THIRD FIVE-YEAR REVIEW REPORT FOR SOMERSWORTH SANITARY LANDFILL SUPERFUND SITE SOMERSWORTH, NEW HAMPSHIRE

Prepared by

U.S. Environmental Protection Agency
REGION 1
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09/23/15

Date

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LIST OF ACRONYMS AND ABREVIATIONS

1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
ARARs	Applicable or Relevant and Appropriate Requirements
AUR	Activity and Use Restriction
BRW	Bedrock Well
CD	Consent Decree
cDCE	cis-1,2-dichloroethene
CE	chlorinated ethene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIC	Community Involvement Coordinator
CTW	Chemical Treatment Wall
DCE	dichloroethene
DCM	dichloromethane
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FYR	Five-Year Review
ft.	feet
GMZ	Groundwater Management Zone
gpm	gallons per minute
ICL	Interim Cleanup Levels
ICs	Institutional Controls
in.	inch
LFG	Landfill Gas
NA	Natural Attenuation
NCP	National Contingency Plan
NHDES	New Hampshire Department of Environmental Services
NPL	National Priorities List
OSRR	Office of Site Remediation and Restoration
OU	Operable Unit
O&M	Operation and Maintenance
PCE	tetrachloroethene
PID	photoionization detector
PLC	permeable landfill cover
POC	point of compliance
ppb	parts per billion
ppm	parts per million
PRA	Preferred Remedial Action
PRB	permeable reactive barrier
PRP	Potentially Responsible Party
RA	Remedial Action
RD	Remedial Design
RAO	Remedial Action Objectives
ROD	Record of Decision
RI/FS	Remedial Investigation/Feasibility Study
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan

SOW	Statement of Work
TBCs	To be considered
TCE	trichloroethene
UCL	upper confidence limit
µg/L	micrograms per liter
VC	vinyl chloride
VI	vapor intrusion
VOC	volatile organic compound
WMD	Waste Management Division
WSDs	Work Settling Defendants
ZVI	zero-valent iron

EXECUTIVE SUMMARY

This is the Third Five-Year Review (FYR) for the Somersworth Sanitary Landfill Superfund Site (Site) located in Somersworth, Strafford County, New Hampshire. The purpose of this FYR is to review information to determine if the remedy is and will continue to be protective of human health and the environment, as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601 *et seq*. The triggering action for this statutory FYR was the signing of the previous FYR on 9/23/2010.

The dominant Site feature is a former sanitary landfill that extends over an area of approximately 26 acres. The remedy implemented at the Site included installation of a Chemical Treatment Wall (CTW), which is a permeable reactive barrier (PRB) consisting of zero-valent iron (ZVI) and sand, along the down-gradient edge of the landfill, placement of a permeable soil cover over the landfill, installation of a bedrock groundwater extraction well and recharge of extracted groundwater into a gallery on the landfill, installation of a landfill gas venting trench, institutional controls, and monitored natural attenuation of contaminated groundwater down-gradient of the CTW. Once groundwater achieves cleanup standards an appropriate final cover for the landfill will be determined. The Site achieved construction completion on September 9, 2005.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Somersworth Sanitary Landfill Superfund Site		
EPA ID: NHD980520225		
Region: I	**State:** NH	**City/County:** Somersworth/Strafford

SITE STATUS	
NPL Status: Final	
Multiple OUs? No	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA
Author name (Federal or State Project Manager): Gerardo Millán-Ramos
Author affiliation: EPA Region I
Review period: 12/4/2014 - 9/23/2015
Date of site inspection: 7/21/2015
Type of review: Statutory
Review number: 3
Triggering action date: 9/23/2010
Due date *(five years after triggering action date)*: 9/23/2015

Issues/Recommendations

Issues and Recommendations Identified in the Five-Year Review:

OU(s): *Site-wide*	**Issue Category: Remedy Performance**			
	Issue: Bedrock groundwater concentrations are decreasing around the extraction well (BRW-1) and in some areas downgradient of BRW-1; however, BRW-1 appears to have limited or no hydraulic connection to the nearby bedrock wells.			
	Recommendation: 1. Determine whether a new extraction well or wells is/are necessary to contain the bedrock plume. 2. If a new well is necessary, determine the optimal location, depth, and pumping rate of such well. 3. Install, operate, maintain, and report the performance of the new extraction well(s) on a semi-annual basis.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Other	EPA/State	9/30/2017
OU(s): *Site-wide*	**Issue Category: Remedy Performance**			
	Issue: The CTW-20 transect has shown periodic elevated concentrations of CEs at the downgradient side of the CTW. It appears that insufficient treatment is occurring in that area of the CTW due to one or more of the following: 1) a gap between the top of the iron content and the clay layer at ground surface, 2) areas of low iron content across the transect in the CTW, or 3) the existence of geologic features either at the subsurface or under the CTW may be creating a preferential pathway for groundwater at the subsurface and/or shallow bedrock within the CTW-20 transect and the Panel 1-D transect.			

	Recommendation: 1. Identify and correct the cause(s) of the insufficient treatment of a portion of the CTW by performing and evaluating one or more of the following activities: a) excavating the top two feet of the cap within the CTW-20 transect and observing the condition of the CTW materials, b) implementing 2-D electrical resistivity surveying or other non-invasive surface geophysical methods to attempt to identify buried geological features which may be present in the subsurface and/or the shallow bedrock, which may be affecting CTW performance, c) electrical conductivity profiling within CTW areas suspected of having low/no iron content. 2. Increase the frequency of monitoring of groundwater in the vicinity of the CTW-20 transect from annual to semi-annual until potential issues with the performance of the CTW in this area have been resolved.

Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	Other	EPA/State	12/30/2016

OU(s): *Site-wide*	**Issue Category: Remedy Performance**
	Issue: It is uncertain whether the NA component of the remedy beyond the CTW will meet groundwater cleanup standards in the timeframe specified in the ROD.
	Recommendation: Complete an updated NA projection based on current scientific knowledge, regulatory guidance, and data trends.

Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	Other	EPA/State	12/30/2016

Sitewide Protectiveness Statement

Protectiveness Determination:
Short-term Protective

Protectiveness Statement:
The remedy currently protects human health and the environment because groundwater institutional controls are in place, landfill gas control measures have been implemented, sufficient cover is present on top of the landfill to prevent exposure to contaminated media, and an Activity and Use Restriction to protect against exposure to contaminated soil and debris on the landfill property has been finalized and recorded. However, in order for the remedy to be protective in the long-term, groundwater cleanup levels specified in the ROD must be attained; final closure of the landfill must be completed; and the actions listed below must be taken.

- Determine whether a new extraction well or wells is/are necessary to contain the bedrock plume. If a new well is necessary, determine the optimal location, depth, and pumping rate

of such well. Install, operate, maintain, and report the performance of the new extraction well on a semi-annual basis

- Identify and correct the cause(s) of the insufficient treatment of a portion of the CTW by performing and evaluating one or more of the following activities: a) excavating the top two feet of the cap within the CTW-20 transect and observing the condition of the CTW materials, b) implementing 2-D electrical resistivity surveying or other non-invasive surface geophysical methods to attempt to identify buried geological features which may be present in the subsurface and may be affecting CTW performance, and c) electrical conductivity profiling within CTW areas suspected of having low/no iron content. Increase the frequency of monitoring of groundwater in the vicinity of the CTW-20 transect from annual to semi-annual until potential issues with the performance of the CTW in this area have been resolved.
- Complete an updated NA projection based on current scientific knowledge, regulatory guidance, and data trends.

