SANBORN HEAD

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MEMORANDUM

To: Mr. David W. Roache, P.E. ~ Mark Development, LLC

From: Kevin Stetson, P.E. and Matthew P. Heil, P.E., LSP ~ Sanborn, Head & Associates, Inc.

File: 4575.00

Date: January 28, 2020

Re: Summary of Environmental Due Diligence and Pre-Characterization Activities
Riverside Station Redevelopment
325-333 Grove Street (MBTA Station) and 399 Grove Street (Hotel Indigo)
Newton, Massachusetts

Executive Summary

Extensive soil and groundwater sampling has been completed at the project Site by Rizzo Associates, Inc. (Rizzo), Haley & Aldrich (H&A), and Sanborn Head. One previous release from the MBTA trolley service area extending partially into the eastern portion of the project Site area was closed with a Permanent Solution Statement without the need for any current or future site use restrictions. Being extremely common in fill soils in eastern Massachusetts, low level soil impacts were also documented from the historical combustion of coal and wood. Nonetheless, construction activities will be managed in accordance with The Massachusetts Contingency Plan (MCP), 310 CMR 40.0000 using a detailed construction Release Abatement Measure (RAM) Plan to ensure compliance with applicable state, local and federal regulations for managing soil and groundwater as well as worker and surrounding population safety. In conclusion, based on the limited Site impacts and their generally common nature, the comprehensive protective measures being implemented during construction, and our extensive experience with other brownfields redevelopment projects in Massachusetts, it is our opinion that the proposed redevelopment project will not adversely impact human health, public safety, public welfare or the environment at the Site and vicinity.

Summary of Proposed Riverside Station Redevelopment Project

Sanborn, Head & Associates, Inc. (Sanborn Head) has prepared this memorandum on behalf of Mark Development, LLC (Client) to summarize the environmental due diligence and pre-characterization activities completed at the above referenced project Site area in Newton, Massachusetts (the Site).

The project Site area consists of the Hotel Indigo property at 399 Grove Street as well as the southern portion of the Riverside Station of the MBTA green line at 325-333 Grove Street. The portion of the project Site area located on the MBTA parcel is limited to paved parking lots, the bus station, and access roads; the project Site area does not include the existing tracks and trolley service area as shown on the attached Figure 1 Exploration Location Plan.

The proposed project consists of an approximately 13-acre development as shown on Figure 1. The proposed development includes the construction of ten buildings ranging from four to eleven stories. The finished floor elevations range from approximate El. 62.3 to 67.5 feet with footprints ranging from approximately 11,800 square feet (ft) for Building 8 to 113,800 SF for the combined Building 9 and 10. Building uses include residential, retail, hotel and a parking garage. Buildings 1 and 5 through 10 will be constructed generally at grade with minor changes in grade resulting in cuts of up to approximately six feet and fills up to four feet. Buildings 2 through 4 will be at grade based on final grades and will require cuts up to approximately 33 feet with the foundations designed as retaining walls along Grove Street. The buildings are anticipated to be supported on conventional spread footings with a slab-on-grade floor system. Buildings 4 through 10 will require ground improvement to allow the existing fill to remain in place and be suitable to support the proposed buildings. The ground improvement method will be a full-displacement method allowing the installation of the elements without generating soil spoils. Three stormwater infiltration systems are proposed at the locations shown on Figure 1.

As the proposed project Site area is located within 500 feet of residential dwellings, the applicable soil category is Reportable Concentration (RC) S-1. Although an Interim Wellhead Protection Area (IWPA) for a Weston water supply well is located approximately 300 to 450 feet to the north of the project Site area as shown on Figure 1, the project Site area is not located within either a Current or Potential Drinking Water Source Area. Therefore, the applicable groundwater category for the project Site area is RCGW-2.

Summary of Former Massachusetts Contingency Plan (MCP) Sites

The MBTA parcel has been associated with three MCP Release Tracking Numbers (RTNs). Two of the RTNs (3-18501 and 3-18969) are located approximately 250 feet to the north of and downgradient from the proposed Project Site redevelopment area as they are related to releases associated with historical activities at the existing trolley service building. These RTNs were previously addressed and closed with Permanent Solution Statements (formerly identified as Response Action Outcome (RAO) closure reports) prepared by Weston & Sampson Engineers, Inc. and ATC Associates, Inc., respectfully, in accordance with the MCP. Both RTNs achieved conditions of No Significant Risk (NSR) with no limiting conditions, which is the regulatory endpoint for permanent closure in Massachusetts without the need for any current or future site use restrictions (e.g., no activity and use limitation/deed restriction was required).

The third RTN (3-10565) was also associated with the trolley service building and achieved a Permanent Solution RAO without restrictions. However, this RTN area extended partly into the northeastern portion of the subject parcel as shown on Figure 1. The primary contaminants of concern (COCs) were identified by Rizzo Associates, Inc. (Rizzo) as petroleum related constituents as would be expected with the historical use of the MBTA parcel for trolley storage and maintenance. All metals detected fell below the Massachusetts Department of Environmental Protection's (DEP's) published "Natural" soil background concentrations. Nonetheless, metals were voluntarily and conservatively retained in the risk characterization. Based on the relatively low concentrations of constituents in soil and groundwater that did not exceed Method 1 and 2 standards, Rizzo concluded that a condition of NSR existed and closed the issue in 1998 with a Permanent Solution without any future use restrictions. A copy of Rizzo's Response Action Outcome Statement has been provided as Attachment A.

Summary of Previous Environmental Assessment Activities

Subsurface Investigation, Proposed MBTA Riverside Development Parcel, Newton, MA, prepared by Haley and Aldrich, Inc., dated October 29, 2009.

Haley and Aldrich (H&A) completed an extensive subsurface exploration and sampling program in support of a previously proposed redevelopment design in 2009. H&A advanced fifteen (15) test borings (identified as HA09-1 through HA09-15) within the project Site area in October 2009 with four (4) completed as groundwater monitoring wells (identified with (OW) designations). The locations of the H&A explorations are shown on Figure 1.

Twelve (12) surficial soil samples were submitted for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, polychlorinated biphenyls (PCBs), extractable petroleum hydrocarbons (EPH), volatile petroleum hydrocarbons (VPH), corrosivity, and ignitability analyses. However, none of the results exceeded the lowest MCP reportable concentrations (RCS-1). In addition, none of the groundwater sampling results exceeded the MCP reportable concentrations.

Although a "moderate petroleum-like odor" was noted in boring HA09-13 at a depth of 9.5 to 13.5 feet, the soil sample results from this location remained well below the lowest RCS-1 reportable concentrations. Further, this observation was generally consistent with the conditions noted previously by Rizzo for RTN 3-10565 which, as noted above, had been previously assessed and closed with a Permanent Solution without restrictions. A copy of H&A's soil and groundwater analytical data summary tables and boring logs have been provided in Attachment B.

Phase I Environmental Site Assessment, Hotel Indigo Boston Newton Riverside, 399 Grove Street, Newton, MA, prepared by FSL Associates, Inc., dated November 24, 2015.

No evidence of Recognized Environmental Conditions in connection with the property were identified. The report noted that a 10,000-gallon underground storage tank (UST) used for the storage of No. 2 fuel oil had been removed from the Hotel Indigo property in June of 2007 without incident. Consistent with the leak detection system in place on the former UST, the Weston Fire Department noted that "no contamination" was observed at the time of the removal.

Summary of Recent Pre-characterization Sampling Activities

In September 2019, Northern Drill Services, Inc (NDS) advanced twelve (12) borings (SH-101 through SH-112) under the observation of Sanborn Head between September 24 and 30, 2019 using a truck-mounted drill rig with hollow stem augers and a 2-foot split-spoon sampler. Deeper borings were completed using drive and wash methods. Six (6) of the borings (SH-101, SH-104, SH-106-108, and SH-111) were subsequently completed as monitoring wells. Soil samples were soil jar headspace screened using a photoionization detector (PID). The approximate locations of the test borings and monitoring wells are shown on Figure 1. Test boring logs are provided in Attachment C.

Test borings completed on the Indigo Hotel parcel (SH-101 and SH-102) generally consisted of approximately 6 to 12 inches of topsoil underlain by an inorganic, granular fill with varying

amount of asphalt content. The fill was underlain by a natural sand deposit with a varying gravel and silt content. Test borings SH-103 through SH-112 were completed on the MBTA parcel and consisted generally of a surface treatment of 4 to 6 inches of asphalt underlain by an inorganic, granular fill underlain by a glacial outwash deposit of varying sand and silt content. A buried organic layer, ranging between 1 and 4 feet thick, was observed within test borings SH- 108 through SH-111. Glacial till was encountered in test borings SH-103 and SH-104. Shallow weathered bedrock was encountered at SH-112 at 3 feet below ground surface (bgs), which corresponds to approximate elevation (El.) 64.5 feet. Groundwater was measured in the monitoring wells ranging from approximately El. 43 to 52 feet as summarized in Table 2.

Very few to frequent ash particles were observed within the fill layer at the test boring locations expect for SH-101 and SH-112. PID field screening values were mostly non-detect, but low levels ranging from 1 to 6 parts per million by volume (ppmv) were encountered at SH-109 through SH-111 in the easternmost portion of the project Site area within the fill and organic layers above the groundwater table. No petroleum or decaying organic like odors were observed during drilling. Our observations were consistent with our understanding of the known environmental conditions at the Site noted previously by both H&A and Rizzo for RTN 3-10565 which was closed with a Permanent Solution without restrictions.

Sanborn Head collected soil analytical samples of the fill from four (4) locations within the vicinity of the known historical release related to RTN 3-10565. The soil samples were submitted for laboratory analysis of specific conductance, pH, reactive cyanide and sulfide, ignitability, PCBs, SVOCs, MCP 14 metals, VOCs, and Total Petroleum Hydrocarbons (TPH). Three groundwater samples were also collected for VOC, VPH and EPH analyses. The laboratory analyses were performed by Alpha Analytical Laboratories, Inc. (Alpha) of Westborough, Massachusetts.

The monitoring well groundwater level measurements, soil analytical data, and groundwater analytical data have been summarized in Tables 1, 2, and 3, respectively.

Summary of Results and Opinion of Notification Exemptions

Based on the measured groundwater elevations (Table 1) and general Site topography, groundwater is estimated to generally flow to the north from the Site toward the Charles River.

As noted in Table 2, several slight exceedances of the MCP RCS-1 standards were identified for petroleum hydrocarbons and an arsenic value in the fill soil samples. Benzo(a)pyrene, phenanthrene, and arsenic were identified in the fill soil sample at location SH-109 where ash was also observed in the fill soil. Both compounds are commonly identified polycyclic aromatic hydrocarbons (PAHs) typically created as a result of combustion (pyrogenic) activities. Detections of this nature are commonly identified in fill soils impacted by historical combustion activities. Such detections are typically linked to the ubiquitous historical use of coal and wood for heating in northern climates which has resulted in coal ash and wood ash residuals being very common in fill soil in eastern New England. In fact, these slight PAH exceedances (3.2 and 11 mg/kg) fall below the DEP published background concentrations for these compounds (7 and 20 mg/kg, respectively) in fill soils known to contain coal ash and/or wood ash. Further, arsenic

concentrations greater than twice the RCS-1 standard (2 x 20 mg/kg) are also commonly associated with coal ash residuals in historical fill soils[1].

Based on our extensive experience characterizing fill soils in eastern Massachusetts and the observation of ash, it is our opinion that the benzo(a)pyrene, phenanthrene, and arsenic detections in soil are associated with historical pyrogenic (burning) activities common to eastern Massachusetts. As such, it is also our opinion that these detections in excess of the RCS-1 standards are exempt from reporting in accordance with 310 CMR 40.0317(9)[2].

2-Methylnaphthalene was also detected in soil at two locations slightly exceeding the MCP RCS-1 standard in the easternmost portion of the project Site area. This compound (commonly associated with petroleum (petrogenic) sources) as well as their locations are consistent with our understanding of the known environmental conditions at the Site previously documented by both H&A and Rizzo for RTN 3-10565. As this RTN was already closed with a Permanent Solution without restrictions, it is also our opinion that these detections are exempt from reporting in accordance with 310 CMR 40.0317(17)[3].

With one exemption, no detections were identified in groundwater at the Site in excess of the laboratory reporting limits as noted on Table 3. Acetone was identified at one location (SH-111) at a trace level (0.0064 mg/L) but well below the applicable MCP RCGW-2 standard (50 mg/L). Further, acetone is a common laboratory artifact (i.e., potential false positive associated with analytical laboratory activities).

Proposed Construction Release Abatement Measure (RAM) Plan

Although the impacts at the project Site area are relatively limited and exempt from notification and groundwater is on the order of 15 feet below proposed finished grade, soil and groundwater must be managed appropriately during construction earthwork activities. Accordingly, the proposed construction will be managed with a detailed construction Release Abatement Measure (RAM) Plan prepared by a Licensed Site Professional (LSP), which represents the standard of care for MCP related response actions at construction projects where Permanent Solutions have already been achieved in accordance with 310 CMR 40.1067(4).

The RAM Plan will be submitted to the Massachusetts DEP prior to construction and will be included in the Project's construction specifications to ensure compliance with applicable state, local and federal regulations during the redevelopment. The RAM Plan will include detailed protective provisions for soil management (i.e., excavation, temporary storage, reuse and/or disposal), groundwater management (if encountered), and ambient air monitoring during construction to ensure that workers and surrounding populations are not adversely impacted by the redevelopment activities. The RAM will also include monitoring

[1] Characterization of Coal Combustion Residuals from Electric Utilities – Leaching and Characterization Data, EPA-600/R-09/151, December 2009 and Historic Fill/Anthropogenic Background Public Comment Draft Technical Update, Version 1.0, DEP, May 2016.

[2] 310 CMR 40.0317(9) exempts releases of OHM related to coal, coal ash, or wood ash, excluding wood ash associated with the combustion of wood products that have been treated with chemical preservatives.

[3] 310 CMR 40.0317(17)(a) exempts releases for which a Permanent Solution has previously been achieved.

action levels which, if exceeded during construction, will require immediate corrective measures.

In summary, it is our opinion that the recent soil detections in slight excess of the RCS-1 soil standards are exempt from notification to DEP because they are associated with historical coal and wood burning activities common to eastern Massachusetts and are consistent with the Permanent Solution Statement previously filed on the Site. Further, based on our review of the extensive historical and recent Site assessment data (which illustrates the limited nature of the impacts to the Site), our extensive experience with brownfields redevelopment activities in Massachusetts, and the comprehensive protective measures to be implemented with the construction RAM Plan, it is also our opinion that the proposed redevelopment is unlikely to adversely impact human health, safety, public welfare or the environment including the Charles River located approximately 600 feet to the north of the project Site area.

We trust this memorandum meets the needs of the project; please contact us should you have any questions.

MPH/KPS:mph

Encl. Table 1 – Summary of Groundwater Level Measurements in Monitoring Wells
Table 2 – Summary of Soil Analytical Data
Table 3 – Summary of Groundwater Analytical Data

Figure 1 - Exploration Location Plan

Attachment A – Response Action Outcome Statement, MBTA Riverside Station, RTN 3-10565, prepared by Rizzo Associates, Inc., dated December 30, 1998
Attachment B – Soil and Groundwater Analytical Data Summary Tables and Test Boring Logs, prepared by H&A
Attachment C – Sanborn Head Test Boring Logs

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TABLES

TABLE 1

SUMMARY OF GROUNDWATER LEVEL MEASUREMENTS IN MONITORING WELLS

Riverside Station and Indigo Hotel
333-399 Grove Street
Newton, Massachusetts

Well ID		SH-101	SH-104	SH-106	SH-107	SH-108	SH-111
Ground Surface Elevation (ft)		90.23	64.77	65.93	65.94	62.55	62.35
Top of Casing (TOC) Elevation (ft)		90.23	64.77	65.93	65.94	62.55	62.35
Top of PVC (TPVC) Elevation (ft)		89.89	64.47	65.47	65.59	62.14	62.02
TPVC to Ground Surface (ft)		0.34	0.30	0.46	0.35	0.41	0.33
Reference Point		TPVC	TPVC	TPVC	TPVC	TPVC	TPVC
Groundwater Levels/Elevations							
10/8/19	Depth to Bottom Below Reference Point (ft)	47.85	23.96	19.91	29.25	19.19	19.03
	Depth to Water Below Reference Point (ft)	37.91	17.45	Dry	22.57	14.61	13.87
	Water Table Elevation (ft)	51.98	47.02	<45.56	43.02	47.53	48.15
10/15/19	Depth to Bottom Below Reference Point (ft)	NM	23.9	NM	29.19	NM	18.88
	Depth to Water Below Reference Point (ft)	NM	17.51	NM	22.66	NM	13.87
	Water Table Elevation (ft)	NM	46.96	NM	42.93	NM	48.15

1. Groundwater level measurements taken in October 2019 were collected by Sanborn Head personnel on the dates shown. The elevations are referenced to the North American Vertical Datum 1988 (NAVD88).

2. Abbreviations:

"NM" - not measured

TABLE 2
SUMMARY OF SOIL ANALYTICAL DATA
Riverside Station Redevelopment
Newton, Massachusetts

LOCATION	Massachusetts Landfill Criteria		MCP RCS-1	Units	SH-110 COMPOSITE FILL	SH-109 COMPOSITE FILL	SH-108 COMPOSITE FILL	SH-106 COMPOSITE FILL
SAMPLING DATE					9/24/2019	9/25/2019	9/30/2019	9/30/2019
SAMPLE TYPE	Lined	Unlined			SOIL	SOIL	SOIL	SOIL
SAMPLE DEPTH (ft.)					0.5-8	0.5-11	0.5-9.5	0.5-4
General Chemistry								
Specific Conductance @ 25 C	8,000	4,000	NS	umhos/cm	150	150	350	110
Solids, Total	NS	NS	NS	%	87.8	91.8	85	94.6
pH (H)	NS	NS	NS	SU	7.5	6.5	8.6	8.6
Cyanide, Reactive	NS	NS	NS	mg/kg	<10	<10	<10	<10
Sulfide, Reactive	NS	NS	NS	mg/kg	<10	<10	<10	<10
Ignitability of Solids								
Ignitability	NS	NS	NS		NI	NI	NI	NI
Polychlorinated Biphenyls								
PCBs, Total	<2	<2	1	mg/kg	<0.0367	<0.0356	<0.0389	<0.0342
Semivolatile Organic Compounds								
Acenaphthene	NS	NS	4	mg/kg	<0.15	1.1	<0.15	<0.7
Fluoranthene	NS	NS	1000	mg/kg	0.43	10	1.5	<0.52
Naphthalene	NS	NS	4	mg/kg	0.5	1.2	1.2	<0.87
Benzo(a)anthracene	NS	NS	7	mg/kg	0.24	3.8	0.66	<0.52
Benzo(a)pyrene	NS	NS	2	mg/kg	0.17	**3.2**	0.41	<0.7
Benzo(b)fluoranthene	NS	NS	7	mg/kg	0.27	4	0.9	<0.52
Benzo(k)fluoranthene	NS	NS	70	mg/kg	<0.11	1.3	0.21	<0.52
Chrysene	NS	NS	70	mg/kg	0.34	3.6	1.4	<0.52
Acenaphthylene	NS	NS	1	mg/kg	<0.15	<0.71	0.18	<0.7
Anthracene	NS	NS	1,000	mg/kg	<0.11	2.4	0.38	<0.52
Benzo(ghi)perylene	NS	NS	1,000	mg/kg	<0.15	1.9	0.31	<0.7
Fluorene	NS	NS	1,000	mg/kg	<0.19	1.2	0.29	<0.87
Phenanthrene	NS	NS	10	mg/kg	0.5	**11**	2	<0.52
Dibenzo(a,h)anthracene	NS	NS	0.7	mg/kg	<0.11	<0.53	0.12	<0.52
Indeno(1,2,3-cd)pyrene	NS	NS	7	mg/kg	<0.15	2	0.3	<0.7
Pyrene	NS	NS	1,000	mg/kg	0.4	8.6	1.2	<0.52
Dibenzofuran	NS	NS	100	mg/kg	<0.19	1	0.38	<0.87
2-Methylnaphthalene	NS	NS	0.7	mg/kg	**0.72**	<1.1	**1.2**	<1
Total SVOCs	100	100	NS	mg/kg	3.57	56.3	12.89	BDL
Total Metals								
Antimony, Total	NS	NS	20	mg/kg	<2.16	8.95	6.79	<2.08
Arsenic, Total	40	40	20	mg/kg	13.4	11.8	**21.3**	3.32
Barium, Total	NS	NS	1000	mg/kg	108	68.5	67.6	20.8
Beryllium, Total	NS	NS	90	mg/kg	0.492	<0.209	0.387	<0.208
Cadmium, Total	80	30	70	mg/kg	<0.431	0.456	<0.467	<0.417
Chromium, Total	1,000	1,000	100	mg/kg	4.95	9.24	13.9	15.5
Lead, Total	2,000	1,000	200	mg/kg	45.3	164	135	11
Mercury, Total	10	10	20	mg/kg	0.089	0.107	0.097	<0.08
Nickel, Total	NS	NS	600	mg/kg	11.2	8.01	11.5	8.46
Selenium, Total	NS	NS	400	mg/kg	<2.16	<2.09	<2.33	<2.08
Silver, Total	NS	NS	100	mg/kg	<0.431	<0.418	<0.467	<0.417
Thallium, Total	NS	NS	8	mg/kg	<2.16	<2.09	<2.33	<2.08
Vanadium, Total	NS	NS	400	mg/kg	12	15.1	13.4	15.9
Zinc, Total	NS	NS	1000	mg/kg	68.1	44.5	37.8	29.8
Volatile Organic Compounds								
Benzene	NS	NS	2	mg/kg	0.0013	0.011	<0.032	<0.00051
Toluene	NS	NS	30	mg/kg	0.0051	0.02	<0.065	<0.001
Ethylbenzene	NS	NS	40	mg/kg	<0.0011	0.0029	<0.065	<0.001
p/m-Xylene	NS	NS	100	mg/kg	<0.0022	0.0073	<0.13	<0.002
o-Xylene	NS	NS	100	mg/kg	<0.0011	0.0045	<0.065	<0.001
Xylenes, Total	NS	NS	100	mg/kg	<0.0011	0.012	<0.065	<0.001
Styrene	NS	NS	3	mg/kg	<0.0011	0.0029	<0.065	<0.001
Acetone	NS	NS	6	mg/kg	0.013	0.34	<0.65	<0.01
Methyl ethyl ketone	NS	NS	4	mg/kg	<0.011	0.012	<0.65	<0.01
1,2,4-Trimethylbenzene	NS	NS	1000	mg/kg	0.0027	0.0051	<0.13	<0.002
Total VOCs	10	4	NS	mg/kg	0.0221	0.4177	BDL	BDL
TCLP Metals								
Lead, TCLP	<5	<5	NS	mg/l	-	-	<0.5	-
Petroleum Hydrocarbon Quantitation								
TPH	5000	2500	1000	mg/kg	607	500	644	293

Notes:
1. Soil samples were collected by Sanborn, Head & Associates, Inc. (Sanborn Head) on the date indicated and were submitted for analysis by Alpha Analytical, Inc. of Westborough, MA.

2. The soil samples are compared to Massachusetts Contingency Plan (MCP)Reportable Concentrations for S-1 soil (RCS-1), and Similar Soils Provision Reportable Concentration for RCS-1 Limiting Soil Concentrations, and Massachusetts Lined and Unlined landfill criteria. Exceedances of the standards are bolded.

3. Massachusetts Landfill Criteria were taken from Table 1 of the Department of Environmental Protection (DEP) Policy #COMM-97-01, "Reuse and Disposal of Contaminated Soil at Massachusetts Landfills."

4. Only VOC, and SVOC analytes detected above the laboratory reporting limit in one or more sample are shown. For a complete list of analytes, refer to the analytical laboratory report.

5. Abbreviations:
BDL = Below Detection Limit
"<" = the analyte was note detected above the laboratory reporting limit shown
NI = Not Ignitable
NS = No Standard
mg/kg = milligrams per kilogram
PCB = Polychlorinated Biphenyl
TPH = Total Petroleum Hydrocarbons

TABLE 3
SUMMARY OF GROUNDWATER ANALYTICAL DATA
Riverside Station Redevelopment
Newton, MA

LOCATION	MCP RCGW-2	Units	20191014_SH_111	20191014_SH_107	20191014_SH_104
SAMPLING DATE			10/14/2019	10/14/2019	10/14/2019
SAMPLE TYPE			WATER	WATER	WATER
Extractable Petroleum Hydrocarbons					
C9-C18 Aliphatics	5	mg/L	<0.1	<0.1	<0.1
C19-C36 Aliphatics	50	mg/L	<0.1	<0.1	<0.1
C11-C22 Aromatics, Adjusted	5	mg/L	<0.1	<0.1	<0.1
Volatile Organic Compounds					
Acetone	50	mg/L	**0.0064**	<0.005	<0.005
Total VOCs	NS	mg/L	**0.0064**	BDL	BDL
Volatile Petroleum Hydrocarbons					
C5-C8 Aliphatics	NS	mg/L	<0.1	<0.1	<0.1
C9-C12 Aliphatics	NS	mg/L	<0.1	<0.1	<0.1
C9-C10 Aromatics	4	mg/L	<0.1	<0.1	<0.1
C5-C8 Aliphatics, Adjusted	3	mg/L	<0.1	<0.1	<0.1
C9-C12 Aliphatics, Adjusted	5	mg/L	<0.1	<0.1	<0.1

Notes:

1. Groundwater samples were collected by Sanborn, Head & Associates, Inc. (Sanborn Head) on the indicated date and were analyzed by Alpha Analytical, Inc. of Westborough, MA.

2. Bolded values indicate the analyte was detected above laboratory reporting limits. The groundwater samples are compared to Massachusetts Contingency Plan (MCP)Reportable Concentrations for GW-2 groundwater (RCGW-2).

3. In general, only VOC analyses detected above the laboratory reporting limits are shown. For a complete list of analytes, refer to the analytical laboratory report.

4. Abbreviations
MCP = Massachusetts Contingency Plan
TPH = Total Petroleum Hydrocarbons
NS = No Standard
mg/L = milligram per liter
< = indicated the analyte was not detected above the laboratory reporting limit shown

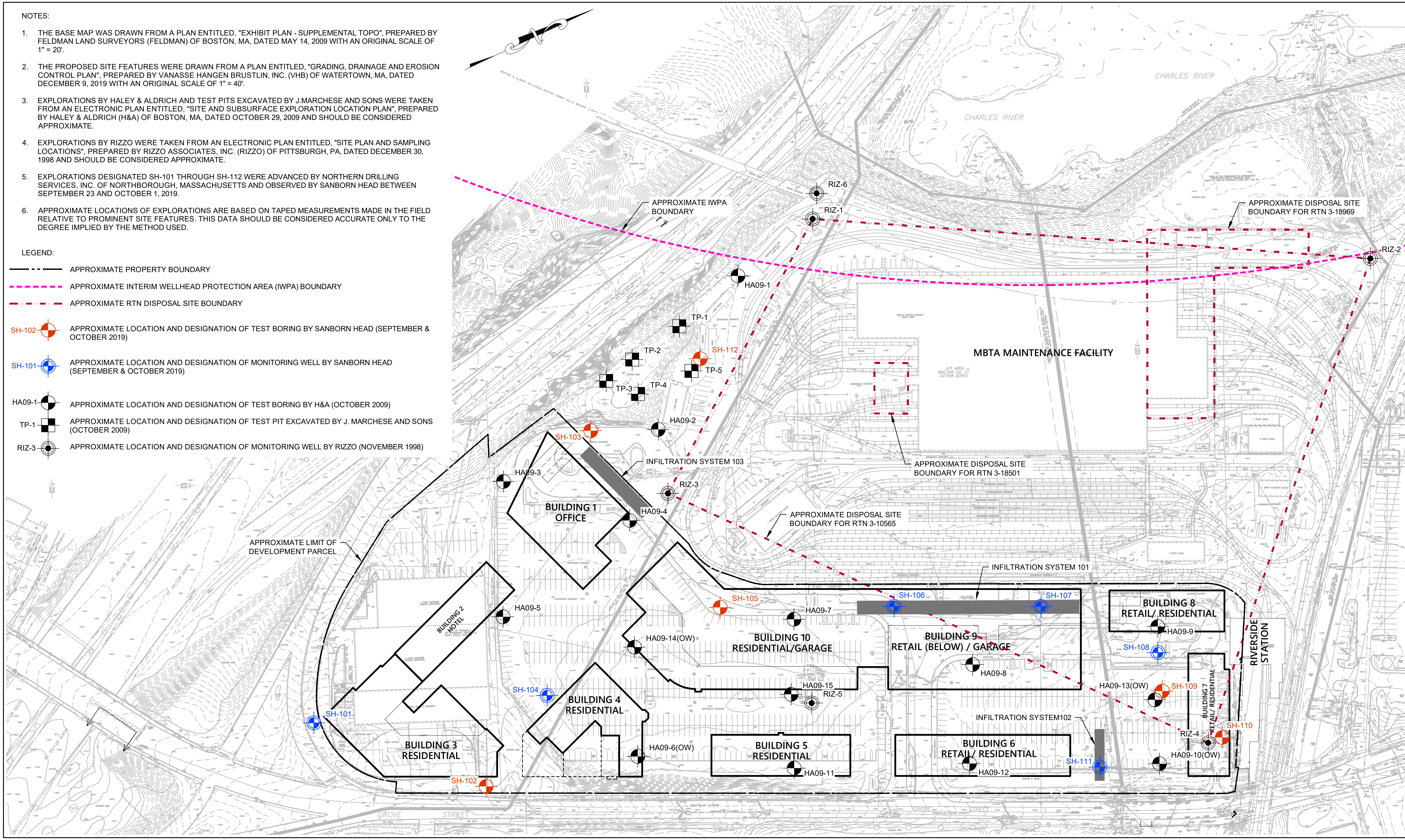
FIGURE

NOTES:

1. THE BASE MAP WAS DRAWN FROM A PLAN ENTITLED, "EXHIBIT PLAN - SUPPLEMENTAL TOPO", PREPARED BY FELDMAN LAND SURVEYORS (FELDMAN) OF BOSTON, MA, DATED MAY 14, 2009 WITH AN ORIGINAL SCALE OF 1" = 20'.
2. THE PROPOSED SITE FEATURES WERE DRAWN FROM A PLAN ENTITLED, "GRADING, DRAINAGE AND EROSION CONTROL PLAN", PREPARED BY VANASSE HANGEN BRUSTLIN, INC. (VHB) OF WATERTOWN, MA, DATED DECEMBER 9, 2019 WITH AN ORIGINAL SCALE OF 1" = 40'.
3. EXPLORATIONS BY HALEY & ALDRICH AND TEST PITS EXCAVATED BY J.MARCHESE AND SONS WERE TAKEN FROM AN ELECTRONIC PLAN ENTITLED, "SITE AND SUBSURFACE EXPLORATION LOCATION PLAN", PREPARED BY HALEY & ALDRICH (H&A) OF BOSTON, MA, DATED OCTOBER 29, 2009 AND SHOULD BE CONSIDERED APPROXIMATE.
4. EXPLORATIONS BY RIZZO WERE TAKEN FROM AN ELECTRONIC PLAN ENTITLED, "SITE PLAN AND SAMPLING LOCATIONS", PREPARED BY RIZZO ASSOCIATES, INC. (RIZZO) OF PITTSBURGH, PA, DATED DECEMBER 30, 1998 AND SHOULD BE CONSIDERED APPROXIMATE.
5. EXPLORATIONS DESIGNATED SH-101 THROUGH SH-112 WERE ADVANCED BY NORTHERN DRILLING SERVICES, INC. OF NORTHBOROUGH, MASSACHUSETTS AND OBSERVED BY SANBORN HEAD BETWEEN SEPTEMBER 23 AND OCTOBER 1, 2019.
6. APPROXIMATE LOCATIONS OF EXPLORATIONS ARE BASED ON TAPED MEASUREMENTS MADE IN THE FIELD RELATIVE TO PROMINENT SITE FEATURES. THIS DATA SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.

LEGEND:

- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE INTERIM WELLHEAD PROTECTION AREA (IWPA) BOUNDARY
- APPROXIMATE RTN DISPOSAL SITE BOUNDARY
- SH-102 — APPROXIMATE LOCATION AND DESIGNATION OF TEST BORING BY SANBORN HEAD (SEPTEMBER & OCTOBER 2019)
- SH-101 — APPROXIMATE LOCATION AND DESIGNATION OF MONITORING WELL BY SANBORN HEAD (SEPTEMBER & OCTOBER 2019)
- HA09-1 — APPROXIMATE LOCATION AND DESIGNATION OF TEST BORING BY H&A (OCTOBER 2009)
- TP-1 — APPROXIMATE LOCATION AND DESIGNATION OF TEST PIT EXCAVATED BY J. MARCHESE AND SONS (OCTOBER 2009)
- RIZ-3 — APPROXIMATE LOCATION AND DESIGNATION OF MONITORING WELL BY RIZZO (NOVEMBER 1998)



SANBORN | HEAD

GRAPHICAL SCALE
70' 35' 0' 70' 140'

NO.	DATE	DESCRIPTION	BY

DRAWN BY: D.DOMBROWSKY
DESIGNED BY: M.RUBERTI
REVIEWED BY: M.HEIL
PROJECT MGR: M.RUBERTI
PIC: K.STETSON
DATE: JANUARY 2020

ENVIRONMENTAL ENGINEERING SERVICES
RIVERSIDE STATION
NEWTON, MASSACHUSETTS

EXPLORATION LOCATION PLAN

PROJECT NUMBER: 4575.00

SHEET NUMBER: 1

ATTACHMENT A

RESPONSE ACTION OUTCOME STATEMENT, MBTA RIVERSIDE STATION, RTN 3-10565. BY RIZZO ASSOCIATES, INC.

NHC

SCANNED

RIZZO ASSOCIATES, INC.

ENGINEERS AND ENVIRONMENTAL SCIENTISTS

Response Action Outcome Statement

MBTA Riverside Station
325 Grove Street
Newton, Massachusetts
RTN 3-10565

Submitted to:
Massachusetts Bay Transportation Authority

Prepared by:
Rizzo Associates, Inc.

December 30, 1998

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC-104

RESPONSE ACTION OUTCOME (RAO) STATEMENT & DOWNGRADIENT PROPERTY STATUS TRANSMITTAL FORM

Pursuant to 310 CMR 40.0160 (Subpart B), 40.0580 (Subpart E) & 40.1056 (Subpart J)

Release Tracking Number: 3 - 10565

A. SITE OR DOWNGRADIENT PROPERTY LOCATION:

Site Name: (optional) MBTA - Riverside Station

Street: 325 Grove St. Location Aid:

City/Town: Newton ZIP Code: 02158

[X] Check here if this Site location is Tier Classified. If a Tier I Permit has been issued, state the Permit Number:

Related Release Tracking Numbers that this Form Addresses:

If submitting an RAO Statement, you must document the location of the Site or the location and boundaries of the Disposal Site subject to this Statement. If submitting an RAO Statement for a PORTION of a Disposal Site, you must document the location and boundaries for both the portion subject to this submittal and, to the extent defined, the entire Disposal Site. If submitting a Downgradient Property Status Submittal, you must provide a site plan of the property subject to the submittal and, to the extent defined, the Disposal Site.

B. THIS FORM IS BEING USED TO: (check all that apply)

[X] Submit a Response Action Outcome (RAO) Statement (complete Sections A, B, C, D, E, F, H, I, J and L).

[ ] Check here if this is a revised RAO Statement. Date of Prior Submittal:

[ ] Check here if any Response Actions remain to be taken to address conditions associated with any of the Releases whose Release Tracking Numbers are listed above. This RAO Statement will record only an RAO-Partial Statement for those Release Tracking Numbers.

Specify Affected Release Tracking Numbers:

[ ] Submit an optional Phase I Completion Statement supporting an RAO Statement or Downgradient Property Status Submittal (complete Sections A, B, H, I, J, and L).

[ ] Submit a Downgradient Property Status Submittal (complete Sections A, B, G, H, I, J and K).

[ ] Check here if this is a revised Downgradient Property Status Submittal. Date of Prior Submittal:

[ ] Submit a Termination of a Downgradient Property Status Submittal (complete Sections A, B, I, J and L).

[ ] Submit a Periodic Review Opinion evaluating the status of a Temporary Solution (complete Sections A, B, H, I, J and L).

Specify one: [ ] For a Class C RAO [ ] For a Waiver Completion Statement indicating a Temporary Solution

Provide Submittal Date of RAO Statement or Waiver Completion Statement:

You must attach all supporting documentation required for each use of form indicated, including copies of any Legal Notices and Notices to Public Officials required by 310 CMR 40.1400.

RECEIVED DEC 3 DEP/NORTHEAST REGION WOBURN, MASS.

C. DESCRIPTION OF RESPONSE ACTIONS: (check all that apply)

[X] Assessment and/or Monitoring Only

[ ] Removal of Contaminated Soils

[ ] Re-use, Recycling or Treatment

( ) On Site ( ) Off Site Est. Vol.: cubic yards

Describe:

[ ] Landfill ( ) Cover ( ) Disposal Est. Vol.: cubic yards

[ ] Removal of Drums, Tanks or Containers

Describe:

[ ] Removal of Other Contaminated Media

Specify Type and Volume:

[ ] Other Response Actions

Describe:

[ ] Deployment of Absorbent or Containment Materials

[ ] Temporary Covers or Caps

[ ] Bioremediation

[ ] Soil Vapor Extraction

[ ] Structure Venting System

[ ] Product or NAPL Recovery

[ ] Groundwater Treatment Systems

[ ] Air Sparging

[ ] Temporary Water Supplies

[ ] Temporary Evacuation or Relocation of Residents

[ ] Fencing and Sign Posting

SECTION C IS CONTINUED ON THE NEXT PAGE.

RESPONSE ACTION OUTCOME (RAO) STATEMENT & DOWNGRADIENT PROPERTY STATUS TRANSMITTAL FORM

Pursuant to 310 CMR 40.0180 (Subpart B), 40.0580 (Subpart E) & 40.1056 (Subpart J)

Release Tracking Number: 3 - 10565

C. DESCRIPTION OF RESPONSE ACTIONS: (continued)

☐ Check here if any Response Action(s) that serve as the basis for this RAO Statement involve the use of Innovative Technologies. (DEP is interested in using this information to create an Innovative Technologies Clearinghouse.)

Describe Technologies: _____

D. TRANSPORT OF REMEDIATION WASTE: (If Remediation Waste was sent to an off-site facility, answer the following questions)

Name of Facility: N/A

Town and State: N/A

Quantity of Remediation Waste Transported to Date: N/A

E. RESPONSE ACTION OUTCOME CLASS:

Specify the Class of Response Action Outcome that applies to the Site or Disposal Site. Select ONLY one Class:

☐ **Class A-1 RAO:** Specify one of the following:

○ Contamination has been reduced to background levels. ○ A Threat of Release has been eliminated.

☐ **Class A-2 RAO:** You MUST provide justification that reducing contamination to background levels is infeasible.

☐ **Class A-3 RAO:** You MUST provide both an implemented Activity and Use Limitation (AUL) and justification that reducing contamination to background levels is infeasible.

If applicable, provide the earlier of the AUL expiration date or date the design life of the remedy will end: _____

☒ **Class B-1 RAO:** Specify one of the following:

○ Contamination is consistent with background levels ⊗ Contamination is NOT consistent with background levels.

☐ **Class B-2 RAO:** You MUST provide an implemented AUL.

If applicable, provide the AUL expiration date : _____

☐ **Class C RAO:** ☐ Check here if you will conduct post-RAO Operation, Maintenance and Monitoring at the Site.

Specify One: ○ Passive Operation and Maintenance ○ Monitoring Only

○ Active Operation and Maintenance (defined at 310 CMR 40.0006)

DEP DEC 0 1 1998

F. RESPONSE ACTION OUTCOME INFORMATION:

☐ If an RAO Compliance Fee is required, check here to certify that the fee has been submitted. You MUST attach a photocopy of the payment.

☐ Check here if submitting one or more AULs. You must attach an AUL Transmittal Form (BWSC-113) and a copy of each implemented AUL related to this RAO Statement. Specify the type of AUL(s) below: (required for all Class A-3 RAOs and Class B-2 RAOs)

○ Notice of Activity and Use Limitation ○ Grant of Environmental Restriction Number of AULs attached: _____

Specify the Risk Characterization Method(s) used to achieve the RAO described above and all Soil and Groundwater Categories applicable to the Site.

More than one Soil Category and more than one Groundwater Category may apply at a Site.
Be sure to check off all APPLICABLE categories, even if more stringent soil and groundwater standards were met.

Risk Characterization Method(s) Used:	☐ Method 1	☐ Method 2	☒ Method 3
Soil Category(ies) Applicable:	☐ S-1	☐ S-2	☒ S-3
Groundwater Category(ies) Applicable:	☒ GW-1	☐ GW-2	☐ GW-3

> **When submitting any Class A-1 RAO or a Class B-1 RAO where contamination is consistent with background levels, do NOT specify a Risk Characterization Method.**

> **When submitting any Class A-2 RAO or a Class B-1 RAO where contamination is NOT consistent with background levels, you cannot use an AUL to maintain a level of no significant risk. Therefore, you must meet S-1 Soil Standards, if using Risk Characterization Method 1.**

Massachusetts Department of Environmental Protection **BWSC-104**
Bureau of Waste Site Cleanup

RESPONSE ACTION OUTCOME (RAO) STATEMENT & DOWNGRADIENT PROPERTY STATUS TRANSMITTAL FORM

Pursuant to 310 CMR 40.0180 (Subpart B), 40.0560 (Subpart E) & 40.1056 (Subpart J)

Release Tracking Number: 3 - 10565

G. DOWNGRADIENT PROPERTY STATUS SUBMITTAL:

☐ If a Downgradient Property Status Submittal Compliance Fee is required, check here to certify that the fee has been submitted. You MUST attach a photocopy of the payment.

