior to remediation, and most likely always had a low percent cover of hummocks. The OU-2 MM2 plot is an area that has been known to be a low, flat wet area since remediation efforts were completed. Although additional fill could be imported to create additional hummocks in this area, the benefit is not believed to

Wetland Attributes	Goals	Comments
		outweigh the impact to adjacent well-established areas with high cover of canopy woody vegetation. In addition, the plot data indicate that on average the Middle Marsh area does include greater than 25% coverage when viewed as a whole. No significant erosion has been noted over the 5-year period.
Hydrology	Groundwater and/or saturated soils should be within 12 inches of the wetland surface for two weeks in each piezometer in the restored wetlands at least three of every five years.	Two rounds of data have not been collected within a two-week period since the project's inception and it can't be confirmed that water levels have been within 12 inches of the wetland surface for two weeks. This attribute is intended to document that hydrology in the restored wetlands is sufficient to support wetland plants. Given the high percentage of wetland plants growing throughout the restored areas, sufficient hydrology has been qualitatively confirmed.
Soil Development	Soils from all ten borings should show a trend to meet the definition of hydric within 10 years.	Soil data indicates that hydric characteristics are present throughout the site, indicating a trajectory towards meeting the definition for a hydric soil in the future.

5.4 SITE INSPECTION

Site inspections of both Operable Units were conducted periodically by AECOM between the previous five-year review and September 2013. Inspection of the OU1 and OU2 portions of the site was conducted on May 16, 2013 and further inspection of the landfill cap and groundwater extraction and treatment system was conducted on June 19, 2013 as part of this five-year review. Inspection of the Unnamed Stream and OU1 and OU2 wetland restoration areas was attended by the EPA remedial project manager and community relations specialist, AECOM wetlands scientist and engineer, and the City of New Bedford Conservation Agent. Inspection of the remaining components of the site was attended by the EPA remedial project manager, MassDEP project manager, AECOM engineer, and included discussion with the treatment plant operations staff. The observations made during these site inspections were used to provide the necessary information for this five-year review. Site Inspection checklists and a photo log are provided in Attachment 4.

The overall current site conditions are that exposures to hazardous constituents remain under control due to completion of construction at the site and continued operation and maintenance activities for both Operable Units. Land uses at the site have not changed since the remedy was constructed. Although the institutional controls are not yet in place, there are no current uses of the site that violate the intent of the required institutional controls.

5.4.1 Operable Unit 1

Groundwater Extraction and Treatment System

The groundwater extraction and treatment system has been inspected by AECOM periodically since start-up in 1999. The most recent inspection was performed on June 19, 2013. The system was operating on the day of inspection.

Outstanding GWTP Operational Problems. The following are GWTP operational problems ongoing during the recent site inspections.

- The motor for bedrock extraction well BEI-1 broke and the well was not operational beginning in mid-April and still down as of June 19, 2013. A replacement pump had been received and needed to be installed. Further, one of the influent lines for BEI-1 ruptured and needed repair, although this does not prevent operation of the well since a second backup line is present.

On-Site Documents and Records

An interview and inspection of site documents and records at the GWTP indicate that the following documents are not up to date.

1. Site Specific Health and Safety Plan (HASP). The plant operators are using the HASP that was developed for construction activities during the Phase 1A Remedial Action, prepared by Harding Lawson and Associates, Inc. (HLA) in April 1998. According to Section 22.4 of the Groundwater Treatment Plant O&M Manual (OBG, August 2000) a site specific HASP must be prepared and reviewed and approved by a Certified Industrial Hygienist.

2. Groundwater Treatment Plant O&M Manual. The Groundwater Treatment Plant O&M Manual (OBG, August 2000) was located at the GWTP; however, the manual should be updated to reflect changes in equipment and operations and maintenance procedures based on several years of GWTP operation. An updated manual has been prepared and the PMC indicated that it will be distributed for review during the summer of 2013.

Landfill Gas Extraction System

The gas extraction system was inspected by AECOM periodically since start-up in June 2004. The most recent inspection of the landfill gas extraction system was performed on May 16, 2013. The system was not operating during the inspection, but plant operators indicated that it had been turned off briefly to perform maintenance and would be turned back on shortly. The system was operating during the June 19, 2013 inspection. A valve handle on the extraction system piping to gas monitoring well GM-19 was broken and stuck in the open position. Plant operators indicated that the valve handle was to be replaced.

Site Features (South of Hathaway Road)

Site features identified in the O&M Plan (Sullivan's Ledge Superfund Site, New Bedford, Massachusetts, Site Operations and Maintenance Plan, Feb. 2002) include the landfill cap, surveyed benchmarks, the access road, site security features, the gas venting system, run-on/run-off controls, and the lined portion of the Unnamed Stream. Site features related to OU1 have been periodically inspected by AECOM since the previous five-year review and most recently on May 16, 2013.

- **Landfill cap.** In general, the cap appeared to be well vegetated and mowing had recently been conducted. Tall woody vegetation and shrubs were observed in and around portions of the drainage swales, along the southern slope of the landfill cap on either side of the southern drainage swale, and along the western fence line. This vegetation should be cut down—which the City of New Bedford is in the process of arranging. An animal hole was observed along the western edge of the cap and should be addressed. A wet area was observed along the northern portion of the eastern fence line; however, it appears to be just outside the limits of the cap. There were no signs of erosion or slope instability on the cap. There were no signs of seepage during the May 16, 2013 inspection; however, during the June 19, 2013 inspection, seepage was observed at the northern edge of the site in the vicinity of gas monitoring well GM-15 and orange staining (due to high iron content) was observed on the sidewalk adjacent to Hathaway Road. EPA is currently discussing with the PRPs whether it is due to overland runoff or groundwater seepage and next steps.

- **Surveyed benchmarks.** No signs of damage and are all accounted for.

- **Run-on/run-off controls.** As noted above, vegetation within the drainage swales should be removed. Otherwise, the swales, catch basins, and Hathaway Road headwall appear to be in good condition.

- **Access road.** The landfill cap access road is in good condition.

- **Site security features.** Fencing, barb wire and locks are in good shape. A bent railing near the gate has no impact on the integrity of the fence or site security. No trespassing signs along the fence are present. Portions of the fence along the western site boundary were difficult to observe due to heavy vegetation, which should be cut down as discussed above.

- **Gas venting system.** All gas vents are in good shape. The gas monitoring well roadbox covers were not opened, however the roadboxes appear to be in good condition.

- **Lined portion of the Unnamed Stream.** The interior of the concrete pipe has not been inspected since its completion. The O&M Plan indicates it is to be inspected every 5 years. EPA is discussing the schedule for completion of the inspection with PMC.

Unnamed Stream and OU1 Wetland Areas

The following observations were made by AECOM during the May 2013 site inspection.

Invasive Species. Although individual purple loosestrife plants are sporadically present, this species is substantially reduced in presence in both the OU1 and OU2 Middle Marsh areas as compared to 2005. At all plants observed, beetle damage of foliage was observed, and/or beetles were directly observed on the plants. The beetles released in 2007 and 2008 appear to be successfully controlling purple loosestrife at the site. Invasive species are very low in cover, or absent, immediately adjacent to the unnamed Stream. Although milfoil was observed in the Unnamed Stream within Middle Marsh near the outlet of the stream at the pond, it was generally sporadically present and not observed to be forming dense mats of cover. Autumn olive (*Elaeagnus umbellata*) and cattail (*Typha latifolia*) were also sporadically observed, and should be monitored to ensure they do not expand to monotypic stands. If they do create such areas, control mechanisms should be implemented. Common reed (*Phragmites australis)* remains present at a high percent cover in the northwestern portion of Middle Marsh, and has extended its range to become the dominant species in the OU1 Middle Marsh Mitigation Area West. As discussed further below, it is recommended that phragmites in the mitigation area be controlled and further monitored.

Multiflora rose (*Rosa multiflora*) was observed to have increased in abundance along the area of the former OU1 diversion swale. It has increased cover to form a monotypic stand at both the upstream and downstream ends of the former diversion swale. It is recommended that the multiflora rose be removed in this area, and that desirable non-invasive woody plants be planted in these locations. Herbicide application is likely the most feasible means of removing multiflora rose in this area, due to the large size and expanse of the plants present.

OU1 Unnamed Stream. Sediment accumulated in the Unnamed Stream just upstream of the double box culvert has decreased substantially since the last five-year inspection. The CONB Conservation Agent, Sarah Porter, indicated that the City Department of Public Works (DPW) has been cleaning out the catch basins on Hathaway Road on a regular basis, the primary source of sediment. Some sediment was observed to be accumulating in the area between Hathaway Road and the box culvert, and it is suggested that this sediment be removed when

the DPW's schedule permits. The stream banks both upstream and downstream of the double box culverts contain significant shade trees due the presence of red maple (*Acer rubrum*), alder (*Alnus incana*), Bebb willow (*Salix bebbiana*) and sweet pepperbush (*Clethra alnifolia*), as well as a number of other species.

A portion of the wooden handrail along the bridge over the box culvert was broken and should be repaired. The rope fence protecting the restored wetlands was not in place along the Unnamed Stream banks just upstream of OU2 Middle Marsh. The rope should be re-installed. The metal handrail along the bridge where the Unnamed Stream enters OU2 Middle Marsh was absent and should be replaced.

OU1 Middle Marsh. A variety of wetland species were observed at the OU1 MM area, including speckled alder (*Alnus* sp.), jewelweed (*Impatiens capensis*), red osier dogwood (*Cornus stolonifera*), red maple (*Acer rubrum*), and sedge species. The canopy cover in this area was lower than the OU2 MM area. Although purple loosestrife was present, *Galerucella* sp. beetles, or foliar damage, were observed on all plants inspected. As indicated above, an abundance of multiflora rose was observed at the eastern and western ends of the OU1 MM area, and appears to have expanded its coverage compared to the last five-year monitoring report. If left uncontrolled, this species may continue to spread in the OU1 MM area, with the potential of forming a monotypic stand and out-competing native wetland species currently present. It is recommended that the multiflora rose be removed to the extent possible, and that additional woody species be planted, such as red maple, willow, and speckled alder.

OU1 Ponds. Desirable wetland herbaceous plants and woody seedlings are present along the banks of the ponds, including willow, speckled alder, sensitive fern, sedges, and rushes. However, the rope fencing is no longer in place, and it appears that at times mowing has extended to the pond banks. The rope should be reestablished, and no mowing should occur on the pond side of the rope fence.

OU1 Mitigation Area East. The area contains a variety of herbaceous wetland species, with red osier dogwood and speckled alder the predominant shrubs present. Most shrubs are located in the eastern half of the area. The previous five-year report indicated that the western half of the mitigation area was consistently inundated with several inches of water preventing the growth of woody species. However, during the May 2013 site visit the western portion was observed to include a few shrubs, and appeared to be less wet than previously reported. A large tree has fallen into the mitigation area, providing habitat diversity. Overall, the area appeared to be functioning well as a wetland habitat. The rope fence adjacent to the Mitigation Area was absent and should be replaced.

OU1 Mitigation Area West. The area was observed to be dominated by phragmites, with very few shrubs remaining. In addition, trash was observed throughout the mitigation area, and an abundance of multiflora rose was observed on the edge of the wetland. The previous five-year report indicated that a small population of phragmites was present and should be treated during invasive species control events in 2008. It appears that control efforts were unsuccessful, and that phragmites has expanded in this area since the 2011 data was collected by the City of New Bedford. It is recommended that the phragmites be treated with an herbicide and that multiflora rose on the edge be controlled/removed on the wetland edge. After control measures are implemented for these invasive species, it is recommended that additional woody shrubs be

planted. In addition, it would be useful to extend/re-establish rope fencing in the area of the OU1 Mitigation Area West to discourage disposal of trash in and near the area.

5.4.2 Operable Unit 2

The following observations of OU2 wetlands areas were made by AECOM during the May 2013 site inspection.

Refer to the previous section for observations regarding invasive species in both OU1 and OU2.

OU2 Middle Marsh. The portion of the OU2 Middle Marsh to the east of the Unnamed Stream contains a smaller population of cattails and common reed as compared to previous years and a diverse emergent plant population exists. Common reed (*Phragmites australis*) remains in the northwestern and southeastern corners of the Middle Marsh, in the areas that are dominated by prolonged surface saturation, and is particularly abundant in the northwestern corner. However, this species appears to be primarily restricted to these two localities and is not prevalent in the Middle Marsh interior. In the southeastern corner, a number of non-invasive herbaceous species are interspersed with the common reed, including sensitive fern and jewelweed.

The woody coverage has increased and is adequate within the majority of the OU2 Middle Marsh area; a woody canopy layer is well-established. Bebb willow is abundant throughout the area, and red maple is also present in the canopy. The survivability of woody tree species should continue to be monitored in accordance with the O&M plan wetland attributes to assess the long-term trajectory of the restoration project. There was evidence of loosestrife beetle damage, and actual sightings of the beetles that were released in OU2 Middle Marsh.

OU2 Adjacent Wetland. This area has developed a substantial amount of woody vegetation since the last five-year report. A diverse emergent plant population also exists between the primary woody species (alder). Dominant species observed include bebb willow, speckled alder, and dogwood species.

5.5 INTERVIEWS

5.5.1 Operable Unit 1

A series of interview questions were developed for the PMC and City of New Bedford for OU1. Answers to the questions were provided in writing via electronic mail from Steve Wood of the PMC on July 19, 2013.

The PMC's overall impression of the project is good. When asked if the remedy is functioning as expected and how well the remedy is performing, the PMC responded that the remedy is working well. The PMC also stated that "*Significant reductions have been achieved in contaminates in recovery and monitoring wells. In fact, the Group and its consultants believe that the groundwater quality now satisfies the criteria for water treatment plant shut-down in the Consent Decree. The Group is requesting permission from EPA and DEP to shut down the treatment system and initiate a 3 year monitoring period to demonstrate that the clean-up criteria that have been achieved and can be maintained without the treatment plant operating. The Group is confident that the from the replacement monitoring well they are installing at EPA's request will be consistent with the low contaminant levels found elsewhere. If so, the Group hopes that EPA will promptly allow the Group and City to shut down the treatment plant and start the three-year monitoring period.*"

The PMC was asked if there have been unexpected O&M difficulties or costs at the site in the last five years and they indicated that there had been none. When asked if there have been opportunities to optimize O&M or sampling efforts and to describe changes and resultant or desired cost savings or improved efficiency, the PMC responded "*Yes. In the winter of 2010, the UV oxidation system was removed and replaced by an air stripper system. This resulted in less complex operations for the plant and a significant reduction in overall O&M costs due to elimination of expensive consumable parts and reduced electricity usage. No loss of performance was encountered in treatment of the discharge effluent which continues to meet the discharge limits.*"

The PMC replied affirmatively when asked whether the O&M activities are being performed consistently with the approved O&M and monitoring plans. When asked if there were any comments, suggestions, or recommendations regarding the project, the PMC responded "*Yes. As has been discussed previously testing of water quality in the shallow collection trench for a period of years has demonstrated it meets or is lower than the standards necessary to discharge to the City of New Bedford POTW. EPA has required that this water first be treated in the on-site treatment plant. Discussions have continued with EPA in this regard and the Group asks that EPA eliminate this unnecessary and expensive treatment step for the collection of trench water.*"

5.5.2 Operable Unit 2

A series of interview questions were developed for the City of New Bedford for OU2. Answers to the questions were provided in writing by Sarah Porter, New Bedford Conservation Agent, via electronic mail on July 2, 2013.

When asked about her overall impression of the project, Ms. Porter stated "*The overall impression is that a successful wetland restoration project was completed. A contaminated*

wetland was successfully remediated by removal of all of the contaminated soils and replacement with clean soils and new vegetation. The vegetation is extremely diverse as a result of plantings, natural succession, and overseeding with wetland seedmix. Invasive species were difficult to combat at first, but the middle marsh now has a healthy diversity of vegetation. It was important to combat invasive species at first with herbicide and biological control (for purple loosestrife). The soils also exhibit hydric soil characteristics which support the wetland vegetation."

When asked if the remedy is functioning as expected and how well the remedy is performing, Ms. Porter responded that "*The remedy is to have the wetland areas restored to forested wetland over time. The results of monitoring have shown they are on a trajectory to reaching a forested wetland with planted trees and colonizing willow on their way to forming a canopy over the site. The canopy will encourage the shading out of the invasive Phragmites australis and Lythrum salicaria. Invasive shrubs such as Rosa multiflora bordering the restoration areas may need to be addressed in the future."*

When asked if there have been unexpected O&M difficulties or costs at the site in the last five year, Ms. Porter stated that "*Continued costs associated with biological control were not expected. However, the costs were not excessive. Cleaning the outfall from Hathaway Road into the restoration area was also not anticipated but was accomplished using in-house personnel and equipment."*

When asked if there were any comments, suggestions, or recommendations regarding the project, Ms. Porter responded "*Yes, the maintenance of the upland meadow habitat bordering the ponds should be prevented from turning woody by an annual mowing of the areas in the late fall. The presence of tall woody vegetation provides a site distance problem for the golfers. The presence of upland meadow habitat adds to the diversity of habitats on the golf course and avoids the spread of the invasive Rosa multiflora which is the primary shrub taking over the upland areas surrounding the pond."*

Ms. Porter responded affirmatively that O&M and monitoring activities are being performed consistently with the approved O&M and monitoring plans and stated that any modifications have been approved by EPA.

When asked if the City plans to continue with invasive species management between now and the next schedules monitoring event in 2016, and if so, what the invasive species management would involve, Ms. Porter stated "*No, it would appear that the invasive species are on the decline in the wetland areas. We will never get rid of all of the invasive species but controlling their spread is the primary goal."*

When asked if there have been issues with access by golfers and golf course personnel to restored areas and how she would describe the status of coordination and co-operation with the golfing community, Ms. Porter responded "*At the moment, the golfers and golf course personnel would like to cut back the Rosa multiflora and some native vegetation such as speckled alder (Alnus rugosa) bordering the large pond because it blocks their site view. The golfers stay out of the restored areas. Most know not to trespass into the wetland areas which are also quite overgrown now, making access difficult in the restored areas to try and retrieve golf balls."*

SECTION 6.0
PROGRESS SINCE THE LAST REVIEW

This is the third five-year review for the site. This section presents the recommendations and follow-up actions identified in the second five-year review, followed by a summary of efforts since 2008 to address the recommendations and follow-up actions.

6.1 PROTECTIVENESS STATEMENT AND RECOMMENDATIONS FROM PRIOR FIVE-YEAR REVIEW

The following protectiveness statement was included in the second five-year review for OU1 and OU2:

The second five-year review concluded that the remedies for both OU1 and OU2 are currently protective of human health and the environment because the construction of the remedy is complete, and operation and maintenance and monitoring of the remedy is being performed. However, in order for the remedy to be protective in the long-term, the following actions need to be taken.

OU1

- Implement Institutional Controls;
- Continue to monitor the groundwater pump and treat operation effectiveness on controlling contaminant migration in order to comply with OU1 remedial action objectives (RAOs);
- Continue to monitor sediment concentrations and implement corrective actions if necessary;
- Continue to monitor landfill gas concentrations, assess non-compliance with ARARs and implement corrective actions if necessary; and
- Continue to implement Wetlands Operation and Maintenance Plan with special emphasis on controlling invasive and nuisance species in the wetlands and controlling sediment buildup within the Unnamed Stream near Hathaway Road and at the entrance to Pond A.

OU2

- Implement Institutional Controls;
- Continue to monitor sediment concentrations and implement corrective actions if necessary; and
- Implement Wetlands Operation and Maintenance Plan with special emphasis on controlling invasive and nuisance species in the wetlands.

6.2 PROGRESS SINCE LAST FIVE-YEAR REVIEW

6.2.1 OU1

Institutional Controls. Since 2008, the draft Grant of Environmental Restrictions (GER) has been agreed upon by the EPA, the Commonwealth of Massachusetts, and the PRPs. The current draft document will have language to address a potential solar project on the site. The draft document is in its final review and will be issued soon.

Groundwater Extraction System and Monitoring Performance. The groundwater treatment plant has been operational throughout this review period. Quarterly groundwater monitoring is conducted in order to evaluate progress toward meeting the ROD cleanup levels. A discussion of the sampling results is provided in Section 5.3.1.2. For the most part, concentrations of total VOCs have decreased significantly since treatment plant startup conditions in 1999. However, continuation of the compliance monitoring set forth in the ROD in accordance with the PCEMP should continue to monitor the effectiveness of the system over time.

The previous five-year review noted that steps had been taken to enhance the management of groundwater migration at the site, with focus on pumping more water from the bedrock extraction wells to achieve greater drawdown in the bedrock aquifer. Since 2008, the PMC and City of New Bedford have continued to conduct groundwater extraction and treatment and conducted quarterly groundwater elevation measurements for the purpose of evaluating the management of groundwater migration. There continue to be periods of extended downtime for individual bedrock extraction wells, which should be avoided as this can impact the management of migration of the bedrock groundwater plume. Evaluation of the performance of the system in terms of hydraulic control has not been well documented in the monitoring reports beyond providing groundwater elevation maps. Discussions are ongoing with the PMC and City of New Bedford regarding the proper target level for the shallow collection system and whether modifications are needed.

Landfill Gas Monitoring. Since the previous five-year review, the full-scale active landfill gas extraction system that was installed in 2004 has continued to operate. The landfill gas extraction system has generally been effective in reducing landfill gas levels along the perimeter of the cap, with the exception of the eastern perimeter and less frequently, the western perimeter, where one or more landfill gas monitoring wells generally exhibit methane levels above 25% LEL. The PMC has continued to take steps to reduce methane levels along the eastern perimeter of the cap. During the past 5 years, two additional monitoring wells along the eastern perimeter were directly connected to the collection system, so that four monitoring wells are now tied directly to the system, resulting in greater vacuum in that area.

Sediment Monitoring. Since the previous five-year review, bi-annual sediment sampling has been performed in September 2009 and September 2011, and additional supplemental sampling was performed in June 2010 as follow-up to the 2009 sampling event. A discussion of the sampling locations and results is provided in Section 5.3.1.3. In 2009, two sediment samples exceeded the sediment target level for PCBs. In order to further assess the 2009 sediment target level exceedances, these two locations were resampled in 2010. Ten samples were collected from each location and composites of several samples were analyzed for PCBs and TOC and the resulting normalized PCB concentrations were well below the sediment target

level. In September 2011, all sediment samples showed normalized PCB concentrations below the sediment target level. Based on the 2010 and 2011 sampling results, it appears overall there are not increased impacts from PCBs within the Unnamed Stream; however, sediment sampling should continue and future results evaluated.

Wetlands O&M. Monitoring was conducted in the fall of 2011 by personnel from the City of New Bedford Department of Environmental Stewardship, and this data was submitted in a January 2012 report (CONB, 2012). A discussion of biological and physical attributes and trajectory toward meeting them is provided in Section 5.3.2.3. Data has been submitted for wetland monitoring events that have occurred in 2011.

No additional invasive species controls have been implemented over the past five years. Previous efforts to control purple loosestrife by releasing *Galerucella* beetles were observed to be very successful, as substantially fewer purple loosestrife plants were observed and those observed included evidence of beetles and/or foliar damage. Recommendations to control sediment buildup within the Unnamed Stream near Hathaway Road and at the entrance to Pond A also appear to have been implemented and these measures were successful, as much less sediment was observed in both locations. However, multiflora rose appears to have expanded in the OU1 MM area of the former diversion swale, and common reed (*Phragmites*) appears to have expanded in the OU1 MM Mitigation Area West area. Significant effort has been expended by the OU1 and OU2 Settling Parties in controlling invasive species as part of their overall implementation of the O&M Plan. However, continued attendance to the invasive species populations is required going forward in these two areas, and planting of woody shrubs and saplings should occur after invasive species control measures are implemented.

6.2.2 OU2

Institutional Controls. Refer to the summary of progress provided under OU1.

Wetlands O&M. Refer to the summary of progress provided under OU1. Wetlands O&M has been performed jointly for OU1 and OU2.

Sediment Monitoring. Since the previous five-year review, unnamed stream sediment sampling was performed in June 2013. A discussion of the sampling locations and results is provided in Section 5.3.2.1. Two out of four sediment samples from the unnamed stream exceeded the sediment target level for PCBs in 2013. One of the samples had a lower unadjusted PCB concentration and the other had a higher unadjusted PCB concentration compared to the previous 2006 monitoring round. Sediment sampling should continue based on these results and future results evaluated.

SECTION 7.0
TECHNICAL ASSESSMENT

This section discusses the technical assessment of the remedy and provides answers to the three questions posed in EPA's Comprehensive Five-Year Review Guidance (June 2001).

7.1 QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

7.1.1 OU1

Yes, a review of documents, ARARs, risk assumptions and site inspection results indicates that the remedy has been constructed as intended by the ROD, as modified by the ESDs.

Institutional controls are in the process of being finalized for the site. EPA, the Commonwealth of Massachusetts, and the PRPs have drafted and agreed upon a Grant of Environmental Restrictions (GER) for the institutional controls for the site. The current draft document will have language added to address a potential solar project on the site. The draft document is in its final review and will be issued soon. Because there are no current uses of the site that violate the intent of the institutional controls, construction is complete, and O&M is being implemented, the short-term protectiveness of the remedy is not impacted.

The excavation of sediments and soils has been performed to comply with soil and sediment cleanup standards set in the ROD and the ESD, thus removing the source of contamination to sediment and surface water and reducing risk to human health and aquatic organisms. However, there continue to be periodic exceedances of sediment clean-up criteria for a limited number of sampling points during bi-annual sampling performed in OU1. Therefore, continued sediment sampling is necessary to monitor the effectiveness of the remedy.

Operation and maintenance of the cap, GWTP, and extraction system has been effective. When there have been operating issues in the groundwater treatment plant such as equipment failures or malfunctions, they have been addressed by the Settling Parties and the City of New Bedford. The Settling Parties should continue to conduct groundwater extraction and treatment and evaluate performance toward the goal of controlling contaminant migration. The continued evaluation of the performance of the system in terms of hydraulic control should be documented in the monitoring reports. Periods of extended downtime for individual bedrock extraction wells should be avoided as this can impact the management of migration of the bedrock groundwater plume. The monitoring reports should also include evaluation of the passive (shallow groundwater) collection system and whether it is performing as designed.

The Unnamed Stream, its banks, and the other OU1 wetland restoration areas were completed in accordance with the ROD and ESDs. Continued monitoring, maintenance, and replantings are necessary to check that the wetlands restoration effort satisfies the requirements of the site Wetlands Operation and Maintenance Plan. Coordination with the golf course is necessary to avoid impacts to golfing activities due to tall woody species along the Unnamed Stream as it passes through fairways. OU1 O&M activities have emphasized and should continue to emphasize the control of invasive species to facilitate the survival of wetlands plantings. In addition, the build-up of sediment in the Unnamed Stream both at Hathaway Road and the

entrance to the OU1 Pond should be monitored to maintain the design elevation of the streambed and should include continued attention to maintenance of the roadway and drainage system. Accumulated sediment could have the effect of altering flow patterns, increasing water temperature, and altering dissolved oxygen levels. The Mitigation Areas – East and West – were initially intended to be restored as forested wetlands; however, due to conflicts with golf course activities, EPA agreed to allow the creation of scrub-shrub wetlands as opposed to forested wetlands. The East Mitigation Area appears to be developing well as a scrub-shrub wetland habitat area, with pockets of emergent habitat present. However, the West Mitigation Area has become dominated by common reed, and a substantial amount of trash is present in the wetland. It is recommended that additional measures be implemented for the West Mitigation Area to improve the functions of the wetland habitat.

The migration of landfill gas in soil is being addressed. The OU1 Settling Parties installed and are operating a long-term active landfill gas collection system to prevent migration of landfill gas to off-site receptors. The landfill gas extraction system has generally been effective in reducing landfill gas levels along the perimeter of the cap; however, one or more landfill gas monitoring wells generally exhibit methane levels above 25% LEL. Further modification to the landfill gas extraction system may be needed in order to achieve compliance with ARARs (Massachusetts Solid Waste regulations). Since four gas monitoring wells have been directly connected to the lower leg of the gas collection system, they are no longer appropriate as monitoring locations for assessing compliance with ARARs (Massachusetts Solid Waste regulations) at the property boundary. Compliance should be determined using points which are not connected to the system and therefore, additional soil gas monitoring points should be installed just beyond directly connected monitoring wells. Once an appropriate perimeter monitoring network is in place, the monitoring data should be evaluated for compliance with the requirement that methane levels be maintained below 25% LEL at the property boundary. Continued operation of the landfill gas extraction system and monitoring of perimeter gas monitoring wells and nearby structures is necessary as a human health protectiveness measure.

7.1.2 OU2

Yes, a review of documents, ARARs, risk assumptions, and site inspection results indicates that the remedy is functioning as intended by the ROD. Sediment excavation and treatment has been performed to meet the site performance standards, thereby minimizing the risk to aquatic organisms. However, exceedances of sediment clean-up criteria have been noted for some monitoring points in the Unnamed Stream during the most recent monitoring event performed for OU2. Therefore, continued sediment sampling is necessary to monitor the effectiveness of the remedy.

Institutional controls are in the process of being finalized for the site, as described above for OU1. Because there are no current uses of the site that violate the intent of the institutional controls; construction is complete; and O&M is being implemented; the short-term protectiveness of the remedy is not impacted.

The OU2 wetland restoration areas have continued to develop over the past five years and overall are functioning well with woody canopy layers established in most areas, as well as a diverse herbaceous community of non-invasive wetland species. The OU2 Middle Marsh northwestern and southeastern corners remain lower in elevation, wetter, and with less microtopography diversity than the rest of Middle Marsh. In these areas, prevalence of

extended surface saturation has likely decreased survival of planted woody species and favored herbaceous species. These observations are similar to those documented by the previous five-year report. Although additional fill could be imported to raise the elevations in these areas, and additional plantings could occur, the benefit is not believed to outweigh the impact to adjacent well-established areas with high cover of canopy woody vegetation. In addition, the southeastern area appears to be supporting a more diverse herbaceous community than in the past. The northwestern area remains dominated by phragmites, as in past years.

Although the water level monitoring of wells and piezometers in the OU2 wetlands are inconclusive regarding the presence of wetland hydrology within 12 inches of the soil surface for two continuous weeks during the growing season, the presence of predominantly wetland species is a general indicator of appropriate wetland hydrology in accordance with the Operations and Maintenance Plan requirements.

There continue to be issues with access by golfers and by golf course personnel to restored areas, primarily in the area of the OU1 Ponds. Throughout the site, rope fences were absent and should be re-established.

The 2011 data and resulting 2012 monitoring report indicate that most of the wetland attribute goals have been reached. Although some goals have not been reached, overall the area appears to continue on a trajectory toward the ultimate goal of achieving a forested wetland ecosystem and in many areas a forested canopy is already fully-established.

7.2 QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS, AND REMEDIAL ACTION OBJECTIVES (RAOs) USED AT THE TIME OF REMEDY SELECTION STILL VALID?

Yes, as evaluated in this section, the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid for OU1 and OU2, since any changes since that time do not impact remedy protectiveness. In order to answer this question, OU1 and OU2 ROD ARARs were reviewed and the OU1 and OU2 risk assessments were revisited to evaluate the impact on remedy protectiveness of any changes in standards, toxicity factors, exposure assumptions, or site conditions.

7.2.1 Review of OU1/OU2 Risk Assessments and Toxicity Factors Serving as the Basis for the Remedies

An evaluation of changes in toxicity values and other contaminant characteristics, changes to the risk assessment methodology, and changes to exposure assumptions used in the human health and ecological risk assessments for the site was performed. The overall conclusion of this evaluation was that the OU1/OU2 remedies, as implemented, are protective of human health and the environment. A discussion of the results and conclusions of the evaluation are provided below.

7.2.1.1 Review of Human Health Risk Assessments

As discussed during the first and second five-year reviews (September 2003 and 2008, respectively), the Phase I and Phase II human health risk assessments (OU1; Ebasco 1987; 1989) and the human health risk assessment for Middle Marsh (OU2; M&E, 1991) were conducted using methodology which would partially comply with current EPA risk assessment guidance. The primary discrepancies between current guidance and previous guidance, as noted in the first and second five-year reviews and requiring re-evaluation during this five-year review, exist in the areas of toxicity values and exposure pathways. The following provides an evaluation of these discrepancies, based on changes that have occurred since 2008 (the date of the last five-year review), and their impact on the protectiveness of the remedy.

Changes in Exposure Pathways/Assumptions

OU1

The Phase I and Phase II human health risk assessments (Ebasco, 1987; 1989) evaluated an older child exposure scenario for the area south of Hathaway Road and the Unnamed Stream extending north of Hathaway Road (OU1). This scenario assumes that the site will be used, to some degree, for recreational purposes. No changes in land use have occurred on or near the site, and no changes are anticipated in the near future. Therefore, the land use assumptions used in the risk assessments continue to be valid for OU1. However, the implementation of institutional controls regulating land use is necessary to assure that land use changes resulting in more intense human exposures than under current conditions do not occur in the future.

The landfill cap and perimeter fencing remain intact, based on recent inspections. Because contamination is present beneath the cap, prevention of a complete exposure pathway between human receptors (e.g., trespassers) and subsurface contamination is necessary. Continued

maintenance of the landfill cap and perimeter fencing is required to assure that human exposure to the capped material does not occur.

The risk assessment also evaluated future residential groundwater use. The risk assessment assumed that groundwater was not currently used as a source of potable water, but may be used as a future resource. Unacceptable risk was estimated for this future exposure scenario using methods and exposure assumptions largely consistent with current guidance. Future use was the primary basis for the groundwater containment and institutional control components of the remedy. The groundwater collection and treatment system and the slurry wall are in place. Contaminant concentrations continue to be present in groundwater at levels that would be associated with unacceptable risk, should groundwater be used as a source of drinking water in the future. Once institutional controls are in place, the remedy will prevent the completion of an exposure pathway between future human receptors and groundwater contaminants.

In the risk assessment, the older child receptor was evaluated for exposures in a manner consistent with current EPA guidance. The exposure pathways evaluated include ingestion and dermal contact with soil and sediment, dermal contact with surface water while wading, and inhalation of volatile compounds and particulates. The method used to estimate dermal doses differs from the current method, but, overall, resulted in an overestimate of dermal risk. However, the exposure assumptions selected were, in general, lower than current recommended values resulting in an underestimate of risk. Because the remedy required the excavation of contaminated sediment and bi-annual monitoring of surface water and sediment for PCBs, PAHs, and metals, along with VOCs in surface water, post-remediation levels of contaminants in sediment and surface water are available and most appropriate to consider when evaluating remedy protectiveness. Therefore, to determine the risk and hazard associated with current recreational exposures, should they be occurring, an assessment of contaminant concentrations in surface water and sediment within OU1 using samples collected between 2009 and 2011 has been performed as documented in the following paragraph.

Current contaminant levels in OU1 surface water would not be associated with an elevated risk or hazard to humans because: (1) PCBs have not been detected; (2) detected VOCs (acetone, benzene, chlorobenzene, chloroform, cis-1,2-dichloroethene, and toluene) are present only at trace levels (0.1 to 2.15 ug/L) and would volatilize quickly from the skin, limiting dermal exposure; (3) total metals, though elevated in concentration up to 10-fold above upstream background levels, are poorly absorbed through the skin, again limiting dermal exposure; and (4) PAHs were detected at two downstream locations (three at SW-4 and one at SW-1) at concentrations (0.05 ug/L to 0.15 ug/L) that would not be associated with a level of concern for the dermal exposure pathway. For sediment, concentrations of noncarcinogenic PAHs range from 0.004 mg/kg to 3.6 mg/kg and levels of carcinogenic PAHs range from 0.016 mg/kg to 2.3 mg/kg. These PAH concentrations would be associated with a cancer risk of approximately 2E-05 and a hazard index of less than 0.01, based on a recreational exposure scenario. Sediment metal concentrations within OU1 exceed upstream concentrations, but generally fall within the range of levels typically seen in background sediments. Two metals of concern for human exposures are arsenic and lead which were detected at maximum sediment concentrations of 3.7 mg/kg and 230 mg/kg, respectively. The maximum detected arsenic concentration would be associated with a cancer risk slightly greater than 1E-06 and a noncarcinogenic hazard of less than 0.1, and the lead level is significantly less than that considered acceptable for a residential setting (400 mg/kg). Total PCBs were detected in on-site sediments at a maximum concentration of approximately 4.2 mg/kg, which would be associated with a cancer risk of

below 3E-06 and a noncarcinogenic hazard of less than 0.6 based on a recreational scenario. Therefore, implementation of the remedy for OU1 has resulted in surface water and sediment contaminant levels that are not of concern for human exposures, considering current land use.

OU2

As discussed in the first and second five-year reviews, the Phase I and Phase II human health risk assessments completed in 1987 and 1989, respectively, which evaluated portions of Middle Marsh, and the OU2 human health risk assessment (completed in 1991) evaluated older child trespasser and adult golfer scenarios for the area north of Hathaway Road. This area is currently part of or adjacent to the Whaling City Golf Course. This portion of the site will continue to be used as a golf course or for other recreational purposes in the foreseeable future. Therefore, the land use assumptions used in the risk assessments continue to be valid for OU2. However, the implementation of institutional controls regulating land use is necessary to assure that land use changes resulting in more intense human exposures than under current conditions do not occur in the future.

The older child exposure pathways evaluated included ingestion and dermal contact with soil and sediment, dermal contact with surface water while wading, and inhalation of volatile compounds and particulates. The same exposure assumptions used for the older child receptors at OU1 were applied to OU2. The adult receptor was evaluated for dermal contact with soil, sediment and surface water along with inhalation of volatile compounds and particulates. Contrary to current guidance, incidental ingestion of soil and sediment was not evaluated, resulting in an underestimate of risk. Consistent with OU1, the method used to estimate dermal doses differs from the current method, but overall, resulted in an overestimate of dermal risk. However, the exposure assumptions selected were, in general, lower than current recommended values resulting in an underestimate of risk. As discussed for OU1, current levels of contaminants in sediment and surface water are available and most appropriate to consider when evaluating remedy protectiveness. Therefore, to determine the risk and hazard associated with current recreational exposures, should they be occurring, an assessment of PCB concentrations in surface water and sediment within OU2 using samples collected in 2013 has been performed as documented in the following paragraph.