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy continues to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Section 121 and the National Contingency Plan (NCP). CERCLA 121 states:

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

EPA interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii), which states:

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

EPA conducted a FYR on the remedy implemented at the Somersworth Sanitary Landfill Superfund Site (Site) in the City of Somersworth, Stafford County, New Hampshire. EPA is the lead agency for developing and implementing the remedy for the Site. The New Hampshire Department of Environmental Services (NHDES), as the support agency representing the State of New Hampshire, has reviewed all supporting documentation and provided input to EPA during this FYR process.

This is the third FYR for the Somersworth Sanitary Landfill Superfund Site. The triggering action for this statutory review is the completion date of the previous FYR. The FYR is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

II. PROGRESS SINCE THE LAST REVIEW

Table 1: Protectiveness Determinations/Statements from the 2010 FYR

OU #	Protectiveness Determination	Protectiveness Statement
Sitewide	Short-term Protective	The remedy is considered protective in the short-term because groundwater institutional controls are in place, landfill gas control measures have been implemented and are effectively operating, activity use restrictions have been implemented, and sufficient cover is present on top of the landfill and around recreational areas of the Site to prevent exposure to contaminated media. In order to be protective in the long-term, the follow up actions listed below need to be taken, groundwater cleanup goals must be attained as specified in the ROD, and final closure of the landfill must be completed.

Table 2: Status of Recommendations from the 2010 FYR

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Party	Original Milestone Date	Current Status	Completion Date (if applicable)
1	Incorporate measures taken to: a) control landfill gas emissions, b) address potential future risk posed to recreational users, c) regulatory changes to Applicable or Relevant and Appropriate Requirements (ARARs), and d) land use restrictions for soil/landfill material, into the remedy through a supplemental CERCLA decision document.	Working Settling Defendants; EPA	EPA	3/30/2012	Completed	8/4/2015
2	Collect additional overburden groundwater data and any other necessary information to confirm that the VI exposure pathway for residents near well B-12R, is not complete.	Working Settling Defendants	EPA & NHDES	9/30/2011	Completed	4/4/2011
3	Conduct groundwater sampling for inorganics to confirm that representative concentrations are consistent with background concentrations.	Working Settling Defendants	EPA & NHDES	9/30/2011	Completed	4/4/2011
4	Examine the reports and data that characterize the nature and depth of the materials capping the City reclaimed area. If these reports cannot be obtained, or the data is deemed insufficient, then conduct further evaluations to confirm there are no potential risks to future recreational users of the Site.	Working Settling Defendants	EPA & NHDES	9/30/2011	Completed	10/17/2013

Recommendation 1

To address item 1, EPA prepared an Explanation of Significant Differences (ESD) that was finalized in May, 2013. One of the issues set forth in the ESD is the need to establish land use restrictions for the area over the landfill. This requirement has been met by the execution and recording of an Activity and Use Restrictions (AUR) in the Strafford County Registry of Deeds in August 2015.

Recommendation 2

As part of the Second Five Year Review, the Settling Defendants presented a vapor intrusion (VI) evaluation of historical Site data and information which concluded that the VOCs in the groundwater south of Blackwater Road are deep in the bedrock, and that there is a lens of clean overburden groundwater above it, and therefore, an incomplete pathway for potential vapor intrusion into residences. EPA requested that additional overburden groundwater data be provided in order to confirm the conceptual model of an incomplete pathway. On November 2010, additional groundwater sampling was conducted by the Settling Defendants in the vicinity of well B12R. Samples were collected from nearby overburden wells (B-12L and B-13WT). The samples were analyzed for the chlorinated ethenes (CEs) at the Site: benzene; dichloromethane (DCM); 1,1dichloroethene (1,1-DCE); cis-dichloroethene (cDCE); trans-dichlorethene (tDCE); tetrachloroethene (PCE); trichloroethene (TCE); and vinyl chloride (VC). As expected, both wells showed non-detect concentrations for all the VOCs analyzed. For more details about the VI evaluation and the confirmatory sampling effort, please see the May 20, 2013 ESD.

Recommendation 3

In November 2010, ten wells were selected and sampled for a list of 14 total metals using low flow purging techniques. The selected wells included upgradient (background), near source and down gradient wells, and both bedrock and overburden wells. Arsenic was detected in all 10 wells (concentrations ranging from 160 µg/L to 660 µg/L, vs. a naturally occurring (background) level of 10 µg/L) with the exception of two bedrock wells. The sampling effort and the evaluation of existing arsenic studies in the area concluded that although arsenic is elevated in groundwater in the landfill and immediately downgradient of the landfill, it is naturally occurring arsenic dissolved in the groundwater below and down-gradient of the landfill due to site conditions. Concentrations at the edges of the GMZ are within background concentration range. For more details on the sampling effort that confirmed that metals are within background concentrations, please see the April 4, 2011 Annual Demonstration of Compliance Report prepared by Geosyntec consultants.

Recommendation 4

Definitive documentation on the nature and depth of the cap materials over the easternmost 10 acres of the land was not available from historical records. An investigation of the cap material thickness in this area indicated that some areas of the landfill needed additional cover to meet the required one foot of thickness, and this requirement was documented in the May 2013 ESD. Additional material was added where needed in August, 2013 and certification/documentation of all the construction activities performed on-site was submitted in October, 2013 and approved by EPA, in consultation with NHDES, in November, 2013.

Remedy Implementation Activities

A summary of remedy activities implemented prior to this five-year review period is provided in Appendices A and B. Other than the placement of additional soil cover material over a portion of the landfill and the establishment of the AUR to restrict access to contaminated soil/debris, as noted above, no additional remedy implementation activities have occurred during this FYR period.

Table 3: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Soils and groundwater	Yes	Yes	Groundwater Management Zone with restrictions based on municipal ordinance covering the Site and adjacent residential properties. Soil ICs for the portion of the property that contains landfill waste	Groundwater ICs to prevent exposure to contaminated groundwater until groundwater cleanup standards are achieved. Soil use restriction provided by the IC to prevent activities that may result in exposures to Site contaminants.	City of Somersworth, New Hampshire Chapter 19 – Zoning Ordinance (August 30, 1989) Notice of Activity and Use Restrictions (August 2015)

The Activity and Use restrictions includes the following provisions:

(a) No digging, excavation or construction within the Restricted Area unless approved by NHDES after consultation with EPA;

(b) No use of the Restricted Area for residences, schools, or child care centers;

(c) In order to protect the integrity of the Selected Remedy (as described in the ROD and in the Site Management Plan attached to the AUR), no action that impacts the integrity of the soil cover within the Site shall be taken unless approval is obtained from NHDES, after consultation with EPA. Prohibited activities include, but are not limited to, use of all-terrain vehicles or other similar vehicles, excavation or other activities that lead to erosion or damage of the soil cover. Any action which may impact the integrity of the soil cover within the Restricted Area must be performed in accordance with the Soil Management Plan; and

(d) The Owner shall not disturb, move, damage, mar, tamper with, interfere with, obstruct, or impede any monitoring wells, treatment facilities, piping, and other facilities associated with the ROD, Consent Decree, ESD or any associated Statement of Work.

