C-0838
November 25, 2015

Mr. Kevin Daoust
Massachusetts Department of Environmental Protection
8 New Bond Street
Worcester, MA 01606

Re: **Environmental Site Assessment Workplan**
Southbridge Recycling and Disposal Park
165 Barefoot Road, Southbridge
RTN 2-19678

Dear Mr. Daoust:

Please find attached a workplan to assess bedrock groundwater in the vicinity of the Southbridge Recycling and Disposal Park (SRDP). This workplan has been developed by Sanborn Head & Associates (Sanborn Head) with the goal of providing groundwater quality information for the deeper bedrock aquifer in this area as it relates to the detection of trichloroethene and various chlorinated hydrocarbon breakdown products, chlorobenzene and 1,4-dioxane in potable wells located to the northeast of the SRDP facility.

This workplan is being provided in advance of our meeting (tentatively planned for December 3 or 4, 2015) at which we hope to discuss the workplan as it relates to confirming the site conceptual model in the vicinity of SRDP. While SRDP understands that under the Massachusetts Contingency Plan (MCP) program, MassDEP does not determine scopes of work, SRDP feels that discussing the workplan with MassDEP in advance of the work will benefit all stakeholders in this matter.

SRDP appreciates your assistance in this matter. If you would like to discuss the workplan or any other facet of this project prior to our meeting, please call me at (413) 572-3227 or Mr. Sam Nicolai at (802) 772-2254.

Very truly yours,

TIGHE & BOND, INC.

Jeffrey L. Arps, LSP
Director, Remediation & Field Services

Enclosures
Copy: SRDP - Tracy Markham, Toni King, Sam Nicolai

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SANBORN HEAD

Building Trust. Engineering Success.

Mr. Kevin Daoust Section Chief, Site Management
Massachusetts Department of Environmental Protection
Western Regional Office 436 Dwight Street Springfield,
Massachusetts 01103

November 25, 2015
File No. 3530.20

Re: Residential Well Groundwater Investigation Work Plan
Southbridge Recycling & Disposal Park, Inc.
Southbridge, Massachusetts

Dear Mr. Daoust:

Sanborn, Head & Associates, Inc. (Sanborn Head) has prepared the following scope of services for an investigation of bedrock groundwater in the vicinity of Southbridge Recycling & Disposal Park, Inc. (SRDP) and residential water supply wells located off of H. Foote Road and Eleanor Lane.

BACKGROUND

The current Residential Well Monitoring Program (Residential Program) for the Southbridge Recycling & Disposal Park facility (landfill) in Southbridge, Massachusetts includes triennial sampling of certain private drinking water wells within one-half (½) mile of the Phase VII area of the landfill footprint. In September 2014, detections of 1,4-dioxane were observed in two residential drinking water wells (70 and 75 H. Foote Road in Charlton, Massachusetts) at concentrations greater than the Massachusetts Drinking Water Guideline (DWG)[1]; in September 2015, detections of 1,4-dioxane were noted in groundwater from three additional residential drinking water wells (65, 74 and 81 H. Foote Road) at concentrations greater than the DWG. In addition, in September 2015, the chlorinated volatile organic compounds (CVOCs) trichloroethene (TCE) and 1,1-dichloroethene (1,1-DCE) were detected for the first time at a concentration greater than the Massachusetts Drinking Water Standards, the Massachusetts Maximum Contaminant Levels (MMCLs), in the well water supply serving the residence at 65 H. Foote Road. Concentrations of other CVOCs namely, cis-1,2-dichloroethene (cis-DCE), 1,1-dichloroethane (DCA), and chlorobenzene (CB) were also detected in samples from the 65 and 81 H. Foote Road residences. These 1,4-dioxane and CVOC detections were reported to MassDEP. Additional sampling in the residential area suggested six residences where 1,4-dioxane and/or CVOCs were detected above the analytical laboratory detection limits.