Surface water exposure pathways would not be associated with an elevated risk or hazard to humans because PCBs have not been detected. For sediment, total PCBs were detected in sediment at a maximum concentration of approximately 0.93 mg/kg, which would be associated with a cancer risk of less than 1E-06 and a noncarcinogenic hazard of 0.1 based on a recreational scenario. Therefore, implementation of the remedy for OU2 has resulted in surface water and sediment contaminant levels that are not of concern for human exposures, considering current land use.

Changes in Toxicity

Toxicity values have changed significantly since the human health risk assessments were prepared. Because a complete exposure pathway does not exist between site groundwater and human receptors for current site use, and the slurry wall, the groundwater collection system, and the soon-to-be-implemented institutional controls will prevent future exposure, changes in toxicity values of groundwater contaminants have not been evaluated for protectiveness.

Significant differences were noted in the cancer slope factors used in the human health risk assessments for PCBs, PAHs, and vinyl chloride during the first five-year review. In all cases, the toxicity values used in the OU1 and OU2 risk assessments were at least two-fold more conservative than the current value. As discussed in the second five-year review, a change that occurred since the first five-year review is the inclusion of an early-life cancer risk for compounds with a mutagenic mode of action, including PAHs and vinyl chloride. The early-life assessment can increase the cancer risk associated with exposure for older children by up to three-fold. However, this difference in toxicity does not affect remedy protectiveness since most of the affected areas have been capped, and current surface water and sediment sampling in areas where exposures could occur indicates acceptable concentrations. Other differences between historical and current toxicity values are minimal.

Summary and Conclusions Relative to Human Health Risks

Because OU1 soils are capped and groundwater extraction and treatment is underway, the remedy is protective of human health as long as the cap is maintained, migration of the groundwater plume is controlled, and institutional controls are implemented to prevent contact with contaminated groundwater and to assure that land use changes resulting in more intense human exposures than under current conditions do not occur in the future. Because PCB-contaminated sediments were removed and levels of contaminants in sediment and surface water remaining are not of concern for current human exposures, the remedy is also protective for the stream bed (OU1) and the area north of Hathaway Road (OU2). Overall, the remedy is considered to be protective of human health.

7.2.1.2 Review of Ecological Risk Assessments

As discussed for the human health risk assessments, the Phase I and Phase II ecological risk assessments (Ebasco 1987; 1989) and the ecological risk assessment for Middle Marsh (OU2; M&E, 1991) were conducted using methodology which would generally comply with current EPA risk assessment guidance. The primary discrepancies between current guidance and previous guidance, as noted in the first and second 5-year reviews, exist in the areas of benchmarks and toxicity values utilized. The following provides an evaluation of these discrepancies, based on changes that have occurred since 2008 (the date of the last 5-year review), and their impact on the protectiveness of the remedy for ecological receptors. Recent compliance monitoring data are also reviewed to evaluate the protectiveness of the remedy. There are no newly promulgated standards, relevant to the site, which bear on the protectiveness of the remedy.

<u>OU1</u>

OU1 consists of a 12-acre historic disposal area and the adjacent Unnamed Stream. The Unnamed Stream flows from the site underneath Hathaway Road and through the OU2 Middle Marsh and Adjacent Wetlands: OU1 includes the Unnamed Stream and sedimentation basin north of Hathaway Road. There are no major changes in site conditions or exposure assumptions on which the risk assessment was based that would result in increased exposure or risk. The principal contaminants of concern for ecological receptors in OU1 identified in the risk assessment were PCBs. Target cleanup levels, protective of ecological receptors, were established for the site for sediments, surface water and soils.

As discussed in the last 5 year review, backfilled stream sediments and wetland soils act as a

barrier between remaining contaminants (including PCBs) and potential aquatic and benthic receptors, thus creating an incomplete exposure pathway to aquatic and semi-aquatic organisms. The sediment cleanup level was established as 20 µg of PCBs per gram of carbon (µg/gC). This risk-based target level was developed based on potential risk to aquatic organisms and wildlife receptors. The cleanup level was estimated in the risk assessment using sediment partitioning and the ambient water quality criteria based on the protection of wildlife consuming aquatic organisms. PCB tissue concentrations estimated from direct exposure to PCB-contaminated sediments were also used in developing the risk-based target level of 20 µg/gC. Based on larger risk-based data sets from other sites in New England with aquatic habitats, this level of PCBs in sediments is expected to be protective of aquatic and semi-aquatic receptors.

Because contaminated sediment and soil has been removed or isolated, and the disposal area capped, the exposure pathway to surface water has also been eliminated for most of the area of OU1. The remaining area for potential aquatic or semi-aquatic receptors in OU1 is within the Unnamed Stream and the sedimentation basin north of Hathaway Road. During the sediment monitoring conducted between 2003 and 2008, total PCBs in OU1 were measured in sediments at a maximum concentration of approximately 3.5 mg/kg. As discussed in the previous five year review, monitored sediment PCB concentrations showed minor exceedances of the risk-based ecological target levels. To determine the ongoing risk to aquatic organisms and wildlife receptors an assessment of contaminant concentrations in sediment within OU1 using samples collected between 2009 and 2011 has been performed and is documented in the following paragraphs.

In 2009, five sediment samples were collected in OU1. The mean PCB concentration of 25.6 µg/gC, was just above the target of 20 µg/gC. The maximum detected concentration was 50.5 µg/gC. This sample at SD-1, and the sample at SD-3, both exceeded the target clean-up level of 20 µg/gC. Since both of these samples were associated with low TOC concentrations, these locations were resampled in 2010 to further evaluate the PCB/g carbon ratios at SD-1 and SD-3 in the unnamed stream. Ten samples were collected in the vicinity of each of these locations and analyzed for TOC, while one of the samples was also analyzed for PCBs. In addition both TOC and PCBs were analyzed on composites of 6 samples at SD-1 and SD-3. The mean TOC values were 13.1% and 15.5% for SD-1 and SD-3, respectively. These measurements indicate that although the TOC in the two samples from 2009 with exceedances of target PCBs were low, these measurements were within the expected range of TOC at these locations. However, the composite samples collected in 2010 had adjusted PCB values less than the target value of 20 µg/gC. In 2011, five sediment samples were collected as part of the routine monitoring program and the PCB concentrations at all locations were below the target level of 20 µg/gC. Similar to data from the previous five-year review, the monitored sediment PCB concentrations in 2009 showed minor exceedances of the risk-based ecological target levels. The monitored sediment PCB concentrations in 2010 and 2011 showed no exceedances of the risk-based ecological target levels. Therefore, the selected remedy is considered generally protective with regard to sediment; however, continued monitoring data should be evaluated to check compliance with the PCB clean-up goal. Since the average site-wide concentrations of PCBs in sediments are below the target level, the remedy continues to be protective of benthic organisms as well as aquatic and semi-aquatic organisms.

In surface water, the standard identified in the risk assessment and ROD was 0.014 µg/L total PCBs, based on the ambient water quality criteria for the protection of aquatic life. This

standard has not changed, with the 2012 National Recommended Water Quality Criteria (NRWQC, chronic) still set at 0.014 µg/L. Current contaminant levels in OU1 surface water would not be associated with an elevated risk or hazard to ecological receptors because PCBs have not been detected in surface water. During the most recent 2011 sampling event, PCBs were not detected at a detection limit of approximately 0.5 µg/L for each Aroclor, which is the lowest practicable detection limit.

Soils east of the stream channel were generally excavated to a depth of 2 to 6 feet and capped. East bank soils (both north and south of the car wash) were excavated to a depth of several feet and capped. Because the cap creates a barrier to the contaminated layer, the exposure pathway in soil is incomplete. Thus, the potential risk to terrestrial receptors is minimal and the remedy continues to be protective.

Although the method used to perform the ecological risk assessments differs from current methods and guidance, target clean-up levels and the selected remedy for OU1 appear to still be valid.

OU2

Similar to OU1, there are no major changes in site conditions or exposure assumptions on which the risk assessment was based that would result in increased exposure or risk to ecological receptors. The primary basis for action in OU2 was the risk related to ecological receptors from PCBs in sediments of Middle Marsh. As discussed in the previous five year review, the Phase I and Phase II investigations demonstrated that the primary source of contamination was the OU1 disposal area. Before the implementation of the remedial action, flood waters from the disposal area could transport contaminants downstream. Because the remedy at OU1 consisted of capping the upstream disposal area, and the remedy at OU2 consisted of excavating sediment from the Middle Marsh to the edge of the flood plain and restoring wetlands, the source of contaminants has been eliminated. Thus, flood water will no longer transport contaminants via surface water or sediment. Furthermore, the clean fill and wetland soil used to reconstruct the Middle Marsh and the Adjacent Wetland act as a barrier to any residual contaminants below the excavation area, effectively eliminating the exposure pathway into sediment pore water. Therefore, the selected remedy is protective of benthic organisms as well as aquatic and semi-aquatic organisms.

The mean sediment quality criterion (20 µg PCB/gC) was established as the cleanup level of aquatic areas in the Middle Marsh. The risk-based sediment/soil cleanup levels for non-aquatic areas in Middle Marsh and for the adjacent wetland were established using site specific food chain modeling and set at 15 mg/kg total PCBs to be protective of wildlife. As with OU1, the surface water standard of 0.014 µg/L was used, and is consistent with current water quality criteria.

As discussed for OU1, current levels of contaminants in sediment, wetland soil, and surface water are available and most appropriate to consider when evaluating remedy protectiveness. Since the last 5 Year Review, no exceedances of water and soil cleanup levels were detected in Middle Marsh or the Adjacent Wetlands (see Attachment 3, Tables A3-5 and A3-6). Exceedances of sediment clean-up criteria were noted for two of the monitoring points in Unnamed Stream during the most recent monitoring event performed for OU2 (see Attachment 3, Tables A3-3). The maximum PCB concentrations measured in sediments from the Unnamed

Stream were 0.53 mg/kg or 64 µg/gC (at 0.82% TOC) at SDPC-2 and 0.83 mg/kg or 32 µg/gC (at 2.59% TOC) at SDPC-4 , which are both above the 20 µg/gC cleanup level. However, during the same monitoring event in 2013, two other sediment samples from the Unnamed Stream (SDPC-1 and SDPC-3) contained PCB concentrations lower than the 20 µg/gC cleanup level. Although a limited number of exceedances of the selected sediment target level of 20 µg/gC, have been observed in the Unnamed Stream sediment, these were most often associated with very low TOC. No consistent pattern of increasing PCB concentrations has been observed for any locations in the Unnamed Stream and the PCB levels in the OU2 monitoring have remained below 1 ppm total PCBs, which indicates that the remedy remains protective. Continued monitoring of sediments in OU2 should be conducted to continue to evaluate the protectiveness of the remedy.

The maximum concentration of total PCBs in non-aquatic soil/sediment samples from the Middle Marsh and Adjacent Wetlands for monitoring data from 2013 were all below the cleanup level of 15 ppm. The maximum concentration of total PCBs in wetland soils was less than 1 ppm, indicating that the remedy is protective for non-aquatic soils/sediments.

Similar to OU1, contaminant levels in surface water measured for OU2 would not be associated with an elevated risk or hazard to ecological receptors because PCBs have not been detected in surface water. During the most recent 2013 sampling event, PCBs were not detected at a detection limit of 0.29 µg/L for each Aroclor, which is the lowest practicable detection limit.

Based on removal of contaminated sediments in Middle Marsh and wetland soils, and the capping of the upstream disposal area in OU1, the source of PCBs for exposure of ecological receptors has been eliminated. Monitoring data since 2002 have indicated that the total PCB concentrations in the surface water and sediment/soils of OU2 are generally meeting the levels established to be protective of ecological receptors, although individual sediment samples have at times exceeded the sediment cleanup level on a total carbon basis. Continued monitoring is recommended to continue to evaluate the protectiveness of the remedy.

Summary and Conclusions Relative to Ecological Risks

In conclusion, although the method used to perform the Ecological Risk Assessments differs from current methods and guidance, target clean-up levels and the selected remedies for OU1 and OU2 appear to be protective. The remedies implemented adequately address the risk to ecological receptors, and monitoring data indicate that the current concentrations of contaminants in site media are meeting levels protective of ecological receptors on the site.

7.2.2 ARARs Review

A review of Applicable or Relevant and Appropriate Requirements was performed to check the impact on the remedy of changes in standards that were identified as ARARs in the ROD, newly promulgated standards for chemicals of potential concern, and TBCs (to be considered) that may affect the protectiveness of the remedy. The tables in Attachment 5 provide the review. The review is summarized below.

OU1

The 1989 ROD for OU1 (USEPA, 1989) set forth the following ARARs for the selected remedy:

- Safe Drinking Water Act
- Toxic Substances Control Act (TSCA)
- Resource Conservation and Recovery Act (RCRA)
- Clean Water Act (CWA)
- Clean Air Act (CAA)
- Occupational Safety and Health Administration (OSHA)
- U.S. Department of Transportation
- 310 CMR 22.00 - Massachusetts Drinking Water Regulations
- 314 CMR 6.00 - Massachusetts Groundwater Quality Standards
- 310 CMR 30.00 - Massachusetts Hazardous Waste Management Regulations
- 314 CMR 8.00 - Massachusetts Supplemental Requirements for Hazardous Waste Management Facilities
- 314 CMR 4.00 - Massachusetts Surface Water Quality Standards
- 310 CMR 10.00 - Massachusetts Wetlands Protection Regulations
- 310 CMR 6.00 - Massachusetts Ambient Air Quality Standards
- 454 CMR 21.000 - Massachusetts Right to Know Regulations
- 310 CMR 7.00 - Massachusetts Air Pollution Control Regulations

In addition, Executive Order 11988 (Floodplain Management), Executive Order 11990 (Protection of Wetlands), and Interim Sediment Quality Criteria were identified in the ROD as To Be Considered (TBC).

Table A5-1 of Attachment 5 provides an evaluation of ARARs for OU1 using the regulations and requirement synopses listed in the ROD as a basis. The evaluation includes a determination of whether the regulation is currently ARAR or TBC and whether the requirements have been met.

As indicated in the previous five-year reviews, the Massachusetts Solid Waste Management Regulations (310 CMR 19.117, 19.132(4), and 19.150) were not included in the ROD, but are now considered applicable because they provide a means to detect, monitor, and address landfill gas at property boundaries at concentrations greater than 25% LEL. These regulations require that the MassDEP be notified when concentrations of landfill gases at the property boundary are measured above 25% LEL. They also mandate the control of landfill gases to concentrations less than 25% LEL to prevent public health and safety concerns. These ARARs were the topic of the ESD issued by EPA on September 29, 2003. Since the ESD was issued, an active landfill gas extraction system has been implemented at the site and quarterly landfill gas monitoring is conducted in order to evaluate the effectiveness of the system in controlling landfill gas migration.

The requirements of many of the ARARs identified in the ROD were met during remedy construction.

OU2

The 1991 ROD for OU2 (USEPA, 1991) set forth the following ARARs for the selected remedy:

Location-specific:

- Clean Water Act (CWA)
- Executive Order 11988 (Floodplain Management)
- Executive Order 11990 (Protection of Wetlands)
- Fish and Wildlife Coordination Act
- Resource Conservation and Recovery Act (RCRA)
- 990 CMR 1.00 - Hazardous Waste Facility Siting Regulations
- 310 CMR 10.00 - Massachusetts Wetlands Protection Act Regulations
- 321 CMR 10.00 - Massachusetts Endangered Species Act Regulations

Action-specific:

- Clean Water Act (CWA)
- Executive Order 11988 (Floodplain Management)
- Executive Order 11990 (Protection of Wetlands)
- Fish and Wildlife Coordination Act
- Toxic Substances Control Act (TSCA)
- Clean Air Act (CAA)
- Federal Noise Control Act
- 314 CMR 4.00 - Massachusetts Surface Water Quality Standards
- 310 CMR 10.00 - Massachusetts Wetlands Protection Act Regulations
- 321 CMR 9.00 - Massachusetts Endangered Wildlife and Wild Plants Regulations
- 314 CMR 9.00 - Massachusetts Certification for Dredging, Dredged Material Disposal, and Filling in Waters
- 314 CMR 8.00 - Massachusetts Supplemental Requirements for Hazardous Waste Management Facilities
- 310 CMR 30.00 - Massachusetts Hazardous Waste Management Regulations
- 310 CMR 6.00 - Massachusetts Ambient Air Quality Standards
- 310 CMR 7.00 - Massachusetts Air Pollution Control Regulations

Additional policies, criteria, and guidance were identified in the ROD as TBC, including:

- Massachusetts Wetlands Protection Policy 90-2
- TSCA Subpart G PCB Spill Cleanup Policy
- Interim Sediment Quality Criteria, Massachusetts Allowable Ambient Air Limits - Annual (AALs) and Massachusetts Threshold Effects Exposure Levels (TELs)
- Guidance on Remedial Actions for Superfund Sites with PCB Contamination
- EPA Interim Policy for Planning and Implementing CERCLA Response Actions

Tables A5-2 and A5-3 of Attachment 5 provide an evaluation of location-specific and action-specific ARARs for OU2 using the regulations, requirement synopses, and descriptions of actions to be taken that were listed in the ROD as a basis. The evaluation includes a determination of whether the regulation is currently ARAR or TBC and whether the requirements

have been met. In some cases, the description of actions to be taken to attain the location-specific ARARs differed for the selected and contingency remedies. In these cases, both descriptions were provided in Table A5-3.

7.2.3 Overall Answer to Question B

In general, a review of ARARs and risk information that were the basis of the OU1 and OU2 remedies indicates that there were no changes that would impact the protectiveness of the remedies.

7.3 QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT COULD CALL INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?

7.3.1 OU1

No, since the previous five-year review, no information has come to light that could call into question the protectiveness of the remedy.

7.3.2 OU2

No, since the previous five-year review, no information has come to light that could call into question the protectiveness of the remedy.

SECTION 8.0
ISSUES

Based on the activities conducted during this Five-Year Review, the issues identified in Table 3 have been noted.

Table 3: Issues

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
OU1 Implement Institutional Controls.	N	Y
The landfill gas monitoring, collection, and extraction system may require modification to ensure it is meeting its objectives.	N	Y
Bedrock groundwater compliance monitoring well ECJ-2 is damaged and needs replacement in order to assess compliance with cleanup levels for the active extraction system.	N	Y
Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.	N	Y
OU2 Implement Institutional Controls.	N	Y
Monitoring of sediments has indicated some PCB concentrations above the TOC normalized clean-up levels, while an equal number have been found below the cleanup levels. Further monitoring is warranted.	N	Y

SECTION 9.0
RECOMMENDATIONS AND FOLLOW-UP ACTIONS

In response to the issues noted above, it is recommended that the actions listed in Table 4 be taken:

Table 4: Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
OU1 Institutional Controls	Finalization of Institutional Controls.	MassDEP & EPA & City of New Bedford	EPA/ MassDEP	2013	N	Y
Landfill gas migration	Monitoring of landfill gas will continue with objective to ensure gas is not migrating beyond the boundaries of the landfill. Monitoring points shall be capable of yielding representative air samples for analysis and consist of a sufficient number of wells properly located to detect the presence and migration of landfill gases. The sampling plan should be updated to reflect the most current monitoring procedures. Corrective actions to the monitoring, extraction, and collection system will be taken if necessary.	OU I Settling Parties	EPA/ MassDEP	quarterly basis	N	Y

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
Compliance monitoring well ECJ-2	Replace multi-port bedrock groundwater monitoring well ECJ – 2.	OU I Settling Parties	EPA/ MassDEP	2013	N	Y
Potential intermittent seepage	Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.	OU I Settling Parties	EPA/ MassDEP	2013	N	Y
OU2 Institutional Controls	Finalization of Institutional Controls.	MassDEP, EPA, & City of New Bedford	EPA/ MassDEP	2013	N	Y
Sediment PCB concentrations	Continue to monitor and implement corrective actions if needed.	AVX Corporation & City of New Bedford (OU2 Settling Parties)	EPA/ MassDEP	2016	N	Y

SECTION 10.0
PROTECTIVENESS STATEMENT

Because the remedial actions undertaken at the Site are protective in the short-term, the Site is protective of human health and the environment in the short-term. However, in order to be protective in the long-term following actions need to be taken:

OU1

- Implement Institutional Controls;
- Monitor and correct landfill gas levels of concern and modify monitoring and extraction system as necessary;
- Replace bedrock monitoring well ECJ-2; and
- Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.

OU2

- Implement Institutional Controls and
- Monitor PCB concentrations in sediment for comparison to cleanup levels.

SECTION 11.0
NEXT REVIEW

The next Five-Year Review for the site is scheduled to begin on March 30, 2018 and to be signed in September 2018, five years after the signature date of this five-year review.

ATTACHMENT 1
SITE MAPS

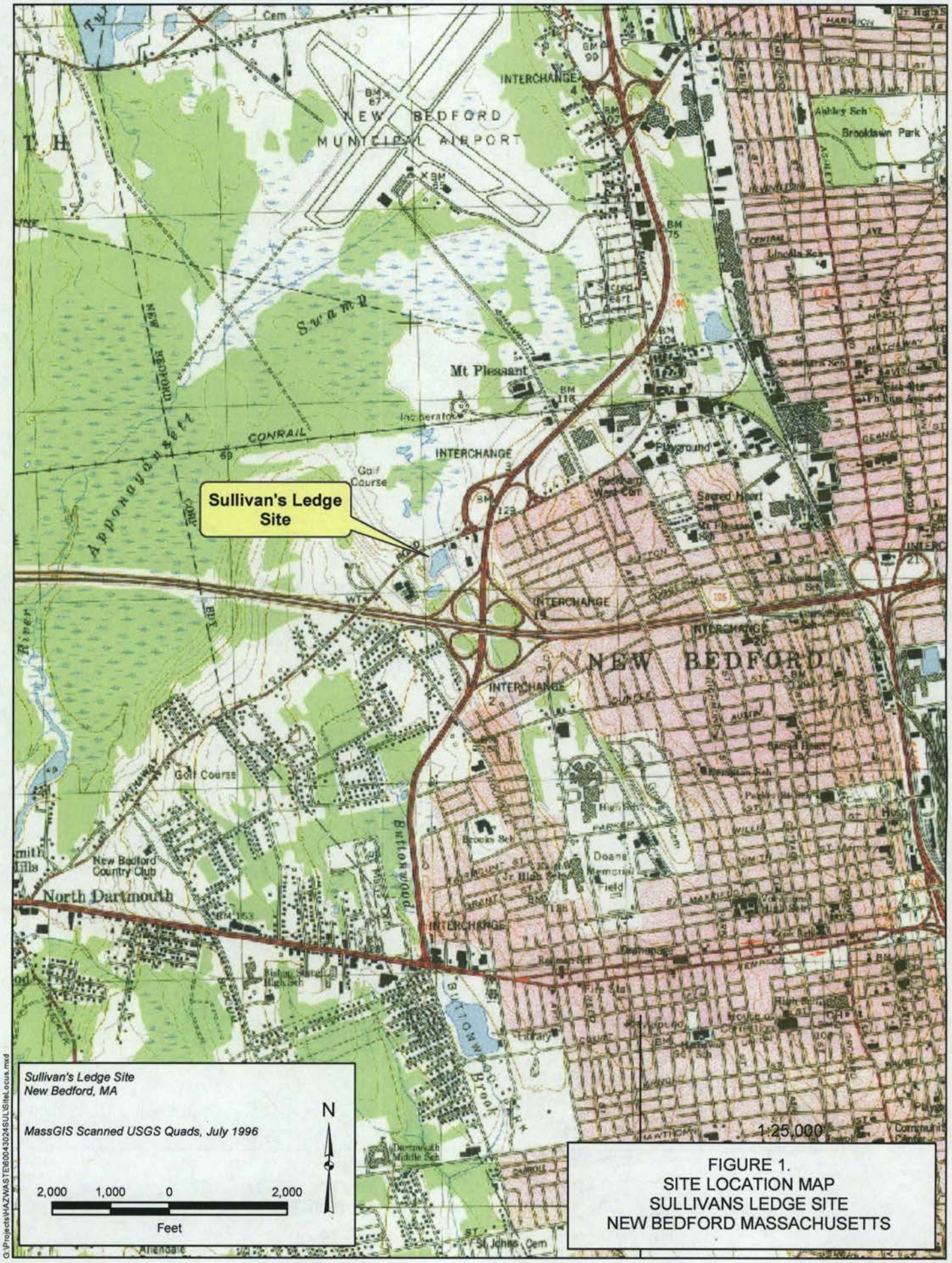
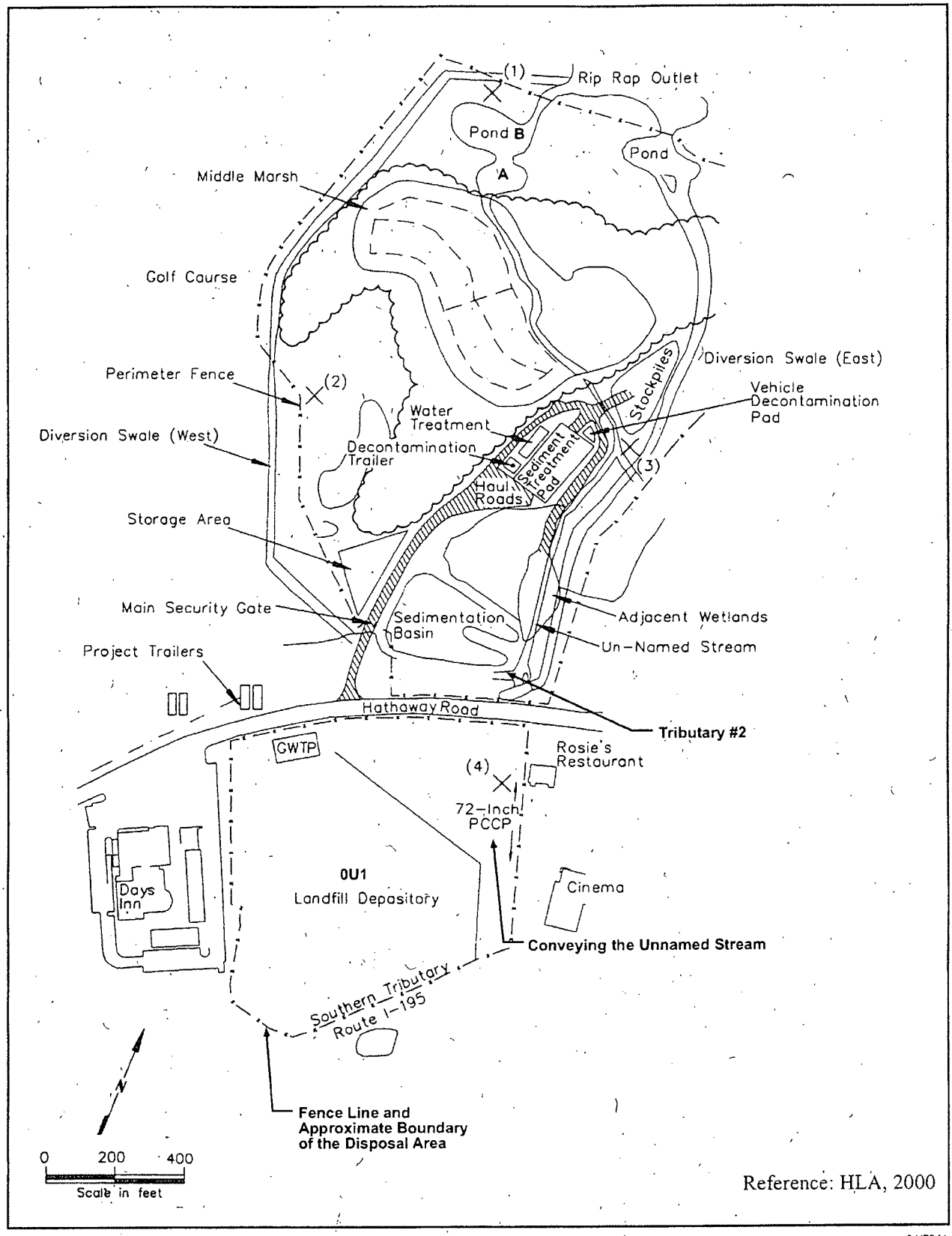
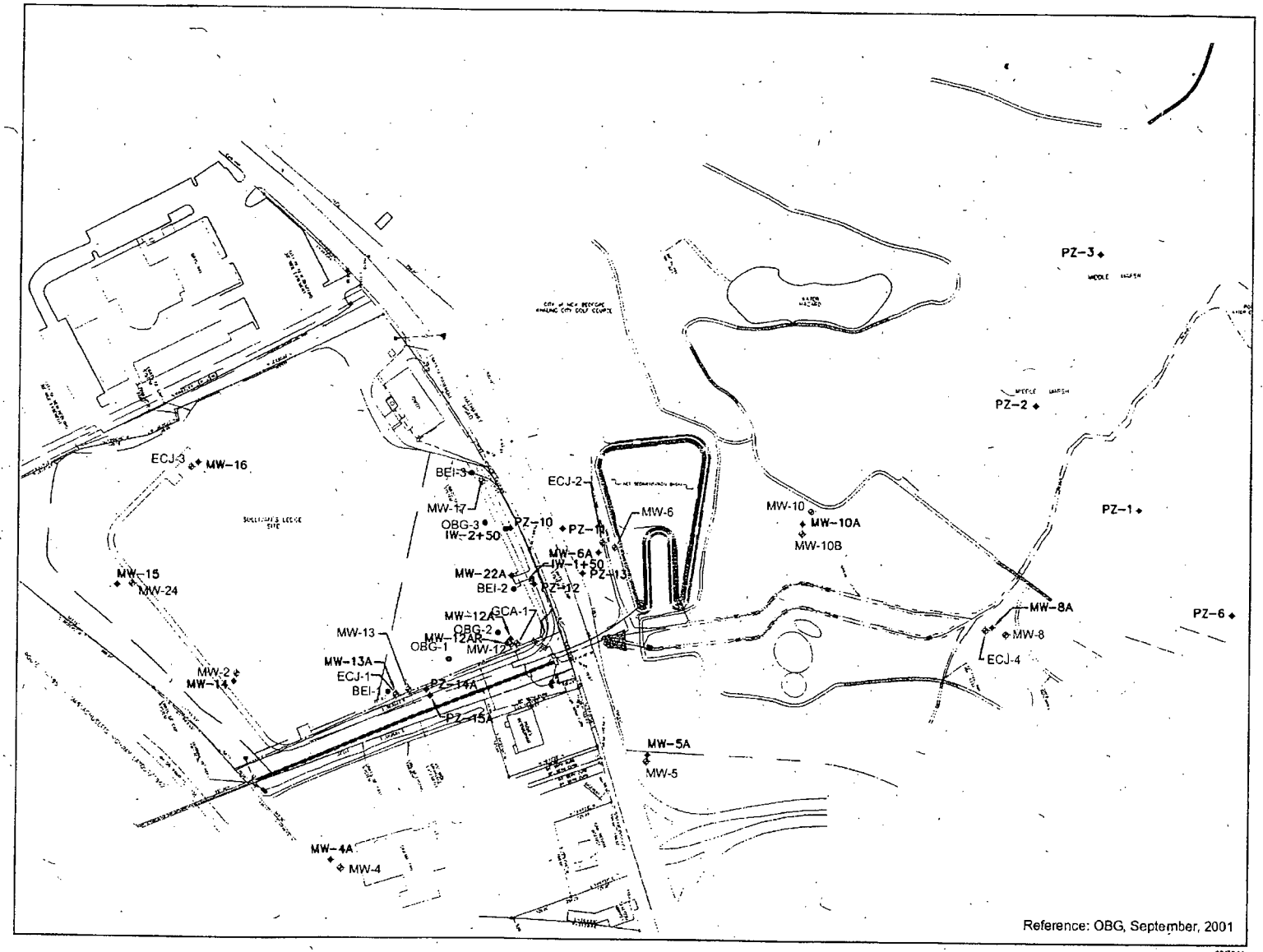


FIGURE 1.
SITE LOCATION MAP
SULLIVANS LEDGE SITE
NEW BEDFORD MASSACHUSETTS



01/7341

FIGURE 2. SITE PLAN
SULLIVAN'S LEDGE SUPERFUND SITE
NEW BEDFORD, MASSACHUSETTS



LEGEND

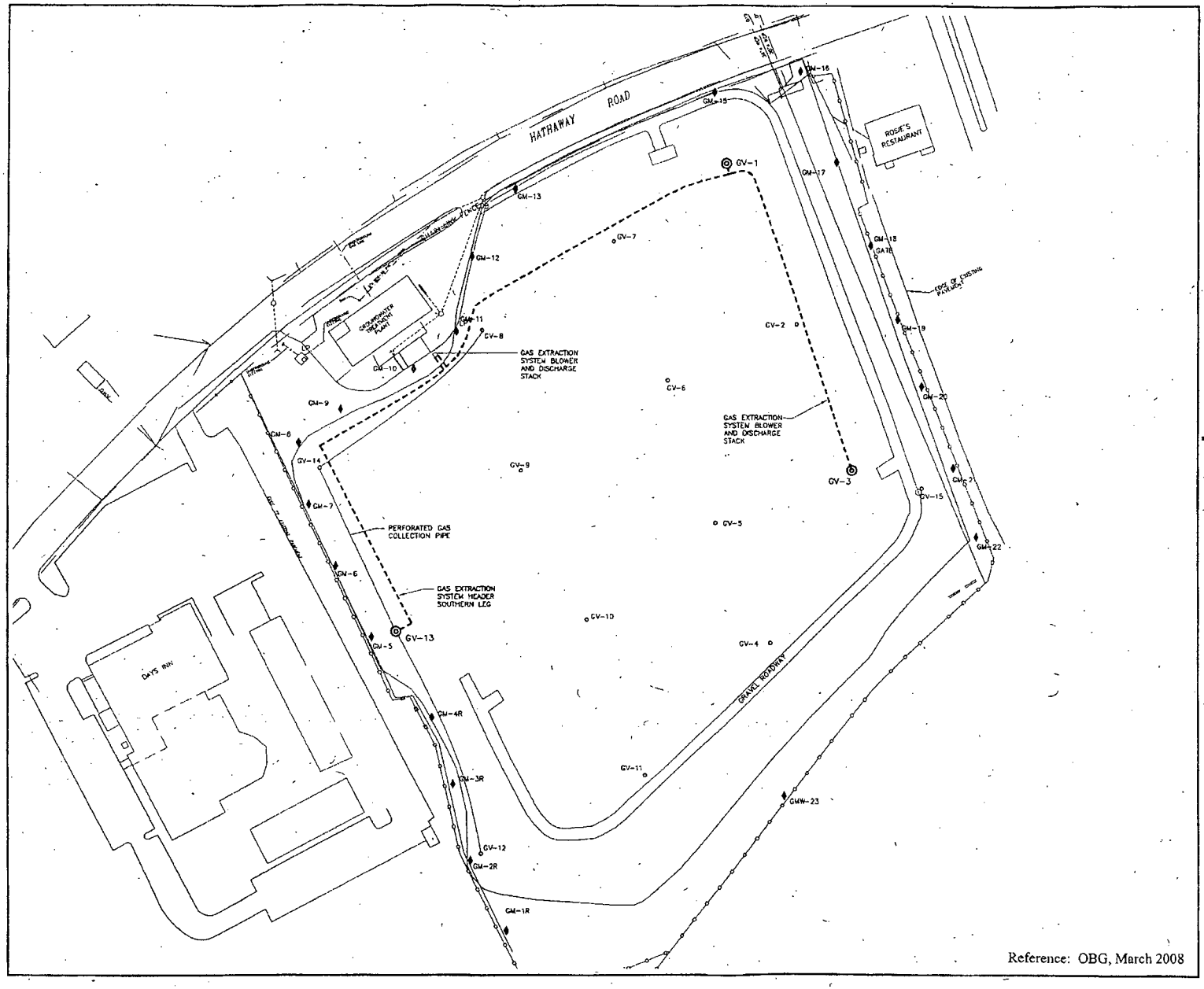
◆ MONITORING WELL LOCATION

⊙ RECOVERY WELL LOCATION

200 0 200

SCALE IN FEET

FIGURE 3.
GROUNDWATER WELL LOCATIONS
SULLIVAN'S LEDGE SUPERFUND SITE
NEW BEDFORD, MASSACHUSETTS



Reference: OBG, March 2008

LEGEND

- GV-15 PASSIVE GAS VENT
- GM-22 GAS MONITORING WELL
- GV-3 GAS VENT MODIFIED INTO A GAS EXTRACTION WELL
- PVC GAS EXTRACTION PIPE HEADER SYSTEM
- PROPERTY BOUNDARY
- LIMITS OF CAP

0 120 240
SCALE IN FEET

FIGURE 4.
LANDFILL GAS VENT AND MONITORING WELL LOCATIONS
SULLIVAN'S LEDGE SUPERFUND SITE
NEW BEDFORD, MASSACHUSETTS

THIRD FIVE-YEAR REVIEW REPORT FOR SULLIVAN'S LEDGE SUPERFUND SITE BRISTOL COUNTY, MASSACHUSETTS

Prepared by

U.S. Environmental Protection Agency
Region I
BOSTON, MASSACHUSETTS

James T. Owens III, Division Director

Date

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Attachment 5 Applicable or Relevant and Appropriate Requirements (ARARs)

LIST OF ACRONYMS AND ABBREVIATIONS

ACRONYM	DEFINITION
ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Ambient Water Quality Criteria
CAA	Clean Air Act
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CONB	City of New Bedford
CWA	Clean Water Act
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FS	Feasibility Study
GAC	Granular Activated Carbon
GER	Grant of Environmental Restrictions
GWTP	Ground Water Treatment Plant
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
LEL	Lower Explosive Limit
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU1	Operable Unit 1
OU2	Operable Unit 2
PAH	Polycyclic Aromatic Hydrocarbon

ACRONYM	DEFINITION
PCB	Polychlorinated Biphenyl
PMC	Project Management Committee (OU I Settling Defendants)
PCCP	Pre-stressed Concrete Cylinder Pipe
POTW	Publicly Owned Treatment Works
PRP	Potentially Responsible Party
RAC	Remedial Action Contract
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SDWA	Safe Drinking Water Act
SQCV	Sediment Quality Criteria Values
SVOC	Semivolatile Organic Compound
TBC	To Be Considered
TOC	Total Organic Carbon
TSCA	Toxic Substances Control Act
TTO	Total Toxic Organics
UV/OX	Ultraviolet/Oxidation
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

The Sullivan's Ledge Site, located in New Bedford, Massachusetts, consists of two operable units, Operable Unit 1 (OU1) and Operable Unit 2 (OU2). OU1 consists of a 12-acre historic disposal area and the adjacent Unnamed Stream. OU2 includes a 13-acre wooded wetland called Middle Marsh, and a 1.5 acre wetland area bordering the Unnamed Stream (400 feet upstream of the Middle Marsh) referred to as the "Adjacent Wetlands."