☐ Check here if a Release(s) of Oil or Hazardous Material(s), other than that which is the subject of this submittal, has occurred at this property.

Release Tracking Number(s): _____

○ Check here if the Releases identified above require further Response Actions pursuant to 310 CMR 40.0000.

Required documentation for a Downgradient Property Status Submittal includes, but is not limited to, copies of notices provided to owners and operators of both upgradient and downgradient abutting properties and of any known or suspected source properties.

H. LSP OPINION:

I attest under the pains and penalties of perjury that I have personally examined and am familiar with this transmittal form, including any and all documents accompanying this submittal. In my professional opinion and judgment based upon application of (i) the standard of care in 309 CMR 4.02(1), (ii) the applicable provisions of 309 CMR 4.02(2) and (3), and (iii) the provisions of 309 CMR 4.03(5), to the best of my knowledge, information and belief,

> *If Section B indicates that a Downgradient Property Status Submittal is being provided*, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in 310 CMR 40.0183(2)(b), and (iii) complies(y) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> *If Section B indicates that either an RAO Statement, Phase I Completion Statement and/or Periodic Review Opinion is being provided*, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, and (iii) complies(y) with the identified provisions of all orders, permits, and approvals identified in this submittal.

I am aware that significant penalties may result, including, but not limited to, possible fines and imprisonment, if I submit information which I know to be false, inaccurate or materially incomplete.

☐ Check here if the Response Action(s) on which this opinion is based, if any, are (were) subject to any order(s), permit(s) and/or approval(s) issued by DEP or EPA. If the box is checked, you MUST attach a statement identifying the applicable provisions thereof.

LSP Name: Richard J. Hughto LSP #: 2261 Stamp:

Telephone: (508) 651-3401 Ext.: 2346

FAX: (optional) (508) 651-1189

Signature: _____

Date: 12 December 1995

I. PERSON MAKING SUBMITTAL:

Name of Organization: Massachusetts Bay Transportation Authority

Name of Contact: Andrew D. Brennan Title: Director of Enveronmental Affairs

Street: 10 Park Plaza

City/Town: Boston State: MA ZIP Code: 02116-3974

Telephone: (617) 222-3126 Ext.: _____ FAX: (optional) (617) 222-1557

J. RELATIONSHIP TO SITE OF PERSON MAKING SUBMITTAL: (check one)

☒ RP or PRP Specify: ⊗ Owner ○ Operator ○ Generator ○ Transporter Other RP or PRP: _____

☐ Fiduciary, Secured Lender or Municipality with Exempt Status (as defined by M.G.L. c. 21E, s. 2)

☐ Agency or Public Utility on a Right of Way (as defined by M.G.L. c. 21E, s. 5(j))

☐ Any Other Person Submitting This Form Specify Relationship: _____

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC-104

RESPONSE ACTION OUTCOME (RAO) STATEMENT & DOWNGRADIENT PROPERTY STATUS TRANSMITTAL FORM

Pursuant to 310 CMR 40.0180 (Subpart B), 40.0580 (Subpart E) & 40.1056 (Subpart J)

Release Tracking Number: 3 - 10565

K. CERTIFICATION OF PERSON SUBMITTING DOWNGRADIENT PROPERTY STATUS SUBMITTAL:

I, _____, attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form; (ii) that, based on my inquiry of the/those individual(s) immediately responsible for obtaining the information, the material information contained herein is, to the best of my knowledge, information and belief, true, accurate and complete; (iii) that, to the best of my knowledge, information and belief, I/the person(s) or entity(ies) on whose behalf this submittal is made satisfy(ies) the criteria in 310 CMR 40.0183(2); (iv) that I/the person(s) or entity(ies) on whose behalf this submittal is made have provided notice in accordance with 310 CMR 40.0183(5); and (v) that I am fully authorized to make this attestation on behalf of the person(s) or entity(ies) legally responsible for this submittal. I/the person(s) or entity(ies) on whose behalf this submittal is made am/are aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

By: _____ Title: _____
(signature)

For: _____ Date: _____
(print name of person or entity recorded in Section I)

Enter address of the person providing certification, if different from address recorded in Section I:

Street: _____

City/Town: _____ State: _____ ZIP Code: _____

Telephone: _____ Ext.: _____ FAX: (optional) _____

L. CERTIFICATION OF PERSON MAKING SUBMITTAL:

If you are completing only a Downgradient Property Status Submittal, you do not need to complete this section of the form.

I, Andrew D. Brennan, attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form, (ii) that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material information contained in this submittal is, to the best of my knowledge and belief, true, accurate and complete, and (iii) that I am fully authorized to make this attestation on behalf of the entity legally responsible for this submittal. I/the person or entity on whose behalf this submittal is made am/is aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

By: Andrew D. Brennan Title: Director of Environmental Affairs
(signature)

For: Massachusetts Bay Transportation Authority Date: DECEMBER 15, 1998
(print name of person or entity recorded in Section I)

Enter address of the person providing certification, if different from address recorded in Section I:

Street: _____

City/Town: _____ DEC 31 1998 State: _____ ZIP Code: _____

Telephone: _____ DEP Ext.: _____ FAX: (optional) _____

YOU MUST COMPLETE ALL RELEVANT SECTIONS OF THIS FORM OR DEP MAY RETURN THE DOCUMENT AS INCOMPLETE. IF YOU SUBMIT AN INCOMPLETE FORM, YOU MAY BE PENALIZED FOR MISSING A REQUIRED DEADLINE, AND YOU MAY INCUR ADDITIONAL COMPLIANCE FEES.

RIZZO ASSOCIATES, INC.
ENGINEERS AND ENVIRONMENTAL SCIENTISTS
AN EMPLOYEE-OWNED COMPANY

December 30, 1998

Mr. Andrew D. Brennan
Massachusetts Bay Transportation Authority
Ten Park Plaza
Boston, MA 02116-3974

Re: Response Action Outcome Statement
MBTA Riverside Station
325 Grove Street
Newton, Massachusetts

Dear Mr. Brennan:

Rizzo Associates, Inc. is pleased to submit this Technical Support Document for the LSP Evaluation Opinion and Class B-1 Response Action Outcome (RAO) Statement for the referenced Massachusetts Bay Transportation Authority (MBTA) facility. Based on the discovery of petroleum-related compounds in the soil, the facility was issued Release Tracking Number (RTN) 3-10565 by the Massachusetts Department of Environmental Protection (DEP) in 1993. An LSP Evaluation and Tier Classification for RTN 3-10565 was submitted on December 31, 1996, and the facility was classified as a Tier II site. The LSP Evaluation Opinion and Response Action Outcome Statement are due on December 31, 1998.

This report is part of the submittal package to the DEP in support of an LSP Evaluation Opinion and Class B-1 RAO Statement for this Site prepared by Rizzo Associates pursuant to the Massachusetts Contingency Plan (MCP), 310 CMR 40.0000. An original of Form BWSC-104, *Response Action Outcome Statement*, is attached to the front of this report. A copy of the form is included in Appendix A.

Very truly yours,

Clark L. Fero
for Environmental Scientist

Michael E. Billa, P.E., L.S.P.
Senior Project Manager

Richard J. Hughto, Ph.D., P.E., L.S.P.
Project Director/Executive Vice President

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1.0 Introduction

Under contract to Massachusetts Bay Transportation Authority (MBTA), Rizzo Associates, Inc. has prepared this Response Action Outcome (RAO) Statement (see Appendix A Form BWSC-104) for the disposal site identified by the Massachusetts Department of Environmental Protection (DEP) as Release Tracking Number (RTN) 3-10565. This document briefly summarizes previous investigations that resulted in listing of the property by DEP as RTN 3-10565, presents the results of soil and groundwater testing recently performed at the Site by Rizzo Associates, and includes an MCP Method 3 Risk Characterization for the Site.

Based on our evaluation of historic information, laboratory data of record, and results of the risk characterization, we believe that there is No Significant Risk for the conditions evaluated at the Site and that an AUL is not necessary to maintain a condition of No Significant Risk. Therefore, a Permanent Solution has been achieved for the property, and the requirements of a Class B-1 RAO have been met.

2.0 History of Regulatory Status

According to the DEP Spills Database, small spills of oil and hazardous materials occurred in 1986, 1987, 1991, and 1992. Each of these incidents was closed within two days. During track renovation work performed at the facility in 1993, Environmental Waste Technology (EWT) generated approximately 2,000 tons of oil-contaminated soil and rail ballast at the facility. In December 1993, the DEP issued a recycling permit for the removal of the contaminated material. This material was later recycled under a Bill of Lading as feedstock in an asphalt batching plant. As a result of the soil removal, the DEP issued Release Tracking Number (RTN) 3-10565 in 1993. In 1994 the DEP issued a Notice of Responsibility (NOR) indicating that the facility should be classified as a Disposal Site based on the evidence of contamination during the soil removal. Rizzo Associates submitted a Phase I — Initial Site Investigation and Tier Classification to the DEP on December 31, 1996, which resulted in the Site being classified as a Tier II Disposal Site.

The Riverside Carhouse is listed as a Small Quantity Generator of hazardous waste under EPA ID MAD981205628.

It was stated in the 1996 Phase I Report that there were seven underground storage tanks (USTs) at the Site. Recent information from the MBTA indicates that there are six USTs at the Site. The tanks were installed in 1974. In accordance with 527 CMR 9.00, the MBTA is planning to upgrade two 20,000-gallon diesel fuel oil UST, replace a 2,000-gallon diesel fuel UST, and remove an inactive 1,000-gallon waste oil UST by the end of 1998. Under the MBTA's current tank removal/upgrade program, two 2,000-gallon USTs have been already been removed.

3.0 Site Background

The facility comprises approximately 22 acres of land located at 325 Grove Street in Newton, Massachusetts (the Site). The Site Locus map is presented as Figure 1. The property serves as the Riverside Station for the MBTA Green Line, as commuter parking, and as a maintenance facility for subway cars. The majority of the facility not occupied by railroad tracks or buildings is covered with asphalt or concrete pavement. Properties that abut the facility include a Holiday Inn Hotel to the south, Grove Street to the east, the former Jordan Marsh warehouse to the north, and the Charles River to the west. A golf course is located across Grove Street, east of the facility. The residential population within one-half mile of the facility is estimated at 4,425 persons. We identified no institutions within 500 feet of the facility.

Historical sources indicate that the subject facility was initially developed as a repair facility and switching yard for the Boston & Albany Railroad. By 1960 the property was acquired by the Metropolitan Transportation Authority (MTA) and was developed as the Riverside Station. Later development of the property by the MBTA has included the addition of the Riverside Carhouse in 1974, used to repair and refurbish subway cars, and additional commuter parking.

It was stated in the 1996 Phase I Report that there were seven USTs at the Site. Recent information from MBTA indicates that there are six. The tanks were installed in 1974. In accordance with 527 CMR 9.00, the MBTA is planning to upgrade two 20,000-gallon fuel oil USTs, replace a 2,000-gallon diesel fuel UST, and remove an inactive 1,000-gallon waste oil UST by the end of 1998. Under the MBTA's current tank removal/upgrade program, two 2,000-gallon USTs have been already been removed from the Site.

Historical operations at the facility have likely included the use of oil and hazardous materials including oil, grease, solvents, paints, thinners, and cleaning agents. DEP records document small spills at this facility in 1986, 1987, 1991, and 1992, all of which were closed within two days.

In 1993, EWT observed the removal of oil-contaminated rail ballast at the facility. During track renovations, areas of oil-contaminated track ballast were sieved to separate the ballast gravel from the oil-contaminated sand and other soils. Reportedly, no subsurface soil samples were collected during the work, and no groundwater monitoring wells were installed at the facility. EWT attributed the contamination to be related to historic non-point source releases from rail traffic. As a result of the contamination identified by EWT, DEP issued Release Tracking Number (RTN) 3-10565 in 1993 and indicated that additional response actions at the facility were required.

In November 1996, Rizzo Associates performed a subsurface investigation, which included the installation and sampling of four soil borings completed as groundwater monitoring wells and a groundwater elevation survey. The monitoring wells, RIZ-1 through RIZ-4, are shown on the site plan, Figure 2. Soil and groundwater samples from each monitoring well were submitted for laboratory analysis.

Oil-contaminated soil was encountered in two of the borings advanced at the facility. Total petroleum hydrocarbons (TPH), tentatively identified as weathered diesel fuel, and some petroleum-related volatile organic compounds (VOCs) were identified from the soil sample collected from the bottom of RIZ-1. TPH, tentatively identified as motor oil, were identified in the surface soil sample collected from RIZ-4. Low concentrations of metals were identified in all of the soil samples submitted for analysis, at levels below reportable concentrations. No detectable levels of polynuclear aromatic hydrocarbons (PAHs), pesticides, or herbicides were detected in the soil submitted for those analyses.

Concentrations of VOCs, TPH, and the 13 priority pollutant (13pp) metals were below detectable concentrations in all of the groundwater samples submitted for analysis.

4.0 Recent Subsurface Investigation

On November 6, 1998 a Rizzo Associates Environmental Scientist supervised the installation of four soil borings, two of which were

completed as monitoring wells, by Soil Exploration of Leominster Massachusetts. The monitoring wells were identified as RIZ-5 and RIZ-6. The soil borings were identified as B-6 and B-7. The locations of the borings and monitoring wells are shown in Figure 2. The borings were advanced using a truck-mounted drill rig equipped with 4.5-inch-diameter hollow stem augers.

4.1 Soil Borings

The location of monitoring well RIZ-5 was selected to assess the current subsurface conditions at one of the areas that reportedly contained contaminated ballast. Borings B-6 and B-7 and monitoring well RIZ-6 were located to further define the conditions around RIZ-1. Soil samples were collected at five-foot intervals using a 2-inch by 24-inch split-spoon sampling device. All soil samples were inspected, characterized, and field screened, following the standard protocols shown in Appendix C, using a photoionization detector (PID) with a 10.2 eV lamp. Positive headspace readings were observed during the field screening of B-7 and RIZ-6. The details of the soil boring and monitoring well construction diagrams, including PID readings, can be seen in Appendix D.

4.2 Soil Sample Collection

Seven soil samples were collected for laboratory analysis for extractable petroleum hydrocarbons (EPH) and volatile petroleum hydrocarbons (VPH) by DEP Method 1.0. The samples were chosen to represent soils which showed positive headspace readings and soils from the level of the water table. The soil samples were placed in glassware provided by AMRO Environmental Laboratories (AMRO) and stored on ice in a cooler until they were picked up on November 9, 1998 under chain of custody by a courier from AMRO. The Laboratory Certificates of Analysis are provided as Appendix E.

4.3 Groundwater Monitoring Wells

RIZ-5 and RIZ-6 were completed as monitoring wells. The monitoring wells were constructed of 0.010-inch machine-slotted, 2-inch-diameter PVC well screen and a solid riser. The annular space around the well screen was filled with filter sand to at least 1 foot above the top of the well screen. Each monitoring well was packed with about 1 foot of bentonite clay above the filter sand to form a seal preventing the vertical migration

of surface water into the well. Flush-mounted aluminum road boxes were set in concrete to protect the wells. The details of the monitoring well construction are presented in the boring logs in Appendix D.

On November 18, 1998 Rizzo Associates measured the groundwater elevation in the four previously surveyed monitoring wells, RIZ-1 through RIZ-4. The measurements were taken using an electronic water level meter. The depths to groundwater ranged from about seven to about thirty feet below the surface of the ground. The elevation of the water table was calculated by subtracting the measured depth to groundwater from the surveyed elevation of the top of the PVC riser. The data were used to determine the potentiometric surfaces shown in Figure 3. The inferred direction of groundwater flow is to the west.

4.4 Groundwater Sample Collection

On November 18, 1998 Rizzo Associates collected groundwater samples from six monitoring wells RIZ-1 through RIZ-6. Each well was purged of at least three well volumes of water or until the well was dry, using a submersible electric pump. Temperature, pH, and specific conductance were measured at the conclusion of purging. Each sample was collected using a dedicated disposable polyethylene bailer. The sample was transferred directly from the bailer to the sample containers provided by AMRO. The samples were stored on ice in a cooler until they were picked up, under chain of custody, on November 19, 1998 by an AMRO courier. The samples were analyzed for EPH and VPH by AMRO. Additionally, one sample from RIZ-6 was analyzed for VOCs by EPA Method 8260. The analytical results can be seen in Appendix E.

5.0 Human Health and Environmental Risk Characterization

Rizzo Associates has conducted a Method 2 Risk Characterization for the Site in conformance with the requirements of the MCP. The DEP guidance document for risk characterization, *Guidance for Disposal Site Risk Characterization In Support of the Massachusetts Contingency Plan* (July 1995), has been followed in this analysis.

The Site currently serves as the Riverside Station for the MBTA Green Line, as commuter parking, and as a maintenance facility for subway cars.

The majority of the facility not occupied by railroad tracks or buildings is covered with asphalt or concrete pavement.

It is anticipated that, in the foreseeable future, use of the Site will remain the same. An overall plan of the Site is presented in Figure 2.

5.1 Appropriateness of Use of Method

In keeping with the level of complexity of the conditions at the Site, and because reported concentrations of compounds of concern were reported only in soil and groundwater, we chose to perform a Method 2 risk characterization (Method 2). As directed in the MCP (310 CMR 40.0983) Method 2 Standards can be derived for compounds which the DEP has not published Method 1 Standards. Copper, a compound without a promulgated Method 1 Standard, was detected in laboratory analysis of Site soil. Therefore, a Method 2 was required. A Method 2 allows for a relatively comprehensive, rapid evaluation of risk at a Site by comparing Exposure Point Concentrations (EPCs) to standards published by the DEP. Method 1 and 2 standards incorporate health protective assumptions for both contaminant transport and exposure, resulting in an overall conservative analysis.

Data used in this characterization include analytical results obtained during the sampling and analysis of soil and groundwater. The data include analytical results for soil and groundwater samples collected by Rizzo Associates in November 1996 and November 1998. The groundwater and soil sampling performed by Rizzo Associates are discussed in Section 3.0 of this RAO support document.

Soil and groundwater sampling locations are presented in Figure 2.

5.2 Soil and Groundwater Categorization

The Massachusetts Geographic Information System (MassGIS) map for the Site (see Figure 4) indicates that the Site is within 500 feet of an Interim Wellhead Protection Area, a Potential Drinking Water Source Area. Public supply wells are located more than half a mile northeast of the Site. No private water supply wells are located within 500 feet of the Site. Under the MCP, groundwater in the northwest portion of the Site is within the Zone II and is classified as GW-1. The groundwater at the Site is also classified as GW-2 since there are currently buildings within 30 feet of groundwater in which COCs have been detected and as GW-3

because all groundwater at disposal sites is classified as GW-3 based on the potential to discharge to surface water. Figure 5 shows where the boundary of the Zone II is in relation to the sample locations and the Site buildings.

Classification of Site soil is based on current and foreseeable future uses of the Site. Although the Site soils may be classified as S-2 under current conditions, we evaluate the Site soil as S-1 in order to avoid use restrictions at the Site. The S-1 classification is suitable for residential use.

5.3 Exposure Point Concentrations (EPCs)

EPCs represent the estimated concentrations of compounds of potential concern (COCs) to which a receptor may be exposed at the point of exposure. In keeping with DEP guidance, this characterization assumes that contaminant concentrations on the Site remain unchanged. Thus, we do not consider any mitigating factors resulting over the course of time (such as biodegradation).

For groundwater exposures, data from individual groundwater samples (e.g., monitoring wells) were evaluated as separate exposure points as required by the guidance for risk characterization under the MCP. This approach provides a conservative, health-protective assessment of risk.

In Table 1, soil concentrations from each sample location are compared to Method 1 S-1/GW-1, S-1/GW-2, and S-1/GW-3, S-2/GW-1, S-2/GW-2, and S-2/GW-3, and S-3/GW-1, S-3/GW-2, and S-3/GW-3 standards and Method 2 versions of these standards derived for copper. The Method 2 Standards are derived in Appendix F. Similarly, in Table 2, groundwater concentrations of each compound of concern from all groundwater samples are compared to Method 1 GW-1, GW-2 and GW-3 standards. MCP Method 1 soil standards are based on a combination of the soil and groundwater classifications because contaminants in soil may affect groundwater. In Table 1, soil samples are divided into shallow samples, representing the samples collected less than 15 feet below the surface, and deep samples, representing samples collected from greater than 15 feet below the surface. To be conservative, we compared all three shallow soil samples to all the S-1 and S-2 standards.

Deep soil samples in the area of RIZ-1 were collected in November 1996 and again in December 1998. The soils were analyzed for TPH in 1996 using EPA Method 8100M and resampled and analyzed for EPH in 1998. Five deep samples in the area of RIZ-1 were collected in 1998, but the

elevated concentration (1,100 mg/kg) of TPH obtained in the soil sample collected from the deep interval in November 1996 could not be duplicated. Therefore, we used an average of the carbon range concentrations obtained through EPH analysis in samples B-6, B-7 and RIZ-6 to represent the TPH in Area 1 (the area surrounding RIZ-1). We compared all deep samples to the S-3 standards.

The top rows of Tables 1 and 2 give information about the sample (e.g., its name, location, and the date it was collected), and the left-most column lists those compounds detected in the soil and groundwater at the Site. The compounds detected in samples collected from the Site include VOCs, PAHs, metals, and TPH/EPH.

Within Tables 1 and 2, we present concentrations of detected compounds in milligrams per kilogram (mg/kg) for soil, equivalent to parts per million (ppm) and micrograms per liter (μg/L) for groundwater and surface water, equivalent to parts per billion (ppb). If the laboratory analyzed for a compound but did not detect it (i.e., the compound was not detected in the sample at a concentration greater than the Method Detection Limit or MDL), we use the notation "<MDL."

In Tables 1 and 2, we present summary statistical information for each detected compound to provide a more general representation of Site conditions. We present the number of times the laboratory detected a compound and the number of times the laboratory sought that compound. We next present the minimum concentration detected for each compound, and then calculate an average for each compound. Finally, we present the maximum concentrations detected for each compound.

In this risk characterization, we evaluate risk from all compounds that were detected on the Site in soil and groundwater.

There are no Method 1 standards for sec-butylbenzene and p-isopropylbenzene. These substituted benzenes are considered EPH components and are assumed to be evaluated in the EPH analysis.

5.4 Risk Characterization

According to the MCP, a finding of no significant risk of harm to human health and the environment exists if no EPC is greater than the applicable MCP Method 1 or Method 2 soil or groundwater standard. This section presents a comparison of risk conditions with reference standards.

Table 1 compares the EPCs (average concentrations) of detected compounds in soil to the MCP S-1/GW-2 and S-1/GW-3 Method 1 and derived Method 2 (for copper) soil standards. The soil EPCs are below the established Method 1 and derived Method 2 standards.

Table 2 compares the groundwater EPCs (maximum detected concentrations of COCs in groundwater) to the appropriate MCP GW-1, GW-2 and GW-3 Method 1 standards. The groundwater EPCs are below the established Method 1 standards.

Given the exclusions outlined earlier in this risk characterization, no compounds were detected in the groundwater or soil sampled at the Site in concentrations exceeding the applicable Method 1 or derived Method 2 standards.

5.4.1 Risk to the Environment

To evaluate risk to the environment, groundwater EPCs were compared to GW-3 Standards (Table 2). No exceedences are noted; therefore, we do not find a condition of significant risk to the environment exists for conditions evaluated at the Site.

5.4.2 Risk to Public Welfare

Threats to public welfare include any conditions that may result in the existence of nuisance conditions, loss of property value, or the unilateral restriction of the use of other people's property, and other societal costs due to degradation of public and private resources, both physical and intangible. For a threat to exist, these conditions must preclude the full use of the resources at the Site under existing conditions or conditions about to occur. We did not find the presence of a risk to public welfare at the Site.

5.4.3 Risk to Public Safety

Threats to public safety include physical conditions and chemical agents that may cause bodily harm or injury (e.g., burns or fractures) as opposed to illness. There are no open pits, lagoons, drums, dangerous structures, or other apparent threats to public safety and no danger of fire or explosion from the conditions evaluated in this report.

5.5 Conclusions

Based on the results of our Method 2 Risk Characterization we find that a condition of "no significant risk" exists to human health or the environment for the conditions evaluated at the Site.

6.0 Public Notification Requirements

Pursuant to the requirements of CMR 40.1403, Minimum Public Involvement Activities in Response Actions, we have filed letters with the Board of Health and Chief Municipal Officer in the City of Newton regarding this RAO Statement and its availability at the DEP Regional Office. Copies of these letters are included in Appendix B.

7.0 Summary and Conclusions

Analytical results of soil and groundwater samples collected on the property indicate that residual contaminant concentrations observed in soil and groundwater are below the applicable MCP Method 1 cleanup standards. An MCP Method 1 Risk Characterization was conducted to determine impacts to human health, public safety and welfare, and the environment. The results of the risk characterization indicate that a condition of No Significant Risk exists for conditions evaluated at the Site and that an AUL is not necessary to maintain the condition of No Significant Risk. Therefore, a Permanent Solution has been achieved for the Site, and the requirements of a Class B-1 RAO have been met.

Table 1	Soil Analytical Data (mg/kg) Shallow Samples								
Location:	**RIZ-1**	**RIZ-3**	**RIZ-4**						
Sample Name:	**MN-RIZ-1-SS**	**MN-RIZ-3-SS**	**MN-RIZ-4-SS**						
Sample Depth:	**5-7'**	**5-7'**	**10-12'**						
Laboratory:	**AMRO**	**AMRO**	**AMRO**	**Method 1 Standard S-1/GW-1**	**Method 1 Standard S-1/GW-2**	**Method 1 Standard S-1/GW-3**	**Method 1 Standard S-2/GW-1**	**Method 1 Standard S-2/GW-2**	**Method 1 Standard S-2/GW-3**
Laboratory I.D.:	**14586-01**	**14586-04**	**14586-02**						
Sample Date:	**11-Nov-96**	**11-Nov-96**	**11-Nov-96**						
Consultant:	**Rizzo**	**Rizzo**	**Rizzo**						
Butylbenzene, sec-	<0.023	<0.025	<0.031	NA	NA	NA			
Isopropyltoluene, p-	<0.023	<0.025	<0.031	NA	NA	NA			
Naphthalene	<0.023	<0.025	<0.031	4	100	100	4	1,000	1,000
Arsenic, Total	2.5	<2.1	5.4	30	30	30	30	30	30
Beryllium, Total	<0.10	<0.10	<0.12	0.7	0.7	0.7	0.8	0.8	0.8
Chromium, Total	8.6	5.5	12	1,000	1,000	1,000	2,500	2,500	2,500
Copper, Total	9.4	5.7	12	NA	NA	NA	NA	NA	NA
Lead, Total	4.1	<2.1	4.4	300	300	300	600	600	600
Nickel, Total	7.9	5.2	9.8	300	300	300	700	700	700
Zinc, Total	19	12	26	2,500	2,500	2,500	2,500	2,500	2,500
Fuel Oil #2/Diesel	<51	<50							
Motor Oil	<51	<50	79						
C_9-C_{18} Aliphatics	<51	<50	32	100	100	100	100	500	500
C_{11}-C_{22} Aromatics			47	200	800	800	200	2,000	2,000
C_9-C_{12} Aliphatics				1,000	1,000	1,000	2,500	2,500	2,500

Notes: Samples collected from less than 15 feet below the ground surface (RIZ-1, RIZ-3, and RIZ-4) are considered S-1 samples.
Samples collected from greater than 15 feet (RIZ-2, RIZ-5, RIZ-1,B-6, B-7, and RIZ-6) are considered S-3.
S-1 soil samples were collected from three diverse points on the Site and were compared individually to S-1 standards.

Table 1 Soil Analytical Data (mg/kg) Deep Samples

Location:	RIZ-2	RIZ-5	RIZ-1	B-6	B-7	RIZ-6	RIZ-6	RIZ-6				
Sample Name:	MN-RIZ-2-SS	SS-RIZ5	MN-RIZ-1-SS	SS-B6	SS-B7	SS-RIZ6	SS-RIZ6	SS-RIZ6	Area 1			
Sample Depth:	20-22'	20-22'	30-32'	30-32'	25-27'	24-27'	30-32'	35-37'	S3			
Laboratory:	AMRO	AMRO	AMRO	AMRO	AMRO	AMRO	AMRO	AMRO	Average	Method 1	Method 1	Method 1
Laboratory I.D.:	14586-03	20849-01	14586-05	20849-02	20849-03	20849-04	20849-05	20849-06	Concentration	Standard	Standard	Standard
Sample Date:	11-Nov-96	6-Nov-98	11-Nov-96	6-Nov-98	6-Nov-98	6-Nov-98	6-Nov-98	6-Nov-98	Detected	S-3/GW-1	S-3/GW-2	S-3/GW-3
Consultant:	Rizzo	Rizzo	Rizzo	Rizzo	Rizzo	Rizzo	Rizzo	Rizzo				
Butylbenzene, sec-	<0.027		0.26						0.26	NA	NA	NA
Isopropyltoluene, p-	<0.027		0.41						0.41	NA	NA	NA
Naphthalene	<0.027		0.22						0.22	4	1,000	1,000
Arsenic, Total	2.4		2.8						2.8	30	30	30
Beryllium, Total	<0.12		0.20						0.20	3	3	3
Chromium, Total	7.4		17						17	5,000	5,000	5,000
Copper, Total	8.8		14						14	NA	NA	NA
Lead, Total	<2.4		11						11	600	600	600
Nickel, Total	6.7		6.7						6.70	700	700	700
Zinc, Total	14		27						27	5,000	5,000	5,000
Fuel Oil #2/Diesel	<55		1,100						1,100			
Motor Oil	<55								ND			
C_9-C_{18} Aliphatics	<55		440						ND	100	500	500
C_{11}-C_{22} Aromatics		<57	660	<53	<62	<52	<61	<57	ND	200	5,000	5,000
C_9-C_{12} Aliphatics		<0.71		1.0	<1.1	<0.75	<1.1	<0.58	1.00	5,000	5,000	5,000
			1b	1b	1b	1b	1b	1b				

Notes: RIZ-2 and RIZ-5 are compared individually to the S-3 standards.

RIZ-1, B-6, B-7, and RIZ-6 were collected from the same area and were averaged together to generate Area 1 EPCs.

TPH data collected for RIZ-1 in November 1996 and analyzed by 8100M was superseded by data collected in B-6, B-7, and RIZ-6 in November 1998.

Table 1 **Soil Analytical Data Summary Statistics (mg/kg)**

	Number of Times Detected	Number of Times Sought	Minimum Concentration Detected	Average Concentration Detected	Maximum Concentration Detected
Butylbenzene, sec-	1	8	0.26	0.26	0.26
Isopropyltoluene, p-	1	8	0.41	0.41	0.41
Naphthalene	7	11	0.22	0.22	0.22
Arsenic, Total	10	11	2.4	3.3	5.4
Beryllium, Total	7	11	0.20	0.20	0.20
Chromium, Total	11	11	5.5	10	17
Copper, Total	5	11	5.7	10.0	14
Lead, Total	9	11	4.1	6.5	11
Nickel, Total	11	11	5.2	7.3	9.8
Zinc, Total	11	11	12	20	27
Fuel Oil #2/Diesel	1	4	1,100		1,100
Motor Oil	1	4	79		79
C_9-C_{18} Aliphatics	8	8	32	236	440
C_{11}-C_{22} Aromatics	8	14	47	354	660
C_5-C_{12} Aliphatics	7	12	1.0	1.0	1.0

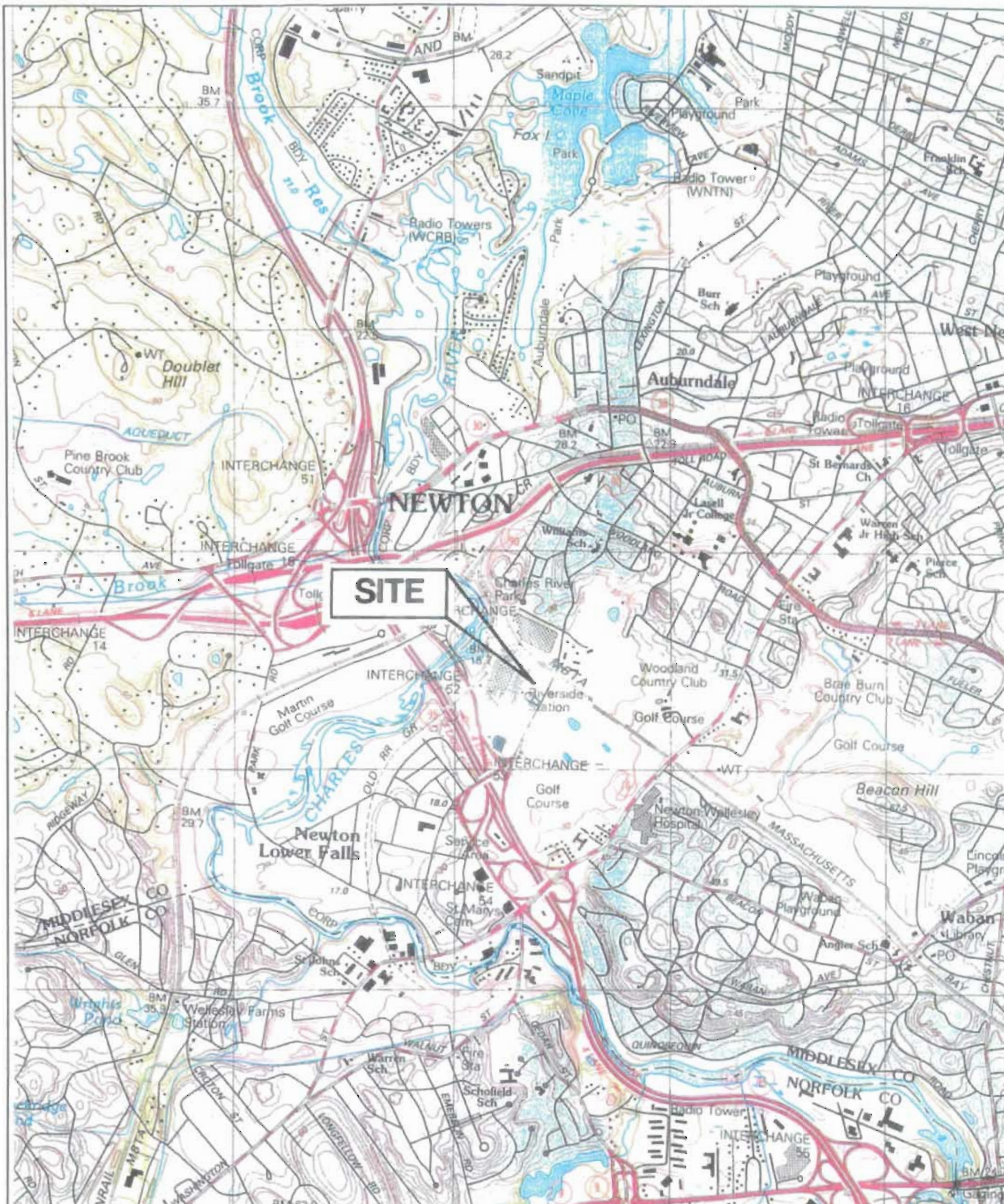
Table 2	Groundwater Analytical Data (µg/L)					
Location:	**RIZ-1**	**RIZ-1**	**RIZ-2**	**RIZ-2**	**RIZ-3**	**RIZ-3**
Sample Name:	**MR-RIZ-1-GW-104**	**RIZ-1-GW-201**	**MR-RIZ-2-GW-103**	**RIZ-2-GW-202**	**MR-RIZ-3-GW-102**	**RIZ-3-GW-203**
Laboratory:	**AMRO**	**AMRO**	**AMRO**	**AMRO**	**AMRO**	**AMRO**
Laboratory I.D.:	**14692-04**	**20998-01**	**14692-03**	**20998-02**	**14692-02**	**20998-03**
Sample Date:	**22-Nov-96**	**18-Nov-98**	**22-Nov-96**	**18-Nov-98**	**22-Nov-96**	**18-Nov-98**
Consultant:	**Rizzo**	**Rizzo**	**Rizzo**	**Rizzo**	**Rizzo**	**Rizzo**
Acenaphthene		<0.10		<0.10		<0.10
Acenaphthylene		<0.10		<0.10		<0.10
Anthracene		<0.10		<0.10		<0.10
Benzo(a)anthracene		<0.10		<0.10		<0.10
Benzo(a)pyrene		<0.10		<0.10		<0.10
Benzo(b)fluoranthene		<0.10		<0.10		<0.10
Benzo(g,h,i)perylene		<0.10		<0.10		<0.10
Benzo(k)fluoranthene		<0.10		<0.10		<0.10
Chrysene		<0.10		<0.10		<0.10
Dibenzo(a,h)anthracene		<0.10		<0.10		<0.10
Fluoranthene		<0.10		<0.10		<0.10
Fluorene		<0.10		<0.10		<0.10
Indeno(1,2,3-cd)pyrene		<0.10		<0.10		<0.10
Naphthalene		<0.10		<0.10		<0.10
Phenanthrene		<0.10		<0.10		<0.10
Pyrene		<0.10		<0.10		<0.10
Arsenic, Total	<10		<10		<10	
C_{11}-C_{22} Aromatics		<100		<100		<100
C_9-C_{12} Aliphatics	<25		<25		<25	
C_9-C_{10} Aromatics	<25		<25		<25	

Table 2 **Groundwater Analytical Data (µg/L)**

Location:	RIZ-4	RIZ-4	RIZ-4		RIZ-5	RIZ-6	RIZ-6	
Sample Name:	MR-RIZ-4-GW-101	RIZ-4-GW-204	RIZ-4-GW-301		RIZ-5-GW-205	RIZ-6-GW-206	RIZ-6-GW-302	
Laboratory:	AMRO	AMRO	ALPHA	RIZ-4	AMRO	AMRO	ALPHA	RIZ-6
Laboratory I.D.:	14692-01	20998-04	L9809827-01	Well	20998-05	20998-06	L9809827-02	Well
Sample Date:	22-Nov-96	18-Nov-98	9-Dec-98	EPC	18-Nov-98	18-Nov-98	9-Dec-98	EPC
Consultant:	Rizzo	Rizzo	Rizzo		Rizzo	Rizzo	Rizzo	
Acenaphthene		<0.10	<0.14	ND	<0.10	1.2		1.2
Acenaphthylene		0.11	<0.14	0.09	<0.10	<0.10		ND
Anthracene		0.14	<0.14	0.11	<0.10	0.27		0.27
Benzo(a)anthracene		0.64	<0.14	0.36	<0.10	<0.10		ND
Benzo(a)pyrene		0.82	<0.14	0.45	<0.10	<0.10		ND
Benzo(b)fluoranthene		1.2	<0.14	0.64	<0.10	<0.10		ND
Benzo(g,h,i)perylene		0.71	<0.14	0.39	<0.10	<0.10		ND
Benzo(k)fluoranthene		0.36	<0.14	0.22	<0.10	<0.10		ND
Chrysene		0.65	<0.14	0.36	<0.10	<0.10		ND
Dibenzo(a,h)anthracene		0.15	<0.14	0.11	<0.10	<0.10		ND
Fluoranthene		1.1	<0.14	0.59	<0.10	<0.10		ND
Fluorene		<0.10	<0.14	ND	<0.10	2.3		2.3
Indeno(1,2,3-cd)pyrene		0.80	<0.14	0.44	<0.10	<0.10		ND
Naphthalene		0.10	<0.14	0.09	<0.10	0.23		0.23
Phenanthrene		<0.10	<0.14	ND	<0.10	2.1		2.1
Pyrene		1.1	<0.14	0.59	<0.10	<0.10		ND
Arsenic, Total	11			11				ND
C_{11}-C_{22} Aromatics		<100		ND	<100	260	101	181
C_9-C_{12} Aliphatics		<25		ND	<25	<25	40	26
C_9-C_{10} Aromatics		<25		ND	<25	80	99	90

Table 2 **Groundwater Summary Statistics (µg/L)**

Location: Sample Name: Laboratory: Laboratory I.D.: Sample Date: Consultant:	Number of Times Detected	Number of Times Sought	Minimum Concentration Detected	Average Concentration Detected	Maximum Concentration Detected	Method 1 Standard GW-1	Method 1 Standard GW-2	Method 1 Standard GW-3
Acenaphthene	1	7	1.2	1.2	1.2	20	NA	5,000
Acenaphthylene	1	7	0.09	0.09	0.09	300	NA	3,000
Anthracene	2	7	0.11	0.19	0.27	2,000	NA	3,000
Benzo(a)anthracene	1	7	0.36	0.36	0.36	1	NA	3,000
Benzo(a)pyrene	1	7	0.45	0.45	0.45	0.2	NA	3,000
Benzo(b)fluoranthene	1	7	0.64	0.64	0.64	1	NA	3,000
Benzo(g,h,i)perylene	1	7	0.39	0.39	0.39	300	NA	3,000
Benzo(k)fluoranthene	1	7	0.22	0.22	0.22	1	NA	3,000
Chrysene	1	7	0.36	0.36	0.36	2	NA	3,000
Dibenzo(a,h)anthracene	1	7	0.11	0.11	0.11	0.5	NA	3,000
Fluoranthene	1	7	0.59	0.59	0.59	300	NA	200
Fluorene	1	7	2.3	2.3	2.3	300	NA	3,000
Indeno(1,2,3-cd)pyrene	1	7	0.44	0.44	0.44	0.5	NA	3,000
Naphthalene	2	7	0.085	0.16	0.23	20	6,000	6,000
Phenanthrene	1	7	2.1	2.1	2.1	300	NA	50
Pyrene	1	7	0.59	0.59	0.59	200	NA	3,000
Arsenic, Total	1	4	11	11	11	50	NA	400
C_{11}-C_{22} Aromatics	2	7	181	181	181	200	50,000	30,000
C_9-C_{12} Aliphatics	1	7	26	26	26	4,000	1,000	20,000
C_9-C_{10} Aromatics	2	7	90	90	90	200	1,000	20,000


SITE
NEWTON
Auburndale
Riverside Station
Woodland Country Club
Golf Course
Newton-Wellesley Hospital
Newton Lower Falls
Wellesley Farms Station
Doublet Hill
Pine Brook Country Club
Martin Golf Course
Brae Burn Country Club
Beacon Hill
Waban
CHARLES
INTERCHANGE 51
INTERCHANGE 52
INTERCHANGE 54
INTERCHANGE 55
Charles River Park
Lasell Jr College
Radio Towers (WCRB)
Radio Tower (WNTN)
MIDDLESEX CO
NORFOLK CO

0 2000 Feet

Quadrangle Location

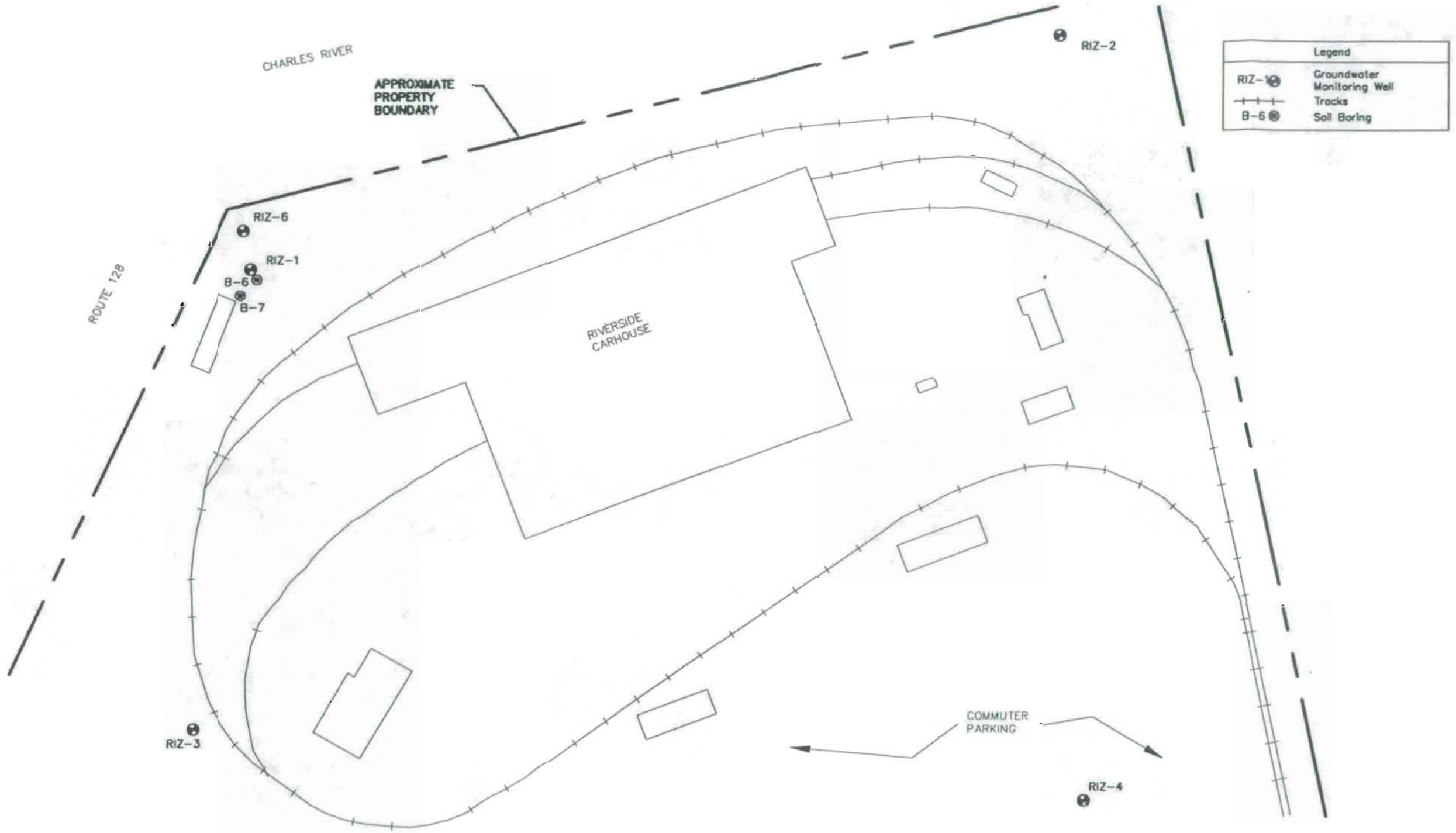
Base Map: USGS Topographic Map
Framingham & Boston South, MA Quadrangles
Maps Printed, 1978; Maps Edited, 1987

MBTA Riverside Station
325 Grove Street
Newton, Massachusetts

RIZZO ASSOCIATES, INC.