The 1,4-dioxane and CVOC detections in residential water supply wells along H. Foote Road are likely *not* associated with the presence of the landfill, based on the following independent and consistent lines of evidence:

[1] The DWG for 1,4-dioxane is equivalent to the Reportable Concentration (RC) GW-1 standard of 0.3 micrograms per liter (µg/L).

- 1,4-Dioxane and certain CVOCs have been co-detected in several residential wells along H. Foote Road. In the approximately ten years of quarterly overburden or bedrock landfill monitoring well data from the landfill, the suite CVOCs detected in residential drinking water along H. Foote Road has not been detected; in addition, the parent CVOC (TCE) was only detected in one well in one sampling round. Detections of 1,4-dioxane at the landfill are limited to monitoring wells downgradient (west/southwest) of the landfill, furthest from the H. Foote Road residences. Both sets of facts suggest another source of contamination may be responsible for the presence of CVOCs and 1,4-dioxane in the residential wells. Several other commercial/industrial properties with known or suspected solvent use have been identified. Those properties are located nearer to the property at 65 H. Foote Road than the landfill, and are in the presumed upgradient direction from the residences.
- CVOCs and 1,4-dioxane have not been detected historically in overburden or shallow bedrock groundwater monitoring wells located east/northeast of the landfill closest to H. Foote Road. Given the surficial nature of the waste deposition, these shallow aquifers would be expected to show at least some evidence of similar impacts if the landfill were the source of the H Foote Road detections.
- In general, available data from the landfill monitoring wells and surface water indicate that overburden and shallow bedrock groundwater flows predominantly to the west/northwest, and away from H. Foote Road. Fracture orientation and dip direction in the local bedrock (as observed in bedrock outcrops located near H. Foote Road and at other outcrops in the vicinity of the landfill) is more likely to facilitate east to west groundwater flow rather than south to north groundwater flow, suggesting that the chlorinated solvents and 1,4-dioxane detected in the residential wells on H. Foote Road may have originated from the east, and not from the south.
- The spatial distribution of 1,4-dioxane and CVOCs in samples from residential wells along H. Foote Road along with the chemical and physical characteristics of 1,4-dioxane suggest that there is a CVOC plume migrating from the east toward H. Foote Road, with 1,4-dioxane as a "leading edge" having advanced farther to the west than the CVOCs.

Our conceptual model of groundwater flow is based on a review of published regional geology/hydrogeology, as well as historical analytical data associated with previous investigations at the landfill; in addition, Sanborn Head completed supplemental field work focused on overburden and shallow bedrock in the vicinity of the landfill in support of the design and permitting of proposed landfill expansion areas. Our review of landfill conditions (e.g. geology, groundwater flow conditions, groundwater quality, properties of overburden soils, bedrock lithology and structure) has been used to preliminarily evaluate analytical data collected from residential wells located on H. Foote Road (northeast of the landfill). As additional data are available from the H. Foote Road area, the conclusions and recommendations presented herein may be updated.

OBJECTIVE

The objective of the bedrock groundwater investigation is to obtain information to supplement the current conceptual site model and evaluate the distribution of 1,4-dioxane and CVOCs the vicinity of SRDP and the residential area to the northeast (i.e., H. Foote Road

and Eleanor Lane). The scope of services included below may vary in that we intend to conduct this work in a phased approach where information obtained and reviewed in each step is used to refine the approach in subsequent tasks.

SCOPE OF SERVICES

As part of this scope of services, Sanborn Head proposes to perform the following tasks which are further described in the subsequent sections:

- **Task 1 - Surface Geophysics** – We will conduct a program of surface geophysics that may aid in identifying fracture zones that may contribute to flow of groundwater that can be targeted with the drilling program outlined in Task 3. Geophysical information gathered during this task will be used to supplement outcrop mapping and other assessments of bedrock at the landfill completed as part of earlier investigations at the landfill.