The selected remedy for Sullivan's Ledge OU1 included site preparation, soil excavation/treatment, sediment treatment, construction of an impermeable cap, diversion and lining of the Unnamed Stream, collection and treatment of on-site groundwater, wetlands restoration/enhancement, long-term environmental monitoring, institutional controls, and five-year reviews.

Three Explanations of Significant Differences (ESDs) have been issued for OU1. The first ESD revised the remedy so that soils in the disposal area would remain in place, untreated, and covered by the cap. Also, excavated soils and sediments from other areas of OU1 that exceeded cleanup standards would remain untreated and would be disposed of beneath the cap within the disposal area. The second ESD revised the remedy so that the stream channel would be permanently placed in an underground 72-inch pre-stressed concrete cylinder pipe (PCCP) and a new stream channel was created on the golf course and vegetation planted to recreate the habitat lost. Also, the ESD called for a slurry wall along a portion of the southern boundary and two recovery wells adjacent to the slurry wall. A third ESD incorporates ARARs related to landfill gas migration and describes the actions taken to comply with the ARARs.

The selected remedy for OU2 included site preparation, excavation of contaminated sediments and soils from portions of Middle Marsh and the Adjacent Wetland, dewatering of the excavated sediment/soils, disposal of the treated sediment/soils beneath the cap, wetlands restoration, institutional controls to prevent future residential use and non-recreational commercial use and to restrict access to Middle Marsh and the Adjacent Wetland, and long-term environmental monitoring.

This is the third five-year review for the site. The trigger for this statutory review is the signature date of the previous five-year review report on September 23, 2008. This review is required by statute as the selected remedies for OU1 and OU2 result in site contaminants being left on the site above levels that allow for unlimited use and unrestricted exposure.

This five-year review concludes that because the remedial actions at the Site are protective in the short-term, the Site is protective of human health and the environment in the short-term. However, in order to be protective in the long-term, the following actions need to be taken.

OU1

- Implement Institutional Controls;
- Monitor and correct landfill gas levels of concern and modify monitoring and extraction system as necessary;
- Replace bedrock monitoring well ECJ-2; and
- Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.

OU2

- Implement Institutional Controls and
- Monitor PCB concentrations in sediment for comparison to cleanup levels.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Sullivan's Ledge		
EPA ID: MAD980731343		
Region: 1	**State:** MA	**City/County:** New Bedford/Bristol

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:**
Author name (Federal or State Project Manager): David Lederer
Author affiliation: US EPA, Region I
Review period: 3/7/2013 – 9/30/2013
Date of site inspection: 5/16/2013 and 6/19/2013
Type of review: Statutory
Review number: 3
Triggering action date: 9/23/2008
Due date *(five years after triggering action date)*: 9/23/2013

Five-Year Review Summary Form (continued)

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): 1	**Issue Category: Institutional Controls**			
	Issue: Implement Institutional Controls.			
	Recommendation: Finalization of Institutional Controls.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA/State	2013
OU(s): 1	**Issue Category: Monitoring**			
	Issue: The landfill gas monitoring, collection, and extraction system may require modification to ensure it is meeting its objectives.			
	Recommendation: Monitoring of landfill gas will continue with objective to ensure gas is not migrating beyond the boundaries of the landfill. Monitoring points shall be capable of yielding representative air samples for analysis and consist of a sufficient number of wells properly located to detect the presence and migration of landfill gases. The sampling plan should be updated to reflect the most current monitoring procedures. Corrective actions to the monitoring, extraction, and collection system will be taken if necessary.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	Quarterly basis
OU(s): 1	**Issue Category: Operations and Maintenance**			
	Issue: Bedrock groundwater compliance monitoring well ECJ-2 is damaged and needs replacement in order to assess compliance with cleanup levels for the active extraction system.			
	Recommendation: Replace multi-port bedrock groundwater monitoring well ECJ-2.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	2013

OU(s): 1	Issue Category: Operations and Maintenance			
	Issue: Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.			
	Recommendation: Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	2013
OU(s): 2	**Issue Category: Institutional Controls**			
	Issue: Implement Institutional controls.			
	Recommendation: Finalization of Institutional Controls.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA/State	2013
OU(s): 2	**Issue Category: Monitoring**			
	Issue: Monitoring of sediments has indicated some PCB concentrations above the TOC normalized clean-up levels, while an equal number have been found below the cleanup levels. Further monitoring is warranted.			
	Recommendation: Continue to monitor and implement corrective actions if needed.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	2016

Protectiveness Statement(s)		
Operable Unit: 1	*Protectiveness Determination:* Short-term Protective	*Addendum Due Date (if applicable):*

Protectiveness Statement:
The remedy for OU1 is currently protective of human health and the environment because the construction of the remedy is complete, and operation and maintenance and monitoring of the remedy is being performed. However, in order for the remedy to be protective in the long-term, the following actions need to be taken:

- Implement Institutional Controls;
- Monitor and correct landfill gas levels of concern and modify monitoring and extraction system as necessary;
- Replace bedrock monitoring well ECJ-2; and
- Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.

Operable Unit: 2	*Protectiveness Determination:* Short-term Protective	*Addendum Due Date (if applicable):*

Protectiveness Statement:
The remedy for OU2 is currently protective of human health and the environment because the construction of the remedy is complete, and operation and maintenance and monitoring of the remedy is being performed. However, in order for the remedy to be protective in the long-term, the following actions need to be taken:

- Implement Institutional Controls and
- Monitor PCB concentrations in sediment for comparison to cleanup levels.

Sitewide Protectiveness Statement (if applicable)

Protectiveness Determination: Protective	*Addendum Due Date (if applicable):*

Protectiveness Statement:
Because the remedial actions at the Site are protective in the short-term, the Site is protective of human health and the environment in the short-term. However, in order for the remedy to be protective in the long-term, the following actions need to be taken:

OU1

- Implement Institutional Controls;
- Monitor and correct landfill gas levels of concern and modify monitoring and extraction system as necessary;
- Replace bedrock monitoring well ECJ-2; and
- Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.

OU2

- Implement Institutional Controls and
- Monitor PCB concentrations in sediment for comparison to cleanup levels.

SECTION 1.0
INTRODUCTION

This document is a comprehensive and interpretive report on the five-year review conducted for the Sullivan's Ledge Superfund Site (the site) in New Bedford, Massachusetts, for the U.S. Environmental Protection Agency's (EPA) Region I office.

The five-year review was conducted to determine whether the remedies for the site are protective of human health and the environment. The methods, findings, and conclusions of the review are documented in this five-year review report. In addition, this report identifies issues found during the review and recommendations to address them.

EPA Region I has conducted this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP). CERCLA §121(c) states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The NCP at Section 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The site consists of two operable units, OU1 and OU2. This five-year review addresses both operable units.

This is the third five-year review for the site. The trigger for this statutory review is the signature date of the previous five-year review report on September 23, 2008. This review is required by statute as the selected remedies for OU1 and OU2 result in site contaminants being left on the site above levels that allow for unlimited use and unrestricted exposure. This is most apparent with OU1 as contaminated soils have been left in place and a groundwater contaminant plume still exists. OU2 requires a statutory review because, although the site was cleaned up to levels that are protective of aquatic organisms, the remedy calls for institutional controls that restrict residential use of the site and thus disallow unlimited use. The OU2 ROD (Page 20) notes that if EPA had assumed that the future use would be residential, cleanup levels would be lower due to higher frequency of exposure. Thus, the ROD implies that contaminants could be left in place that are above levels that allow unlimited use and unrestricted exposure.

SECTION 2.0
SITE CHRONOLOGY

The chronology of the site, including all significant site events and dates is included in Table 1.

Table 1: Chronology of Site Events	
Event	**Date**
Quarrying operations conducted at the site	prior to 1846 through 1921
Land acquired by the City of New Bedford through tax title foreclosure	1935
Pits used for waste disposal	1930's through early 1970's
Fires in quarry pits lead to backfilling of one pit	early 1970's
Geotechnical borings by Massachusetts Department of Public Works indicate presence of capacitors in subsurface	1982
EPA conducted air monitoring program of the Greater New Bedford Area	1982
EPA installed groundwater monitoring wells around the site	1983
NPL Listing	September 21, 1984
OU1 Phase I Remedial Investigation report by NUS Corporation	September 1987
OU2 Final Remedial Investigation/Feasibility Study report by Ebasco Services Inc.	January 1989
ROD issued by EPA for OU1	June 29, 1989
OU2 Final Remedial Investigation - Additional Studies of Middle Marsh report by Metcalf & Eddy, Inc.	April 1991
OU2 Feasibility Study of Middle Marsh report by Metcalf & Eddy, Inc.	May 1991
ROD issued by EPA for OU2	September 27, 1991
Consent Decree for OU2 was lodged in U.S. District Court in Massachusetts	January 25, 1993
ESD issued by EPA, modifying the remedy so that treatment would no longer be required for OU1 soil and sediments to be covered by the OU1 landfill cap.	July 26, 1995
100% remedial design approved by EPA for OU1	June 1997

Table 1: Chronology of Site Events	
Event	**Date**
Start of on-site construction at Operable Unit 1	March 2, 1998
Start of on-site construction at Operable Unit 2	April 8, 1999
Start-up of the OU1 groundwater collection and treatment system	December 10, 1999
ESD issued by EPA substituting a slurry wall for the shallow collection trench along a section of the site boundary and culverting a section of the Unnamed Stream instead of a concrete lining	September 27, 2000
Final Remedial Construction Report, OU2 by URS Corporation and Certification of Remedial Construction Completion	August 13, 2001
Remedial Construction Report, OU1 by O'Brien & Gere Engineers, Inc. and Certification of Construction Completion	March 8, 2002
Approval of OU2 Construction Completion Report	January 23, 2003
Approval of OU1 Construction Completion Report	January 23, 2003
ESD issued by EPA adding Solid Waste regulations as an ARAR and requiring mitigation of a landfill gas migration issue	September 29, 2003
Completion of first five-year review	September 29, 2003
Start-up of the full-scale landfill gas extraction system	June 10, 2004
Fifth year of post-construction wetland monitoring	2006
Completion of second five-year review	September 23, 2008
First year of long-term wetland monitoring	2011

SECTION 3.0
BACKGROUND

3.1 PHYSICAL CHARACTERISTICS AND LAND AND RESOURCE USE

The Sullivan's Ledge Superfund Site is located in New Bedford, Massachusetts, Bristol County, near the intersection of Route 195 and Hathaway Road (see Figure 1, provided in Attachment 1 of this report). The Sullivan's Ledge Superfund Site consists of two operable units, OU1 and OU2.

OU1 consists of a 12-acre historic disposal area and the adjacent Unnamed Stream (see Figure 2, provided in Attachment 1 of this report). The Unnamed Stream flows from the site underneath Hathaway Road into OU2, which consists of the Middle Marsh and adjacent wetlands. The disposal area is bounded on the south by the highway interchange with Route 140 and I-195, on the east and west by commercial establishments, and on the north by Hathaway Road.

OU2 is located within the Whaling City Golf Course at New Bedford, just north of Hathaway Road. OU2 is bounded on the south by the southern banks of the tributary of the Unnamed Stream, on the north by the Apponogansett Swamp, and on the east and west by fairways of the golf course. OU2 includes a 13-acre wooded wetland called Middle Marsh, and a 1.5 acre wetland area bordering the Unnamed Stream (400 feet upstream of the Middle Marsh) referred to as the Adjacent Wetlands (see Figure 5, provided in Attachment 1 of this report).

Regional groundwater flow in the overburden, shallow bedrock, and deep bedrock is to the north. In the absence of the installed groundwater pump and treatment system, local groundwater flow in the overburden and shallow bedrock is from the southwest to the northeast corner of the former disposal area. Flow from the southwest corner of the site entered the quarry pits. A portion of the groundwater discharged out of the pits into the overburden and the Unnamed Stream and the remainder discharged into the bedrock. Prior to installation of the OU1 cap, most of the former disposal area was covered by a layer of fill which overlayed the bedrock and quarry pits. The thickness of the fill generally increased to the south and east across the property with the maximum observed thickness of 22.4 feet found in the southwest corner of the site. Shallow bedrock is highly fractured, with fracture planes varying in frequency and orientation, which means that the shallow bedrock exhibits the properties of a porous medium, with groundwater flowing in the direction of the hydraulic gradient. The deep bedrock contains fewer fractures than the shallow bedrock and the fractures follow a regional north/northwest lineament trend. Thus, contaminant migration in the deep bedrock is controlled by the orientation of the fractures.

3.2 HISTORY OF CONTAMINATION

The OU1 disposal area was originally operated as a granite quarry that supplied building stone to the New Bedford area. Quarry operations began in the 1800s and continued until 1921. During that time, as many as four separate quarry pits were in use on the property.

After serving as a local swimming hole, the city of New Bedford assumed ownership of the property in 1935 through a tax title foreclosure. The pits and adjacent areas were operated by

the City of New Bedford and used by local industry as a disposal site for wastes such as electrical transformers and capacitors, fuel oil, volatile liquids, old tires, glass, metal, steel tanks, smoke stack soot, and scrap rubber. The site also was used for disposal of other types of debris such as brush and trees, cobblestones, bricks, and demolition materials. The pits and adjacent areas are referred to throughout this report as the disposal area.

In the early 1970s, a major fire erupted on-site, primarily involving the mass of tires disposed of in the quarry pits. This fire was difficult to control due to the presence of the tires, and created a dense, black smoke. Due to concern regarding possible recurrence of such fires, an effort was undertaken to backfill the remainder of the smaller pit and to regrade the site, covering any exposed refuse. In early 1982, Massachusetts Department of Public Works, District 6, conducted test borings on-site in conjunction with a proposal for construction of a commuter parking lot, but recommended cancelling the project when borings indicated the presence of electrical capacitors.

EPA conducted an air monitoring program of the Greater New Bedford area in 1982 and installed groundwater monitoring wells around the site in 1983. Based in part on the results of these studies, the site was included in the National Priorities List (NPL) in September 1984.

3.3 INITIAL RESPONSE

In September 1984, EPA issued the owner and operator of the site, the City of New Bedford, an Administrative Order under Section 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). In compliance with this order, the City of New Bedford secured the disposal area by installing a perimeter fence and posting signs warning against unauthorized trespassing at the site.

On November 29, 1988, EPA notified parties who owned or operated the facility, generated wastes that were shipped to the facility, or transported wastes to the facility, of their potential liability with respect to the site.

A Remedial Investigation (RI) of the site was completed in two phases. The Phase I RI completed by NUS in September 1987 under subcontracts to EBASCO (EBASCO, 1987), provided the data necessary for site characterization. The draft final Phase II RI and Feasibility Study (FS) was completed in March of 1988 by E.C. Jordan under subcontract to EBASCO (EBASCO, 1989).

In June 1989, EPA concluded that additional studies of the Middle Marsh and adjacent wetland were needed and these areas were grouped into a second operable unit. The Remedial Investigation - Additional Studies of Middle Marsh report was completed in April 1991 by Metcalf & Eddy, Inc (M&E, 1991a). The Feasibility Study of Middle Marsh was completed by Metcalf & Eddy, Inc. on May 29, 1991 (M&E, 1991b).

3.4 BASIS FOR TAKING ACTION

Based on results of the Phase I and Phase II RIs, three source areas of contamination were identified for the site: the quarry pits, site soils, and PCB-contaminated sediments. The RIs also determined that contaminants from the quarry pits had contaminated on- and off-site groundwater and surface water in the Unnamed Stream.

The following summarizes the contamination at the site:

Soils. The Phase II RI and pre-design sampling confirmed semivolatile organic compound (SVOC) contamination within the disposal area and along the eastern site boundary. Polychlorinated biphenyls (PCBs) were also detected within the disposal area and along the eastern site boundary.

Sediment. PCBs were the only compound of concern in the sediments. PCB contamination was detected in sediments from the Unnamed Stream, Middle Marsh, golf course water hazards, and Apponagansett Swamp. PCB concentrations occurred at levels above the Sediment Quality Criteria Values (SQCVs) in each of the four habitats.

Groundwater. The majority of on-site groundwater contamination is caused by volatile organic compounds (VOCs); less significant levels of SVOCs and PCBs were also reported. VOCs were identified in the overburden groundwater, shallow bedrock groundwater (less than 100 feet), and deep bedrock groundwater (down to 200 feet below ground surface).

Surface Water. Relatively high concentrations of VOCs, SVOCs, and inorganics were reported in the Phase II RI at groundwater seeps located east and north of the disposal area. For several contaminants, the concentrations exceed the ambient water quality criteria (AWQC). Impacts to the Unnamed Stream, however, appeared minimal due to the effects of dilution by the large volume of water in the Unnamed Stream. There was no public health risk associated with surface water.

The human health risk assessment for OU1 estimated potential human health risks associated with exposure to contaminants of concern in surface soils, sediments, air, surface water, and groundwater. The risk assessment assumed that access to the site is restricted and the land is zoned as commercial, but considered a proposed future use of the site as a soccer field. PCBs and total PAHs contributed the majority of the total carcinogenic risk from direct contact with surface soils. Noncarcinogenic hazard from incidental ingestion of on-site soils by children was elevated due to the lead concentration in an on-site shallow soil sample. Though groundwater was not a current source of drinking water, carcinogenic risks and noncarcinogenic hazards from future ingestion of groundwater were estimated. Benzene, trichloroethene, vinyl chloride, and PCBs contributed over 99 percent of the total cancer risk. 1,1-Dichloroethene was the major contributor to the noncarcinogenic groundwater hazard at the site. Direct contact with contaminated sediments in the Unnamed Stream was the highest carcinogenic risk contributor from exposure to sediments. The ecological risk assessment indicated that a potential risk existed for aquatic organisms due to exposure to contaminants in surface water of the Unnamed Stream. It was noted that risk to aquatic organisms due to PCB exposure in water could not be accurately evaluated because the detection limit for PCBs (1.0 ug/l) was greater than the water quality criteria concentration (0.014 ug/l).

The human health risk assessment for OU2 concluded that human exposure to contaminants in Middle Marsh and the golf course/wetland area through current and future pathways would not result in significant increases in carcinogenic risk, and that there are no significant risks to human health posed by exposure to noncarcinogenic contaminants under the assumption that current and future site use would be as a golf course. The OU2 Record of Decision (ROD) notes that if EPA had assumed that the future use would be residential, cleanup levels would be

lower due to higher frequency of exposure. The OU2 ROD requires the use of institutional controls to prohibit residential use and restrict commercial use, thereby assuring the protectiveness of human health. The ecological risk assessment concluded that aquatic exposures and wetland/terrestrial exposures to PCB-contaminated sediments in portions of the Middle Marsh present an unacceptable risk to biota present in OU2. This is the primary basis of the OU2 remedial action.

SECTION 4.0
REMEDIAL ACTIONS

4.1 REMEDY SELECTION

This section outlines the selected remedies for OU1 and OU2.

4.1.1 Operable Unit 1

The EPA ROD for Sullivan's Ledge OU1 was issued on June 29, 1989. The remedial action objectives (RAOs) listed in the ROD are:

- Prevent or mitigate the continued release of hazardous substances to the Unnamed Stream, Middle Marsh, and Apponagansett Swamp;
- Reduce risks to human health associated with direct contact with and incidental ingestion of contaminants in the surface and subsurface soils;
- Reduce risks to animal and aquatic life associated with the contaminated surface soils and sediments;
- Reduce the volume, toxicity, or mobility of the hazardous contaminants;
- Maintain air quality at protective levels for on-site workers and nearby residents during site remediation;
- Reduce further migration of groundwater contamination from the quarry pits in the upper 150 feet of the bedrock groundwater flow system;
- Significantly reduce the mass of contaminants in groundwater located in and immediately adjacent to the quarry pits;
- Provide flushing of groundwater through the pits to encourage continued removal of contaminants at the site; and
- Minimize the threat posed to the environment from contaminant migration in the groundwater and surface water.

The selected remedy for OU1, as identified in the ROD, consisted of the following components. Items related to soil/sediment excavation, treatment, and placement are source control measures. Items related to groundwater collection/treatment are management of migration measures.

- Site Preparation;
- Soil Excavation/Treatment;
- Sediment Treatment;

- Construction of an Impermeable Cap;
- Diversion and Lining of the Unnamed Stream;
- Collection and Treatment of On-site Groundwater;
- Wetlands Restoration/Enhancement;
- Long-term Environmental Monitoring and Five-Year Reviews; and
- Institutional Controls.

As stated in the ROD, the EPA determined that contaminants have contaminated on- and off-site groundwater and surface water in the Unnamed Stream. Due to technical impractibility, Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) were not used as cleanup goals. Rather significant reduction of the contaminant mass and protection of surface water bodies were used as cleanup goals. A two part plan for the cleanup of on-site contaminated groundwater and seeps involved an active extraction system (bedrock extraction wells) and a passive collection system (shallow collection trench).

On July 26, 1995, EPA issued an ESD documenting changes to the remedial action specified in the OU1 ROD. The ROD called for excavation of soils within the disposal area down to the seasonal low water table, de-watering, solidification, and placement back within the disposal area under an impermeable cap. The revised remedy described in the ESD called for soils in the disposal area to remain in place, untreated, and covered by the cap. The ROD also called for soils and sediments from the Unnamed Stream, water hazards, and other areas of OU1 outside the disposal area that exceed cleanup standards to be excavated, treated, and disposed of under the impermeable cap within the disposal area. Under the revised remedy, excavated soils and sediments from these areas would remain untreated and would be disposed of under the impermeable cap within the disposal area.

Another ESD was issued by EPA on September 27, 2000, documenting additional changes to the remedial action specified in the OU1 ROD. The ROD described the concrete lining of about 750 feet of the Unnamed Stream in the portion parallel to the eastern boundary of the site. As described, the revised remedy included the permanent placement of the stream channel in an underground 72-inch PCCP, the creation of a new stream channel on the golf course, and the planting of vegetation to recreate the habitat lost. Under the ROD, passive groundwater collection along the eastern and northern boundary of the site consisted of an under drain pipe within a shallow trench. The ESD substituted this collection system with a slurry wall along a portion of the northern boundary and two recovery wells adjacent to the slurry wall.

A third ESD was issued by EPA on September 29, 2003. It incorporated methane gas collection into the remedy to comply with Massachusetts Solid Waste Management Regulations and to prevent the off-site migration of gas.

4.1.2 Operable Unit 2

The ROD for Sullivan's Ledge OU2 was issued by EPA on September 27, 1991. The remedial action objectives listed in the ROD are:

- Reduce exposure of aquatic organisms to PCB-contaminated pore water and sediments either through direct contact or diet-related bioaccumulation;
- Reduce exposure of terrestrial and wetland species to PCB-contaminated sediment/soils through direct contact or diet-related bio-accumulation;
- Prevent or reduce releases of PCBs to the Unnamed Stream and the Apponagansett Swamp; and
- Mitigate the impacts of remediation on wetlands.

The selected remedy, as identified in the ROD, consisted of the following components:

- Site preparation;
- Excavation of contaminated sediments and soils from portions of Middle Marsh and the Adjacent Wetland;
- Dewatering and stabilization of the excavated sediment/soils;
- Disposal of the stabilized sediment/soils beneath the cap constructed over portions of the disposal area of the site;
- Wetlands restoration;
- Institutional controls to prevent future residential use and restrict commercial use; and
- Long-term environmental monitoring.

4.2 REMEDY IMPLEMENTATION

This section summarizes the implementation of the remedial actions specified in the RODs for OU1 and OU2.

4.2.1 Operable Unit 1

The settling defendants for OU1 formed the Sullivan's Ledge Site Group led by a project management committee (PMC) and hired a design engineering firm, O'Brien & Gere Engineers, Inc. (OBG), to implement the EPA OU1 Statement of Work. In June 1997, EPA approved the 100% design, initiating the time track for remedial action. The PMC contracted with Harding Lawson and Associates, Inc. (HLA) to implement the remedial actions. On-site construction activities for OU1 were initiated in March 1998 with Phase I mobilization.

Implementation of the remedial action for OU1 is discussed below, by component, as identified in the ROD. The information below is based primarily on the Remedial Construction Report (OBG, 2002d) for OU1.

Site Preparation

Site preparation work that was conducted included the installation of fencing and gates, clearing of vegetative material and debris and placement on the disposal area, placement of drums of soil and personal protective equipment and various construction debris on the disposal area, demolition of the former car wash located adjacent to the site and placement of the resulting debris on the disposal area, grading of the site to remove high points, abandonment of monitoring wells in the disposal area, proof rolling (or ensuring there are no unstable areas) of the site, and placement of a 12-inch ordinary borrow interim cover on the portion of the site not scheduled for capping until a later phase.

Soil Excavation

Soil excavation was conducted in several areas of the site. The approximate total volume of material removed from each area is provided as follows:

- Unnamed Stream bed and southern tributary soil and sediments - 950 cubic yards plus 50 cubic yards of rock
- East bank soils (south of car wash) - 140 cubic yards
- Soils east of stream channel - 910 cubic yards
- East bank soils (north of car wash) - 40 cubic yards

In each area, post-excavation confirmation samples were collected and compared to the clean-up criteria for soils of 10 ppm PCBs. When necessary, additional excavation was performed until confirmation sampling indicated that the clean-up criteria had been met. The excavated materials were placed in areas within the limits of the cap system in accordance with construction specifications.

Diversion and Lining of the Unnamed Stream

This component of the remedy involved lining the Unnamed Stream east of the disposal area with a 72-inch PCCP. The 72-inch PCCP was installed during Phase I of the remedial action.

Collection and Treatment of On-Site Groundwater

This component of the remedy involved the construction of the active groundwater collection system, the passive groundwater collection system, the slurry wall, and the groundwater treatment plant.

The active groundwater collection system was installed during Phase I of the remedial action and consisted of the installation of three bedrock recovery wells, conversion of three existing bedrock wells to recovery wells, installation of two high density polyethylene (HDPE) piping access vaults, installation of HDPE piping from each bedrock recovery well to a manifold in the groundwater treatment plant, and installation of pumps and controls in each of the six bedrock

recovery wells.

The passive groundwater collection system was installed during Phase I of the remedial action and consisted of approximately 660 feet of shallow collection trench (12-inch diameter HDPE perforated collection pipe surrounded by crushed stone backfill), HDPE manholes, a pump station, a valve vault, and associated double-walled piping.

A slurry wall was constructed along the northern limits of the landfill cap. The slurry wall was installed to a depth of 20 to 25 feet and a width of 6 to 30 feet. Two recovery wells (called "Interim Wells") with pumps, controls, and associated piping were installed adjacent to the slurry wall.

The groundwater treatment plant was constructed during Phase I of the remedial action. The start-up period and initial operations occurred from December 10, 1999 through October 19, 2000.

Construction of an Impermeable Cap

This component of the remedy involved the following activities:

- installation of the geogrids along the former quarry limits;
- construction of the gas venting system including placement of granular material, installation of gas vent risers and horizontal gas collection pipe, and installation of 22 gas monitoring wells around the perimeter of the landfill cap system;
- installation of the geosythetic clay liner;
- installation of the flexible membrane (LLDPE) cover;
- installation of the synthetic drainage layer;
- placement of the barrier protection material;
- placement of topsoil;
- excavation and construction of the sedimentation basin;
- augmentation of the Hathaway Road culvert;
- construction of run-on/run-off controls including berms, lined swales, and culverts;
- construction of access roads; and
- installation of site security measures including fencing and gates.

Wetlands Restoration/Enhancement

The restoration of affected wetlands in OU1 was conducted concurrently with OU2 wetlands restoration. HLA subcontracted certain wetland restoration tasks (vegetation plantings, invasive control, monitoring, reporting) for both OUs to New England Environmental (NEE) of Amherst, Massachusetts.

Sediment Treatment

Sediment excavation was performed within a tributary of the Unnamed Stream (Tributary #2), and two golf course hazards (Ponds A and B). Post-excavation confirmation samples were

collected and compared to the clean-up criteria of 20 µg PCBs/gram carbon. A total of approximately 7,590 cubic yards of sediment was excavated from these areas. Excavated sediments were transferred to the treatment pad, stabilization agents (lime kiln dust and sand) were added and mixed using an excavator, and then the material was spread out and moisture conditioned (treated with admixtures to dry the sediment and improve usability as fill). A total of approximately 9,340 cubic yards of stabilized sediment was placed within the limits of the cap system.

The Sullivan's Ledge Superfund Site, Operable Unit 1, Remedial Construction Report was completed in March 2002 by OBG (OBG, 2002d). This report included a Certification of Completion of Construction, signed on March 8, 2002. This report was approved by EPA on January 23, 2003, which triggered the start of the O&M period.

Institutional Controls

To date, the institutional controls identified in the OU1 ROD have not been implemented. These include:

- ordinances and zoning restrictions to prevent the use of groundwater for drinking water; and
- deed restrictions regulating land use at the site

EPA, the Commonwealth of Massachusetts, and the PRPs have drafted and agreed upon a Grant of Environmental Restrictions (GER) for the institutional controls for the site. The current draft document will have language to address a potential solar project on the site. The draft document is in its final review and expected to be issued during 2013. The remedy is protective in the short-term without the GER in place because exposures to hazardous constituents remain under control due to completion of construction at the Site and continued operation and maintenance activities.

Active Landfill Gas Extraction System

Active methane gas removal was not part of the remedy specified in the ROD for OU1. However, landfill gas monitoring conducted in 2001 and 2002, in accordance with the Post-Construction Environmental Monitoring Plan (OBG, 1996b), indicated that several gas monitoring wells had methane concentrations that exceeded 25% of the lower explosive limit (LEL) for methane. On-site landfill gas vents were also monitored and methane was found to be present. Methane was not detected in explosive gas screenings of subsurface structures and buildings, on and adjacent to the site. Soil gas surveys were performed in spring and summer 2002, indicating that methane was present at greater than 25% LEL both east and west of the landfill but was not detected in any adjacent buildings or structures screened.

A Corrective Action Alternative Analysis was performed to mitigate the migration of explosive gases from the landfill which exceeded the concentrations specified in 310 CMR 19.132(4)(g) and (h). The corrective action chosen was active gas control concurrent with data collection to evaluate the effectiveness in removing landfill gas and reducing off-site migration of landfill gases above 25% LEL. On November 15, 2002 a revised Corrective Action Design was submitted for approval on behalf of the Settling Parties by OBG. The PMC proposed to install a pilot gas extraction system consisting of a trailer mounted 8 horsepower blower with knockout

tank and gauges to record stack discharge velocity and temperature. The pilot system was run initially for a three month period, and then continued to operate until early 2004 when it was dismantled to allow for installation of the full scale system as described below.

OBG, on behalf of the OU1 PMC, submitted a conceptual design for the full scale landfill gas collection system dated May 8, 2003. The design was based on the results of the pilot system. The design included collection from the east, west, and north sides of the landfill via a 200 GPM blower and subsequent release to the atmosphere.

Installation of the full scale landfill gas collection system was conducted during the beginning of 2004. The full scale landfill gas collection system became operational on June 10, 2004.

4.2.2 Operable Unit 2

On January 25, 1993, EPA gave notice that the Consent Decree (CD) for OU2 had been lodged in United States District Court in Massachusetts. The Consent Decree was entered into by AVX Corporation (AVX) as the lead Settling Party, the City of New Bedford, the OU1 Settling Parties, EPA, and the Massachusetts Department of Environmental Protection (MassDEP). AVX Corporation hired a design engineering firm, Dames & Moore (now known as URS Corporation) to implement the EPA Statement of Work.

The remedial action at OU2 was conducted between 1998 and 2001. The OU2 Settling Parties contracted with HLA to implement the RA.

Activities associated with soil/sediment removal were conducted from April 1999 through September 2000. The calculated volume of soil, sediment, and debris wastes that were removed from Middle Marsh and the adjacent wetland was 25,485 cubic yards. Activities associated with the stabilization of soil/sediment and placement in the disposal area were conducted from June 1999 through June 2000. Activities associated with wetlands restoration were conducted from July 1999 through September 2000.

The Final Remedial Construction Report, Sullivan's Ledge Superfund Site, Second Operable Unit was completed on August 13, 2001 by URS Corporation. The report included a Certification of Remedial Construction Completion, signed on August 13, 2001. This report was approved by EPA on January 23, 2003, which triggered the start of the O&M period.

To date, land use restrictions identified in the OU2 ROD have not been fully implemented. The ROD called for zoning ordinances and/or deed restrictions to ensure that future uses of Middle Marsh and the Adjacent Wetland are limited to existing recreation and conservation purposes, and to prohibit residential and restrict commercial uses.

EPA, the Commonwealth of Massachusetts, and the PRPs have drafted and agreed upon a GER reflecting the above mentioned restrictions. The current draft document will have language added to address a potential solar project on the site. The draft document is in its final review and will be issued soon. The remedy is protective in the short-term without the GER in place because exposures to hazardous constituents remain under control due to completion of construction at the Site and continued operation and maintenance activities.

4.3 SYSTEM OPERATIONS/O&M

The Settling Parties for OU1 and OU2 are currently performing O&M as described below.

4.3.1 Operable Unit 1

4.3.1.1 OU1 O&M Activities

An Operations and Maintenance Plan, Post-Construction Environmental Monitoring Plan, and Wetlands Restoration Plan were prepared by OBG and finalized in July 1997.

A Site Operations and Maintenance Manual (OBG, 2002a) was prepared by OBG in February 2002 as an update to the 1997 O&M Plan. The O&M activities that are specified in accordance with the Site Operations and Maintenance Manual include:

- Routine inspections of the landfill cap to look for signs of vegetative stress, burrowing animals, settlement, erosion, slope instability, or any other damage (to be performed monthly throughout the first year and quarterly thereafter);
- Inspections of three surveyed benchmarks for signs of damage at the same frequency as landfill cap inspections;
- Inspections of the access road on the cap system at the same frequency as landfill cap inspections;
- Monthly site security inspections looking for breaches in fence integrity;
- Inspection of the gas vents for signs of damage or obstruction at the same frequency as landfill cap inspections;
- Inspection of run-on/run-off controls, including swales, berms, catch basins, vaults, headwalls, and the sedimentation basin, at the same frequency as landfill cap inspections; and
- Inspection of the lined portion of the Unnamed Stream every five years and repairs as necessary.

Activities that are being conducted in accordance with the Post-Construction Environmental Monitoring Plan include:

- Groundwater compliance monitoring for the active and passive collection systems (results provided in quarterly or semi-annual monitoring reports);
- Collection and analysis of surface water and sediment samples from five locations within the Unnamed Stream (results documented in the monitoring reports (OBG, 2001c; OBG, 2004a; OBG, 2006a; and OBG, 2008a, OBG, 2010, OBG, 2012) and other correspondence (OBG, 2010; PMC, 2011));

- Quarterly monitoring of the perimeter gas monitoring wells and other locations for explosive gases and annual monitoring for hydrogen sulfide (results provided in quarterly or semi-annual monitoring reports); and

- Monitoring of representative perimeter gas monitoring wells for VOCs using SUMMA canisters.

Groundwater compliance monitoring was conducted quarterly through 2008 and then reduced to semi-annually beginning with the March 2009 monitoring round.

The Wetlands Restoration Plan specifies that wetlands monitoring be performed annually for the first three years after completion of the initial restoration, during the fifth year, and once every following five years. Monitoring activities include stream flow and elevation monitoring, groundwater elevation monitoring, and evaluation of percent cover of the restored and created wetlands. To date, annual wetland monitoring reports have been submitted for monitoring conducted in 2001 through 2006 and 2011 (NEE, 2002; NEE, 2003; NEE, 2004; OU1 & OU2, 2005; OU1 & OU2, 2006; OU1 & OU2, 2007; and CONB, 2012). The wetland monitoring reports address both OU1 and OU2.

A Ground Water Treatment Plant (GWTP) Operation and Maintenance Manual, finalized by OBG in August 2000, specifies the following O&M activities:

- Quarterly inspections of the GWTP to determine the total volume of remedial waste water treated since the previous inspection, average flow rate of the system, total volume of non-aqueous phase oil or hazardous materials recovered since the previous inspection, and whether any maintenance activities are necessary;

- Routine monitoring of effluent for various parameters; and

- Routine monitoring of the air discharge from the GAC canister in service with the tank venting system for benzene, trichlorethylene, and vinyl chloride using colorimetric tubes and follow-up laboratory analyses.

The manual also describes recommended maintenance activities that should be performed on the GWTP process equipment. Monthly reports documenting the effluent monitoring and other operating data are submitted by the City of New Bedford.