Project Locus Map

Figure
1



4413EBP01.DWG

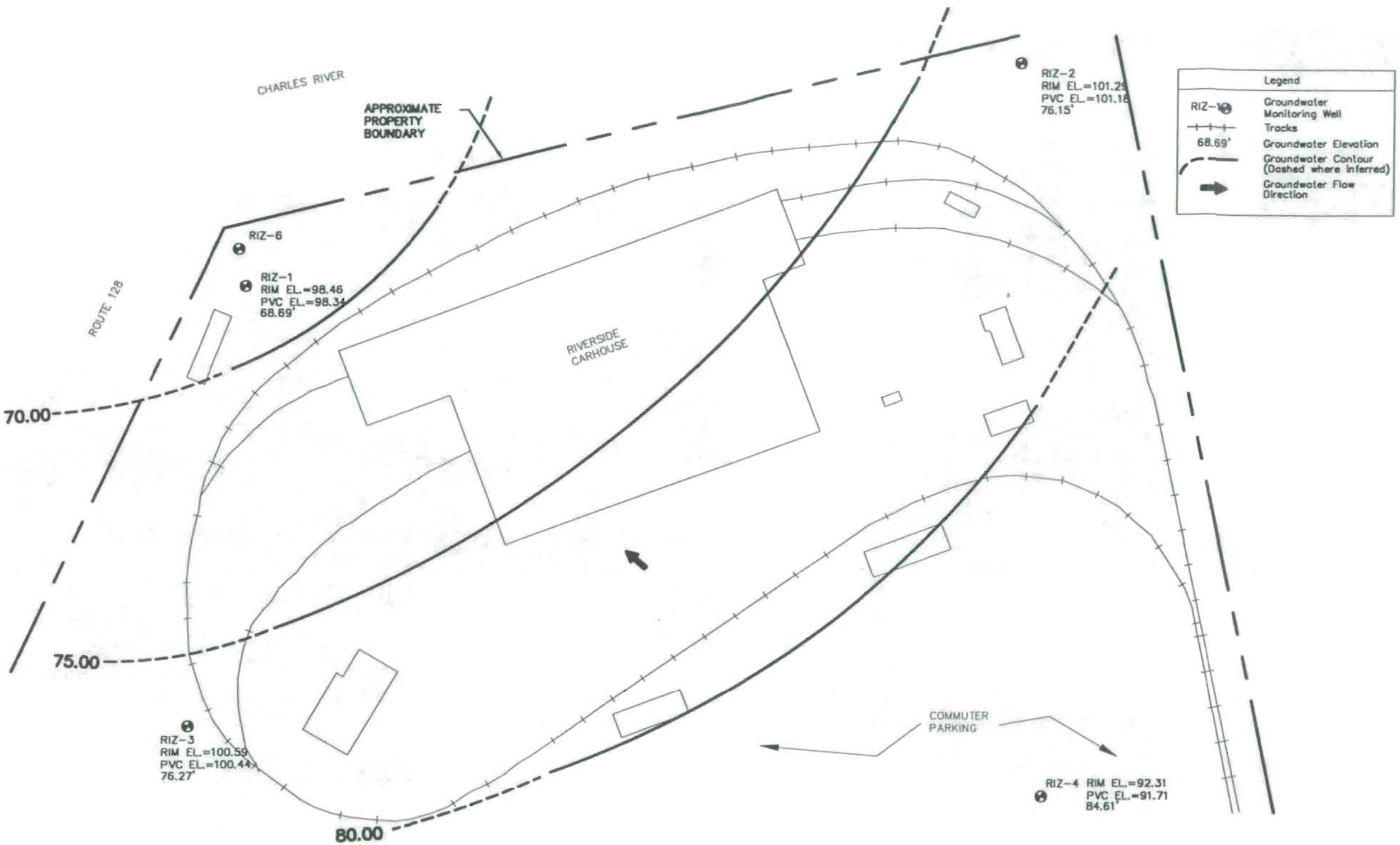
0 120 Feet

RIZZO ASSOCIATES, INC.

M.B.T.A. RIVERSIDE STATION
325 GROVE ST.
NEWTON MASSACHUSETTS

Site Plan and Sampling Locations

Figure 2



NOTE: RAILBED IS APPROXIMATE
NOT ALL TRACKS ARE SHOWN

4413ESP01.DWG

0 120 Feet

RIZZO ASSOCIATES, INC.

M.B.T.A. RIVERSIDE STATION
325 GROVE ST
NEWTON MASSACHUSETTS

Potentiometric Surface Map

Figure
3

MA DEP - Bureau of Waste Site Cleanup

Site Scoring Map: 500 feet & 0.5 Mile Radii

SITE NAME:
MBTA - Riverside Station
325 Grove Street
Newton, MA
4689403n 314254ew

Site Location

The information shown on this map is the best available at the date of printing. Please refer to the data source descriptions document.

MASS GIS — Massachusetts Geographic Information System — Massachusetts Executive Office of Environmental Affairs 1998

DEP

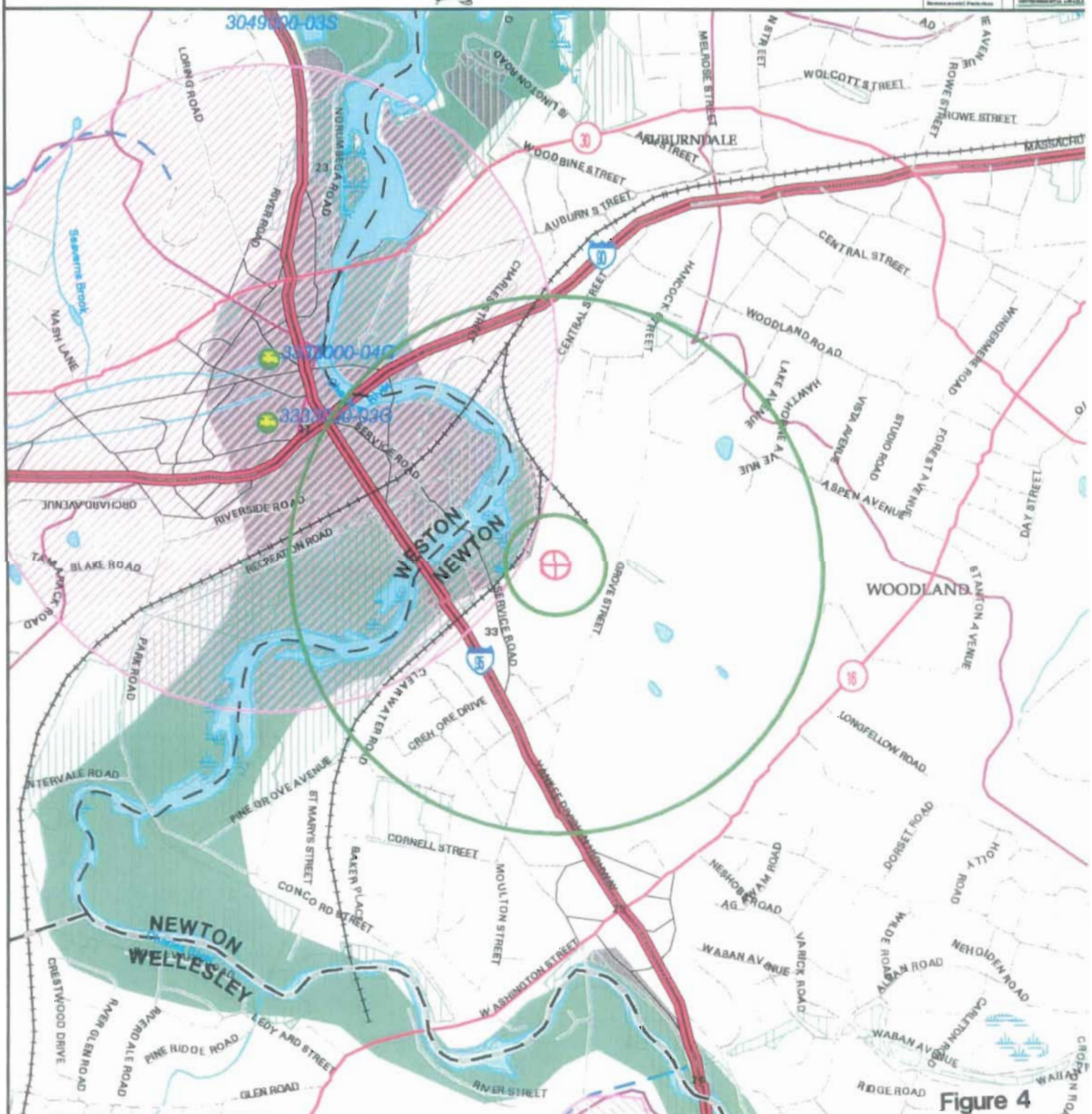


Figure 4

Roads: Interstate,US,State,Street,Trail
Boundaries: Municipal,County,DEP Region
Train; Powerline; Pipeline
Drainage Basins: Major,Sub
Streams: Perennial,Intermittent,Aqueduct
Potentially Productive Aquifers: Medium Yield,High Yield
Non-Potential Drinking Water Source Area: Medium,High Yield
EPA Designated Sole Source Aquifer
Public Water Supplies: Ground,Surface,Non Community
Approved Zone2; IWPA; Surface Water Supply Zone A
Hydrography: Water Features,Public Surface Water Supply
Wetlands: Fresh,Salt,NHESP Wetlands Habitat
Protected Open Space; ACEC
DEP Permitted Solid Waste Facilities; Certified Vernal Pools

N W E S

SCALE 1:15000

0 1/2 MILES
0 1/2 KILOMETERS

September 17, 199

4443-01

0 200 Feet

325 Grove Street
Newton, Massachusetts

Rizzo Associates, Inc.

Sampling Locations
and Zone II Boundary

Figure
5

Appendix A

Transmittal Form (Form BWSC-104) and Statement of Limitations and Conditions

Massachusetts Department of Environmental Protection **BWSC-104**
Bureau of Waste Site Cleanup

RESPONSE ACTION OUTCOME (RAO) STATEMENT & DOWNGRADIENT PROPERTY STATUS TRANSMITTAL FORM

Pursuant to 310 CMR 40.0180 (Subpart B), 40.0580 (Subpart E) & 40.1056 (Subpart J)

COPY

Release Tracking Number: 3 - 10565

A. SITE OR DOWNGRADIENT PROPERTY LOCATION:

Site Name: (optional) MBTA - Riverside Station

Street: 325 Grove St. Location Aid:

City/Town: Newton ZIP Code: 02158

[X] Check here if this Site location is Tier Classified. If a Tier I Permit has been issued, state the Permit Number:

Related Release Tracking Numbers that this Form Addresses:

If submitting an RAO Statement, you must document the location of the Site or the location and boundaries of the Disposal Site subject to this Statement. If submitting an RAO Statement for a PORTION of a Disposal Site, you must document the location and boundaries for both the portion subject to this submittal and, to the extent defined, the entire Disposal Site. If submitting a Downgradient Property Status Submittal, you must provide a site plan of the property subject to the submittal and, to the extent defined, the Disposal Site.

B. THIS FORM IS BEING USED TO: (check all that apply)

[X] Submit a Response Action Outcome (RAO) Statement (complete Sections A, B, C, D, E, F, H, I, J and L).

[ ] Check here if this is a revised RAO Statement. Date of Prior Submittal:

[ ] Check here if any Response Actions remain to be taken to address conditions associated with any of the Releases whose Release Tracking Numbers are listed above. This RAO Statement will record only an RAO-Partial Statement for those Release Tracking Numbers.

Specify Affected Release Tracking Numbers:

[ ] Submit an optional Phase I Completion Statement supporting an RAO Statement or Downgradient Property Status Submittal (complete Sections A, B, H, I, J, and L).

[ ] Submit a Downgradient Property Status Submittal (complete Sections A, B, G, H, I, J and K).

[ ] Check here if this is a revised Downgradient Property Status Submittal. Date of Prior Submittal:

[ ] Submit a Termination of a Downgradient Property Status Submittal (complete Sections A, B, I, J and L).

[ ] Submit a Periodic Review Opinion evaluating the status of a Temporary Solution (complete Sections A, B, H, I, J and L).

Specify one: [ ] For a Class C RAO [ ] For a Waiver Completion Statement Indicating a Temporary Solution

Provide Submittal Date of RAO Statement or Waiver Completion Statement:

You must attach all supporting documentation required for each use of form indicated, including copies of any Legal Notices and Notices to Public Officials required by 310 CMR 40.1400.

C. DESCRIPTION OF RESPONSE ACTIONS: (check all that apply)

[X] Assessment and/or Monitoring Only

[ ] Removal of Contaminated Soils

[ ] Re-use, Recycling or Treatment

( ) On Site ( ) Off Site Est. Vol.: _____ cubic yards

Describe:

[ ] Landfill ( ) Cover ( ) Disposal Est. Vol.: _____ cubic yards

[ ] Removal of Drums, Tanks or Containers

Describe:

[ ] Removal of Other Contaminated Media

Specify Type and Volume:

[ ] Other Response Actions

Describe:

[ ] Deployment of Absorbant or Containment Materials

[ ] Temporary Covers or Caps

[ ] Bioremediation

[ ] Soil Vapor Extraction

[ ] Structure Venting System

[ ] Product or NAPL Recovery

[ ] Groundwater Treatment Systems

[ ] Air Sparging

[ ] Temporary Water Supplies

[ ] Temporary Evacuation or Relocation of Residents

[ ] Fencing and Sign Posting

SECTION C IS CONTINUED ON THE NEXT PAGE.

Massachusetts Department of Environmental Protection **BWSC-104**
Bureau of Waste Site Cleanup

RESPONSE ACTION OUTCOME (RAO) STATEMENT & DOWNGRADIENT PROPERTY STATUS TRANSMITTAL FORM

Pursuant to 310 CMR 40.0180 (Subpart B), 40.0560 (Subpart E) & 40.1050 (Subpart J)

Release Tracking Number: 3 - 10565

C. DESCRIPTION OF RESPONSE ACTIONS: (continued)

☐ Check here if any Response Action(s) that serve as the basis for this RAO Statement involve the use of Innovative Technologies. (DEP is interested in using this information to create an Innovative Technologies Clearinghouse.)

Describe Technologies: _____

D. TRANSPORT OF REMEDIATION WASTE: (If Remediation Waste was sent to an off-site facility, answer the following questions)

Name of Facility: N/A

Town and State: N/A

Quantity of Remediation Waste Transported to Date: N/A

E. RESPONSE ACTION OUTCOME CLASS:

Specify the Class of Response Action Outcome that applies to the Site or Disposal Site. Select ONLY one Class:

☐ **Class A-1 RAO:** Specify one of the following:

○ Contamination has been reduced to background levels. ○ A Threat of Release has been eliminated.

☐ **Class A-2 RAO:** You MUST provide justification that reducing contamination to background levels is infeasible.

☐ **Class A-3 RAO:** You MUST provide both an implemented Activity and Use Limitation (AUL) and justification that reducing contamination to background levels is infeasible.

If applicable, provide the earlier of the AUL expiration date or date the design life of the medy will end: _____

☒ **Class B-1 RAO:** Specify one of the following:

○ Contamination is consistent with background levels ⊗ Contamination is NOT consistent with background levels.

☐ **Class B-2 RAO:** You MUST provide an implemented AUL.

If applicable, provide the AUL expiration date : _____

☐ **Class C RAO:** ☐ Check here if you will conduct post-RAO Operation, Maintenance and Monitoring at the Site.

Specify One: ○ Passive Operation and Maintenance ○ Monitoring Only

○ Active Operation and Maintenance (defined at 310 CMR 40.0006)

F. RESPONSE ACTION OUTCOME INFORMATION:

☐ If an RAO Compliance Fee is required, check here to certify that the fee has been submitted. You MUST attach a photocopy of the payment.

☐ Check here if submitting one or more AULs. You must attach an AUL Transmittal Form (BWSC-113) and a copy of each implemented AUL related to this RAO Statement. Specify the type of AUL(s) below: (required for all Class A-3 RAOs and Class B-2 RAOs)

○ Notice of Activity and Use Limitation ○ Grant of Environmental Restriction Number of AULs attached: _____

Specify the Risk Characterization Method(s) used to achieve the RAO described above and all Soil and Groundwater Categories applicable to the Site.

More than one Soil Category and more than one Groundwater Category may apply at Site.
Be sure to check off all APPLICABLE categories, even if more stringent soil and groundwater standards were met.

Risk Characterization Method(s) Used:	☐ Method 1	☐ Method 2	☒ Method 3
Soil Category(ies) Applicable:	☐ S-1	☐ S-2	☒ S-3
Groundwater Category(ies) Applicable:	☒ GW-1	☐ GW-2	☐ GW-3

> **When submitting any Class A-1 RAO or a Class B-1 RAO where contamination is consistent with background levels, do NOT specify a Risk Characterization Method.**

> **When submitting any Class A-2 RAO or a Class B-1 RAO where contamination is NOT consistent with background levels, you cannot use an AUL to maintain a level of no significant risk. Therefore, you must meet S-1 Soil Standards, if using Risk Characterization Method 1.**

Massachusetts Department of Environmental Protection **BWSC-104**
Bureau of Waste Site Cleanup

RESPONSE ACTION OUTCOME (RAO) STATEMENT & DOWNGRADIENT PROPERTY STATUS TRANSMITTAL FORM

Pursuant to 310 CMR 40.0160 (Subpart B), 40.0580 (Subpart E) & 40.1056 (Subpart J)

COPY

Release Tracking Number: 10565

G. DOWNGRADIENT PROPERTY STATUS SUBMITTAL:

☐ If a Downgradient Property Status Submittal Compliance Fee is required, check here to certify that the fee has been submitted. You MUST attach a photocopy of the payment.

☐ Check here if a Release(s) of Oil or Hazardous Material(s), other than that which is the subject of this submittal, has occurred at this property.

Release Tracking Number(s): _____

○ Check here if the Releases identified above require further Response Actions pursuant to 310 CMR 40.0000.

Required documentation for a Downgradient Property Status Submittal includes, but is not limited to, copies of notices provided to owners and operators of both upgradient and downgradient abutting properties and of any known or suspected source properties.

H. LSP OPINION:

I attest under the pains and penalties of perjury that I have personally examined and am familiar with this transmittal form, including any and all documents accompanying this submittal. In my professional opinion and judgment based upon application of (i) the standard of care in 309 CMR 4.02(1), (ii) the applicable provisions of 309 CMR 4.02(2) and (3), and (iii) the provisions of 309 CMR 4.03(5), to the best of my knowledge, information and belief,

> *If Section B indicates that a Downgradient Property Status Submittal is being provided,* the response action(s) that is (are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in 310 CMR 40.0183(2)(b), and (iii) complies(y) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> *If Section B indicates that either an RAO Statement, Phase I Completion Statement and/or Periodic Review Opinion is being provided,* the response action(s) that is (are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, and (iii) complies(y) with the identified provisions of all orders, permits, and approvals identified in this submittal.

I am aware that significant penalties may result, including, but not limited to, possible fines and imprisonment, if I submit information which I know to be false, inaccurate or materially incomplete.

☐ Check here if the Response Action(s) on which this opinion is based, if any, are (were) subject to any order(s), permit(s) and/or approval(s) issued by DEP or EPA. If the box is checked, you MUST attach a statement identifying the applicable provisions thereof.

LSP Name: Richard J. Hughto LSP #: 2261 Stamp:

Telephone: (508) 651-3401 Ext.: 2346

FAX: (optional) (508) 651-1189

Signature: _____

Date: 17 December 1998

COMMONWEALTH OF MASSACHUSETTS RICHARD J. HUGHTO No. 2261 REGISTERED LICENSED SITE PROFESSIONAL

I. PERSON MAKING SUBMITTAL:

Name of Organization: Massachusetts Bay Transportation Authority

Name of Contact: Andrew D. Brennan Title: Director of Enveronmental Affairs

Street: 10 Park Plaza

City/Town: Boston State: MA ZIP Code: 02116-3974

Telephone: (617) 222-3126 Ext.: _____ FAX: (optional) (617) 222-1557

J. RELATIONSHIP TO SITE OF PERSON MAKING SUBMITTAL: (check one)

☒ RP or PRP Specify: ⊗ Owner ○ Operator ○ Generator ○ Transporter Other RP or PRP: _____

☐ Fiduciary, Secured Lender or Municipality with Exempt Status (as defined by M.G.L. c. 21E, s. 2)

☐ Agency or Public Utility on a Right of Way (as defined by M.G.L. c. 21E, s. 5(j))

☐ Any Other Person Submitting This Form Specify Relationship: _____

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

BWSC-104

RESPONSE ACTION OUTCOME (RAO) STATEMENT & DOWNGRADIENT PROPERTY STATUS TRANSMITTAL FORM

Pursuant to 310 CMR 40.0160 (Subpart B), 40.0580 (Subpart E) & 40.1056 (Subpart J)

Release Tracking Number: 3 - 10565

K. CERTIFICATION OF PERSON SUBMITTING DOWNGRADIENT PROPERTY STATUS SUBMITTAL:

I, _____, attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form; (ii) that, based on my inquiry of the/those individual(s) immediately responsible for obtaining the information, the material information contained herein is, to the best of my knowledge, information and belief, true, accurate and complete; (iii) that, to the best of my knowledge, information and belief, I/the person(s) or entity(ies) on whose behalf this submittal is made satisfy(ies) the criteria in 310 CMR 40.0183(2); (iv) that I/the person(s) or entity(ies) on whose behalf this submittal is made have provided notice in accordance with 310 CMR 40.0183(5); and (v) that I am fully authorized to make this attestation on behalf of the person(s) or entity(ies) legally responsible for this submittal. I/the person(s) or entity(ies) on whose behalf this submittal is made is/are aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

By: _____ Title: _____
(signature)

For: _____ Date: _____
(print name of person or entity recorded in Section I)

Enter address of the person providing certification, if different from address recorded in Section I:

Street: _____

City/Town: _____ State: _____ ZIP Code: _____

Telephone: _____ Ext.: _____ FAX: (optional) _____

L. CERTIFICATION OF PERSON MAKING SUBMITTAL:

If you are completing only a Downgradient Property Status Submittal, you do not need to complete this section of the form.

I, Andrew D. Brennan, attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form, (ii) that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material information contained in this submittal is, to the best of my knowledge and belief, true, accurate and complete, and (iii) that I am fully authorized to make this attestation on behalf of the entity legally responsible for this submittal. I/the person or entity on whose behalf this submittal is made am/is aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

By: Andrew D Brennan Title: Director of Environmental Affairs
(signature)

For: Massachusetts Bay Transportation Authority Date: DECEMBER 15, 1998
(print name of person or entity recorded in Section I)

Enter address of the person providing certification, if different from address recorded in Section I:

Street: _____

City/Town: _____ State: _____ ZIP Code: _____

Telephone: _____ Ext.: _____ FAX: (optional) _____

YOU MUST COMPLETE ALL RELEVANT SECTIONS OF THIS FORM OR DEP MAY RETURN THE DOCUMENT AS INCOMPLETE. IF YOU SUBMIT AN INCOMPLETE FORM, YOU MAY BE PENALIZED FOR MISSING A REQUIRED DEADLINE, AND YOU MAY INCUR ADDITIONAL COMPLIANCE FEES.

Statement of Limitations and Conditions

Attachment to Opinion of Massachusetts Licensed Site Professional

Rizzo Associates, Inc.

Name of Licensed Site Professional:	Richard J. Hughto
LSP Registration Number:	2261
Date of Opinion:	December 17, 1998
Client to Whom Opinion was Rendered:	Massachusetts Bay Transportation Authority
Date of Agreement between Rizzo Associates and Client pursuant to which Opinion was Rendered:	Contract No. X2PS83 Task Order Authorization: 9/30/98
Response Tracking No./Site No.:	3-10565

This Statement of Limitations and Conditions is an integral part of, and is incorporated by reference into, the Opinion of Massachusetts Licensed Site Professional referenced above.

Limitations

1. Purpose of Opinion

A. This Opinion is being provided in compliance with the requirements set forth in the Massachusetts Contingency Plan ("MCP"), 310 CMR 40.0000 et seq. Specifically, the LSP has prepared this Opinion at the request of the Client identified above as part of a Response Action Outcome Statement. This stated purpose has been a significant factor in determining the scope and level of services required to render this Opinion.

B. Should the purpose for which this Opinion is to be used change, this Opinion shall no longer be valid.

2. General

A. This Opinion was prepared for the sole and exclusive use of the Client, subject to the provisions of the MCP. No other party is

entitled to rely in any way on the conclusions, observations, specifications, or data contained herein without the express written consent of Rizzo Associates, Inc. and the LSP who rendered this opinion. Any use of this Opinion by anyone other than Client, or any use of this Opinion by Client or others for any purpose other than the stated purpose set forth above, without the LSP's review and the written authorization of Rizzo Associates, Inc. and the LSP, shall be at the user's sole risk, and neither Rizzo Associates, Inc. nor the LSP shall have any liability or responsibility therefor.

B. This Opinion was prepared pursuant to an Agreement between Rizzo Associates, Inc. and the Client referenced above which defines the scope of work and sets out agreements regarding waivers of consequential damages, limitations on liability, and other important conditions and restrictions pursuant to which the Opinion is rendered. All uses of the Opinion are subject to and deemed acceptance of the conditions and restrictions contained in such Agreement. A copy of the Agreement or relevant excerpts from the Agreement will be made available upon requests to any authorized person seeking to use the Opinion.

3. Scope of Services

The observations and conclusions described in this Opinion are based solely on the Services provided pursuant to the Agreement with the Client and any approved additional services authorized by Client. Without limitation of any other applicable limitations or conditions, neither Rizzo Associates, Inc. nor the LSP shall be liable for the existence of any condition, the discovery of which would have required the performance of services not authorized under the Agreement. To the best of the knowledge and belief of Rizzo Associates, Inc. and the LSP who signed this Opinion, no inquiry of an attorney-at-law having being made, no laws, regulations, orders, permits or approvals are applicable to the response actions to which this opinion relates except, if and to the extent applicable, M.G.L. c. 21A, Sections 19-19J, 309 CMR, M.G.L. c. 21 E and 310 CMR 40.0000. Accordingly, this opinion is not intended to and does not address compliance with any other laws, regulation, orders, permits or approvals.

4. Changed Circumstances

The passage of time may result in changes in technology, economic conditions or regulatory standards, manifestations of latent conditions, or the occurrence of future events which would render this Opinion inaccurate or otherwise inapplicable. Neither Rizzo Associates, Inc. nor the LSP shall be liable or responsible for the consequences of any such changed circumstances or conditions on the accuracy of this Opinion. In addition, under no circumstances shall the Client nor any other person or entity rely on the information or conclusions contained in this Opinion after six months from its date of submission without the express written consent of Rizzo Associates, Inc. and the LSP. Reliance on the Opinion after such period of time shall be at the user's sole risk.

5. Should Rizzo Associates, Inc. or the LSP be required or requested to review or authorize others to use this Opinion after its date of submission, Rizzo Associates, Inc. shall be entitled to additional compensation at then existing rates or such other terms as may be agreed upon between Rizzo Associates, Inc. and the Client. Nothing herein contained shall be deemed to require Rizzo Associates, Inc. or the LSP to undertake any such review or authorize others to use this Opinion.

6. The conclusions stated in this Opinion are based upon:

- Visual inspection of existing physical conditions;
- Review and interpretation of site history and site usage information which was made available or obtained within the scope of work authorized by the Client;
- Information provided by the Client;
- Information and/or analyses for designated substances or parameters provided by an independent testing service or laboratory on a limited number of samples;
- A limited number of subsurface explorations made on dates indicated in documentation supporting this Opinion;

upon which the LSP has relied and presumed accurate, and upon which the LSP is entitled to reasonably rely. The LSP was not authorized and did not attempt to independently verify the accuracy or

completeness of information or materials received from the Client and/or from laboratories and other third parties during the performance of its services. Neither Rizzo Associates, Inc. nor the LSP shall be liable for any condition, information, or conclusion, the discovery of which required information not available to the LSP or for independent investigation of information provided to the LSP by the Client and/or independent third parties.

7. This Opinion is rendered for the limited purpose stated above, and is not and should not be deemed to be an opinion concerning the compliance of any past or present owner or operator of the site with any federal, state or local law or regulation. No warranty or guarantee, whether express or implied, is made by this opinion, and any implied warranties of merchantability or fitness for a particular purpose are expressly disclaimed. Without limiting the generality of the foregoing, no warranty or guarantee is made that all contamination at a site or sources or contamination has been detected or identified, that any action or recommended action will achieve all of its objectives, or that this Opinion or any action as to which this Opinion relates will be upheld by any audit conducted by the DEP or any other party.

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Appendix B

Public Involvement Filings

COPY

RIZZO ASSOCIATES, INC.
ENGINEERS AND ENVIRONMENTAL SCIENTISTS
AN EMPLOYEE-OWNED COMPANY

235 West Central Street
Natick, MA 01760-3755
Phone (508) 903-2000
Fax (508) 903-2001

December 23, 1998

David Naporstek
Health Department
1294 Centre Street
Newton, MA 02159

Re: Response Action Outcome Statement
DEP RTN# 3-10565
MBTA Riverside Station
325 Grove Street
Newton, Massachusetts

To Whom it May Concern:

On behalf of the Massachusetts Bay Transportation Authority, Rizzo Associates Inc. is providing notification that a Response Action Outcome (RAO) Statement will be filed with the Massachusetts Department of Environmental Protection (DEP) on or about December 31, 1998 in relation to the property referenced above. You can review the RAO Statement at the DEP Northeast Regional Office in Wilmington.

Very truly yours,

Richard J. Hughto, Ph.D., P.E., L.S.P
Executive Vice President, Principal

COPY

RIZZO ASSOCIATES, INC.
ENGINEERS AND ENVIRONMENTAL SCIENTISTS
AN EMPLOYEE-OWNED COMPANY

235 West Central Street
Natick, MA 01760-3755
Phone (508) 903-2000
Fax (508) 903-2001

December 23, 1998

Mayor David B. Cohen
Mayor's Office
1000 Commonwealth Ave.
Newton, MA 02159

Re: Response Action Outcome Statement
DEP RTN# 3-10565
MBTA Riverside Station
325 Grove Street
Newton, Massachusetts

To Whom it May Concern :

On behalf of the Massachusetts Bay Transportation Authority, Rizzo Associates Inc. is providing notification that a Response Action Outcome (RAO) Statement will be filed with the Massachusetts Department of Environmental Protection (DEP) on or about December 31, 1998 in relation to the property referenced above. You can review the RAO Statement at the DEP Northeast Regional Office in Wilmington.

Very truly yours,

Richard J. Hughto, Ph.D., P.E., L.S.P
Executive Vice President, Principal

Appendix C

Standard Operating Procedures

Standard Operating Protocol for Jar Headspace Screening

The following procedures will be used to screen soil samples for volatile organic compounds with a portable photoionization detector (PID) or a flame ionization detector (FID).

1. Half-fill a clean glass 8-ounce jar with the sample to be analyzed. Quickly cover the open top with a sheet of clean aluminum foil and apply the screw cap to tightly seal the jar.

2. Vigorously shake the jar for 10 seconds both at the beginning and end of the headspace development period. Allow the jar to stand 10 minutes for headspace development. When ambient temperatures are below 32°F (0°C), allow the samples to stand in a heated vehicle or building.

3. After the headspace development period, remove screw lid to expose the foil seal. Puncture the foil seal with an instrument sampling probe, to a point about one-half of the headspace depth. Do not allow water droplets or soil particulates to touch the instrument probe.

4. Observe the instrument response and record the highest meter response as the jar headspace concentration. The maximum response should occur from two to five seconds after the probe is inserted into the jar. The meter response may be erratic when the concentration of organic vapor is high or if there is excessive moisture in the sample. The experience and judgment of the instrument operator must be used to determine the validity of the headspace measurement.

5. Benzene or an equivalent compound will be used to calibrate the field screening instrument. Jar headspace sample results will be reported as total organic vapors in ppm (v/v). Instruments will be operated, maintained, and calibrated in accordance with the manufacturer's specifications. A calibration and maintenance log is kept at Rizzo Associates' office for each instrument. The daily calibration data are transcribed to the field log for each day that the instrument is used. Some samples may be collected and analyzed in duplicate to measure sample variability.

G:\project\forms\protocol for jar headspace screening.doc

Standard Operating Protocol for Completing Soil Borings and Monitoring Well Borings in Unconsolidated Surficial Deposits

1. All drilling is inspected continuously by a staff geologist or inspector. The geologist or inspector is familiar with the particular drilling program, and is responsible for ensuring that established procedures are followed. The geologist or inspector has the authority to modify the program and/or procedures when warranted by unanticipated field conditions.

2. The geologist or inspector is responsible for maintaining field notes and for keeping a well log independent of the driller.

3. All drilling equipment is steam-cleaned prior to each use. Steam cleaning is performed on the augers and/or casing, drilling rods, samplers, auger forks, lifting hooks, and other equipment needed for establishing the well. The working end of the drill rig is steam-cleaned, and the rig is generally inspected by the geologist or inspector for evidence of leaks (i.e., gasoline or diesel fuel and hydraulic fluid). Finally, well construction materials, including casing, screens, protective risers, and/or road boxes, are also steam-cleaned prior to use.

4. Soil samples are collected at five-foot intervals unless otherwise specified, and/or at changes in strata, utilizing a clean split-spoon sampler. These soil samples are used for characterizing the physical nature of the subsurface sediments and may be collected for laboratory analyses. Similarly, spoon samples may be screened in the field for contamination utilizing appropriate field analytical devices.

5. Sediments collected from the sampler or brought to the surface by the drilling process are left on-site, unless there are specific instructions to the contrary. Sediments will be screened using a photoionization detector (PID) or a flame ionization detector (FID), and the results of that screening will be used to determine the disposal method for the soil. Soils exhibiting detector responses of greater then 10 ppm will be placed in drums or will be stockpiled on and covered with polyethylene sheeting. Soils exhibiting responses of less than 10 ppm will be placed in an unlined stockpile on the site.

6. When installing a groundwater monitoring well, the well screen is set at a depth whereby it intercepts the surface of the water table, unless otherwise specified. The screen is set to extend above the highest anticipated groundwater levels to a maximum of within two feet of the land surface. The annular space between the wall of the bore hole and the screen is then packed with clean silica sand to a level one foot above the screen (to allow for settling), and then with a minimum one-foot bentonite seal. The method of backfilling the borehole above the bentonite seal will be left to the discretion of the site geologist or inspector. If the borehole creates the potential for migration of contaminants into previously uncontaminated deposits, the borehole will be filled with a portland cement and bentonite slurry. If migration of contaminants is not a concern, then the well will be backfilled with the drill cuttings if detector responses are less than 10 ppm, or with clean backfill material if detector responses are greater than 10 ppm. The final one foot is filled with cement, into which is set a protective riser with locking cap or a road box.

Standard Operating Protocol for Decontaminating Sampling Equipment

Whenever possible, sampling equipment will be dedicated to each sampling location or disposable equipment will be used. When this is not possible, field decontamination of the equipment will occur prior to the collection of samples for chemical analysis. The method of choice for decontamination is that which most fully removes site contaminants from the sampling equipment with the least interference to the ultimate chemical analysis. Do not use fluids that have been stored in plastic bottles to decontaminate field equipment. Deionized water and methanol used for decontamination should be stored in nalgene or teflon bottles.

Equipment used to collect samples for chemical analysis will be decontaminated as follows:

1. Wash equipment with a nonphosphate detergent solution (e.g., Alconox) and a brush.

2. Rinse thoroughly with tap water.

3. Rinse with reagent grade methanol.

4. Rinse the equipment thoroughly with deionized water.

5. Equipment that is stored or transported will be kept in a dedicated plastic bag or wrapped in aluminum foil to prevent contamination prior to use.

6. When collecting water samples, rinse the equipment three times with the media being sampled before collecting the sample.

Steam cleaning is another acceptable technique for field decontamination.

Decontamination procedures will be recorded in the field book or on the field report form. These entries will include the date, time, location, personnel, equipment, and specific procedures used for the decontamination of field equipment and the source of all fluids, including water, used in the procedure. Deviations from the standard protocols will also be noted in the field log.

Waste water and methanol solutions generated during decontamination procedures will be discharged on-site, provided that the pH is between 2 and 12.

