Five Year Review Report
For
Bennington Landfill Superfund Site
Bennington, Vermont

September 2004

Prepared By:

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Approved by: **Date:** 9-21-04

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BENNINGTON Landfill Superfund Site
Bennington, VT

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Executive Summary

EPA completed the construction of the cleanup actions for the Bennington Municipal Landfill in 1999. The cleanup actions included the placement of a multi-layer cap over the landfill, collection and treatment system of water discharging from a landfill underdrain, interception of shallow groundwater in a collection trench, and institutional controls. All of these actions were implemented as part of a Non-Time-Critical Removal Action (NTCRA). The Record of Decision for the Bennington Municipal Landfill documented that No Further Action beyond the NTCRA was necessary to protect human health and the environment.

This Five-Year Review Report documents that the cleanup actions remain protective of public health and the environment. The immediate threats at the Site were fully addressed by the NTCRA.

Five-Year Review Summary Form

Site Identification
Site name: Bennington Municipal Sanitary Landfill Superfund Site
EPA ID: VTD981064223
Region: 1 State: Vermont City/County: Bennington/Bennington
Site Status
NPL Status: Final
Remediation Status: Construction Complete with long-term operation, maintenance, and monitoring
Multiple Operable Units: No Further Action ROD and NTCRA
Construction Completion Date: 06/30/1999
Has Site been put into reuse: No
Review Status
Lead Agency: EPA
Author Name: Edward Hathaway
Author Title: Remedial Project Manager Author Affiliation: EPA New England
Review Period: 12/23/2003 to 08/31/2004
Date of Site Inspection: 06/18/2004
Type of Review: Post-SARA – policy
Review Number: 1
Triggering Action: Preliminary Close-out Report
Triggering Action Date: 06/30/1999
Due Date for Five Year Review: 06/30/2004

Five-Year Review Summary Form

Issues:

No major issues were identified as a result of the five-year review.

Recommendations and Follow-Up Actions:

Continue with long-term monitoring, maintenance, and inspection program.

Protective Statements:

All immediate threats at the Site have been addressed. The cleanup actions remain protective of human health and the environment as a result of the institutional controls and the maintenance of the actions implemented as part of the NTCRA. The basis for the No Further Action has been supported by the Five-Year Review. The combined NTCRA and No Further Action ROD are considered to be protective of human health and the environment in the short-term and long-term. Short-term protectiveness is achieved because:

- There is no current exposure of Site related waste to humans or the environment at levels that would represent a health concern.
- The landfill cover system prevents exposure to the waste material and contaminants within the landfill.
- The land use restriction (restrictive covenant and groundwater reclassification) prevents any use of the land or groundwater that would result in an exposure to hazardous substances, pollutants, or contaminants.

Long-term protectiveness will be accomplished through continued performance of operation, maintenance, and monitoring activities along with the eventual restoration of the groundwater.

Long-Term Protectiveness:

Long-term protectiveness of the response actions will be verified through periodic inspections and long-term monitoring of the Site. The data collected since the signing of the ROD supports that there is only a limited plume of contaminated groundwater at the downgradient edge of the landfill. The area containing the groundwater contamination is included in the groundwater reclassification zone and is further controlled by a restrictive covenant on the land, therefore, future use of the groundwater is not likely. Leachate

flow from the landfill, as documented by the influent flow for the leachate collection and treatment system, has been reduced by over 90% since the installation of the cap. There continues to be no unacceptable risk to human health or the environment outside the perimeter of the cap.

1 INTRODUCTION

A policy five-year review was conducted of the No Further Action decision for the Bennington Landfill, in Bennington, Vermont. The purpose of the five-year review is to determine whether the decision to take no further action at the Site remains protective of human health and the environment. The methods, findings, and conclusions of the five-year review are documented in this Five-Year Review Report. In addition, this report presents any issues identified during the review and provides recommendations to address them.

This Five-Year Review Report was prepared pursuant to CERCLA §121 and the National Contingency Plan. CERCLA §121 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 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 the 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 Agency interpreted this requirement further in the National Contingency Plan (NCP); 40 CFR § 300.430 (f)(4)(ii) 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.

This five-year review is not a statutory review. This five-year review is a policy review that is being performed by EPA to confirm the appropriateness of the No Further Action decision.

2 SITE CHRONOLOGY

TABLE 1

Date	Event
Prior to 1969	Location of the site was a sand and gravel operation
1969 – 1985	Location of Site was leased by Town of Bennington for use as a municipal solid waste and industrial waste dump
1969 – 1975	Portion of Site used for a liquid waste lagoon
1987	Landfill was closed
1989	EPA placed the Bennington Landfill on the Superfund National Priorities List
1990	Town of Bennington performs a state solid waste closure of the Site
1991 – 1997	Remedial Investigation and Feasibility Study performed by PRPs
1994	Action Memorandum signed to initiate Non-Time-Critical Removal Action (NTCRA)
1996	Administrative Order on Consent for Design of NTCRA
1997	Consent Decree for construction and maintenance of the NTCRA
1998	Restrictive Covenant and Groundwater Reclassification for landfill and area of groundwater impact
1998	No Further Action Record of Decision
1998 -	Maintenance and monitoring
1999	Completion of NTCRA construction activities

3 BACKGROUND

3.1 **Physical Characteristics**

The Site consists of a 15 acre municipal solid waste landfill and associated drainage pond situated in an 85 acre parcel owned by the Town of Bennington, Vermont. Prior to the landfill, the location of the Site was a sand and gravel pit. The areas to the north and east of the Site are former borrow pits. Reclamation of the borrow pits has begun. The area directly east of the Site is wetland/woodland that is within the groundwater institutional control area and is unlikely to be developed in the future. The others areas surrounding the Site are residential. The Site is bordered by wetlands serving as the headwaters for Hewitt Brook to the east of the Site, residential areas are to the south, and U.S. Route 7 to the west. A map of the Site is included as Figure 1.

3.2 Land and Resource Use

There were no zoning or other land use restrictions in place at the start of the remedial investigation/feasibility study (RI/FS) that would have precluded future residential use of the Site area. The restrictive covenant and groundwater re-classification implemented as part of the NTCRA effectively prevent the potential for an individual to come into contact with the contaminated groundwater.