System Operation/Operation and Maintenance Activities

One of the components of the remedy is the bedrock groundwater extraction system. Groundwater has

been extracted from the bedrock with well BRW-1 and returned to the infiltration gallery within the landfill for the majority of the time from the previous five-year review until present. The target groundwater extraction rate was 8 gallons per minute (gpm) and actual annual averages during this five year review period were between 3.2 and 8.6 gpm. Regular (3 to 5 times per year) maintenance was conducted to clean the extraction pump and system lines, evaluate the condition of the pump and other system components, and keep extraction operating at the desired rate. See Figure 2 for the location of the extraction system.

Although the bedrock groundwater concentrations are decreasing around the extraction well and in some areas downgradient of BRW-1, there is no evidence of direct hydraulic connection between the extraction well and surrounding bedrock monitoring wells. It is not known if the groundwater extraction at BRW-1 was responsible for the reduction in concentrations of CEs that has been observed during the last decade of groundwater extraction. Based on discussions with EPA and NHDES in February and May 2014, it was agreed that the bedrock groundwater extraction system could be shut down on a trial basis for one year, and the impact of the shutdown would be assessed by monitoring selected bedrock wells in order to determine whether the continued operation of the extraction well is justified. A sampling plan to evaluate the impact of shutting down the groundwater extraction system (Geosyntec, 2014a) was approved by EPA and NHDES in June 2014. The extraction system was shut down on July 28, 2014. The first post-shutdown monitoring event in October 2014 did not show any indication of rebounding groundwater concentrations as a result of the shutdown. Based on this data, the bedrock groundwater extraction system will remain off in 2015 and sampling of system shutdown monitoring wells will occur twice in 2015.

Additional maintenance activities for other aspects of the remedy include yearly inspection of the condition of the landfill cover, monitoring wells, and soil gas vent pipes. Repairs are completed as needed. Annual groundwater sampling of the compliance wells is conducted and soil gas sampling of the soil gas probes and vapor from the landfill gas venting trench is conducted every two years. The results of these sampling events are discussed in Section IV.

It is also noteworthy that on November 2013, EPA prepared and presented to the Somersworth City Council a preliminary assessment of renewable energy opportunities for the Site. As a result, the City embraced the idea of building a solar generation facility on top of the landfill. The City has reviewed proposals for redevelopment of the Site with such a solar project in mind and, in March 2015, selected the American Capital Energy, Inc. (ACE) team, which includes Renewable Energy Development Partners LLC (REDP), and Weston & Sampson Engineers, Inc. to begin the ground work to further evaluate and potentially develop a solar photovoltaic facility at the Site.

A preliminary project overview was presented by the ACE team to the City of Somersworth on July 1, 2015, and the City accepted the team's recommended next steps:

- Monitoring the announcement of a Request for Proposal for a New Hampshire Public Utilities Commission grant.
- ACE/REDP preparing a grant proposal with support from City staff.
- City providing a letter of support for grant proposal.
- Once incentive award is made, ACE/REDP providing an energy price quote to City.
- Parties negotiating a Prospective Purchase Agreement (PPA) and lease based on an agreed energy price.
- ACE/REDP proceeding with a final design & permitting after contracts are in place.

The design of the project will be subject to review from EPA and NHDES to ensure compatibility with the ongoing remedy, including the newly recorded AUR.

III. FIVE-YEAR REVIEW PROCESS

Administrative Components

The Site's Five-Year Review was led by Gerardo Millán-Ramos, EPA Remedial Project Manager for the Site. Rudy Brown, the EPA Community Involvement Coordinator (CIC), and Andrew Hoffman, the NHDES project manager (representative for the support agency), assisted in the review.

The review, which began on 12/4/2014, consisted of the following components:

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

Community Notification and Involvement

Activities to involve the community in this five-year review process were initiated with a meeting in December 2014 between the RPM, the CIC for the Site and all other members of the review team. A press-release was sent to several media outlets in New England on 1/5/2015, stating that there was a five-year review and inviting the public to submit any comments to EPA. See a copy of the news release in Attachment D in Appendix B. The results of this review and the report will be made available at the Site information repository located at the EPA Region 1 Office of Site Remediation and Restoration (OSRR) Records and Information Center, 1st Floor, 5 Post Office Square, Suite 100 (HSC), Boston, MA 02109-3912 and at the Somersworth Public Library, 25 Main Street, Somersworth, NH 03878.

Document Review

This five-year review consisted of a review of relevant documents including Annual Monitoring and Demonstration of Compliance Reports for the Site which include Operation and Management (O&M) records and monitoring data. Applicable groundwater cleanup standards, as listed in the June 1994 Record of Decision, were also reviewed.

The following is a list of documents reviewed:

- American Capital Energy/Renewable Energy Development Partners, LLC. Somersworth Landfill PV Project - Project Overview. July 1, 2015.
- Beak and Geosyntec. 100% Design Report. February 5, 1999.
- Geosyntec. 1999. Preferred Remedial Action 100% Design Report.
- Geosyntec. 2011a. Annual Monitoring and Demonstration of Compliance Report for 2010. Draft Report, April 4, 2011.
- Geosyntec. 2011b. Updated Sampling and Analysis Plan for Groundwater Monitoring During Preferred Remedial Action. Revised Draft Report, October 20, 2011.
- Geosyntec. 2012. Annual Monitoring and Demonstration of Compliance Report for 2011. Draft Report, July 17, 2012.
- Geosyntec. 2013a. Annual Monitoring and Demonstration of Compliance Report for 2012. Draft Report, July 12, 2013.
- Geosyntec. 2013b. Addition of Clean Fill Certification Somersworth Sanitary Landfill Superfund Site. October 17, 2013.
- Geosyntec 2014a. Proposed Plan for Evaluating the Continued Need for Operating the Bedrock Groundwater Extraction System at the Somersworth Sanitary Landfill Superfund Site, Somersworth, New Hampshire, June 17, 2014.
- Geosyntec. 2014b. Annual Monitoring and Demonstration of Compliance Report for 2013. Draft Report, July 7, 2014.
- Geosyntec. 2015. Annual Monitoring and Demonstration of Compliance Report for 2014. Draft Report, February 20, 2015.
- GeoTrans. 1996. Technical Memorandum from "Design Investigation Plan for the Evaluation of the Need for Bedrock Groundwater Extraction Downgradient of the Chemical Treatment Wall". June 28, 1996.
- HSI GeoTrans. 1997. Technical Memorandum about re-sampling of bedrock extraction well. May 1997.
- US EPA Record of Decision (ROD). June 21, 1994.
- US EPA Consent Decree. September 28, 1995.
- US EPA First Five Year Review Report. September 23, 2005.
- US EPA Second Five Year Review Report. September 23, 2010.
- US EPA Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental

Response, Compensation and Liability Act Five-Year Reviews. OSWER Directive 9200.2-111. September 2012.

- US EPA Explanation of Significant Differences (ESD). May 30, 2013.
- US EPA. Determining Groundwater Exposure Point Concentrations. OSWER Directive 9283.1-42. February 2014.
- US EPA. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive 9200.1-120. February 6, 2014.
- City of Somersworth, New Hampshire. Chapter 19 – Zoning Ordinance. August 30, 1989.
- City of Somersworth. Letters sent to new property owners within the GMZ. March 25, 2010.
- City of Somersworth. Letters sent to new property owners within the GMZ. April 29, 2011.
- City of Somersworth. Letters sent to new property owners within the GMZ. April 25, 2013.
- City of Somersworth. Letters sent to new property owners within the GMZ. March 26, 2014.
- City of Somersworth. Letters sent to new property owners within the GMZ. May7, 2015.