Standard Operating Protocol for Sampling Monitoring Wells

Discussion

To obtain a representative sample of groundwater, it must be understood that the water within the well casing and in close proximity to the well is generally not representative of the groundwater quality at that sampling site. Therefore, the well will be pumped or bailed until it is thoroughly flushed of standing water and contains water from the aquifer. Wells may be purged and sampled with a pump from the ground surface, with a submersible pump or with a bailer, depending on the specific needs of the sampling program. Bailers are generally preferred for collecting samples where volatile stripping is of concern. Pumps are useful for purging large volumes of water from deep wells or when a sample from a discrete depth below the water surface is desired. Refer to DEP Policy #WSC-310-91 to choose the appropriate method for purging and sampling a well and operate sampling equipment according to manufacturer's directions.

Procedures for Purging and Sampling

1. Using clean, noncontaminating equipment (i.e., an electronic level indicator [avoid indicating paste]), determine and record in the field logbook the water level in the well, then calculate the fluid volume in the casing.

   The volume of water in the well can be calculated using the following equation:

   $$v = \frac{(\pi r^2 h)}{c}$$

   where:

   v = one well volume of water (gallons)
   π = 3.14
   r = the radius of the well or one half of the diameter (inches)
   h = the height of the water column in the well (inches)

c = 231 cubic inches per gallon; constant to convert cubic inches to gallons

2. Use a pump or bailer to begin flushing the well. Periodically during the purging of the well, measure and record the pH, temperature, and specific conductivity of the water being removed.

3. Avoid contamination and do not allow sampling equipment or the bailer line to contact the ground while sampling.

4. Continue purging the well until the following is achieved:

   a. a minimum of three casing volumes have been removed from the well, and pH, temperature, and conductivity have stabilized; or

   b. five well volumes have been removed; or

   c. the well is evacuated to dryness

   Three times the well volume (gallons) in a 2-inch-diameter well is approximately one half the height of the water column measured in feet.

5. After water pH, temperature, and specific conductance have stabilized, allow the water level to return to a sufficient level to collect a complete sample and proceed with the sample collection as described below.

6. Select sample bottles and preservative as required by the analysis. Sample bottles containing preservative may be obtained from the laboratory, or samples may be preserved in the field. Samples for metals analysis that require field filtering will be collected in a transfer vessel and then filtered into a preserved container.

7. When transferring the sample in the bailer to the sample container, tip the bailer to allow a slow discharge from the bailer top to flow gently down the side of the sample bottle with minimum entry turbulence.

8. When collecting a sample with a pump, the flow rate of the pump should be low so as to minimize disturbing the sample.

9. In order to compare analytical data for a given well over time, the same purging and sampling method should be used consistently at a given well.

10. Check that a teflon liner is present in the cap, if required. Secure the cap tightly.

11. Label the sample bottle with an appropriate label and waterproof ink. Record the sample number, location, well purging information, the temperature, pH, specific conductivity, and deviations from protocol and relevant observations, such as colors, odors, or sheens, in the field logbook. Complete the chain of custody. Samples will be stored in a cooler until they are delivered to the laboratory.

12. Discard disposable bailers after use in one well. If reusable bailers are used, clean and store each bailer according to the Standard Operating Protocol for Decontaminating Sampling Equipment.

13. Tubing used with a pump may be discarded after each well or cleaned by pumping the decontamination fluids through the tubing according to the Standard Operating Procedure for Decontaminating Field Equipment.

Adapted from:

Standard References for Monitoring Wells, The Massachusetts Department of Environmental Protection #WSC-310-91.

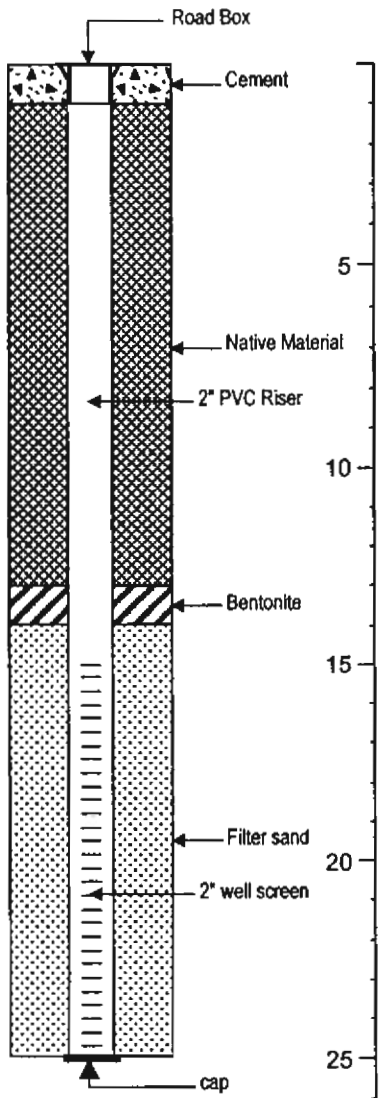
G:\PROJECT\FORMS\PROTOCOL FOR SAMPLING MONITORING WELLS.DOC Last updated 4/17/92

Appendix D

Soil Boring Logs and Well Construction Diagrams

RIZ-5

Well Construction



Blow Counts	Recovery/ Advance	PID (ppm)	Depth (ft)	Sample Interval	Graphic Log	Materials Description
15 13 10 10	12/24	0				Black & brown fine sand and silt with coarse sand and gravel. Dry. Poorly sorted. No odor.
45 120 120 120	6/24		5			Wood.
7 3 4 3	1/24		10			Wood.
						Brown medium sand with coarse sand. Trace fine sand and silt. Moist. Poorly sorted. No odor.
5 18 22 25	1/24	0	15			Groundwater encountered at 18 feet.
4 8 11 11	18/24	0	20			Brown coarse sand with fine sand and silt. Trace plant fibers. Loose. Poorly sorted. Saturated. No odor.
			25			End of Boring
			30			

BORING LOG AND WELL CONSTRUCTION FOR WELL Riz-5

Project: MBTA RIVERSIDE | Project Number: 4413.01 | Location: Newton, MA

Well Location: South Commuter Parking Lot

Rizzo Associates, Inc.

Engineers and Environmental Scientists

235 West Central Street, Natick, MA 01760

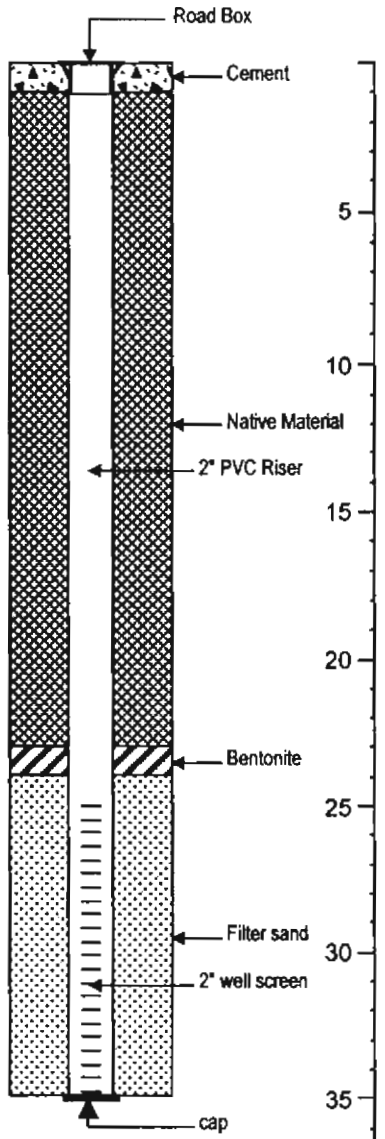
Installation Date: 11/6/98 | Depth of Boring: 25

Inspector: Clark Fero | Depth to Water: 18

Contractor: Soil Exploration | PID used: HNU

Drilling Method: HSA

RIZ-6



Blow Counts	Recovery/ Advance	PID (ppm)	Depth (ft)	Sample Interval	Graphic Log	Materials Description
5, 10, 11	10/24	3				Light brown fine sand & silt with trace coarse sand ans gravel. Dry. Poorly sorted. No odor.
15, 12, 13, 12	20/24	4	5			Light brown medium sand with fine sand. Trace silt, coarse sand and gravel. Dry. Poorly sorted. Loose. No odor.
6, 8, 9, 10	18/24	4	10			Same as above.
11, 12, 13, 15	18/24	3	15			Light brown coarse sand with fine sand,silt and gravel to 3 cm. Poorly sorted. Dry. No odor.
18, 20, 19, 19	1/24	4.5	20			Brown medium sand with silt and coarse sand. Moist. Poorly sorted. No odor.
11, 12, 13, 15	18/24	4.6	25			Light brown interbedded coarse, medium and fine sand with silt. Dry. Loose. No odor.
4, 5, 5, 6	16/24	4.8	30			Groundwater encountered at 30 feet. Brown fine sand and silt. Dense. Cohesive. Poorly sorted. Saturated. No odor.
			35			End of Boring
			40			

BORING LOG AND WELL CONSTRUCTION FOR WELL Riz-6

Project: MBTA RIVERSIDE | Project Number: 4413.01 | Location: Newton, MA

Well Location: West of Carhouse

Rizzo Associates, Inc.

Engineers and Environmental Scientists

235 West Central Street, Natick, MA 01760

Installation Date: 11/6/98 | Depth of Boring: 35

Inspector: Clark Fero | Depth to Water: 30

Contractor: Soil Exploration | PID used: HNU

Drilling Method: HSA

B-7

Well Construction	Blow Counts	Recovery/ Advance	PID (ppm)	Depth (ft)	Sample Interval	Graphic Log	Materials Description
No well installed.	2 4 6 13	12/24	0				Brown and tan fine sand and silt with coarse sand, gravel and brick fragments. Fill. Poorly sorted, cohesive. Dry. No odor.
	5 5 6 7	1/24	0	5			Black fine sand & silt with coarse sand & gravel. Loose, poorly sorted. Dry. No odor.
	3 3 3 3	10/24	0	10			Brown fine sand and silt with trace gravel. Coarsens down to coarse sand with silt, fine sand and trace gravel. Poorly sorted. Dry. No odor.
	1 1 1	9/24	0	15			Brown fine and medium sand and silt with trace coarse sand and gravel. Layered light, dark brown and greyish brown. Two 1 cm. Dark bands containing plant fibers. Dry. No
	9 17 23 25	12/24	2	20			Light brown coarse sand with fine sand, silt and gravel to 3 cm. Poorly sorted. Dry. No odor.
	8 12 13 13	20/24	0	25			Dense light brown fine sand and silt. Cohesive, poorly sorted. Some slightly darker layers. Saturated. No odor.
							Groundwater encountered at 27 feet.
	8 12 12 13	6/24	3	30			Grey clay and reddish brown fine sand and silt. Angular gravel and stone fragments. Poorly sorted. Saturated. No odor.
							No well installed
				35			

BORING LOG FOR B-7

Project: MBTA RIVERSIDE | Project Number: 4413.01 | Location: Newton, MA

Well Location: West of Carhouse

Rizzo Associates, Inc.
Engineers and Environmental Scientists
235 West Central Street, Natick, MA 01760

Installation Date: 12:00:00 AM | Depth of Boring: 32
Inspector: Clark Fero | Depth to Water: 27
Contractor: Soil Exploration | PID used: HNU
Drilling Method: HSA

Appendix E

Laboratory Certificates of Analysis

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 · FAX: (603) 429-8496

November 18, 1998

Mr. Clark Ferro
Rizzo Associates, Inc.
235 West Central Street
Natick, MA 01760

RE Your project: 4413-01

Dear Clark:

Enclosed please find the results for the above-referenced project, received on November 09, 1998. AMRO operates a Quality Control Program which meets or exceeds EPA and state requirements. A copy of the appropriate State Certificate is attached. The enclosed Sample Receipt Checklist details the condition of your sample upon receipt. No quality control deviations which impact the enclosed results were noted during the analyses associated with this project. This project was assigned AMRO Project Number 20849. If you have any questions regarding this project in the future, please refer to this number.

Please be advised that any unused sample volume and sample extracts will be stored for a period of thirty (30) days from this report date. After this time, AMRO will properly dispose of the remaining sample. If you require further analysis, or need the samples held for a longer period, please contact us immediately.

This letter is an integral part of your data report.

Please do not hesitate to call if you have any questions.

Sincerely,

Richard Ravenelle

Richard Ravenelle
Organics Laboratory Manager

Encl.

AM

Laboratory Report
Extractable Petroleum Hydrocarbons (EPH)

EPH ANALYTICAL RESULTS

Extraction Method: EPA 3541	Client ID	SS-RIZ5-20'-22'		SS-B6-30'-32'		SS-B7-25'-27'	
Method for Ranges: MADEP EPH 98-1							
Method for Target Analytes: MADEP EPH 98-1	AMRO Lab ID	20849-01		20849-02		20849-03	
EPH Surrogate Standards - Extraction	Date Collected	11/6/98		11/6/98		11/6/98	
Aliphatic: 1-Chlorooctadecane	Date Received	11/9/98		11/9/98		11/9/98	
Aromatic: o-Terphenyl	Date Extracted	11/13/98		11/13/98		11/13/98	
EPH Surrogate Standards - Analysis	Date Analyzed	11/16/98		11/16/98		11/16/98	
2-Fluorobiphenyl	Dilution Factor	1		1		1	
2-Bromonaphthalene	% Solids	85.6		93.2		80.5	
Range/Target Analyte	**UNITS**	**RESULTS**	**RL**	**RESULTS**	**RL**	**RESULTS**	**RL**
C_9-C_{18} Aliphatic Hydrocarbons [1]	mg/Kg	ND	57	ND	53	ND	62
C_{19}-C_{36} Aliphatic Hydrocarbons [1]	mg/Kg	ND	57	ND	53	ND	62
C_{11}-C_{22} Aromatic Hydrocarbons [1,2]	mg/Kg	ND	57	ND	53	ND	62
Naphthalene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
2-Methylnaphthalene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Acenaphthylene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Acenaphthene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Fluorene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Phenanthrene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Anthracene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Fluoranthene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Pyrene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Benzo(a)Anthracene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Chrysene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Benzo(b)fluoranthene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Benzo(k)fluoranthene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Benzo(a)pyrene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Dibenzo(a,h)anthracene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Indeno(1,2,3-cd)pyrene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
Benzo(g,h,i)perylene	mg/Kg	ND	0.29	ND	0.26	ND	0.31
2-Fluorobiphenyl % Recovery	%	92.1	N/A	95.8	N/A	86.3	N/A
2-Bromonaphthalene % Recovery	%	93.5	N/A	88.3	N/A	86.4	N/A
o-Terphenyl % Recovery	%	76.9	N/A	75.6	N/A	71.4	N/A
1-Chlorooctadecane % Recovery	%	75.5	N/A	87.1	N/A	70.5	N/A
Surrogate Acceptance Range	%	40-140%	40-140%	40-140%	40-140%	40-140%	40-140%

[1] Hydrocarbon Range data exclude concentrations of any surrogate(s) and/or internal standards eluting in that range

[2] C_{11}-C_{22} Aromatic Hydrocarbons exlude the concentration of Target PAH Analytes

N/A = Not Applicable

ND = Not Detected at or above the Reporting Limit (RL) indicated.

COMMENTS:

CERTIFICATION

Were all QA/QC procedures REQUIRED by the EPH Method followed?	[X] Yes [ ]	No - See Comments
Were all performance/acceptance standards for required QA/QC procedures achieved?	[X] Yes [ ]	No - See Comments
Were any significant modifications made to the EPH method, as specified in Sect 11.3?	[ ] No [X]	Yes - Details attached

I attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

SIGNATURE: Richard Ravenelle POSITION: Organic Division Manager

PRINTED NAME: Richard Ravenelle DATE: 11/18/98

AM

Laboratory Report
Extractable Petroleum Hydrocarbons (EPH)

EPH ANALYTICAL RESULTS

Extraction Method: EPA 3541	Client ID	SS-RIZ6-25'-27'		SS-RIZ6-30'-32'		SS-RIZ6-35'-37'	
Method for Ranges: MADEP EPH 98-1							
Method for Target Analytes: MADEP EPH 98-1	AMRO Lab ID	20849-04		20849-05		20849-06	
EPH Surrogate Standards - Extraction	Date Collected	11/6/98		11/6/98		11/6/98	
Aliphatic: 1-Chlorooctadecane	Date Received	11/9/98		11/9/98		11/9/98	
Aromatic: o-Terphenyl	Date Extracted	11/13/98		11/13/98		11/13/98	
EPH Surrogate Standards - Analysis	Date Analyzed	11/16/98		11/16/98		11/17/98	
2-Fluorobiphenyl	Dilution Factor	1		1		1	
2-Bromonaphthalene	% Solids	94.9		81.0		87.1	
Range/Target Analyte	**UNITS**	**RESULTS**	**RL**	**RESULTS**	**RL**	**RESULTS**	**RL**
C_9-C_{18} Aliphatic Hydrocarbons [1]	mg/Kg	ND	52	ND	61	ND	57
C_{19}-C_{36} Aliphatic Hydrocarbons [1]	mg/Kg	ND	52	ND	61	ND	57
C_{11}-C_{22} Aromatic Hydrocarbons [1,2]	mg/Kg	ND	52	ND	61	ND	57
Naphthalene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
2-Methylnaphthalene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Acenaphthylene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Acenaphthene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Fluorene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Phenanthrene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Anthracene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Fluoranthene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Pyrene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Benzo(a)Anthracene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Chrysene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Benzo(b)fluoranthene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Benzo(k)fluoranthene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Benzo(a)pyrene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Dibenzo(a,h)anthracene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Indeno(1,2,3-cd)pyrene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
Benzo(g,h,i)perylene	mg/Kg	ND	0.26	ND	0.30	ND	0.28
2-Fluorobiphenyl % Recovery	%	91.5	N/A	85.4	N/A	94.3	N/A
2-Bromonaphthalene % Recovery	%	92.2	N/A	82.6	N/A	91.6	N/A
o-Terphenyl % Recovery	%	78.8	N/A	74.2	N/A	81.8	N/A
1-Chlorooctadecane % Recovery	%	78.9	N/A	70.7	N/A	79.3	N/A
Surrogate Acceptance Range	%	40-140%	40-140%	40-140%	40-140%	40-140%	40-140%

[1] Hydrocarbon Range data exclude concentrations of any surrogate(s) and/or internal standards eluting in that range

[2] C_{11}-C_{22} Aromatic Hydrocarbons exlude the concentration of Target PAH Analytes

N/A = Not Applicable

ND = Not Detected at or above the Reporting Limit (RL) indicated.

COMMENTS:

CERTIFICATION

Were all QA/QC procedures REQUIRED by the EPH Method followed?	[X] Yes [ ]	No - See Comments
Were all performance/acceptance standards for required QA/QC procedures achieved?	[X] Yes [ ]	No - See Comments
Were any significant modifications made to the EPH method, as specified in Sect 11.3?	[ ] No [X]	Yes - Details attached

I attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

SIGNATURE: Richard Ravenelle POSITION: Organic Division Manager

PRINTED NAME: Richard Ravenelle DATE: 11/19/98

AM

Laboratory Report
Volatile Petroleum Hydrocarbons (VPH)

Method for Ranges: MADEP VPH 98-1	Client ID	SS-RIZ5-20'-22'		SS-B6-30'-32'		SS-B7-25'-27'	
Method for Target Analytes: EPA 8260	AMRO Lab ID	20849-01		20849-02		20849-03	
VPH Surrogate Standards	Date Collected	11/06/98		11/06/98		11/06/98	
1,2-Dichloroethane-d4	Date Received	11/09/98		11/09/98		11/09/98	
Toluene-d8	Date Analyzed	11/14/98		11/14/98		11/14/98	
Bromofluorobenzene	mL Methanol/g soil						
2,5-Dibromotoluene	1:1 +/- 25%	[X] Yes	[ ] No	[X] Yes	[ ] No	[ ] Yes	[X] No
	Dilution Factor	1		1		1	
	% Solids	85.6		93.2		80.5	
Range/Target Analyte	**UNITS**	**RESULTS**	**RL**	**RESULTS**	**RL**	**RESULTS**	**RL**
C_5-C_8 Aliphatic Hydrocarbons [1,2]	mg/Kg	ND	2.8	ND	3.1	ND	4.2
C_9-C_{12} Aliphatic Hydrocarbons [1,3]	mg/Kg	ND	0.71	1.0	0.77	ND	1.1
C_9-C_{10} Aromatic Hydrocarbons [1]	mg/Kg	ND	0.71	ND	0.77	ND	1.1
Methyl-tert-butylether	mg/Kg	ND	0.057	ND	0.062	ND	0.085
Benzene	mg/Kg	ND	0.057	ND	0.062	ND	0.085
Toluene	mg/Kg	ND	0.057	ND	0.062	ND	0.085
Ethylbenzene	mg/Kg	ND	0.057	ND	0.062	ND	0.085
m- & p-Xylenes	mg/Kg	ND	0.057	ND	0.062	ND	0.085
o-Xylene	mg/Kg	ND	0.057	ND	0.062	ND	0.085
Naphthalene	mg/Kg	ND	0.057	ND	0.062	ND	0.085
1,2-Dichloroethane-d4 Limits (70-130%)	%	106	NA	100	NA	98.6	NA
Toluene-d8 Limits (70-130%)	%	102	NA	95.9	NA	96.3	NA
Bromofluorobenzene Limits (70-130%)	%	95.6	NA	91.1	NA	93.6	NA
2,5-Dibromotoluene Limits (70-130%)	%	63.1*	NA	69.5*	NA	70.4	NA

[1] Hydrocarbon Range data exclude concentrations of any surrogate(s) and/or internal standards eluting in that range

[2] C5-C8 Aliphatic Hydrocarbons exlude the concentration of Target Analytes eluting in that range

[3] C9-C12 Aliphatic Hydrocarbons exclude conc of Target Analytes eluting in that range AND conc of C9-C10 Aromatic Hydrocarbons

NA = Not Applicable

ND = Not Detected at or above the Reporting Limit (RL) indicated.

COMMENTS: * = Low surrogate recovery; no impact to data.

CERTIFICATION

Were all QA/QC procedures REQUIRED by the VPH Method followed?	[X] Yes	[ ] No - See Comments
Were all performance/acceptance standards for required QA/QC procedures achieved?	[ ] Yes	[X] No - See Comments
Were any significant modifications made to the VPH method, as specified in Sect 11.3?	[ ] No	[X] Yes - Details attached

I attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

SIGNATURE: Richard Ravenelle POSITION: Organic Division Manager

PRINTED NAME: Richard Ravenelle DATE: 11/18/98

AMRO

Laboratory Report
Volatile Petroleum Hydrocarbons (VPH)

Method for Ranges: MADEP VPH 98-1	Client ID	SS-RIZ6-25'-27'		SS-RIZ6-30'-32'		SS-RIZ6-35'-37'	
Method for Target Analytes: EPA 8260	AMRO Lab ID	20849-04		20849-05		20849-06	
VPH Surrogate Standards	Date Collected	11/06/98		11/06/98		11/06/98	
1,2-Dichloroethane-d4	Date Received	11/09/98		11/09/98		11/09/98	
Toluene-d8	Date Analyzed	11/14/98		11/14/98		11/14/98	
Bromofluorobenzene	mL Methanol/g soil						
2,5-Dibromotoluene	1:1 +/- 25%	[X] Yes [ ] No		[ ] Yes [X] No		[X] Yes [ ] No	
	Dilution Factor	1		1		1	
	% Solids	94.9		81.0		87.1	
Range/Target Analyte	**UNITS**	**RESULTS**	**RL**	**RESULTS**	**RL**	**RESULTS**	**RL**
C_5-C_8 Aliphatic Hydrocarbons [1,2]	mg/Kg	ND	3.0	ND	4.3	ND	2.3
C_9-C_{12} Aliphatic Hydrocarbons [1,3]	mg/Kg	ND	0.75	ND	1.1	ND	0.58
C_9-C_{10} Aromatic Hydrocarbons [1]	mg/Kg	ND	0.75	ND	1.1	ND	0.58
Methyl-tert-butylether	mg/Kg	ND	0.061	ND	0.086	ND	0.047
Benzene	mg/Kg	ND	0.061	ND	0.086	ND	0.047
Toluene	mg/Kg	ND	0.061	ND	0.086	ND	0.047
Ethylbenzene	mg/Kg	ND	0.061	ND	0.086	ND	0.047
m- & p-Xylenes	mg/Kg	ND	0.061	ND	0.086	ND	0.047
o-Xylene	mg/Kg	ND	0.061	ND	0.086	ND	0.047
Naphthalene	mg/Kg	ND	0.061	ND	0.086	ND	0.047
1,2-Dichloroethane-d4 Limits (70-130%)	%	97.9	NA	106	NA	104	NA
Toluene-d8 Limits (70-130%)	%	96.5	NA	104	NA	98.9	NA
Bromofluorobenzene Limits (70-130%)	%	91.5	NA	96.6	NA	92.4	NA
2,5-Dibromotoluene Limits (70-130%)	%	67.9*	NA	71.4	NA	77.7	NA

[1] Hydrocarbon Range data exclude concentrations of any surrogate(s) and/or internal standards eluting in that range

[2] C5-C8 Aliphatic Hydrocarbons exlude the concentration of Target Analytes eluting in that range

[3] C9-C12 Aliphatic Hydrocarbons exclude conc of Target Analytes eluting in that range AND conc of C9-C10 Aromatic Hydrocarbons

NA = Not Applicable

ND = Not Detected at or above the Reporting Limit (RL) indicated.

COMMENTS: * = Low surrogate recovery; no impact to data.

CERTIFICATION

Were all QA/QC procedures REQUIRED by the VPH Method followed?	[X] Yes	[ ] No - See Comments
Were all performance/acceptance standards for required QA/QC procedures achieved?	[ ] Yes	[X] No - See Comments
Were any significant modifications made to the VPH method, as specified in Sect 11.3?	[ ] No	[X] Yes - Details attached

I attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

SIGNATURE: Richard Ravenelle POSITION: Organic Division Manager

PRINTED NAME: Richard Ravenelle DATE: 11/18/98

Volatile Petroleum Hydrocarbons (VPH)
Massachusetts Department of Environmental Protection (MADEP)
Method 1.0 - January 1998
AMRO Modifications

This modification is based on the use of a purge and trap gas chromatography mass spectrometer (GCMS) system to analyze samples for VPH. The hydrocarbon ranges are quantified using predominant mass fragmentation ions which are characteristic for the range being measured. This approach eliminates potential false positives for the target analytes while providing accurate hydrocarbon range data.

The chromatographic column is an HP-624 capillary column which has been validated by GCMS analysis of a gasoline standard to correctly identify the marker compounds and elution order of specific gasoline components. Batch quality control includes, at a minimum, method blank, laboratory control sample, and duplicate analysis. A matrix spike and/or matrix spike duplicate is analyzed if sufficient sample is submitted to the laboratory.

The Reporting Limit (RL) of this method for each of the collective aliphatic and aromatic ranges is approximately 0.6-2.8 mg/kg in soil and 25-110 µg/L in water. The RL of this method for the target analytes ranges from approximately 0.05-0.13 mg/kg in soil and 2.0-5.0 µg/L for water samples.

Extractable Petroleum Hydrocarbons (EPH)
Massachusetts Department of Environmental Protection (MADEP)
Method 1.0 - January 1998
AMRO Modifications

This modification is based on a solvent extraction and gas chromatography mass spectrometer (GCMS) analysis. The hydrocarbon ranges are quantified using predominant mass fragmentation ions which are characteristic for the range being measured. This approach eliminates the silica gel solid-phase fractionation step. False positives for targeted PAH analytes are eliminated by using GCMS as the primary analysis technique.

The chromatographic column is a J&W Scientific DB-5ms capillary column. Internal standard calibration is performed using 5α-Androstane at a concentration of 40 ng/µL. o-Terphenyl and 1-Chlorooctadecane are added as surrogate compounds at 20 ng/µL in the sample extract. These two surrogates monitor the effects of the sample matrix and extraction efficiency. Two additional surrogates, 2-Fluorobiphenyl and 2-Bromonaphthalene, are added to the finished extract prior to analysis to monitor instrument performance. Batch quality control includes, at a minimum, a procedure blank, laboratory control sample and duplicate sample analysis. A matrix spike is analyzed if sufficient sample is submitted to the laboratory.

The Reporting Limit (RL) of this method for each of the collective aliphatic and aromatic ranges is approximately 2-15 mg/kg in soil and 10-50 µg/L in water. The RL of this method for the Target PAH analytes ranges from approximately 0.25 to 0.5 mg/kg in soil, 1.0 µg/L for water when operating the GCMS in full scan mode, and 0.1 to 1.0 µg/L when operating the GCMS in SIM mode. For sites requiring the lowest levels cited in the Massachusetts Contingency Plan for water, GCMS in the Selected Ion Monitoring (SIM) mode is used

AMRO

Sample Receipt Checklist

Client: RZBO			AMRO ID: 20869			
Project Name: GW3-Q			Date Rec.: 11-9-98			
Ship via: (circle one) Fed Ex., UPS, (AMRO Courier),			Date Due: 11-18-98			
Hand Del., Other Courier, Other						
Items to be Checked Upon Receipt			Yes	No	NA	Comments
1. Custody Seals present?					✓	
2. Custody Seals Intact?					✓	
3. Air Bill included in folder if received?					✓	
4. Is COC included with samples?			✓			
5. Is COC signed and dated by client?			✓			
6. Laboratory receipt temperature.	TEMP = 6°C					
	Samples rec. with Ice ✓ Ice packs ___ neither ___					
7. Were samples received the same day they were sampled?				✓		
Is client temperature < 6 degrees C?			✓			
If no obtain authorization from the client for the analyses.						
Client authorization from:	**Date:**	**Obtained by:**				
8. Is the COC filled out correctly and completely?			✓			
9. Does the info on the COC match the samples?			✓			
10. Were samples rec. within holding time?			✓			
11. Were all samples properly labeled?			✓			
12. Were all samples properly preserved?			✓			
13. Were proper sample containers used?			✓			
14. Were all samples received intact? (none broken or leaking)			✓			
15. Were VOA vials rec. with no air bubbles?					✓	
16. Were the sample volumes sufficient for requested analysis?			✓			
17. Were all samples received?			✓			
18. VPH Soils only:						
Samples preserved in Methanol or air tight container?			✓			
Samples received in Methanol covering the soil?			✓			
Samples received in air tight container?			✓			
19. Subcontracted Samples:					✓	
What samples sent:						
Where sent:						
Date:						
Analysis:						
TAT:						
20. Information entered into:						
Internal Tracking Log?			✓			
Dry Weight Log?			✓			
Client Log?			✓			
Received By: BJ	Date: 11/9/98					
Labeled By: ↓	Date:					
Logged in By: ✓	Date: ↓					
Checked By:	Date:					

NA = Not Applicable

Rev. 10 10/30/98

20849

CHAIN OF CUSTODY RECORD

Rizzo Associates, Inc.
235 West Central Street
Natick, MA 01760
(508) 651-3401
(508) 651-1189 (FAX)

Rizzo Project Number: 4413-01
Rizzo Project Name:
Samplers (signatures): [signature]

Lab: Amro
Lab ID #:
Send report to:
Turnaround Time:

Rizzo Sample Number	Sample Depth	Sample Location	Sample Collected		Container			Sample Matrix	Requested Analyses
			Date	Time	#	Type	Preservative		
SS-Riz5	20'-22'		11/6/98	08:45	1	4oz Amber	ICE	Soil	EPH
↓	↓		↓	↓	3	Voa Vial	Methanol	↓	VPH
SS-B6-	30'-32'		11/6/98	10:40	1	4oz Amber	ICE		EPH
↓	↓		↓	↓	3	Voa Vial	Methanol		VPH
SS-B7-	25'-27'			12:00	1	4oz Amber	ICE		EPH
↓	↓			↓	3	VOA Vial	Methanol		VPH
SS-Riz6	25'-27'			13:50	1	4oz Amber	ICE		EPH
↓	↓			↓	3	VOA vial	Methanol		VPH
SS-Riz6	30'-32'			14:00	1	4oz Amber	ICE		EPH
↓	↓		↓	↓	3	VOA vial	Methanol		VPH
SS-Riz6	35'-37'			14:15	1	4oz Amber	ICE		EPH
↓	↓		↓	↓	~~3~~ 2	VOA vial	Methanol	↓	VPH
					[illegible]				

Relinquished by:	Received by:	Date:	Time:
[signature]	[signature]	11-9-98	12:25
[signature]	[signature]	11-9-98	2:45

Method of Shipment:

WHITE - ANALYTICAL LABORATORY • YELLOW - QC OFFICER • PINK - CHAIN-OF-CUSTODY NOTEBOOK • GOLD - PROJECT FILE

The Commonwealth of Massachusetts

Department of Environmental Protection

Division of Environmental Analysis
Senator William X. Wall Experiment Station

certifies

M- NH012 Amro Environmental Lab
111 Herrick St.
Merrimack, NH 03054

Laboratory Director: **Nancy Stewart**

for the ***Chemical Analysis of Potable and Non-Potable Water***

pursuant to 310 CMR 42.00

This certificate supersedes all previous Massachusetts certificates issued to this laboratory. The laboratory is regulated by and shall be responsible for being in compliance with Massachusetts regulations at 310 CMR 42.00.

This certificate is valid only when accompanied by the latest dated Certified Parameter List as issued by the Massachusetts D.E.P.

Certification is no guarantee of the validity of the data. This certification is subject to unannounced laboratory inspections.

Director, Division of Environmental Analysis

Issued: **07/01/98**

Expires: **06/30/99**

AMRO Environmental Laboratories Corporation

111 Herrick Street, Merrimack, NH 03054
TEL: (603) 424-2022 · FAX: (603) 429-8496

December 07, 1998

Mr. Clark Ferro
Rizzo Associates, Inc.
235 West Central Street
Natick, MA 01760

RE Your project: 4413.01

Dear Clark:

Enclosed please find the results for the above-referenced project, received on November 19, 1998. AMRO operates a Quality Control Program which meets or exceeds EPA and state requirements. A copy of the appropriate State Certificate is attached. The enclosed Sample Receipt Checklist details the condition of your sample upon receipt. This project was assigned AMRO Project Number 20998. If you have any questions regarding this project in the future, please refer to this number.

Please be advised that any unused sample volume and sample extracts will be stored for a period of thirty (30) days from this report date. After this time, AMRO will properly dispose of the remaining sample. If you require further analysis, or need the samples held for a longer period, please contact us immediately.

This letter is an integral part of your data report.

Please do not hesitate to call if you have any questions.

Sincerely,

Richard Ravenelle

Richard Ravenelle
Organics Laboratory Manager

Encl.

AMRO

Volatile Petroleum Hydrocarbons (VPH)

Method for Ranges: MADEP VPH 98-1	Client ID	RIZ-1-GW-201		RIZ-2-GW-202		RIZ-3-GW-203	
Method for Target Analytes: EPA 8260	AMRO Lab ID	20998-01		20998-02		20998-03	
VPH Surrogate Standards	Date Collected	11/18/98		11/18/98		11/18/98	
1,2-Dichloroethane-d4	Date Received	11/19/98		11/19/98		11/19/98	
Toluene-d8	Date Analyzed	11/25&12/02/98		11/25&12/02/98		11/25/98	
Bromofluorobenzene	Dilution Factor	1		1		1	
2,5-Dibromotoluene	pH	[X] <2	[ ] >2	[X] <2	[ ] >2	[X] <2	[ ] >2
Range/Target Analyte	**UNITS**	**RESULTS**	**RL**	**RESULTS**	**RL**	**RESULTS**	**RL**
C_5-C_8 Aliphatic Hydrocarbons [1,2]	ug/L	ND	100	ND	100	ND	100
C_9-C_{12} Aliphatic Hydrocarbons [1,3]	ug/L	ND	25	ND	25	ND	25
C_9-C_{10} Aromatic Hydrocarbons [1]	ug/L	ND	25	ND	25	ND	25
Methyl-tert-butylether	ug/L	ND	2.0	ND	2.0	ND	2.0
Benzene	ug/L	ND	2.0	ND	2.0	ND	2.0
Toluene	ug/L	ND	2.0	ND	2.0	ND	2.0
Ethylbenzene	ug/L	ND	2.0	ND	2.0	ND	2.0
m- & p-Xylenes	ug/L	ND	2.0	ND	2.0	ND	2.0
o-Xylene	ug/L	ND	2.0	ND	2.0	ND	2.0
Naphthalene	ug/L	ND	2.0	ND	2.0	ND	2.0
1,2-Dichloroethane-d4 Limits (76-114%)	%	93.4	NA	95.2	NA	94.1	NA
Toluene-d8 Limits (84-138%)	%	101	NA	101	NA	102	NA
Bromofluorobenzene Limits (86-115%)	%	92.4	NA	90.8	NA	93.2	NA
2,5-Dibromotoluene Limits (70-130%)	%	148*	NA	152*	NA	144*	NA

[1] Hydrocarbon Range data exclude concentrations of any surrogate(s) and/or internal standards eluting in that range
[2] C5-C8 Aliphatic Hydrocarbons exlude the concentration of Target Analytes eluting in that range
[3] C9-C12 Aliphatic Hydrocarbons exclude conc of Target Analytes eluting in that range AND conc of C9-C10 Aromatic Hydrocarbons
NA = Not Applicable
ND = Not Detected at or above the Reporting Limit (RL) indicated.

COMMENTS: * = Surrogate outside upper QC limits; no impact to data.
Naphthalene exceeds upper QC limit in the batch QC LCS; no impact to data.

CERTIFICATION

Were all QA/QC procedures REQUIRED by the VPH Method followed?	[X] Yes	[ ] No - See Comments
Were all performance/acceptance standards for required QA/QC procedures achieved?	[ ] Yes	[X] No - See Comments
Were any significant modifications made to the VPH method, as specified in Sect 11.3?	[ ] No	[X] Yes - Details attached

I attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

SIGNATURE: Richard Ravenelle POSITION: Organic Division Manager

PRINTED NAME: Richard Ravenelle DATE: 12/8/98

AMRO

Volatile Petroleum Hydrocarbons (VPH)

Method for Ranges: MADEP VPH 98-1	Client ID	RIZ-4-GW-204		RIZ-5-GW-205		RIZ-6-GW-206	
Method for Target Analytes: EPA 8260	AMRO Lab ID	20998-04		20998-05		20998-06	
VPH Surrogate Standards	Date Collected	11/18/98		11/18/98		11/18/98	
1,2-Dichloroethane-d4	Date Received	11/19/98		11/19/98		11/19/98	
Toluene-d8	Date Analyzed	11/25&12/02/98		11/25/98		11/25/98	
Bromofluorobenzene	Dilution Factor	1		1		1	
2,5-Dibromotoluene	pH	[X] <2	[ ] >2	[X] <2	[ ] >2	[X] <2	[ ] >2
Range/Target Analyte	**UNITS**	**RESULTS**	**RL**	**RESULTS**	**RL**	**RESULTS**	**RL**
C_5-C_8 Aliphatic Hydrocarbons [1,2]	ug/L	ND	100	ND	100	ND	100
C_9-C_{12} Aliphatic Hydrocarbons [1,3]	ug/L	ND	25	ND	25	ND	25
C_9-C_{10} Aromatic Hydrocarbons [1]	ug/L	ND	25	ND	25	80	25
Methyl-tert-butylether	ug/L	ND	2.0	ND	2.0	ND	2.0
Benzene	ug/L	ND	2.0	ND	2.0	ND	2.0
Toluene	ug/L	ND	2.0	ND	2.0	ND	2.0
Ethylbenzene	ug/L	ND	2.0	ND	2.0	ND	2.0
m- & p-Xylenes	ug/L	ND	2.0	ND	2.0	ND	2.0
o-Xylene	ug/L	ND	2.0	ND	2.0	ND	2.0
Naphthalene	ug/L	ND	2.0	ND	2.0	ND	2.0
1,2-Dichloroethane-d4 Limits (76-114%)	%	98.9	NA	96.5	NA	101	NA
Toluene-d8 Limits (84-138%)	%	101	NA	101	NA	98.0	NA
Bromofluorobenzene Limits (86-115%)	%	93.7	NA	94.1	NA	93.2	NA
2,5-Dibromotoluene Limits (70-130%)	%	150*	NA	146*	NA	150*	NA

[1] Hydrocarbon Range data exclude concentrations of any surrogate(s) and/or internal standards eluting in that range

[2] C5-C8 Aliphatic Hydrocarbons exlude the concentration of Target Analytes eluting in that range

[3] C9-C12 Aliphatic Hydrocarbons exclude conc of Target Analytes eluting in that range AND conc of C9-C10 Aromatic Hydrocarbons

NA = Not Applicable

ND = Not Detected at or above the Reporting Limit (RL) indicated.

COMMENTS: * = Surrogate outside upper QC limits; no impact to data.
Naphthalene exceeds upper QC limit in the batch QC LCS; no impact to data.