A solid waste transfer station and recycling facility are currently located adjacent to the landfill. The remaining has been used periodically by recreational off-road vehicles. There is a large wetland area adjacent to the Site. The United States Fish and Wildlife Service and the Town of Bennington have been actively working to restore the former borrow pit to the north and east of the Site.

3.3 History of Contamination

The landfill began operation in 1969 and received commercial, residential, and industrial solid and liquid wastes. The Town of Bennington leased the property for use as a landfill until 1985, when it purchased the property. In April 1987, the landfill was closed and the Town established a transfer station adjacent to the location of the landfill.

Throughout the entire period of operation (1969-1987) residential, industrial, and commercial waste was disposed in the landfill. One portion of the landfill was used for the disposal of liquid wastes from 1969 – 1975. This area, known as the "lagoon", was covered with debris and is within the limits of the current solid waste mass. A drainage system was constructed within the landfill in 1976 to lower the groundwater level in the waste. The outlet for this drainage system was a pipe whose discharge was responsible for the creation of the drainage pond.

The Town of Bennington performed a solid waste closure of the landfill in 1990 in accordance with the Vermont Solid Waste Program. Collection of the underdrain discharge was not included in the solid waste closure.

The surficial sand and gravel aquifer has been impacted by the landfill. Polychlorinated Biphenyls (PCBs), volatile organic compounds (including vinyl chloride, chloroethane, 1,1 dichloroethene, 1,2 dichloroethene, 1,1,1 trichloroethane, trichloroethene, methylene chloride, and benzene) and several metals (arsenic, barium, and manganese) have been detected at elevated levels. Elevated levels of PCBs were also found in the soil and sediment of a small area of standing water near the outlet to the discharge from the drainage pipe.

The contamination of the surficial sand and gravel aquifer extends from under the landfill to area east of the landfill where the groundwater recharges into a wetland that serves as the headwaters for Hewitt Brook. Elevated of contaminants were detected in wells

abutting the landfill and drop significantly within several hundred feet from the landfill. There is an increase in arsenic with distance from the landfill that is likely a result of the mobilization of arsenic from the natural soil materials due to the reducing environment created by the presence of landfill leachate. Very low levels volatile organic compounds were detected in the bedrock aquifer adjacent to the landfill. High levels of PCBs were found in the soil and sediment adjacent to the discharge from the underdrain discharge pipe. Some of the PCBs migrated into the sediments of the wetland and Hewitt Brook.

3.4 Initial Response

In December 1994, EPA signed an Action Memorandum to initiate a non-time-critical removal action (NTCRA) at the Site to address the source of contamination. The NTCRA was designed to control the source of the groundwater, surface water, and sediment contamination. The major components of the NTCRA are:

- construction of a multi-barrier landfill cap over the entire waste mass;
- construction of an upgradient interceptor trench to divert groundwater upgradient of the landfill around the waste;
- construction of a leachate collection and treatment system to collect the discharge from the underdrain discharge pipe and treat that water prior to discharge; and
- excavation and consolidation of sediments and soils with PCB concentrations above 1 mg/kg.

The NTCRA also included institutional controls to prevent future use of the Site. EPA entered into an Administrative Order with the potentially responsible parties (PRPs) for the design of the NTCRA in 1996. EPA entered into Consent Decree with the PRPs in August 1997. The Consent Decree required the PRPs to perform the construction and long-term operation and maintenance of the NTCRA. All construction activities and institutional controls included in the NTCRA were completed in June 1999.

3.5 Basis for Taking Action

The initial cleanup action was taken to address the PCB contamination in the sediments adjacent to the landfill and to comply with federal and state landfill closure requirements. The Human Health and Ecological Risk Assessment concluded that there was not an unacceptable risk to human health or the environment after completion of the NTCRA.

4 REMEDIAL ACTIONS

4.1 Remedy Selection

A No Further Action Record of Decision was signed in September 1998. The ROD included long-term monitoring to confirm that the conditions upon which the No Further Action was made do not change. EPA is responsible for years 1 – 10 of the monitoring and the State of Vermont will be responsible for the remainder of the monitoring.

4.2 Remedy Implementation

The long-term monitoring required by the ROD has been implemented by EPA. The NTCRA construction activities and institutional controls were completed in 1999. The cleanup actions implemented by the NTCRA are operated and maintained by the Town of Bennington with EPA oversight.

4.3 Operation and Maintenance

The operation and maintenance activities for the NTCRA are being implemented by the PRPs. Maintenance reports are submitted to EPA and Vermont ANR for review. In addition, EPA has an oversight contractor perform site inspections and oversee the PRP activities. EPA performs the long-term monitoring at the Site.

The operation, maintenance, and monitoring activities focus on:

- the vegetative cover of the cap and repair of any erosion;
- treatment of the discharge from an underdrain system in an on-site treatment plant; and
- collection and analysis of samples to monitor trends in groundwater concentrations.

5 PROGRESS SINCE LAST REVIEW

This is the first five-year review.

6 FIVE-YEAR REVIEW PROCESS

6.2 Administrative Components

EPA, the lead agency for this five-year review, notified VTDEC and the PRPs in early 2004 that the five-year review would be completed. The Five-Year Review Team was led by Edward Hathaway of EPA, Remedial Project Manager, for the Bennington Landfill Superfund Site, and included staff from EPA's oversight and five-year review support contractor, TRC Environmental Corporation Inc. John Schmeltzer of the Vemont DEC was as also part of the review team.

The review components included:

- Community Involvement;
- Document Review;
- Data Review;
- Site Inspection;
- Local Interviews; and
- Five-Year Review Report Development and Review.

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6.3 Community Involvement

EPA issued a fact sheet to notify the public of the five-year review. There has been minimal public interest in the Site. One adjacent resident has requested a water sample. This resident is upgradient of the Site and is not at risk.

6.4 Document Review

The five-year review consisted of a review of relevant documents including O&M records and monitoring data, Record of Decision, Consent Decree, and Preliminary Close Out Report.