4.3.1.2 Summary of OU1 O&M Issues and Operational Modifications

The OU1 remedy has generally performed as designed since construction completion. During this review period, the groundwater treatment plant underwent a modification to replace the ultraviolet/oxidation (UVOX) system with an air stripper and liquid-phase granular activated carbon (GAC) system, which is further described below. Also, O&M issues/problems that have occurred in relation to the landfill cap, landfill gas extraction system, groundwater monitoring wells, and groundwater collection system over this review period are summarized below. Additional O&M issues are discussed in other sections of this report.

GWTP Modification. The OU1 PMC and City of New Bedford elected with EPA's support to

replace the existing ultraviolet/oxidation (UVOX) system, which treats VOCs in extracted groundwater, with an air stripper and liquid-phase activated carbon (GAC) system. The OU1 ROD had contemplated the use of air stripping with GAC if the UVOX system was determined to be ineffective or significantly more costly. A Draft Groundwater Treatment Plant Modification Design Report (Lightship, 2010) was prepared on behalf of the OU1 PMC in March 2010 and was approved by EPA on May 27, 2010. Installation and initial startup of the new treatment train occurred in November 2010. Initial problems with clogging by iron floc, which limited the flow through the GAC, have been addressed to some extent by routine cleaning of the tanks and piping, which the plants operators indicate has become a standard maintenance activity. The air stripper requires frequent cleaning to prevent blockages which affect the removal efficiency of the air stripper. Air stripper cleaning has also become a standard maintenance activity.

Landfill Cap Settlement. In 2011, settlement was observed on a portion of the landfill cap. In order to evaluate the significance of the settlement and whether any actions were necessary, the OU1 PMC had the landfill cap surveyed and the results were evaluated. It was determined that some settlement in that portion of the cap was anticipated during the cap design and geogrids were placed in that specific area to help prevent damage to the cap liner from the anticipated settlement. Further, ponding did not appear to be a concern because sufficient slope was present. It was determined that no action was needed.

Landfill Gas Extraction System. Since the initial startup of the full scale landfill gas collection system in 2004, some modifications have occurred to the system to address the accumulation of water/condensate in the lower leg of the collection system and to apply additional vacuum to the eastern portion of the landfill cap. In 2009, gas monitoring wells GM-19 and GM-20 were directly connected via piping to the lower leg of the collection system to improve landfill gas removal. Gas monitoring wells GM-17 and GM-18 has previously been connected. In 2006, a pneumatic valve was installed near the blower system and is operated on a timer, such that the valve is open for 60 minutes and closed for 120 minutes. When the valve is closed, vacuum is applied only to the lower leg of the piping, producing a higher vacuum which helps remove water or condensate from the piping and also provides a higher vacuum to the direct connection points in the eastern portion of the cap. When the valve is open, vacuum is applied to both the upper and lower legs.

Groundwater Monitoring Wells. Two multi-level Westbay monitoring wells (ECJ-2 and ECJ-4) have become damaged within the past 5 years. Well ECJ-2 experienced a failure in mid-2009, apparently due to damage or deterioration of the packing ring which caused the sample ports to no longer be sealed off from each other. Well ECJ-4 experienced a similar failure in mid-2010. The OU1 Settling Parties intend to replace well ECJ-2 with a similar multi-level Westbay well that will have sampling ports at 4 depth zones that target shallow, mid, and deep bedrock, instead of the original 5 depth zones. It is anticipated that installation of the replacement well will occur in the summer of 2013. Well ECJ-2 is a Point of Compliance well that is used to assess compliance with the cleanup goal for the active collection system. Both monitoring wells were part of the routine compliance monitoring program prior to failure. There are no plans to replace well ECJ-4 since it is not a point of compliance.

Groundwater Collection System. On frequent occasions within the past 5 years, one or more of the six bedrock extraction wells has had downtime due to problems with the pumps that require repair or replacement. This is an ongoing maintenance issue that is addressed as

needed.

4.3.1.3 OU1 O&M Costs

Due to agreements between the OU1 Settling Parties and the City of New Bedford, O&M costs are paid separately by both groups. The table below summarizes these costs.

Table 2: Annual Approximate System Operations/O&M Costs for Operable Unit 1

Type of Cost and Time Period	Total Cost
Groundwater Treatment Plant O&M Costs:	
July 1, 2008 – June 30, 2009	$489,141
July 1, 2009 – June 30, 2010	$341,410
July 1, 2010 – June 30, 2011	$344,732
July 1, 2011 – June 30, 2012	$337,879
Monitoring, Engineering, Capital Improvement, Administrative, and Legal Costs:	
January 1, 2008 – December 31, 2008	$317,430
January 1, 2009 – December 31, 2009	$376,760
January 1, 2010 – December 31, 2010	$289,430
January 1, 2011 – December 31, 2011	$363,860
January 1, 2012 – December 31, 2012	$287,100

4.3.2 Operable Unit 2

4.3.2.1 OU2 O&M Activities

Post-construction environmental monitoring and post-construction and long-term wetlands monitoring activities are currently being performed in accordance with the Final Operation and Maintenance Plan for the Second Operable Unit, dated January 13, 1999. The O&M period officially began on January 23, 2003 (the date of approval of the Construction Completion Report). However, some O&M activities did occur prior to that date to maintain the integrity of the restored wetlands. The following post-construction environmental monitoring activities are required to be conducted once per year during the first three years, in year five, and then once every five years:

- Collection of four surface water samples from reaches of the Unnamed Stream and analysis for pH and PCBs;
- Collection of four sediment samples from the reaches of the Unnamed Stream, within the area of OU2 impacted by remedial action construction and analysis for PCBs and

total organic carbon (TOC); and

- Collection of two wetland sediment/soil samples from the adjacent wetland and four sediment/soil samples from the Middle Marsh and analysis for PCBs.

The O&M Plan also specifies that post-construction wetland monitoring be conducted annually, for a period of at least five years. Long-term wetland monitoring will then be conducted to ensure the long-term effectiveness of the wetland restoration program. Wetlands monitoring activities include monitoring of hummocks, wetlands hydrology, soil development, and biological attributes including survival rates of planted trees and shrubs, tree growth, vegetative diversity, plant community, and presence of the Mystic Valley Amphipod.

Annual O&M reports are required to be submitted to EPA. To date, seven annual wetland monitoring reports have been submitted (NEE, 2002; NEE, 2003; NEE, 2004; OU1 & OU2, 2005; OU1 & OU2, 2006; OU1 & OU2, 2007; and CONB, 2012). The first six annual O&M reports documented wetland monitoring activities for both OU1 and OU2, as well as environmental monitoring for OU2. The most recent wetland monitoring report (CONB, 2012) documented the first year of long-term wetland monitoring which occurred during 2011. In 2013, EPA conducted environmental monitoring, including surface water and sediment sampling, to meet the requirements for OU2.

The next wetlands and environmental monitoring event is scheduled for 2016.

4.3.2.2 OU2 O&M Costs

O&M costs incurred by the City of New Bedford Department of Environmental Stewardship over the period from 2008 through 2012 are estimated at $6,774. These costs include wetland O&M and monitoring activities for both OU1 and OU2. Activities included two beetle releases in 2008 and 2009 for control of invasive purple loosestrife, periodic monitoring and inspection/on-site meetings with EPA, and effort for the 2011 long-term wetland monitoring event.

SECTION 5.0
FIVE-YEAR REVIEW PROCESS

This section describes the activities performed during the five-year review process and provides a summary of findings.

5.1 COMMUNITY NOTIFICATION AND INVOLVEMENT

On May 9, 2013, EPA issued a press release announcing that EPA was beginning five-year reviews of 16 Superfund sites across New England, including Sullivan's Ledge. A similar press release will be issued by EPA once the five-year reviews are complete. On May 11, 2013, an article was published in the Standard Times announcing that five-year reviews were being conducted at Sullivan's Ledge and another nearby Superfund site.

Interviews were conducted with parties involved in O&M and monitoring of the remedy, including the City of New Bedford Water Superintendent, City of New Bedford Conservation Agent, and a representative of the OU1 Project Management Committee. A summary of responses to questions posed to PRPs and City personnel is provided in Section 5.5.

5.2 DOCUMENT REVIEW

This five-year review consisted of a review of relevant documents for both OUs including the remedial investigation reports, RODs, remedial construction reports, and O&M and monitoring plans and reports. See Attachment 2 for a list of documents that were reviewed.

5.3 DATA REVIEW

5.3.1 Operable Unit 1

5.3.1.1 Groundwater Treatment Plant Effluent Monitoring

Effluent from the GWTP is discharged to the City of New Bedford publicly-owned treatment works (POTW). The New Bedford POTW has established discharge criteria that must be met by the GWTP for discharge to the municipal sewer system. Treatment plant effluent sample analyses were evaluated to determine if pretreatment discharge limitations were met. PCB samples have been typically collected on a weekly basis and although there have been a small number of exceedances of the discharge limit within the past 5 years, no PCBs have been detected in samples collected during 2012 and the first quarter of 2013. Where there were effluent exceedances in past years, they were typically attributed to temporary operational problems or maintenance within the treatment plant. There have been fewer effluent exceedances since the modifications to the GWTP, which occurred in late 2010. Samples have typically been collected for VOCs, metals, and cyanide on a monthly or bi-weekly basis and review of data over the past 5 years has not indicated any exceedances of the discharge limits for Total Toxic Organics (TTO), metals, and cyanide. Semivolatile organics (SVOCs) and pesticides have been analyzed on a less frequent basis. SVOCs were last analyzed for in January 2011 and no SVOCs were detected. Pesticides were last analyzed for in August 2012 and no pesticides were detected. Table A3-1 (located in Attachment 3) provides a comparison of recent effluent data from April 2013 to the pretreatment discharge limitations.

5.3.1.2 Groundwater Monitoring

Monitoring is being conducted while the groundwater treatment plant is operating until the groundwater clean-up standards are achieved in accordance with the requirements of the CD with the OU1 Settling Parties. Once performance standards are met, performance monitoring will be conducted for a period of three years, in order to evaluate whether achievement of the cleanup standards is sustained. After performance monitoring, long-term monitoring will be conducted (OBG, 1996b).

The Post-Closure Environmental Monitoring Plan (PCEMP) (OBG, 1996b) describes compliance monitoring requirements for both the active extraction system and the passive collection system. With regard to the active extraction system, the plan specifies that bedrock and Westbay monitoring wells be sampled on a quarterly basis and that overburden monitoring wells be sampled on a quarterly basis for the first four quarters and annually thereafter. Since the PCEMP was developed, certain modifications and reductions have been made to the sampling program with EPA's approval. Most recently, the frequency of groundwater monitoring was reduced from quarterly to semi-annually beginning with the March 2009 monitoring round. Water level measurements continue to be conducted on a quarterly basis.

The current sampling program includes a March sampling event and a more comprehensive September (annual) sampling event. The March events include the sampling of the recovery system components (bedrock extraction wells and shallow collection trench), eight conventional monitoring wells and multiple zones in two Westbay monitoring wells. The September events include the sampling of the recovery system components, 21 conventional monitoring wells, and multiple ports in 4 Westbay monitoring wells.

To date, a Post-Construction Baseline Groundwater Sampling Event report (OBG, 2000a) followed by quarterly groundwater monitoring reports through 2008, and semi-annual groundwater reports from 2009 through 2013 have been submitted. The Fall/Winter monitoring reports (Winter monitoring reports prior to 2009) are annual reports that provide additional discussion of historical data and data trends.

Active Collection System

The active collection system has been delivering contaminated groundwater to the treatment plant since startup in 1999. The bedrock cleanup goal identified in the ROD for the active collection system is the significant reduction in the mass of the bedrock contamination. Two criteria are used to evaluate this goal: (1) a concentration range of 1 to 10 ppm (1,000 to 10,000 ppb) of total VOCs; and/or (2) an asymptotic curve using groundwater monitoring data indicating that significant concentration reductions are no longer being achieved. Several bedrock monitoring wells serve as points of compliance and were established in the PCEMP. A summary of total VOC data for the points of compliance from 1999 through 2012 is presented in Table A3-2 (located in Attachment 3) and summarized below. Total VOC concentrations are based on totals provided in the Fall and Winter 2012 Monitoring Event report (OBG, 2013).

Point of compliance wells ECJ-1, GCA-1, MW-13, and MW-17 are located within the former disposal area on the downgradient side. In general, total VOC concentrations in most zones of Westbay monitoring well ECJ-1 and wells GCA-1, MW-13, and MW-17 have decreased since plant startup. Total VOC concentrations in ECJ-1(267), in the deep bedrock zone have

generally been higher over than past 5 years compared to the previous 9 years, but are consistently well below 1,000 ppb. Total VOC concentrations in ECJ-1(122) and ECJ-1(148) have fluctuated and periodically exceed 1,000 ppb, but have not exceeded 10,000 ppb since 2006. Similarly, total VOC concentrations in ECJ-1(37), ECJ-1(62), and ECJ-1(72) continue to fluctuate, but concentrations in ECJ-1(37) have not exceeded 1,000 ppb since 1999 and concentrations in ECJ-1(62) and ECJ-1(72) have not exceeded 1,000 ppb since 2008. Total VOC concentrations in well GCA-1 have been consistently between 100 and 300 ppb since 2003. Total VOC concentrations in wells MW-13 and MW-17 have shown concentrations below 10 ppb since 2002, with one exception. The total VOC concentration in well MW-13 in the fall of 2010 was 699 ppb (significantly higher than typical levels) and appears to be anomalous.

Point of compliance wells located within the former disposal area on the upgradient side include ECJ-3, MW-2, and MW-24. Total VOC concentrations in each zone of Westbay well ECJ-3 have generally been low and have been below 10 ppb since 2005. Total VOC concentrations in well MW-24 appeared to decrease following plant startup through the Winter 2004 round and have since shown an increasing trend, with concentrations ranging between 4,000 and 10,000 ppb over the past five years. Since MW-24 is located within the former disposal area, the apparent increasing trend does not indicate an off-site source or other concern. Total VOC concentrations in well MW-2 generally decreased through the spring 2006 round and have since shown a slight increasing trend, with concentrations ranging between 200 and 1,400 ppb over the past five years.

Point of compliance wells ECJ-2, MW-4, MW-5, and MW-6 are located outside of the former disposal area. As discussed elsewhere, Westbay well ECJ-2 experienced damage in mid-2009 and although some monitoring data has been collected since then, it is not considered reliable and therefore not presented or discussed in this data review. Prior to mid-2009, monitoring data has shown that total VOC concentrations in each zone of ECJ-2 have generally decreased significantly since plant startup. Total VOC concentrations in ECJ-2(117) decreased following plant startup but have appeared to increase since the winter 2005 round. Both ECJ-2(117) and ECJ-2(152) showed spikes in total VOC concentration over 10,000 ppb during the year prior to well failure. Total VOC concentrations in well MW-4 have appeared to fluctuate with no overall trend and concentrations have ranged between 800 and 2,500 ppb over the past 5 years. Total VOC concentrations in well MW-5 have been very low (less than 10 ppb) relative to other point of compliance wells since plant startup with no apparent increasing or decreasing trend. Total VOC concentrations in well MW-6 have decreased significantly since plant startup but have remained relatively steady over the past few years of monitoring.

For the most part, concentrations of total VOCs have decreased significantly since treatment plant startup conditions in 1999. However, continuation of the compliance monitoring set forth in the ROD in accordance with the PCEMP should continue. Special attention to any wells exhibiting increasing concentrations in total VOCs is warranted as data continues to be collected. Westbay well ECJ-2 should be repaired as soon as possible so that monitoring can continue at that point of compliance.

Passive Collection System

The objective of the passive collection system is to prevent degradation of the Unnamed Stream by collecting shallow contaminated groundwater. Cleanup levels are to be determined based on AWQC and the designated uses of the receiving waters. Compliance is measured at the

influent to the treatment plant. Quarterly groundwater monitoring includes collection of groundwater from the passive collection system for chemical analysis. In addition to the quarterly monitoring, the City of New Bedford has generally been sampling the collection trench groundwater for PCBs on a weekly to biweekly basis since March 2005 and at other frequencies prior to that time. To date, specific cleanup levels have not been defined for the passive collection system; however, cleanup levels will need to be determined in the future to assess compliance and determine whether continued operation of the passive collection system is warranted.

During the recent September 2012 monitoring round, groundwater from the shallow collection trench was analyzed for VOCs, PCBs, and metals and a summary of detected analytes is provided as Table A3-3 in Attachment 3. In general, levels of VOCs, PCBs, and metals have remained relatively consistent since treatment plant startup. SVOCs were last sampled in December 2008 and none were detected.

The passive collection system continues to collect shallow contaminated groundwater. Flow from the collection system is providing essential additional flow to the treatment plant to ensure continuous/semi-continuous operation. During dry weather periods and the resultant lower than expected flow rate from the passive collection system vault, the treatment plant has been operating intermittently.

5.3.1.3 Sediment Monitoring

Bi-annual sediment sampling was performed in September 2009 and September 2011 and additional supplemental sediment sampling was performed in June 2010. In 2009 and 2011, sediment samples were collected from the Unnamed Stream just upstream of Pond A, OU1 diversion swale, sedimentation basin, the Unnamed Stream just downstream of the Hathaway Road culvert, and from upstream of the former disposal area at the OU1 cap swale. Sediment samples were analyzed for PCBs, PAHs, TOC, metals, and percent solids. During the 2009 and 2011 sampling events, an additional sediment sample was collected from within a culvert pipe at the headwall just north of Hathaway Road and analyzed for PCBs, PAHs, and metals.

In 2009, two sediment samples exceeded the sediment target level of 20 ug PCB/g carbon, including the sediment sample from the sedimentation basin (45.16 ug PCB/g carbon) and the sediment sample from the Unnamed Stream just upstream of Pond A (50.48 ug PCB/g carbon). All other sediment samples from September 2009 showed concentrations below the sediment target level (OBG, 2010a). In order to further assess the 2009 sediment target level exceedances, these two locations were resampled in 2010. Ten samples were collected in the vicinity of each of these locations and analyzed for TOC, while one of the samples was also analyzed for PCBs. In addition both TOC and PCBs were analyzed on composites of 6 samples at each of the two locations. The normalized PCB concentrations for the composite samples were 0.96 ug PCB/g carbon and 0.53 ug PCB/g carbon for the sediment samples from the Unnamed Stream upstream of Pond A and the sedimentation basin, respectively, and were below the sediment target level.

In September 2011, all sediment samples showed normalized PCB concentrations below the sediment target level (OBG, 2012a).

During each of the 2009 and 2011 sediment sampling events, PAHs were detected at all sample

locations including the location upstream of the former disposal area at the OU1 cap swale. Concentrations of PAHs were generally highest in the sediment sample collected from just downstream of the Hathaway Road culvert. OBG has attributed the higher concentrations at this location to runoff from Hathaway Road. Similarly, several metals were detected in all sediment samples including the upstream samples from the OU1 cap swale. While the downstream metals concentrations were generally higher than the upstream metals concentrations, there do not appear to be any sharp upward trends between monitoring events. Also, the highest metals concentrations were not consistently detected at one sample location (OBG, 2010a and 2012a).

5.3.1.4 Surface Water Monitoring

Bi-annual surface water sampling was performed in September 2009 and September 2011. Surface water samples were generally collected from the Unnamed Stream, OU1 diversion swale, sedimentation basin, downstream of the Hathaway Road culvert, and OU1 cap swale (upstream location). The surface water samples were analyzed for VOCs, PAHs, PCBs, metals, and pH.

Generally, surface water data showed similar results for each of the two sampling events. PCBs were not detected in any surface water samples. Very low concentrations of VOCs, primarily chlorinated VOCs and benzene, were detected at multiple downstream locations with no increasing trends. Metals concentrations were generally similar between the two monitoring events. PAHs were not detected during the 2009 event but were detected in 2011 at the sampling locations just downstream of the Hathaway Road culvert and within the sedimentation basin (OBG, 2010a and 2012a).

5.3.1.5 Landfill Gas Monitoring

As described above, a full scale active landfill gas collection system has been operating since June 2004. Landfill gas monitoring is conducted on a quarterly basis in accordance with the Surface Water, Sediment, and Landfill Gas Monitoring Field Sampling Plan. During each event, the landfill gas monitoring wells along the perimeter of the landfill cap, the discharge stack of the gas extraction system, and ambient air in the vicinity of the gas extraction unit are screened for VOCs, methane, carbon dioxide, oxygen, and hydrogen sulfide. See Figure 4, provided in Attachment 1, for the locations of the landfill gas monitoring wells and discharge stack. Ambient air, along the fence line and within catch basins at the gas station (formerly Rosie's Restaurant) located next to the former disposal area, is also screened for landfill gases.

During the recent December 2012 monitoring event, VOCs and hydrogen sulfide were not detected in any of the gas monitoring wells. Methane was detected in four of the landfill gas monitoring wells located on the eastern side of the landfill cap at concentrations ranging from 2% to 29% of the lower explosive limit (LEL). The methane concentration at well GM-18 at 29% of the LEL is not in compliance with the Massachusetts Solid Waste regulations since methane was present at the property boundary above 25% LEL. As frequently occurs, one landfill gas monitoring well on the southern perimeter of the landfill cap was not monitored because the area around the wells was submerged with water. Methane was detected at the discharge stack of the landfill gas extraction system at a concentration greater than 100% of the LEL. As is typical of previous monitoring events, no methane, hydrogen sulfide, or VOCs were detected in ambient air around the gas extraction system or around the gas station. Indoor air was not

monitored at the adjacent gas station during the Winter 2012 event or previous events; methane was not detected in ambient air along the fence line or within catch basins on the gas station property (OBG, 2013).

Methane has typically been detected in one or more landfill gas monitoring wells at levels above 25% LEL. The following list summarizes the locations of these elevated methane levels for the past 8 monitoring rounds (2011 and 2012) as documented in the semi-annual monitoring reports (OBG, 2011, 2012a, 2012b, 2013):

Monitoring Date	Monitoring Wells Containing Methane at >25% LEL
March 2011	GM-2R, GM-3R, GM-5, GM-8, GM-10, GM-12
June 2011	None
September 2011	GM-17
December 2011	GM-17
March 2012	GM-2R, GM-3R, GM-16, GM-18
June 2012	GM-17
September 2012	GM-2R
December 2012	GM-18

As shown on Figure 4, gas monitoring well GM-2R through GM-12 are located closest to the southern (upper) leg of the gas collection header and GM-16 through GM-20 are located along the eastern property boundary near the northern (lower) leg of the gas collection header.

As discussed in Section 4.3.1.2, the landfill gas extraction system currently alternates between two modes of operation. For 60 minutes, vacuum is applied to both the upper and lower legs of the collection piping and then for 120 minutes, vacuum is applied only to the lower leg of the piping. For the majority of recent monitoring events, the mode of operation during which wells were monitored was not noted although greater attention was paid to this during the most recent monitoring round. While the elevated methane readings along the eastern property boundary are typical of previous years, the periodic elevated methane readings in wells GM-2R and GM-3R are not typical of the previous five-year review period. The periodic elevated methane readings in well GM-2R and GM-3R, in particular, call into question whether the current system operation is adequate to continuously control landfill gas levels at the property boundary in that area, since vacuum is no longer continuously applied to the upper leg of the collection piping. Further, the current monitoring procedure should be documented in the sampling plan to establish clarity and consistency with respect to when measurements are collected.

Between 2005 and 2009, gas monitoring wells GM-17, GM-18, GM-19, and GM-20 were piped directly to the lower leg of the gas collection system in an effort to improve landfill gas removal. Since these wells are now connected to the system, they are no longer appropriate as monitoring locations for assessing compliance with Massachusetts Solid Waste regulations at the property boundary. The reason for this is that when the system is in operation, landfill gas is drawn to these directly connected wells and it is expected that they would contain methane. Compliance should be determined using points which are not connected to the system and therefore, additional soil gas monitoring points should be installed just beyond directly connected monitoring wells. Once an appropriate perimeter monitoring network is in place, the monitoring data should be evaluated for compliance with the requirement that methane levels be maintained below 25% LEL at the property boundary.

5.3.1.6 Wetlands Monitoring

The biological and physical goals for wetland restoration in OU1 areas were modified to align with the goals established for the OU2 area. Therefore, monitoring for OU1 and OU2 areas was combined and the data was presented in single annual reports. A summary of the data review is provided in OU2 section below.

5.3.2 Operable Unit 2

5.3.2.1 Sediment and Soil Monitoring

Since the previous five-year review, sediment/wetland soil sampling was performed in June 2013 by EPA in order to meet monitoring requirements for OU2. Sediment samples were collected from four locations within the unnamed stream, within the area of OU2 impacted by the remedial action construction. At each unnamed stream location, four individual samples were collected and analyzed for TOC and then the sample with the TOC concentration closest to average was analyzed for PCBs. Normalized total PCB concentrations ranged from nondetect to 64 ug PCBs/g carbon. Two out of four sediment samples from the unnamed stream exceeded the sediment target level of 20 ug PCBs/g carbon, with PCB concentrations of 64 ug PCBs/g carbon (at 0.82% TOC) at location SDPC-2 and 32 ug PCBs/g carbon (at 2.58% TOC) at location SDPC-4. Compared to the previous monitoring round in 2006, location SDPC-2 had a lower unadjusted PCB concentration and a much lower TOC concentration in 2013 and location SDPC-4 had a higher unadjusted PCB concentration and a higher TOC concentration in 2013. Continued monitoring of sediments in the unnamed stream should be conducted to evaluate the protectiveness of the remedy and in particular to assess whether the PCB result for location SDPC-4 is indicative of greater impacts to the unnamed stream at that location.

Wetland soil samples were collected from four locations within non-aquatic plot areas in the Middle Marsh and two locations within the adjacent wetlands and analyzed for PCBs. PCBs were not detected in wetland soil samples from the adjacent wetlands. PCBs were detected at concentrations ranging from 0.12 to 0.93 mg/kg in the four Middle Marsh samples. All detected PCB concentrations were well below the 15 mg/kg total PCBs cleanup level.

Sediment and wetland soil results are provided in Attachment 3.

5.3.2.2 Surface Water Monitoring

Since the previous five-year review, surface water samples were collected in June 2013 by EPA from four locations within the unnamed stream and analyzed for PCBs and pH. PCBs were not detected above the detection limit in any of the samples collected.

Surface water results are provided in Attachment 3.

5.3.2.3 Wetlands Monitoring

Data has been submitted for wetland monitoring that occurred in 2011. Monitoring was conducted in the fall of 2011 by personnel from the City of New Bedford Department of Environmental Stewardship (CONB, 2012).

The data were collected and compared to the various biological and physical indicators that were established prior to remediation to monitor the progress towards reaching the goal of wetland restoration. The first two columns of the following table identify the goals that were established and described in the O&M Plan for OU2 (Dames & Moore, 1999) and subsequently adopted by OU1. Comments regarding the trajectory towards meeting these goals are provided in the third column. Refer to Figure 5, provided in Attachment 1, for the locations of the OU1 and OU2 wetland and stream restoration areas.

Wetland Attributes	Goals	Comments
	Biological Indicators	
Survival Rates of Planted Trees and Shrubs	At least 80% of the original number of plantings of each species should be viable five years after planting. The 80% may be comprised of both plantings and volunteers of the species.	At least 80% of the original number of plantings of each species do not appear to be viable five years after planting in some areas of the site, including the OU1 Mitigation Area West and the OU2 Middle Marsh northwestern and southeastern corners. In these areas, prevalence of extended surface saturation and/or abundant phragmites has likely decreased survival of planted woody species and favored herbaceous species. These observations are similar to those documented by 2005 data. In other areas, this attribute appears to be met.
Tree Growth	Mean tree height and diameter (dbh) for planted trees should increase at least 20% from the original planting height and dbh every 5-year interval.	Documentation that this criterion has been met is not complete, because height and dbh of all planted tree species was not well documented at the time of planting, or during the 2005 inspection. However, the 2011 data do document this data for current conditions,

Wetland Attributes	Goals	Comments
		and will provide a basis of comparison for the next five year event. Overall the data suggest that the intent of this goal is being met for most areas because a woody canopy layer has become well established, with the exception of the extreme northwestern and southeastern corners.
Vegetative Diversity	Demonstrate an ever increasing trend up from the 15 woody and 10 herbaceous planted species, by providing at least one additional woody and one additional herbaceous non-invasive wetland species every 5 years.	Addition of new plant species has slowed over the last five years, however the 2011 Wetland Monitoring Report (CONB, 2012) documents that there are many species present throughout both the OU1 and OU2 areas.
Plant Community	(a) Herbaceous, shrub, and woody relative cover at the end of the second growing season must achieve an overall 75% areal coverage of wetland plant species. (Also a Performance Standard) (b) To ensure the area continues to meet the federal wetland definition, greater than 50% of the dominant plants, exclusive of invasive species, should be wetland species.	Wetland species appear to cover at least 75% of the restored wetland areas in all plots but one. The one plot that was identified as not currently dominated by wetland species based on the 2011 data is OU1-STRM-1; this plot included unidentified herbs that were conservatively classified as upland. As a result, the herbaceous layer was classified as dominated by upland species. However, shrub and tree layers are dominated by wetland species and hydric soil indicators are present, suggesting that the herb layer will continue to accumulate additional wetland species. In addition, most of the plots met the criteria of greater than 50% dominance by non-invasive wetland plants. Although still

Wetland Attributes	Goals	Comments
		present at the site, invasive species are becoming less prevalent. In 2011, six of the plots included greater than 50% dominance by invasive wetland species, compared to 10 plots in 2005, which demonstrates a trend toward reduction in dominance by invasive species.
Mystic Valley Amphipod	The Mystic Valley Amphipod (MVA) must occur within areas of the Second Operable Unit by the end of the third year after wetland construction. (Also a Performance Standard)	The MVA was observed in the OU2 MM in 2003. No confirmation sampling has been performed to indicate the maintenance of this species in the wetlands; however, site conditions have remained stable over the 10-year period since the initial sampling.
	Physical Indicators	
Hummocks	Maintain greater than 25% mean areal coverage of hummocks in the sampling plots.	All six of the Middle Marsh plots were assessed for hummock coverage in 2011. For four of the six plots, the percent of hummocks was established at greater than 25%. Two of the plots, OU2-MM2 and OU2-MM 3, had only 15% hummock coverage and were observed to be in low, flat areas. OU2-MM3 is in an area documented as very wet prior to remediation, and most likely always had a low percent cover of hummocks. The OU-2 MM2 plot is an area that has been known to be a low, flat wet area since remediation efforts were completed. Although additional fill could be imported to create additional hummocks in this area, the benefit is not believed to

Wetland Attributes	Goals	Comments
		outweigh the impact to adjacent well-established areas with high cover of canopy woody vegetation. In addition, the plot data indicate that on average the Middle Marsh area does include greater than 25% coverage when viewed as a whole. No significant erosion has been noted over the 5-year period.
Hydrology	Groundwater and/or saturated soils should be within 12 inches of the wetland surface for two weeks in each piezometer in the restored wetlands at least three of every five years.	Two rounds of data have not been collected within a two-week period since the project's inception and it can't be confirmed that water levels have been within 12 inches of the wetland surface for two weeks. This attribute is intended to document that hydrology in the restored wetlands is sufficient to support wetland plants. Given the high percentage of wetland plants growing throughout the restored areas, sufficient hydrology has been qualitatively confirmed.
Soil Development	Soils from all ten borings should show a trend to meet the definition of hydric within 10 years.	Soil data indicates that hydric characteristics are present throughout the site, indicating a trajectory towards meeting the definition for a hydric soil in the future.

5.4 SITE INSPECTION

Site inspections of both Operable Units were conducted periodically by AECOM between the previous five-year review and September 2013. Inspection of the OU1 and OU2 portions of the site was conducted on May 16, 2013 and further inspection of the landfill cap and groundwater extraction and treatment system was conducted on June 19, 2013 as part of this five-year review. Inspection of the Unnamed Stream and OU1 and OU2 wetland restoration areas was attended by the EPA remedial project manager and community relations specialist, AECOM wetlands scientist and engineer, and the City of New Bedford Conservation Agent. Inspection of the remaining components of the site was attended by the EPA remedial project manager, MassDEP project manager, AECOM engineer, and included discussion with the treatment plant operations staff. The observations made during these site inspections were used to provide the necessary information for this five-year review. Site Inspection checklists and a photo log are provided in Attachment 4.

The overall current site conditions are that exposures to hazardous constituents remain under control due to completion of construction at the site and continued operation and maintenance activities for both Operable Units. Land uses at the site have not changed since the remedy was constructed. Although the institutional controls are not yet in place, there are no current uses of the site that violate the intent of the required institutional controls.

5.4.1 Operable Unit 1

Groundwater Extraction and Treatment System

The groundwater extraction and treatment system has been inspected by AECOM periodically since start-up in 1999. The most recent inspection was performed on June 19, 2013. The system was operating on the day of inspection.

Outstanding GWTP Operational Problems. The following are GWTP operational problems ongoing during the recent site inspections.

- The motor for bedrock extraction well BEI-1 broke and the well was not operational beginning in mid-April and still down as of June 19, 2013. A replacement pump had been received and needed to be installed. Further, one of the influent lines for BEI-1 ruptured and needed repair, although this does not prevent operation of the well since a second backup line is present.

On-Site Documents and Records

An interview and inspection of site documents and records at the GWTP indicate that the following documents are not up to date.

1. Site Specific Health and Safety Plan (HASP). The plant operators are using the HASP that was developed for construction activities during the Phase 1A Remedial Action, prepared by Harding Lawson and Associates, Inc. (HLA) in April 1998. According to Section 22.4 of the Groundwater Treatment Plant O&M Manual (OBG, August 2000) a site specific HASP must be prepared and reviewed and approved by a Certified Industrial Hygienist.

2. Groundwater Treatment Plant O&M Manual. The Groundwater Treatment Plant O&M Manual (OBG, August 2000) was located at the GWTP; however, the manual should be updated to reflect changes in equipment and operations and maintenance procedures based on several years of GWTP operation. An updated manual has been prepared and the PMC indicated that it will be distributed for review during the summer of 2013.

Landfill Gas Extraction System

The gas extraction system was inspected by AECOM periodically since start-up in June 2004. The most recent inspection of the landfill gas extraction system was performed on May 16, 2013. The system was not operating during the inspection, but plant operators indicated that it had been turned off briefly to perform maintenance and would be turned back on shortly. The system was operating during the June 19, 2013 inspection. A valve handle on the extraction system piping to gas monitoring well GM-19 was broken and stuck in the open position. Plant operators indicated that the valve handle was to be replaced.

Site Features (South of Hathaway Road)

Site features identified in the O&M Plan (Sullivan's Ledge Superfund Site, New Bedford, Massachusetts, Site Operations and Maintenance Plan, Feb. 2002) include the landfill cap, surveyed benchmarks, the access road, site security features, the gas venting system, run-on/run-off controls, and the lined portion of the Unnamed Stream. Site features related to OU1 have been periodically inspected by AECOM since the previous five-year review and most recently on May 16, 2013.

- **Landfill cap.** In general, the cap appeared to be well vegetated and mowing had recently been conducted. Tall woody vegetation and shrubs were observed in and around portions of the drainage swales, along the southern slope of the landfill cap on either side of the southern drainage swale, and along the western fence line. This vegetation should be cut down—which the City of New Bedford is in the process of arranging. An animal hole was observed along the western edge of the cap and should be addressed. A wet area was observed along the northern portion of the eastern fence line; however, it appears to be just outside the limits of the cap. There were no signs of erosion or slope instability on the cap. There were no signs of seepage during the May 16, 2013 inspection; however, during the June 19, 2013 inspection, seepage was observed at the northern edge of the site in the vicinity of gas monitoring well GM-15 and orange staining (due to high iron content) was observed on the sidewalk adjacent to Hathaway Road. EPA is currently discussing with the PRPs whether it is due to overland runoff or groundwater seepage and next steps.

- **Surveyed benchmarks.** No signs of damage and are all accounted for.

- **Run-on/run-off controls.** As noted above, vegetation within the drainage swales should be removed. Otherwise, the swales, catch basins, and Hathaway Road headwall appear to be in good condition.

- **Access road.** The landfill cap access road is in good condition.

- **Site security features.** Fencing, barb wire and locks are in good shape. A bent railing near the gate has no impact on the integrity of the fence or site security. No trespassing signs along the fence are present. Portions of the fence along the western site boundary were difficult to observe due to heavy vegetation, which should be cut down as discussed above.

- **Gas venting system.** All gas vents are in good shape. The gas monitoring well roadbox covers were not opened, however the roadboxes appear to be in good condition.

- **Lined portion of the Unnamed Stream.** The interior of the concrete pipe has not been inspected since its completion. The O&M Plan indicates it is to be inspected every 5 years. EPA is discussing the schedule for completion of the inspection with PMC.

Unnamed Stream and OU1 Wetland Areas

The following observations were made by AECOM during the May 2013 site inspection.

Invasive Species. Although individual purple loosestrife plants are sporadically present, this species is substantially reduced in presence in both the OU1 and OU2 Middle Marsh areas as compared to 2005. At all plants observed, beetle damage of foliage was observed, and/or beetles were directly observed on the plants. The beetles released in 2007 and 2008 appear to be successfully controlling purple loosestrife at the site. Invasive species are very low in cover, or absent, immediately adjacent to the unnamed Stream. Although milfoil was observed in the Unnamed Stream within Middle Marsh near the outlet of the stream at the pond, it was generally sporadically present and not observed to be forming dense mats of cover. Autumn olive (*Elaeagnus umbellata*) and cattail (*Typha latifolia*) were also sporadically observed, and should be monitored to ensure they do not expand to monotypic stands. If they do create such areas, control mechanisms should be implemented. Common reed (*Phragmites australis)* remains present at a high percent cover in the northwestern portion of Middle Marsh, and has extended its range to become the dominant species in the OU1 Middle Marsh Mitigation Area West. As discussed further below, it is recommended that phragmites in the mitigation area be controlled and further monitored.

Multiflora rose (*Rosa multiflora*) was observed to have increased in abundance along the area of the former OU1 diversion swale. It has increased cover to form a monotypic stand at both the upstream and downstream ends of the former diversion swale. It is recommended that the multiflora rose be removed in this area, and that desirable non-invasive woody plants be planted in these locations. Herbicide application is likely the most feasible means of removing multiflora rose in this area, due to the large size and expanse of the plants present.