CERTIFICATION

Were all QA/QC procedures REQUIRED by the VPH Method followed?	[X] Yes	[ ] No - See Comments
Were all performance/acceptance standards for required QA/QC procedures achieved?	[ ] Yes	[X] No - See Comments
Were any significant modifications made to the VPH method, as specified in Sect 11.3?	[ ] No	[X] Yes - Details attached

I attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

SIGNATURE: Richard Ravenelle POSITION: Organic Division Manager

PRINTED NAME: Richard Ravenelle DATE: 12/8/98

AMRO

Volatile Petroleum Hydrocarbons (VPH)

Method for Ranges: MADEP VPH 98-1	Client ID	RIZ-1-GW-201 DUP					
Method for Target Analytes: EPA 8260	AMRO Lab ID	20998-07					
VPH Surrogate Standards	Date Collected	11/18/98					
1,2-Dichloroethane-d4	Date Received	11/19/98					
Toluene-d8	Date Analyzed	11/25/98					
Bromofluorobenzene	Dilution Factor	1					
2,5-Dibromotoluene	pH	[X] <2	[ ] >2	[ ] <2	[ ] >2	[ ] <2	[ ] >2
Range/Target Analyte	**UNITS**	**RESULTS**	**RL**	**RESULTS**	**RL**	**RESULTS**	**RL**
C_5-C_8 Aliphatic Hydrocarbons [1,2]	ug/L	ND	100				
C_9-C_{12} Aliphatic Hydrocarbons [1,3]	ug/L	ND	25				
C_9-C_{10} Aromatic Hydrocarbons [1]	ug/L	ND	25				
Methyl-tert-butylether	ug/L	ND	2.0				
Benzene	ug/L	ND	2.0				
Toluene	ug/L	ND	2.0				
Ethylbenzene	ug/L	ND	2.0				
m- & p-Xylenes	ug/L	ND	2.0				
o-Xylene	ug/L	ND	2.0				
Naphthalene	ug/L	ND	2.0				
1,2-Dichloroethane-d4 Limits (76-114%)	%	92.5	NA				
Toluene-d8 Limits (84-138%)	%	101	NA		NA		NA
Bromofluorobenzene Limits (86-115%)	%	95.6	NA		NA		NA
2,5-Dibromotoluene Limits (70-130%)	%	145*	NA		NA		NA

[1] Hydrocarbon Range data exclude concentrations of any surrogate(s) and/or internal standards eluting in that range

[2] C5-C8 Aliphatic Hydrocarbons exlude the concentration of Target Analytes eluting in that range

[3] C9-C12 Aliphatic Hydrocarbons exclude conc of Target Analytes eluting in that range AND conc of C9-C10 Aromatic Hydrocarbons

NA = Not Applicable

ND = Not Detected at or above the Reporting Limit (RL) indicated.

COMMENTS: * = Surrogate outside upper QC limits; no impact to data.
Naphthalene exceeds upper QC limit in the batch QC LCS; no impact to data.

CERTIFICATION

Were all QA/QC procedures REQUIRED by the VPH Method followed?	[X] Yes	[ ] No - See Comments
Were all performance/acceptance standards for required QA/QC procedures achieved?	[ ] Yes	[X] No - See Comments
Were any significant modifications made to the VPH method, as specified in Sect 11.3?	[ ] No	[X] Yes - Details attached

I attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

SIGNATURE: Richard Ravenelle POSITION: Organic Division Manager

PRINTED NAME: Richard Ravenelle DATE: 12/8/98

AMRO

LABORATORY REPORT
VOLATILE ORGANIC COMPOUNDS-EPA METHOD 8260B

Client: Rizzo Associates, Inc.
Client I.D.: 4413.01
RIZ-6-GW-206
AMRO I.D.: 20998-06
Date sampled: 11/18/98 Date Received: 11/19/98
Date prepared: 12/01/98 Date Analyzed: 12/01/98
Sample Qty/Type: 1/Water

Test Parameter	Results (ug/L)	Reporting Limit (ug/L)
Chloromethane	ND	5.0
Bromomethane	ND	2.0
Vinyl Chloride	ND	2.0
Dichlorodifluoromethane	ND	5.0
Chloroethane	ND	5.0
Methylene Chloride	ND	5.0
Trichlorofluoromethane	ND	2.0
1,1-Dichloroethene	ND	1.0
Bromochloromethane	ND	2.0
1,1-Dichloroethane	ND	2.0
cis-1,2-Dichloroethene	ND	2.0
trans-1,2-Dichloroethene	ND	2.0
Chloroform	ND	2.0
Dibromomethane	ND	2.0
1,2-Dichloroethane	ND	2.0
2,2-Dichloropropane	ND	2.0
1,1,1-Trichloroethane	ND	2.0
Carbon Tetrachloride	ND	2.0
Bromodichloromethane	ND	2.0
1,2-Dichloropropane	ND	2.0
1,1-Dichloropropene	ND	2.0
Trichloroethene	ND	2.0
Dibromochloromethane	ND	2.0
1,1,2-Trichloroethane	ND	2.0
Benzene	ND	2.0
1,3-Dichloropropane	ND	2.0
Bromoform	ND	2.0
1,1,1,2-Tetrachloroethane	ND	2.0
Tetrachloroethene	ND	2.0
1,2-Dibromoethane	ND	2.0
1,1,2,2-Tetrachloroethane	ND	2.0
Toluene	ND	2.0
Chlorobenzene	ND	2.0
Ethylbenzene	ND	2.0
Bromobenzene	ND	2.0
Isopropylbenzene	ND	2.0
Styrene	ND	2.0
n-Propylbenzene	ND	2.0

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LABORATORY REPORT
VOLATILE ORGANIC COMPOUNDS-EPA METHOD 8260B

Client: Rizzo Associates, Inc.
Client I.D.: RIZ-6-GW-206
AMRO I.D.: 20998-06

Test Parameter	Results (ug/L)	Reporting Limit (ug/L)
cis-1,3-Dichloropropene	ND	1.0
trans-1,3-Dichloropropene	ND	1.0
Xylene (total)	ND	2.0
1,2-Dibromo-3-chloropropane	ND	5.0
tert-Butylbenzene	ND	2.0
2-Chlorotoluene	ND	2.0
Hexachlorobutadiene	ND	2.0
4-Chlorotoluene	ND	2.0
sec-Butylbenzene	ND	2.0
1,3-Dichlorobenzene	ND	2.0
1,2-Dichlorobenzene	ND	2.0
1,4-Dichlorobenzene	ND	2.0
1,2,3-Trichloropropane	ND	2.0
n-Butylbenzene	ND	2.0
4-Isopropyltoluene	ND	2.0
Naphthalene	ND	2.0
1,2,4-Trimethylbenzene	ND	2.0
1,3,5-Trimethylbenzene	ND	2.0
1,2,3-Trichlorobenzene	ND	2.0
1,2,4-Trichlorobenzene	ND	2.0
Methyl-tert-butyl ether (MTBE)	ND	2.0

ND = Not Detected at or above the reporting limit.

The Reporting Limit is defined as the lowest concentration the laboratory can accurately quantitate.

Analyzed By: KTY

AMRO

Laboratory Report
Extractable Petroleum Hydrocarbons (EPH)

EPH ANALYTICAL RESULTS

Extraction Method: EPA 3510	Client ID	RIZ-1-GW-201		RIZ-2-GW-202		RIZ-3-GW-203	
Method for Ranges: MADEP EPH 98-1							
Method for Target Analytes: MADEP EPH 98-1	AMRO Lab ID	20998-01		20998-02		20998-03	
EPH Surrogate Standards - Extraction	Date Collected	11/18/98		11/18/98		11/18/98	
Aliphatic: 1-Chlorooctadecane	Date Received	11/19/98		11/19/98		11/19/98	
Aromatic: o-Terphenyl	Date Extracted	12/1/98		12/1/98		12/1/98	
EPH Surrogate Standards - Analysis	Date Analyzed	12/3/98		12/3/98		12/3/98	
2-Fluorobiphenyl	Dilution Factor	1		1		1	
2-Bromonaphthalene							
Range/Target Analyte	**UNITS**	**RESULTS**	**RL**	**RESULTS**	**RL**	**RESULTS**	**RL**
C_9-C_{18} Aliphatic Hydrocarbons [1]	ug/L	ND	100	ND	100	ND	100
C_{19}-C_{36} Aliphatic Hydrocarbons [1]	ug/L	ND	100	ND	100	ND	100
C_{11}-C_{22} Aromatic Hydrocarbons [1,2]	ug/L	ND	100	ND	100	ND	100
Naphthalene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
2-Methylnaphthalene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Acenaphthylene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Acenaphthene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Fluorene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Phenanthrene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Anthracene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Fluoranthene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Pyrene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Benzo(a)Anthracene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Chrysene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Benzo(b)fluoranthene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Benzo(k)fluoranthene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Benzo(a)pyrene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Dibenzo(a,h)anthracene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Indeno(1,2,3-cd)pyrene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Benzo(g,h,i)perylene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
2-Fluorobiphenyl % Recovery	%	103	N/A	89.2	N/A	82.2	N/A
2-Bromonaphthalene % Recovery	%	104	N/A	92.8	N/A	89.1	N/A
o-Terphenyl % Recovery	%	73.5	N/A	77.4	N/A	69.5	N/A
1-Chlorooctadecane % Recovery	%	67.2	N/A	73.9	N/A	49.4	N/A
Surrogate Acceptance Range	%	40-140%	40-140%	40-140%	40-140%	40-140%	40-140%

[1] Hydrocarbon Range data exclude concentrations of any surrogate(s) and/or internal standards eluting in that range

[2] C_{11}-C_{22} Aromatic Hydrocarbons exlude the concentration of Target PAH Analytes

N/A = Not Applicable

ND = Not Detected at or above the Reporting Limit (RL) indicated.

COMMENTS: * = EPA 8270 SIM analysis performed on 12/4/98.

CERTIFICATION

Were all QA/QC procedures REQUIRED by the EPH Method followed?	[X] Yes	[ ] No - See Comments
Were all performance/acceptance standards for required QA/QC procedures achieved?	[X] Yes	[ ] No - See Comments
Were any significant modifications made to the EPH method, as specified in Sect 11.3?	[ ] No	[X] Yes - Details attached

I attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

SIGNATURE: Richard Ravenelle POSITION: Organic Division Manager

PRINTED NAME: Richard Ravenelle DATE: 12/8/98

AMRO

Laboratory Report
Extractable Petroleum Hydrocarbons (EPH)

EPH ANALYTICAL RESULTS

Extraction Method: EPA 3510	Client ID	RIZ-4-GW-204		RIZ-5-GW-205		RIZ-6-GW-206	
Method for Ranges: MADEP EPH 98-1							
Method for Target Analytes: MADEP EPH 98-1	AMRO Lab ID	20998-04		20998-05		20998-06	
EPH Surrogate Standards - Extraction	Date Collected	11/18/98		11/18/98		11/18/98	
Aliphatic: 1-Chlorooctadecane	Date Received	11/19/98		11/19/98		11/19/98	
Aromatic: o-Terphenyl	Date Extracted	12/01/98		12/1/98		12/1/98	
EPH Surrogate Standards - Analysis	Date Analyzed	12/4/98		12/4/98		12/4/98	
2-Fluorobiphenyl	Dilution Factor	1		1		1	
2-Bromonaphthalene							
Range/Target Analyte	**UNITS**	**RESULTS**	**RL**	**RESULTS**	**RL**	**RESULTS**	**RL**
C_9-C_{18} Aliphatic Hydrocarbons [1]	ug/L	ND	100	ND	100	ND	100
C_{19}-C_{36} Aliphatic Hydrocarbons [1]	ug/L	ND	100	ND	100	ND	100
C_{11}-C_{22} Aromatic Hydrocarbons [1,2]	ug/L	ND	100	ND	100	260	100
Naphthalene	ug/L	0.10B	0.10*	ND	0.10*	0.23B	0.10*
2-Methylnaphthalene	ug/L	ND	0.10*	ND	0.10*	ND	0.10*
Acenaphthylene	ug/L	0.11	0.10*	ND	0.10*	ND	0.10*
Acenaphthene	ug/L	ND	0.10*	ND	0.10*	1.2	0.10*
Fluorene	ug/L	ND	0.10*	ND	0.10*	2.3	1.0
Phenanthrene	ug/L	ND	0.10*	ND	0.10*	2.1	1.0
Anthracene	ug/L	0.14	0.10*	ND	0.10*	0.27	0.10*
Fluoranthene	ug/L	1.1	0.10*	ND	0.10*	ND	0.10*
Pyrene	ug/L	1.1	0.10*	ND	0.10*	ND	0.10*
Benzo(a)Anthracene	ug/L	0.64	0.10*	ND	0.10*	ND	0.10*
Chrysene	ug/L	0.65	0.10*	ND	0.10*	ND	0.10*
Benzo(b)fluoranthene	ug/L	1.2	0.10*	ND	0.10*	ND	0.10*
Benzo(k)fluoranthene	ug/L	0.36	0.10*	ND	0.10*	ND	0.10*
Benzo(a)pyrene	ug/L	0.82	0.10*	ND	0.10*	ND	0.10*
Dibenzo(a,h)anthracene	ug/L	0.15	0.10*	ND	0.10*	ND	0.10*
Indeno(1,2,3-cd)pyrene	ug/L	0.80	0.10*	ND	0.10*	ND	0.10*
Benzo(g,h,i)perylene	ug/L	0.71	0.10*	ND	0.10*	ND	0.10*
2-Fluorobiphenyl % Recovery	%	112	N/A	100	N/A	90.0	N/A
2-Bromonaphthalene % Recovery	%	108	N/A	101	N/A	93.8	N/A
o-Terphenyl % Recovery	%	71.7	N/A	79.3	N/A	67.8	N/A
1-Chlorooctadecane % Recovery	%	55.9	N/A	72.8	N/A	60.0	N/A
Surrogate Acceptance Range	%	40-140%	40-140%	40-140%	40-140%	40-140%	40-140%

[1] Hydrocarbon Range data exclude concentrations of any surrogate(s) and/or internal standards eluting in that range

[2] C_{11}-C_{22} Aromatic Hydrocarbons exlude the concentration of Target PAH Analytes

N/A = Not Applicable

ND = Not Detected at or above the Reporting Limit (RL) indicated.

COMMENTS: * EPA 8270SIM analysis performed on 12/4/98.

B = This analyte has been found in the associated method blank at 0.10 ug/l.

CERTIFICATION

Were all QA/QC procedures REQUIRED by the EPH Method followed?	[X] Yes	[ ] No - See Comments
Were all performance/acceptance standards for required QA/QC procedures achieved?	[ ] Yes	[X No - See Comments
Were any significant modifications made to the EPH method, as specified in Sect 11.3?	[ ] No	[X] Yes - Details attached

I attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

SIGNATURE: Richard Ravenelle POSITION: Organic Division Manager

PRINTED NAME: Richard Ravenelle DATE: 12/8/98

AMRO

Laboratory Report
Extractable Petroleum Hydrocarbons (EPH)

EPH ANALYTICAL RESULTS

Extraction Method: EPA 3510	Client ID	RIZ-1-GW-201 DUP					
Method for Ranges: MADEP EPH 98-1							
Method for Target Analytes: MADEP EPH 98-1	AMRO Lab ID	20998-07					
EPH Surrogate Standards - Extraction	Date Collected	11/18/98					
Aliphatic: 1-Chlorooctadecane	Date Received	11/19/98					
Aromatic: o-Terphenyl	Date Extracted	12/01/98					
EPH Surrogate Standards - Analysis	Date Analyzed	12/3/98					
2-Fluorobiphenyl	Dilution Factor	1					
2-Bromonaphthalene							

Range/Target Analyte	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL
C_9-C_{18} Aliphatic Hydrocarbons [1]	ug/L	ND	100				
C_{19}-C_{36} Aliphatic Hydrocarbons [1]	ug/L	ND	100				
C_{11}-C_{22} Aromatic Hydrocarbons [1,2]	ug/L	ND	100				
Naphthalene	ug/L	ND	0.10*				
2-Methylnaphthalene	ug/L	ND	0.10*				
Acenaphthylene	ug/L	ND	0.10*				
Acenaphthene	ug/L	ND	0.10*				
Fluorene	ug/L	ND	0.10*				
Phenanthrene	ug/L	ND	0.10*				
Anthracene	ug/L	ND	0.10*				
Fluoranthene	ug/L	ND	0.10*				
Pyrene	ug/L	ND	0.10*				
Benzo(a)Anthracene	ug/L	ND	0.10*				
Chrysene	ug/L	ND	0.10*				
Benzo(b)fluoranthene	ug/L	ND	0.10*				
Benzo(k)fluoranthene	ug/L	ND	0.10*				
Benzo(a)pyrene	ug/L	ND	0.10*				
Dibenzo(a,h)anthracene	ug/L	ND	0.10*				
Indeno(1,2,3-cd)pyrene	ug/L	ND	0.10*				
Benzo(g,h,i)perylene	ug/L	ND	0.10*				
2-Fluorobiphenyl % Recovery	%	114	N/A				
2-Bromonaphthalene % Recovery	%	111	N/A				
o-Terphenyl % Recovery	%	72.7	N/A				
1-Chlorooctadecane % Recovery	%	79.7	N/A				
Surrogate Acceptance Range	%	40-140%	40-140%	40-140%	40-140%	40-140%	40-140%

[1] Hydrocarbon Range data exclude concentrations of any surrogate(s) and/or internal standards eluting in that range

[2] C_{11}-C_{22} Aromatic Hydrocarbons exlude the concentration of Target PAH Analytes

N/A = Not Applicable

ND = Not Detected at or above the Reporting Limit (RL) indicated.

COMMENTS: * EPA 8270SIM analysis performed on 12/4/98.

CERTIFICATION

Were all QA/QC procedures REQUIRED by the EPH Method followed?	[X] Yes	[ ] No - See Comments
Were all performance/acceptance standards for required QA/QC procedures achieved?	[X] Yes	[ ] No - See Comments
Were any significant modifications made to the EPH method, as specified in Sect 11.3?	[ ] No	[X] Yes - Details attached

I attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

SIGNATURE: Richard Ravenelle POSITION: Organic Division Manager

PRINTED NAME: Richard Ravenelle DATE: 12/8/98

AMRO

Sample Receipt Checklist

Client: RITZO | AMRO ID: 20998
Project Name: 4413.01 | Date Rec.: 11-19-98
Ship via: (circle one) Fed Ex., UPS, AMRO Courier, | Date Due: 12-03-98
Hand Del., Other Courier, Other

Items to be Checked Upon Receipt		Yes	No	NA	Comments
1. Custody Seals present?			✓		
2. Custody Seals Intact?				✓	
3. Air Bill included in folder if received?				✓	
4. Is COC included with samples?		✓			
5. Is COC signed and dated by client?		✓			
6. Laboratory receipt temperature.	TEMP = 4°				
	Samples rec. with ice ✓ ice packs ✓ neither				
7. Were samples received the same day they were sampled?			✓		
Is client temperature < 6 degrees C?	4°	✓			
If no obtain authorization from the client for the analyses.					
Client authorization from: Date: Obtained by:					
8. Is the COC filled out correctly and completely?		✓			
9. Does the info on the COC match the samples?		✓			
10. Were samples rec. within holding time?		✓			
11. Were all samples properly labeled?		✓			
12. Were all samples properly preserved?		✓			
13. Were proper sample containers used?		✓			
14. Were all samples received intact? (none broken or leaking)		✓			
15. Were VOA vials rec. with no air bubbles?		✓			
16. Were the sample volumes sufficient for requested analysis?		✓			
17. Were all samples received?		✓			
18. VPH Soils only:					
Samples preserved in Methanol or air tight container?					
Samples received in Methanol covering the soil?					
Samples received in air tight container?					
19. Subcontracted Samples:					
What samples sent:					
Where sent:					
Date:					
Analysis:					
TAT:					
20. Information entered into:					
Internal Tracking Log?		✓			
Dry Weight Log?				✓	
Client Log?		✓			
Received By: PCB	Date: 11-1998				
Labeled By: DCB	Date: 11-20-98				
Logged in By:	Date:				
Checked By:	Date:				

NA = Not Applicable
Rev 10 10/30/98

h/free/logbooks/SAM-REC-2

AMRO

Please Circle if:
Sample = Soil
Sample = Waste

Sample ID	Analysis	Volume Sample	Preserv. Listed	Initial pH	Acceptable? Y or N	List Preserv. Added by AMRO	Solution ID # of Preserv.	Volume Preservative Added	Final adjusted pH
20998 01	EPH	2 1L Amb	Hcl	<2	Y				
02	VPH	3 40mL VOA	Hcl	unable to ck					
03									
04									
05									
06	EPH	2 1L Amb		<2	Y				
	VPH	3 40mL VOA		VTC					
	8260	3 40mL VOA							
07	EPH	2 1L Amber		<2	Y				
	VPH	3 40mL VOA		VTC					

VTC = Unable to check.

pH Checked By: DCB Date: 11/21/96 pH adjusted By: Date:

CHAIN OF CUSTODY RECORD

Rizzo Associates, Inc.
235 West Central Street
Natick, MA 01760
(508) 651-3401
(508) 651-1189 (FAX)

Rizzo Project Number: 4413.01
Rizzo Project Name:
Samplers (signatures): Clark Fero

Lab: Amro
Lab ID #: 20998
Send report to: Clark Fero
Turnaround Time: standard

Rizzo Sample Number	Sample Depth	Sample Location	Sample Collected		Container			Sample Matrix	Requested Analyses
			Date	Time	#	Type	Preservative		
Riz-4-GW-204			11/18/98	10:20	2	Amber	HCL	Ground Water	EPH
↓			↓	↓	3	VOA	HCL		VPH
Riz-5-GW-205				11:15	2	Amber			EPH
↓				↓	3	VOA			VPH
Riz-1-GW-201				13:15	2	Amber			EPH
↓					3	VOA			VPH
Riz-1-GW-201 DUP					2	Amber			EPH
↓				↓	3	VOA			VPH
Riz-6-GW-206				13:30	2	Amber			EPH
↓				↓	3	VOA			VPH
↓				↓	3	VOA			8260
Riz-2-GW-202				14:30	2	AMBER			EPH
↓			↓	↓	3	VOA	↓	↓	VPH

Relinquished by: Clark Fero — Received by: [signature] — Date: 11/19/98 — Time: 12:55

[signature] — [signature] — 11/19/98 — 16:35

Method of Shipment:

WHITE - ANALYTICAL LABORATORY • YELLOW - QC OFFICER • PINK - CHAIN-OF-CUSTODY NOTEBOOK • GOLD - PROJECT FILE

CHAIN OF CUSTODY RECORD

Rizzo Associates, Inc.
235 West Central Street
Natick, MA 01760
(508) 651-3401
(508) 651-1189 (FAX)

Rizzo Project Number: 4413-01
Rizzo Project Name:
Samplers (signatures): Clark Fero

Lab: Amro
Lab ID #: 20998
Send report to: Clark Fero
Turnaround Time: Standard

Rizzo Sample Number	Sample Depth	Sample Location	Sample Collected		Container			Sample Matrix	Requested Analyses
			Date	Time	#	Type	Preservative		
RIZ-3-GW-203			11/18/95	15:00	2	Amber	HCL	Ground Water	EPH
↓			↓	↓	3	VOA	↓	↓	VPH

Relinquished by: Clark Fero — Received by: Dan Stefanko — Date: 11/19/95 — Time: 12:55

Dan Stefanko — [illegible] — 11/19/95 — 16:35

Method of Shipment:

[redacted] - AN[redacted]AL L[redacted]TORY [redacted]ELLO[redacted]OFFI[redacted] PIN[redacted]AIN-O[redacted]TODY [redacted]BOOK[redacted]OLD - [redacted]CT F[redacted]

The Commonwealth of Massachusetts

Department of Environmental Protection

Division of Environmental Analysis
Senator William X. Wall Experiment Station

certifies

M- NH012 Amro Environmental Lab
111 Herrick St.
Merrimack, NH 03054

Laboratory Director: **Nancy Stewart**

for the ***Chemical Analysis of Potable and Non-Potable Water***

pursuant to 310 CMR 42.00

This certificate supersedes all previous Massachusetts certificates issued to this laboratory. The laboratory is regulated by and shall be responsible for being in compliance with Massachusetts regulations at 310 CMR 42.00.

This certificate is valid only when accompanied by the latest dated Certified Parameter List as issued by the Massachusetts D.E.P.

Certification is no guarantee of the validity of the data. This certification is subject to unannounced laboratory inspections.

Director, Division of Environmental Analysis

Issued: **07/01/98**

Expires: **06/30/99**

ALPHA ANALYTICAL LABORATORIES

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

MA:M-MA-086 NH:200395-B/C CT:PH-0574 ME:MA086 RI:65

CERTIFICATE OF ANALYSIS

Client: Rizzo Associates

Address: 235 West Central Street
Natick, MA 01760

Attn: Clark Fero

Project Number: 4413-01

Site:

Laboratory Job Number: L9809827

Invoice Number: 21391

Date Received: 09-DEC-98

Date Reported: 14-DEC-98

Delivery Method: Alpha

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
L9809827-01	RIZ-4-GW-301	
L9809827-02	RIZ-6-GW-302	

Authorized by:

Scott McLean - Laboratory Director

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA:M-MA-086 NH:200395-B/C CT:PH-0574 ME:MA086 RI:65

Laboratory Sample Number: L9809827-01
RIZ-4-GW-301
Sample Matrix: WATER

Date Collected: 09-DEC-1998
Date Received : 09-DEC-98
Date Reported : 14-DEC-98

Condition of Sample: Satisfactory

Field Prep: None

Number & Type of Containers: 2-Amber Glass

PARAMETER	RESULT	UNITS	RDL	REF	METHOD	DATES PREP	DATES ANALYSIS	I
PAH by GC/MS SIM 8270M				1	8270C-M	11-Dec	11-Dec	M
Acenaphthene	ND	ug/l	0.14					
2-Chloronaphthalene	ND	ug/l	0.14					
Fluoranthene	ND	ug/l	0.14					
Naphthalene	ND	ug/l	0.14					
Benzo(a)anthracene	ND	ug/l	0.14					
Benzo(a)pyrene	ND	ug/l	0.14					
Benzo(b)fluoranthene	ND	ug/l	0.14					
Benzo(k)fluoranthene	ND	ug/l	0.14					
Chrysene	ND	ug/l	0.14					
Acenaphthylene	ND	ug/l	0.14					
Anthracene	ND	ug/l	0.14					
Benzo(ghi)perylene	ND	ug/l	0.14					
Fluorene	ND	ug/l	0.14					
Phenanthrene	ND	ug/l	0.14					
Dibenzo(a,h)anthracene	ND	ug/l	0.14					
Indeno(1,2,3-cd)Pyrene	ND	ug/l	0.14					
Pyrene	ND	ug/l	0.14					
1-Methylnaphthalene	ND	ug/l	0.14					
2-Methylnaphthalene	ND	ug/l	0.14					
Surrogate Recovery								
Nitrobenzene-d5	91.0	%						
2-Fluorobiphenyl	87.0	%						
4-Terphenyl-d14	50.0	%						

Comments: Complete list of References and Glossary of Terms found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA:M-MA-086 NH:200395-B/C CT:PH-0574 ME:MA086 RI:65

Laboratory Sample Number: L9809827-02
RIZ-6-GW-302
Sample Matrix: WATER

Date Collected: 09-DEC-1998
Date Received : 09-DEC-98
Date Reported : 14-DEC-98

Condition of Sample: Satisfactory

Field Prep: None

Number & Type of Containers: 2-Amber Glass

PARAMETER	RESULT	UNITS	RDL	REF	METHOD	DATES PREP	DATES ANALYSIS	ID
Extractable Petroleum Hydrocarbons				46	98-1	10-Dec	11-Dec	MI
C9-C18 Aliphatics	307.	ug/l	110.					
C19-C36 Aliphatics	140.	ug/l	110.					
C11-C22 Aromatics	318.	ug/l	110.					
Surrogate Recovery								
Chloro-Octadecane	91.0	%						
o-Terphenyl	98.0	%						
2-Fluorobiphenyl	86.0	%						
2-Bromonaphthalene	50.0	%						

Comments: Complete list of References and Glossary of Terms found in Addendum I

ALPHA ANALYTICAL LABORATORIES
QUALITY ASSURANCE BATCH SPIKE ANALYSES

Laboratory Job Number: L9809827

Parameter	% Recovery
PAH by GC/MS SIM 8270M LCS for sample(s) 01	
Acenaphthene	76
Pyrene	94
Extractable Petroleum Hydrocarbons LCS for sample(s) 02	
Nonane (C9)	29
Tetradecane (C14)	111
Nonadecane (C19)	88
Eicosane (C20)	153
Octacosane (C28)	83
Naphthalene	52
Acenaphthene	98
Anthracene	122
Pyrene	97
Chrysene	93

ALPHA ANALYTICAL LABORATORIES
QUALITY ASSURANCE BATCH MS/MSD ANALYSIS

Laboratory Job Number: L9809827

Parameter	MS %	MSD %	RPD
PAH by GC/MS SIM 8270M for sample(s) 01			
Acenaphthene	91	82	10
Pyrene	96	91	5

ALPHA ANALYTICAL LABORATORIES
QUALITY ASSURANCE BATCH BLANK ANALYSIS

Laboratory Job Number: L9809827

PARAMETER	RESULT	UNITS	RDL	REF	METHOD	DATES PREP	DATES ANALYSIS	I
Blank Analysis for sample(s) 01								
PAH by GC/MS SIM 8270M				1	8270C-M	11-Dec	11-Dec	MI
Acenaphthene	ND	ug/l	0.20					
2-Chloronaphthalene	ND	ug/l	0.20					
Fluoranthene	ND	ug/l	0.20					
Naphthalene	ND	ug/l	0.20					
Benzo(a)anthracene	ND	ug/l	0.20					
Benzo(a)pyrene	ND	ug/l	0.20					
Benzo(b)fluoranthene	ND	ug/l	0.20					
Benzo(k)fluoranthene	ND	ug/l	0.20					
Chrysene	ND	ug/l	0.20					
Acenaphthylene	ND	ug/l	0.20					
Anthracene	ND	ug/l	0.20					
Benzo(ghi)perylene	ND	ug/l	0.20					
Fluorene	ND	ug/l	0.20					
Phenanthrene	ND	ug/l	0.20					
Dibenzo(a,h)anthracene	ND	ug/l	0.20					
Indeno(1,2,3-cd)Pyrene	ND	ug/l	0.20					
Pyrene	ND	ug/l	0.20					
1-Methylnaphthalene	ND	ug/l	0.20					
2-Methylnaphthalene	ND	ug/l	0.20					
Surrogate Recovery								
Nitrobenzene-d5	96.0	%						
2-Fluorobiphenyl	94.0	%						
4-Terphenyl-d14	137.	%						
Blank Analysis for sample(s) 02								
Extractable Petroleum Hydrocarbons				46	98-1	10-Dec	11-Dec	M
C9-C18 Aliphatics	206.	ug/l	100.					
C19-C36 Aliphatics	100.	ug/l	100.					
C11-C22 Aromatics	219.	ug/l	100.					
Surrogate Recovery								
Chloro-Octadecane	88.0	%						
o-Terphenyl	94.0	%						
2-Fluorobiphenyl	92.0	%						
2-Bromonaphthalene	58.0	%						

REFERENCES

1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. Update III, 1997.

46. Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), Massachusetts Department of Environmental Protection, (MADEP-EPH-98-1), January 1998.

GLOSSARY OF TERMS AND SYMBOLS

REF Reference number in which test method may be found.

METHOD Method number by which analysis was performed.

ID Initials of the analyst.

LIMITATION OF LIABILITIES

Alpha Analytical, Inc. performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical, Inc., shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical, Inc. be held liable for any incidental consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical, Inc.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding times and splitting of samples in the field.

Rizzo Associates, Inc.
235 West Central Street
Natick, MA 01760
(508) 651-3401
(508) 651-1189 (FAX)

CHAIN OF CUSTODY RECORD

Rizzo Project Number: 4413.01
Rizzo Project Name
Samplers (signatures): Clark Fero

Lab: Alpha
Lab ID #:
Send report to: Clark Fero
Turnaround Time: ASAP - Fax 12/14/98

Rizzo Sample Number	Sample Depth	Sample Location	Sample Collected		Container			Sample Matrix	Requested Analyses
			Date	Time	#	Type	Preservative		
RIZ-4-GW-301			12/9/98	14:50	2	Glass Amber	ICE	Ground Water	PAH by 8270
RIZ-6-GW-302			↓	15:15	↓	↓	ICE HCL	↓	EPH Standard
									* Please analyze bottle #1 of each sample first.

Clark Fero

Relinquished by:	Received by:	Date:	Time:
Clark Fero		12/9/98	16:05
		12/9/98	1652

Method of Shipment: Courier

WHITE - ANALYTICAL LABORATORY • YELLOW QC OFFICER • PINK CHAIN OF CUSTODY NOTEBOOK • GOLD PROJECT FILE

Appendix F

Derivation of Method 2 Standards

1.0 Introduction

The risk characterization for 325 Grove Street was conducted using Method 2 as prescribed by the Massachusetts Contingency Plan (MCP). Method 2 was employed for this site because Method 1 standards are not available for copper, one of the hazardous materials identified in soils at the Site. Soil standards were derived for copper using the procedures described in Background Documentation for the Development of the MCP Numerical Standards, (MADEP, 1994).

Soil standards developed by MADEP are used in Method 1 and 2 risk characterizations. Method 1 standards consider both risks associated with direct contact (ingestion and dermal contact) exposures associated with contaminants in soil and the potential for contaminants to leach from the soil and impact groundwater. Method 1 soil standards may be adjusted to consider site-specific soil leaching characteristics but not to account for other site-related factors and is limited by consideration of direct contact. Method 2 soil standards may be generated for chemicals with no available standards, using the same methodology DEP used to develop Method 1 standards.

The MADEP has created a multi-step technique for deriving site-specific risk-based Method 1 and 2 standards, which is described below. The Method 2 soil standards for copper in S-1, S-2, and S-3 soils have been calculated and are presented in Table F-1.

2.0 Description of Soil Standards

There are three categories of soils upon which standards are developed. These categories are defined by the potential frequency and intensity of exposure and the accessibility of the soils. S-1 standards are based on current or future uses of accessible soil on sites. These standards are calculated using direct contact with contaminated soils based on a residential exposure scenario. S-2 standards are based on current or future moderate uses of accessible soils and are developed considering an occupational exposure scenario which was found to be protective of passive recreational exposures of children, an exposure scenario also covered by S-2 standards. S-3 standards consider current and future restricted access to sites with limited potential for exposure. They are based upon a short-term exposure scenario (3 months for non-cancer endpoints and 7 years for cancer endpoints). Additional measures are

established for the protection of groundwater, based upon leaching from the site soils. The Method 1 soil standards are calculated considering both direct contact exposures for the relevant soil category as well as the potential for leaching from soil to groundwater.

The procedures for estimating soil and groundwater standards, as described in the Background Documentation for the Development of MCP Numerical Standards, include several sequential steps. To derive Method 2 standards for oil and hazardous materials (OHM) without promulgated standards, or to modify Method 1 standards with site-specific information, these sequential procedures have to be followed. Soil categories present at the 325 Grove Street site are S-1 and S-3, and the groundwater present is GW-2 and GW-3. However, because copper is not volatile and is unlikely to leach into groundwater under current conditions, consideration of groundwater protection was eliminated from derivation of the soil standards.

3.0 Derivation of MCP Method 2 Direct Contact Soil Standards

The DEP's method for calculating Method 2 soil standards involves six steps:

1. Identify the lowest of three values based on: (a) 20 percent of an allowable daily intake (based on non-cancer health effects), (b) a one in one million excess lifetime cancer risk, or (c) a leaching-based concentration (i.e., a level in soil which is protective of the applicable groundwater standard).

2. Identify the practical quantitation limit (PQL) for an appropriately sensitive analytical method.

3. Identify background concentrations of the chemicals of concern, if available.

4. Carry the highest value generated in Steps 1, 2, and 3 to Step 6.

5. Identify a ceiling concentration based on compound volatility and odor recognition.

6. Choose the lowest of the two values identified in Steps 4 and 5 and adopt this value as the Method 2 Direct Contact Standard (MADEP, 1994).

The sequence is followed for copper and standards are developed in Table F-1. The risk-based concentrations are discussed below.

3.1 Calculation of the Risk-based Concentrations Based on Direct Contact

The first step in development of a Method 2 standard is the comparison of two risk-based concentrations and one leaching-based concentration. As described above, we have discounted the ability of copper to leach into groundwater under natural conditions and hence do not calculate a leaching-based concentration. Similarly, copper is not a known or suspected carcinogen, and we have not calculated a carcinogenic risk-based concentration. The non-carcinogenic risk-based concentration used to describe potential health effects from direct ingestion and dermal contact with contaminated soil is obtained from Equation 1 below.

$$[OHM]_{soil} = \frac{0.2 \times RfD \times C}{(NADSIR \times RAF_1) + (NADSCR \times RAF_2)}$$

where:

$[OHM]_{soil}$ = A risk-based (non-cancer risk) concentration, in soil, for the OHM (mg/kg).

0.2 = A 20 percent Source Allocation Factor, used to ensure that only 20 percent of an allowable daily intake of the OHM may come from exposure to the site soil (unitless)

RfD = The oral Reference Dose identified for the OHM: .037 mg/kg/day (from HEAST, 1995)

C = Units Conversion Factor: 106 mg/kg.

NADSIR = The Normalized Average Daily Soil Ingestion Rate (normalized to bodyweight) for the exposure period of concern: 3.1 (S-1), 0.29 (S-2), and 0.63 (S-3) mg/kg/day (Background Documentation for the Development of Numerical Standards, MassDEP, 1994).

NADSCR = The Normalized Average Daily Soil Dermal Contact Rate (normalized to bodyweight) for the exposure period of concern: 28.5 (S-1), 15.2 (S-2), and 32.5 (S-3) mg/kg/day (Background Documentation for the Development of Numerical Standards, MassDEP, 1994).

RAF = The Relative Absorption Factors for soil ingestion or dermal contact and threshold health effects (a chemical-, medium-, route-, and health endpoint-specific value): 1.0 (ingestion) and 0.02 (dermal contact).

3.2 Practical Quantitation Limit and Background Concentrations

The practical quantitation limit (PQL) for copper in soil was taken to be 1.0 mg/kg, the average detection limit reported for analyses of copper in soil at this site. Although the detection limit is not strictly equal to the PQL (Background Documentation for the Development of the MCP Numerical Standards, MassDEP, 1994), the PQL is several orders of magnitude lower than the risk-based concentration developed above regardless of how the PQL is derived, so the specific relationship between EPA Method 6010 detection limits and the PQL is not considered to be important in this case.

The background concentrations of copper in Massachusetts soils was taken as 38 mg/kg (Guidance for Disposal Site Risk Characterization, MassDEP, 1995, pg. 2-33). This value represents the 90th percentile of data collected from suburban and rural locations across Massachusetts.

3.3 Ceiling Concentrations

As required in Step 5 of the process described above, a ceiling concentration for each OHM has to be identified. The ceiling concentrations in soil are set considering the odor index of the chemical, the volatility of the chemical, and the soil category. The odor index for each chemical is estimated by the following equation:

$$\text{Odor Index} = \frac{VP_{20\text{-}30C}}{ORT_{50\%}}$$

where:

$VP_{20\text{-}30C}$ = The vapor pressure of the chemical measured at approximately 20 to 30 degrees celsius.

$ORT_{50\%}$ = The 50^{th} percentile odor recognition threshold.

The vapor pressure of copper at 20 to 30°C is negligible, and so the odor index for copper is 0. This odor index corresponds to ceiling concentrations of 1,000 (S-1), 2,500 (S-2), and 5,000 (S-3) mg/kg.

3.4 Method 2 Standards

Using the six-step approach outlined above, and the parameters described in the preceding sections, we obtained the following Method 2 standards for copper in soil:

S-1: 1,000 mg/kg

S-2: 2,500 mg/kg

S-3: 5,000 mg/kg

These standards are controlled by the limits placed on the ceiling value for odor thresholds (i.e., the risk-based concentrations were higher than the maximum ceiling values allowed. The calculations are outlined in Table F-1.

References

Massachusetts Department of Environmental Protection, 1994. Background Documentation for the Development of the MCP Numerical Standards. Bureau of Waste Site Cleanup and Office of Research and Standards, April 1994.