6.5 Data Review

Environmental monitoring data are available for groundwater, surface water, and sediments. Monitoring data presented in the Semi-Annual and Annual Data Evaluation Reports for the Site for the following years: 1999, 2000, 2001, 2002, 2003, and 2004 was reviewed as part of the Five-Year Review. Leachate treatment system discharge monitoring data provided by *de maximis, Inc* was also reviewed. Environmental monitoring data are available for the ground water, surface water, and sediments, and the

leachate collection system. The following sections provide a summary of findings for each media.

6.6 Groundwater

Monitoring Program

During the five-year review period, groundwater quality at the Site has been monitored in approximately 22 monitoring wells for Volatile Organic Compounds (VOCs), PCBs, and metals.

Groundwater is divided into two systems at the Site. The shallow system is comprised of surficial sand and gravel, ranging in thickness from 7 to 29 feet. Groundwater flows predominantly west to east in this system, with the headwaters of Hewitt Brook serving as a discharge zone. This layer is underlain by a dense till that has been characterized as a confining layer ranging in thickness from 0 feet west of the landfill to 530 feet east of the landfill. The bedrock and deep sand and gravel represents the second water bearing formation at the site.

6.6.1 Contaminant Trends in Groundwater

Since the completion of the landfill cap, contaminant levels in groundwater have been monitored periodically to ensure that the remedy is protective of human health and the environment. Table 2 compares the maximum concentrations in groundwater of contaminants of concern found during the RI/FS (as documented in Table 1 of the ROD) to the most current set of groundwater data obtained in April of 2004.

Table 2
Comparison of Maximum Contaminant Concentrations in Groundwater: RI/FS to 2004 Data
Bennington Landfill

Contaminant of Concern	VTGES or MCL	ROD Maximum (all wells)	ROD Maximum (excluding B-6 and B-14)	April 2004 (all wells)
Volatile Organic Compounds (ug/L)				
1,1,1-Trichloroethane	200	**660**	ND	ND
1,1-Dichloroethene	7	**30**	ND	ND
1,2-Dichoroethene	70	**4050**	14	ND
Benzene	5	**25**	4	ND
Methylene chloride	5	**180**	2	4 J
Tetrachloroethene	5	**70**	ND	ND
Toluene	1000	**1650**	0.8	ND
Trichloroethene	5	**53**	ND	2 J
Vinyl chloride	2	**95**	**11**	ND
Polychlorinated Biphenyls (ug/L)				
Total PCBs	0.5	**7**	**12**	**5.2**
Metals (ug/L)				
Arsenic	50/10	**17**	**31**	**24.3**
Barium	2000	**4270**	**4040**	1780
Beryllium	4	**5.4**	ND	ND
Chromium	100	**145**	24	0.91 J
Cadmium	5	**6**	ND	0.20 J
Lead	15	**120**	11	3.1
Manganese	840	**2300**	**1480**	**1540**
Nickel	100	**247**	50	31.2

MCL – Maximum contaminant level from National Primary Drinking Water Regulations, updated 2002.

ND – No detections of given contaminant for sampling event.

VTGES – Vermont Groundwater Enforcement Standard

Bolded concentrations exceed MCL standards.

Out of the 18 contaminants of concern, all eighteen were detected at levels above drinking water standards in groundwater during the RI/FS. When the two wells located adjacent to the landfill, B-6 and B-14 are removed from the data set, the RI/FS data showed a significant decrease in concentrations with increasing distance from the landfill for almost all contaminants (excluding arsenic, barium, and PCBs which remain almost

constant). The B-6 cluster is still currently monitored; however, B-14 was removed during the completion of the NTCRA landfill cap.

The April 2004 groundwater data show a marked decrease in contaminant levels in comparison to the RI/FS data. Only three out of the eighteen contaminants (arsenic, manganese, and PCBs) exceed the drinking water standards. The elevated levels of arsenic and manganese are likely the result of continued mobilization of these metals from the natural soil materials due to the reducing environment present adjacent to the landfill cap. The area of highest PCB concentrations are hydraulically down gradient of the original underdrain discharge pipe that previously discharged high concentrations of PCB-impacted water to the former drainage pond. The groundwater contamination is contained within the groundwater reclassification and institutional control area.

Further discussion of contaminant concentration trends is provided below by constituent type.

6.6.2 VOCs

There are currently no exceedances of drinking water standards for VOCs. The only exceedance since the completion of the NTCRA landfill cap was for methylene chloride, a common laboratory contaminant also detected in the associated blank sample

Low concentrations of VOCs were detected in bedrock monitoring wells adjacent to the landfill prior to the completion of the landfill cap. However, these concentrations were always below drinking water standards and therefore not considered a problem. The total VOC concentrations in groundwater collected from these wells were consistently less than 10 ug/L in post-NTCRA samples and concentrations of individual constituents were less than all applicable drinking water standards.

6.6.3 PCBs

Table 3 summarizes the maximum concentration of total PCBs in groundwater for each sampling event since the completion of the NTCRA landfill cap. The table also lists the number of wells that had samples exceeding the MCL of 0.5 ug/L. A review of this data shows the groundwater PCB concentrations have been fairly consistent, and the highest concentrations have been consistently observed in wells located east of the landfill and the former leachate underdrain pipe and drainage pond.

Table 3
Maximum PCB Concentration per Sampling Event
Bennington Landfill

			Sept. 1999	Nov. 1999	June 2000	Oct. 2000	Nov. 2001	May 2002	Oct. 2002	May 2003	April 2004
Total Wells Sampled		**MCL**	**13**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**
Number of Wells with Groundwater PCB Levels Exceeding MCLS:											
Bedrock			-	-	-	-	-	-	-	-	-
Overburden			5	6	3	7	6	4	5	4	4
Max.	Concentration (ug/l)	0.5	5.52	8.16	5.61	10.8	5.50	6.50	5.60	5.20	5.20
	Location		B-5-2	B-22	B-5-2	B-5-2	B-5-2	B-5-2	B-5-2	B-5-2	B-5-2

MCL – Maximum contaminant level from National Primary Drinking Water Regulations, updated 2002.

Although the data appear to fluctuate, trend lines suggest an overall decrease in the levels of PCB contaminants. While the concentrations of PCBs appear to be decreasing in Site groundwater, they have not yet reached drinking water standards, and should continue to be monitored.