OU1 Unnamed Stream. Sediment accumulated in the Unnamed Stream just upstream of the double box culvert has decreased substantially since the last five-year inspection. The CONB Conservation Agent, Sarah Porter, indicated that the City Department of Public Works (DPW) has been cleaning out the catch basins on Hathaway Road on a regular basis, the primary source of sediment. Some sediment was observed to be accumulating in the area between Hathaway Road and the box culvert, and it is suggested that this sediment be removed when

the DPW's schedule permits. The stream banks both upstream and downstream of the double box culverts contain significant shade trees due the presence of red maple (*Acer rubrum*), alder (*Alnus incana*), Bebb willow (*Salix bebbiana*) and sweet pepperbush (*Clethra alnifolia*), as well as a number of other species.

A portion of the wooden handrail along the bridge over the box culvert was broken and should be repaired. The rope fence protecting the restored wetlands was not in place along the Unnamed Stream banks just upstream of OU2 Middle Marsh. The rope should be re-installed. The metal handrail along the bridge where the Unnamed Stream enters OU2 Middle Marsh was absent and should be replaced.

OU1 Middle Marsh. A variety of wetland species were observed at the OU1 MM area, including speckled alder (*Alnus* sp.), jewelweed (*Impatiens capensis*), red osier dogwood (*Comus stolonifera*), red maple (*Acer rubrum*), and sedge species. The canopy cover in this area was lower than the OU2 MM area. Although purple loosestrife was present, *Galerucella* sp. beetles, or foliar damage, were observed on all plants inspected. As indicated above, an abundance of multiflora rose was observed at the eastern and western ends of the OU1 MM area, and appears to have expanded its coverage compared to the last five-year monitoring report. If left uncontrolled, this species may continue to spread in the OU1 MM area, with the potential of forming a monotypic stand and out-competing native wetland species currently present. It is recommended that the multiflora rose be removed to the extent possible, and that additional woody species be planted, such as red maple, willow, and speckled alder.

OU1 Ponds. Desirable wetland herbaceous plants and woody seedlings are present along the banks of the ponds, including willow, speckled alder, sensitive fern, sedges, and rushes. However, the rope fencing is no longer in place, and it appears that at times mowing has extended to the pond banks. The rope should be reestablished, and no mowing should occur on the pond side of the rope fence.

OU1 Mitigation Area East. The area contains a variety of herbaceous wetland species, with red osier dogwood and speckled alder the predominant shrubs present. Most shrubs are located in the eastern half of the area. The previous five-year report indicated that the western half of the mitigation area was consistently inundated with several inches of water preventing the growth of woody species. However, during the May 2013 site visit the western portion was observed to include a few shrubs, and appeared to be less wet than previously reported. A large tree has fallen into the mitigation area, providing habitat diversity. Overall, the area appeared to be functioning well as a wetland habitat. The rope fence adjacent to the Mitigation Area was absent and should be replaced.

OU1 Mitigation Area West. The area was observed to be dominated by phragmites, with very few shrubs remaining. In addition, trash was observed throughout the mitigation area, and an abundance of multiflora rose was observed on the edge of the wetland. The previous five-year report indicated that a small population of phragmites was present and should be treated during invasive species control events in 2008. It appears that control efforts were unsuccessful, and that phragmites has expanded in this area since the 2011 data was collected by the City of New Bedford. It is recommended that the phragmites be treated with an herbicide and that multiflora rose on the edge be controlled/removed on the wetland edge. After control measures are implemented for these invasive species, it is recommended that additional woody shrubs be

planted. In addition, it would be useful to extend/re-establish rope fencing in the area of the OU1 Mitigation Area West to discourage disposal of trash in and near the area.

5.4.2 Operable Unit 2

The following observations of OU2 wetlands areas were made by AECOM during the May 2013 site inspection.

Refer to the previous section for observations regarding invasive species in both OU1 and OU2.

OU2 Middle Marsh. The portion of the OU2 Middle Marsh to the east of the Unnamed Stream contains a smaller population of cattails and common reed as compared to previous years and a diverse emergent plant population exists. Common reed (*Phragmites australis*) remains in the northwestern and southeastern corners of the Middle Marsh, in the areas that are dominated by prolonged surface saturation, and is particularly abundant in the northwestern corner. However, this species appears to be primarily restricted to these two localities and is not prevalent in the Middle Marsh interior. In the southeastern corner, a number of non-invasive herbaceous species are interspersed with the common reed, including sensitive fern and jewelweed.

The woody coverage has increased and is adequate within the majority of the OU2 Middle Marsh area; a woody canopy layer is well-established. Bebb willow is abundant throughout the area, and red maple is also present in the canopy. The survivability of woody tree species should continue to be monitored in accordance with the O&M plan wetland attributes to assess the long-term trajectory of the restoration project. There was evidence of loosestrife beetle damage, and actual sightings of the beetles that were released in OU2 Middle Marsh.

OU2 Adjacent Wetland. This area has developed a substantial amount of woody vegetation since the last five-year report. A diverse emergent plant population also exists between the primary woody species (alder). Dominant species observed include bebb willow, speckled alder, and dogwood species.

5.5 INTERVIEWS

5.5.1 Operable Unit 1

A series of interview questions were developed for the PMC and City of New Bedford for OU1. Answers to the questions were provided in writing via electronic mail from Steve Wood of the PMC on July 19, 2013.

The PMC's overall impression of the project is good. When asked if the remedy is functioning as expected and how well the remedy is performing, the PMC responded that the remedy is working well. The PMC also stated that "*Significant reductions have been achieved in contaminates in recovery and monitoring wells. In fact, the Group and its consultants believe that the groundwater quality now satisfies the criteria for water treatment plant shut-down in the Consent Decree. The Group is requesting permission from EPA and DEP to shut down the treatment system and initiate a 3 year monitoring period to demonstrate that the clean-up criteria that have been achieved and can be maintained without the treatment plant operating. The Group is confident that the from the replacement monitoring well they are installing at EPA's request will be consistent with the low contaminant levels found elsewhere. If so, the Group hopes that EPA will promptly allow the Group and City to shut down the treatment plant and start the three-year monitoring period.*"

The PMC was asked if there have been unexpected O&M difficulties or costs at the site in the last five years and they indicated that there had been none. When asked if there have been opportunities to optimize O&M or sampling efforts and to describe changes and resultant or desired cost savings or improved efficiency, the PMC responded "*Yes. In the winter of 2010, the UV oxidation system was removed and replaced by an air stripper system. This resulted in less complex operations for the plant and a significant reduction in overall O&M costs due to elimination of expensive consumable parts and reduced electricity usage. No loss of performance was encountered in treatment of the discharge effluent which continues to meet the discharge limits.*"

The PMC replied affirmatively when asked whether the O&M activities are being performed consistently with the approved O&M and monitoring plans. When asked if there were any comments, suggestions, or recommendations regarding the project, the PMC responded "*Yes. As has been discussed previously testing of water quality in the shallow collection trench for a period of years has demonstrated it meets or is lower than the standards necessary to discharge to the City of New Bedford POTW. EPA has required that this water first be treated in the on-site treatment plant. Discussions have continued with EPA in this regard and the Group asks that EPA eliminate this unnecessary and expensive treatment step for the collection of trench water.*"

5.5.2 Operable Unit 2

A series of interview questions were developed for the City of New Bedford for OU2. Answers to the questions were provided in writing by Sarah Porter, New Bedford Conservation Agent, via electronic mail on July 2, 2013.

When asked about her overall impression of the project, Ms. Porter stated "*The overall impression is that a successful wetland restoration project was completed. A contaminated*

wetland was successfully remediated by removal of all of the contaminated soils and replacement with clean soils and new vegetation. The vegetation is extremely diverse as a result of plantings, natural succession, and overseeding with wetland seedmix. Invasive species were difficult to combat at first, but the middle marsh now has a healthy diversity of vegetation. It was important to combat invasive species at first with herbicide and biological control (for purple loosestrife). The soils also exhibit hydric soil characteristics which support the wetland vegetation."

When asked if the remedy is functioning as expected and how well the remedy is performing, Ms. Porter responded that "*The remedy is to have the wetland areas restored to forested wetland over time. The results of monitoring have shown they are on a trajectory to reaching a forested wetland with planted trees and colonizing willow on their way to forming a canopy over the site. The canopy will encourage the shading out of the invasive Phragmites australis and Lythrum salicaria. Invasive shrubs such as Rosa multiflora bordering the restoration areas may need to be addressed in the future."*

When asked if there have been unexpected O&M difficulties or costs at the site in the last five year, Ms. Porter stated that "*Continued costs associated with biological control were not expected. However, the costs were not excessive. Cleaning the outfall from Hathaway Road into the restoration area was also not anticipated but was accomplished using in-house personnel and equipment."*

When asked if there were any comments, suggestions, or recommendations regarding the project, Ms. Porter responded "*Yes, the maintenance of the upland meadow habitat bordering the ponds should be prevented from turning woody by an annual mowing of the areas in the late fall. The presence of tall woody vegetation provides a site distance problem for the golfers. The presence of upland meadow habitat adds to the diversity of habitats on the golf course and avoids the spread of the invasive Rosa multiflora which is the primary shrub taking over the upland areas surrounding the pond."*

Ms. Porter responded affirmatively that O&M and monitoring activities are being performed consistently with the approved O&M and monitoring plans and stated that any modifications have been approved by EPA.

When asked if the City plans to continue with invasive species management between now and the next schedules monitoring event in 2016, and if so, what the invasive species management would involve, Ms. Porter stated "*No, it would appear that the invasive species are on the decline in the wetland areas. We will never get rid of all of the invasive species but controlling their spread is the primary goal."*

When asked if there have been issues with access by golfers and golf course personnel to restored areas and how she would describe the status of coordination and co-operation with the golfing community, Ms. Porter responded "*At the moment, the golfers and golf course personnel would like to cut back the Rosa multiflora and some native vegetation such as speckled alder (Alnus rugosa) bordering the large pond because it blocks their site view. The golfers stay out of the restored areas. Most know not to trespass into the wetland areas which are also quite overgrown now, making access difficult in the restored areas to try and retrieve golf balls."*

SECTION 6.0
PROGRESS SINCE THE LAST REVIEW

This is the third five-year review for the site. This section presents the recommendations and follow-up actions identified in the second five-year review, followed by a summary of efforts since 2008 to address the recommendations and follow-up actions.

6.1 PROTECTIVENESS STATEMENT AND RECOMMENDATIONS FROM PRIOR FIVE-YEAR REVIEW

The following protectiveness statement was included in the second five-year review for OU1 and OU2:

The second five-year review concluded that the remedies for both OU1 and OU2 are currently protective of human health and the environment because the construction of the remedy is complete, and operation and maintenance and monitoring of the remedy is being performed. However, in order for the remedy to be protective in the long-term, the following actions need to be taken.

OU1

- Implement Institutional Controls;
- Continue to monitor the groundwater pump and treat operation effectiveness on controlling contaminant migration in order to comply with OU1 remedial action objectives (RAOs);
- Continue to monitor sediment concentrations and implement corrective actions if necessary;
- Continue to monitor landfill gas concentrations, assess non-compliance with ARARs and implement corrective actions if necessary; and
- Continue to implement Wetlands Operation and Maintenance Plan with special emphasis on controlling invasive and nuisance species in the wetlands and controlling sediment buildup within the Unnamed Stream near Hathaway Road and at the entrance to Pond A.

OU2

- Implement Institutional Controls;
- Continue to monitor sediment concentrations and implement corrective actions if necessary; and
- Implement Wetlands Operation and Maintenance Plan with special emphasis on controlling invasive and nuisance species in the wetlands.

6.2 PROGRESS SINCE LAST FIVE-YEAR REVIEW

6.2.1 OU1

Institutional Controls. Since 2008, the draft Grant of Environmental Restrictions (GER) has been agreed upon by the EPA, the Commonwealth of Massachusetts, and the PRPs. The current draft document will have language to address a potential solar project on the site. The draft document is in its final review and will be issued soon.

Groundwater Extraction System and Monitoring Performance. The groundwater treatment plant has been operational throughout this review period. Quarterly groundwater monitoring is conducted in order to evaluate progress toward meeting the ROD cleanup levels. A discussion of the sampling results is provided in Section 5.3.1.2. For the most part, concentrations of total VOCs have decreased significantly since treatment plant startup conditions in 1999. However, continuation of the compliance monitoring set forth in the ROD in accordance with the PCEMP should continue to monitor the effectiveness of the system over time.

The previous five-year review noted that steps had been taken to enhance the management of groundwater migration at the site, with focus on pumping more water from the bedrock extraction wells to achieve greater drawdown in the bedrock aquifer. Since 2008, the PMC and City of New Bedford have continued to conduct groundwater extraction and treatment and conducted quarterly groundwater elevation measurements for the purpose of evaluating the management of groundwater migration. There continue to be periods of extended downtime for individual bedrock extraction wells, which should be avoided as this can impact the management of migration of the bedrock groundwater plume. Evaluation of the performance of the system in terms of hydraulic control has not been well documented in the monitoring reports beyond providing groundwater elevation maps. Discussions are ongoing with the PMC and City of New Bedford regarding the proper target level for the shallow collection system and whether modifications are needed.

Landfill Gas Monitoring. Since the previous five-year review, the full-scale active landfill gas extraction system that was installed in 2004 has continued to operate. The landfill gas extraction system has generally been effective in reducing landfill gas levels along the perimeter of the cap, with the exception of the eastern perimeter and less frequently, the western perimeter, where one or more landfill gas monitoring wells generally exhibit methane levels above 25% LEL. The PMC has continued to take steps to reduce methane levels along the eastern perimeter of the cap. During the past 5 years, two additional monitoring wells along the eastern perimeter were directly connected to the collection system, so that four monitoring wells are now tied directly to the system, resulting in greater vacuum in that area.

Sediment Monitoring. Since the previous five-year review, bi-annual sediment sampling has been performed in September 2009 and September 2011, and additional supplemental sampling was performed in June 2010 as follow-up to the 2009 sampling event. A discussion of the sampling locations and results is provided in Section 5.3.1.3. In 2009, two sediment samples exceeded the sediment target level for PCBs. In order to further assess the 2009 sediment target level exceedances, these two locations were resampled in 2010. Ten samples were collected from each location and composites of several samples were analyzed for PCBs and TOC and the resulting normalized PCB concentrations were well below the sediment target

level. In September 2011, all sediment samples showed normalized PCB concentrations below the sediment target level. Based on the 2010 and 2011 sampling results, it appears overall there are not increased impacts from PCBs within the Unnamed Stream; however, sediment sampling should continue and future results evaluated.

Wetlands O&M. Monitoring was conducted in the fall of 2011 by personnel from the City of New Bedford Department of Environmental Stewardship, and this data was submitted in a January 2012 report (CONB, 2012). A discussion of biological and physical attributes and trajectory toward meeting them is provided in Section 5.3.2.3. Data has been submitted for wetland monitoring events that have occurred in 2011.

No additional invasive species controls have been implemented over the past five years. Previous efforts to control purple loosestrife by releasing *Galerucella* beetles were observed to be very successful, as substantially fewer purple loosestrife plants were observed and those observed included evidence of beetles and/or foliar damage. Recommendations to control sediment buildup within the Unnamed Stream near Hathaway Road and at the entrance to Pond A also appear to have been implemented and these measures were successful, as much less sediment was observed in both locations. However, multiflora rose appears to have expanded in the OU1 MM area of the former diversion swale, and common reed (*Phragmites*) appears to have expanded in the OU1 MM Mitigation Area West area. Significant effort has been expended by the OU1 and OU2 Settling Parties in controlling invasive species as part of their overall implementation of the O&M Plan. However, continued attendance to the invasive species populations is required going forward in these two areas, and planting of woody shrubs and saplings should occur after invasive species control measures are implemented.

6.2.2 OU2

Institutional Controls. Refer to the summary of progress provided under OU1.

Wetlands O&M. Refer to the summary of progress provided under OU1. Wetlands O&M has been performed jointly for OU1 and OU2.

Sediment Monitoring. Since the previous five-year review, unnamed stream sediment sampling was performed in June 2013. A discussion of the sampling locations and results is provided in Section 5.3.2.1. Two out of four sediment samples from the unnamed stream exceeded the sediment target level for PCBs in 2013. One of the samples had a lower unadjusted PCB concentration and the other had a higher unadjusted PCB concentration compared to the previous 2006 monitoring round. Sediment sampling should continue based on these results and future results evaluated.

SECTION 7.0
TECHNICAL ASSESSMENT

This section discusses the technical assessment of the remedy and provides answers to the three questions posed in EPA's Comprehensive Five-Year Review Guidance (June 2001).

7.1 QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

7.1.1 OU1

Yes, a review of documents, ARARs, risk assumptions and site inspection results indicates that the remedy has been constructed as intended by the ROD, as modified by the ESDs.

Institutional controls are in the process of being finalized for the site. EPA, the Commonwealth of Massachusetts, and the PRPs have drafted and agreed upon a Grant of Environmental Restrictions (GER) for the institutional controls for the site. The current draft document will have language added to address a potential solar project on the site. The draft document is in its final review and will be issued soon. Because there are no current uses of the site that violate the intent of the institutional controls, construction is complete, and O&M is being implemented, the short-term protectiveness of the remedy is not impacted.

The excavation of sediments and soils has been performed to comply with soil and sediment cleanup standards set in the ROD and the ESD, thus removing the source of contamination to sediment and surface water and reducing risk to human health and aquatic organisms. However, there continue to be periodic exceedances of sediment clean-up criteria for a limited number of sampling points during bi-annual sampling performed in OU1. Therefore, continued sediment sampling is necessary to monitor the effectiveness of the remedy.

Operation and maintenance of the cap, GWTP, and extraction system has been effective. When there have been operating issues in the groundwater treatment plant such as equipment failures or malfunctions, they have been addressed by the Settling Parties and the City of New Bedford. The Settling Parties should continue to conduct groundwater extraction and treatment and evaluate performance toward the goal of controlling contaminant migration. The continued evaluation of the performance of the system in terms of hydraulic control should be documented in the monitoring reports. Periods of extended downtime for individual bedrock extraction wells should be avoided as this can impact the management of migration of the bedrock groundwater plume. The monitoring reports should also include evaluation of the passive (shallow groundwater) collection system and whether it is performing as designed.

The Unnamed Stream, its banks, and the other OU1 wetland restoration areas were completed in accordance with the ROD and ESDs. Continued monitoring, maintenance, and replantings are necessary to check that the wetlands restoration effort satisfies the requirements of the site Wetlands Operation and Maintenance Plan. Coordination with the golf course is necessary to avoid impacts to golfing activities due to tall woody species along the Unnamed Stream as it passes through fairways. OU1 O&M activities have emphasized and should continue to emphasize the control of invasive species to facilitate the survival of wetlands plantings. In addition, the build-up of sediment in the Unnamed Stream both at Hathaway Road and the

entrance to the OU1 Pond should be monitored to maintain the design elevation of the streambed and should include continued attention to maintenance of the roadway and drainage system. Accumulated sediment could have the effect of altering flow patterns, increasing water temperature, and altering dissolved oxygen levels. The Mitigation Areas – East and West – were initially intended to be restored as forested wetlands; however, due to conflicts with golf course activities, EPA agreed to allow the creation of scrub-shrub wetlands as opposed to forested wetlands. The East Mitigation Area appears to be developing well as a scrub-shrub wetland habitat area, with pockets of emergent habitat present. However, the West Mitigation Area has become dominated by common reed, and a substantial amount of trash is present in the wetland. It is recommended that additional measures be implemented for the West Mitigation Area to improve the functions of the wetland habitat.

The migration of landfill gas in soil is being addressed. The OU1 Settling Parties installed and are operating a long-term active landfill gas collection system to prevent migration of landfill gas to off-site receptors. The landfill gas extraction system has generally been effective in reducing landfill gas levels along the perimeter of the cap; however, one or more landfill gas monitoring wells generally exhibit methane levels above 25% LEL. Further modification to the landfill gas extraction system may be needed in order to achieve compliance with ARARs (Massachusetts Solid Waste regulations). Since four gas monitoring wells have been directly connected to the lower leg of the gas collection system, they are no longer appropriate as monitoring locations for assessing compliance with ARARs (Massachusetts Solid Waste regulations) at the property boundary. Compliance should be determined using points which are not connected to the system and therefore, additional soil gas monitoring points should be installed just beyond directly connected monitoring wells. Once an appropriate perimeter monitoring network is in place, the monitoring data should be evaluated for compliance with the requirement that methane levels be maintained below 25% LEL at the property boundary. Continued operation of the landfill gas extraction system and monitoring of perimeter gas monitoring wells and nearby structures is necessary as a human health protectiveness measure.

7.1.2 OU2

Yes, a review of documents, ARARs, risk assumptions, and site inspection results indicates that the remedy is functioning as intended by the ROD. Sediment excavation and treatment has been performed to meet the site performance standards, thereby minimizing the risk to aquatic organisms. However, exceedances of sediment clean-up criteria have been noted for some monitoring points in the Unnamed Stream during the most recent monitoring event performed for OU2. Therefore, continued sediment sampling is necessary to monitor the effectiveness of the remedy.

Institutional controls are in the process of being finalized for the site, as described above for OU1. Because there are no current uses of the site that violate the intent of the institutional controls; construction is complete; and O&M is being implemented; the short-term protectiveness of the remedy is not impacted.

The OU2 wetland restoration areas have continued to develop over the past five years and overall are functioning well with woody canopy layers established in most areas, as well as a diverse herbaceous community of non-invasive wetland species. The OU2 Middle Marsh northwestern and southeastern corners remain lower in elevation, wetter, and with less microtopography diversity than the rest of Middle Marsh. In these areas, prevalence of

extended surface saturation has likely decreased survival of planted woody species and favored herbaceous species. These observations are similar to those documented by the previous five-year report. Although additional fill could be imported to raise the elevations in these areas, and additional plantings could occur, the benefit is not believed to outweigh the impact to adjacent well-established areas with high cover of canopy woody vegetation. In addition, the southeastern area appears to be supporting a more diverse herbaceous community than in the past. The northwestern area remains dominated by phragmites, as in past years.

Although the water level monitoring of wells and piezometers in the OU2 wetlands are inconclusive regarding the presence of wetland hydrology within 12 inches of the soil surface for two continuous weeks during the growing season, the presence of predominantly wetland species is a general indicator of appropriate wetland hydrology in accordance with the Operations and Maintenance Plan requirements.

There continue to be issues with access by golfers and by golf course personnel to restored areas, primarily in the area of the OU1 Ponds. Throughout the site, rope fences were absent and should be re-established.

The 2011 data and resulting 2012 monitoring report indicate that most of the wetland attribute goals have been reached. Although some goals have not been reached, overall the area appears to continue on a trajectory toward the ultimate goal of achieving a forested wetland ecosystem and in many areas a forested canopy is already fully-established.

7.2 QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS, AND REMEDIAL ACTION OBJECTIVES (RAOs) USED AT THE TIME OF REMEDY SELECTION STILL VALID?

Yes, as evaluated in this section, the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid for OU1 and OU2, since any changes since that time do not impact remedy protectiveness. In order to answer this question, OU1 and OU2 ROD ARARs were reviewed and the OU1 and OU2 risk assessments were revisited to evaluate the impact on remedy protectiveness of any changes in standards, toxicity factors, exposure assumptions, or site conditions.

7.2.1 Review of OU1/OU2 Risk Assessments and Toxicity Factors Serving as the Basis for the Remedies

An evaluation of changes in toxicity values and other contaminant characteristics, changes to the risk assessment methodology, and changes to exposure assumptions used in the human health and ecological risk assessments for the site was performed. The overall conclusion of this evaluation was that the OU1/OU2 remedies, as implemented, are protective of human health and the environment. A discussion of the results and conclusions of the evaluation are provided below.

7.2.1.1 Review of Human Health Risk Assessments

As discussed during the first and second five-year reviews (September 2003 and 2008, respectively), the Phase I and Phase II human health risk assessments (OU1; Ebasco 1987; 1989) and the human health risk assessment for Middle Marsh (OU2; M&E, 1991) were conducted using methodology which would partially comply with current EPA risk assessment guidance. The primary discrepancies between current guidance and previous guidance, as noted in the first and second five-year reviews and requiring re-evaluation during this five-year review, exist in the areas of toxicity values and exposure pathways. The following provides an evaluation of these discrepancies, based on changes that have occurred since 2008 (the date of the last five-year review), and their impact on the protectiveness of the remedy.

Changes in Exposure Pathways/Assumptions

OU1

The Phase I and Phase II human health risk assessments (Ebasco, 1987; 1989) evaluated an older child exposure scenario for the area south of Hathaway Road and the Unnamed Stream extending north of Hathaway Road (OU1). This scenario assumes that the site will be used, to some degree, for recreational purposes. No changes in land use have occurred on or near the site, and no changes are anticipated in the near future. Therefore, the land use assumptions used in the risk assessments continue to be valid for OU1. However, the implementation of institutional controls regulating land use is necessary to assure that land use changes resulting in more intense human exposures than under current conditions do not occur in the future.

The landfill cap and perimeter fencing remain intact, based on recent inspections. Because contamination is present beneath the cap, prevention of a complete exposure pathway between human receptors (e.g., trespassers) and subsurface contamination is necessary. Continued

maintenance of the landfill cap and perimeter fencing is required to assure that human exposure to the capped material does not occur.

The risk assessment also evaluated future residential groundwater use. The risk assessment assumed that groundwater was not currently used as a source of potable water, but may be used as a future resource. Unacceptable risk was estimated for this future exposure scenario using methods and exposure assumptions largely consistent with current guidance. Future use was the primary basis for the groundwater containment and institutional control components of the remedy. The groundwater collection and treatment system and the slurry wall are in place. Contaminant concentrations continue to be present in groundwater at levels that would be associated with unacceptable risk, should groundwater be used as a source of drinking water in the future. Once institutional controls are in place, the remedy will prevent the completion of an exposure pathway between future human receptors and groundwater contaminants.

In the risk assessment, the older child receptor was evaluated for exposures in a manner consistent with current EPA guidance. The exposure pathways evaluated include ingestion and dermal contact with soil and sediment, dermal contact with surface water while wading, and inhalation of volatile compounds and particulates. The method used to estimate dermal doses differs from the current method, but, overall, resulted in an overestimate of dermal risk. However, the exposure assumptions selected were, in general, lower than current recommended values resulting in an underestimate of risk. Because the remedy required the excavation of contaminated sediment and bi-annual monitoring of surface water and sediment for PCBs, PAHs, and metals, along with VOCs in surface water, post-remediation levels of contaminants in sediment and surface water are available and most appropriate to consider when evaluating remedy protectiveness. Therefore, to determine the risk and hazard associated with current recreational exposures, should they be occurring, an assessment of contaminant concentrations in surface water and sediment within OU1 using samples collected between 2009 and 2011 has been performed as documented in the following paragraph.

Current contaminant levels in OU1 surface water would not be associated with an elevated risk or hazard to humans because: (1) PCBs have not been detected; (2) detected VOCs (acetone, benzene, chlorobenzene, chloroform, cis-1,2-dichloroethene, and toluene) are present only at trace levels (0.1 to 2.15 ug/L) and would volatilize quickly from the skin, limiting dermal exposure; (3) total metals, though elevated in concentration up to 10-fold above upstream background levels, are poorly absorbed through the skin, again limiting dermal exposure; and (4) PAHs were detected at two downstream locations (three at SW-4 and one at SW-1) at concentrations (0.05 ug/L to 0.15 ug/L) that would not be associated with a level of concern for the dermal exposure pathway. For sediment, concentrations of noncarcinogenic PAHs range from 0.004 mg/kg to 3.6 mg/kg and levels of carcinogenic PAHs range from 0.016 mg/kg to 2.3 mg/kg. These PAH concentrations would be associated with a cancer risk of approximately 2E-05 and a hazard index of less than 0.01, based on a recreational exposure scenario. Sediment metal concentrations within OU1 exceed upstream concentrations, but generally fall within the range of levels typically seen in background sediments. Two metals of concern for human exposures are arsenic and lead which were detected at maximum sediment concentrations of 3.7 mg/kg and 230 mg/kg, respectively. The maximum detected arsenic concentration would be associated with a cancer risk slightly greater than 1E-06 and a noncarcinogenic hazard of less than 0.1, and the lead level is significantly less than that considered acceptable for a residential setting (400 mg/kg). Total PCBs were detected in on-site sediments at a maximum concentration of approximately 4.2 mg/kg, which would be associated with a cancer risk of

below 3E-06 and a noncarcinogenic hazard of less than 0.6 based on a recreational scenario. Therefore, implementation of the remedy for OU1 has resulted in surface water and sediment contaminant levels that are not of concern for human exposures, considering current land use.

OU2

As discussed in the first and second five-year reviews, the Phase I and Phase II human health risk assessments completed in 1987 and 1989, respectively, which evaluated portions of Middle Marsh, and the OU2 human health risk assessment (completed in 1991) evaluated older child trespasser and adult golfer scenarios for the area north of Hathaway Road. This area is currently part of or adjacent to the Whaling City Golf Course. This portion of the site will continue to be used as a golf course or for other recreational purposes in the foreseeable future. Therefore, the land use assumptions used in the risk assessments continue to be valid for OU2. However, the implementation of institutional controls regulating land use is necessary to assure that land use changes resulting in more intense human exposures than under current conditions do not occur in the future.

The older child exposure pathways evaluated included ingestion and dermal contact with soil and sediment, dermal contact with surface water while wading, and inhalation of volatile compounds and particulates. The same exposure assumptions used for the older child receptors at OU1 were applied to OU2. The adult receptor was evaluated for dermal contact with soil, sediment and surface water along with inhalation of volatile compounds and particulates. Contrary to current guidance, incidental ingestion of soil and sediment was not evaluated, resulting in an underestimate of risk. Consistent with OU1, the method used to estimate dermal doses differs from the current method, but overall, resulted in an overestimate of dermal risk. However, the exposure assumptions selected were, in general, lower than current recommended values resulting in an underestimate of risk. As discussed for OU1, current levels of contaminants in sediment and surface water are available and most appropriate to consider when evaluating remedy protectiveness. Therefore, to determine the risk and hazard associated with current recreational exposures, should they be occurring, an assessment of PCB concentrations in surface water and sediment within OU2 using samples collected in 2013 has been performed as documented in the following paragraph.

Surface water exposure pathways would not be associated with an elevated risk or hazard to humans because PCBs have not been detected. For sediment, total PCBs were detected in sediment at a maximum concentration of approximately 0.93 mg/kg, which would be associated with a cancer risk of less than 1E-06 and a noncarcinogenic hazard of 0.1 based on a recreational scenario. Therefore, implementation of the remedy for OU2 has resulted in surface water and sediment contaminant levels that are not of concern for human exposures, considering current land use.

Changes in Toxicity

Toxicity values have changed significantly since the human health risk assessments were prepared. Because a complete exposure pathway does not exist between site groundwater and human receptors for current site use, and the slurry wall, the groundwater collection system, and the soon-to-be-implemented institutional controls will prevent future exposure, changes in toxicity values of groundwater contaminants have not been evaluated for protectiveness.

Significant differences were noted in the cancer slope factors used in the human health risk assessments for PCBs, PAHs, and vinyl chloride during the first five-year review. In all cases, the toxicity values used in the OU1 and OU2 risk assessments were at least two-fold more conservative than the current value. As discussed in the second five-year review, a change that occurred since the first five-year review is the inclusion of an early-life cancer risk for compounds with a mutagenic mode of action, including PAHs and vinyl chloride. The early-life assessment can increase the cancer risk associated with exposure for older children by up to three-fold. However, this difference in toxicity does not affect remedy protectiveness since most of the affected areas have been capped, and current surface water and sediment sampling in areas where exposures could occur indicates acceptable concentrations. Other differences between historical and current toxicity values are minimal.

Summary and Conclusions Relative to Human Health Risks

Because OU1 soils are capped and groundwater extraction and treatment is underway, the remedy is protective of human health as long as the cap is maintained, migration of the groundwater plume is controlled, and institutional controls are implemented to prevent contact with contaminated groundwater and to assure that land use changes resulting in more intense human exposures than under current conditions do not occur in the future. Because PCB-contaminated sediments were removed and levels of contaminants in sediment and surface water remaining are not of concern for current human exposures, the remedy is also protective for the stream bed (OU1) and the area north of Hathaway Road (OU2). Overall, the remedy is considered to be protective of human health.

7.2.1.2 Review of Ecological Risk Assessments

As discussed for the human health risk assessments, the Phase I and Phase II ecological risk assessments (Ebasco 1987; 1989) and the ecological risk assessment for Middle Marsh (OU2; M&E, 1991) were conducted using methodology which would generally comply with current EPA risk assessment guidance. The primary discrepancies between current guidance and previous guidance, as noted in the first and second 5-year reviews, exist in the areas of benchmarks and toxicity values utilized. The following provides an evaluation of these discrepancies, based on changes that have occurred since 2008 (the date of the last 5-year review), and their impact on the protectiveness of the remedy for ecological receptors. Recent compliance monitoring data are also reviewed to evaluate the protectiveness of the remedy. There are no newly promulgated standards, relevant to the site, which bear on the protectiveness of the remedy.

<u>OU1</u>

OU1 consists of a 12-acre historic disposal area and the adjacent Unnamed Stream. The Unnamed Stream flows from the site underneath Hathaway Road and through the OU2 Middle Marsh and Adjacent Wetlands: OU1 includes the Unnamed Stream and sedimentation basin north of Hathaway Road. There are no major changes in site conditions or exposure assumptions on which the risk assessment was based that would result in increased exposure or risk. The principal contaminants of concern for ecological receptors in OU1 identified in the risk assessment were PCBs. Target cleanup levels, protective of ecological receptors, were established for the site for sediments, surface water and soils.

As discussed in the last 5 year review, backfilled stream sediments and wetland soils act as a

barrier between remaining contaminants (including PCBs) and potential aquatic and benthic receptors, thus creating an incomplete exposure pathway to aquatic and semi-aquatic organisms. The sediment cleanup level was established as 20 µg of PCBs per gram of carbon (µg/gC). This risk-based target level was developed based on potential risk to aquatic organisms and wildlife receptors. The cleanup level was estimated in the risk assessment using sediment partitioning and the ambient water quality criteria based on the protection of wildlife consuming aquatic organisms. PCB tissue concentrations estimated from direct exposure to PCB-contaminated sediments were also used in developing the risk-based target level of 20 µg/gC. Based on larger risk-based data sets from other sites in New England with aquatic habitats, this level of PCBs in sediments is expected to be protective of aquatic and semi-aquatic receptors.

Because contaminated sediment and soil has been removed or isolated, and the disposal area capped, the exposure pathway to surface water has also been eliminated for most of the area of OU1. The remaining area for potential aquatic or semi-aquatic receptors in OU1 is within the Unnamed Stream and the sedimentation basin north of Hathaway Road. During the sediment monitoring conducted between 2003 and 2008, total PCBs in OU1 were measured in sediments at a maximum concentration of approximately 3.5 mg/kg. As discussed in the previous five year review, monitored sediment PCB concentrations showed minor exceedances of the risk-based ecological target levels. To determine the ongoing risk to aquatic organisms and wildlife receptors an assessment of contaminant concentrations in sediment within OU1 using samples collected between 2009 and 2011 has been performed and is documented in the following paragraphs.

In 2009, five sediment samples were collected in OU1. The mean PCB concentration of 25.6 µg/gC, was just above the target of 20 µg/gC. The maximum detected concentration was 50.5 µg/gC. This sample at SD-1, and the sample at SD-3, both exceeded the target clean-up level of 20 µg/gC. Since both of these samples were associated with low TOC concentrations, these locations were resampled in 2010 to further evaluate the PCB/g carbon ratios at SD-1 and SD-3 in the unnamed stream. Ten samples were collected in the vicinity of each of these locations and analyzed for TOC, while one of the samples was also analyzed for PCBs. In addition both TOC and PCBs were analyzed on composites of 6 samples at SD-1 and SD-3. The mean TOC values were 13.1% and 15.5% for SD-1 and SD-3, respectively. These measurements indicate that although the TOC in the two samples from 2009 with exceedances of target PCBs were low, these measurements were within the expected range of TOC at these locations. However, the composite samples collected in 2010 had adjusted PCB values less than the target value of 20 µg/gC. In 2011, five sediment samples were collected as part of the routine monitoring program and the PCB concentrations at all locations were below the target level of 20 µg/gC. Similar to data from the previous five-year review, the monitored sediment PCB concentrations in 2009 showed minor exceedances of the risk-based ecological target levels. The monitored sediment PCB concentrations in 2010 and 2011 showed no exceedances of the risk-based ecological target levels. Therefore, the selected remedy is considered generally protective with regard to sediment; however, continued monitoring data should be evaluated to check compliance with the PCB clean-up goal. Since the average site-wide concentrations of PCBs in sediments are below the target level, the remedy continues to be protective of benthic organisms as well as aquatic and semi-aquatic organisms.

In surface water, the standard identified in the risk assessment and ROD was 0.014 µg/L total PCBs, based on the ambient water quality criteria for the protection of aquatic life. This

standard has not changed, with the 2012 National Recommended Water Quality Criteria (NRWQC, chronic) still set at 0.014 µg/L. Current contaminant levels in OU1 surface water would not be associated with an elevated risk or hazard to ecological receptors because PCBs have not been detected in surface water. During the most recent 2011 sampling event, PCBs were not detected at a detection limit of approximately 0.5 µg/L for each Aroclor, which is the lowest practicable detection limit.

Soils east of the stream channel were generally excavated to a depth of 2 to 6 feet and capped. East bank soils (both north and south of the car wash) were excavated to a depth of several feet and capped. Because the cap creates a barrier to the contaminated layer, the exposure pathway in soil is incomplete. Thus, the potential risk to terrestrial receptors is minimal and the remedy continues to be protective.