- **Task 2 - Residential Geophysics and Well Replacement** – We will complete borehole hydro-geophysical logging (including borehole geophysics and packer testing to assess where VOCs may be entering) in one deep water supply well in the H. Foote Road area to assess patterns of fracturing and water quality. Once the hydro-geophysical logging is complete, we will use that information to assess the prospect for a successful replacement at 70 H. Foote Road. Once drilled, down-hole geophysics will also be used in the replacement well at the 70 H. Foote Road property to obtain additional data about the depth, orientation, and groundwater quality of flowing fractures in the residential area.

- **Task 3 - Onsite Bedrock Boreholes** – Drill and test deep bedrock boreholes located on SRDP property. The boreholes will be located in consideration of the results of Task 1 and will be advanced to depths appropriate to obtain bedrock groundwater flow and quality data relating to the targeted residential supply. Once drilled, down-hole geophysics and packer testing will be used in the boreholes to obtain data about the depth, orientation, and groundwater quality of bedrock fractures.

- **Task 4 - Groundwater Elevation Monitoring** – Water level elevation data will be obtained to gain an understanding of groundwater flow in the vicinity of the landfill and the residential area to the northeast. Pressure transducer data loggers will be installed in select existing bedrock monitoring wells and in select residential wells to provide a continuous record of water level fluctuations that may occur as a result of pumping in the residential area. Once completed, new bedrock boreholes on completed on SRDP property (Task 3) will be equipped with water level monitoring capability. In addition, up to three comprehensive water elevation monitoring rounds will be performed using existing monitoring wells at the landfill; residential water supply wells will be included in these monitoring rounds, as available.

- **Task 5 - Development of Site Conceptual Model** – The existing site conceptual model will be revised, as appropriate, to reflect our understanding of groundwater quality and flow within the investigation area upon completion of the above-described tasks.

Sanborn Head estimates that the field program will require a total of approximately four months to complete; a general summary of the anticipated schedule is provided in Exhibit 1 below. Aspects of the proposed schedule are contingent upon availability of subcontractors, weather/snow cover, obtaining access agreements, and other permits that may be required, and may therefore extend beyond the anticipated timeframe presented below.

Exhibit 1 Proposed Schedule of Tasks

		Month 1	Month 2	Month 3	Month 4
Task 1	Surface Geophysics				
Task 2	Residential Geophysics and Well Replacement				
Task 3a	Onsite Bedrock Borehole Installation				
Task 3b	Borehole Geophysics				
Task 3c	Packer Testing				
Task 4	Groundwater Elevation Monitoring				
Task 5	Development of Site Conceptual Model				

Task 1 – Surface Geophysics

Surface geophysical surveys will be completed along several transects in the vicinity of the landfill and the residential area to the northeast. The surface geophysical survey will be performed to attempt to identify the location and orientations of steeply dipping bedrock fracture zones and will consist of very-low-frequency electromagnetics (VLF). Results will be reviewed with the information from previous investigations at the landfill to provide a more complete understanding of potential fracture zones and orientations in the vicinity of the landfill and the residential area to the northeast. The data will be incorporated into selection of the proposed locations of bedrock borings identified for completion as part of Task 3.

Task 2 – Residential Geophysics and Well Replacement

As requested by SRDP, Sanborn Head will replace the existing water supply well at 70 H. Foote Road with a deeper residential supply well.[2]

Prior to installation of this well, Sanborn Head will use borehole geophysical logging in the residential supply well at 65 H. Foote Road (where concentrations of CVOCs and 1,4-dioxane exceed MMCLs/DWG). The well completion report for this well (on file with the Charlton Board of Health [BOH]) indicates that this well is approximately 500 feet (ft) deep. Borehole geophysical logging will be performed to determine the depths and orientations (dip azimuths and dip angles) of bedrock fractures intersected by this residential water

[2] According to information available from the Town of Charlton Board of Health, the current residential well at the 65 H. Foote Road residence is 165 feet deep. Other residential wells in the area are 500 feet deep or more.

supply well. The borehole geophysical logging program will consist of fluid temperature, fluid conductivity/resistivity, caliper, optical televiewer (OTV), acoustic televiewer (ATV), and heat pulse flow meter (HPFM).