6.6.4 Metals

Twelve metals (aluminum, antimony, arsenic, barium, cadmium, iron, lead, manganese, mercury, sodium, thallium, and zinc) have all been detected above either primary or secondary drinking water standards in groundwater from various downgradient overburden wells across the Site. Iron, lead, manganese, and thallium also exceeded standards in groundwater samples from upgradient overburden wells. The MCL for arsenic decreased in late-2002 from 50 ug/L to 10 ug/L. This new value is only used in comparison with the newer (2003 and 2004) data to determine if any exceedances exist and has not been compared to the historic data.

Table 4 presents the maximum concentration for each constituent as a function of time since the completion of the NTCRA landfill cap. The concentrations for most analytes appear to be either decreasing or remaining constant over time.

Table 4
Maximum Concentrations of Metals in Groundwater (ug/L)
Bennington Landfill

		VTGES or MCL	Sept. 1999	Nov. 1999	June 2000	Oct. 2000	Nov. 2001	May 2002	Oct. 2002	May 2003	April 2004
Aluminum											
Max.	Concentration	200	**570**	**257**	**993**	**246**	**359**	137	**204**	181	119
	Location		B-6-3	B-6-3	B-6-3	B-6-3	B-6-3	B-6-3	B-5-2	B-6-3	B-17
Antimony											
Max.	Concentration	6	5.7	5.3	5.6	ND	**7.1**	4.7	1.8	**9.8**	0.40
	Location		B-1-2	B-22	B-5-2	-	B-1-1	B-23	B-23	B-2-2	B-5-1
Arsenic											
Max.	Concentration	10	**35.2**	**39**	**36.8**	**38.2**	**33.2**	**25.5**	**47.6**	**33**	**24.3**
	Location		MW-3	B-22	B-22	MW-3	B-23	MW-3	PZHB-1	B-22	MW-3
Barium											
Max.	Concentration	2000	**2680**	**3150**	**3290**	**3470**	**2680**	**2680**	**2730**	**2180**	1780
	Location		B-5-2	B-5-2	B-5-2	B-5-2	B-5-2	B-5-2	B-5-2	B-5-2	B-5-2
Mean Concentration			599	602	717	736	940	702	777	561	517
Cadmium											
Max.	Concentration	5	ND	ND	ND	ND	0.49	**5.3**	ND	ND	0.20
	Location		-	-	-	-	B-6-3	B-18	-	-	B-20
Iron											
Max.	Concentration	300	**21500**	**29500**	**31300**	**31200**	**27200**	**20100**	**32800**	**24400**	**21300**
	Location		B-23	B-23	B-22	B-23	B-23	B-23	B-19	B-22	B-22
Lead											
Max.	Concentration	15	**253**	ND	1.8	1.7	**41.1**	14.1	14.6	2.6	3.1
	Location		B-2-3	-	B-23	B-22	B-6-3	B-18	PZHB-1	PZHB-1	PZHB-1
Manganese											
Max.	Concentration	840	**5980**	**3820**	**3990**	**4730**	**3540**	**5140**	**4500**	**1810**	**1540**
	Location		B-19	B-19	B-19	B-1-1	B-1-1	B-19	B-19	B-22	MW-3
Mercury											
Max.	Concentration	2	ND	ND	0.22	0.13	0.18	ND	ND	**9.8**	0.32
	Location		-	-	MW-3	MW-3	MW-4	-	-	B-17	B-17
Sodium											
Max.	Concentration	250000	188000	107000	78000	91200	**269000**	206000	218000	219000	**284000**
	Location		B-2-2	B-20	B-5-2	B-5-2	B-2-2	B-2-2	B-2-2	B-21	B-2-2
Thallium											
Max.	Concentration	2	**7.2**	**8.9**	**16.9**	ND	**5.2**	ND	**6.8**	**5.6**	0.3
	Location		B-2-1	MW-3	MW-3	-	B-8-1	-	B-19	MW-3	B-21
Zinc											
Max.	Concentration	5000	61.3	54.4	903	328	922	181	**12300**	4190	1470
	Location		B-2-3	B-6-3	PZHB-1	PZHB-1	PZHB-1	PZHB-1	PZHB-1	PZHB-1	PZHB-1

MCL – Maximum contaminant level from National Primary Drinking Water Regulations, updated 2002.
ND = No detections of given analyte during sampling event

While the concentrations of some contaminants of concern appear to be decreasing in Site groundwater, they have not yet reached drinking water standards, and should continue to be monitored.

6.7 Surface Water

Surface water monitoring data were evaluated as part of the five-year review process to determine if a change in concentration occurred that would question the finding in the ROD regarding risk. As documented in the ROD, EPA determined that no unacceptable human health or ecological risks remained after the completion of the NTCRA (based on the risk assessment conducted in 1995 during the RI/FS and included as part of the ROD). The ROD states that the Leachate Collection and Treatment System (LCTS) and landfill cap are expected to prevent any further degradation of surface water and sediment quality.

There are five major landfill seep and leachate discharge points: the wetland areas, Ponds A, B, and C, and Hewitt Brook. Water quality criteria applicable to these discharge points include Federal and State Ambient Water Quality Criteria. These five surface water bodies were sampled three times since the completion of the landfill cap: once in October 1999, June 2000 and October 2000 for total PCBs and TAL metals.

Table 5 presents the minimum and maximum concentrations of select metals and total PCBs in surface water samples. The table compares the data from the RI to data collected in October 1999 and 2000. In general, the concentrations for metals in the 1999 and 2000 data sets appear to be consistent with the RI data. Concentrations of total PCBs in surface water samples collected along Hewitt Brook from Pond B to Houghton Lane are also consistent with the RI data. However, PCB concentrations in surface water samples collected from Pond B are several orders of magnitude lower than the historic data.