Although the method used to perform the ecological risk assessments differs from current methods and guidance, target clean-up levels and the selected remedy for OU1 appear to still be valid.

OU2

Similar to OU1, there are no major changes in site conditions or exposure assumptions on which the risk assessment was based that would result in increased exposure or risk to ecological receptors. The primary basis for action in OU2 was the risk related to ecological receptors from PCBs in sediments of Middle Marsh. As discussed in the previous five year review, the Phase I and Phase II investigations demonstrated that the primary source of contamination was the OU1 disposal area. Before the implementation of the remedial action, flood waters from the disposal area could transport contaminants downstream. Because the remedy at OU1 consisted of capping the upstream disposal area, and the remedy at OU2 consisted of excavating sediment from the Middle Marsh to the edge of the flood plain and restoring wetlands, the source of contaminants has been eliminated. Thus, flood water will no longer transport contaminants via surface water or sediment. Furthermore, the clean fill and wetland soil used to reconstruct the Middle Marsh and the Adjacent Wetland act as a barrier to any residual contaminants below the excavation area, effectively eliminating the exposure pathway into sediment pore water. Therefore, the selected remedy is protective of benthic organisms as well as aquatic and semi-aquatic organisms.

The mean sediment quality criterion (20 µg PCB/gC) was established as the cleanup level of aquatic areas in the Middle Marsh. The risk-based sediment/soil cleanup levels for non-aquatic areas in Middle Marsh and for the adjacent wetland were established using site specific food chain modeling and set at 15 mg/kg total PCBs to be protective of wildlife. As with OU1, the surface water standard of 0.014 µg/L was used, and is consistent with current water quality criteria.

As discussed for OU1, current levels of contaminants in sediment, wetland soil, and surface water are available and most appropriate to consider when evaluating remedy protectiveness. Since the last 5 Year Review, no exceedances of water and soil cleanup levels were detected in Middle Marsh or the Adjacent Wetlands (see Attachment 3, Tables A3-5 and A3-6). Exceedances of sediment clean-up criteria were noted for two of the monitoring points in Unnamed Stream during the most recent monitoring event performed for OU2 (see Attachment 3, Tables A3-3). The maximum PCB concentrations measured in sediments from the Unnamed

Stream were 0.53 mg/kg or 64 µg/gC (at 0.82% TOC) at SDPC-2 and 0.83 mg/kg or 32 µg/gC (at 2.59% TOC) at SDPC-4 , which are both above the 20 µg/gC cleanup level. However, during the same monitoring event in 2013, two other sediment samples from the Unnamed Stream (SDPC-1 and SDPC-3) contained PCB concentrations lower than the 20 µg/gC cleanup level. Although a limited number of exceedances of the selected sediment target level of 20 µg/gC, have been observed in the Unnamed Stream sediment, these were most often associated with very low TOC. No consistent pattern of increasing PCB concentrations has been observed for any locations in the Unnamed Stream and the PCB levels in the OU2 monitoring have remained below 1 ppm total PCBs, which indicates that the remedy remains protective. Continued monitoring of sediments in OU2 should be conducted to continue to evaluate the protectiveness of the remedy.

The maximum concentration of total PCBs in non-aquatic soil/sediment samples from the Middle Marsh and Adjacent Wetlands for monitoring data from 2013 were all below the cleanup level of 15 ppm. The maximum concentration of total PCBs in wetland soils was less than 1 ppm, indicating that the remedy is protective for non-aquatic soils/sediments.

Similar to OU1, contaminant levels in surface water measured for OU2 would not be associated with an elevated risk or hazard to ecological receptors because PCBs have not been detected in surface water. During the most recent 2013 sampling event, PCBs were not detected at a detection limit of 0.29 µg/L for each Aroclor, which is the lowest practicable detection limit.

Based on removal of contaminated sediments in Middle Marsh and wetland soils, and the capping of the upstream disposal area in OU1, the source of PCBs for exposure of ecological receptors has been eliminated. Monitoring data since 2002 have indicated that the total PCB concentrations in the surface water and sediment/soils of OU2 are generally meeting the levels established to be protective of ecological receptors, although individual sediment samples have at times exceeded the sediment cleanup level on a total carbon basis. Continued monitoring is recommended to continue to evaluate the protectiveness of the remedy.

Summary and Conclusions Relative to Ecological Risks

In conclusion, although the method used to perform the Ecological Risk Assessments differs from current methods and guidance, target clean-up levels and the selected remedies for OU1 and OU2 appear to be protective. The remedies implemented adequately address the risk to ecological receptors, and monitoring data indicate that the current concentrations of contaminants in site media are meeting levels protective of ecological receptors on the site.

7.2.2 ARARs Review

A review of Applicable or Relevant and Appropriate Requirements was performed to check the impact on the remedy of changes in standards that were identified as ARARs in the ROD, newly promulgated standards for chemicals of potential concern, and TBCs (to be considered) that may affect the protectiveness of the remedy. The tables in Attachment 5 provide the review. The review is summarized below.

OU1

The 1989 ROD for OU1 (USEPA, 1989) set forth the following ARARs for the selected remedy:

- Safe Drinking Water Act
- Toxic Substances Control Act (TSCA)
- Resource Conservation and Recovery Act (RCRA)
- Clean Water Act (CWA)
- Clean Air Act (CAA)
- Occupational Safety and Health Administration (OSHA)
- U.S. Department of Transportation
- 310 CMR 22.00 - Massachusetts Drinking Water Regulations
- 314 CMR 6.00 - Massachusetts Groundwater Quality Standards
- 310 CMR 30.00 - Massachusetts Hazardous Waste Management Regulations
- 314 CMR 8.00 - Massachusetts Supplemental Requirements for Hazardous Waste Management Facilities
- 314 CMR 4.00 - Massachusetts Surface Water Quality Standards
- 310 CMR 10.00 - Massachusetts Wetlands Protection Regulations
- 310 CMR 6.00 - Massachusetts Ambient Air Quality Standards
- 454 CMR 21.000 - Massachusetts Right to Know Regulations
- 310 CMR 7.00 - Massachusetts Air Pollution Control Regulations

In addition, Executive Order 11988 (Floodplain Management), Executive Order 11990 (Protection of Wetlands), and Interim Sediment Quality Criteria were identified in the ROD as To Be Considered (TBC).

Table A5-1 of Attachment 5 provides an evaluation of ARARs for OU1 using the regulations and requirement synopses listed in the ROD as a basis. The evaluation includes a determination of whether the regulation is currently ARAR or TBC and whether the requirements have been met.

As indicated in the previous five-year reviews, the Massachusetts Solid Waste Management Regulations (310 CMR 19.117, 19.132(4), and 19.150) were not included in the ROD, but are now considered applicable because they provide a means to detect, monitor, and address landfill gas at property boundaries at concentrations greater than 25% LEL. These regulations require that the MassDEP be notified when concentrations of landfill gases at the property boundary are measured above 25% LEL. They also mandate the control of landfill gases to concentrations less than 25% LEL to prevent public health and safety concerns. These ARARs were the topic of the ESD issued by EPA on September 29, 2003. Since the ESD was issued, an active landfill gas extraction system has been implemented at the site and quarterly landfill gas monitoring is conducted in order to evaluate the effectiveness of the system in controlling landfill gas migration.

The requirements of many of the ARARs identified in the ROD were met during remedy construction.

OU2

The 1991 ROD for OU2 (USEPA, 1991) set forth the following ARARs for the selected remedy:

Location-specific:

- Clean Water Act (CWA)
- Executive Order 11988 (Floodplain Management)
- Executive Order 11990 (Protection of Wetlands)
- Fish and Wildlife Coordination Act
- Resource Conservation and Recovery Act (RCRA)
- 990 CMR 1.00 - Hazardous Waste Facility Siting Regulations
- 310 CMR 10.00 - Massachusetts Wetlands Protection Act Regulations
- 321 CMR 10.00 - Massachusetts Endangered Species Act Regulations

Action-specific:

- Clean Water Act (CWA)
- Executive Order 11988 (Floodplain Management)
- Executive Order 11990 (Protection of Wetlands)
- Fish and Wildlife Coordination Act
- Toxic Substances Control Act (TSCA)
- Clean Air Act (CAA)
- Federal Noise Control Act
- 314 CMR 4.00 - Massachusetts Surface Water Quality Standards
- 310 CMR 10.00 - Massachusetts Wetlands Protection Act Regulations
- 321 CMR 9.00 - Massachusetts Endangered Wildlife and Wild Plants Regulations
- 314 CMR 9.00 - Massachusetts Certification for Dredging, Dredged Material Disposal, and Filling in Waters
- 314 CMR 8.00 - Massachusetts Supplemental Requirements for Hazardous Waste Management Facilities
- 310 CMR 30.00 - Massachusetts Hazardous Waste Management Regulations
- 310 CMR 6.00 - Massachusetts Ambient Air Quality Standards
- 310 CMR 7.00 - Massachusetts Air Pollution Control Regulations

Additional policies, criteria, and guidance were identified in the ROD as TBC, including:

- Massachusetts Wetlands Protection Policy 90-2
- TSCA Subpart G PCB Spill Cleanup Policy
- Interim Sediment Quality Criteria, Massachusetts Allowable Ambient Air Limits - Annual (AALs) and Massachusetts Threshold Effects Exposure Levels (TELs)
- Guidance on Remedial Actions for Superfund Sites with PCB Contamination
- EPA Interim Policy for Planning and Implementing CERCLA Response Actions

Tables A5-2 and A5-3 of Attachment 5 provide an evaluation of location-specific and action-specific ARARs for OU2 using the regulations, requirement synopses, and descriptions of actions to be taken that were listed in the ROD as a basis. The evaluation includes a determination of whether the regulation is currently ARAR or TBC and whether the requirements

have been met. In some cases, the description of actions to be taken to attain the location-specific ARARs differed for the selected and contingency remedies. In these cases, both descriptions were provided in Table A5-3.

7.2.3 Overall Answer to Question B

In general, a review of ARARs and risk information that were the basis of the OU1 and OU2 remedies indicates that there were no changes that would impact the protectiveness of the remedies.

7.3 QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT COULD CALL INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?

7.3.1 OU1

No, since the previous five-year review, no information has come to light that could call into question the protectiveness of the remedy.

7.3.2 OU2

No, since the previous five-year review, no information has come to light that could call into question the protectiveness of the remedy.

SECTION 8.0
ISSUES

Based on the activities conducted during this Five-Year Review, the issues identified in Table 3 have been noted.

Table 3: Issues

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
OU1 Implement Institutional Controls.	N	Y
The landfill gas monitoring, collection, and extraction system may require modification to ensure it is meeting its objectives.	N	Y
Bedrock groundwater compliance monitoring well ECJ-2 is damaged and needs replacement in order to assess compliance with cleanup levels for the active extraction system.	N	Y
Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.	N	Y
OU2 Implement Institutional Controls.	N	Y
Monitoring of sediments has indicated some PCB concentrations above the TOC normalized clean-up levels, while an equal number have been found below the cleanup levels. Further monitoring is warranted.	N	Y

SECTION 9.0
RECOMMENDATIONS AND FOLLOW-UP ACTIONS

In response to the issues noted above, it is recommended that the actions listed in Table 4 be taken:

Table 4: Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
OU1 Institutional Controls	Finalization of Institutional Controls.	MassDEP & EPA & City of New Bedford	EPA/ MassDEP	2013	N	Y
Landfill gas migration	Monitoring of landfill gas will continue with objective to ensure gas is not migrating beyond the boundaries of the landfill. Monitoring points shall be capable of yielding representative air samples for analysis and consist of a sufficient number of wells properly located to detect the presence and migration of landfill gases. The sampling plan should be updated to reflect the most current monitoring procedures. Corrective actions to the monitoring, extraction, and collection system will be taken if necessary.	OU I Settling Parties	EPA/ MassDEP	quarterly basis	N	Y

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
Compliance monitoring well ECJ-2	Replace multi-port bedrock groundwater monitoring well ECJ – 2.	OU I Settling Parties	EPA/ MassDEP	2013	N	Y
Potential intermittent seepage	Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.	OU I Settling Parties	EPA/ MassDEP	2013	N	Y
OU2 Institutional Controls	Finalization of Institutional Controls.	MassDEP, EPA, & City of New Bedford	EPA/ MassDEP	2013	N	Y
Sediment PCB concentrations	Continue to monitor and implement corrective actions if needed.	AVX Corporation & City of New Bedford (OU2 Settling Parties)	EPA/ MassDEP	2016	N	Y

SECTION 10.0
PROTECTIVENESS STATEMENT

Because the remedial actions undertaken at the Site are protective in the short-term, the Site is protective of human health and the environment in the short-term. However, in order to be protective in the long-term following actions need to be taken:

OU1

- Implement Institutional Controls;
- Monitor and correct landfill gas levels of concern and modify monitoring and extraction system as necessary;
- Replace bedrock monitoring well ECJ-2; and
- Potential intermittent seepage noted at cap during inspection will be investigated and corrected as appropriate.

OU2

- Implement Institutional Controls and
- Monitor PCB concentrations in sediment for comparison to cleanup levels.

SECTION 11.0
NEXT REVIEW

The next Five-Year Review for the site is scheduled to begin on March 30, 2018 and to be signed in September 2018, five years after the signature date of this five-year review.

ATTACHMENT 1
SITE MAPS

FIGURE 1.
SITE LOCATION MAP
SULLIVANS LEDGE SITE
NEW BEDFORD MASSACHUSETTS

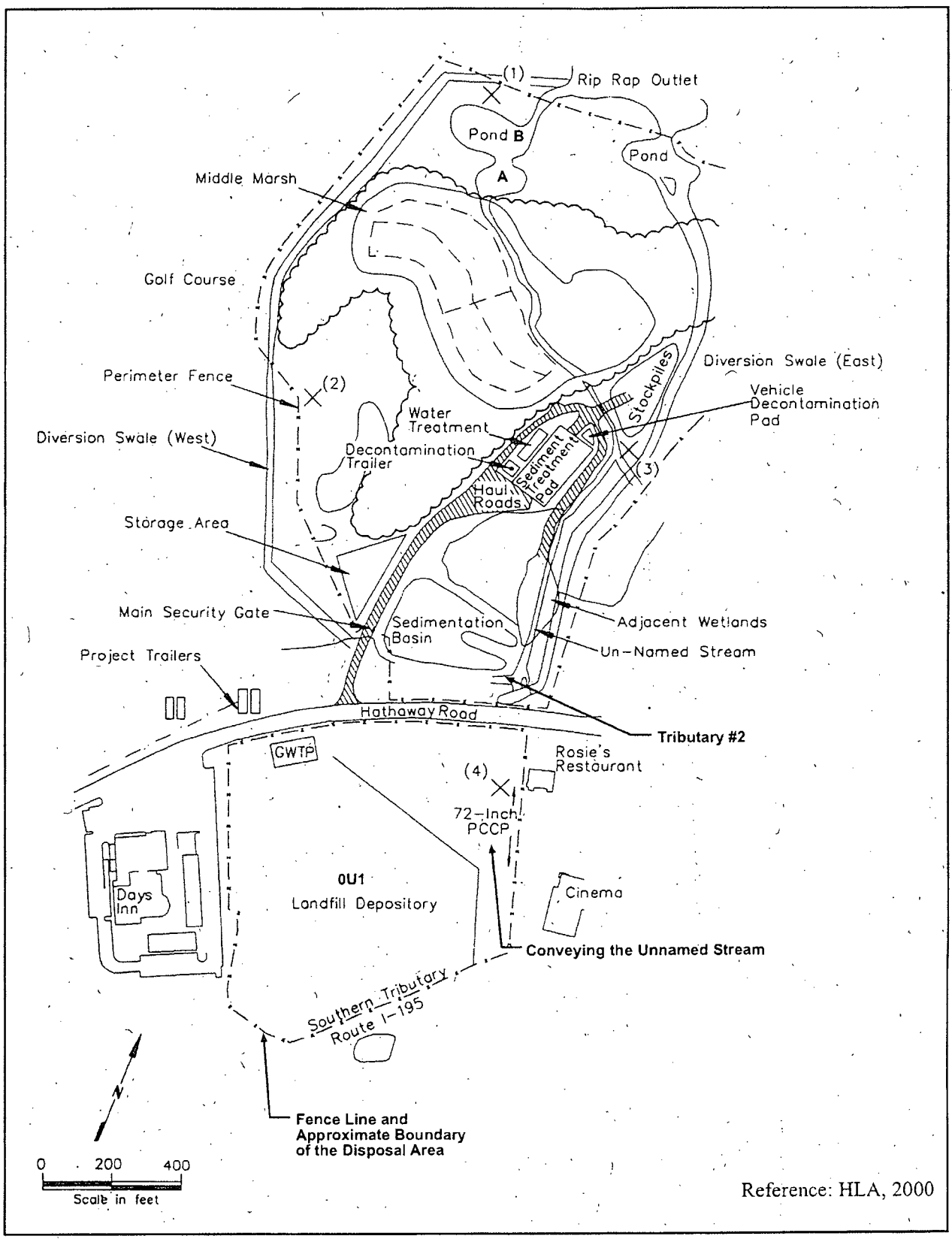

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FIGURE 2. SITE PLAN
SULLIVAN'S LEDGE SUPERFUND SITE
NEW BEDFORD, MASSACHUSETTS

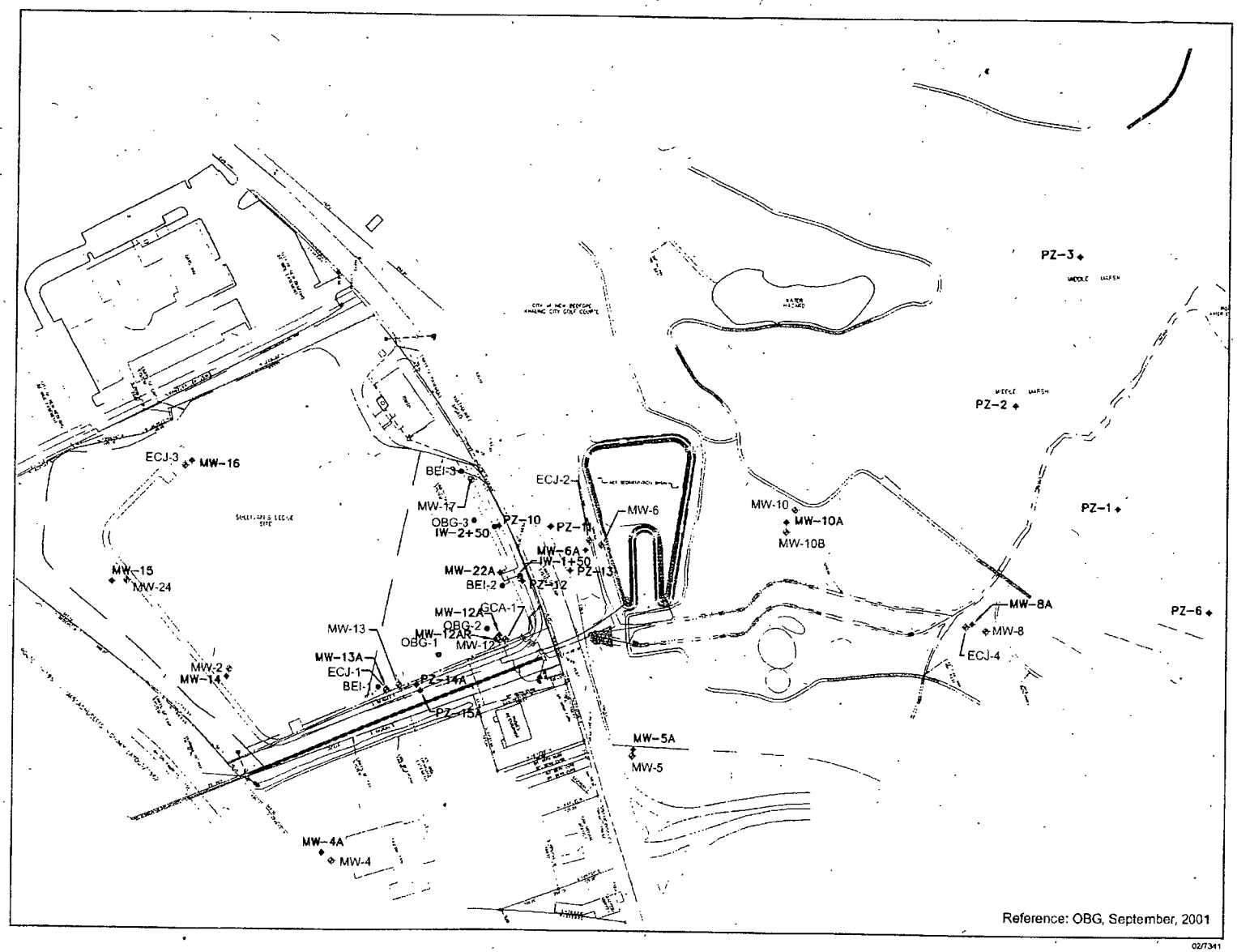
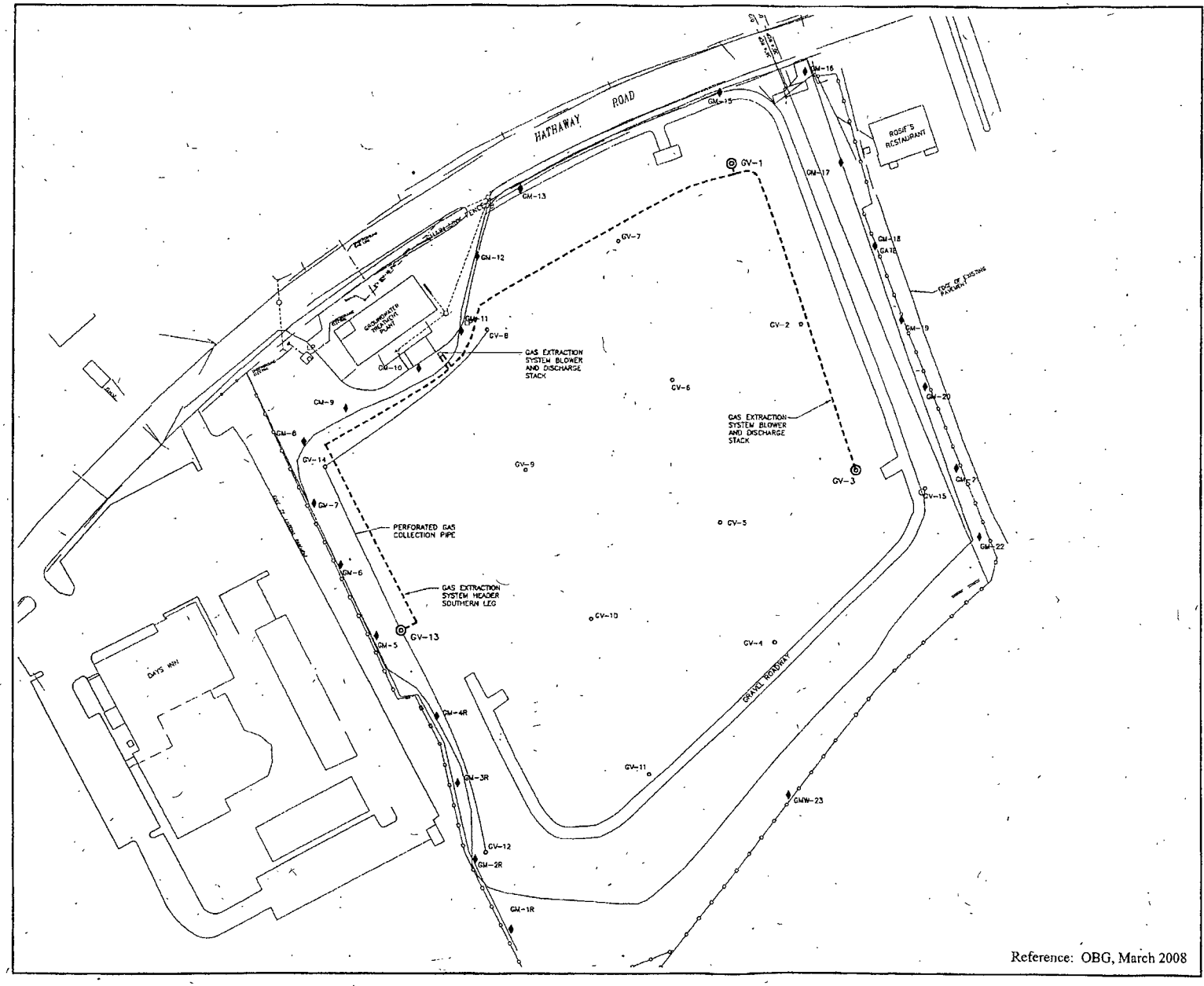


FIGURE 3.
GROUNDWATER WELL LOCATIONS
SULLIVAN'S LEDGE SUPERFUND SITE
NEW BEDFORD, MASSACHUSETTS



Reference: OBG, March 2008

LEGEND

- GV-15 PASSIVE GAS VENT
- GM-22 GAS MONITORING WELL
- GV-3 GAS VENT MODIFIED INTO A GAS EXTRACTION WELL
- PVC GAS EXTRACTION PIPE HEADER SYSTEM
- PROPERTY BOUNDARY
- LIMITS OF CAP

0 120 240
SCALE IN FEET

FIGURE 4.
LANDFILL GAS VENT AND MONITORING WELL LOCATIONS
SULLIVAN'S LEDGE SUPERFUND SITE
NEW BEDFORD, MASSACHUSETTS

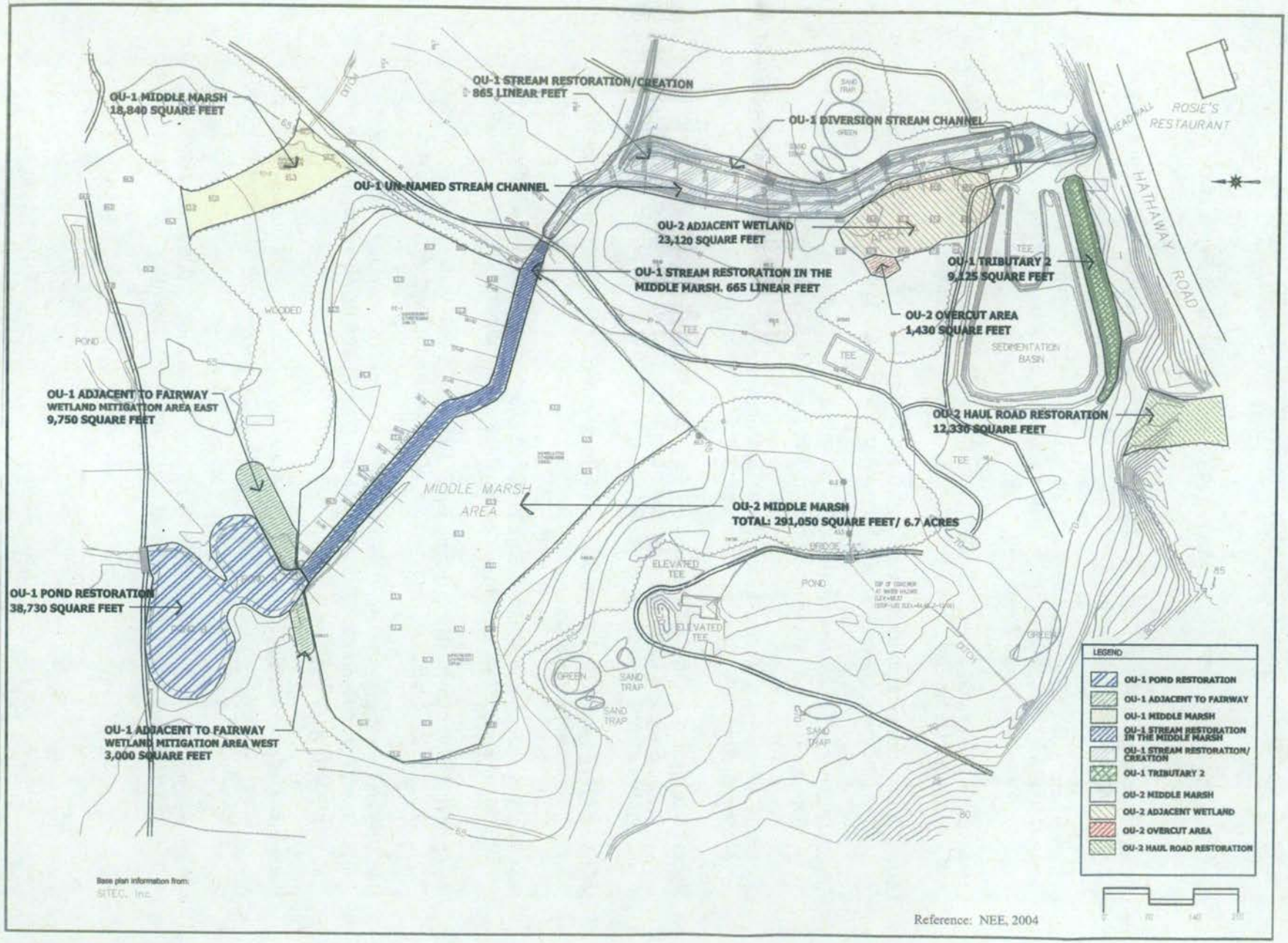


FIGURE 5.
OU1 AND OU2 WETLAND RESTORATION AREAS
SULLIVAN'S LEDGE SUPERFUND SITE
NEW BEDFORD, MASSACHUSETTS

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ATTACHMENT 3
MONITORING DATA

Table A3-1
Comparison of Groundwater Treatment Plant Effluent Data to City of New Bedford Pretreatment Discharge Limitations

	Effluent Sample from 4/3/13 (mg/l)	City of New Bedford Pretreatment Discharge Limitations (mg/l)
Volatile Organic Compounds[1]		
Acrolein	0.020 U	4.0
Benzene	0.018	(2)
Chlorobenzene	0.021	(2)
Chloromethane	0.005 U	(2)
1,3-Dichlorobenzene	0.0074	(2)
1,4-Dichlorobenzene	0.013	(2)
cis-1,2-Dichloroethene	1.2	(2)
Toluene	0.020	(2)
Trichloroethene	0.0098	(2)
Vinyl chloride	0.010	(2)
Polychlorinated Biphenyls		
Aroclor 1016	0.004 U	0.005
Aroclor 1221	0.004 U	0.005
Aroclor 1232	0.004 U	0.005
Aroclor 1242	0.004 U	0.005
Aroclor 1248	0.004 U	0.005
Aroclor 1254	0.004 U	0.005
Aroclor 1260	0.004 U	0.005
Metals		
Arsenic	0.005 U	1.4
Cadmium	0.002 U	1.2
Chromium	0.002 U	5
Copper	0.002 U	4.5
Lead	0.002 U	0.6
Mercury	0.0002 U	0.01
Magnesium	10	(3)
Nickel	0.0037	2.1
Silver	0.002 U	0.5
Zinc	0.0034	3.5
Cyanide	0.063	1.9

Notes:
1. Only VOCs which were detected or for which there is a discharge limitation have been presented.
2. Total toxic organics (TTO) less than 2.0 mg/l limit.
3. There is no pretreatment discharge limitation for magnesium.

NA - Not Analyzed

References:
1. City of New Bedford's April 2013 Monthly GWTP Report (CONB, 2013)
2. Groundwater Treatment Plant O&M Manual (OBG, 2000b)

Table A3-2
OU-1 Active Recovery System
Points of Compliance - Bedrock Monitoring Wells

Well	Well Screen Location	Total Volatile Organic Compounds (ug/L)										
		Winter 1999	Spring 2001	Summer 2001	Fall 2001	Winter 2001	Spring 2002	Summer 2002	Fall 2002	Winter 2002	Spring 2003	Summer 2003
ECJ-1 (37)	Shallow Bedrock	2,297.6	109.0	64.0	83.0	64.0	64.2	53.2	46.1	37.4	20.3	45.9
ECJ-1 (62)	Shallow Bedrock	72,950.1	9,410	5,383	3,180	1,860	1,164.5	2,017.3	1,505	1,060	1,350	1,120
ECJ-1 (72)	Shallow Bedrock	145,337.1	26,780	37,050	38,330	41,770	66,900	60,690	56,710	33,550	60,800	77,200
ECJ-1 (122)	Intermediate Bedrock	71,911.5	8,532	8,220	6,670	13,263	42,400	8,155	32,760	10,937	6,290	6,570
ECJ-1 (148)	Intermediate Bedrock	36,477.2	74,600	104,600	16,270	18,520	49,550	36,390	71,750	34,900	33,180	27,000
ECJ-1 (267)	Deep Bedrock	106.5	52.1	39.8	37.5	52.5	-	-	-	39.5	-	-
ECJ-2(47)	Shallow Bedrock	2,533	1,920	2,468	1,511	2,171	1,150	2,130	3,167	2,970	1,690	2,530
ECJ-2(82)	Intermediate Bedrock	15,942	16,080	23,990	15,740	18,810	23,470	27,060	22,840	21,200	14,400	13,100
ECJ-2(117)	Intermediate Bedrock	55,380	29,730	51,600	37,600	48,800	31,680	31,800	27,610	29,600	35,410	38,800
ECJ-2(152)	Intermediate Bedrock	400.4	4,594	6,180	11,330	19,570	18,840	38,640	46,030	58,500	62,100	89,300
ECJ-2(187)	Deep Bedrock	3,605.8	4,440	76.4	43,460	5,200	19,220	2,011	29,191	80,240	24,610	25,480
ECJ-3(51)	Shallow Bedrock	-	15.0	ND	12.0	0.6	-	-	-	ND	-	-
ECJ-3(91)	Shallow Bedrock	-	ND	1.0	ND	1.1	-	-	-	ND	-	-
ECJ-3(126)	Intermediate Bedrock	-	ND	1.0	0.9	1.2	-	-	-	ND	-	-
ECJ-3(146)	Intermediate Bedrock	-	-	-	ND	ND	-	-	-	ND	-	-
MW-2	Shallow Bedrock	3,440	2,181	905	1,139	963	1,003	1,163	1,257	1,205	1,349	403.6
MW-12	Shallow Bedrock	106.1	-	-	-	-	-	-	-	-	-	-
MW-13	Shallow Bedrock	991.6	7.1	2.1	13.1	26.9	-	-	-	10.5	-	-
MW-17	Shallow Bedrock	36.4	1.2	20.2	18.4	28.8	-	-	-	0.6	-	
MW-24	Shallow Bedrock	3,843.3	6,530	3,480	6,370	6,040	4,600	3,145	6,052	5,600	3,640	3,860
GCA-1	Shallow Bedrock	13,946.0	172.9	229.6	321.9	284.5	960.0	300.7	822.3	1,054	269.1	207.1
MW-4	Shallow Bedrock	1,271.9	1,034.2	1,113.2	1,149	753.9	1,260	1,193	1,393	1,078	912.4	1,664.5
MW-5	Shallow Bedrock	ND	6.8	3.6	3.9	3.6	-	-	-	2.0	-	-
MW-6	Shallow Bedrock	4,837.2	2,950	3,998	2,137	4,533	4,728	6,081	9,469	6,100	4,000	4,725

Notes
- = Not sampled
ND = Not detected above detection limits
Reference: OBG, 2013

Table A3-2
OU-1 Active Recovery System
Points of Compliance - Bedrock Monitoring Wells

Well	Well Screen Location	Total Volatile Organic Compounds (ug/L)										
		Fall 2003	Winter 2003	Spring 2004	Summer 2004	Fall 2004	Winter 2004	Spring 2005	Summer 2005	Fall 2005	Winter 2005	Spring 2006
ECJ-1 (37)	Shallow Bedrock	80.97	55.33	73.51	41.98	60.07	21.1	9.36	512	293.03	40.1	478.58
ECJ-1 (62)	Shallow Bedrock	196.1	100.1	122.77	46.32	50.37	19.39	28.12	61.86	111.82	43.86	72.99
ECJ-1 (72)	Shallow Bedrock	54,200	44,920	39,614	51,170	1378.9	612.5	209.48	611.76	392.3	203.4	244.75
ECJ-1 (122)	Intermediate Bedrock	13,975	3,694	29,582	7,927	23,210	23,990	23,880	55,510	62,480	87,990	118,080
ECJ-1 (148)	Intermediate Bedrock	25,060	29,150	63,170	41,550	54,530	43,420	27,160	55,140	71,040	83,680	108,880
ECJ-1 (267)	Deep Bedrock	-	40.2	-	-	-	45.6	-	-	-	23.63	-
ECJ-2(47)	Shallow Bedrock	1,661	1,466	1,233.9	1,263.7	977.2	403.7	508.8	864.2	785.6	1,005	885.8
ECJ-2(82)	Intermediate Bedrock	25,500	23,100	18,810	13,960	7941.3	2,481.2	1,992.5	2,050	1,885	1,160.5	603
ECJ-2(117)	Intermediate Bedrock	47,100	13,120	9,244	4,638.3	4196.1	3,430.5	1,492	841.5	1,069.5	683.8	1,029.5
ECJ-2(152)	Intermediate Bedrock	50,700	60,100	34,298	27,081	29483	7,004.1	5,341	4,215.5	3,125	3,966	4,048.5
ECJ-2(187)	Deep Bedrock	21,770	17,050	15,692	12,900	15,394	5,047.4	1,769	2,273.8	2,869	2,108.5	2,792
ECJ-3(51)	Shallow Bedrock	-	12	-	-	-	0.13	-	-	-	0.13	-
ECJ-3(91)	Shallow Bedrock	-	ND	-	-	-	28	-	-	-	ND	-
ECJ-3(126)	Intermediate Bedrock	-	6	-	-	-	57	-	-	-	ND	-
ECJ-3(146)	Intermediate Bedrock	-	45.47	-	-	-	0.2	-	-	-	1.06	-
MW-2	Shallow Bedrock	494.8	546.3	596.6	558.4	561.8	553.9	649.5	374.5	313.5	578.6	238.58
MW-12	Shallow Bedrock	-	-	-	-	-	-	-	-	-	-	-
MW-13	Shallow Bedrock	-	3	-	-	-	0.91	-	-	-	0.94	-
MW-17	Shallow Bedrock	-	2.2	-	-	-	0.17	-	-	-	0.86	-
MW-24	Shallow Bedrock	3,222	4,150	3,122	2,879	2,778	2,037	2,467	4,362	3,800	3,050	3,576
GCA-1	Shallow Bedrock	282.6	253.7	292.3	206.6	219.61	164.78	164.25	285.1	203.3	167.65	166.85
MW-4	Shallow Bedrock	2,449	1,019.8	1,495.6	1,532.1	1,373.7	1,172.4	1,122.3	1,774	1,016.5	1,725.25	2,588.05
MW-5	Shallow Bedrock	-	ND	-	-	-	0.15	-	-	-	ND	-
MW-6	Shallow Bedrock	1,001	1,639	1,615.2	992	1,055.3	1,321.9	1,858.2	2,012	1,804.5	1,979.5	1,801.3