Data Review

Review of records and monitoring reports covering sampling results through 2014 indicate that the remedy is performing substantially as designed. The following data and information were reviewed as part of this five-year review:

- Volatile Organic Compound (VOC) concentration data collected annually between 2010 and 2014, as provided in Table D-1 included in Appendix B. Figures 2.8a and 2.14a, in Appendix B, show the locations of the wells and figure 2.8b – d and 2.14 b-d show the concentration trends for each of the wells;
- Landfill gas data collected in 2010, 2011, 2012, and 2014 (Table 3.1 and Figure 3.1 included in Appendix B);
- Addition of Clean Fill Certification (17 October, 2013);

Specific observations from the monitoring of groundwater, soil gas, and the implementation of institutional controls at the Site are presented below:

- VOCs continue to be present in the landfill waste in the area around OB-16U and OB-17U, as indicated by the presence of groundwater concentrations above the 1994 ROD interim cleanup levels (ICLs).
- The concentrations of all VOCs in all samples in shallow monitoring wells downgradient of the CTW and within transects CTW-30 and CTW-40 were less than ICLs, with the exception of well

CTW-33U where the vinyl chloride (VC) concentration in 2014 was slightly above ICLs for the first time in over a decade (5 µg/L vs ICL of 2 µg/L). Continued data collection from this well will determine if this was an anomaly.

- At the CTW-20 transect, there have been periodic short term exceedances of the ICLs for cDCE and VC at the downgradient wells CTW-23U and CTW-24U. These exceedances occurred in 2004, 2008, 2013 and July 2014. During the last sampling event for this review period (October 2014) the concentrations were again below ICLs at the compliance boundary (CTW-23U). It is possible that a flow path is present in the CTW at the CTW-20 transect and/or the area between this transect and the Panel 1-D transect which allows periodic short circuiting through the ZVI under certain groundwater flow conditions. This will be evaluated further in 2015 by assessing the integrity of the wall via the vertical deployment of conductivity probes along the entire depth of this transect, and if necessary by conducting a targeted excavation at the top of the CTW in this area.

- The concentrations of VOCs in some of the compliance wells downgradient of the CTW have not yet been reduced below ICLs. At this stage in the operation of the CTW, it is too early to expect that VOC concentrations in groundwater beyond the CTW will be below the ICLs at many of the wells. However, wells B-13WT, OB-4U and R, and OB-6R have achieved compliance and are now only monitored every two years. Other wells have demonstrated compliance (several of the CTW transect wells, CTW-10U and OB-7U and R) but annual monitoring of these wells will be continued to address monitoring objectives related to performance of the CTW (CTW transect wells and CTW-10U) and the potential for VOCs to migrate onto the Site (background wells OB-7U and R). See Appendix B for historical groundwater data.

- The hydraulic testing, geochemical and biomass data are within the ranges expected in a zero-valent iron CTW and do not indicate any significant levels of precipitation or bio-fouling within the CTW. Minor hydraulic conductivity loss had been observed in the CTW-40 transect in 2012 and this was corrected with well rehabilitation.

- Measured vertical gradients, calculated water table mounding, measured groundwater VOC concentrations, and groundwater flux calculations show no evidence of substantial amounts of groundwater exceeding ICLs being diverted around or beneath the CTW.

- Natural attenuation processes continue to reduce VOC concentrations beyond the CTW.

- Data indicated that continued bedrock groundwater extraction at BRW-1 may not be functioning as intended (*i.e.*, effective hydraulic control) and the system was shutdown to evaluate this possibility). Continued monitoring and/or an expanded hydraulic evaluation maybe used to determine whether an additional extraction well or well(s) is/are necessary to contain the bedrock plume.

- Groundwater migrating from the landfill to areas beyond the POC meets the benzene and methylene chloride ICLs.

- Methane concentrations measured in soil gas probes before and after the installation of the LFG venting system indicate that the system is performing as designed and cutting off the migration of landfill gases out from the landfill.

Site Inspection

The inspection of the Site was conducted on 7/21/2015. In attendance were Gerardo Millán-Ramos, U.S. EPA RPM, Mr. William Brandon, U.S. EPA hydrologist, Mr. Andrew Hoffman, P.E., NHDES Project Manager, and Mr. Robert Belmore, City Manager for the City of Somersworth. The purpose of the inspection was to assess the protectiveness of the remedy and observe the first stage of the investigation of the CTW-20 transect.

The inspection showed that the remedy continues to be protective of human health and the environment. A few minor problems such as some wells and soil gas probes being unlocked were observed and reported to the WSDs. These items do not impact the protectiveness of the remedy and the vast majority of them were rectified as of July 30, 2015. The WDS's consultant, Geosyntec, has agreed to fix the remaining few items on/before the week of August 10, 2015.

Interviews

During the FYR process the EPA RPM interviewed a representative of the Work Settling Defendants (WSDs), and the NHDES project manager. The purpose of the interviews was to document any perceived problems or successes with the remedy that has been implemented to date. Interviews were conducted on 7/21/2015 and 07/29/2015.

Mr. Andrew Hoffman, P.E., NHDES Project Manager, was interviewed on 07/21/2015 during the Five Year Review Site Inspection and Mr. Robert Belmore, City Manager for the City of Somersworth was interviewed via telephone on 07/29/2015. Both interviews show that the remedy is seen as adequate given the Site specifics and that it is generally working towards achieving the cleanup goals. They also show that there is a common understanding about recurring issues that need to be addressed. For the complete interview records, please see Attachment B.

IV. TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The review of documents, ARARs, risk assumptions and the results of the Site inspections indicate that the components of the remedy are functioning as intended by the ROD, with the exception of the bedrock groundwater extraction system at BRW-1.

Based on existing data, there are multiple lines of evidence showing that Natural Attenuation (NA) is occurring on-site and that the CTW is effectively and consistently reducing chlorinated ethenes overall, with the exception of the CTW-20 transect area which has shown the intermittent anomalies as previously mentioned and described further in Section V below. Nonetheless it remains uncertain whether the NA component of the remedy beyond the CTW will meet groundwater cleanup standards in the timeframe specified in the ROD. The NA timeframe (56 years from the time the CTW began operating, per the ROD) is now uncertain since periodic elevated VOC concentrations (above the NHDES AGQS) have been observed at monitoring wells downgradient from the CTW. Specifically, data from the CTW-20

Transect in October 2013 and July 2014 showed elevated cis-1,2-dichloroethene (cDCE) and vinyl chloride (VC) concentrations at monitoring well CTW-24U. Also, such elevated downgradient concentrations have been observed in past monitoring events (2004 and 2008). The elevated concentrations in downgradient wells have occurred when concentrations upgradient of the CTW have also been elevated and subsequently have declined to the typically observed levels within 6 months. These intermittent anomalies are being further investigated.

The bedrock groundwater extraction system continued to operate up until July 2014 within the design parameters that were approved when the system became operational in November 2001[1]. The extraction system was shut down in July 2014 for a one year period, to evaluate if its continued operation is effectively functioning as intended to meet remedial objectives as discussed in Section II – System Operation/Operation and Maintenance Activities. Increased monitoring of key groundwater wells has been initiated to evaluate the shutdown, and the first post-shutdown monitoring event in October 2014 showed no indications of rebounding concentrations as a result of the system shutdown. However, the most recent hydraulic data from the bedrock monitoring wells most proximate to extraction well BRW-1 show that the connection between these wells and the extraction well is negligible, therefore containment of the localized bedrock plume is questionable, and additional investigations must be implemented to further evaluate the need for hydraulic containment that would facilitate the attainment of ICLs downgradient of the CTW.