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Table F 1 Method 2 Standards for Copper

Compound		S-1 and GW-1 (µg/L)	S-1 and GW-2 (µg/L)	S-1 and GW-3 (µg/L)	S-1 and GW-1 (mg/kg)	S-1 and GW-2 (mg/kg)	S-1 and GW-3 (mg/kg)	S-2 and GW-1 (mg/kg)	S-2 and GW-2 (mg/kg)	S-2 and GW-3 (mg/kg)	S-3 and GW-1 (mg/kg)	S-3 and GW-2 (mg/kg)	S-3 and GW-3 (mg/kg)	Upper Concentration Limits Groundwater (µg/L)	Upper Concentration Limits Soil (mg/kg)
Copper total	M2	1,300	NA	30	1,000	1,000	1,000	2,500	2,500	2,500	5,000	5,000	5,000	13,000	10,000

Toxicological Potency Values for the Study Compounds

Compound	Cancer Potency Factors: Oral (mg/(kg*d))-1	Cancer Potency Factors: Inhalation (µg/m³)-1	Chronic Reference Doses and Concentrations: Oral (mg/(kg*d))	Chronic Reference Doses and Concentrations: Inhalation (µg/m³)	Subchronic Reference Doses and Concentrations: Oral (mg/(kg*d))	Subchronic Reference Doses and Concentrations: Inhalation (µg/m³)
Copper total	No data	No data	3.7E-02	No data	3.7E-02	No data

Toxicological Potency Values for the Study Compounds

Sources:

IRIS	Downloaded from US EPA IRIS Database, December, 1998.
HEAST	US EPA Health Effects Assessment Tables, Fiscal Year 1997, and supplements.
DEP	Background Documentation for the Development of MCP Numerical Standards, 1994
RBC	USEPA Region III Risk Based Concentration Table, October 1998

Relative Absorption Factors for the Study Compounds

Compound	Subchronic Soil Ingestion	Subchronic Soil Dermal	Chronic Soil Ingestion	Chronic Soil Dermal	Cancer Soil Ingestion	Cancer Soil Dermal	Chronic Water Ingestion	Cancer Water Ingestion
Copper total	1.00	0.02	1.00	0.02	NC	NC	1.00	NC

Physical and Chemical Properties of the Study Compounds

Compound	Molecular Weight (g/mol)	Water Solubility (µg/L)	Vapor Pressure (atm)	Vapor Pressure (torr)	Henry's Law Constant (atm m3/mol)	Henry's Law Constant (—)	Koc eqn. 4-5 based on S (mL/g)	Koc eqn. 4-8 based on Kow (mL/g)	Koc (mL/g)	Log10 Kow (—)	Odor Threshold in Water (µg/L)	Odor Threshold in Air (µg/m³)	Odor Threshold in Air (ppm)	Odor Index for Soil (—)
Copper total	1.6E+02	1.4E+08	NA	NA	0.0E+00	NA	6.4E+00	NA	NA	NA	NA	NA	NA	NA

Sources:

US EPA Handbook of RCRA Groundwater Monitoring Constituents. Chemical and Physical Properties, 1992.
Agency for Toxic Substances and Disease Registry, Toxicological Profiles for Chemicals.
Verschueren, Handbook of Environmental Data on Organic Chemicals, 1983
MA DEP Background Documentation for the Development of MCP Numerical Standards, 1994

Input Values for Deriving Method 2 Standards for Copper

Compound	Background			Practical Quantitation Limits		Ceiling Concentrations				Soil Leaching Concentrations		
	Water (µg/L)	Soil (mg/kg)	Air (µg/m³)	Water (µg/L)	Soil (mg/kg)	Water (µg/L)	S-1 (mg/kg)	S-2 (mg/kg)	S-3 (mg/kg)	for GW-1 (µg/L)	for GW-2 (µg/L)	for GW-3 (µg/L)
Copper, total	7.0E+00	3.0E+01	1.0E-01	6.0E+00	NA	5.0E+04	1.0E+03	2.5E+03	5.0E+03	none	none	none

Input Values for Deriving Method 2 Standards for Copper

Compound	Non-Cancer Risk Based Concentrations						Cancer Risk-Based Concentrations			Direct Contact Standards					
	GW-1 (µg/L)	GW-2 (air) (µg/m³)	GW-3 (µg/L)	S-1 (mg/kg)	S-2 (mg/kg)	S-3 (mg/kg)	GW-1 (µg/L)	GW-2 (air) (µg/m³)	GW-3 (µg/L)	S-1 (mg/kg)	S-2 (mg/kg)	S-3 (mg/kg)	S-1 (mg/kg)	S-2 (mg/kg)	S-3 (mg/kg)
Copper, total	2.6E+02	none	NA	2.1E+03	1.4E+04	6.3E+03	none	none	NA	none	none	none	1.0E+03	2.5E+03	5.0E+03

Input Values for Deriving Method 2 Standards for Copper

Compound	Ambient Water Quality Criteria					Drinking Water Criteria	
	Freshwater Acute (µg/L)	Freshwater Chronic (µg/L)	Marine Acute (µg/L)	Marine Chronic (µg/L)	Minimum AWQC (µg/L)	MMCL (µg/L)	ORSGL (µg/L)
Copper, total	1.3E+01	9.0E+00	4.8E+00	3.1E+00	3.1E+00	1.3E+03	none

Variables	Values	Units	Description
BWa	70	kg	Body weight of an adult
IRw	2	L/d	Water ingestion rate for an adult
alpha	0.0005	—	Attenuation factor (310 CMR 40.0983)
dil	0.1	—	Dilution factor (310 CMR 40.0983)
CF_1	1,000	µg/mg	Units conversion factor
CF_2	1,000	L/m³	Units conversion factor
R_	8.21E-05	atm*m³/mol*K	Gas constant
T_	298	K	25 °C, converted to Kelvin
HIlim	0.2	—	Hazard Index limit
ILCRlim	1.00E-06	—	Cancer Risk limit
Mair	28.97	g/mol	molecular weight of air
Vair	20.1	cm³/mol	molar volume of air
P_	1	atm	atmospheric pressure
CF_3	1.00E+06	mg/kg	Units conversion factor
RAFo	1	—	Relative Absorption Factor (oral)
RAFd	1	—	Relative Absorption Factor (dermal)
NADSIR_S1	3.1	mg/(kg*d)	Normalized Average Daily Soil Ingestion Rate (S-1)
NADSIR_S2	0.29	mg/(kg*d)	Normalized Average Daily Soil Ingestion Rate (S-2)
NADSIR_S3	0.63	mg/(kg*d)	Normalized Average Daily Soil Ingestion Rate (S-3)
NADSCR_S1	28.5	mg/(kg*d)	Normalized Average Daily Soil Contact Rate (S-1)
NADSCR_S2	15.2	mg/(kg*d)	Normalized Average Daily Soil Contact Rate (S-2)
NADSCR_S3	32.5	mg/(kg*d)	Normalized Average Daily Soil Contact Rate (S-3)
NLADSIR_S1	0.41	mg/(kg*d)	Normalized Lifetime Average Daily Soil Ingestion Rate (S-1)
NLADSIR_S2	0.11	mg/(kg*d)	Normalized Lifetime Average Daily Soil Ingestion Rate (S-2)
NLADSIR_S3	0.029	mg/(kg*d)	Normalized Lifetime Average Daily Soil Ingestion Rate (S-3)
NLADSCR_S1	7.3	mg/(kg*d)	Normalized Lifetime Average Daily Soil Contact Rate (S-1)
NLADSCR_S2	5.48	mg/(kg*d)	Normalized Lifetime Average Daily Soil Contact Rate (S-2)
NLADSCR_S3	1.5	mg/(kg*d)	Normalized Lifetime Average Daily Soil Contact Rate (S-3)

ATTACHMENT B

SOIL AND GROUNDWATER ANALYTICAL DATA SUMMARY TABLES AND TEST BORING LOGS BY HALEY AND ALDRICH

TABLE I - SUMMARY OF SOIL QUALITY DATA
RIVERSIDE DEVELOPMENT
NEWTON, MASSACHUSETTS
FILE NO.: 33528-015

SAMPLE DESIGNATION	MA RCS-1	HA09-1, S1	HA09-2, 1-4	HA09-3, 1-3.5	HA09-4, 1-3	HA09-6, S2	HA09-7, 1-3	HA09-9, S3	HA 09-10, S1	HA09-11, S3	HA09-12, S2	HA09-13, S5	HA09-14, 0.5-1.5
SAMPLING DATE	(mg/Kg)	10/8/2009	10/8/2009	10/7/2009	10/2/2009	10/1/2009	10/2/2009	10/9/2009	9/29/2009	10/1/2009	9/28/2009	10/12/2009	10/2/2009
LAB SAMPLE ID		128626-1/3/5	128626-2/4/6	128599-1/2/3	128496-2/5/8	128463-1/3/5	128496-1/4/7	128647-1/2/3/4	128401-1/2/3	128463-2/4/6	128366-1/2/3	128720-1/2/3	128496-3/6/9
SAMPLE DEPTH (FT.)		0.5 to 2	1 to 4	1 to 3.5	1 to 3	3 to 5	1 to 3	5 to 7	1 to 3	4 to 6	3 to 5	9.5 to 11.5	0.5 to 1.5
VOCs (mg/kg)													
Total VOCs	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SVOCs (mg/kg)													
Phenanthrene	10	ND(0.17)	ND(0.175)	ND(0.17)	ND(0.165)	ND(0.175)	ND(0.175)	2.1	ND(0.17)	ND(0.165)	1.2	0.49	ND(0.165)
Anthracene	1,000	ND(0.17)	ND(0.175)	ND(0.17)	ND(0.165)	ND(0.175)	ND(0.175)	0.4	ND(0.17)	ND(0.165)	ND(0.175)	ND(0.195)	ND(0.165)
Fluoranthene	1,000	ND(0.17)	ND(0.175)	0.55	ND(0.165)	ND(0.175)	ND(0.175)	2.6	ND(0.17)	ND(0.165)	1.7	0.57	ND(0.165)
Pyrene	1,000	ND(0.17)	ND(0.175)	0.54	ND(0.165)	ND(0.175)	ND(0.175)	2.3	ND(0.17)	ND(0.165)	1.5	0.49	ND(0.165)
Benzo[a]anthracene	7	ND(0.17)	ND(0.175)	ND(0.17)	ND(0.165)	ND(0.175)	ND(0.175)	1.2	ND(0.17)	ND(0.165)	0.73	ND(0.195)	ND(0.165)
Chrysene	70	ND(0.17)	ND(0.175)	ND(0.17)	ND(0.165)	ND(0.175)	ND(0.175)	1	ND(0.17)	ND(0.165)	0.63	ND(0.195)	ND(0.165)
Benzo[b]fluoranthene	7	ND(0.17)	ND(0.175)	0.35	ND(0.165)	ND(0.175)	ND(0.175)	1.5	ND(0.17)	ND(0.165)	0.88	ND(0.195)	ND(0.165)
Benzo[k]fluoranthene	70	ND(0.17)	ND(0.175)	ND(0.17)	ND(0.165)	ND(0.175)	ND(0.175)	0.44	ND(0.17)	ND(0.165)	ND(0.175)	ND(0.195)	ND(0.165)
Benzo[a]pyrene	2	ND(0.17)	ND(0.175)	ND(0.17)	ND(0.165)	ND(0.175)	ND(0.175)	1.1	ND(0.17)	ND(0.165)	0.66	ND(0.195)	ND(0.165)
Indeno[1,2,3-c,d]pyrene	7	ND(0.17)	ND(0.175)	ND(0.17)	ND(0.165)	ND(0.175)	ND(0.175)	0.77	ND(0.17)	ND(0.165)	ND(0.175)	ND(0.195)	ND(0.165)
Benzo[g,h,i]perylene	1,000	ND(0.17)	ND(0.175)	ND(0.17)	ND(0.165)	ND(0.175)	ND(0.175)	0.64	ND(0.17)	ND(0.165)	ND(0.175)	ND(0.195)	ND(0.165)
Total SVOCs	NA	ND	ND	1.44	ND	ND	ND	14.05	ND	ND	7.3	1.55	ND
Metals (mg/kg)													
Arsenic, Total	20	ND(1.55)	ND(1.6)	4	ND(1.55)	ND(1.6)	4.1	8.3	ND(1.5)	ND(1.5)	4.2	9.4	ND(1.55)
Barium, Total	1,000	ND(10.5)	110	ND(11)	ND(10.5)	ND(10.5)	39	77	22	ND(10)	25	53	ND(10.5)
Cadmium, Total	2	ND(0.26)	ND(0.265)	ND(0.275)	ND(0.26)	ND(0.265)	ND(0.275)	ND(0.28)	ND(0.255)	ND(0.25)	ND(0.255)	ND(0.295)	ND(0.26)
Chromium, Total	30	ND(5)	17	ND(5.5)	ND(5)	ND(5.5)	12	13	13	ND(5)	16	12	15
Lead, Total	300	37	11	17	ND(5)	ND(5.5)	14	130	ND(5)	ND(5)	24	63	38
Selenium, Total	400	ND(5)	ND(5.5)	ND(5.5)	ND(5)	ND(5.5)	ND(5.5)	ND(5.5)	ND(5)	ND(5)	ND(5)	ND(6)	ND(5)
Silver, Total	100	ND(2.6)	ND(2.65)	ND(2.75)	ND(2.6)	ND(2.65)	ND(2.75)	ND(2.8)	ND(2.55)	ND(2.5)	ND(2.55)	ND(2.95)	ND(2.6)
Mercury, Total	20	ND(0.0085)	ND(0.009)	0.044	ND(0.0085)	ND(0.009)	ND(0.009)	0.05	ND(0.009)	ND(0.01)	0.035	0.062	ND(0.008)
PCBs (mg/kg)													
Aroclor 1254	2	0.47	ND(0.0425)	ND(0.0415)	ND(0.041)	ND(0.042)	ND(0.0425)	ND(0.044)	ND(0.0405)	ND(0.0405)	ND(0.042)	ND(0.046)	ND(0.04)
Total PCBs	2	0.47	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
EPH (mg/kg)													
C9 to C18 Aliphatic Hydrocarbons	1,000	ND(15)	ND(15.5)	ND(16)	ND(15)	ND(15.5)	ND(16)	ND(16)	ND(15.5)	ND(15)	ND(15.5)	40	ND(15)
C19 to C36 Aliphatic Hydrocarbons	3,000	90	44	ND(16)	75	ND(15.5)	59	57	ND(15.5)	ND(15)	71	140	59
C11 to C22 Aromatic Hydrocarbons	1,000	43	37	ND(16)	60	ND(15.5)	44	120	ND(15.5)	ND(15)	65	140	39
Unadjusted C11 to C22 Aromatic Hydrocarbons	NA	45	38	33	61	ND(15.5)	45	130	ND(15.5)	ND(15)	71	150	39

SAMPLE DESIGNATION	MA RCS-1	HA09-1, S1	HA09-2, 1-4	HA09-3, 1-3.5	HA09-4, 1-3	HA09-6, S2	HA09-7, 1-3	HA09-9, S3	HA 09-10, S1	HA09-11, S3	HA09-12, S2	HA09-13, S5	HA09-14, 0.5-1.5
SAMPLING DATE	(mg/Kg)	10/8/2009	10/8/2009	10/7/2009	10/2/2009	10/1/2009	10/2/2009	10/9/2009	9/29/2009	10/1/2009	9/28/2009	10/12/2009	10/2/2009
LAB SAMPLE ID		128626-1/3/5	128626-2/4/6	128599-1/2/3	128496-2/5/8	128463-1/3/5	128496-1/4/7	128647-1/2/3/4	128401-1/2/3	128463-2/4/6	128366-1/2/3	128720-1/2/3	128496-3/6/9
SAMPLE DEPTH (FT.)		0.5 to 2	1 to 4	1 to 3.5	1 to 3	3 to 5	1 to 3	5 to 7	1 to 3	4 to 6	3 to 5	9.5 to 11.5	0.5 to 1.5
VPH (mg/kg)													
C9 to C12 Aliphatic Hydrocarbons	1,000	ND(0.5)	ND(0.6)	ND(0.6)	ND(1)	ND(0.55)	ND(1)	1.6	ND(0.5)	ND(0.55)	ND(0.55)	ND(0.7)	ND(1)
Unadjusted C9 to C12 Aliphatic Hydrocarbons	NA	ND(0.5)	ND(0.6)	ND(0.6)	ND(1)	ND(0.55)	2.3	2.1	ND(0.5)	ND(0.55)	ND(0.55)	ND(0.7)	ND(1)
Waste Characterization (mg/kg)													
Corrosivity (as pH) (pH)	NA	7.2	7.4	7.4	7.3	7.2	6.9	7.1	7.2	7.3	7.5	7.3	7.1
Ignitability (as Flashpoint) (deg F)	NA	>165	>165	>165	>165	>165	>165	>165	>165	>165	>165	> 165	>165

ABBREVIATIONS:

NA : Not applicable.

ND(0.006): Not detected; number in parentheses is one-half the laboratory detection limit.

- : Not analyzed

VOCs: Volatile Organic Compounds

SVOCs: Semivolatile Organic Compounds

PCBs: Polychlorinated Biphenyls

EPH: Extractable Petroleum Hydrocarbons

VPH: Volatile Petroleum Hydrocarbons

NOTES:

1. This table includes only those compounds detected at least once on the dates indicated.
2. Bold values indicate an exceedance of RCGW-1 Standards.
3. Bold ND values indicate that one-half the laboratory quantitation limit exceeds RCGW-1 Standards.

TABLE II - SUMMARY OF GROUNDWATER QUALITY DATA
RIVERSIDE DEVELOPMENT
NEWTON, MASSACHUSETTS
FILE NO.: 33528-015

SAMPLE DESIGNATION	**MA RCGW-1**	**HA09-10 OW**	**HA09-13 OW**	**HA09-14 OW**
SAMPLING DATE	(mg/L)	10/14/2009	10/19/2009	10/14/2009
DEPTH TO GROUNDWATER (FT.)		9.25	9.9	20.75
VOCs (mg/L)				
Total SVOCs		ND	ND	ND
Metals (mg/L)				
Barium, Dissolved	2	-	0.4	-
Barium, Total	2	0.4	-	ND(0.1)
EPH (mg/L)				
Benzo[a]anthracene	0.001	ND(0.00005)	0.0001	ND(0.00005)
Chrysene	0.002	ND(0.00005)	0.0001	ND(0.00005)
Benzo[b]fluoranthene	0.001	ND(0.00005)	0.0002	ND(0.00005)
Benzo[a]pyrene	0.0002	ND(0.00005)	0.0001	ND(0.00005)
Indeno[1,2,3-c,d]pyrene	0.0005	ND(0.00005)	0.0001	ND(0.00005)
Benzo[g,h,i]perylene	0.02	ND(0.00005)	0.0001	ND(0.00005)
n-C9 to n-C18 Aliphatic Hydrocarbons	0.7	ND(0.25)	ND(0.25)	ND(0.25)
n-C19 to n-C36 Aliphatic Hydrocarbons	14	ND(0.25)	ND(0.25)	ND(0.25)
n-C11 to n-C22 Aromatic Hydrocarbons	0.2	ND(0.075)	ND(0.075)	ND(0.075)
MA DEP VPH (mg/L)				
n-C5 to n-C8 Aliphatic Hydrocarbons	0.3	ND(0.01)	ND(0.01)	ND(0.01)
n-C9 to n-C12 Aliphatic Hydrocarbons	0.7	ND(0.01)	ND(0.01)	ND(0.01)
n-C9 to n-C10 Aromatic Hydrocarbons	0.2	ND(0.01)	ND(0.01)	ND(0.01)

ABBREVIATIONS:
NA : Not applicable.
ND(0.0015): Not detected; number in parentheses is one-half the laboratory detection limit.
- : Not analyzed
VOCs: Volatile Organic Compounds
VPH: Volatile Petroleum Hydrocarbons
EPH: Extractable Petroleum Hydrocarbons

NOTES:
1. With the exception of EPH and VPH, this table includes only those compounds detected at least once on the dates indicated.
2. Bold values indicate an exceedance of RCGW-1 Standards.
3. Bold ND values indicate that one-half the laboratory quantitation limit exceeds RCGW-1 Standards.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-1

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 2
Start 8 October 2009
Finish 8 October 2009
Driller M. D'Ambrosio
H&A Rep. D. Warren
Elevation 68.0 (est.)
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	NV II	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4	1 3/8	2	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Driven to 6.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				67.7		-BLACK BITUMINOUS ASPHALT-										
	4 6 11	S1 10	0.5 2.0	0.3	SP-SM	Medium dense brown poorly graded SAND with silt and gravel (SP-SM), mps 1.0 in., no structure, no odor, dry PID = 0.0/0.0 ppm	5	5	5	40	35	10				
				66.0 2.0		-FILL-										
						-GLACIAL TILL-										
	8 9 100/0"	S2 8	3.0 4.0	64.0 4.0	ML	Very stiff light gray sandy elastic SILT with gravel (ML), mps 1.5 in., well bonded in situ, moist PID = 0.0/0.0 ppm	5	10	5	5	10	65				
						TOP OF BEDROCK 4.0 FT										
5	10 48 86 49	S3 14	5.5 7.5		GM	Very dense purple-gray silty GRAVEL with sand (GM), mps 1.5 in., distinct rock fabric, moist Note: Sample consists of highly weathered completely fractured Bedrock. PID = 0.0/0.0 ppm Note: Casing driven askew in highly fractured rock with irregular bedrock surface. Unable to core. Moved rig 2.0 ft south and restarted hole.	30	40	5	5	5	15				
						SEE CORE BORING REPORT FOR ROCK DETAILS 6.3 TO 10.3 FT										
10	14 65 75/1"	S4 8	10.3 11.4		GM	Similar to S3	30	40	5	5	5	15				
				56.6 11.4		-BEDROCK- BOTTOM OF EXPLORATION 11.4 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
10/8/09	1200		6.3	11.4	Dry

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 7.4
Rock Cored (ft) 4.0
Samples S4, C1

Boring No. HA09-1

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

CORE BORING REPORT

Boring No. **HA09-1**
File No. 33528-015
Sheet No. 2 of 2

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
	3	C1	6.3 10.3	30 15	63 31	Slight		Hard slightly weathered purple-gray to green-gray coarse-grained to aphanitic Porphyritic Rhyolite. Cleavage moderately dipping. Joints very close to moderately close, smooth to rough, planar to stepped, fresh to discolored and oxidized, tight to open. Approximately 75% water loss noted.
	4							-BEDROCK-
	3					Complete	59.0 9.0	Note: Core barrel dropped with no resistance at 9.0 ft with 100% water loss observed. Drove split spoon in completely weathered rock from 10.3 to 11.4 ft. Driller not equipped to telescope casing to continue boring.
10	0							SEE TEST BORING REPORT FOR OVERBURDEN DETAILS 10.3 TO 11.4 FT
15								
20								
25								
30								
35								

H+A_CORE+WELL07-1 HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\33528\NORMANDY\RIVERSIDE MBTA\015 NEWTON RVRSDE ENV + GEO\FIELD DATA\33528-015_TB.GPJ 29 Oct 09

TEST BORING REPORT

Boring No. HA09-2

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 2
Start 8 October 2009
Finish 9 October 2009
Driller M. D'Ambrosio
H&A Rep. Warren/Dodson
Elevation 68.0 (est.)
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	NV II	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4	1 3/8	2	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Driven to 10.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	2 7 14 20	S1 15	0.0 2.0	67.5 0.5	OH ML	S1 top 5.0 in.: Soft brown sandy ORGANIC SOIL (OH), mps 0.25 in., no structure, no odor, moist -TOPSOIL/FILL-	15	15	5			65				
	20 30 40 33	S2 9	2.0 4.0		ML	S1 bottom 10.0 in.: Dense gray gravelly SILT (ML), mps 1.0 in., no structure, no odor, dry PID = 0.0/0.0 ppm Similar to above PID = 0.0/0.0 ppm -INTERMIXED BLASTROCK/GLACIAL TILL FILL-	30	15				55				
5	41 53 53 94	S3 12	4.0 6.0	62.5 5.5	GW-GM	Very dense gray well graded GRAVEL with silt and sand (GW-GM), mps 1.5 in., no structure, no odor, wet PID = 0.0/0.0 ppm TOP OF BEDROCK APPROXIMATELY 5.5 FT										
						Note: Top 3.0 to 4.0 ft of bedrock are extremely fractured, possibly due to previous blasting in the vicinity.										
10	100/5"	S4 4	9.5 9.9		GW	Very dense gray well graded GRAVEL (GW), mps 1.5 in., no structure, no odor, wet -PROBABLE BEDROCK-	30	55		5	5	5				
	50/0"	NR 0	12.5 12.5			Note: No recovery. Spoon refusal at 12.5 ft. Drill action indicates some Bedrock at approximately 13.0 ft. SEE CORE BORING REPORT FOR ROCK DETAILS										
15																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
10/9/09	0820	0.1	10.0	18.5	9.5
10/9/09	0830	0.1	Pulled	18.5	Dry

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 13.5
Rock Cored (ft) 5.0
Samples S4, C1

Boring No. HA09-2

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

CORE BORING REPORT

Boring No. **HA09-2**
File No. 33528-015
Sheet No. 2 of 2

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
15	4	C1	13.5 18.5	60 23	100 38	Fresh to Slight		Hard slightly weathered to fresh greenish gray to purple coarse gravel to aphanitic highly altered CRYSTALINE TUFF. Primary joint set dipping at low angle, very close to moderately spaced, rough, planar to undulating, fresh to discolored, tight. Possible secondary horizontal joint set close to widely spaced, rough to slightly smoothed, planar to undulating, slightly weathered.
	3							
	3							-BEDROCK-
	3.5							
	4						49.5 18.5	BOTTOM OF EXPLORATION 18.0 FT
20								
25								
30								
35								
40								

TEST BORING REPORT

Boring No. HA09-3

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 2
Start 7 October 2009
Finish 7 October 2009
Driller M. D'Ambrosio
H&A Rep. D. Warren
Elevation 68.0
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Driven to 24.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				67.5		-BLACK BITUMINOUS ASPHALT-										
	10 13 12 12	S1 15	0.5 2.5	0.5	ML/ SM	Medium dense mottled brown-tan sandy SILT (ML) to silty SAND (SM), trace fine gravel, mps 0.5 in., no structure, no odor, dry PID = 0.0/0.0 ppm		5			45	50				
						-FILL-										
	11 14	S2 10	2.5 3.5		SM	Medium dense brown silty SAND (SM), mps <1 mm, no structure, no odor, dry				35	50	15				
	17 18	S2A 8	3.5 4.5	64.5 3.5	ML	Dense tan sandy SILT (ML), mps <1 mm, stratified, no odor, dry PID = 0.0/0.0 ppm					25	75				
5	12 9 11 10	S3 18	4.5 6.5			S3 top 9.0 in.: Similar to above except medium dense					25	75				
				62.5		-ALLUVIAL DEPOSITS-										
				5.5		S3 bottom 9.0 in.: Medium dense gray poorly graded SAND (SP), mps <1 mm, stratified, no odor, dry PID = 0.0/0.0 ppm					95	5				
						-ALLUVIAL DEPOSITS-										
10	11 11 17 19	S4 14	9.5 11.5		ML/ SM	Medium dense tan sandy SILT (ML) interbedded with silty SAND (SM), mps <1 mm, stratified, no odor, dry					50	50				
				55.5 12.5		-GLACIAL TILL-										
15	10 12 13 35	S5 10	14.5 16.5		MH	Very stiff tan sandy elastic SILT with gravel (MH), mps 1.5 in., no structure, no odor, wet	10	15	5	5	15	50				
				50.0 18.0		-GLACIAL TILL-										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
10/7/09	1100		24.0	26.5	Dry

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 26.5
Rock Cored (ft) -
Samples S7
Boring No. HA09-3

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-3
File No. 33528-015
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	22 36 22 19	S6 12	19.5 21.5		ML	Very dense tan gravelly SILT with sand (ML), mps 1.5 in., moderately bonded in situ, wet	20	15	5	5	5	50				
						-GLACIAL TILL-										
25	18 58 78 82	S7 10	24.5 26.5		ML	Very dense gray sandy SILT with gravel (ML), mps 1.5 in., well bonded in situ, moist	10	10	5	5	20	50				
				41.5 26.5		BOTTOM OF EXPLORATION 26.5 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA09-3

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-4

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 2
Start 2 October 2009
Finish 2 October 2009
Driller M. D'Ambrosio
H&A Rep. D. Warren
Elevation 67.0 (est.)
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW/PW	S	-	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4/6	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW to 29.0 ft; PW to 6.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				66.5		Note: Pre-excavated from 0.0 to 0.6 ft with Vactor. PW casing driven 6.0 ft.										
				0.5	SP-SM	-BLACK BITUMINOUS ASPHALT-										
						Brown poorly graded SAND with silt and gravel (SP-SM), mps 5.0 in., no structure, no odor, dry										
						-FILL-										
				64.0												
				3.0		Note: Coarse gravel and cobbles, mps 8.0 in., noted in open borehole from 3.0 to 6.0 ft. Hole continuously collapsing.										
5	9 14 20 14	S1 7	6.0 8.0		GW	Dense brown well graded GRAVEL (GW), mps 1.5 in., no structure, no odor, dry PID = 0.0/0.0 ppm	30	55	15							
10	11 7 7 4	NR 0	9.5 11.5			Note: No recovery. Drill action indicates coarse gravel and cobbles.										
						-GLACIOFLUVIAL DEPOSITS-										
15	11 5 7 8	S2 8	14.5 16.5		GW	Medium dense gray well graded GRAVEL (GW), mps 1.5 in., no structure, no odor, wet Note: Drill action indicates frequent cobbles.	60	40								

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
10/2/09	1445		22.0	28.0	Dry

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 31.5
Rock Cored (ft) -
Samples S5

Boring No. HA09-4

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-4
File No. 33528-015
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	18 29 29 22	S3 14	19.5 21.5		GM	Very dense gray brown silty GRAVEL with sand (GM), mps 1.5 in., no structure, no odor, wet	50	25	5	5		15				
						-GLACIOFLUVIAL DEPOSITS-										
25	22 18 9 14	S4 10	24.5 26.5		GW/ SM	Dense gray brown well graded GRAVEL with sand (GW) interbedded with seams of brown stratified silty SAND (SM), mps 1.5 in., no structure, no odor, wet	30	30	5	5	20	10				
30	10 15 13 13	S5 12*	29.5 31.5		SW	Medium dense brown well graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, wet *No initial recovery. Overdrove spoon to retain sample.	10	15	20	40	15					
				35.5 31.5		BOTTOM OF EXPLORATION 31.5 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA09-4

TEST BORING REPORT

Boring No. HA09-5

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 2
Start 7 October 2009
Finish 7 October 2009
Driller M. D'Ambrosio
H&A Rep. D. Warren
Elevation 67.0 (est.)
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Driven to 29.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				66.2		-BLACK BITUMINOUS ASPHALT-										
				0.8												
	22 24 35 33	S1 15	1.0 3.0		SP	Very dense brown poorly graded SAND (SP), mps 0.5, no structure, no odor, dry PID = 0.0/0.0 ppm		10	5	30	50	5				
	30 29 25 20	S2 17	3.0 5.0		SP	Similar to above PID = 0.0/0.0 ppm		5	5	50	40					
5	6 7 5 5	S3 18	5.0 7.0		SP SW	Similar to above except medium dense grading to well graded SAND (SW), mps 0.5 in. at approximately 6.0 ft PID = 0.0/0.0 ppm		5	10	55	30					
						-GLACIOFLUVIAL DEPOSITS-										
10	4 3 4 4	S4 12	9.5 11.5		SP/ SM	Loose brown poorly graded SAND (SP) interbedded with occasional seams of silty SAND (SM), mps 0.5 in., no structure, no odor, moist		5	5	50	30	10				
15	5 18 16 14	S5 10	14.5 16.5		SP	Dense brown poorly graded SAND (SP), mps 0.25 in., no structure, no odor, moist			5	60	35					

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
10/8/09	0710		25.0	27.0	18.0

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 35.0
Rock Cored (ft) -
Samples S9

Boring No. HA09-5

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-5
File No. 33528-015
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	15 16 18 20	S6 16	19.5 21.5		SW	Dense well graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, wet	20	20	20	30	10					
						-GLACIOFLUVIAL DEPOSITS-										
				44.5 22.5		-GLACIOLACUSTRINE DEPOSITS-										
	5	S7	24.5	42.0	ML	Loose brown sandy SILT (ML), mps < 1 mm, no structure, no odor, wet					20	80				
25	9 6 14	6 S7A 10	25.0 25.0 26.5	25.0	MH	Stiff light gray sandy elastic SILT with gravel (MH), mps 1.5 in., no structure, no odor, wet	10	10	5	5	10	60				
						-GLACIAL TILL-										
				38.5 28.5												
30	31 72 102	S8 12	29.5 31.0		GW-GM	Very dense gray well graded GRAVEL with silt and sand (GW-GM), mps 1.5 in., moderately bonded in situ, wet	35	30	10	10	5	10				
						-GLACIAL TILL-										
35	120/4"	S9 3	34.5 34.9	32.0 35.0	GW-GM	Similar to above	35	30	10	10	5	10				
						BOTTOM OF EXPLORATION 35.0 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA09-5

TEST BORING REPORT

Boring No.HA09-6(OW)

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 2
Start 1 October 2009
Finish 1 October 2009
Driller M. D'Ambrosio
H&A Rep. D. Warren
Elevation 64.0 (est.)
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Driven to 24.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					63.5		-BLACK BITUMINOUS ASPHALT-										
					0.5												
	17 24 23 17	S1 17	1.0 3.0			SP-SM/SW	Dense brown poorly graded SAND with silt and gravel (SP-SM) with seams of well graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, dry PID = 0.0/0.0 ppm	5	10	5	30	40	10				
	16 13 14 11	S2 12	3.0 5.0			SM/ML	Medium dense dark brown silty SAND to sandy SILT with gravel (SM/ML), mps 1.5 in., no structure, no odor, dry PID = 0.0/0.0 ppm	5	10	5	10	35	35				
5	10 11 6 10	S3 9	5.0 7.0			SM/ML	Similar to above except with trace asphalt fragments PID = 0.0/0.0 ppm	5	10	5	10	35	35				
							-FILL-										
	8 11 6 5	S4 10	7.0 9.0			SM	Medium dense mottled light brown to tan silty SAND with gravel (SM), mps 1.5 in., no structure, no odor, dry PID = 0.0/0.0 ppm	5	10	5	5	40	35				
10	5 5 5 5	S5 11	9.5 11.5			SM	Medium dense light brown silty SAND (SM), mps <1 mm, no structure, no odor, dry PID = 0.0/0.0 ppm					65	35				
					51.0												
					13.0		-GLACIOFLUVIAL DEPOSITS-										
15	12 11 10 12	S6 14	14.5 16.5			GM	Medium dense brown silty GRAVEL (GM), mps 1.5 in., no structure, no odor, wet PID = 0.0/0.0 ppm										
	30 42 63 58/5" 25/0"	S7 17	17.0 19.0			SW	Very dense brown well graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, wet PID = 0.0/0.0 ppm	20	20	20	25	10	5				

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
10/1/09	1230		24.0	26.5	12.5
10/2/09	1130		-	20.0	Dry*
		*Initial OW reading			

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 26.5
Rock Cored (ft) -
Samples S9
Boring No. HA09-6(OW)

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-6(OW)
File No. 33528-015
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	30 46 100/5"	S8 14	19.5 20.9			SW	Similar to above Note: Bottom 3.0 in. of sample oxidized with higher silt content noted.	20	20	20	25	10	5				
					42.5 21.5		-GLACIOFLUVIAL DEPOSITS-										
25	14 12 15 15	S9 20	24.5 26.5			ML/ SM	-GLACIOLACUSTRINE DEPOSITS- Medium dense orange brown to gray brown silty SAND (SM) to sandy SILT (ML), mps < 1 mm, stratified, no odor, wet					50	50				
					37.5 26.5		BOTTOM OF EXPLORATION 26.5 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA09-6(OW)

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-7

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 2
Start 2 October 2009
Finish 5 October 2009
Driller M. D'Ambrosio
H&A Rep. D. Warren
Elevation 65.0 (est.)
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Driven to 34.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: PID Malfunctioning

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				64.5		Note: Pre-excavated from 0.0 to 8.0 ft with Vactor.										
				0.5	SM	-BLACK BITUMINOUS ASPHALT-										
						Brown silty SAND with gravel (SM)										
						-FILL-										
5				59.5												
				5.5												
	4 5 5 4	S1 19	8.0 10.0		SM	Medium dense tan silty SAND (SM), mps < 1 mm, stratified, no odor, dry PID = 0.0/0.0 ppm					55	45				
10	6 7 6 5	S2 20	10.0 12.0		SM	Similar to above					55	45				
						-ALLUVIAL DEPOSITS-										
15	1 2 2 5	S3 17	14.5 16.5		ML/ SW	Loose brown SILT (ML) interbedded with occasional seams of well graded SAND with gravel (SW), trace organic soil and roots in occasional thin laminae, mps 1.0 in., stratified, wet	5	5	5	5	5	75				
				48.0												
				17.0		-GLACIOFLUVIAL DEPOSITS-										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
10/5/09	1100		27.0	36.5	22.5

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 36.5
Rock Cored (ft) -
Samples S7
Boring No. HA09-7

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-7
File No. 33528-015
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	16 19 20 17	S4 15	19.5 21.5		SP	Dense brown poorly graded SAND with gravel (SP), mps 0.75 in., no structure, no odor, moist		15	5	60	20					
						-GLACIOFLUVIAL DEPOSITS-										
25	11 11 16 25	S5 9	24.5 26.5		SW	Dense brown well graded SAND with gravel (SW), mps 1.0 in., no structure, no odor, wet	5	10	15	60	10					
30	16 13 13 13	S6 10	29.5 31.5		SW	Similar to above except dense	5	10	20	60	5					
35	21 19 20 25	S7 12	34.5 36.5		SW	Dense brown well graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, wet	10	25	25	30	10					
				28.5 36.5		BOTTOM OF EXPLORATION 36.5 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA09-7

HALEY & ALDRICH — TEST BORING REPORT

Boring No. HA09-8

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 2
Start 12 October 2009
Finish 12 October 2009
Driller M. D'Ambrosio
H&A Rep. D. Warren
Elevation 65.0 (est.)
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Driven to 29.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				64.5		-BLACK BITUMINOUS ASPHALT-										
				0.5	SP-SM	-FILL- PID = 0.0/0.0 ppm										
	16 12 22 37	S1 14	1.0 3.0	63.5 1.5	SP-SM/ML	S1 top 6.0 in.: Brown poorly graded SAND with silt and gravel (SP-SM) S1 bottom: Dense tan poorly graded SAND with silt (SP-SM) grading to orange-brown sandy SILT (ML), mps < 1 mm, stratified, no odor, dry PID = 0.0/0.0 ppm					25	75				
	62 26 19 15	S2 15	3.0 5.0		ML/SW	Dense orange-brown SILT (ML) interbedded with seams of tan well-graded SAND (SW), mps 0.25 in., stratified, dry PID = 0.0/0.0 ppm			5	10	15	70				
5	11 12 11 12	S3 17	5.0 7.0		SM	Medium dense tan silty SAND (SM), mps < 1 mm, stratified, no odor, dry					65	35				
						-ALLUVIAL DEPOSITS-										
10	11 13 32 27	S4 10	9.5 11.5		SM/ML	Similar to above except dense, grading to sandy SILT (ML) in frequent seams Note: Trace coarse gravel in spoon tip. PID = 0.0/0.0 ppm	5				55	45				
				52.5 12.5												
15	26 20 23 21	S5 12	14.5 16.5		SW	Dense brown well-graded SAND (SW), mps 1.0 in., no structure, no odor, moist	5	5	15	55	15	5				
						-GLACIOFLUVIAL DEPOSITS-										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
10/12/09	1100		~21.0	~21.0	Dry*
10/12/09	1110		~17.0	~17.0	Dry*
		*At completion			

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 31.5
Rock Cored (ft) -
Samples S8
Boring No. HA09-8

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\33528\NORMANDY\RIVERSIDE MBTA\015 NEWTON RVRSDE ENV + GEO\FIELD DATA\33528-015_TB.GPJ 29 Oct 09

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-8
File No. 33528-015
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	17 18 24 24	S6 14	19.5 21.5		SW	Similar to above	5	5	20	60	10					
						-GLACIOFLUVIAL DEPOSITS-										
25	8 11 21 19	S7 15	24.5 26.5		SW	Similar to above	5	5	25	60	5					
30	13 17 19 29	S8 14	29.5 31.5		SW	Similar to above										
				33.5 31.5		BOTTOM OF EXPLORATION 31.5 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA09-8

HALEY & ALDRICH — TEST BORING REPORT

Boring No. HA09-9

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 2
Start 9 October 2009
Finish 9 October 2009
Driller M. D'Ambrosio
H&A Rep. D. Palleiko
Elevation 64.0 (est.)
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Driven
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				63.2		-BITUMINOUS CONCRETE PAVING-										
				0.8												
	14 14 14 13	S1 18	1.0 3.0		SP	Medium dense tan poorly graded SAND (SP), mps 0.2 in., no structure, no odor, moist PID = ND ppm				10	85	5				
	13 16 18 24	S2 17	3.0 5.0		SP	Dense tan to black poorly graded SAND (SP), mps 0.4 in., no structure, no odor, moist, bottom 4.0 in. black layer of coal ash, dust, brick in frequent particles and specks PID = ND ppm		10		10	75	5				
5	33 23 18 25	S3 16	5.0 7.0		SM	Dense black silty SAND (SM), mps 1.2 in., no structure, no odor, dry, 70% coal dust, 10% coal ash, 10% slag, 10% brick all in fragments, particles and specks PID = ND ppm		5	5	20	50	20				
	17 55 18 16	S4 5	7.0 9.0		SM	Very dense black silty SAND (SM), mps 0.8 in., no structure, no odor, dry, 100% ash, coal, slag in fragments, particles, and specks PID = ND ppm		5	5	20	50	20				
						-COAL/ASH FILL-										
	3 3 5 15	S5 14	9.0 11.0	54.3	SM	S5 top: Similar to above except loose										
10				9.8	SM	S5 bottom: Medium dense olive-gray silty SAND (SM), mps 0.2 in., single 2-in. layer or organic silt with root hairs, no odor, wet PID = ND ppm		5	5	15	50	25				
						-ALLUVIAL DEPOSITS-										
				49.5												
	5 4 8 7	S6 19	14.5 16.5	14.5	ML	Medium dense olive-gray to gray SILT with sand (ML), mps 0.1 in., occasional interbed of lean clay up to 0.5-in. thick, no odor, wet PID = ND ppm					15	85	R	N	N	
15						-GLACIOLACUSTRINE DEPOSITS-										
				46.2												
				17.8		Note: Occasional gravel 17.8 to 19.5 ft. -GLACIOFLUVIAL DEPOSITS-										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 36.5
Rock Cored (ft) -
Samples S10

Boring No. HA09-9

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-9
File No. 33528-015
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	13 15 17 15	S7 14	19.5 21.5		SM	Dense olive-gray silty SAND (SM), frequent interbeds of sandy silt up to 1.0 in. thick, occasional gravel dropstone, no odor, wet PID = ND ppm		10	10	25	35	20				
						-GLACIOFLUVIAL DEPOSITS- Note: Frequent gravel.										
25	27 24 29 29	S8 10	24.5 26.5		SM	Dense olive-gray silty SAND with gravel (SM), mps 1.2 in., no structure, no odor, wet PID = ND ppm	5	15	20	30	15	15				
30	25 17 17 16	S9 9	29.5 31.5		SM	Dense olive-gray silty SAND with gravel (SM), mps 1.2 in., no structure, no odor, wet PID = ND ppm Note: Frequent cobbles/gravelly from 31.5 to 34.0 ft.	10	15	20	25	15	15				
				30.0 34.0		Note: Stratum change at 34.0 ft.										
35	15 6 6 5	S10 16	34.5 36.5		SM	Medium dense olive-gray SILT (ML), mps 0.1 in., frequent varve-like structures, no odor, wet PID = ND ppm					5	95	R	N	L	
				26.0 38.0		-GLACIOLACUSTRINE DEPOSITS- Note: Stratum change at 38.0 ft.										
	13 17 17 17	S11 10	39.5 41.5		SP-SM	-GLACIOFLUVIAL DEPOSITS- Dense gray poorly graded SAND with silt (SP-SM), mps 0.05 in., coursing-up sequence, no odor, wet PID = ND ppm				30	60	10				
				22.5 41.5		BOTTOM OF EXPLORATION 41.5 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA09-9