Notes
- = Not sampled
ND = Not detected above detection limits
Reference: OBG, 2013

Table A3-2
OU-1 Active Recovery System
Points of Compliance - Bedrock Monitoring Wells

Well	Well Screen Location	Total Volatile Organic Compounds (ug/L)									
		Summer 2006	Fall 2006	Winter 2006	Spring 2007	Summer 2007	Fall 2007	Winter 2007	Spring 2008	Summer 2008	Fall 2008
ECJ-1 (37)	Shallow Bedrock	274.4	199.9	36.13	-	-	-	21.19	-	30.5 J	-
ECJ-1 (62)	Shallow Bedrock	62.51	48.1	113.3	107.55	-	-	69.1	1809.7 J	187.95 J	81.08 J
ECJ-1 (72)	Shallow Bedrock	249.8	303.05	620.9	814.1	708.75	289.3	650.8	1787.4 J	731.8 J	328
ECJ-1 (122)	Intermediate Bedrock	111,880	113,980	487	984.65	902.05	227.3	658.4	1900.4 J	730.4 J	418
ECJ-1 (148)	Intermediate Bedrock	111,860	118,020	635.4	944	814.6	260.3	635.4	486.4 J	643.4 J	484.2
ECJ-1 (267)	Deep Bedrock	-	-	116.05	-	-	-	416.85	-	-	-
ECJ-2(47)	Shallow Bedrock	688.8	1,859	1,210.2	552	1,601.5	881.15	391.2	553.5 J	2447.2 J	580.6 J
ECJ-2(82)	Intermediate Bedrock	774.8	1,710	1,101.6	820.7	1,708	969	265	645 J	2583.8 J	758.3 J
ECJ-2(117)	Intermediate Bedrock	981.5	2,542	3,102.4	3,110.5	4,114.5	9,901.5	4,414	3380 J	20416 J	5766 J
ECJ-2(152)	Intermediate Bedrock	2,966	6,014	2,322.5	2,739.5	2,451	1,932.5	2,448	874.5 J	1,158	1685 J
ECJ-2(187)	Deep Bedrock	3,493.5	6,502	1,722	2,024	1,737.5	1,775	1,345.5	858 J	1,471.5	1341 J
ECJ-3(51)	Shallow Bedrock	-	-	ND	-	-	-	0.51	-	-	-
ECJ-3(91)	Shallow Bedrock	-	-	ND	-	-	-	1.61	-	-	-
ECJ-3(126)	Intermediate Bedrock	-	-	0.11	-	-	-	0.24	-	-	-
ECJ-3(146)	Intermediate Bedrock	-	-	0.24	-	-	-	1.95	-	-	-
MW-2	Shallow Bedrock	244.92	246.92	329.19	426.7	408.4	492.1	527.2	504.4	187 J	213.3 J
MW-12	Shallow Bedrock	-	-	-	-	-	-	-	-	-	-
MW-13	Shallow Bedrock	-	-	0.88	-	-	-	1.72	-	-	-
MW-17	Shallow Bedrock	-	-	1.07	-	-	-	6.61	-	-	-
MW-24	Shallow Bedrock	4,056	7,192	6,708	5,743	6,696	8,337.5	8,056	5082 J	3728 J	5782 J
GCA-1	Shallow Bedrock	206.35	191.3	204.05	171.95	157.1	177.3	193.4	141.1	127.45 J	172.15 J
MW-4	Shallow Bedrock	2,110	2,207	1,553.5	1,220.5	982.5	967.75	639.6	1630	1926.2 J	1480.8 J
MW-5	Shallow Bedrock	-	-	4.64	-	-	-	8.28	-	-	-
MW-6	Shallow Bedrock	1,694.5	2,074.5	2,061.5	1,777.5	1,579.5	1,603	1,359	1264.5 J	1147 J	1,047.5

Notes
- = Not sampled
ND = Not detected above detection limits
Reference: OBG, 2013

Table A3-2
OU-1 Active Recovery System
Points of Compliance - Bedrock Monitoring Wells

Well	Well Screen Location	Total Volatile Organic Compounds (ug/L)								
		Winter 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012
ECJ-1 (37)	Shallow Bedrock	26.45 J	483.7	245.24	75.21	277	42.77	14.6	40.32	309
ECJ-1 (62)	Shallow Bedrock	63.58 J	462	241	287.4	187.4	104.35	82	439.3	279.5
ECJ-1 (72)	Shallow Bedrock	45 J	595	265.2	435.1	292.5	583.6	339.4	441	223.54
ECJ-1 (122)	Intermediate Bedrock	282.2 J	598.8	278	556.8	1562.4	566.8	325.1	813	55.69
ECJ-1 (148)	Intermediate Bedrock	305.8 J	534.6	278.2	691.2	1509.4	518.4	486.2	1093.55	138.15
ECJ-1 (267)	Deep Bedrock	218 J	262.6	236.8	-	283.1	-	219.8	-	-
ECJ-2(47)	Shallow Bedrock	399.4 J	4341.2	-	-	-	*	*	*	*
ECJ-2(82)	Intermediate Bedrock	444.8	3624	-	-	-	*	*	*	*
ECJ-2(117)	Intermediate Bedrock	-	28795.5 J	-	-	-	*	*	*	*
ECJ-2(152)	Intermediate Bedrock	832.2 J	35,912.5	-	-	-	*	*	*	*
ECJ-2(187)	Deep Bedrock	584.2	2,982.5	-	-	-	*	*	*	*
ECJ-3(51)	Shallow Bedrock	0.12 J	-	1.22	-	0.49 J	-	0.59	-	0.32
ECJ-3(91)	Shallow Bedrock	0.13 J	-	3.14	-	0.50 J	-	1.15	-	0.34
ECJ-3(126)	Intermediate Bedrock	2.7 J	-	1.49	-	0.35 J	-	1.29	-	0.3
ECJ-3(146)	Intermediate Bedrock	9.97 J	-	4.7	-	0.31 J	-	1.35	-	0.35
MW-2	Shallow Bedrock	296.25 J	386.7	950.4	1367.2	636.95	923.2	868.2	851.4	729.6
MW-12	Shallow Bedrock	-	-	-	-	-	-	-	-	-
MW-13	Shallow Bedrock	0.57 J	-	1.72	-	699.31	-	0.42	-	2.67
MW-17	Shallow Bedrock	0.46 J	-	-	-	6.87	-	2.49	-	3.66
MW-24	Shallow Bedrock	5532 J	4,650	5,596	5,264	6,990	8,348	4,772	6016	9048
GCA-1	Shallow Bedrock	171.4 J	127.85	213.95	149.92	177.36	191.34	143.81	263.8	221.8
MW-4	Shallow Bedrock	1501.4 J	1791.4	2160.5	2463.5	2412	2270.5	894.65	2087.5	2106.5
MW-5	Shallow Bedrock	5.58 J	-	1.77	-	U	-	0.25	-	1.75
MW-6	Shallow Bedrock	1007.5 J	740.25	2,018.8	2,053.5	3,341	1,382.5	561.5	685.5	367.4

Notes
- = Not sampled
ND = Not detected above detection limits
Reference: OBG, 2013
* = Well damaged. Data inconclusive and not reported.

Table A3-3
September 2012 Shallow Collection Trench Results

Analyte	Concentration (ug/l)
Volatile Organic Compounds (1)	
1,1-Dichloroethane	0.24 J
Acetone	2.48 J
Benzene	53.7
Chlorobenzene	80.3
Chloroethane	3.26
cis-1,2-Dichloroethylene	0.78 J
Ethylbenzene	0.4 J
Toluene	0.6 J
Xylene (total)	2.76
Polychlorinated Biphenyls	
Total PCBs	3.12
Metals (1)	
Barium	770
Calcium	69,000
Iron	64,000
Magnesium	10,000
Manganese	1,200
Potassium	9,600
Sodium	140,000
Zinc	22

Notes
1. Only detected VOCs and metals are shown.
J - Indicates that concentration is an estimated value.
Reference: OBG, 2013

Table A3-4
TOC and PCB Results for Unnamed Stream Sediment Samples Collected on June 10, 2013 by EPA

Analysis:	TOC Rep1	TOC Rep2	Avg TOC	Total PCBs	Normalized PCBs
Units:	%	%	%	mg/kg	ug PCBs/g Carbon
Sample Location SDPC-1:					
SDPC1-6/10/13-1	0.347	0.176	0.26	ND (0.06)	ND
SDPC1-6/10/13-2	0.183	0.169	0.18	--	--
SDPC1-6/10/13-3	0.236	0.194	0.22	--	--
SDPC1-6/10/13-4	0.195	0.517	0.36	--	--
Sample Location SDPC-2:					
SDPC2-6/10/13-1	0.564	0.704	0.63	--	--
SDPC2-6/10/13-1 DUP	1.04	0.776	0.91	--	--
SDPC2-6/10/13-2	0.787	0.862	0.82	0.53	64
SDPC2-6/10/13-3	0.443	0.551	0.50	--	--
SDPC2-6/10/13-4	0.582	1.42	1.00	--	--
Sample Location SDPC-3:					
SDPC3-6/10/13-1	2.02	2.66	2.34	--	--
SDPC3-6/10/13-2	0.205	0.208	0.21	--	--
SDPC3-6/10/13-3	0.732	0.724	0.73	--	--
SDPC3-6/10/13-4	0.441	1.33	0.89	0.12	14
Sample Location SDPC-4:					
SDPC4-6/10/13-1	2.44	2.73	2.59	0.83	32
SDPC4-6/10/13-2	1.95	1.57	1.76	--	--
SDPC4-6/10/13-3	3.30	4.34	3.82	--	--
SDPC4-6/10/13-4	3.04	3.52	3.28	--	--

Notes:
-- Not analyzed or not applicable
ND - Not detected (reporting limit provided in parentheses)
PCBs - Polychlorinated biphenyls
TOC - Toal organic carbon

Table A3-5
PCB Results for OU2 Adjacent Wetlands and Middle Marsh Non-Aquatic Sediment Samples Collected in June 2013 by EPA

Site Location:	OU2 Adjacent Wetlands		OU2 Middle Marsh				
Sample ID:	Soil PC-1	Soil PC-2	Soil PC-3	Soil PC-4	Soil PC-4 DUP	Soil PC-5	Soil PC-6
Sampling Date:	6/10/2013	6/10/2013	6/19/2013	6/19/2013	6/19/2013	6/19/2013	6/19/2013
Aroclor 1016	ND (0.09)	ND (0.07)	ND (0.08)	ND (0.11)	ND (0.11)	ND (0.07)	ND (0.09)
Aroclor 1221	ND (0.09)	ND (0.07)	ND (0.08)	ND (0.11)	ND (0.11)	ND (0.07)	ND (0.09)
Aroclor 1232	ND (0.09)	ND (0.07)	ND (0.08)	ND (0.11)	ND (0.11)	ND (0.07)	ND (0.09)
Aroclor 1242	ND (0.09)	ND (0.07)	ND (0.08)	ND (0.11)	ND (0.11)	ND (0.07)	ND (0.09)
Aroclor 1248	ND (0.09)	ND (0.07)	ND (0.08)	ND (0.11)	ND (0.11)	ND (0.07)	ND (0.09)
Aroclor 1254	ND (0.09)	ND (0.07)	0.78	0.62	0.24	0.12	0.45
Aroclor 1260	ND (0.09)	ND (0.07)	0.15	0.14	ND (0.11)	ND (0.07)	ND (0.09)
Aroclor 1262	ND (0.09)	ND (0.07)	ND (0.08)	ND (0.11)	ND (0.11)	ND (0.07)	ND (0.09)
Aroclor 1268	ND (0.09)	ND (0.07)	ND (0.08)	ND (0.11)	ND (0.11)	ND (0.07)	ND (0.09)

Notes:
All results and reporting limits are in mg/kg.
ND - Not detected (reporting limit provided in parentheses)
PCBs - Polychlorinated biphenyls

Table A3-6
PCB Results for OU2 Unnamed Stream Surface Water Samples Collected in June 2013 by EPA

Sample ID:	SWPC-1	SWPC-2	SWPC-2 DUP	SWPC-3	SWPC-4
Sampling Date:	6/10/2013	6/10/2013	6/10/2013	6/10/2013	6/10/2013
Aroclor 1016	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)
Aroclor 1221	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)
Aroclor 1232	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)
Aroclor 1242	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)
Aroclor 1248	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)
Aroclor 1254	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)
Aroclor 1260	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)
Aroclor 1262	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)
Aroclor 1268	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)	ND (0.29)

Notes:
All results and reporting limits are in ug/L.
ND - Not detected (reporting limit provided in parentheses)
PCBs - Polychlorinated biphenyls

ATTACHMENT 4
SITE INSPECTION DOCUMENTATION

Five-Year Review Site Inspection Checklist for Operable Unit 1 (OU1)

(Note: OU1 wetland restorations areas are included in separate checklist)

I. SITE INFORMATION	
Site name: *Sullivan's Ledge OU1*	**Date of inspection:** *5/16/13*
Location and Region: *New Bedford, MA / Region 1*	**EPA ID:** *MAD980731343*
Agency, office, or company leading the five-year review: EPA (with assistance from AECOM)	**Weather/temperature:** *Sunny, lower 70s*

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other _____
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

Interviews were conducted separately. See text of Five-Year Review report for documentation.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☒ O&M manual — ☒ Readily available — ☐ Up to date — ☐ N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☒ Maintenance logs — ☒ Readily available — ☐ Up to date — ☐ N/A

   Remarks *GWTP O&M manual has not been updated since system start-up.*

2. **Site-Specific Health and Safety Plan** — ☒ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks *HASP is out of date and was prepared during remedy construction.*

3. **O&M and OSHA Training Records** — ☒ Readily available — ☐ Up to date — ☐ N/A

   Remarks *Present but not closely reviewed.*

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☒ N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☒ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Other permits _____ — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks *Permit for discharge to POTW not reviewed.*

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks *Not verified; however, monthly reports document periodic inspections of the monuments.*

7. **Groundwater Monitoring Records** — ☒ Readily available — ☐ Up to date — ☐ N/A

   Remarks *Included in monthly and quarterly reports.*

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — ☒ N/A
   - ☒ Water (effluent) — ☒ Readily available — ☐ Up to date — ☐ N/A

   Remarks *Water effluent data is included in monthly reports.*

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — ☒ N/A

    Remarks *Not reviewed.*

IV. O&M COSTS

O&M costs were obtained separately and are provided in the text of the Five-Year Review report.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☒ N/A
Remarks *Fence appeared in good condition overall; a bent railing near the gate has no impact on security.* See attached photo log.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks *"No Trespassing" signs are in place along the fence.*

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	☐ Yes	☐ No	☒ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☐ No	☒ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date	☐ Yes	☐ No	☒ N/A
Reports are verified by the lead agency	☐ Yes	☐ No	☒ N/A
Specific requirements in deed or decision documents have been met	☐ Yes	☐ No	☒ N/A
Violations have been reported	☐ Yes	☐ No	☒ N/A

Other problems or suggestions: ☐ Report attached
Grant of Environmental Restrictions is not yet in place. Draft GER being reviewed by PRP's attorneys.

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☒ N/A
Remarks *ICs have not been finalized yet.*

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks

2. **Land use changes on site** ☒ N/A
Remarks None.

3. **Land use changes off site** ☐ N/A
Remarks *Former Rosies Restaurant located adjacent to the site has been replaced with a gas station and convenience store*

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks

B. Other Site Conditions

Remarks

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident
Areal extent Depth
Remarks

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident
Lengths Widths Depths
Remarks

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
Areal extent Depth
Remarks

4. **Holes** ☐ Location shown on site map ☒ Holes not evident
Areal extent Depth
Remarks *Animal hole near western edge of cap (see photo log) should be addressed.*

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☒ No signs of stress
☒ Trees/Shrubs (indicate size and locations on a diagram)
Remarks *Trees, shrubs and tall vegetation along southern slope and on north side of southern drainage swale and along western fence line should be cut down.*

6. **Alternative Cover (armored rock, concrete, etc.)** ☒ N/A
Remarks

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident
Areal extent_____ Height_____
Remarks_____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
☒ Wet areas ☐ Location shown on site map Areal extent *see photo log*
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks *Wet area along northern portion of the eastern fence line appears to be outside the limits of the cap.*

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent_____
Remarks_____

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____

C. Letdown Channels ☐ Applicable ☒ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☒ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____

2. **Gas Monitoring Probes**
☒ Properly secured/locked ☐ Functioning ☒ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks____*Covers not opened during inspection.*_____

3. **Monitoring Wells** (within surface area of landfill)
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks____*Wells ECJ-2 and ECJ-4 should be secured.*_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks__*Not inspected*_____

E. Gas Collection and Treatment ☒ Applicable ☐ N/A

1. **Gas Treatment Facilities**
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☒ Good condition ☐ Needs Maintenance
Remarks *Active landfill gas extraction/blower system in place and operating.*

2. **Gas Collection Wells, Manifolds and Piping**
☒ Good condition ☒ Needs Maintenance
Remarks *Most of the piping is underground. Broken valve handle on piping to one of the gas monitoring wells that is directly connected to the extraction system needs to be replaced.*

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
☒ Good condition ☐ Needs Maintenance ☐ N/A
Remarks *Gas monitor at adjacent motel was not inspected. PRPs indicated it is still operating.*

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
Remarks

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
Remarks

G. Detention/Sedimentation Ponds ☒ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
☒ Siltation not evident
Remarks

2. **Erosion** Areal extent_____ Depth_____
☒ Erosion not evident
Remarks

3. **Outlet Works** ☒ Functioning ☐ N/A
Remarks

4. **Dam** ☐ Functioning ☒ N/A
Remarks

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☒ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☒ Siltation not evident
Areal extent_____ Depth_____
Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent_____ Type_____
Remarks____*Tall vegetation and shrubs were present along portions of drainage swales and should be cut down.*

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
Areal extent_____ Depth_____
Remarks_____

4. **Discharge Structure** ☒ Functioning ☐ N/A
Remarks_____

VIII. VERTICAL BARRIER WALLS ☒ Applicable ☐ N/A

1. **Settlement** ☐ Location shown on site map ☒ Settlement not evident
Areal extent_____ Depth_____
Remarks_____

2. **Performance Monitoring** Type of monitoring_____
☒ Performance not monitored
Frequency_____ ☐ Evidence of breaching
Head differential_____
Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☒ Good condition ☐ All required wells properly operating ☒ Needs Maintenance ☐ N/A
Remarks *Bedrock extraction well BEI-1 was not operating during 6/16/13 inspection. Plant operators indicated that the motor was to be replaced.*

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☒ Needs Maintenance
Remarks *The plant operators noted one of the influent lines from extraction well BEI-1 was ruptured and planned to conduct maintenance. The second (backup) line is still usable.*

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks *Not inspected*

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
   ☒ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☒ Air stripping ☒ Carbon adsorbers
   ☒ Filters
   ☒ Additive (*e.g.*, chelation agent, flocculent)
   ☐ Others
   ☒ Good condition ☐ Needs Maintenance
   ☒ Sampling ports properly marked and functional
   ☒ Sampling/maintenance log displayed and up to date (including in monthly reports)
   ☒ Equipment properly identified
   ☐ Quantity of groundwater treated annually
   ☐ Quantity of surface water treated annually
   Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks *Not verified.*

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☒ Good condition ☒ Proper secondary containment ☐ Needs Maintenance
   Remarks

4. **Discharge Structure and Appurtenances**
   ☒ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks *Not accessible but operating.*

5. **Treatment Building(s)**
   ☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair
   ☒ Chemicals and equipment properly stored
   Remarks

6. **Monitoring Wells** (pump and treatment remedy)
   ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks

D. Monitoring Data

1. Monitoring Data
   ☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring data suggests:
   ☐ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

D. Monitored Natural Attenuation **Not Applicable**

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

See report text Section 4.3 for discussion of system operations/O&M issues.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

See report text Section 4.3 for discussion of O&M issues.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. *N/A*
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. *N/A*

Sullivan's Ledge Superfund Site
Wetlands Restoration Area (OU-1)
Site No.
5-Year Review Checklist

The following checklist was created to review maintenance and monitoring of the mitigation wetlands on the north side of Hathaway Road at Sullivan's Ledge Superfund Site in New Bedford, MA. A project site inspection was completed on May 12, 2013. Attendees at the site inspection included EPA (D. Lederer), City of New Bedford (CONB) Conservation Commission (S. Porter), AECOM scientist (J. Doyle-Breen), and AECOM engineer (C. Castleberry). The project goals stated in the Wetlands Restoration Plan (WRP) dated July 1997 were used as a basis for the OU-1 checklist.

I. HYDROLOGY			
Has the long-term goal for the wetland hydrology, namely the presence of groundwater and/or saturated soils within 12 inches of the wetland surface in each piezometer for at least three of the first five years and each fifth year thereafter, been met?	Yes **X**	No	Unknown
Comment: Two rounds of data have not been collected within a two-week period since the project's inception and it can't be confirmed that water levels have been within 12 inches of the wetland surface for two weeks. This attribute is intended to document that hydrology in the restored wetlands is sufficient to support wetland plants. Given the high percentage of wetland plants growing throughout the restored areas, and visible observations of saturated soils across the site throughout the growing season, sufficient hydrology has been qualitatively confirmed and observed during the 2008 site visit and previous site visits.			
II. PERMANENT SAMPLING PLOTS			
Did the OU-1 restoration and mitigation areas achieve and maintained a total 75% areal coverage of wetland plant species by the end of the second growing season?	Yes **X**	No	Unknown
Comment: Since this is a 5-year review, the discussion can be expanded to conditions beyond the second growing season. The 2012 Wetland Report for OU1 and OU2 prepared by the City of New Bedford indicates that wetland species have been documented to cover at least 75% of the restored wetland areas in all monitored plots but one, which is close to and on a trajectory to meet the 75% cover goal. The 2011 data and 2012 report indicate that the restored OU1 Middle Marsh area contained a wide variety of species, including emergent, shrub, and tree species. May 2013 observations suggest that the OU1 West Mitigation area has a high abundance of phragmites, and this should be further evaluated in terms of invasive species control.			
Has greater than 25% mean areal coverage of hummocks within the OU-1 Middle Marsh restoration area been maintained?	Yes **X**	No	Unknown
Comment: According to the City of New Bedford's 2011 Wetland Report, both OU-1 Middle Marsh plots contained greater than 25% hummock.			
III. HYDRIC SOILS			
Has an annual soil profile description for test pits within the 13 sampling plots been produced			

annually for the first three years, at the end of the fifth growing season, and every five years thereafter?	Yes **X**	No	Unknown
Comment: The City of New Bedford's 2012 Wetland Monitoring Report includes a soil profile description of test pits adjacent to the permanent sampling plots. All soil profiles included hydric soil indicators. In two plots, soil profiles could not be completed due to inundation, which is also an indication that hydric soil conditions are present.			
IV. MAINTENANCE			
Has the Contractor been performing periodic replanting in areas where the vegetation did not survive?	Yes	No **X**	Unknown
Comment: The Contractor has not installed additional plants since the last 5-year inspection/review. The OU1 Mitigation Area – West was observed to be almost devoid of shrubs during the 2013 inspection. The previous 5-year review reported that this area may be too wet to support wetland shrubs. During the 2013 site visit, the area did not appear to be inundated or saturated at the surface. It is recommended that additional wetland shrubs be installed in this area after invasive species measures are implemented.			
Has the Contractor been providing adequate control of invasive species in the OU-1 restoration and mitigation areas?	Yes **X**	No	Unknown
Comment: During the previous 5-year inspection it was reported that Galerucella beetles had been released to control purple loosestrife at the site. The population of this species, as well as cattail (*Typha* sp.) and common reed (*Phragmites australis*), have been reduced since the last 5-year review due to previously implemented control measures. An abundance of multiflora rose (*Rosa multiflora*) was observed in the area of the former OU1 Diversion Swale, and an abundance of phragmites was observed in the Mitigation Area West. It is recommended that measures be implemented to reduce the abundance and further control the further spread of these species, including removal and replanting with desirable native wetland species.			
Is erosion being controlled at:			
- Stream Channel?	Yes **X**	No	Unknown
- OU-1 Tributary 2?	Yes **X**	No	Unknown
- OU-1 Ponds?	Yes **X**	No	Unknown
- OU-1 Middle Marsh restoration area?	Yes **X**	No	Unknown
Comment: During the 2013 inspection, it was noted the entire rope fence was absent along the unnamed stream banks just upstream of OU2 Middle Marsh as well as around the OU1 Ponds. The rope should be re-installed to ensure continued protection of the bank. No significant erosion at any of the listed locations was noted in the 2012 Wetland Monitoring Report or during the May 2013 site visit.			
V. ADDITIONAL COMMENTS			
Comment:			

Sullivan's Ledge Superfund Site
Wetlands Restoration Area (OU-2)
Site No.
5-Year Review Checklist

The following checklist was created to review maintenance and monitoring of the mitigation wetlands on the north side of Hathaway Road. A project site inspection was completed on May 12, 2013. Attendees at the site inspection included EPA (D. Lederer), City of New Bedford (CONB) Conservation Commission (S. Porter), AECOM scientist (J. Doyle-Breen), and AECOM Engineer (C. Castleberry). The Performance Standards and Wetland Attribute Goals stated in the Final Operation and Maintenance (O&M) Plan Second Operable Unit were used as a basis for the OU-2 Wetland Restoration Area checklist.

I. Biological Indicators			
Survival			
Did 80% of the plantings of each tree and shrub species in the restored wetland survive after five years?	Yes	No	Unknown **X**
Have dead or moribund plants been replaced at the earliest possible time consistent with the growing season to achieve a minimum of the original plant density?	Yes **X**	No	Unknown
Comment: As noted during the 2008 site visit and previous inspections, where the OU2 Middle Marsh consistently contains several inches of standing water (e.g. in the northwest corner and southeast corner of Middle Marsh), suitable habitat is not present for the survival of woody species. Other areas of OU2 Middle Marsh contain thriving woody species.			
Tree Growth			
Did the tree height and dbh increase every five years at least 20% from original planting height?	Yes **X**	No	Unknown
Comment: Woody species present at the site during the 2013 site visit were notably larger and more robust than in previous years. Documentation that this criterion has been met is not complete, because height and dbh of all planted tree species was not well documented at the time of planting, or during the 2005 inspection. However, the 2011 data do document this data for current conditions, and will provide a basis of comparison for the next five year event. Overall the data suggest that the intent of this goal is being met for most areas because a woody canopy layer has become well established, with the exception of the extreme northwestern and southeastern corners.			
Vegetative Diversity			
Was at least one woody and herbaceous non-invasive wetland species, in addition to the planted species, noted after five years and every five years thereafter?	Yes **X**	No	Unknown
Comment: As reported in all monitoring reports received since the 2003 monitoring, this standard has been met.			
Vegetative Cover			
Has 75% areal coverage of wetland plant species been achieved?	Yes **X**	No	Unknown
If 75% areal coverage of wetland plant species has <u>not</u> been achieved by the second growing season, has a plan of action been submitted?	Yes	No	N/A **X**
Comment: Wetland species appear to cover at least 75% of the restored wetland areas in all plots but			

one.			
Are greater than 50% of the dominant plants, exclusive of invasive species, wetland species?	Yes	No **X**	Unknown
Comment: Most of the plots met the criteria of greater than 50% dominance by non-invasive wetland plants. Although still present at the site, invasive species are becoming less prevalent. In 2011, six of the plots included greater than 50% dominance by invasive wetland species, compared to 10 plots in 2005, which demonstrates a trend toward reduction in dominance by invasive species.			
II. Mystic Valley Amphipod (MVA)			
OU-2 wetland areas with suitable MVA habitat restored based on presence of MVA in restored OU-2 areas?	Yes **X**	No	Unknown
Plan for re-establishment required due to lack of presence of MVA within 3 years of initiation of restoration (in 2000)?	Yes	No	Not Applicable **X**
Comment: The 2003 Wetland Monitoring Report indicated that the Mystic Valley Amphipod was found in the restored OU2 areas during the sampling events in 2003.			
III. Wetland Substrate/Soils			
Physical Substrate Restoration			
Have areas of eroded soil been repaired?	Yes **X**	No	Unknown
Are hydric soils present based on soil profile descriptions?	Yes **X**	No	Unknown
Comment: The goal for restored wetland soils will be a trend for soils from all ten borings to meet the definition of hydric within ten years. However, based on soil data included in the 2006 and 2012 Wetland Monitoring Reports, the soils within the restored areas are showing positive indicators of ground water presence within 12 inches of the ground surface during the growing season.			
Has 25% mean areal coverage of hummocks in Middle Marsh been achieved?	Yes **X**	No	Unknown
Comment: Data conducted during the previous five-year review period did not address hummock coverage in Middle Marsh Plots #1 and #3. Based on the 2011 data collected by the City of New Bedford, these plots do not contain greater than 25% hummocks. Plots #2 and #4 in Middle Marsh continue to include greater than 25% hummocks. On a mean basis, the plots show that on average Middle Marsh does include greater than 25% mean areal coverage of hummocks. In addition, although additional fill could be imported to create additional hummocks in this area, the benefit is not believed to outweigh the impact to adjacent well-established areas with high cover of canopy woody vegetation.			
IV. Wetland Hydrology			
Restored wetland sediments replicate water retention characteristics of the pre-remediation conditions?	Yes **X**	No	Unknown
Comment:			
Depth to groundwater less than 12 inches at piezometer locations?	Yes **X**	No	Unknown
Hydrology restored to pre-remediation conditions in Middle Marsh?	Yes **X**	No	Unknown
Comment: Two rounds of data have not been collected within a two-week period since the project's inception and it can't be confirmed that water levels have been within 12 inches of the wetland surface for two weeks. In addition, no discussion of the water retention characteristics of the sediments was presented in any of the Wetland Monitoring Reports received over the last five years or previously. This attribute is intended to document that hydrology in the restored wetlands is sufficient to support wetland plants. Given the high percentage of wetland plants growing throughout the restored areas, and visible observations of saturated soils across the site throughout the growing season, sufficient hydrology has been qualitatively confirmed and observed during the 2013 site visit and previous site visits.			
V. Post-Construction and Long-Term Monitoring			
Are post-construction and long-term monitoring events occurring annually and every five years, respectively?	Yes **X**	No	Unknown

(O&M 1/99 4.2)			
Are monitoring reports being prepared and submitted for review in accordance with the monitoring programs? (O&M 1/99 4.5)	Yes **X**	No	Unknown
Are corrective actions required for death or failure of plants to properly grow? (O&M 1/99 4.4)	Yes	No **X**	Unknown
Are corrective actions required for excessive plant damage caused by animals? (O&M 1/99 4.4)	Yes **X**	No **X**	Unknown
Are corrective actions required for invasion of opportunistic plant species into restoration areas? (O&M 1/99 4.4)	Yes	No **X**	Unknown
Are corrective actions required for erosion of an amount of topsoil/backfill that modifies the topography of restoration areas to a degree that it would affect the success of restoration in those areas? (O&M 1/99 4.4)	Yes	No **X**	Unknown
Comment: There has been positive evidence that CONB purchased *Galerucella* beetles previously released during the prior five-year review are continuing to have a positive effect on controlling purple loosestrife, with beetle damage and also sightings of the beetles on loosestrife plants during the 2013 site visit. No mechanical and/or chemical methods to suppress the population of invasive species have been implemented in the last five years. In most areas, invasive species have remained at an acceptable, or decreasing, low level, suggesting that additional active management of invasive species in the OU2 area is not needed at this time.			

Sullivan's Ledge May 16, 2013 Site Inspection for 5-Year Review

OU1 Mitigation Area West is dominated by Common Reed (*Phragmites australis*) and contains a substantial amount of trash.

Common Reed (*Phragimites australis*) remains dominant in the northwest corner of the OU2 Middle Marsh area forming a monotypic stand

Common Reed (*Phragimites australis*) in the northwest corner of the OU2 Middle Marsh area may be expanding its range toward the Unnamed Stream

Metal hand rails are missing from the bridge at the location where the Unnamed Stream enters Middle Marsh.

Broken railing on bridge across Unnamed Stream just downstream of Hathaway Road.

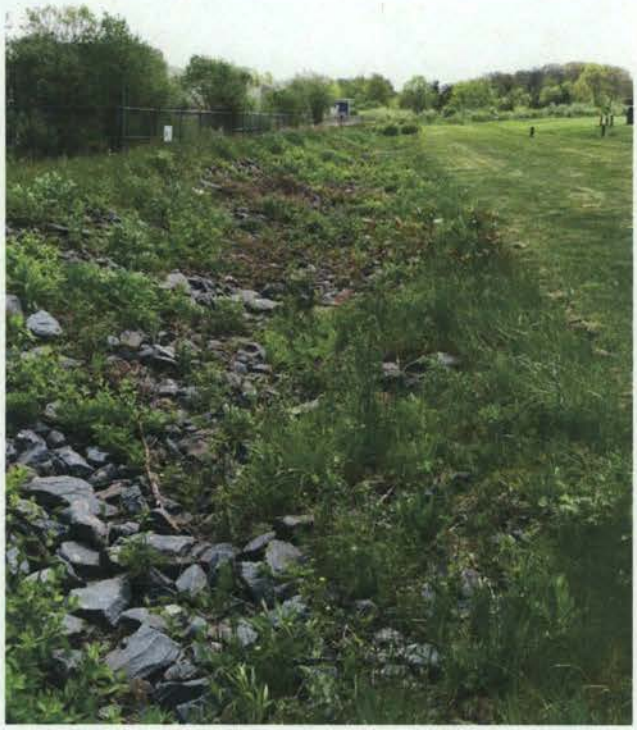
Protective rope fence along edge of wetland restoration area in need of replacement (condition is typical of other restored areas)

OU1 Middle Marsh area including the former diversion swale includes an abundance of non-invasive trees, shrubs, and herbs

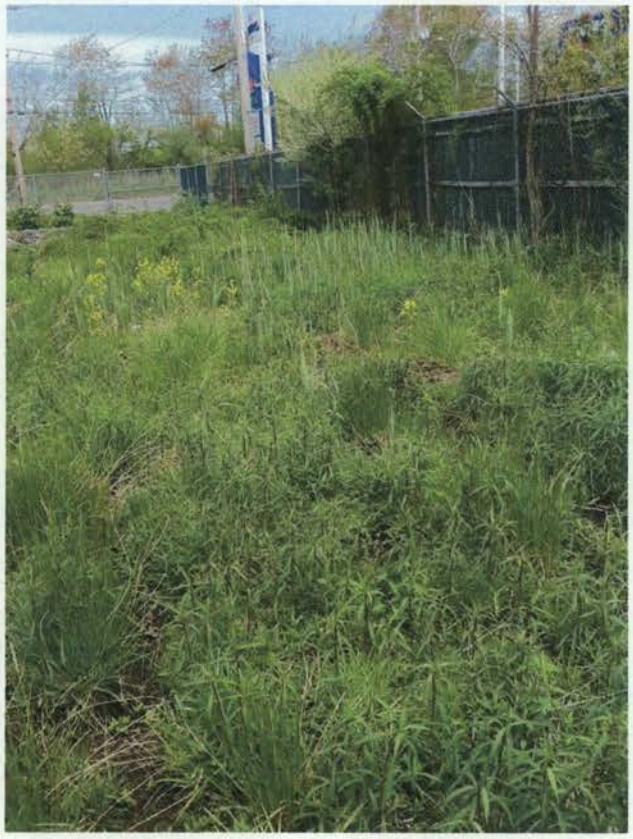
The Unnamed Stream and adjacent areas of Middle Marsh have developed a woody canopy of non-invasive trees and saplings

Although Common Reed (*Phragmites australis*) continues to be present in the relatively wet southeast corner of Middle Marsh, it is existing with other non-invasive species.

Purple loosestrife (*Lythrum salicaria*) plants observed included Galerucella beetles and/or foliar damage, indicating that previous beetle releases are effectively controlling this population.