The effective implementation of institutional controls has prevented exposure to, or ingestion of, contaminated groundwater, as well as any exposure to contaminated soil/debris within the portion of the property that contains landfill waste. Historically, approximately 10 acres of the eastern portion of the Site had been used by the City as recreational facilities (e.g., basketball courts, ball fields). Use of these recreational facilities has been discontinued with the exception of the basketball courts, located on the southern fringe of the property, and the availability of the entire property for use for passive recreation (such as walking). To further reduce risks a Notice of Activity and Use Restrictions (AUR) was finalized and recorded on August 2015. The AUR will prevent digging, excavation or construction on the Site; use of the restricted area for residences, schools, or child care centers; any action that impacts the integrity of the soil cover; and disturbance of monitoring wells and other facilities associated with the ROD.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

No. There have been changes to the exposure assumptions and toxicity data. However, these changes do not impact the protectiveness of the remedy. The cleanup level for each groundwater constituent was set at the MCL in the 1994 ROD and these MCLs have not changed for any of these contaminants since that time. There have been no changes in groundwater use that would affect the protectiveness of the groundwater components of the remedy.

Changes in Standards and TBCs

The May 2013 ESD added IC requirements to prevent access to contaminated soil/debris within the landfill portion of the Site. No specific cleanup standards for soil were established. The ESD also updated the ARARs cited in the 1994 ROD both to include revised State and Federal standards, and to identify

[1] These parameters are laid out in the Beak and Geosyntec 100% Design Report, dated February 5, 1999.

additional landfill/soil standards that were not specifically identified in the 1994 ROD. None of these updates changed any of the exposure assumptions, cleanup levels, and remedial action objectives (RAOs) for the remedy.

Changes in Exposure Assumptions and Risk Assessment Methods

Since the 1994 ROD, changes have been adopted to the equations used to calculate risks from Site exposures to soil, sediment and groundwater.

In 2014, EPA finalized the Directive on Determine Groundwater Exposure Point Concentrations (EPCs): http://www.epa.gov/oswer/riskassessment/pdf/superfund-hh-exposure/OSWER-Directive-9283-1-42-GWEPC-2014.pdf This Directive provides recommendations to develop groundwater EPCs. The recommendations are to calculate the 95% upper confidence limit (UCL) of the arithmetic mean concentration for each contaminant from wells within the core/center of the plume, using the statistical software "ProUCL". This approach could result in lower groundwater EPCs than the maximum concentrations routinely used for EPCs as was past practice in risk assessments, leading to changes in groundwater risk screening and evaluation. In general, this approach could result in slightly lower risk or lower screening levels[2].

In 2014, EPA finalized the Directive on the Update of Standard Default Exposure Factors and Frequently Asked Questions associated with these updates: http://www.epa.gov/oswer/riskassessment/superfund_hh_exposure.htm (items # 22 and #23 of this web link). Many of these exposure factors differ from those used in the risk assessment supporting the 1994 ROD. These changes in general would result in a slight decrease of the risk estimates for most chemicals[3].

Although calculated risks from potential exposure pathways at the Site may differ from those previously estimated, slightly higher for some contaminants and slightly lower for others, the revised methodologies themselves are not expected to affect the protectiveness of the remedy. A review of Site information reveals that these updates do not call into question the protectiveness of the remedy.

Changes in Exposure Pathways

There is no change in exposure pathways at Site since the previous FYR conducted in 2010.

Changes in Toxicity and Other Contaminant Characteristics

Since the 2010 FYR, there are updates in toxicity values for some contaminants that were identified in the 1994 ROD.

- cis-1,2-dichloroethene non-cancer toxicity values
  In January 2010, EPA revised the non-cancer toxicity values for cis-1,2-DCE and determined that currently there are no available cancer value nor inhalation values. It is now not possible to quantify cancer risk and inhalation risk from exposure to cis-1,2-DCE.

[2] US EPA. Determining Groundwater Exposure Point Concentrations. OSWER Directive 9283.1-42. February 2014.
[3] US EPA. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive 9200.1-120. February 6, 2014.

- Methylene Chloride cancer and non-cancer toxicity values
  On November 18, 2011, EPA finalized the toxicity assessment for methylene chloride. The new values indicate that methylene chloride is more toxic from non-cancer health effects but less toxic from cancer health effects. These toxicity changes would result in an increased non-cancer hazard and a decreased cancer risk from exposure to methylene chloride.

- TCE cancer and non-cancer toxicity values
  On September 28, 2011, EPA finalized the December 2009 revised toxicity values for TCE. The new values indicate that TCE is more toxic from both cancer and non-cancer health effects. These toxicity changes would result in increased non-cancer hazard and cancer risk from exposure to TCE.

- PCE cancer and non-cancer toxicity values
  On February 10, 2012, EPA finalized the cancer and non-cancer toxicity values for PCE. These new values indicate that PCE is now more toxic from cancer health effects but less toxic from non-cancer hazard effects. These toxicity changes would result in an increased cancer risk and a decreased non-cancer hazard from exposure to PCE.

Although calculated risks from potential exposure pathways at the Site may differ from those previously estimated due to the updated toxicity values for most of the contaminants identified in the ROD, slightly higher for some contaminants and slightly lower for others, the selected cleanup levels for these contaminants remain unchanged as the MCLs selected in the ROD. Therefore, the changes in toxicity values are not expected to affect the protectiveness of the remedy.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

Technical Assessment Summary

The remedy at the Site is still functioning as intended. Cleanup levels for all of the constituents involved are still valid. Overall, the remedy is still protective in the short-term because the selected remedy components have been implemented and are continually monitored and maintained. However, there are some issues that could affect long term protectiveness and must be addressed as discussed in the following section.

V. ISSUES/RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 4: Issues and Recommendations/Follow-up Actions

OU #	Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
						Current	Future
00 Entire Site	Bedrock groundwater concentrations are decreasing around the extraction well (BRW-1) and in some areas downgradient of BRW-1; however, BRW-1 appears to have limited or no hydraulic connection to the nearby bedrock wells.	1. Determine whether a new extraction well or wells is/are necessary to contain the bedrock plume. 2. If a new well is necessary, determine the optimal location, depth, and pumping rate of such well. 3. Install, operate, maintain, and report the performance of the new extraction well(s) on a semi-annual basis.	Working Settling Defendants (WSDs)	EPA and NHDES	9/30/2017	No	Yes

00 Entire Site	The CTW-20 transect has shown periodic elevated concentrations of CEs at the downgradient side of the CTW. It appears that insufficient treatment is occurring in that area of the CTW due to one or more of the following: 1) a gap between the top of the iron content and the clay layer at ground surface, 2) areas of low iron content across the transect in the CTW, or 3) the existence of geologic features under the wall may be creating a preferential pathway for groundwater at shallow bedrock in the area between the CTW-20 transect and the Panel 1-D transect.	1. Identify and correct the cause(s) of the insufficient treatment of a portion of the CTW by performing and evaluating one or more of the following activities: a) excavating the top two feet of the cap within the CTW-20 transect and observing the condition of the CTW materials, b) implementing 2-D electrical resistivity surveying or other non-invasive surface geophysical methods to attempt to identify buried geological features which may be present in the subsurface and/or the shallow bedrock, which may be affecting CTW performance, c) electrical conductivity profiling within CTW areas suspected of having low/no iron content. 2. Increase the frequency of monitoring of groundwater in the vicinity of the CTW-20 transect from annual to semi-annual until potential issues with the performance of the CTW in this	WSDs	EPA and NHDES	12/30/2016	No	Yes

OU #	Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
						Current	Future
		area have been resolved.					
OO Entire Site	It is uncertain whether the NA component of the remedy beyond the CTW will meet groundwater cleanup standards in the timeframe specified in the ROD.	Complete an updated NA projection based on current scientific knowledge, regulatory guidance, and data trends.	WSDs	EPA and NHDES	12/30/2016	No	Yes

VI. PROTECTIVENESS STATEMENT

Sitewide Protectiveness Statement	
Protectiveness Determination: Short-term Protective	*Addendum Due Date (if applicable):* Click here to enter a date.