Using the information about fracture flow obtained in the well at 65 H. Foote Road, a replacement water supply well will be installed at the 70 H. Foote Road residence. Following installation, we will use borehole geophysical logging in a second borehole in the residential area to provide additional information regarding the depths and orientations (dip azimuths and dip angles) of bedrock fractures intersected by the borehole.

Following completion of the borehole geophysics, drillers will properly size and install a pump, and develop the well per the usual standard of care for installation of a residential water supply well. The driller will also install a stilling tube in the replacement well to allow the pressure transducer to be deployed as part of Task 4.

Task 3 – Onsite Bedrock Boreholes

According to information obtained from well records at the Charlton BOH, existing supply wells at residences located northeast of the landfill along Eleanor Lane and H. Foote Road are installed to depths of up to approximately 600 ft below ground surface (bgs); given our understanding of topography in this area, these well depths correlate with approximately 100 ft AMSL. We propose to install up to five bedrock boreholes identified in Figure 1. The locations of those boreholes will be selected in consideration of the VLF geophysical survey described as Task 1, above.

The actual number, location, and depth of boreholes may vary in that we intend to conduct this work in a phased approach where information obtained and reviewed in each step is used to refine the approach in subsequent steps.

For discussion purposes at this time with the available data, we initially propose to begin drilling at location 1 as shown on Figure 1 and will proceed to the next locations driven by the data and findings if the evaluation indicates that additional information is required.

The borings will initially be advanced no greater than 100 ft into bedrock and testing will then be performed as described below. Depending on the results of the initial testing, we may advise that the boring be advanced deeper and further testing performed. We may recommend that drilling is halted prior to achieving these proposed depths if site conditions are identified which indicate that the work plan and approach need to be revised. If suitable conditions exist, we may propose, based on continual evaluation of the data, that each deep bedrock borehole may be advanced up to approximately 500 ft into bedrock at each location. Dependent on the groundwater flow and quality conditions present in the upper bedrock, we may also advise that the first boring is terminated at a certain depth and that a second adjacent boring is advanced once a protective casing has been advanced to at least the depth of termination of the first boring.

Drilling Program

The bedrock monitoring wells will be advanced through overburden and into bedrock. At this time, we anticipate that the bedrock monitoring wells will be cased through the overburden to some depth into rock; an open borehole will be extended beyond the bottom of the casing equipped with a grout seal. There are several feasible drilling methods for drilling the open borehole and we propose to select the method based on prevailing conditions (access, weather, logistics, contractor availability and project schedule) and the technical goals of the investigation.

In addition, grab groundwater samples will be collected and submitted for laboratory analysis for VOC/1,4-dioxane analysis using a 24-hr turnaround time. Samples will also be collected based on information about water producing zones inferred from information noted above. Depending on the conditions observed in the field, we may employ the use of temporary packers in the open borehole to aid in isolating upper and lower fracture zones.

Following the completion of drilling, the boring will be developed by the drillers in order to remove sediment/material introduced from the drilling process.

Borehole Geophysics Program

We will conduct borehole geophysical logging in each of the bedrock boreholes. Upon reaching a target depth in each of the bedrock borings, borehole geophysical logging will be performed to determine the depths and orientations (dip azimuths and dip angles) of bedrock fractures intersected by the boreholes and attempt to determine depths where water flows into and out of the boreholes under ambient and stressed (low constant rate pumping) conditions. The borehole geophysical logging program will consist of fluid temperature, fluid conductivity/resistivity, caliper, OTV, ATV, and HPFM under ambient and pumping conditions.

In addition to completing borehole geophysical logging in the bedrock boreholes drilled on the landfill property and in the replacement well at the 70 H. Foote Road residence, we propose completing borehole geophysical logging in the residential well at the 65 H. Foote Road residence, if possible.