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-10

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 3
Start 29 September 2009
Finish 1 October 2009
Driller M. D'Ambrosio
H&A Rep. D. Warren
Elevation 60.0 (est.)
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Driven to 25.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				59.5		-BLACK BITUMINOUS ASPHALT-										
				0.5												
	11 18 28 15	S1 15	1.0 3.0		SM	Dense light brown silty SAND with gravel (SM), mps 1.5 in., no structure, no odor, dry	5	10	5	10	55	15				
	13 9 11 8	S2 12	3.0 5.0		SM	Similar to above except medium dense with trace glass fragments	5	5	5	10	50	25				
						-FILL-										
5	10 7 8 8	S3 9	5.0 7.0		SM	Similar to above except no glass fragments	5	5	5	10	55	20				
	6 6 8 5	S4 12	7.0 9.0		SP-SM	Medium dense brown poorly graded SAND with silt and gravel (SP-SM), mps 1.5 in., no structure, no odor, dry	5	10	5	10	60	10				
10	8 10 12 9	S5 3	9.5 11.5		SW	Medium dense brown well graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, wet Note: Poor recovery due to spoon pushing coarse gravel.	5	10	20	50	15					
	14 10	S6 10	11.5 12.5		SW	Similar to above	5	15	25	40	15					
				47.5												
	8 23	S6A 8	12.5 13.5	12.5	SM	Dense gray silty SAND (SM), mps < 1 mm, no structure, no odor, wet					60	40				
						-ALLUVIAL DEPOSITS-										
				46.0												
				14.0												
15	9 8 8 8	S7 19	14.5 16.5		ML	Medium dense gray SILT (ML), mps < 1 mm, trace coarse gravel, weakly stratified, wet	5					95				
						-GLACIOLACUSTRINE DEPOSITS-										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
9/29/09	1345		25.0	54.5	14.8
9/29/09	1415		12.0	approx. 25.0 ft	12.5

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 56.5
Rock Cored (ft) -
Samples S15

Boring No. HA09-10

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-10
File No. 33528-015
Sheet No. 2 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	1 2 2 2	S8 20	19.5 21.5		ML	Loose gray SILT (ML), mps < 1 mm, stratified, no odor, wet						100				
						-GLACIOLACUSTRINE DEPOSITS-										
25	1 4 6 6	S9 20	24.5 26.5		ML	Similar to above except trace fine sand in occasional partings					5	95				
30	WOR/12" 2 2	S10 24	29.5 31.5		ML	Similar to above except very loose WOR = Weight of Rods										
35	WOR 2 2 3	S11 9	34.5 36.5		ML	Loose gray SILT with sand (ML), mps < 1 mm, no structure, no odor, wet					15	85				
40	3 3 4 7	S12 18	39.5 41.5		ML	Loose gray sandy SILT (ML), mps < 1 mm, no structure, no odor, wet					30	70				
45	6 8 8 10	S13 16	44.5 46.5		ML	Medium dense gray SILT (ML), trace fine sand in occasional partings, mps < 1 mm, stratified, no odor, wet					5	95				

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-10
File No. 33528-015
Sheet No. 3 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
50	15 15 7 6	S14 14	49.5 51.5		ML/ SM	Medium dense gray sandy SILT (ML) interbedded with silty SAND (SM), mps < 1 mm, no structure, no odor, wet -GLACIOFLUVIAL DEPOSITS-					40	60				
				8.0 52.0		Note: Drill action indicates sand and gravel from approximately 52.0 to 53.0 ft.										
				7.0 53.0		-GLACIOFLUVIAL DEPOSITS-										
55	16 15 17 20	S15 15	54.5 56.5		SM	Dense tan silty SAND (SM), mps <1 mm, no structure, no odor, wet -GLACIOLACUSTRINE DEPOSITS-					65	35				
				3.5 56.5		BOTTOM OF EXPLORATION 56.5 FT Note: Moved rig 3.0 ft west and installed observation well at 18.0 ft in unsampled borehole.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA09-10

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-11

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 2
Start 1 October 2009
Finish 2 October 2009
Driller M. D'Ambrosio
H&A Rep. D. Warren
Elevation 65.0 (est.)
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Driven to 39.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	4 8 10 10	S1 14	0.0 2.0	64.5 0.5	OL/ OH	S1 top 6.0 in.: Soft brown sandy ORGANIC SOIL (OL/OH), mps <1 mm, no structure, no odor, dry PID = 0.0/0.0 ppm -TOPSOIL-					20	80				
	14 12 13 12	S2 15	2.0 4.0		SM SP- SM	S1 bottom 8.0 in.: Medium dense brown silty SAND with gravel (SM), mps 1.0 in., no structure, no odor, dry S2: Medium dense tan poorly graded SAND with silt and gravel (SP-SM), mps 0.5 in., no structure, no odor, dry PID = 0.0/0.0 ppm	5	5 15	5	15 5	25 70	25 10				
5	11 11 8 6	S3 16	4.0 6.0		SP- SM	Similar to above except mps 1.5 in. PID = 0.0/0.0 ppm -FILL-	5	10		5	70	10				
	13 15 8 9	S4 12	6.0 8.0		ML	Medium dense orange brown-tan sandy SILT (ML), trace roots PID = 0.0/0.0 ppm				20	80					
	33 165	S5 8	8.0 9.0	56.0 9.0	ML ML	S5 top 4.0 in.: Similar to above except dense S5 bottom 4.0 in.: Very dense light gray decomposed CONCRETE Note: Drilled through probable concrete block from approximately 8.5 to 9.0 ft.				20	80					
10																
	11 15 13 34	S6 9	12.0 14.0		SP	Medium dense brown poorly graded SAND (SP), mps 0.5 in., no structure, no odor, moist		5	5	60	25	5				
	20 18 19 24	S7 15	14.0 16.0		SP	Similar to above except dense with distinct stratification		5	5	60	30					
15						-GLACIOFLUVIAL DEPOSITS-										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
10/2/09	1100		27.0	30.0	21.5

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 41.0
Rock Cored (ft) -
Samples S12

Boring No. HA09-11

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-11
File No. 33528-015
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	14 13 20 20	S8 18	19.0 21.0		SW	Dense brown well graded SAND (SW), mps 0.25 in., no structure, no odor, wet			20	60	20					
						-GLACIOFLUVIAL DEPOSITS-										
				42.5 22.5												
25	7 13 10 11	S9 12	24.0 26.0		SP	Medium dense orange brown poorly graded SAND (SP), mps <1 mm, no structure, no odor, wet			35	60	5					
						-GLACIOLACUSTRINE DEPOSITS-										
30	10 11 12 11	S10 15	29.0 31.0		SP	Similar to above										
35	10 11 15 15	S11 18	34.0 36.0		SP	Medium dense orange brown poorly graded SAND (SP), mps <1 mm, no structure, no odor, wet					95	5				
40	15 22 25 19	S12 14	39.0 41.0		SP-SM/SW	Dense brown poorly graded SAND with silt (SP-SM) interbedded with occasional thin seams of well graded SAND (SW), mps 0.25 in., no structure, no odor, wet			5	10	35	40	10			
				24.0 41.0		BOTTOM OF EXPLORATION 41.0 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA09-11

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-12

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 3
Start 28 September 2009
Finish 29 September 2009
Driller M. D'Ambrosio
H&A Rep. D. Warren
Elevation 65.0 (est.)
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Driven to 45.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				64.3		-BLACK BITUMINOUS ASPHALT-										
				0.7												
	30 43 62 42	S1 18	1.0 3.0		SM	Very dense brown silty SAND with gravel S(M), mps 1.5 in., no structure, no odor, dry, grace concrete, asphalt fragments PID = 0.0/0.0 ppm	10	10	10	10	30	30				
	30 49 36 26	S2 19	3.0 5.0		SP-SM	Very dense light brown poorly graded SAND with silt and gravel (SP-SM), mps 1.5 in., no structure, no odor, dry PID = 0.0/0.0 ppm	5	10	5	5	65	10				
						-FILL-										
5	14 7 8 7	S3 16	5.0 7.0	59.5		Note: Faint petroleum(?) odor and possible staining noted from 4.5 to 5.0 ft.										
				5.5	SM	Medium dense light gray silty SAND (SM), mps <1 mm, stratified, no odor, moist PID = 0.0/0.0 ppm					55	45				
	8 6	S4 7	7.0 8.0		SM	Similar to above except with trace organic soil					55	45				
				57.0		-ALLUVIAL DEPOSITS-										
	7 4	S4A 8	8.0 9.0	8.0		Stiff brown sandy ORGANIC SOIL, trace roots, peat fibers PID = 0.0/0.0 ppm					20	80				
						-ORGANIC DEPOSITS-										
10	2 3 5 6	S5 16	9.5 11.5	55.0 10.0		S5 top 3.0 in.: Similar to above except very soft PID = 0.0/0.0 ppm					20	80				
					ML/CL	S5 bottom 13.0 in.: Loose tan SILT (ML) interbedded with very thin laminae of lean CLAY (CL), mps <1 mm, laminated, wet						100				
						-GLACIOLACUSTRINE DEPOSITS-										
15	9 7 12 12	S6 16	14.5 16.5		ML/CL-SW	Similar to above except medium dense interbedded with seams of well graded SAND with gravel (SW)		5	5	5	10	75				

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
9/29/09	0710		45.0	51.5	22.75

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 51.5
Rock Cored (ft) -
Samples S13

Boring No. HA09-12

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-12
File No. 33528-015
Sheet No. 2 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	9 10 11 10	S7 18	19.5 21.5		ML/ SM	Medium dense tan SILT (ML) interbedded with very thin clay laminae and seams of silty SAND (SM), mps <1 mm, laminated, no odor, wet					15	85				
						-GLACIOLACUSTRINE DEPOSITS-										
25	10 8 9 14	S8 14	24.5 26.5		ML	Medium dense tan sandy SILT (ML), mps <1 mm, laminated, wet					20	80				
				37.0 28.0												
30	17 13 10 10	S9 10	29.5 31.5		SP- SM	Medium dense brown poorly graded SAND (SP-SM), mps <1 mm, no structure, no odor, wet					90	10				
						-GLACIOLACUSTRINE DEPOSITS-										
35	55 21 26 28	S10 14	34.5 36.5		SP- SM	Dense brown poorly graded SAND (SP) interbedded with occasional seams of silty SAND (SM), mps 2 mm, weakly stratified, wet Note: Spoon pushing cobble.				40	45	15				
40	13 10 11 10	S11 17	39.5 41.5		SP- SM	Medium dense brown poorly graded SAND with silt (SP-SM)					90	10				
45	10 12 15 16	S12 15	44.5 46.5		SM/ ML	Medium dense brown silty SAND (SM) interbedded with sandy SILT (ML), mps <1 mm, no structure, no odor, wet					60	40				

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA09-12

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-12
File No. 33528-015
Sheet No. 3 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
50	16 21 19 18	S13 17	49.5 51.5	13.5 51.5	SP	Dense brown poorly graded SAND (SP), mps < 1 mm, weakly stratified, wet -GLACIOLACUSTRINE DEPOSITS- BOTTOM OF EXPLORATION 51.5 FT				30	65	5				

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA09-12

TEST BORING REPORT

Boring No. HA09-13 (OW)

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 2
Start 12 October 2009
Finish 12 October 2009
Driller M. D'Ambrosio
H&A Rep. D. Warren
Elevation 61.0 (est.)
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Driven to 24.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					60.5		-BLACK BITUMINOUS ASPHALT-										
					0.5												
	14 15 15 13	S1 17	1.0 3.0			SP-SM	Medium dense brown poorly graded SAND with silt and gravel (SP-SM), mps 1.5 in., no structure, no odor, dry PID = 0.0/0.0 ppm	5	10	5	40	30	10				
	16 15 15 13	S2 20	3.0 5.0			SM	Medium dense black silty SAND (SM) intermixed with cinders, ash, and coal dust, mps 1.5 in., no structure, cinder odor, dry, trace brick and wood fragments PID = 0.0/0.0 ppm	5	5	5	20	30	35				
5	10 10 10 13	S3 15	5.0 7.0			SM	Medium dense olive-gray to black silty SAND (SM), mps 0.25 in., no structure, cinder odor, dry, trace brick fragments PID = 0.0/0.0 ppm			5	20	50	25				
	19 20 26 16	S4 14	7.0 9.0			SM	Similar to above except dense PID = 0.0/0.0 ppm	5	5	5	20	30	35				
							-FILL-										
10	12 11 11 12	S5 12	9.5 11.5			SW-SM	Medium dense black well-graded SAND with silt and gravel (SW-SM), mps 1.0 in., no structure, moderate petroleum-like odor, wet PID = 0.0/10.5 ppm	10	10	20	30	20	10				
	3 3 2 5	S6 12	11.5 13.5				Similar to above except with decreased petroleum-like odor PID = 0.0/4.0 ppm	10	10	20	30	20	10				
					47.0												
					14.0		-ORGANIC DEPOSITS-										
15	2 1 3 4	S7 18	14.5 16.5			PT	S7 top 7.0 in.: Very soft brown fibrous PEAT, mps < 1 mm, no structure, organic odor, wet PID = 0.0/0.0 ppm						100				
					45.5 15.5	OL/OH	S7 bottom 9.0 in.: Medium stiff gray-brown ORGANIC SOIL (OL/OH), mps < 1 mm, no structure, organic odor, wet, trace peat fibers						100				
							-ORGANIC DEPOSITS-										
					42.5 18.5		-GLACIOLACUSTRINE DEPOSITS-										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
10/12/09					

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 26.5
Rock Cored (ft) -
Samples S9

Boring No. HA09-13 (OW)

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-13 (OW)
File No. 33528-015
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	2 2 5 6	S8 12	19.5 21.5			ML	Loose gray SILT (ML), mps <1 mm, no structure, no odor, wet PID = 0.0/0.0 ppm						100				
							-GLACIOLACUSTRINE DEPOSITS-										
25	1 1 1 1	S9 18	24.5 26.5			ML	Similar to above except very loose PID = 0.0/0.0 ppm						100				
					34.5 26.5		BOTTOM OF EXPLORATION 26.5 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA09-13 (OW)

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-14 (OW)

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 2
Start 2 October 2009
Finish 6 October 2009
Driller M. D'Ambrosio
H&A Rep. D. Warren
Elevation 64.0 (est.)
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Driven to 34.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					63.5		Note: Pre-excavated from 0.0 to 6.0 ft with Vactor.										
					0.5	SW-SM	-BLACK BITUMINOUS ASPHALT- Brown well graded SAND with silt and gravel (SW-SM) -FILL-										
					62.5 1.5	GW	Note: Well graded GRAVEL (GW) noted in open borehole from 1.5 to 6.0 ft. Hole continuously collapsing.										
5	19 18 22 27	S1 1	6.0 8.0			GW	One piece coarse GRAVEL (GW) PID = 0.0/0.0 ppm	100									
	8 11 11 14 15	S2 7	8.0 10.5			SW	Medium dense brown well graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, wet PID = 0.0/0.0 ppm	10	20	30	35	5					
10							-GLACIOFLUVIAL DEPOSITS-										
15	10 9 10 10	S3 5	14.5 16.5			SW	Similar to above	10	25	30	35						

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
10/6/09	0715		29.0	29.5	16.5
10/6/09	1515	*Initial OW reading	-	33.0	20.6*

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 34.7
Rock Cored (ft) -
Samples S7

Boring No. HA09-14 (OW)

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 HA-LIB07-1-BOS.GLB HA-TB+CORE+WELL-07-1.GDT G:\33528\NORMANDY\RIVERSIDE MBTA\015 NEWTON RVRSDE ENV + GEO\FIELD DATA\33528-015_TB.GPJ 29 Oct 09

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-14 (OW)
File No. 33528-015
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test: Dilatancy	Field Test: Toughness	Field Test: Plasticity	Field Test: Strength
20	5 7 11 13	S4 8	19.5 21.5			SW	Similar to above	10	25	30	35						
							-GLACIOFLUVIAL DEPOSITS-										
25	6 6 9 13	S5 6	24.5 26.5			SW/ ML	Similar to above with occasional seams of orange brown sandy SILT (ML), mps 1.5, no structure, no odor, wet	5	15	20	30	15	15				
30	8 9 17 37	S6 10	29.5 31.5			SM/ ML	Similar to above	5	15	20	30	15	15				
					31.0		TOP OF PROBABLE BEDROCK 33.0 FT										
					33.0		-PROBABLE BEDROCK-										
	120/3"	S7 3	34.5 34.7		29.3 34.7	SM	Very dense light gray silty SAND with gravel (SM), mps 1.5 in., distinct friable rock fabric, wet Note: Sample consists of probable decomposed bedrock.	5	10	10	20	25	30				
							BOTTOM OF EXPLORATION 34.7 FT Note: Groundwater observation well installed at 33.0 ft.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA09-14 (OW)

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-15

Project RIVERSIDE MBTA DEVELOPMENT, NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.

File No. 33528-015
Sheet No. 1 of 2
Start 6 October 2009
Finish 6 October 2009
Driller M. D'Ambrosio
H&A Rep. D. Warren
Elevation 64.0 (est.)
Datum NAVD
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	-	Rig Make & Model: B-57 Mobile Drill
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Driven to 29.0 ft
				Hoist/Hammer: Winch Safety Hammer
				PID Make & Model: MiniRAE 2000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				63.5		-BLACK BITUMINOUS ASPHALT-										
				0.5												
	15 9 10 12	S1 17	1.0 3.0		ML	Medium dense brown sandy SILT with gravel (ML), trace concrete, brick fragments, mps 1.5 in., no structure, no odor, dry PID = 0.0/0.0 ppm	5	10	5	10	20	50				
	8 6 8 7	S2 14	3.0 5.0		SM	Medium dense brown silty SAND (SM), trace fine gravel, mps 0.5 in., no structure, no odor, moist Note: Brick fragments noted in wash at approximately 3.0 ft. PID = 0.0/0.0 ppm		5		10	45	40				
5	1/12" 3 8	S3 15	5.0 7.0		SM	Loose mottled gray-brown silty SAND (SM), mps <1 mm, no structure, no odor, moist, trace brick fragments, cinders Note: 6-in. wood fragment lodged in spoon tip. PID = 0.0/0.0 ppm				10	45	45				
	7 100	S4 4	7.0 8.0			One, 4-in. wood fragment										
	6 9 9 11	S5 9	9.0 11.0			Similar to above with trace organic silt noted on spoon tip -FILL-										
10				53.0 11.0		Note: Drill action indicates borehole advanced alongside edge of wood timber or sheeting structure from approximately 6.0 to 12.0 ft. -ORGANIC DEPOSITS-										
	3 6	S6 8	14.5 15.5		OL/ OH	Stiff black sandy ORGANIC SOIL (OL/OH), trace wood fragments, mps 0.25 in., no structure, organic odor, wet			5	10	10	75				
15				48.5 15.5												
	11 18	S6A 9	15.5 16.5		SP	Medium dense gray poorly graded SAND (SP), trace fine gravel, mps 0.5 in., no structure, no odor, dry -GLACIOFLUVIAL DEPOSITS-		5	5	70	20					

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
10/6/09	1345		29.0	36.5	18.0

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 36.5
Rock Cored (ft) -
Samples S10

Boring No. HA09-15

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. HA09-15
File No. 33528-015
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	25 27 17 16	S7 7*	19.5 21.5		SW	Dense brown well graded SAND (SW), mps 1.0 in., no structure, no odor, wet *No initial recovery. Spoon pushing cobble/gravel. Re-drove spoon to obtain sample. Blow counts possibly elevated.	5	5	35	45	10					
						-GLACIOFLUVIAL DEPOSITS-										
25	18 18 23 21	S8 10*	24.5 26.5		SW	Similar to above										
				37.0 27.0		-GLACIOLACUSTRINE DEPOSITS-										
30	8 11 11 16	S9 10	29.5 31.5		SM	Medium dense brown silty SAND (SM), mps < 1 mm, stratified, no odor, wet				10	70	20				
						Note: Drill action indicates occasional gravel seams.										
				30.0 34.0												
35	19 19 18 19	S10 18	34.5 36.5		SP	Dense orange brown poorly graded SAND (SP), mps 0.5 in., no structure, no odor, wet			15	70	10	5				
						-GLACIOLACUSTRINE DEPOSITS-										
				27.5 36.5		BOTTOM OF EXPLORATION 36.5 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA09-15

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. HA09-6(OW)
Boring No. HA09-6(OW)

Project RIVERSIDE MBTA DEVELOPMENT
Location NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.
Driller M. D'Ambrosio

Initial Water Level (depth bgs) 12.5 ft

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 33528-015
Date Installed 1 Oct 2009
H&A Rep. D. Warren
Location See Plan

Ground El. 64.0 (est.)
Datum NAVD

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	64.0
ASPHALT	0.5			0.8	63.3
				2.0	62.0
FILL	13.0			5.0	59.0
				8.0	56.0
				10.0	54.0
GLACIOFLUVIAL DEPOSITS	21.5			20.0	44.0
GLACIOLACUSTRINE DEPOSITS	26.5			26.5	37.5

WELL CONSTRUCTION DETAILS

Type of protective cover: Compression Cover
Depth of Roadway Box below ground surface: 0.0 ft
Depth of top of riser below ground surface: 0.3 ft
Type of protective casing: Roadway Box
- Length: 1.0 ft
- Inside diameter: 6.0 in.
- Depth of bottom of Roadway Box: 1.0 ft

Type of riser pipe: Schedule 40 PVC
- Inside diameter of riser pipe: 2.0 in.
- Depth of bottom of riser pipe: 10.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	0.8
Bentonite	5.0	3.0
	-	-

Diameter of borehole: 4.5 in.
Depth to top of well screen: 10.0 ft
Type of screen: Machine slotted Sch 40 PVC
Screen gauge or size of openings: 0.010 in.
Diameter of screen: 2.0 in.
Type of Backfill around Screen: Filter Sand
Depth to bottom of well screen: 20.0 ft
Bottom of silt trap: -
Depth of bottom of borehole: 26.5 ft

COMMENTS: Hole collapsed from 20.0 to 26.5 ft.

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. HA09-10 (OW)
Boring No. HA09-10 (OW)

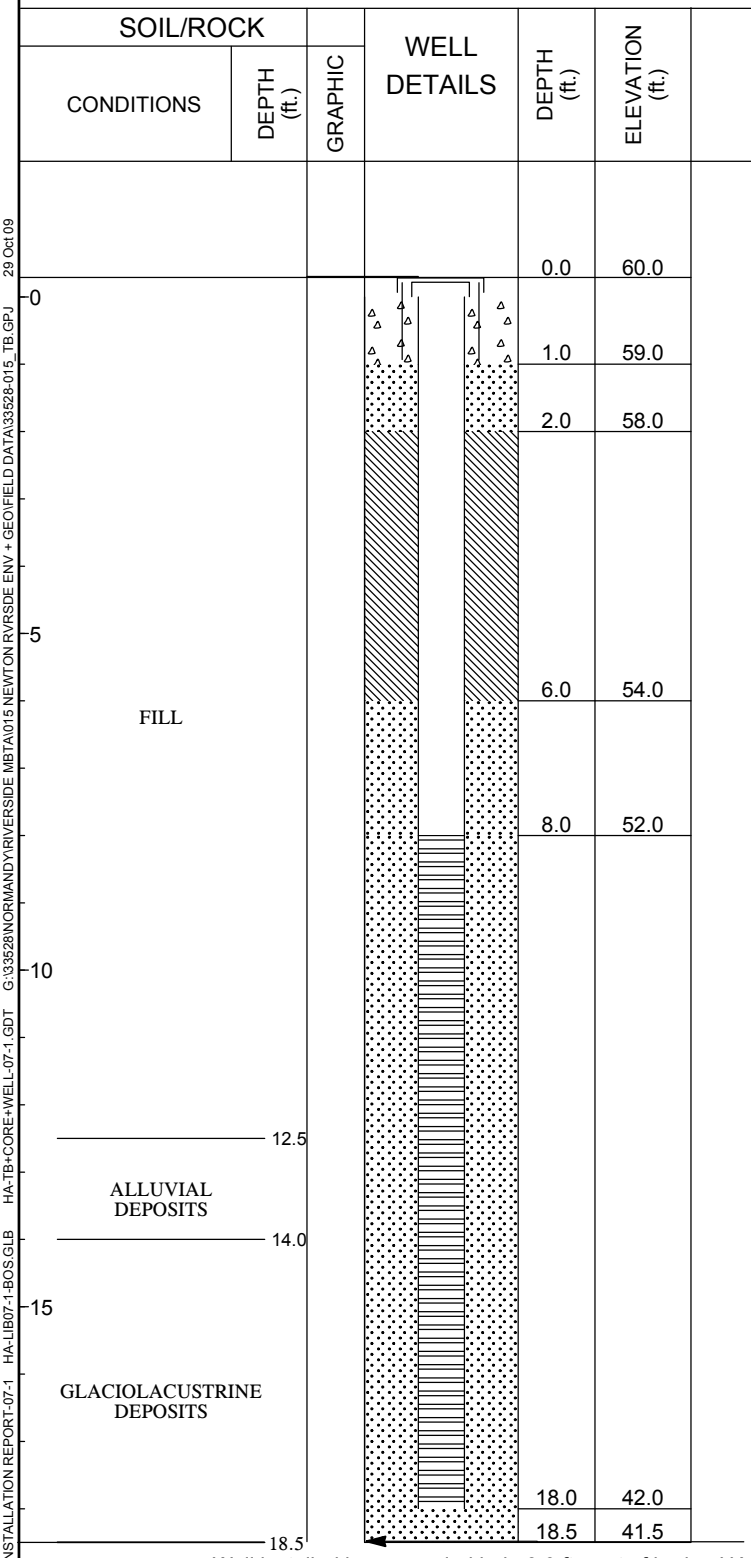
Project RIVERSIDE MBTA DEVELOPMENT
Location NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.
Driller M. D'Ambrosio

Initial Water Level (depth bgs) ft

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 33528-015
Date Installed 1 Oct 2009
H&A Rep. D. Warren
Location See Plan

Ground El. 60.0 (est.)
Datum NAVD



WELL CONSTRUCTION DETAILS

Type of protective cover: Compression Cover
Depth of Roadway Box below ground surface: 0.0 ft
Depth of top of riser below ground surface: 0.3 ft
Type of protective casing: Roadway Box
- Length: 1.0 ft
- Inside diameter: 6.0 in.
- Depth of bottom of Roadway Box: 1.0 ft

Type of riser pipe: Schedule 40 PVC
- Inside diameter of riser pipe: 2.0 in.
- Depth of bottom of riser pipe: 8.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	1.0
Bentonite	2.0	4.0
	-	-

Diameter of borehole: 4.5 in.
Depth to top of well screen: 8.0 ft
- Type of screen: Machine slotted Sch 40 PVC
- Screen gauge or size of openings: 0.010 in.
- Diameter of screen: 2.0 in.
- Type of Backfill around Screen: Filter Sand
- Depth to bottom of well screen: 18.0 ft

Bottom of silt trap: -
Depth of bottom of borehole: 18.5 ft

COMMENTS: Well installed in unsampled hole 3.0 ft west of boring HA09-10.

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. HA09-13 (OW)
Boring No. HA09-13 (OW)

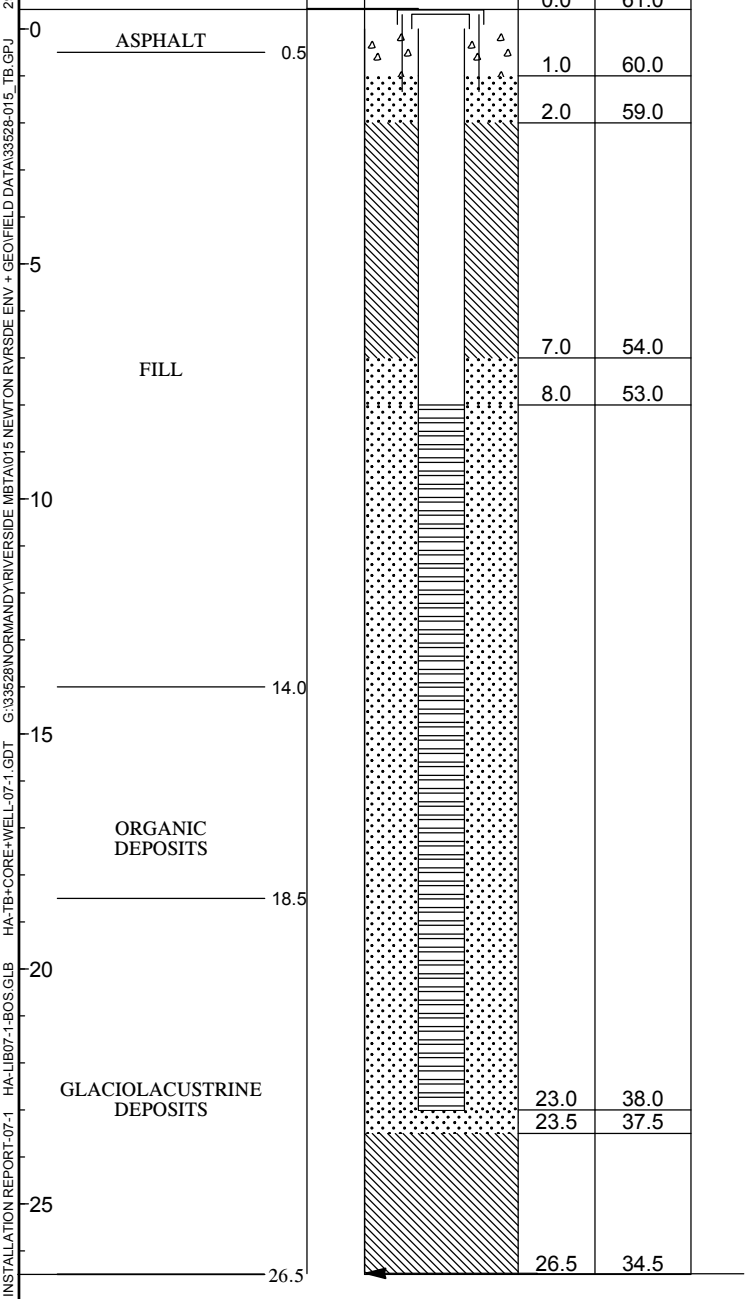
Project RIVERSIDE MBTA DEVELOPMENT
Location NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.
Driller M. D'Ambrosio

Initial Water Level (depth bgs) ft

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 33528-015
Date Installed 12 Oct 2009
H&A Rep. D. Warren
Location See Plan

Ground El. 61.0 (est.)
Datum NAVD



WELL CONSTRUCTION DETAILS

Type of protective cover: Roadway Box
Depth of Roadway Box below ground surface: 1.0 ft
Depth of top of riser below ground surface: 0.3 ft
Type of protective casing: Roadway Box
- Length: 1.0 ft
- Inside diameter: 6.0 in.
- Depth of bottom of Roadway Box: 2.0 ft

Type of riser pipe: Schedule 40 PVC
- Inside diameter of riser pipe: 2.0 in.
- Depth of bottom of riser pipe: 8.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	1.0
Bentonite	2.0	5.0
	-	-

Diameter of borehole: 4.5 in.
Depth to top of well screen: 8.0 ft
- Type of screen: Machine slotted Sch 40 PVC
- Screen gauge or size of openings: 0.010 in.
- Diameter of screen: 2.0 in.
- Type of Backfill around Screen: Filter Sand
- Depth to bottom of well screen: 23.0 ft

Bottom of silt trap: -
Depth of bottom of borehole: 26.5 ft

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. HA09-14 (OW)
Boring No. HA09-14 (OW)

Project RIVERSIDE MBTA DEVELOPMENT
Location NEWTON, MA
Client BH NORMANDY RIVERSIDE LLC
Contractor NEW HAMPSHIRE BORING, INC.
Driller M. D'Ambrosio

Initial Water Level (depth bgs) 16.5 ft

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 33528-015
Date Installed 6 Oct 2009
H&A Rep. D. Warren
Location See Plan

Ground El. 64.0 (est.)
Datum NAVD

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	64.0
ASPHALT					
FILL	0.5			1.0	63.0
	1.5			1.5	62.5
				13.0	51.0
GLACIOFLUVIAL DEPOSITS				16.0	48.0
				18.0	46.0
	33.0			33.0	31.0
				33.5	30.5
PROBABLE BEDROCK	34.7			34.7	29.3

WELL CONSTRUCTION DETAILS

Type of protective cover	Compression Cover
Depth of Roadway Box below ground surface	0.0 ft
Depth of top of riser below ground surface	0.3 ft
Type of protective casing	Roadway Box
Length	1.0 ft
Inside diameter	2.0 in.
Depth of bottom of Roadway Box	1.0 ft
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	18.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	1.0
Bentonite	13.0	3.0
Bentonite	33.5	1.2

Diameter of borehole	4.5 in.
Depth to top of well screen	18.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	Filter Sand
Depth to bottom of well screen	33.0 ft
Bottom of silt trap	-
Depth of bottom of borehole	34.7 ft

COMMENTS: Hole collapsed from 1.5 to 13.0 ft.

ATTACHMENT C

SANBORN HEAD TEST BORING LOGS

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Monitoring Well SH-101

Ground Elevation: 90.2 feet
TOC Elevation: 90.2 feet
PVC Elevation: 89.9 feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4" Drive and Wash

Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Northern Drill Services, Inc.

Foreman: J. Bierholme

Date Started: 09/26/19 **Date Finished: 09/26/19**

Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/26/19	---	45.5'	Ground Surface	44'	46'	None
10/08/19	---	37.91'	Top of PVC	Well Installed	49'	12 Days

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Stratum: Description	Geologic Description	Well Diagram	Well Description
0	S-1	0 - 2	4 8 20 12	24/19	PID: ND PID: ND		-----0'----- TOPSOIL -----1'-----	S-1A (0 to 1'): Medium dense, brown, fine to coarse SAND, little Gravel, little Silt, common Root fragments. Moist. TOPSOIL.		2" Dia. Sch. 40 PVC Riser (0.3 to 39')
2	S-2	2 - 4	3 4 5 5	24/8	PID: ND		FILL	S-1B (1 to 2'): Medium dense, tan/gray, fine to coarse SAND, some Gravel, trace Silt. Moist. FILL. S-2 (2 to 4'): Loose, brown, fine to coarse SAND, some Gravel, trace Silt, very few Asphalt pieces. Moist. FILL. Asphalt layer observed from 2-2.3 feet.		
4	S-3	4 - 6	12 11 27 100	24/16	PID: ND PID: ND		-----4.8'-----	S-3A (4 to 4.8'): Dense, dark brown, fine to coarse SAND, some Gravel, little Silt, very few Organic fragments. Moist. FILL. S-3B (4.8 to 6'): Dense, tan, fine to coarse SAND, some Gravel, trace Silt. Moist.		
8	S-4	9 - 11	5 6 5 5	24/10	PID: N/A			S-4 (9 to 11'): Medium dense, tan, fine to coarse SAND, little Gravel, trace Silt. Moist.		
14	S-5	14 - 16	2 1 2 2	24/8	PID: ND		SAND	S-5 (14 to 16'): Very loose, brown, fine to coarse SAND, some Gravel, trace Silt. Moist.		Cuttings (0.8 to 35')
18	S-6	19 - 21	2 2 2 3	24/0	PID: ND			S-6 (19 to 21'): Loose, No Recovery.		
24	S-7	24 - 26	2 3 3 3	24/8	PID: ND			S-7 (24 to 26'): Loose, brown, fine to coarse SAND, some Gravel, trace Silt. Moist.		

BORING LOG \\WESSER\V2\SHDATA\4500S\4575.00\WORK\LOGS\4575.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 11/8/19

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Monitoring Well SH-101

Ground Elevation: 90.2 feet
TOC Elevation: 90.2 feet
PVC Elevation: 89.9 feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4" Drive and Wash

Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Northern Drill Services, Inc.

Foreman: J. Bierholme

Date Started: 09/26/19 **Date Finished: 09/26/19**

Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/26/19	---	45.5'	Ground Surface	44'	46'	None
10/08/19	---	37.91'	Top of PVC	Well Installed	49'	12 Days

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Well Diagram	Well Description
30	S-8	29 - 31	15 14 13 15	24/12	PID: ND			S-8 (29 to 31'): Medium dense, tan, fine to coarse SAND, trace Gravel, trace Silt. Moist.		
34	S-9	34 - 36	11 12 11 14	24/13	PID: ND			S-9 (34 to 36'): Medium dense, tan, fine to coarse SAND, trace Gravel, little Silt. Moist.		Bentonite Chips (35 to 37')
40	S-10	39 - 41	8 11 13 13	24/14	PID: ND		SAND	S-10 (39 to 41'): Medium dense, tan, fine to coarse SAND, trace Silt, trace Gravel. Stratified. Moist.		Well Sand (37 to 49')
44	S-11	44 - 46	9 12 12 11	24/15	PID: ND			S-11 (44 to 46'): Medium dense, tan, fine to coarse SAND, trace Silt, trace Gravel. Moist to wet.		2" Dia. Sch. 40 PVC Well Screen (0.010" Slots) (39 to 49')
48							-----49'-----	Boring terminated at 49 feet. No refusal encountered.		

NOTES:

1. Soil samples were screened for volatile organic compounds (VOCs) using a MiniRAE 3000 Photoionization Detector (PID) with a 10.6 eV lamp, calibrated to a 100 parts per million by volume (ppmv) isobutylene-in-air standard using a response factor of 1.0. Results are presented in ppmv; the typical detection limit is 1 ppmv. ND indicates not detected. NA indicates not available. The PID measures relative levels of VOCs. Although PID screening cannot be used directly to quantify VOC concentrations or identify individual compounds, the results can serve as a relative indicator for the presence of VOCs.

BORING LOG \\WESSERV2\SHDATA\4500S\4575.00\WORK\LOGS\4575.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 11/8/19

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Boring SH-102

Ground Elevation: 98.5 ± feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4" Drive and Wash

Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Northern Drill Services, Inc.

Foreman: J. Bierholme

Date Started: 09/25/19 **Date Finished: 09/26/19**

Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/26/19	07:20	No Groundwater Encountered		29'	31'	~14 Hours

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0	S-1	0 - 2	1 7 13 14	24/22	PID: ND PID: ND		-----0'----- TOPSOIL -----0.5'-----	S-1A (0 to 0.6'): Medium dense, dark brown, fine to coarse SAND, some Silt, trace Gravel, frequent Grass Root fibers. Moist. TOPSOIL.	
2	S-2	2 - 4	15 19 18 8	24/16				S-1B (0.6 to 2'): Medium dense, brown, fine to coarse SAND, some Gravel, trace Silt, very few Asphalt pieces, very few Ash particles. Moist. FILL. S-2 (2 to 4'): Dense, brown to black, fine to coarse SAND, some Gravel, trace Silt, few Asphalt pieces. Moist. FILL. Asphalt layer observed from 3.7-4 feet.	
4	S-3	4 - 6	5 3 3 5	24/3	PID: ND		FILL	S-3 (4 to 6'): Loose, tan, fine to coarse SAND and Gravel, trace Silt. Moist. FILL.	
6	S-4	6 - 8	7 5 5 6	24/15	PID: ND PID: ND		-----7'-----	S-4A (6 to 7'): Medium dense, dark brown, fine to coarse SAND and Gravel, trace Silt. Moist. FILL. S-4B (7 to 8'): Medium dense, tan, fine to coarse SAND, little Gravel, trace Silt. Moist.	
8									
10	S-5	9 - 11	5 6 6 5	24/11	PID: ND			S-5 (9 to 11'): Medium dense, tan, fine to coarse SAND, some Gravel, trace Silt. Moist.	
12									
14	S-6	14 - 16	5 5 5 5	24/11				S-6 (14 to 16'): Medium dense, tan, fine to coarse SAND, some Gravel, trace Silt. Moist.	
16									
18							SAND		
20	S-7	19 - 21	11 15 14 13	24/0	PID: ND			S-7 (19 to 21'): Medium dense, No Recovery.	
22									
24	S-8	24 - 26	13 12 12 9	24/0	PID: ND			S-8 (24 to 26'): Medium dense, gray/tan, fine to coarse SAND, some Gravel, trace Silt. Moist.	Drove 3-inch spoon for soil recovery.
26									
28									

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Boring SH-102

Ground Elevation: 98.5 ± feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4" Drive and Wash
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/25/19 **Date Finished: 09/26/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/26/19	07:20	No Groundwater Encountered		29'	31'	~14 Hours

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
30	S-9	29 - 31	10 16 16 13	24/10	PID: ND			S-9 (29 to 31'): Dense, tan, fine to coarse SAND, some Gravel, trace Silt. Moist.	
34	S-10	34 - 36	14 15 15 14	24/13	PID: ND			S-10 (34 to 36'): Dense, tan, fine to coarse SAND, trace Gravel, trace Silt. Moist.	
38							SAND		
40	S-11	39 - 41	12 16 16 17	24/12	PID: ND			S-11 (39 to 41'): Dense, tan, fine to coarse SAND, trace Gravel, trace Silt. Moist.	
44	S-12	44 - 46	14 13 16 17	24/14	PID: ND			S-12 (44 to 46'): Medium dense, tan, fine to coarse SAND, trace Silt, trace Gravel. Moist.	
46							-----46'-----	Boring terminated at 46 feet. No refusal encountered.	
48								NOTES:	
50								1. Soil samples were screened for volatile organic compounds (VOCs) using a MiniRAE 3000 Photoionization Detector (PID) with a 10.6 eV lamp, calibrated to a 100 parts per million by volume (ppmv) isobutylene-in-air standard using a response factor of 1.0. Results are presented in ppmv; the typical detection limit is 1 ppmv. ND indicates not detected. NA indicates not available. The PID measures relative levels of VOCs. Although PID screening cannot be used directly to quantify VOC concentrations or identify individual compounds, the results can serve as a relative indicator for the presence of VOCs.	
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BORING LOG \\WESSERV2\SHDATA\4500S\4575.00\WORK\LOGS\4575.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 11/8/19

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Boring SH-103

Ground Elevation: 69.0 ± feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4" Drive and Wash

Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: New England Boring

Foreman: J. Bierholme

Date Started: 09/23/19 **Date Finished: 09/23/19**

Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/23/19	---	No Groundwater Encountered				

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----		
							ASPHALT	(0 to 0.5'): ASPHALT.	
							-----0.5'-----		
	S-1	0.5 - 2	19 19 13	18/18	PID: ND			S-1 (0.5 to 2'): Dense, brown, fine to coarse SAND, some Gravel, trace Silt, very few Ash particles. Moist. FILL.	
2	S-2	2 - 4	12 15 20 15	24/16	PID: ND		FILL	S-2A (2 to 3.5'): Dense, tan, fine to coarse SAND, some Gravel, trace Silt. Moist. FILL.	
					PID: ND			S-2B (3.5 to 4'): Dense, gray/white, fine to coarse SAND and Gravel, little Silt. Moist. FILL.	
4	S-3	4 - 5.4	19 25 100/5"	17/17	PID: ND PID: ND		-----4.5'-----	S-3A (4 to 4.5'): Very dense, gray/white, fine to coarse SAND and Gravel, little Silt. Moist. FILL.	
							TILL		
							-----5.5'-----	S-3B (4.5 to 5.4'): Very dense, gray/tan, fine to coarse SAND and Gravel, little Silt. Moist. GLACIAL TILL.	
6								Boring terminated at 5.5 feet due to auger refusal on probable bedrock.	
8								NOTES:	
10								1. Soil samples were screened for volatile organic compounds (VOCs) using a MiniRAE 3000 Photoionization Detector (PID) with a 10.6 eV lamp, calibrated to a 100 parts per million by volume (ppmv) isobutylene-in-air standard using a response factor of 1.0. Results are presented in ppmv; the typical detection limit is 1 ppmv. ND indicates not detected. NA indicates not available. The PID measures relative levels of VOCs. Although PID screening cannot be used directly to quantify VOC concentrations or identify individual compounds, the results can serve as a relative indicator for the presence of VOCs.	
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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Monitoring Well SH-104

Ground Elevation: 64.8 feet
TOC Elevation: 64.8 feet
PVC Elevation: 64.5 feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger

Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Northern Drill Services, Inc.