Small vegetation in eastern landfill cap drainage swale (looking south)



Wet area in northeast corner (appears to be just outside landfill cap limits)

Broken valve handle on piping to gas monitoring well GM-19

Looking southwest at vegetation in and adjacent to southern drainage swale on the landfill cap

Trees adjacent to western section of southern drainage swale

View looking north across landfill cap – Grass cover is plentiful and recently mowed

One of several brush piles along western edge of landfill cap – Dense vegetation along fence line

Animal hole along western fence line across from adjacent motel building

Vegetation recently cut for access to gas monitoring well (typical along western and eastern boundaries)

Bent railing on fence near entrance gate

ATTACHMENT 5
APPLICABLE RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

TABLE 1. REVIEW OF ARARS FOR OPERABLE UNIT 1
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Safe Drinking Water Act Regulations, 40 CFR Part 141, Subpart B	ROD: waived	Establishes MCLs for public drinking water supplies. These relevant and appropriate regulations will be waived because of technical impracticability.	Not provided in ROD	These regulations were waived in the ROD.
TSCA PCB Disposal Requirements, 40 CFR 761.60	ROD: applicable, some requirements will be waived	Disposal of soils and sediments with PCBs over 50 ppm, must be by incinerator or equivalent alternative method, or chemical waste landfill. Remedy will result in chemical waste landfill containing existing wastes which have been previously landfilled on site and solidified soils and sediments. Some requirements of chemical waste landfill which are not necessary to protect against risk of injury to health or environment will be waived under the waiver provisions of the TSCA regulations.	Not provided in ROD	The requirements of 40 CFR 761.75(b)(4-9) were met during remedy construction. Other requirements of chemical waste landfills were waived in the ROD. These requirements were also complied with for off-site disposal of sludge from the GWTP. When the sludge was determined to contain greater than 50 ppm PCBs, the sludge was disposed of at an EPA-approved chemical waste landfill.
RCRA Land Disposal Regulations, 40 CFR 268 Subpart C	ROD: not applicable	These regulations are not applicable because solidified soils are not expected to contain characteristic or listed hazardous waste.	Not provided in ROD	These regulations are not applicable because pre-design studies (TCLP metals analyses) showed that soil and sediment, representative of material that was excavated, did not exhibit the toxicity characteristics and therefore did not constitute a hazardous waste.
RCRA Minimum Technology Regulations, 40 CFR 264.300	ROD: not applicable	These regulations establish standards for new or replacement landfills, or lateral expansions of landfills, including double liner and leachate collection. Not applicable because remedy does not involve creation of new or replacement landfill, or lateral expansion of landfill. Double liners are not relevant and appropriate because it is technically infeasible to construct a double liner separating wastes in quarry pits from the groundwater. Remedy will comply with leachate collection requirements, except inappropriate length of operation requirements.	Not provided in ROD	It should be noted that numerous amendments have been made to these regulations since June 28, 1989. The remedy remains protective because the groundwater treatment plant continues to collect and treat groundwater and leachate collected.

TABLE 1. REVIEW OF ARARS FOR OPERABLE UNIT 1
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Surface Water Discharge Regulations, 40 CFR 122, promulgated pursuant to Clean Water Act	ROD: applicable	Applicable to discharge of groundwater treatment system effluent. If effluent is discharged to surface waters, regulations will be attained through compliance with state water quality standards, and monitoring of discharge.	Not provided in ROD	These regulations are not applicable to the groundwater treatment system effluent, since it is discharged to the POTW. The discharge contemplated in the ROD is no longer necessary. Therefore the remedy remains protective.
Pretreatment Regulations for Indirect Discharges to POTWs, 40 CFR Part 403	ROD: applicable	These regulations control the discharge of pollutants into POTWs, including specific and general prohibitions. If groundwater from passive collection system is discharged to sewer after New Bedford secondary treatment plant becomes operational, these regulations will be applicable, and the remedy will comply through pretreatment.	Not provided in ROD	Numerous amendments have been made to these regulations since June 28, 1989. Changes to the regulations do not impact the protectiveness of the remedy because the GWTP is complying with the local sewer use ordinance which complies with the regulations.
Discharge of Dredged and Fill Materials Regulations, 40 CFR 230, promulgated under Section 404 of Clean Water Act	ROD: applicable	This regulation applies to the use of fill material in stream and wetlands. Remedy will comply because there is no practicable alternative having a less adverse impact on aquatic organisms, and steps will be taken to minimize adverse impacts, such as sedimentation basins, baffles and stream and wetlands restoration.	Not provided in ROD	There are no impacts to the protectiveness of the remedy. These requirements were applicable during remedy construction but are no longer part of any action contemplated during operation and maintenance of the site.
National Ambient Air Quality Standards (NAAQS), 40 CFR 50.6, promulgated pursuant to Clean Air Act	ROD: applicable	These applicable regulations set primary and secondary 24-hour concentrations for emissions of particulate matter. Fugitive dust from excavation, treatment, solidification and disposal will be maintained below these standards, by dust suppressants if necessary.	Not provided in ROD	These requirements remain applicable if further land disturbing activities are conducted. No major activities of this kind are currently anticipated.

TABLE 1. REVIEW OF ARARS FOR OPERABLE UNIT 1
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
OSHA Worker Safety Regulations, 29 CFR Part 1910	ROD: applicable	These applicable regulations contain safety and health standards that will be met during all remedial activities, including construction of the cap and installation of groundwater wells.	Not provided in ROD	OSHA worker protection standards are no longer considered ARAR for CERCLA response actions, but are To Be Considered. The Settling Parties and their Contractors are required to comply with OSHA worker protection standards during operation and maintenance of facilities on-site that are still contaminated with hazardous substances; for instance the groundwater treatment facility.
Department of Transportation Regulations for Transport of Hazardous Materials, 49 CFR Parts 107, 171.1 - 172.558	ROD: applicable	Requirements for transporting hazardous materials off-site will be met.	Not provided in ROD	Transport of treatment residuals and chemicals to/from the site is performed in compliance with DOT rules.
Massachusetts Drinking Water Regulations (310 CMR 22.00)	ROD: waived	Establishes maximum contaminant levels for public drinking water supplies. Attainment of this relevant and appropriate regulation will be waived because of technical impracticability.	Not provided in ROD	These regulations were waived in the ROD.
Massachusetts Groundwater Quality Standards (314 CMR 6.00)	ROD: waived	Establishes minimum groundwater criteria. Attainment of this relevant and appropriate regulation will be waived because of technical impracticability.	Not provided in ROD	These regulations were waived in the ROD.
Massachusetts Hazardous Waste Closure and Post Closure Regulations, 310 CMR 30.580 and 30.590	ROD: relevant and appropriate	The closure and post closure regulations are relevant and appropriate. The cap will be constructed and maintained and monitoring will be performed in compliance with these requirements.	Not provided in ROD	The closure and post closure regulations are applicable and maintenance and monitoring are being performed in accordance with the Site Operations and Maintenance Manual. A Site Closure Plan was developed in compliance with 310 CMR 30.580.
Massachusetts Hazardous Waste Location Regulations, 310 CMR 30.700	ROD: relevant and appropriate	The cap will be constructed outside the 100-year floodplain in accordance with these relevant and appropriate regulations.	Not provided in ROD	These location requirements were met during construction. The culverts beneath Hathaway Road were augmented to carry the potential flood from the 100-yr storm away from the cap.

TABLE 1. REVIEW OF ARARS FOR OPERABLE UNIT 1
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Massachusetts Hazardous Waste Groundwater Protection Regulations, 310 CMR 30.660	ROD: relevant and appropriate	The groundwater monitoring requirements are relevant and appropriate. Semi-annual monitoring for specified indicators of hazardous constituents are required to verify the effectiveness of closure. The remedy will comply with the substantive requirements, except that monitoring will be quarterly for the first three years and the frequency will be reevaluated thereafter.	Not provided in ROD	Groundwater monitoring is being conducted on a routine basis in accordance with the Post-Construction Environmental Monitoring Plan. Monitoring was conducted quarterly through 2008 and is now conducted semi-annually.
Massachusetts Hazardous Waste Landfill Regulations, 310 CMR 30.620	ROD: relevant and appropriate	Landfill requirements include double liners, leachate collection systems, and technical requirements for cap. Double liner requirements are not appropriate to this site, since groundwater below landfill will remain contaminated. Other requirements are relevant and appropriate and will be attained, except that leachate collection may be terminated prior to 30 years after closure, if target levels for the passive system have been achieved.	Not provided in ROD	The requirement for post-closure care is relevant and appropriate and is on-going in accordance with the Site Operation and Maintenance Manual.
Massachusetts Supplemental Requirements for Hazardous Waste Management Facilities, 314 CMR 8.00	ROD: applicable	RCRA facilities subject to surface water discharge requirements must also comply with DEQE regulations regarding location, technical standards for landfills, closure and post-closure, and management standards.	Not provided in ROD	These requirements are not applicable because the groundwater treatment plant discharges to the New Bedford POTW, not to surface water.
Massachusetts Surface Water Quality Standards, 314 CMR 4.00	ROD: applicable	Surface waters must be free from pollutants which are present in toxic amounts, which exceed recommended limits for most sensitive use, or which exceed safe exposure levels. These applicable standards will be attained during remedial design and operation of the treatment system.	Not provided in ROD	As constructed, the groundwater treatment plant discharges to the New Bedford POTW, not to surface water. As a result, surface waters are not impacted by a discharge at the Site.

TABLE 1. REVIEW OF ARARS FOR OPERABLE UNIT 1
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Massachusetts Wetlands Protection Regulations, 310 CMR 10.00	ROD: applicable	This applicable regulation sets performance standards for dredging banks, vegetated wetlands, and lands under water. The remedy and mitigative measures will attain these standards.	Not provided in ROD	The soil and sediment excavation and stream lining were conducted so that adverse effects were minimized. Erosion control measures were used throughout remedy construction. A Wetlands Restoration Plan was prepared which outlined measures to attain these standards. Post-construction wetland monitoring was conducted annually following completion of excavation and initial wetlands restoration and through 2006. Long-term wetland monitoring was conducted in 2011 and will be conducted every five years to ensure the long-term effectiveness of the wetland restoration program. Annual wetland monitoring reports have been submitted during the post-construction period and for the first long-term monitoring event. The reports summarize maintenance and monitoring performed within wetland restoration areas of OU1 and OU2.
Massachusetts Ambient Air Quality Standards, 310 CMR 6.00	ROD: applicable	This applicable regulation sets primary and secondary standards for emissions of particulate matter. These standards will be met during implementation.	Not provided in ROD	These requirements were met during remedy construction activities.
Massachusetts Right to Know Regulations, 454 CMR 21.000	ROD: applicable	Informational requirements of these regulations will be attained during implementation.	Not provided in ROD	Worker safety rules are no longer considered ARAR for CERCLA reponse actions but are To Be Considered.

TABLE 1. REVIEW OF ARARS FOR OPERABLE UNIT 1
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Executive Orders 11990 and 11988	ROD: To be considered	These executive orders regarding protection of floodplains and wetlands were considered in the evaluation and development of remedial alternatives. The soil and sediment excavation and stream lining will be conducted in such a manner to avoid or minimize adverse impacts.	Not provided in ROD	The requirements to avoid or minimize adverse impacts to wetlands were met during remedy construction. A Wetlands Restoration Plan was prepared which outlined measures to attain these standards. Post-construction wetland monitoring was conducted annually following completion of excavation and initial wetlands restoration and through 2006. Long-term wetland monitoring was conducted in 2011 and will be conducted every five years to ensure the long-term effectiveness of the wetland restoration program. Annual wetland monitoring reports were submitted during the post-construction period and for the first long-term monitoring event. The reports summarize maintenance and monitoring performed within wetland restoration areas of OU1 and OU2.
Interim Sediment Quality Criteria	ROD: To be considered	Interim sediment quality criteria were considered in establishing target levels for cleanup of sediments.	Not provided in ROD	Although the Interim Sediment Quality Criterion for PCBs was never finalized, the technical basis for sediment quality criteria for non-ionic organic contaminants such as PCBs remains a scientifically defensible approach to setting sediment quality criteria for PCBs. These criteria were considered in the development of cleanup standards for the site.

TABLE 1. REVIEW OF ARARS FOR OPERABLE UNIT 1
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Masachusetts Solid Waste Management Regulations, 310 CMR 19.117	ROD: not provided in ROD	Not provided in ROD	Not provided in ROD	Considered applicable due to the detection of landfil gas at perimeter monitoring wells at concentrations greater than 25% LEL. The provisions of this regulation mandate the control of landfill gases to concentrations less than 25% LEL to prevent public health and safety concerns. Although this regulation was not included in the ROD, it provides a mechanism to measure the performance of landfill gas generation at the site. Other ARARs listed do not provide such a mechanism. A process is in place to comply with the regulation. An active landfill gas collection system has been implemented by the OU1 Settling Parties. Quarterly landfill gas monitoring is conducted in order to evaluate the effectiveness of the system in controlling landfill gas migration.
Masachusetts Solid Waste Management Regulations, 310 CMR 19.118(4)	ROD: not provided in ROD	Not provided in ROD	Not provided in ROD	Considered applicable; requires the installation of gas monitoring wells to monitor the possible migration of explosive gases.
Masachusetts Solid Waste Management Regulations, 310 CMR 19.132 (4)	ROD: not provided in ROD	Not provided in ROD	Not provided in ROD	Considered applicable due to the detection of landfil gas at perimeter monitoring wells at concentrations greater than 25% LEL. The provisions of this regulation require the DEP be notified when concentrations of landfill gas are measured above 25% LEL at the property boundary. Although this was not included in the ROD, other ARARs listed do not provide a requirement to notify the DEP under such conditions, which is considered an appropriate means to maintain public health and safety.

TABLE 1. REVIEW OF ARARS FOR OPERABLE UNIT 1
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Masachusetts Solid Waste Management Regulations, 310 CMR 19.150	ROD: not provided in ROD	Not provided in ROD	Not provided in ROD	Considered applicable due to the detection of landfill gas at property boundaries at concentrations greater than 25% LEL. Although this was not included in the ROD, it provides a method to address the landfill gas concentrations above 25% LEL, and is referenced in 310 CMR 19.132(4). Other ARARs do not provide a means to address the landfill gas concentrations.
Massachusetts Air Pollution Control Regulations, 310 CMR 7.00	ROD: applicable	Applicable to emissions of particulates during implementation of remedy.	Not provided in ROD	The emissions of particulates during remedy construction were addressed. 310 CMR 7.00 is applicable to the discharge of emissions from the active landfill gas collection system which has been implemented and is currently operating. The need for off-gas controls was evaluated as part of the design for the gas extraction and discharge system and was determined to not be needed based on anticipated VOC discharges. Quarterly monitoring of the stack effluent and ambient air at locations near and downwind of the discharge point is being conducted.

TABLE 2. REVIEW OF LOCATION-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE FOR OPERABLE UNIT 2 (MIDDLE MARSH)
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

Medium/Authority (from ROD)	ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Federal Regulatory Requirements	Clean Water Act (CWA) Guidelines for Disposal of Dredged or Fill Material (33 U.S.C. 1344) (40 CFR Part 230)	ROD: Applicable	No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the discharge which would have a less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. Appropriate and practicable steps must be taken which will minimize the potential adverse impacts of the discharge of the dredged material on the aquatic ecosystem.	Any activities that involve the discharge of dredge or fill materials in wetlands shall be conducted in a manner utilizing the alternative which would have the least adverse impact on the aquatic ecosystem and the environment, pursuant to 40 CFR 230.10(a).	This requirement was met during remedy construction. The discharge of fill materials in wetlands was conducted to have the least adverse impact on the aquatic ecosystem and the environment. Fill materials were obtained from off-site. Soils used as fill were tested to demonstrate that they met wetland soil requirements and had less than 1 mg/kg total PCBs.
	Statement of Procedures on Floodplain Management and Wetlands Protection (40 CFR 6, App. A)	ROD: Applicable	Federal agencies shall avoid, wherever possible, the long and short term impacts associated with the destruction of wetlands and the occupancy and modifications of floodplains and wetlands development wherever there is a precticable alternative in accordance with Executive Orders 11990 and 11988. The agency shall promote the preservation and restoration of floodplains so that their natural and beneficial values can be realized. Any plans for actions in wetlands or floodplains must be submitted for public review.	All practicable means will be used to minimize harm to wetlands and floodplains. Wetlands and floodplains disturbed by excavation will be restored to their original conditions.	Remedial construction was conducted so that impacts to wetlands were minimized. Erosion control measures were used throughout construction. A wetlands restoration plan was prepared which outlined measures to attain these standards. Post-construction wetland monitoring was conducted annually following completion of excavation and initial wetlands restoration and through 2006. Long-term wetland monitoring was conducted in 2011 and will be conducted every five years to ensure the long-term effectiveness of the wetland restoration program. Annual wetland monitoring reports were submitted during the post-construction period and for the first long-term monitoring event. The reports summarize maintenance and monitoring performed within wetland restoration areas of OU1 and OU2.

TABLE 2. REVIEW OF LOCATION-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE FOR OPERABLE UNIT 2 (MIDDLE MARSH)
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

Medium/Authority (from ROD)	ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
	Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.)	ROD: Applicable	Under 662, any modification of a body of water requires consultation with the U.S. Fish and Wildlife Services, to develop measures to prevent, mitigate, or compensate for losses to fish and wildlife. This requirement is addressed under CWA Section 404 requirements.	During the identification, screening, and evaluation of alternatives, the effects on wetlands are evaluated. If an alternative modifies a body of water, EPA must consult the U.S. Fish and Wildlife Service. Whenever possible, the remedial alternative describes measures to prevent, mitigate, or compensate for losses to fish and wildlife.	This requirement was met during remedy construction. U.S. Fish and Wildlife Service was consulted.
	RCRA Location Standards (40 CFR 264.18)	ROD: Relevant and Appropriate	This regulation outlines the requirements for constructing a RCRA facility on a 100-year floodplain.	A RCRA facility that is located on a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood, unless waste may be removed safely before floodwater can reach the facility or no adverse effects on human health and the environment would result if washout occurred.	No facility has been constructed within OU2. If a facility is proposed, it must be approved in accordance with this regulation.
	Hazardous Waste Facility Siting Regulations (990 CMR 1.00)	ROD: Relevant and Appropriate	These regulations outline the criteria for the construction, operation, and maintenance of a new facility or increase in an existing facility for the storage, treatment, or disposal of hazardous waste.	No portion of the facility may be located within a wetland or bordering a vegetated wetland, or within a 100-year floodplain, unless approved by the state.	These regulations are not applicable since no facility has been constructed within OU2.

TABLE 2. REVIEW OF LOCATION-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE FOR OPERABLE UNIT 2 (MIDDLE MARSH)
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

Medium/Authority (from ROD)	ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
State Regulatory Requirements	Massachusetts Wetlands Protection Act (M.G.L. 131, §40); Massachusetts Wetlands Protection Regulations (310 CMR §10.00)	ROD: Applicable	These regulations are promulgated under Wetlands Protection Laws, which regulate dredging, filling, altering, polluting of inland wetlands. Work within 100 feet of a wetland is regulated under this requirement. The requirement also defines wetlands based on vegetation type and requires that effects on wetlands be mitigated. Each remedial alternative will be evaluated for its ability to attain regulatory performance standards, including mitigation of impacted wetlands.	If alternatives involve removing, filling, dredging, or altering a DEP-defined wetland, or conducting work within 100 feet of a wetland, it must be demonstrated that the modifications are not significant to the wetland or that the proposed work will contribute to the protection of the wetland. Whenever possible, remedial actions will be conducted so that impacts to wetlands will be minimized or mitigated.	Remedial construction was conducted so that impacts to wetlands were minimized. Erosion control measures were used throughout construction. A wetlands restoration plan was prepared which outlined measures to attain these standards. Post-construction wetland monitoring was conducted annually following completion of excavation and initial wetlands restoration and through 2006. Long-term wetland monitoring was conducted in 2011 and will be conducted every five years to ensure the long-term effectiveness of the wetland restoration program. Annual wetland monitoring reports were submitted during the post-construction period and for the first long-term monitoring event. The reports summarize maintenance and monitoring performed within wetland restoration areas of OU1 and OU2.
	Massachusetts Endangered Species Act (M.G.L. ch. 131, §40); Massachusetts Endangered Species Act Regulations, Part III (321 CMR §§10.30 - 10.43)	ROD: Applicable	These regulations established Massachusetts' list of threatened and endangered species and species of special concern. The habitat of any species listed under this requirement is protected by the regulations promulgated under the MA Wetlands Protection Act.	If alternatives involve impacts to the habitat of any listed species, appropriate actions must be taken during remediation to mitigate or minimize impacts to the species and its critical habitat. Habitats of any listed species will be identified prior to remediation.	This requirement was met during remedial design and construction. The Mystic Valley amphipod was identified as a species of special concern at the site, and measures were taken to minimize impacts to the species and its critical habitat.
State Nonregulatory Requirements to be Considered	Massachusetts Wetlands Protection Policy 90-2; Standards and Procedures for Determining Adverse Impacts to Rare Species	ROD: To be Considered	This policy clarifies the rules regarding rare species habitat contained at 310 CMR 10.59.	Habitats of rare species, as determined by the Massachusetts Natural Heritage Program, will be considered in the mitigation plans.	This requirement was met during remedial design and construction. The Mystic Valley amphipod was identified as a species of special concern at the site, and was considered in the site mitigation plans.

TABLE 3. REVIEW OF ACTION-SPECIFIC ARARS FOR THE SELECTED AND CONTINGENCY REMEDIES, OPERABLE UNIT 2 (MIDDLE MARSH)
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
National Pollution Discharge Elimination System (NPDES) (40 CFR 122 and 125)	ROD: Applicable	Regulates the discharge of water into public surface waters.	Discharged water will be monitored for the required pollutants and standards will be met.	No water was discharged to surface waters during construction. Instead, construction water was treated and discharged to the New Bedford POTW in accordance with pretreatment program requirements.
Toxic Pollutant Effluent Standards (40 CFR 129)	ROD: Applicable	Regulates the discharge of the following pollutants: aldrin/dieldrin, DDT, endrin, toxaphene, benzidine, and PCBs.	All discharge waters will be monitored for the regulated pollutants and will meet standards.	No water was discharged to surface waters during construction. Instead, construction water was treated and discharged to the New Bedford POTW in accordance with pretreatment program requirements.
Massachusetts Surface Water Quality Standards 314 CMR 4.00	ROD: Applicable	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected. Minimum water quality criteria required to sustain the designated uses are established. Federal AWQC are to be considered in determining effluent discharge limits. Where recommended limits are not available, site-specific limits shall be developed. Any on-site water treatment and discharge is subject to these requirements.	Water from the dewatering process will be discharged directly to the unnamed stream. If this water does not meet state standards, it will be treated prior to discharge. Effluent limitations for water discharges will be established so that such discharges shall not result in a violation of state water quality standards.	These regulations are not applicable since no water was discharged to surface waters during construction. Instead, construction water was treated and discharged to the New Bedford POTW in accordance with pretreatment program requirements.

TABLE 3. REVIEW OF ACTION-SPECIFIC ARARS FOR THE SELECTED AND CONTINGENCY REMEDIES, OPERABLE UNIT 2 (MIDDLE MARSH)
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Clean Water Act 404 (40 CFR 230)	ROD: Applicable	No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the discharge which would have a less adverse impact to the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. Appropriate and practicable steps must be taken which will minimize the potential adverse impacts of the discharge material on the aquatic ecosystem.	**Selected Remedy:** Any activities that involve the discharge of dredge or fill materials in wetlands shall be conducted in a manner utilizing the alternative which would have the least adverse impact on the aquatic ecosystem and the environment, pursuant to 40 CFR 230.10(a), and any excavated areas to be filled shall be filled with clean materials from off-site, in accordance with 40 CFR 230. **Contingency Remedy:** Any activities that involve the discharge of dredge or fill materials in wetlands shall be conducted in a manner utilizing the alternative which would have the least adverse impact on the aquatic ecosystem and the environment, pursuant to 40 CFR 230.10(a), and any excavated areas to be filled shall be filled with adequately treated and appropriately reconditioned materials.	This requirement was met during remedy construction. The discharge of fill materials in wetlands was conducted to have the least adverse impact on the aquatic ecosystem and the environment. Fill materials were obtained from off-site. Soils used as fill were tested to demonstrate that they met wetland soil requirements and had less than 1 mg/kg total PCBs.

TABLE 3. REVIEW OF ACTION-SPECIFIC ARARS FOR THE SELECTED AND CONTINGENCY REMEDIES, OPERABLE UNIT 2 (MIDDLE MARSH)
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Procedures on Floodplain Management and Wetlands Protection (40 CFR 6, App A)	ROD: Applicable	Federal agencies shall avoid, wherever possible, the long and short term impacts associated with the destruction of wetlands and the occupancy and modifications of floodplains and wetlands development wherever there is a practicable alternative in accordance with Executive Orders 11990 and 11988. The agency shall promote the preservation and restoration of floodplains so that their natural and beneficial values can be realized. Any plans for actions in wetlands or floodplains must be submitted for public review.	This alternative will take into consideration this statement. All practicable means will be used to minimize harm to wetlands and floodplains. Wetlands and floodplains disturbed by excavation will be restored to their original conditions. Temporary fill placed in the golf course and wetland for access roads and staging area will not have a significant impact on the extent of flooding. Culverts will be placed under the access roads to allow for undiverted passage of flood waters.	Remedial construction was conducted so that impacts to wetlands were minimized. Erosion control measures were used throughout construction. A wetlands restoration plan was prepared which outlined measures to attain these standards. Post-construction wetland monitoring was conducted annually following completion of excavation and initial wetlands restoration and through 2006. Long-term wetland monitoring was conducted in 2011 and will be conducted every five years to ensure the long-term effectiveness of the wetland restoration program. Annual wetland monitoring reports were submitted during the post-construction period and for the first long-term monitoring event. The reports summarize maintenance and monitoring performed within wetland restoration areas of OU1 and OU2.

TABLE 3. REVIEW OF ACTION-SPECIFIC ARARS FOR THE SELECTED AND CONTINGENCY REMEDIES, OPERABLE UNIT 2 (MIDDLE MARSH) SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Massachusetts Wetlands Protection Act (M.G.L. 131, §40) (310 CMR 10.00)	ROD: Applicable	The dredging, filling, altering, or polluting of inland wetlands and work within 100 feet of a wetland is regulated. Each remedial alternative will be evaluated for its ability to attain regulatory performance standards, including mitigation of impacted wetlands.	Wetlands disturbed by excavation will be restored to original conditions. All practicable means will be used to minimize wetland disturbance. Remedial activities will be selected based on the ability to minimize adverse effects on such habitats.	Remedial construction was conducted so that impacts to wetlands were minimized. Erosion control measures were used throughout construction. A wetlands restoration plan was prepared which outlined measures to attain these standards. Post-construction wetland monitoring was conducted annually following completion of excavation and initial wetlands restoration and through 2006. Long-term wetland monitoring was conducted in 2011 and will be conducted every five years to ensure the long-term effectiveness of the wetland restoration program. Annual wetland monitoring reports were submitted during the post-construction period and for the first long-term monitoring event. The reports summarize maintenance and monitoring performed within wetland restoration areas of OU1 and OU2.

TABLE 3. REVIEW OF ACTION-SPECIFIC ARARS FOR THE SELECTED AND CONTINGENCY REMEDIES, OPERABLE UNIT 2 (MIDDLE MARSH)
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Massachusetts Endangered Wildlife and Wild Plants Regulations (321 CMR 8.00)	ROD: Applicable	These regulations established Massachusetts' list of threatened and endangered species and species of special concern. The habitat of any species listed under this requirement is protected by the regulations promulgated under the Massachusetts Wetlands Protection Act.	If the alternative involves impact to the habitat of any listed species, appropriate actions must be taken during remediation to mitigate or minimize impacts to the species and its critical habitat. Habitats of any listed species will be identified prior to remediation.	This requirement was met during remedial design and construction. The Mystic Valley amphipod was identified as a species of special concern at the site, and actions were taken to mitigate or minimize impacts to the species and critical habitat.
Massachusetts Certification for Dredging, Dredged Material Disposal, and Filling in Waters (314 CMR 9.00)	ROD: Applicable	The substantive portions of these regulations establish criteria and standards for the dredging, handling and disposal of fill material and dredged material.	Excavation, filling, and disposal operations will meet substantive criteria and standards in these regulations. The remedial alternative will be designed to ensure the maintenance or attainment of the MA Water Quality Standards in the affected waters and to minimize the impact on the environment.	This requirement was met during remedy construction. The discharge of fill materials in wetlands was conducted to have the least adverse impact on the aquatic ecosystem and the environment. Fill materials were obtained from off-site. Soils used as fill were tested to demonstrate that they met wetland soil requirements and had less than 1 mg/kg total PCBs.
Fish and Wildlife Coordination Act (16 U.S.C. 166 et seq.)	ROD: Applicable	Any modification of a body of water requires prior consultation with the U.S. FWS to develop measures to prevent, mitigate, or compensate for losses to fish and wildlife.	Prior to excavation, EPA will consult with U.S. FWS. This alternative includes measures to prevent, mitigate, or compensate for losses to fish and wildlife.	This requirement was met during remedy construction. U.S. Fish and Wildlife Service was consulted.

TABLE 3. REVIEW OF ACTION-SPECIFIC ARARS FOR THE SELECTED AND CONTINGENCY REMEDIES, OPERABLE UNIT 2 (MIDDLE MARSH) SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
TSCA, Subpart D, Storage and Disposal (40 CFR 761.60, 761.65, 761.79)	ROD: Applicable if PCB concentrations are >50 ppm; Relevant and appropriate if PCB concentrations are <50 ppm	All dredged materials that contain PCBs at concentrations of 50 ppm or greater shall be disposed of in an incinerator or in a chemical waste landfill or, upon application, using a disposal method to be approved by the EPA Region in which the PCBs are located. On-site storage facilities for PCBs shall meet, at a minimum, the following criteria:	**Selected Remedy:** Disposal of soils/sediments under the cap at the Disposal Area will comply with chemical waste landfill requirements except requirements waived in the ROD for the First Operable Unit. These regulations will be considered by U.S. EPA Region I in the selection of this alternative and in the design of storage facilities.	This requirement was met during remedy construction. None of the soils handled during OU2 remedial actions exceeded the 50 ppm level for PCBs. No off-site treatment or disposal of solid debris was required during construction. The contingency remedy identified in the ROD was not utilized.
		• Adequate roof and walls to prevent rain • Adequate floor with continuous curbing • No openings that would permit liquids to flow from curbed area • Not located at a site that is below the 100-year flood water elevation	Solid debris,excluding trees and bushes, shall be decontaminated prior to off-site transport or off-site disposal in accordance with 40 CFR 761.79; storage facilities shall be designed consistent with 40 CFR 761.65(b)(a)(i), (ii), and (iii). **Contingency Remedy:** These regulations will be considered by U.S. EPA Region I in the selection of this alternative and in the design of storage facilities. Solid debris, excluding trees and bushes, shall be decontaminated prior to off-site transport or off-site disposal in accordance with 40 CFR 761.79; storage facilities shall be designed consistent with 40 CFR 761.65(b)(a)(i), (ii), and (iii). PCB-concentrated waste oils from the solvent extraction process will be disposed of in accordance with these regulations.	

TABLE 3. REVIEW OF ACTION-SPECIFIC ARARS FOR THE SELECTED AND CONTINGENCY REMEDIES, OPERABLE UNIT 2 (MIDDLE MARSH)
SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Massachusetts Supplemental Requirements for Hazardous Waste Management Facilities (314 CMR 8.00)	ROD: Relevant and Appropriate	Water treatment units which are exempted from M.G.L.c.21C and which treat, store, or dispose of hazardous wastes generated at the same site are regulated to ensure that such activities are conducted in a manner which protects public health and safety and the environment.	If treatment of sediment/soil dewatering water is necessary, all process will comply with Massachusetts requirements regarding location, technical standards, closure and post-closure, and management standards.	Temporary treatment of sediment dewatering water during remedial actions complied with Massachusetts regulations.
Massachusetts Hazardous Waste Regulations 310 CMR 30.000)	ROD: Applicable if sediments/soils are defined as hazardous, waste under Mass. Law; relevant and appropriate if sediments/soils are similar to hazardous wastes; For contingency remedy, applicable to PCB-concentrated waste oil	Regulate the generation, storage, collection, transport, treatment, disposal, use, reuse, and recycling of hazardous waste in Massachusetts. The regulations provide procedural standards for the following: generators (310 CMR 30.300), general management standards for all facilities (301 CMR 30.510), contingency plan, emergency procedures, preparedness, and prevention (314 CMR 30.520), manifest system (310 CMR 30.530), closure and post-closure (310 CMR 30.580), landfill requirements (310 CMR 30.620), protection (310 CMR 30.660), use and management of containers (310 CMR 30.680), and facility location standards and land disposal restrictions (310 CMR 30.700).	**Selected and Contingency Remedies:** Based on known information, EPA expects that the sediment/soil are not hazardous waste under Massachusetts law. However, if the sediment/soil is designated hazardous waste under Massachusetts law, all processes involving the contaminated sediment/soil will be conducted in accordance with state hazardous waste regulations. **Contingency Remedy:** All processes involving the PCB-concentrated waste oil will be conducted in accordance with these regulations.	Post-closure requirements are being addressed by OU1. The contingency remedy identified in the ROD was not ultilized.
RCRA, Land Disposal Regulations (40 CFR 268, Subpart C)	ROD: Applicable if the sediments/soil are characteristic of hazardous waste under federal law	Prohibits the disposal of RCRA hazardous waste in the land unless treatment standards are met or treatability variance is obtained.	Based on known information, EPA expects that the sediment/soil are not hazardous waste. However, if the sediment/soil is hazardous waste due to the presence of metals, it will be solidified to render it non-hazardous or, alternatively, to meet the treatability variance requirements in the land disposal requirements.	These regulations are not applicable because pre-design studies (TCLP metals analyses) conducted for OU1 showed that soil and sediment, representative of material that was excavated, did not exhibit the toxicity characteristics and therefore did not constitute a hazardous waste.

TABLE 3. REVIEW OF ACTION-SPECIFIC ARARS FOR THE SELECTED AND CONTINGENCY REMEDIES, OPERABLE UNIT 2 (MIDDLE MARSH) SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
National Ambient Air Quality Standards (NAAQS), 40 CFR 50.6, promulgated pursuant to Clean Air Act	ROD: Applicable	The maximum primary and secondary 24-hr. concentration for particulate emissions from site excavation activities must be maintained below 150 ug/m^3, 24-hour average for particulates having a mean diameter of 10 micrometers or less. The annual standard is 50 ug/m^3, annual arithmetic mean.	The ambient air will be continuously monitored to ensure compliance with federal regulations.	Particulate monitoring was conducted and dust suppressants were used when necessary to control fugitive dust. These requirements are only applicable if further land disturbing activities are conducted.
Massachusetts Ambient Air Quality Standards (310 CMR 6.00) and Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	ROD: Applicable	**Selected Remedy:** The applicable portions of these regulations prohibit burning or emissions of dust which causes or contributes to a condition of air pollution. **Contingency Remedy:** All construction and treatment activities will utilize Best Available Control Technology in order to prevent contaminant transfer between other media and air. Massachusetts AALs and TELs are used in determining compliance with these regulations. Burning or emissions of dust which causes or contributes to a condition of air pollution are prohibited.	**Selected Remedy:** Control measures will be implemented to ensure compliance with state regulations. **Contingency Remedy:** The ambient air will be continuously monitored and control measures shall be implemented to ensure compliance with state regulations.	These requirements were met during remedy construction activities. The contingency remedy identified in the ROD was not utilized.
Federal Noise Control Act (40 CFR 204, 205, 211)	ROD: Relevant and Appropriate	Regulates construction and transportation equipment noise, process equipment and noise levels, and noise levels at the property boundaries of the project.	Site noise levels will be in accordance with federal requirements.	These requirements were met during remedy construction.
Toxic Substance Control Act (TSCA), Subpart G, PCB Spill Clean-up Policy (40 CFR 761.120-135)	ROD: To be considered	Sets cleanup levels for PCB spills of 50 ppm or greater at 10 ppm for non-restricted access areas, and 25 ppm for restricted access areas.	Cleanup levels established in Chapter Six of the Feasibility Study are consistent with this policy.	The requirements were met during remedy construction. Soils and sediment sampling is being conducted as part of post-construction environmental monitoring to verify continued compliance with the cleanup levels.
Interim Sediment Quality Criteria	ROD: To be considered	These criteria were developed by U.S. EPA for certain hydrophobic organic compounds, including PCBs, to protect benthic organisms. The criteria for PCBs is 19.5 ug PCB/g carbon.	The cleanup levels developed in Chapter 6 of the Feasibility Study are consistent with interim criteria.	The Interim Sediment Quality Criterion for PCBs was never finalized. The technical basis for sediment quality criteria for non-ionic organic contaminants such as PCBs remains a scientifically defensible approach to setting sediment quality criteria for PCBs in sediment.

TABLE 3. REVIEW OF ACTION-SPECIFIC ARARS FOR THE SELECTED AND CONTINGENCY REMEDIES, OPERABLE UNIT 2 (MIDDLE MARSH) SULLIVAN'S LEDGE SUPERFUND SITE, NEW BEDFORD, MASSACHUSETTS

ARAR (from ROD)	Status (from ROD)	Requirement Synopsis (from ROD)	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Massachusetts Allowable Ambient Air Limits - Annual (AALs) and Massachusetts Threshold Effects Exposure Levels (TELs)	ROD: To be considered	These guidances are to be considered in evaluating whether a condition of air pollution exists. The TEL for PCB is 0.003 ug/m^3 and the AAL is 0.005 ug/m^3.	Massachusetts air limits and exposure levels will be considered in the evaluation of emissions monitoring results.	These requirements were considered during construction. An air monitoring program was implemented to monitor and ensure compliance with these emission limits.
Guidance on Remedial Actions for Superfund Sites with PCB Contamination	ROD: To be considered	Describes various scenarios and considerations pertinent to determining the appropriate level of PCBs that can be left in each contaminated media to achieve protection of human health and the environment.	This guidance will be considered in determining the appropriate level of PCBs that will be left in the sediment/soil. Management of PCB-contaminated residuals will be designed in accordance with the guidance.	This guidance was considered during remedial design.
EPA Interim Policy for Planning and Implementing CERCLA Response Actions. Proposed Rule, 50 CFR 45933 (November 5, 1985)	ROD: To be considered	Discusses the need to consider treatment, recycling, and reuse before offsite land disposal is used. Prohibits use of a RCRA facility for offsite management of Superfund hazardous substances if it has significant RCRA violations.	**Selected Remedy:** This policy will be considered in the treatment of the PCB-contaminated sediment/soil. **Contingency Remedy:** This policy will be considered in the treatment of the PCB-contaminated waste oil stream.	Off-site disposal of PCB-contaminated sediment/soil was not conducted. The contingency remedy identified in the ROD was not utilized.