Packer Testing and Groundwater Sampling and Analysis

Following completion of the borehole geophysical logging in each of the bedrock boreholes, a grab groundwater sample may be collected from each of the open boreholes by collecting a sample of the purge water obtained as part of the pumping condition HPFM logging.

The groundwater samples will be submitted to a Massachusetts-certified analytical laboratory for analysis for VOCs and 1,4-dioxane by USEPA Method 8260B, or equivalent. Upon receipt of the laboratory results, we will review the data and determine the need for additional testing. If the results indicate that CVOCs and 1,4-dioxane are below the analytical detection limit (i.e., non-detect), the boring will be left as an open bedrock monitoring point, and we will install the groundwater pressure transducer data-logger and begin groundwater elevation monitoring as described in Task 4.

If the groundwater analytical results indicate that CVOCs and/or 1,4-dioxane are present in the grab groundwater samples, we will proceed with additional testing of the boreholes. The borehole geophysical data will be reviewed to determine depth intervals for discrete interval groundwater sampling. An inflatable packer system will be used to isolate discrete depth intervals within the open bedrock borehole. Water will be pumped from between the packers in order to collect a representative sample from the isolated section of bedrock; groundwater samples will be collected and analyzed for CVOCs and 1,4-dioxane as described above.

Installation of Multi-level Monitoring System

We propose to leave the bedrock borings as open bedrock holes until the data from the borehole geophysics, packer testing, and groundwater sampling have been evaluated.

Task 4 – Groundwater Elevation Monitoring

Sanborn Head will deploy pressure transducer data-loggers in a sub-set of existing overburden and shallow bedrock monitoring wells in the northeastern portion of the landfill, including MW-109BR, MW-8SR, MW-8BR, MW-9, and MW-9B to monitor groundwater elevations in the wells closest to the residential area to evaluate the potential for pumping within the residential area to influence the groundwater elevation at the landfill. These data-loggers will be left in these existing monitoring locations for at least two weeks; during this time data will be downloaded after the first week and again after the two weeks of operation.

Sanborn Head will also deploy pressure transducer data-loggers in the supply wells located at 65, 70, 74, 81, and 89 H. Foote Road to provide continuous monitoring of groundwater elevations in the residential area. Data loggers will be deployed at appropriate depths based on water levels observed in the field.

Following completion and testing of the bedrock borings/monitoring wells described in Task 3, the data-loggers installed in MW-109BR, MW-8SR, MW-8BR, MW-9, and MW-9B will be re-deployed in the new bedrock boreholes installed as part of Task 3. We anticipate that these data-loggers will remain deployed for three months; during this time data will be downloaded after the first month and again after each succeeding month of operation.

During deployment of the pressure transducers, Sanborn Head will collect three comprehensive rounds of water level measurements from available groundwater monitoring wells and surface water monitoring points in the landfill's existing monitoring network to supplement the data from the data-loggers and provide a more comprehensive site-wide assessment of groundwater and surface water elevations at the landfill and in the residential area.

Task 5 – Development of Site Conceptual Model

Sanborn Head will continue to refine the site conceptual model as data are generated during completion of Task 1 through Task 4. This will involve additional review of existing

geologic and groundwater analytical data, and subsequent preparation of plan view and cross-section figures.

Documentation

Upon completion of Tasks 1 through 4, Sanborn Head will prepare a summary report. The summary report will include a discussion of the refined conceptual model for the landfill and residential area to the northeast.

We would be happy to meet with you discuss the proposed work plan described above. Should you have any questions in the mean time, please do not hesitate to call us.

Very truly yours,
SANBORN, HEAD & ASSOCIATES, INC.