Table 5
Comparison of Surface Water Analytical Data (ug/L)
Bennington Landfill

Pond B				
Analyte	**RI (1)**	**Oct-99**	**Jun-00**	**Oct-00**
Aluminum	ND	19.6 - 115	55.1 - 62.3	ND - 108
Arsenic	25.3	6 - 20.2	5.2 - 9.2	ND - 5.7
Barium	611	755 - 869	598 - 774	681 - 823
Calcium	104,000 J	124,000 - 138,000	97,400 - 118,000	126,000 - 132,000
Cobalt	5 J	15.4 - 19.8	4.6 - 13.0	ND - 9.6
Iron	2,420 J	4,730 - 13,800	1,750 - 5,350	401 - 3,400
Manganese	121	1,220 - 1,310	569 - 1,310	53.3 - 1,040
Nickel	14 J	5.1 - 8.2	3.7 - 5.3	4.2 - 6.2
Silver	ND	ND - 1.7	ND	ND
Sodium	53,500	38,200 - 59,400	35,700 - 54,400	26,900 - 31,900
Total PCB	427	0.56 - 0.97	0.559 - 1.487	0.32 - 0.833
Hewitt Brook (Pond B - Pond C)				
	RI (2)	**Oct-99**	**Jun-00**	**Oct-00**
Aluminum	ND	31.9 - 35.3	49.8 - 51.3	51.3 - 204
Arsenic	4 J	ND - 8.2	5.5 - 9.5	5.6 - 9.5
Barium	227	738 - 756	570 - 573	570 - 990
Calcium	78,400	121,000 - 122,000	97,600 - 102,000	63,000 - 102,000
Cobalt	ND	15.4 - 16.4	13.4 - 13.7	10.0 - 13.4
Iron	1,690 J	1,660 - 3,290	4,480 - 7,070	7070 - 7500
Manganese	246	1,400 - 1,690	1,030 - 1,240	338 - 1,030
Nickel	ND	5.6 - 8.4	2.9 - 3.7	3.4 - 3.7
Silver	ND	1.5 - 1.6	ND	ND
Sodium	7,500	40,400 - 42,700	25,600 - 26,400	10,600 - 26,400
Total PCB	ND	0.43 - 0.44	0.507 - 0.676	0.093
Hewitt Brook (Pond C - Houghton Lane)				
	RI	**Oct-99**	**Jun-00**	**Oct-00**
Aluminum	ND - 4,490	25.2 - 59.9	66.2 - 71.7	ND - 137
Arsenic	ND - 36	ND	ND -3.3	ND
Barium	336 - 1,940	302 - 736	407 - 576	440 - 652
Calcium	62,000 - 118,000	38,100 - 124,000	68,600 - 103,000	71,300 - 91,500
Cobalt	ND - 154	ND - 6	ND - 4.6	ND - 2.9
Iron	68.6 - 82,000	74 - 637	143 - 463	92 - 2,420
Manganese	14.5 - 28,200	31.4 - 766	52.4 - 698	79.2 - 873
Nickel	ND - 30.3 J	ND - 5.5	1.3 - 3.4	ND - 4
Silver	ND - 3.4 J	ND - 1.3	ND	ND
Sodium	13,700 - 35,400	12,400 - 42,000	18,200 - 29,900	13,600 - 24,900
Total PCB	0.297 (3)	0.042 - 0.24	0.238 - 0.355	0.039 - 0.135

Notes:
Concentrations in ug/L
(1) Represented by one sample collected at southern end of Pond B (SW - 18).
(2) Represented by one sample collected just upstream from Pond C (SWAT - 01).
(3) Represented by one sample collected just upstream of staff gauge GHB-03 (SW - 002).
RI - Remedial Investigation (McLaren/Hart, 1997).
ND - Not Detected

The 1999 and 2000 analytical data indicate concentrations of some metals and PCBs exceeded benchmark standards in surface water samples collected at and immediately downstream of Pond B. The samples collected in Hewitt Brook decrease in concentration with respect to distance from Pond B. Concentrations in the samples collected at the Houghton Lane crossing were below most benchmark values. Surface water sampling was discontinued after the initial post-ROD monitoring confirmed that the conditions were not changing.

Since the EPA determined no unacceptable risk would remain after completion of the NCTRA, and the post NTCRA concentrations are consistent with the RI/FS data, it is reasonable to conclude that there are currently no unacceptable risks due to surface water.

6.8 Sediment

Post-NTCRA sediment monitoring data were evaluated as part of the five-year review process to determine if a change in concentration occurred that would question the finding in the ROD regarding risk. Prior to the NTCRA, soil and sediment samples were obtained from leachate outbreaks within the landfill limits, areas surrounding the landfill, and the pond areas and Hewitt Brook between 1993 and 1997. The samples were analyzed for VOCs, pesticides, Semi-VOCs, PCBs, and metals. Based on a subsequent risk analysis, it was determined that PCBs were the only constituent of concern. All soils and sediments with PCB concentrations greater than 1,000 ug/kg were excavated and placed under the landfill cap to prevent contact and migration of contamination.

One round of post-NTCRA sediment samples were collected in October 1999. Analytical results indicated the highest concentrations of TAL metals and total PCBs were detected in samples from Pond B and immediately downstream of Pond B. The concentrations decreased with distance downstream from Pond C. One sediment sample collected exhibited a total PCB concentration of 1,327 ug/kg, which is above the NTCRA cleanup level. This isolated concentration does not represent a risk and is only slightly above the 1,000 ug/kg clean-up level. Table 6 compares post NTCRA data for select PCBs and metals in sediment samples collected from three general sampling areas to concentrations detected during the RI at similar locations.

Table 6
Comparison of Sediment Analytical Data (mg/kg)
Bennington Landfill

	Pond B		Hewitt Brook (Pond B to Pond C)		Hewitt Brook (Pond C to Houghton Lane)	
Analytes	**RI**	**1999**	**RI**	**1999**	**RI**	**1999**
PCBs	ND – 0.796	0.055 – 1.327	ND – 0.113	0.017 – 0.706	NA	0.017 – 0.268
Metals						
Aluminum	1440 – 2580	1410 - 4360	3040	886 – 3120	1770 – 4490	2240 – 3750
Arsenic	4.6 – 9.9	7.2 – 37.8	1.6	4.6 – 201	3.1 – 64.2	2 – 19.3
Barium	27.8 – 61.4	46 – 437	248	58.3 – 5410	250 – 2700	61.4 – 750
Calcium	81200 – 123000	2720 – 10500	62800	23300 – 33900	11200 – 31500	3550 – 26200
Cobalt	8.7 - 14.3	7.6 – 41.1	24.2	13.1 – 67.8	16.1 – 57.1	4.6 – 58.9
Iron	16300 – 182000	10100 – 42600	13200	6710 – 166000	8400 – 57200	5740 – 28400
Manganese	426 – 672	133 – 1210	1720	619 – 31000	2050 – 13300	75.6 – 3410
Nickel	6.3 – 12.6	4 – 12.8	8.6	5.5 – 51.6	7 – 21.9	4.5 – 12.7
Silver	NA	0.03 – 0.15	NA	0.05 – 0.1	ND – 1.6	0.06 – 0.11
Sodium	NA	23 – 89.8	NA	23.4 - 241	NA	25.1 - 142