Protectiveness Statement:

The remedy currently protects human health and the environment because groundwater institutional controls are in place, landfill gas control measures have been implemented, sufficient cover is present on top of the landfill to prevent exposure to contaminated media, and an Activity and Use Restriction to protect against exposure to contaminated soil and debris on the landfill property has been finalized and recorded. However, in order for the remedy to be protective in the long-term, groundwater cleanup levels specified in the ROD must be attained; final closure of the landfill must be completed; and the actions listed below must be taken.

- Determine whether a new extraction well or wells is/are necessary to contain the bedrock plume. If a new well is necessary, determine the optimal location, depth, and pumping rate of such well. Install, operate, maintain, and report the performance of the new extraction well(s) on a semi-annual basis
- Identify and correct the cause(s) of the insufficient treatment of a portion of the CTW by performing and evaluating one or more of the following activities: a) excavating the top two feet of the cap within the CTW-20 transect and observing the condition of the CTW materials, b) implementing 2-D electrical resistivity surveying or other non-invasive surface geophysical methods to attempt to identify buried geological features which may be present in the subsurface and may be affecting CTW performance, and c) electrical conductivity profiling within CTW areas suspected of having low/no iron content. Increase the frequency of monitoring of groundwater in the vicinity of the CTW-20 transect from annual to semi-annual until potential issues with the performance of the CTW in this area have been resolved.
- Complete an updated NA projection based on current scientific knowledge, regulatory guidance, and data trends.

VII. NEXT REVIEW

The next five-year review report for the Somersworth Sanitary Landfill Superfund Site is required five years from the completion/signature date of this review.

APPENDIX A – EXISTING SITE INFORMATION

A.1 SITE CHRONOLOGY

Event	Date
Landfill started to accept waste	Mid 1930s
City ceased waste disposal	1981
Final NPL listing	Sept, 1983
Removal actions	N/A
ROD signature	June, 1994
ROD Amendments or ESDs signature dates	ESD - May 30, 2013
Enforcement documents (CD, AOC, Unilateral Administrative Order)	Consent Decree – October 1999
Bedrock Extraction Well Installation	April, 1996
City Ordinance prohibiting groundwater use within GMZ	February 1999
Remedial design complete	July, 2000
On-site remedial action construction start (CTW)	August, 2000
Completion of CTW Construction Activities	September, 2000
Final Inspection Meeting for Landfill Cover and Bedrock Extraction	August, 2001
Completion of Landfill Gas Venting Trench	December 2003
Pre-Final Inspection	June, 2004
Final Close-out Report (if applicable)	N/A
Deletion from NPL (if applicable)	N/A
Previous five-year reviews	2005, 2010
AUR establishing land use restrictions	August 2015

N/A = not applicable

A.2 BACKGROUND

Physical Characteristics

The Site is located on the north side of Blackwater Road approximately one mile southwest of the center of the City of Somersworth (the City) in Strafford County, New Hampshire as shown in Figure 1.1. The Site layout is shown in Figure 1.2. The dominant Site feature is a former sanitary landfill that extends over an area of approximately 26 acres. These figures and all data tables are included in Appendix B.

Hydrology

The landfill is located entirely within the Peters Marsh Brook surface water drainage basin. The brook flows northwesterly through the wetlands at the Site into Tate's Brook, which in turn flows into the Salmon Falls River which is located about 1 mile east of the Site (see Figure 1.1).

The Site is relatively flat and low lying except that the quarrying activities immediately to the north of the landfill have resulted in the presence of a 15 to 20-foot vertical escarpment which runs parallel to the northern edge of the landfill. The western edge of the landfill slopes gently downward toward the wetland. The Site is underlain by an unconfined sand and gravel aquifer ranging from about 15 to 75 feet thick. Metamorphic bedrock occurs beneath the sand and gravel overburden deposits. A peat layer is present at ground surface in and near the wetland. Groundwater flows through the overburden in a northwesterly direction. The bedrock is fractured, with flow in the shallow bedrock appearing to be slightly north of west. Groundwater from both the bedrock and overburden discharges to Peters Marsh Brook and the wetland.

Land and Resource Use

The landfill accepted municipal and industrial wastes from the mid-1930's to 1981. Initially the wastes were burned, but in 1958, the burning was stopped and the wastes were landfilled after excavating the natural soils. Soils were used to cover the wastes daily and the landfill expanded westward. The approximate extent of buried landfill wastes is shown on Figure 1.2.

Historically, approximately 10 acres of the easternmost portion of the Site had been covered and then used by the City as recreational facilities (e.g., basketball courts, ball fields). Use of these recreational facilities was discontinued in June 2011 with the exception of the basketball courts, located on the southern fringe of the property (although the area is still open to passive recreational use). Residential properties are present to the east, west and south of the Site and a wooded area and former quarry are located to the north. A National Guard Armory and fire station are also located to the east of the Site. Recently, the City of Somersworth decided to pursue the possible development of a solar photovoltaic (PV) facility on the Site.

At the time of the Remedial Investigation (1989), two municipal water supply wells were located near the landfill: well #3 (approximately 2,300 ft. north-northwest of the landfill) and well #4 (approximately 800 ft. southwest of the landfill). By 1994 both of them were dismantled and sealed because of high metals, inadequate yields, and the risk of contamination from the landfill. Another well (residential well RW-2) located immediately south of the landfill, was decommissioned by 1989 (1994 ROD).

Currently, all residences within the GMZ (see GMZ Map at Attachment D) obtain drinking water from the Somersworth municipal supply system, and extraction of the groundwater (for any use) within the GMZ is prohibited by a City Ordinance. Both the City of Somersworth and the City of Berwick, Maine withdraw water from the Salmon Falls River for their drinking water supplies, and their water intakes are located approximately 1.5 miles to the north-northeast of the landfill (1989 RI/FS).

History of Contamination

The source of contamination was the landfilling operations occurring on Site. Monitoring wells were installed and groundwater sampling was conducted by the City when landfilling ceased at the Site in 1981. The results of this sampling indicated the presence of volatile organic compounds (VOCs) in the groundwater. As a result, the Site was placed on the NPL on September 8, 1983.

Groundwater sampling conducted at the Site during the Remedial Investigation and Feasibility Study (RI/FS) between 1985 and 1992 indicated the presence of low concentrations (parts per billion to about one part per million) of the following VOCs:

- trichloroethene (also known as trichloroethylene; TCE);
- tetrachloroethene (also known as tetrachloroethylene or perchloroethylene; PCE);
- 1,1-dichloroethene (1,1-DCE);
- cis and trans isomers of 1,2-dichloroethene (cDCE and tDCE, respectively);
- 1,2-dichloroethane (1,2-DCA);
- vinyl chloride (VC);
- benzene; and
- methylene chloride (also known as dichloromethane; DCM).