Nicole D. Roy, P.G.
Senior Project Manager

Matthew R. Poirier
Senior Vice President and Principal

AEA/NDR/MRP:aea/ndr/dbc/mrp

Enclosure: Figure 1 – Proposed Boring Locations

Cc: Tracy Markham, SRDP
Jeff Arps, LSP, Tighe & Bond, Inc.
Mr. James A. McQuade, Section Chief, Division of Solid Waste, MassDEP

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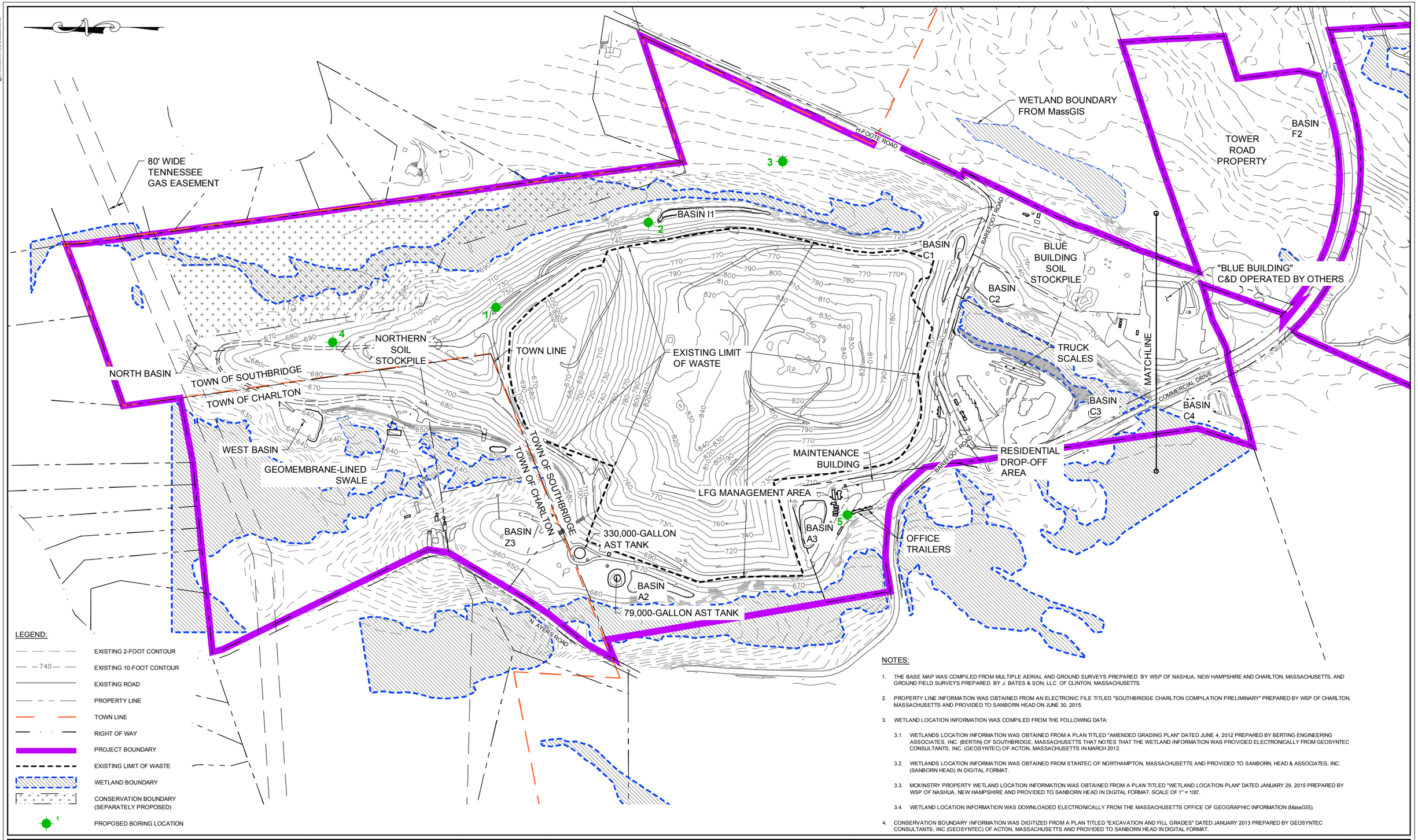

LEGEND:

- EXISTING 2-FOOT CONTOUR
- 740 EXISTING 10-FOOT CONTOUR
- EXISTING ROAD
- PROPERTY LINE
- TOWN LINE
- RIGHT OF WAY
- PROJECT BOUNDARY
- EXISTING LIMIT OF WASTE
- WETLAND BOUNDARY
- CONSERVATION BOUNDARY (SEPARATELY PROPOSED)
- 1 PROPOSED BORING LOCATION

NOTES:

1. THE BASE MAP WAS COMPILED FROM MULTIPLE AERIAL AND GROUND SURVEYS PREPARED BY WSP OF NASHUA, NEW HAMPSHIRE AND CHARLTON, MASSACHUSETTS, AND GROUND FIELD SURVEYS PREPARED BY J. BATES & SON, LLC OF CLINTON, MASSACHUSETTS
2. PROPERTY LINE INFORMATION WAS OBTAINED FROM AN ELECTRONIC FILE TITLED "SOUTHBRIDGE CHARLTON COMPILATION PRELIMINARY" PREPARED BY WSP OF CHARLTON, MASSACHUSETTS AND PROVIDED TO SANBORN HEAD ON JUNE 30, 2015.
3. WETLAND LOCATION INFORMATION WAS COMPILED FROM THE FOLLOWING DATA:
   - 3.1. WETLANDS LOCATION INFORMATION WAS OBTAINED FROM A PLAN TITLED "AMENDED GRADING PLAN" DATED JUNE 4, 2012 PREPARED BY BERTING ENGINEERING ASSOCIATES, INC. (BERTIN) OF SOUTHBRIDGE, MASSACHUSETTS THAT NOTES THAT THE WETLAND INFORMATION WAS PROVIDED ELECTRONICALLY FROM GEOSYNTEC CONSULTANTS, INC. (GEOSYNTEC) OF ACTON, MASSACHUSETTS IN MARCH 2012.
   - 3.2. WETLANDS LOCATION INFORMATION WAS OBTAINED FROM STANTEC OF NORTHAMPTON, MASSACHUSETTS AND PROVIDED TO SANBORN, HEAD & ASSOCIATES, INC. (SANBORN HEAD) IN DIGITAL FORMAT.
   - 3.3. MCKINSTRY PROPERTY WETLAND LOCATION INFORMATION WAS OBTAINED FROM A PLAN TITLED "WETLAND LOCATION PLAN" DATED JANUARY 29, 2015 PREPARED BY WSP OF NASHUA, NEW HAMPSHIRE AND PROVIDED TO SANBORN HEAD IN DIGITAL FORMAT. SCALE OF 1" = 100'.
   - 3.4. WETLAND LOCATION INFORMATION WAS DOWNLOADED ELECTRONICALLY FROM THE MASSACHUSETTS OFFICE OF GEOGRAPHIC INFORMATION (MassGIS).
4. CONSERVATION BOUNDARY INFORMATION WAS DIGITIZED FROM A PLAN TITLED "EXCAVATION AND FILL GRADES" DATED JANUARY 2013 PREPARED BY GEOSYNTEC CONSULTANTS, INC (GEOSYNTEC) OF ACTON, MASSACHUSETTS AND PROVIDED TO SANBORN HEAD IN DIGITAL FORMAT.

SANBORN HEAD

GRAPHICAL SCALE
200' 100' 0 200' 400'

NO.	DATE	DESCRIPTION	BY

DRAWN BY: D. LONG / E. WRIGHT
DESIGNED BY: D. LONG / A. ASHTON
REVIEWED BY: R. ST. MICHEL
PROJECT MGR: N. ROY
PIC: M. POIRIER
DATE: NOVEMBER 2015

RESIDENTIAL WELL GROUNDWATER INVESTIGATION WORK PLAN
SOUTHBRIDGE RECYCLING & DISPOSAL PARK, INC.
SOUTHBRIGE, MASSACHUSETTS

PROJECT NUMBER: 3530.06

PROPOSED BORING LOCATIONS

FIGURE NUMBER: 1