Foreman: J. Bierholme

Date Started: 09/23/19 **Date Finished: 09/24/19**

Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/23/19	---	18.5'	Ground Surface	8'	21'	None
10/08/19	---	17.45'	Top of PVC	Well Installed	23.9'	14 Days
10/15/19	---	17.51'	Top of PVC	Well Installed	23.9'	21 Days

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Well Diagram	Well Description
0					PID: ND		-----0'----- ASPHALT -----0.5'-----	(0 to 0.5'): ASPHALT.		4" Dia. Flushmounted Road Box (0 to 1')
	S-1	0.5 - 2	28 25 17	18/18	PID: ND		FILL	S-1 (0.5 to 2'): Very dense, dark brown, fine to coarse SAND, some Gravel, trace Silt, few Ash particles, few Concrete pieces, very few Brick particles. Moist. FILL.		2" Dia. Sch. 40 PVC Riser (0.3 to 15')
2	S-2	2 - 4	15 15 12 11	24/20	PID: ND		-----2'-----	S-2 (2 to 4'): Medium dense, tan, fine to coarse SAND, little Gravel, little Silt. Moist.		
4	S-3	4 - 6	5 5 5 3	24/18	PID: ND			S-3 (4 to 6'): Loose, tan, fine to coarse SAND, little Gravel, trace Silt. Moist.		
6	S-4	6 - 8	7 6 5 4	24/19	PID: ND			S-4 (6 to 8'): Medium dense, tan, fine to coarse SAND, little Gravel, trace Silt. Moist.		Cuttings (1 to 11')
8	S-5	8 - 10	3 1 2 2	24/21	PID: ND			S-5 (8 to 10'): Very loose, tan, fine to coarse SAND, little Silt, trace Gravel. Stratified. Moist.		
10	S-6	10 - 12	2 3 2 2	24/24	PID: ND			S-6 (10 to 12'): Loose, tan, fine to coarse SAND, little Silt, trace Gravel. Stratified. Moist.		Bentonite Seal (11 to 13')
12										Well Sand (13 to 26')
14	S-7	14 - 16	4 15 29 26	24/24	PID: ND PID: ND		SAND	S-7A (14 to 14.5'): Dense, tan, fine to coarse SAND, little Silt, trace Gravel. Moist. S-7B (14.5 to 16'): Dense, tan, fine to coarse SAND, little Gravel, trace Silt. Moist.		2" Dia. Sch. 40 PVC Well Screen (0.010" Slots) (15 to 25')
16										
18										
20	S-8	19 - 21	4 6 6 7	24/24	PID: ND PID: ND			S-8A (19 to 20'): Medium dense, tan, fine to coarse SAND, little Gravel, trace Silt. Wet. S-8B (20 to 21'): Medium dense, tan, fine to medium SAND, some Silt. Wet.		
22										
24	S-9	24 - 26	11 20 21 14	24/17	PID: ND PID: ND		-----24.5'----- TILL	S-9A (24 to 24.5'): Dense, tan, fine to coarse SAND, trace Silt. Wet. S-9B (24.5 to 26'): Dense, tan, fine to coarse SAND and Gravel, little Silty Clay. Wet. GLACIAL TILL.		
26							-----26'-----	Boring terminated at 26 feet.		
28								NOTES: 1. Soil samples were screened for volatile organic compounds (VOCs) using a MiniRAE 3000		

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Monitoring Well SH-104

Ground Elevation: 64.8 feet
TOC Elevation: 64.8 feet
PVC Elevation: 64.5 feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/23/19 **Date Finished: 09/24/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/23/19	---	18.5'	Ground Surface	8'	21'	None
10/08/19	---	17.45'	Top of PVC	Well Installed	23.9'	14 Days
10/15/19	---	17.51'	Top of PVC	Well Installed	23.9'	21 Days

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Well Diagram	Well Description
30								Photoionization Detector (PID) with a 10.6 eV lamp, calibrated to a 100 parts per million by volume (ppmv) isobutylene-in-air standard using a response factor of 1.0. Results are presented in ppmv; the typical detection limit is 1 ppmv. ND indicates not detected. NA indicates not available. The PID measures relative levels of VOCs. Although PID screening cannot be used directly to quantify VOC concentrations or identify individual compounds, the results can serve as a relative indicator for the presence of VOCs.		
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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Boring SH-105

Ground Elevation: 65.5 ± feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/23/19 **Date Finished: 09/23/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/23/19	---	23'	Ground Surface	29'	31'	None

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----		
							CONCRETE	(0 to 0.5'): CONCRETE.	
							-----0.5'-----		
	S-1	0.5 - 2	6 4 4	18/14	PID: ND			S-1 (0.5 to 2'): Medium dense, brown/black, fine to coarse SAND, little Gravel, little Silt, frequent Ash particles. Moist. FILL.	
2	S-2	2 - 4	9 16 17 14	24/18	PID: ND PID: ND		FILL	S-2A (2 to 3'): Dense, black, fine to coarse SAND, little Gravel, little Silt, frequent Ash particles, few Brick particles. Moist. FILL.	
							-----3'-----		
4	S-3	4 - 6	7 6 20 24	24/14	PID: ND			S-2B (3 to 4'): Dense, tan/white, fine to coarse SAND & GRAVEL, trace Silt. Moist. S-3 (4 to 6'): Medium dense, tan/brown, fine to coarse SAND and Gravel, trace Silt. Moist.	
6	S-4	6 - 8	34 23 25 25	24/18	PID: ND			S-4 (6 to 8'): Dense, tan, fine to coarse SAND, some Gravel, trace Silt. Moist.	
8									
	S-5	9 - 11	8 14 24 29	24/18	PID: ND			S-5 (9 to 11'): Dense, tan, fine to coarse SAND, some Gravel, trace Silt. Moist.	
10									
12									
14	S-6	14 - 16	8 17 20 13	24/20	PID: ND			S-6 (14 to 16'): Dense, tan, fine to coarse SAND, some Gravel, trace Silt. Moist.	
16							SAND		
18									
	S-7	19 - 21	5 4 3 2	24/9	PID: ND			S-7 (19 to 21'): Loose, brown, fine to coarse SAND, some Gravel, trace Silt. Moist.	
20									
22									
24	S-8	24 - 26	5 3 2 2	24/5	PID: ND			S-8 (24 to 26'): Loose, brown, fine to coarse SAND, little Gravel, trace Silt. Wet.	
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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Boring SH-105

Ground Elevation: 65.5 ± feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/23/19 **Date Finished: 09/23/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/23/19	---	23'	Ground Surface	29'	31'	None

Depth (ft)	Sample Information					Stratum		Geologic Description	Remarks
	Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Log	Description		
30	S-9	29 - 31	3 3 3 3	24/6	PID: ND		SAND	S-9 (29 to 31'): Loose, brown, fine to coarse GRAVEL, little Sand. Wet.	
							-----31'-----	Boring terminated at 31 feet. No refusal encountered.	
32								NOTES: 1. Soil samples were screened for volatile organic compounds (VOCs) using a MiniRAE 3000 Photoionization Detector (PID) with a 10.6 eV lamp, calibrated to a 100 parts per million by volume (ppmv) isobutylene-in-air standard using a response factor of 1.0. Results are presented in ppmv; the typical detection limit is 1 ppmv. ND indicates not detected. NA indicates not available. The PID measures relative levels of VOCs. Although PID screening cannot be used directly to quantify VOC concentrations or identify individual compounds, the results can serve as a relative indicator for the presence of VOCs.	
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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Monitoring Well SH-106

Ground Elevation: 65.9 feet
TOC Elevation: 65.9 feet
PVC Elevation: 65.5 feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/30/19 **Date Finished: 10/01/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/30/19	---	11'	Ground Surface	9'	11'	None
10/08/19	---	No Groundwater Encountered		Well Installed	19.91'	7 Days

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Well Diagram	Well Description
0							-----0'-----			4" Dia. Flushmounted Road Box Set (0 to 1')
							ASPHALT	(0 to 0.5'): ASPHALT.		
							-----0.5'-----			2" Dia. Sch. 40 PVC Riser (0.5 to 10')
	S-1	0.5 - 2	8 19 32	18/13	PID: ND			S-1 (0.5 to 2'): Very dense, tan/dark brown, fine to coarse SAND, some Gravel, trace Silt, few Ash particles. Moist. FILL.		
2	S-2	2 - 4	14 18 44 44	24/14	PID: ND		FILL	S-2 (2 to 4'): Very dense, tan/dark brown, fine to coarse SAND, some Gravel, trace Silt, few Ash particles, few Root particles. Moist. FILL.		Cuttings (1 to 6')
4	S-3	4 - 6	25 27 17 13	24/16	PID: ND PID: ND		-----5'-----	S-3A (4 to 5'): Dense, brown, fine to coarse SAND, little Silt, few Ash particles. Moist. FILL. S-3B (5 to 6'): Dense, brown, fine to coarse SAND, little Gravel, little Silt. Moist.		
6	S-4	6 - 8	7 8 10 7	24/19	PID: ND			S-4 (6 to 8'): Medium dense, brownish gray, fine to coarse SAND, little Silt, trace Gravel, few Organic particles. Moist.		Bentonite (6 to 8')
8										
	S-5	9 - 11	4 4 3 3	24/22	PID: ND		SAND	S-5 (9 to 11'): Loose, brown/gray, fine to medium SAND, some Silt. Stratified. Moist to wet.		2" Dia. Sch. 40 PVC Well Screen (0.010" Slots) (10 to 20')
10										
12										
14	S-6	14 - 16	1 1 1 1	24/20	PID: ND		-----14'-----	S-6 (14 to 16'): Soft, brown/gray, SILT and Sand, trace Clay. Stratified. Wet. [SANDY LOAM].		
16	S-7	16 - 18	WOH 2 2 2	24/24	PID: ND		SAND & SILT	S-7 (16 to 18'): Loose, brown/gray, fine to medium SAND and SILT, trace Clay, very few Wood fragments. Stratified. Wet. [SANDY LOAM].		
18	S-8	18 - 20	10 30 30 26	24/24	PID: ND PID: ND		-----18.5'-----	S-8A (18 to 18.5'): Very dense, gray, fine to medium SAND and SILT, little Clay. Wet. [SANDY LOAM]. S-8B (18.5 to 20'): Very dense, tan/brown, fine to coarse SAND and Gravel, trace Silt. Wet. [SAND].		Well Sand (8 to 30')
20	S-9	20 - 22	29 30 25 22	24/21	PID: ND			S-9 (20 to 22'): Very dense, tan/brown, fine to coarse SAND, some Gravel, trace Silt. Wet. [SAND].		
22	S-10	22 - 24	14 22 20 18	24/15	PID: ND			S-10 (22 to 24'): Dense, brown/gray, fine to coarse SAND and Gravel, trace Silt. Wet. [SAND].		
24	S-11	24 - 26	8 15 19 30	24/15	PID: ND		SAND & GRAVEL	S-11 (24 to 26'): Dense, brown/gray, fine to coarse SAND and Gravel, trace Silt. Wet. [SAND].		
26	S-12	26 - 28	15 23 20 26	24/24	PID: ND			S-12 (26 to 28'): Dense, gray, fine to coarse SAND and Gravel, trace Silt. Wet. [SAND].		
28	S-13	28 - 30	12 20	24/15	PID: ND			S-13 (28 to 30'): Dense, orange, fine to coarse SAND and Gravel, trace Silt. Wet. [SAND].		

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Monitoring Well SH-106

Ground Elevation: 65.9 feet
TOC Elevation: 65.9 feet
PVC Elevation: 65.5 feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/30/19 **Date Finished: 10/01/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/30/19	---	11'	Ground Surface	9'	11'	None
10/08/19	---	No Groundwater Encountered		Well Installed	19.91'	7 Days

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Well Diagram	Well Description
30			24 24				SAND & GRAVEL -----30'-----			

Boring terminated at 30 feet. No refusal encountered.

NOTES:

1. Soil samples were screened for volatile organic compounds (VOCs) using a MiniRAE 3000 Photoionization Detector (PID) with a 10.6 eV lamp, calibrated to a 100 parts per million by volume (ppmv) isobutylene-in-air standard using a response factor of 1.0. Results are presented in ppmv; the typical detection limit is 1 ppmv. ND indicates not detected. NA indicates not available. The PID measures relative levels of VOCs. Although PID screening cannot be used directly to quantify VOC concentrations or identify individual compounds, the results can serve as a relative indicator for the presence of VOCs.
2. USDA textural soil classifications are shown in brackets.
3. Groundwater observed at approximately 11 feet is likely due to perched water above the silt layer and not representative of stabilized groundwater levels.

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Monitoring Well SH-107

Ground Elevation: 65.9 feet
TOC Elevation: 65.9 feet
PVC Elevation: 65.6 feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/29/19 **Date Finished: 09/30/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/29/19	---	22.5'	Ground Surface	22'	24'	None
10/08/19	---	22.57'	Top of PVC	Well Installed	29.19'	8 Days
10/15/19	---	22.66'	Top of PVC	Well Installed	29.19'	15 Days

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Well Diagram	Well Description
0							-----0'-----			
							ASPHALT	(0 to 0.5'): ASPHALT.		4" Dia. Flushmounted Road Box (0 to 0.5')
	S-1	0.5 - 2	16 8 8	18/12	PID: ND		-----0.5'-----	S-1 (0.5 to 2'): Medium dense, tan, fine to coarse SAND, little Gravel, trace Silt. Moist. FILL.		2" Dia. Sch. 40 PVC Riser (0.4 to 30')
2	S-2	2 - 4	7 9 8 7	24/17	PID: ND			S-2A (2 to 2.5'): Medium dense, tan, fine to coarse SAND, little Gravel, trace Silt. Moist. FILL. S-2B (2.5 to 4'): Medium dense, light tan, fine to medium SAND, trace Silt. Moist. FILL.		Cuttings (0.5 to 16')
4	S-3	4 - 6	6 4 5 6	24/22	PID: ND		FILL	S-3 (4 to 6'): Loose, tan, fine to coarse SAND, trace Gravel, trace Silt. Moist. FILL.		
6	S-4	6 - 8	6 7 8 8	24/18	PID: ND			S-4 (6 to 8'): Medium dense, tan, fine to coarse SAND, trace Gravel, trace Silt, very few Ash particles. Moist. FILL.		
8	S-5	8 - 10	3 4 8 8	24/17	PID: ND		-----8'-----	S-5A (8 to 9'): Medium dense, light tan, fine to medium SAND, trace Silt. Moist. S-5B (9 to 10'): Medium dense, tan, fine to medium SAND, little Silt. Moist.		
10										
12										
14	S-6	14 - 16	8 8 12 13	24/18	PID: ND			S-6 (14 to 16'): Medium dense, light tan, fine to coarse SAND, little Gravel, trace Silt. Moist. [SAND].		
16	S-7	16 - 18	15 11 16 14	24/24	PID: ND			S-7 (16 to 18'): Medium dense, light tan, fine to coarse SAND, little Gravel, trace Silt. Moist. [SAND].		Bentonite (16 to 18')
18	S-8	18 - 20	12 12 9 10	24/23	PID: ND		SAND	S-8 (18 to 20'): Medium dense, light tan, fine to coarse SAND, little Gravel, trace Silt. Moist. [SAND].		Well Sand (18 to 30')
20	S-9	20 - 22	14 13 10 10	24/20	PID: ND			S-9A (20 to 21'): Medium dense, light tan, fine to coarse SAND, little Gravel, trace Silt. Moist. [SAND]. S-9B (21 to 22'): Medium dense, tan/orange, fine to coarse SAND, little Gravel, trace Silt. Moist. Redoximorphic features observed from 21.8-22 feet. [SAND].		1" Dia. Sch. 40 PVC Well Screen (0.010" Slots) (20 to 30')
22	S-10	22 - 24	16 21 18 24	24/0	PID: ND			S-10 (22 to 24'): Dense, orange, fine to coarse SAND, some Gravel, trace Silt. Moist to wet. [SAND].		
24	S-11	24 - 26	20 14 14 12	24/15	PID: ND			S-11A (24 to 25'): Medium dense, orange, fine to coarse SAND, some Gravel, little Silt. Wet. [LOAMY SAND]. S-11B (25 to 26'): Medium dense, brown/orange, fine to coarse SAND, some Gravel, little Silt. Wet. [LOAMY SAND].		
26	S-12	26 - 28	16 15 15 13	24/8	PID: ND			S-12 (26 to 28'): Dense, brown, fine to coarse SAND, some Gravel, trace Silt. Wet. [SAND].		
28	S-13	28 - 30	6 7	24/24	PID: ND			S-13 (28 to 30'): Medium dense, brown, fine to coarse SAND, some Gravel, trace Silt. Wet. [SAND].		

BORING LOG \\WESSERV2\SHDATA\4500S\4575.00\WORK\LOGS\4575.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 11/8/19

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Monitoring Well SH-107

Ground Elevation: 65.9 feet
TOC Elevation: 65.9 feet
PVC Elevation: 65.6 feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/29/19 **Date Finished: 09/30/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/29/19	---	22.5'	Ground Surface	22'	24'	None
10/08/19	---	22.57'	Top of PVC	Well Installed	29.19'	8 Days
10/15/19	---	22.66'	Top of PVC	Well Installed	29.19'	15 Days

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Well Diagram	Well Description
30			9 10				SAND -----30'-----	Boring terminated at 30 feet. No refusal encountered.		

NOTES:

1. Soil samples were screened for volatile organic compounds (VOCs) using a MiniRAE 3000 Photoionization Detector (PID) with a 10.6 eV lamp, calibrated to a 100 parts per million by volume (ppmv) isobutylene-in-air standard using a response factor of 1.0. Results are presented in ppmv; the typical detection limit is 1 ppmv. ND indicates not detected. NA indicates not available. The PID measures relative levels of VOCs. Although PID screening cannot be used directly to quantify VOC concentrations or identify individual compounds, the results can serve as a relative indicator for the presence of VOCs.

2. USDA textural soil classifications are shown in brackets.

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Monitoring Well SH-108

Ground Elevation: 62.6 feet
TOC Elevation: 62.6 feet
PVC Elevation: 62.1 feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/29/19 **Date Finished: 09/30/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/30/19	01:20	14'	Ground Surface	12'	14'	None
10/08/19	---	14.61'	Top of PVC	Well Installed	20'	8 Days

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Well Diagram	Well Description
0							-----0'-----			9" Dia. Flushmounted Road Box (0 to 1')
							ASPHALT	(0 to 0.5'): ASPHALT.		
	S-1	0.5 - 2	10 10 6	18/12	PID: ND		-----0.5'-----	S-1 (0.5 to 2'): Medium dense, tan/brown, fine to coarse SAND, some Gravel, trace Silt, few Asphalt particles. Moist. FILL.		2" Dia. Sch. 40 PVC Riser (0.4 to 10')
2	S-2	2 - 4	5 6 9 10	24/17	PID: ND		FILL	S-2 (2 to 4'): Medium dense, tan/brown, fine to coarse SAND, little Gravel, trace Silt, very few Ash particles. Moist. FILL.		Cuttings (0.5 to 6')
4	S-3	4 - 6	11 12 9 15	24/18	PID: ND		-----4'-----	S-3 (4 to 6'): Medium dense, black/red, fine to coarse SAND, little Gravel, trace Silt, frequent Ash particles, common Brick fragments. Moist. FILL.		
6	S-4	6 - 8	13 13 9 9	24/24	PID: ND		FILL	S-4 (6 to 8'): Medium dense, black, fine to coarse SAND, little Gravel, trace Silt, numerous Ash particles, few Slag fragments, very few Brick particles. Moist. FILL.		Bentonite Chips (6 to 8')
8	S-5	8 - 10	7 5 5 3	24/21	PID: ND			S-5A (8 to 9.5'): Medium dense, black, fine to coarse SAND, little Gravel, trace Silt, numerous Ash particles, very few Porcelain particles, very few Slag fragments, very few Brick particles. Moist. FILL. [SAND].		Molliston Well Sand (8 to 20')
10	S-6	10 - 12	3 7 14 12	24/24	PID: ND PID: ND		-----9.5'----- BURIED ORGANICS -----10.5'-----	S-5B (9.5 to 10'): Medium dense, black, fine to coarse SAND and Silt, trace Gravel, common Plant Root fragments, few Ash particles. Moist. BURIED ORGANICS. [SILT LOAM].		2" Dia. Sch. 40 PVC Well Screen (0.010" Slots) (10 to 20')
12	S-7	12 - 14	8 8 7 9	24/19				S-6A (10 to 10.5'): Medium dense, black, fine to coarse SAND and Silt, little Gravel, few Root fragments, common Ash particles. Moist. BURIED ORGANICS. [LOAM].		
14	S-8	14 - 16	4 6 7 6	24/22	PID: ND		SAND	S-6B (10.5 to 12'): Medium dense, gray/brown, fine to coarse SAND and Silt, trace Gravel, trace Clay. Moist. [SANDY LOAM].		
16	S-9	16 - 18	4 3 1 2	24/24	PID: ND			S-7 (12 to 14'): Medium dense, gray, fine to coarse SAND and Silt, trace Gravel, trace Clay. Moist to wet. [SANDY LOAM].		
								S-8 (14 to 16'): Medium dense, gray, fine to coarse SAND and Silt, trace Gravel, trace Clay. Wet. [SANDY LOAM].		
18	S-10	18 - 20	7 8 4 6	24/16	PID: ND			S-9A (16 to 17'): Very loose, gray, fine to coarse SAND, trace Silt, trace Gravel. Wet. [SAND].		
								S-9B (17 to 18'): Very loose, gray, fine to coarse SAND and Silt, trace Clay, trace Gravel. Wet. [SANDY LOAM].		
20							-----20'-----	S-10A (18 to 19'): Medium dense, gray, fine to coarse SAND, little Gravel, little Silt. Wet. [SANDY LOAM].		
22								S-10B (19 to 20'): Medium dense, gray, SILT, some Sand, trace Gravel. Wet. [SANDY LOAM].		
								Boring terminated at 20 feet. No refusal encountered.		
24								NOTES:		
26								1. Soil samples were screened for volatile organic compounds (VOCs) using a MiniRAE 3000 Photoionization Detector (PID) with a 10.6 eV lamp, calibrated to a 100 parts per million by volume (ppmv) isobutylene-in-air standard using a response factor of 1.0. Results are presented in ppmv; the typical detection limit is 1 ppmv. ND indicates not detected. NA indicates not available. The PID measures relative levels of VOCs. Although PID screening cannot be used directly to quantify VOC concentrations or identify individual compounds, the		
28										

BORING LOG \\WESSERV2\SHDATA\4500S\4575.00\WORK\LOGS\4575.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 11/8/19

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Monitoring Well SH-108

Ground Elevation: 62.6 feet
TOC Elevation: 62.6 feet
PVC Elevation: 62.1 feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/29/19 **Date Finished: 09/30/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/30/19	01:20	14'	Ground Surface	12'	14'	None
10/08/19	---	14.61'	Top of PVC	Well Installed	20'	8 Days

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Well Diagram	Well Description
30								results can serve as a relative indicator for the presence of VOCs. 2. USDA textural soil classifications are shown in brackets.		
32										
34										
36										
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42										
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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Boring SH-109

Ground Elevation: 61.5 ± feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/25/19 **Date Finished: 09/25/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/25/19	08:00	9'	Ground Surface	8'	12'	None

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----		
							ASPHALT	(0 to 0.5'): ASPHALT.	
							-----0.5'-----		
	S-1	0.5 - 2	11 13 15	18/13	PID: 6.0 ppmv PID: ND			S-1A (0.5 to 1'): Medium dense, brown, fine to coarse SAND and Gravel, trace Silt, few Ash particles, very few Asphalt particles. Moist. FILL.	
2	S-2	2 - 4	11 1 2 4	24/17	PID: 2.7 ppmv PID: ND			S-1B (1 to 2'): Medium dense, tan, fine to coarse SAND, some Gravel, trace Silt. Moist. FILL. S-2A (2 to 2.5'): Very loose, tan, fine to coarse SAND, little Gravel, trace Silt. Moist. FILL.	
4	S-3	4 - 6	10 14 19 12	24/18	PID: ND			S-2B (2.5 to 4'): Very loose, black, fine to coarse SAND, little Gravel, little Silt, common Ash particles, few Organic Root particles, very few Brick particles. Moist. FILL.	
6	S-4	6 - 8	15 15 19 21	24/24	PID: 1.4 ppmv		FILL	S-3 (4 to 6'): Dense, black/tan, fine to coarse SAND, some Gravel, trace Silt, common Ash particles, common Concrete pieces, very few Brick particles. Moist. FILL. S-4 (6 to 8'): Dense, black, fine to coarse SAND, trace Gravel, trace Silt, numerous Brick fragments, frequent Ash particles. Moist. FILL.	
8	S-5	8 - 10	11 13 15 16	24/24	PID: ND			S-5 (8 to 10'): Medium dense, black, fine to coarse SAND, little Gravel, trace Silt, numerous Ash particles, common Wood fragments, few Brick particles. Moist to wet. FILL.	
10	S-6	10 - 12	14 13 2 2	24/20	PID: ND PID: ND		-----11'-----	S-6A (10 to 11'): Medium dense, black, fine to coarse SAND, little Gravel, trace Silt, frequent Ash particles, very few Porcelain particles. Wet. FILL.	
12	S-7	12 - 14	WOH 1 2 4	24/24	PID: ND PID: ND		PEAT	S-6B (11 to 12'): Medium dense, dark brown, fine to coarse SAND, trace Organic Silt, trace Gravel, frequent Plant fibers. Wet. PEAT. S-7A (12 to 13.5'): Soft, dark brown, Organic SILT, little Sand, trace Gravel, frequent Plant fibers. Wet. PEAT.	
14	S-8	14 - 16	1 2 3 3	24/22	PID: ND PID: ND		-----15'-----	S-7B (13.5 to 14'): Soft, brown, Organic SILT, trace Sand, numerous Plant fibers. Wet. PEAT. S-8A (14 to 15'): Medium stiff, light brown, Organic SILT, little Sand, frequent Plant fibers. Wet. PEAT.	
16								S-8B (15 to 16'): Loose, gray, fine to medium SAND and Silt, trace Gravel. Wet.	
18									
20	S-9	19 - 21	3 1 1 2	24/19	PID: ND			S-9 (19 to 21'): Very loose, gray, fine to coarse SAND and Silt, trace Clay. Wet.	
22							SAND & SILT		
24	S-10	24 - 26	WOH 2 3 6	24/8	PID: ND			S-10A (24 to 25.5'): Loose, gray, fine to coarse SAND and Silt, trace Gravel, trace Clay. Wet.	
26					PID: ND			S-10B (25.5 to 26'): Loose, gray, fine to coarse SAND, little Gravel, little Silt. Wet.	
28									

BORING LOG \\WESSERV2\SHDATA\4500S\4575.00\WORK\LOGS\4575.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 11/8/19

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Boring SH-109

Ground Elevation: 61.5 ± feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/25/19 **Date Finished: 09/25/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/25/19	08:00	9'	Ground Surface	8'	12'	None

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
30	S-11	29 - 31	5 5 5 3	24/21	PID: ND		SAND & SILT -----31'-----	S-11 (29 to 31'): Medium dense, gray, fine to medium SAND and Silt, trace Clay. Wet. Boring terminated at 31 feet. No refusal encountered.	

NOTES:

1. Soil samples were screened for volatile organic compounds (VOCs) using a MiniRAE 3000 Photoionization Detector (PID) with a 10.6 eV lamp, calibrated to a 100 parts per million by volume (ppmv) isobutylene-in-air standard using a response factor of 1.0. Results are presented in ppmv; the typical detection limit is 1 ppmv. ND indicates not detected. NA indicates not available. The PID measures relative levels of VOCs. Although PID screening cannot be used directly to quantify VOC concentrations or identify individual compounds, the results can serve as a relative indicator for the presence of VOCs.

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Boring SH-110

Ground Elevation: 59.5 ± feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/24/19 **Date Finished: 09/24/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/24/19	12:30	7.5'	Ground Surface	4'	8'	None

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----		
							ASPHALT	(0 to 0.5'): ASPHALT.	
							-----0.5'-----		
	S-1	0.5 - 2	10 11 9	18/12	PID: ND		FILL	S-1 (0.5 to 2'): Medium dense, tan, fine to coarse SAND, some Gravel, trace Silt. Moist. FILL.	
2	S-2	2 - 4	9 8 6 3	24/22	PID: ND			S-2A (2 to 3'): Medium dense, tan/gray, fine to coarse SAND, some Gravel, trace Silt. Moist. FILL.	
					PID: ND		-----3'-----	S-2B (3 to 4'): Medium dense, black, fine to coarse SAND, little Gravel, trace Silt, common Ash particles, few Slag fragments, few Brick particles. Moist. FILL.	
4	S-3	4 - 6	5 2 2 2	24/16	PID: 1.1 ppmv			S-3 (4 to 6'): Very loose, black, fine to coarse SAND, little Gravel, trace Silt, numerous Ash particles, common Slag fragments, few Wood particles. Moist. FILL.	
							FILL		
6	S-4	6 - 8	3 2 3 2	24/10	PID: ND			S-4 (6 to 8'): Loose, black, fine to coarse SAND, little Gravel, trace Silt, numerous Ash particles, few Slag fragments. Moist to wet. FILL.	
8	S-5	8 - 10	WOH 1 2 6	24/22	PID: 1.3 ppmv		-----8'-----	S-5A (8 to 9.5'): Soft, dark brown, Organic SILT, little Sand, trace Gravel, numerous Plant fibers. Wet. PEAT.	
					PID: ND		PEAT		
							-----9.5'-----	S-5B (9.5 to 10'): Very loose, brown/gray, fine to coarse SAND, little Gravel, little Silt, few Root particles. Wet.	
10	S-6	10 - 12	7 8 7 7	24/20	PID: ND			S-6 (10 to 12'): Medium dense, brown/gray, fine to coarse SAND, some Silt, trace Gravel. Wet.	
12									
14	S-7	14 - 16	4 2 3 2	24/20	PID: ND		SAND	S-7 (14 to 16'): Loose, gray, fine to coarse SAND, little Silt, trace Clay. Wet.	
16									
18									
	S-8	19 - 21	4 4 2 2	24/21	PID: ND		-----19'-----	S-8A (19 to 20.8'): Loose, gray, fine to medium SAND and Silt. Wet.	
20							SAND & SILT		
					PID: ND		-----20.8'-----	S-8B (20.8 to 21'): Medium stiff, gray, Silty CLAY, trace Sand. Wet.	
22							SILTY CLAY		
24	S-9	24 - 26	4 3 5 3	24/20	PID: ND		-----24'-----	S-9 (24 to 26'): Loose, gray, fine to coarse SAND and Silt, little Clay. Wet.	
26							SAND & SILT		
28									

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Boring SH-110

Ground Elevation: 59.5 ± feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/24/19 **Date Finished: 09/24/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/24/19	12:30	7.5'	Ground Surface	4'	8'	None

Depth (ft)	Sample Information					Stratum		Geologic Description	Remarks
	Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Log	Description		
30	S-10	29 - 31	2 4 7 5	24/24	PID: ND		SAND & SILT -----31'-----	S-10 (29 to 31'): Medium dense, gray, fine to medium SAND and Silt, little Clay. Wet. Boring terminated at 31 feet. No refusal encountered.	

NOTES:

1. Soil samples were screened for volatile organic compounds (VOCs) using a MiniRAE 3000 Photoionization Detector (PID) with a 10.6 eV lamp, calibrated to a 100 parts per million by volume (ppmv) isobutylene-in-air standard using a response factor of 1.0. Results are presented in ppmv; the typical detection limit is 1 ppmv. ND indicates not detected. NA indicates not available. The PID measures relative levels of VOCs. Although PID screening cannot be used directly to quantify VOC concentrations or identify individual compounds, the results can serve as a relative indicator for the presence of VOCs.

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Monitoring Well SH-111

Ground Elevation: 62.4 feet
TOC Elevation: 62.4 feet
PVC Elevation: 62.1 feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger

Sampling Method: 2" O.D. Split Spoon, Automatic Hammer

Drilling Company: Northern Drill Services, Inc.

Foreman: J. Bierholme

Date Started: 09/24/19 **Date Finished: 09/24/19**

Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/24/19	09:45	14'	Ground Surface	12'	16'	None
10/08/19	---	13.87'	Top of PVC	Well Installed	18.88'	14 Days
10/15/19	---	13.87'	Top of PVC	Well Installed	18.88'	21 Days

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Well Diagram	Well Description
0							-----0'-----			
							ASPHALT	ASPHALT.		4" Dia. Flushmounted Road Box (0 to 1')
							-----0.5'-----			
	S-1	0.5 - 2	13 14 13	18/18	PID: ND PID: ND			S-1A (0.5 to 1'): Medium dense, dark brown, fine to coarse SAND, little Gravel, trace Silt, frequent Ash particles, few Brick particles. Moist. FILL.		2" Dia. Sch. 40 PVC Riser (0.3 to 10')
2	S-2	2 - 4	17 20 14 10	24/17	PID: ND			S-1B (1 to 2'): Medium dense, tan, fine to coarse SAND, some Gravel, trace Silt. Moist. FILL. S-2 (2 to 4'): Medium dense, tan, fine to coarse SAND, some Gravel, trace Silt. Moist. FILL.		
							FILL			Cuttings (1 to 6')
4	S-3	4 - 6	8 9 13 60	24/18	PID: ND PID: ND			S-3A (4 to 5'): Medium dense, tan, fine to coarse SAND, some Gravel, trace Silt. Moist. FILL. S-3B (5 to 6'): Medium dense, black, fine to coarse SAND and Gravel, trace Silt, frequent Ash particles. very few Brick particles, few Concrete pieces. Moist. FILL.		
6	S-4	6 - 8	75 23 22 24	24/23	PID: ND		-----6'-----			Bentonite Seal (6 to 8')
								S-4 (6 to 8'): Dense, black, fine to coarse SAND, little Gravel, trace Silt, frequent Ash particles, common Brick fragments, few Porcelain particles. Moist. FILL.		
8	S-5	8 - 10	14 9 3 3	24/8	PID: ND		FILL	S-5 (8 to 10'): Medium dense, black, fine to coarse SAND, little Gravel, trace Silt, frequent Ash particles, very few Brick particles, very few Wood fragments. Moist. FILL.		Well Sand (8 to 20')
10	S-6	10 - 12	3 2 2 9	24/13	PID: ND PID: 1.3 ppmv		-----10'----- ORGANIC SILT -----11'-----	S-6A (10 to 11'): Soft, dark brown, Organic Clayey SILT, some Sand, trace Gravel, few Root particles. Moist.		1" Dia. Sch. 40 PVC Well Screen (0.010" Slots) (10 to 20')
12	S-7	12 - 14	8 16 10 8	24/20	PID: ND			S-6B (11 to 12'): Loose, gray, fine to medium SAND and Silt, few Root particles. Moist. S-7 (12 to 14'): Medium dense, gray, fine to coarse SAND and Silt, little Gravel, trace Clay, very few Plant particles. Moist to wet. [SANDY LOAM].		
14	S-8	14 - 16	5 6 8 9	24/9	PID: ND			S-8 (14 to 16'): Medium dense, gray, fine to coarse SAND and Silt, little Gravel, trace Clay, very few Plant particles. Wet. [SANDY LOAM].		
							SAND			
16	S-9	16 - 18	8 11 12 10	24/8	PID: ND			S-9 (16 to 18'): Medium dense, gray, fine to coarse SAND, little Gravel, little Silt. Wet. [LOAMY SAND].		
18	S-10	18 - 20	5 6 6 7	24/3	PID: ND			S-10 (18 to 20'): Medium dense, gray, fine to coarse SAND, little Silt, trace Gravel. Wet. [LOAMY SAND].		
20							-----20'-----	Boring terminated at 20 feet. No refusal encountered.		
22										
24										
26										
28										

NOTES:

1. Soil samples were screened for volatile organic compounds (VOCs) using a MiniRAE 3000 Photoionization Detector (PID) with a 10.6 eV lamp, calibrated to a 100 parts per million by volume (ppmv) isobutylene-in-air standard using a response factor of 1.0. Results are presented in ppmv; the typical detection limit is 1 ppmv. ND indicates not detected. NA indicates not available. The PID measures relative levels of VOCs. Although PID screening cannot be used directly to quantify VOC concentrations or identify individual compounds, the results can serve as a relative indicator for the presence of VOCs.
2. USDA textural soil classifications are shown in brackets.

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: Riverside Station
Location: Newton, MA
Project No.: 4575.00

Log of Boring SH-112

Ground Elevation: 67.5 ± feet
Datum: NAVD 1988

Drilling Method: B57 Mobile Drill Truck Mounted Drill Rig, 4¼" ID Hollow Stem Auger
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: Northern Drill Services, Inc.
Foreman: J. Bierholme
Date Started: 09/24/19 **Date Finished: 09/24/19**
Logged By: K. Le **Checked By: A. Blomeke**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/24/19	---	No Groundwater Encountered				

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							0' ASPHALT -----0.3-----	(0 to 0.3'): ASPHALT.	
	S-1	0.5 - 2	13 16 16	18/12	PID: ND		FILL	S-1 (0.3 to 2'): Medium dense, light tan, fine to coarse SAND, some Gravel, trace Silt. Moist. FILL.	
2	S-2	2 - 4	27 30 45 24	24/17	PID: ND PID: ND		-----3'-----	S-2A (2 to 3'): Very dense, light tan, fine to coarse SAND, some Gravel, trace Silt. Moist. FILL.	
4							WEATHERED ROCK	S-2B (3 to 4'): Very dense, green/gray, fine to coarse GRAVEL, little Sand, trace Silt. Moist. WEATHERED ROCK.	Auger refusal encountered at approximately 3 feet. Advanced split spoons from 3 to 5 feet and 5 to 6.9 feet.
	S-4	5 - 6.9	27 64 43 100/5"	23/23	PID: ND			S-3 (5 to 6.9'): Very dense, green/gray, fine to coarse GRAVEL, little Sand, little Sand. Moist. WEATHERED ROCK.	
6							-----6.9'-----	Boring terminated at 6.9 feet due to auger refusal.	
8								NOTES: 1. Soil samples were screened for volatile organic compounds (VOCs) using a MiniRAE 3000 Photoionization Detector (PID) with a 10.6 eV lamp, calibrated to a 100 parts per million by volume (ppmv) isobutylene-in-air standard using a response factor of 1.0. Results are presented in ppmv; the typical detection limit is 1 ppmv. ND indicates not detected. NA indicates not available. The PID measures relative levels of VOCs. Although PID screening cannot be used directly to quantify VOC concentrations or identify individual compounds, the results can serve as a relative indicator for the presence of VOCs.	
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BORING LOG \\WESSERV2\SHDATA\4500S\4575.00\WORK\LOGS\4575.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 11/8/19