NA – Not analyzed
ND – Not detected

In general, the concentrations of PCBs resulting from the October 1999 sample event are comparable to historical data from the RI/FS. Concentrations of arsenic, barium, and iron were detected at higher than the pre-removal action (RI) levels. These higher concentrations of increased arsenic concentration at one location do not change the threat to human health. The risk would be within the EPA acceptable risk range given the limited frequency and duration of exposure in these wetland areas. Sediment sampling was discontinued after 1999.

6.9 Leachate Collection and Treatment System

Construction of the leachate collection and treatment system (LCTS) was required as part of the NTCRA for the landfill. The ROD states that after completion of the NTCRA, all of the landfill waste will be above the water table. Therefore, significant reduction in the generation of leachate was expected to occur as a result of the NTCRA.

The LCTS is described below:

1. Leachate is collected from the landfill via a series of underdrain pipes installed at the base of the landfill;

2. The leachate is then transferred to an influent pump chamber (IPC);

3. From the IPC, the leachate is transferred through the treatment system, where large particles are removed by bag filters and granular activated carbon filters (3) and cartridge filters remove the PCBs and VOCs. The treatment system also includes a control panel that allows for remote monitoring of the system.

4. Treated leachate is transferred into an effluent pump pit and then to the on-site groundwater infiltration system.

The LCTS effluent discharge standard is a total PCB concentration of 0.5 ug/L based on a twelve-month running average. Since 2000, the running average total PCB concentration has been less than the 0.5 ug/L standard.

The concentrations of total PCBs in the LCTS influent stream have increased dramatically over the last few monitoring events. However, the effluent stream has consistently met discharge standards, so the increase in influent concentration is not considered to be an issue.

The operation and maintenance of the LCTS is performed by the Town of Bennington and consists of the following:

- Monthly monitoring of leachate flow;
- Quarterly change-out of the bag filter, cartridge filter and primary GAC unit;
- Annual change-out of the secondary and tertiary GAC units;
- Annual inspection of the influent pump chamber and effluent pump pit; and
- Biennial cleaning for the influent pump chamber.

The ROD indicated that the reduction of leachate generation was already evident in the flow into the leachate collection and treatment system. Prior to the installation of the landfill cap and the upgradient groundwater diversion system, the rate of flow of the leachate from the underdrain discharge pipe was between 1 and 6 gpm, with an average of approximately 2 gpm. In September 1998, the flow of water into the LCTS was recorded as being consistently below 1 gpm with no fluctuation since the installation of the groundwater interception trench in December 1997. The flow rate of leachate from the landfill underdrain has been less than 0.1 gpm since May 2001; with the average flow rate from October 2001 through August 2003 of less than 0.04 gpm. Flow rates continue to be monitored on a monthly basis.

6.10 Air Monitoring

A system of landfill gas vents was installed below the landfill cap to allow landfill gases to escape from the waste into the ambient air in order to ensure that there would be no buildup of gas pressure within the landfill that might destabilize the cap. Air quality monitoring is not required by the ROD, and is not performed as part of the Site monitoring program. Instead, qualitative observations are made during Site inspections. These observations indicate no evidence of the existence of excessive gas pressure below the liner such as slope instability or breaching of the liner through the cap cover soils.

6.11 Site Inspection

Summary of Current Site Inspection

The site inspection is summarized as follows:

- Overall the landfill cap is in good condition with no evidence of erosion, cracks, or slumping. Only one animal burrow was observed during the inspection.
- Minor differential settlement has been observed in the cap during the semi-annual inspections. The differential settlement does not appear to affect the performance of the cap at this time.
- The passive gas vents were generally in good condition and appeared to be functioning as intended. While not affecting the performance of the vents, small cuts in the geomembrane boot at the base of several riser pipes were observed. The cuts should be sealed to minimize the amount of water that could seep into the landfill.
- The above ground components of the LCTS were in good condition. The interior of the treatment building was clean and orderly and O&M record sheets and information were readily available.
- The site access roads were in good condition.
- The gabion retaining walls located at the end of the perimeter diversion trench was generally in good condition. Some bulging of the gabion baskets was noted. While the deformation is likely due to the rearrangement of the riprap and not a stability concern, the gabions should be monitored in the future and repaired as needed.
- The slope bench storm water drainage swales and perimeter drainage swales were in good condition and appeared to be functioning as designed.

Interviews were conducted concurrent with the June 18, 2004 Site inspection. John Schmeltzer of the VTDEC, Stuart Hurd of the Town of Bennington, and Geoffrey Seibel of *de maximis* (the O&M contractor for the Town) were present during the inspection to answer questions and voice concerns. There were no major concerns regarding the condition of the removal action. EPA also identified several new homes that were constructed in the area of the Site since the signing of the ROD. All of these homes were determined to be either side gradient or upgradient of the Site and not at risk of contamination. EPA will sample some of these wells over the next five years to provide confirmation that there are no impacts from the Site.

Past Inspections

Semi-annual inspections of the Bennington Landfill have been conducted by the PRPs, EPA (EPA's oversight contractor TRC Solutions, Inc), and Vermont ANR since 1999. There have been no major issues regarding the operation and maintenance of the landfill remedial system. Operations, maintenance, and monitoring have adequately established the landfill cap integrity, and leachate collection continued operation.

6.11 Interviews

The facility owner, maintenance personnel, and adjacent residents were interviewed as part of the five- year review process. There were no major concerns identified.

7 TECHNICAL ASSESSMENT

7.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?