Initial Response

No initial response (CERCLA or Non-CERCLA removal actions) was taken at the Site. The Site was included in the NPL on September 1983 and EPA proceeded with the preparation of a ROD which was finalized on June 1994.

Basis for Taking Action

The 1994 ROD for the Site (Section IV) states ... *The selected remedy was developed by combining components of different source control and management of migration alternatives to obtain a comprehensive approach for Site remediation. In summary, the selected remedy provides treatment of contaminated overburden and bedrock groundwater with flushing of contamination from the source area. This remedial action will address the principal threat to human health and the environment posed by the Site: the potential future ingestion of contaminated groundwater.*

The ROD also established Interim Cleanup Levels (ICLs) for eight VOCs in groundwater as listed below:

• benzene	5	micrograms per liter (µg/l)
• methylene chloride	5	µg/l
• tetrachloroethene (PCE)	5	µg/l
• trichloroethene (TCE)	5	µg/l
• 1,1-dichloroethene (1,1-DCE)	7	µg/l
• cis-1,2-dichloroethene (cDCE)	70	µg/l
• trans-1,2-dichloroethene (tDCE)	100	µg/l
• vinyl chloride (VC)	2	µg/l

The six chlorinated ethenes (i.e., PCE, TCE, 1,1-DCE, cDCE, tDCE, and VC) in the above list are referred to as the "CEs" at the Site.

Potential risks posed by exposure to contaminated soil/landfill material were not quantified in the ROD. However, in 2006 samples of sediment pore water and surface water in the wetland down-gradient of the CTW were collected and no VOCs were detected in either type of samples. Therefore, this exposure

pathway was not investigated any further. For more details please see Section A.3. Remedy Implementation below.

A.3. REMEDIAL ACTIONS

Remedy Selection

The ROD for the Somersworth Sanitary Landfill Superfund Site was signed on June 21, 1994 (EPA, 1994).

The remedial action objectives (RAO) stated in Section VII, Part A of the ROD were:

- *Prevent ingestion of contaminated groundwater by local residents;*
- *Prevent the public from coming into direct contact with contaminated solid wastes, surface soils, surface water, and sediments;*
- *Reduce or eliminate migration of contaminants from the solid wastes or soils into ground or surface water*[4]*;*
- *Reduce or eliminate off-site migration of contaminants in excess of regulated allowable limits; and*
- *Ensure that the groundwater and surface water have residual contaminant levels that are protective of human health and the environment.*

To meet these objectives, the selected remedy described in the 1994 ROD included both source control and management of migration components to obtain a comprehensive remedy for the Site.

The source control remedial components of the preferred alternative included:

- *installation of a treatment wall composed of impermeable barrier sections and innovative, permeable, chemical treatment sections to provide in-situ (in-place), follow-through treatment of contaminated groundwater at the landfill waste boundary (the compliance boundary). The barrier sections, sheet piling or slurry walls, will direct contaminated groundwater through the treatment sections where detoxification of the VOCs will occur; and*
- *placement of a permeable cover over the landfill allowing precipitation to flush contamination from the waste area. This cover will remain as long as contaminants continue to leach from the landfill waste and the chemical treatment "wall" is functioning. After cleanup levels have been achieved and can be maintained without use of the treatment "wall," EPA will evaluate an appropriate landfill cover to be installed to close the landfill.*

The management of migration remedial components of the preferred and contingency remedies

[4] Under the remedy called for in the 1994 ROD, this RAO would not be met until groundwater standards are achieved and a final cap is installed on the landfill.

included:

- *installation of a pump in bedrock monitoring well B-12R[5] to extract contaminated groundwater. The contaminated groundwater will be either discharged onto the landfill to enhance flushing or injected just upgradient of the chemical treatment wall to receive treatment for the preferred alternative or treated with the extracted overburden groundwater for the contingency alternative. The need for bedrock groundwater extraction wells down gradient of the chemical treatment wall or perimeter slurry wall will be investigated during the design. This investigation will focus on the number, location, and flow rate of the wells; the timing of their installation; and the impacts on the overall groundwater cleanup[6].*
- *natural attenuation of contaminated groundwater beyond the compliance boundary to lower contaminant concentrations through physical, chemical and biological processes until groundwater cleanup levels are met.*

Additional remedial components of the selected remedy included:

- *institutional controls to ensure that the affected groundwater will not be used until groundwater cleanup levels have been met;*
- *a fence will be installed around the landfill to prevent access; and*
- *a detailed groundwater monitoring program to be developed during remedial design. The program will address long-term monitoring of the aquifer and performance monitoring of the chemical treatment wall.*

Finally, the 1994 ROD included a contingency alternative. The contingency alternative was to be invoked if it was determined that the source control preferred alternative would not meet performance standards. The source control contingency alternative included:

- *construction of a diversion trench on the upgradient side of the landfill to intercept and divert groundwater around the landfill. To the extent practicable, this diverted groundwater will be used to recharge the downgradient wetlands. A perimeter slurry wall would be completed around the landfill waste. Permeable treatment sections of chemical treatment wall would be removed and replaced by slurry wall material. The final component would be a landfill cover which complies*

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[5] Well BRW-1 was chosen instead because well B-12R is a 1.5 in diameter well which precluded the installation of a continuous operating pump. In addition, hydraulic testing conducted by HSI GeoTrans (Technical Memorandum Regarding Re-Sampling of Bedrock Extraction Well BRW-1; HSI GeoTrans May 1997) indicated that the yield from B-12R was expected to be quite low and thus it would not be an appropriate extraction well.

[6] The evaluation of the "need for additional bedrock extraction" was performed and concluded that no such wells were necessary. The entire evaluation is shown in the following documents:

- GeoTrans Technical Memorandum from 28 June 1996 "Design Investigation Plan for the Evaluation of the Need for Bedrock Groundwater Extraction Downgradient of the Chemical Treatment Wall";
- HSI GeoTrans Technical Memorandum from May 1997 about Re-Sampling of Bedrock Extraction Well BRW-1;
- 100% Design Report Beak Geosyntec 5 February 1999 (Appendix D which includes "Technical Memorandum Hydrogeological Design Analysis Groundwater Extraction Well BRW-1" HIS GeoTrans 2 February 1999).

with hazardous waste landfill requirements and other ARARs set out in the ROD. The purpose of these components is to lower the groundwater to below the waste in an attempt to meet interim groundwater cleanup levels in the overburden aquifer at the compliance boundary. The groundwater levels would be monitored to determine if the water table would be lowered below the waste and groundwater quality would be monitored to ensure that overburden groundwater will meet interim groundwater cleanup levels at the compliance boundary. If either of these conditions cannot be met, then extraction and treatment of overburden groundwater from within the slurry wall will be implemented. The remedial design will determine the number, location and pumping rates of each well, as well as, the most appropriate treatment technology and discharge location. On-site treatment and disposal methods and pretreatment and discharge at the Somersworth wastewater treatment facility are the two options which will be evaluated.