Remedial Action Performance

The long-term monitoring data and oversight inspections confirm that the NTCRA is functioning as intended and that the No Further Action ROD monitoring program is being implemented. The information sources include review of the available documents, review of post NTCRA monitoring data, the interviews, and the site inspection. The landfill cap and the LCTS have achieved the remedial objectives: to minimize the migration of contaminants and prevent direct contact with or ingestion of contaminants.

Evidence to indicate that the remedy is performing as intended includes the following:

- The remedial objectives of the cap have been achieved by preventing direct exposure to waste and contaminated soils. All waste materials added to the cap as part of the NTCRA were placed at least 30 feet above the groundwater table to ensure there would be no further impact to area groundwater.

- There is no indication that the cap is leaking; therefore, the objective of reducing or eliminating the generation of landfill leachate has been met. The cap is well maintained, and is periodically inspected and repaired as necessary.

- At the time of this five-year review, the landfill cap and upgradient groundwater isolation system appear to be functioning as designed and in good condition. The surface of the landfill remains stable and shows no signs of erosion or cracks. The benches in the landfill surface are also functioning as designed and in good condition. Perimeter ditches remain in good condition and operating as designed. The outlet pipes and riprap outlet of the drainage layer at the perimeter of the

cover system remains in good condition. The upgradient groundwater isolation system continues to function as designed and requires minimal maintenance.

- Construction of the landfill cap and the collection and discharge of leachate to the POTW were designed to eliminate the discharge of contaminants to surface water receptors. With continued maintenance of the landfill cap and leachate collection system, future compliance regarding surface water and sediments can be expected without additional remedial action.

- There is evidence of a significant decrease in leachate generation into the LCTS. The flow rate of leachate into the system has dropped from an initial average of 2 gpm prior to the completion of the NTCRA to an average of less than 0.04 gpm.

- The running average of total PCB concentrations in the effluent leachate stream for the LCTS comply with the EPA monitoring requirements of a twelve-month running average of less than 0.5 ug/L.

System Operations/O&M

Operation and maintenance of the cap and leachate seep collection and groundwater extraction systems has been, and continues to be effective. Issues identified during the semi-annual site inspections are regularly addressed or continue to be monitored. The current sampling and analytical methods for groundwater are adequate to evaluate the performance of the remedy. The location and number of wells sampled give sufficient coverage to monitor the location and concentrations of the contaminant plume.

Opportunities for Optimization

No opportunities for optimization were identified as part of the review.

Early Indicators of Potential Issues

There are no early indication of potential issues at the Site.

Implementation of Institutional Controls and Other Measures

A restrictive covenant has also been placed on the property to prevent the use of the contaminated groundwater. The impacted groundwater has been reclassified as non-potable to further prevent future use. No activities were observed that would have violated the institutional controls.

Is There a Need to Update any of the Monitoring Plans used to Evaluate the Performance of the Remedy?

A review of the sampling and analytical procedures was conducted to determine the need to update any of the monitoring plans used to evaluate the performance of the remedy.

Several new residential wells have been installed in an area that is generally upgradient and side gradient of the Site and outside the delineate extent of contamination. Sampling of these wells to confirm that there are no Site related impacts is being considered.

7.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of the Remedy Selection Still Valid?

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

The exposure assumptions used to develop the ROD were focused on the groundwater ingestion pathway. No individuals are currently exposed to contaminated groundwater. The exposure pathway assumptions used at the time of remedy selection are still valid.

There are no cleanup levels or remedial action objectives for the No Further Action decision. The new toxicity data for arsenic is not an issue as no groundwater cleanup levels were identified for the Site. In addition, future use of the contaminated groundwater is prevented by institutional controls and the reclassification of the groundwater.

Changes in Standards and To Be Considered

Applicable or relevant and appropriate requirements (ARARs) were evaluated as part of the 1998 Record of Decision. There have been two changes to ARAR or To Be Considered requirements that would call into question the protectiveness of the remedy. The Vermont Groundwater Protective Standards have been revised to be more consistent with federal MCLs. The federal MCL for arsenic was identified as 50 ug/l in the ROD. Subsequent to the ROD, EPA has reduced the federal MCL for arsenic to 10 ug/l. There are no groundwater cleanup levels identified for the Site, therefore, no action is necessary relative to the change in the arsenic MCL. The cover system installed as part of the NTCRA would comply with all current regulations and guidance.

7.3 Question C: Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

From all of the activities conducted as part of this five-year review, no new information has come to light, which would call into question the effectiveness of the remedy with the possible exception of the newly constructed residences with private wells. As a precautionary measure, water samples should be collected and analyzed, and the use of groundwater in these areas should be evaluated.

No new ecological receptors have been identified at this time. No evidence of damage due to natural disasters or lack of maintenance was noted during the site inspection.

8 ISSUES

There are no major issues that were identified as part of this five-year review. A few minor issues identified as part of the Site inspections are:

- While not affecting the performance of the vents, small cuts in the geomembrane boot at the base of several riser pipes were observed. The cuts should be sealed to minimize the amount of water that could seep into the landfill.

- The gabion retaining walls located at the end of the perimeter diversion trench was generally in good condition. Some bulging of the gabion baskets was noted. While the deformation is likely due to the rearrangement of the riprap and not a stability concern, the gabions should be monitored in the future and repaired as needed.

9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

The recommendation and follow-up actions involve the continued oversight of the work being performed by the PRPs to assure compliance with the consent decree and Record of Decision requirements.

10.0 PROTECTIVENESS STATEMENT(S)

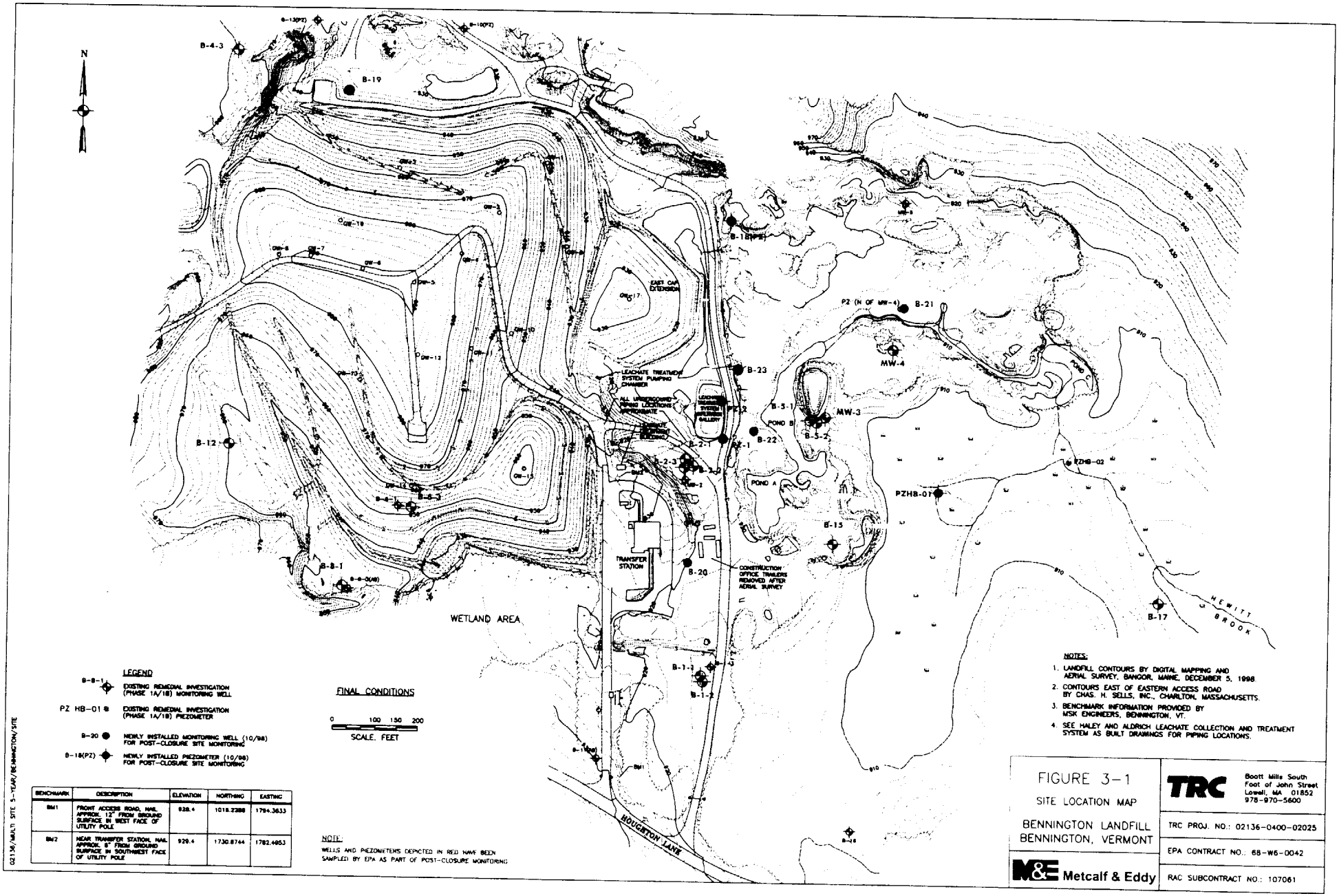
The basis for the No Further Action has been supported by the five-year review. The combined NTCRA and No Further Action ROD are considered to be protective of human health and the environment in the short-term and long-term. Short-term protectiveness is achieved because:

- There is no current exposure of Site-related waste to humans or the environment at levels that would represent a health concern.
- The landfill cover system prevents exposure to the waste material and contaminants with the landfill.
- The land use restriction prevents any use of the land that would result in an exposure to hazardous substances, pollutants, or contaminants.

Long-term protectiveness will be accomplished through continued performance of operation, maintenance, and monitoring activities along with the eventual restoration of the groundwater.

11.0 NEXT REVIEW

The next five-year review will be conducted by September 2009.



LEGEND

- B-8-1 — EXISTING REMEDIAL INVESTIGATION (PHASE 1A/1B) MONITORING WELL
- PZ HB-01 — EXISTING REMEDIAL INVESTIGATION (PHASE 1A/1B) PIEZOMETER
- B-20 — NEWLY INSTALLED MONITORING WELL (10/98) FOR POST-CLOSURE SITE MONITORING
- B-18(PZ) — NEWLY INSTALLED PIEZOMETER (10/98) FOR POST-CLOSURE SITE MONITORING

FINAL CONDITIONS

0 100 150 200
SCALE, FEET

BENCHMARK	DESCRIPTION	ELEVATION	NORTHING	EASTING
BM1	FRONT ACCESS ROAD, NAIL APPROX. 12" FROM GROUND SURFACE IN WEST FACE OF UTILITY POLE	928.4	1018.2288	1794.3633
BM2	NEAR TRANSFER STATION, NAIL APPROX. 8" FROM GROUND SURFACE IN SOUTHWEST FACE OF UTILITY POLE	929.4	1730.8744	1782.4953

NOTE:
WELLS AND PIEZOMETERS DEPICTED IN RED HAVE BEEN SAMPLED BY EPA AS PART OF POST-CLOSURE MONITORING

NOTES:
1. LANDFILL CONTOURS BY DIGITAL MAPPING AND AERIAL SURVEY, BANGOR, MAINE, DECEMBER 5, 1998.
2. CONTOURS EAST OF EASTERN ACCESS ROAD BY CHAS. H. SELLS, INC., CHARLTON, MASSACHUSETTS.
3. BENCHMARK INFORMATION PROVIDED BY MSK ENGINEERS, BENNINGTON, VT.
4. SEE HALEY AND ALDRICH LEACHATE COLLECTION AND TREATMENT SYSTEM AS BUILT DRAWINGS FOR PIPING LOCATIONS.

FIGURE 3-1

SITE LOCATION MAP

BENNINGTON LANDFILL
BENNINGTON, VERMONT

TRC
Boott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

TRC PROJ. NO.: 02136-0400-02025

EPA CONTRACT NO.: 68-W6-0042

Metcalf & Eddy

RAC SUBCONTRACT NO.: 107061

02136/MULTI SITE 5-YEAR/BENNINGTON/SITE