An ESD was issued on May 2013 and included the following changes to the CERCLA remedy:

- *Adding measures that had already been taken to control landfill gas emissions (soil gas monitoring and a passive venting system);*
- *Removal of the requirement that a fence be installed around the landfill to restrict access;*
- *Changing use restrictions to indicate that limited passive recreation within the Site can be carried out without posing a health risk;*
- *Requiring and documenting that the Pre-CERCLA Cover area meets the same protectiveness standards as areas of the Site covered as part of the ROD remedy (the ROD cover).*
- *Establishing land use restrictions in soil, in the form of an AUR;*
- *Updating applicable ARARs to include revised State and Federal standards, and to identify additional landfill/soil standards that were not specifically identified in the ROD; and*
- *Incorporating measures that were taken to evaluate the potential for vapor intrusion in the residential areas along Blackwater Road as part of the remedial action.*

Remedy Implementation

The Preferred Source Control Remedy includes a zero-valent iron (ZVI) chemical treatment wall (CTW) to provide *in situ*, flow-through treatment of groundwater containing CEs at the downgradient edge of the waste management area of the landfill and a permeable landfill cover (PLC) over the waste management area at the Site. A determination on a final cover configuration is also a component of the PRA.

The CTW was constructed during the fall of 2000 at the location shown in Figure 1.2. and CTW performance monitoring started in the winter of 2001. The CD requires that the CTW prevent all untreated overburden groundwater that contains CEs at concentrations greater than ICLs (>ICLs) from migrating from the landfill to areas beyond the Point of Compliance (POC), except for insubstantial amounts of such groundwater. The POC is the edge of the waste management area, except where the CTW has been constructed, in which case it is the outer edge of the CTW (Figure 1.2). It was required that groundwater passing through the CTW achieve ICLs for the CEs within 18 months after the Preferred Remedial Action Pre-final Inspection Meeting and that ICLs be maintained thereafter. A report was prepared to assess

CTW performance 18 months after the construction of the CTW (Geosyntec, 2002a) to address this requirement. The conclusion of this report was that no modifications to the CTW were considered necessary, at that time, as overall performance was meeting the performance requirements.

The permeable cover was installed over the waste management area at the Site in 2001. The extent of the cover installed in 2001 was consistent with the Preferred Remedial Action 100% Design (Geosyntec, 1999) for the Site, and covers the waste management area but not the area where the recreational facilities used to be located. The cover is intended to allow precipitation to infiltrate and flush chemicals from the waste management area into the CTW where they will be treated.

The area where the recreational facilities used to be located is covered by a combination of sand and top soil that is at least one foot deep and offers the same protectiveness as the rest of the site. For further details, see the status of Recommendation #4 under Section II above.

The surface water and pore water concentrations in Peters Marsh Brook were evaluated in 2006. Surface water and pore water sampling was conducted at six locations in the wetland down-gradient of the CTW to fulfill EPA and NHDES request to determine whether intermediate de-chlorination products are being discharged to the surface water such that chlorinated ethenes (CEs) are present in surface water at concentrations above the surface water standards per New Hampshire Rule [Env.–Ws 1700]. The measured concentrations of VOCs in surface water samples were compared with historical surface water data and pore water sample results were compared with the groundwater water standards per New Hampshire Rule [Env.–Wm 1403]. No VOCs were detected in surface water or pore water samples and as such, it met the standards per New Hampshire Rule [Env.–Ws 1700] and New Hampshire Rule [Env.–Wm 1403].

System Operation/Operation and Maintenance

All Operations and Maintenance (O&M) requirements of the preferred remedial action are described in the Operation and Maintenance Plan (Geosyntec, 2004b). In addition to the groundwater monitoring described above, O&M activities include:

- Biennial hydraulic testing of the CTW;
- Annual inspections of the PLC, access roads, monitoring wells, soil gas probes, and LFG venting system;
- Repairs to damaged areas of the PLC, access roads, monitoring wells, soil gas probes and LFG venting system; and
- O&M of the bedrock groundwater extraction system components including the extraction well, extraction well pump, well vault, flow meter, piping and infiltration gallery were conducted a minimum of three times a year until July 2014 when the system was temporarily shut down.

The CTW is hydraulically tested biennially to evaluate any changes in the condition of the CTW. Groundwater data is also used to evaluate whether the groundwater in the area at and beyond the POC complies with ICLs for a period of three consecutive years. At this stage in the operation of the CTW, it is too early to expect that VOC concentrations in groundwater (at and beyond the POC) will be below the ICLs at many of the wells, although some wells achieved compliance as of 2003.

In addition to the groundwater monitoring, soil gas samples for total VOCs, methane, carbon dioxide, oxygen, and hydrogen sulfide are collected biennially (annually up until 2012 and biennially since then) at the soil gas probes on the Site. Since the construction of the landfill gas venting trench (December, 2003), samples of the landfill gas for the same parameters measured at the soil gas samples plus air flow rate, have been collected at least annually from the vent pipes.

Monitoring of the soil gas probes (SGPs) and the vent pipes from the LFG venting trench was conducted on a quarterly basis in 2004 and 2005. During those years, the concentrations of methane in SGPs (used to evaluate the performance of the LFG venting trench) were significantly lower than in concentrations observed in 2002 and 2003. In 2004 and 2005 the vast majority of the SGPs had methane concentrations less than 2.5% (which is 50 % of the lower explosive limit for this gas, also the NHDES standard) and many (SGP1a, SGP-9, SGP-10 and SGP-7) had non-detect concentrations of methane. Based on those results, the monitoring of the SGPs and vent pipes was conducted at a reduced frequency (annually) from 2006 to 2012 at which point, based on the consistently low levels of methane (below 2.5%), the recommendation was made to further decrease the sampling frequency from annual to biennial.

During this five year review period, the methane concentrations at the vent pipes continued to show a wide fluctuation ranging from non-detections to levels as high as 32.1 %. This range of concentrations is similar to the one observed in the past. Nonetheless, since 2012 methane concentrations at all the SGPs, have been below the State standard (2.5%). In fact, in the most recent data available for this review (2014) all of the SGPs were non-detect for methane.

The results observed so far warrant continued monitoring of landfill gas at both the SGPs and the vent stacks but they also indicate that the LFG venting trench is performing as designed, cutting off the migration of landfill gases, and thus continuing to protect nearby residents from the risk of explosion due to landfill gas accumulation inside buildings and possible exposures to the gas.

The ROD (Section VIII) specifies that a total of $2,240,100.00 in Operations, Maintenance and Monitoring (OM&M) costs would be spent over the course of 30 years. Thus, the estimated OM&M annual costs in 1994 dollars was approximately $75,000.00 per year.

A look at the actual OM&M costs from the beginning of 2010 to the end of 2014 reveals that a total of approximately $670,000.00 has been spent during these past five years. In current dollars, this figure amounts to $134,000.00 per year.

To compare these two annual OM&M costs, a calculation of the inflation between them, using the Consumer Price Index as published by the U.S. Bureau of Labor Statistics (http://www.bls.gov/data/inflation_calculator.htm), shows that the $75,000.00 in 1994 would have the same buying power as $120,768.22 in 2015. Therefore the actual annual OM&M cost for this review period ($134,000.00) slightly exceeds the projected OM&M cost after inflation adjustment ($120,768.22) by approximately 11%.

APPENDIX B – ADDITIONAL MAPS, DATA, FIGURES, OR TABLES FOR REFERENCE

Table 1: Interim Cleanup Levels

TABLE 1.2
INTERIM CLEANUP LEVELS
Somersworth Sanitary Landfill Superfund Site, New Hampshire

Chemical of Concern	**Interim Cleanup Level (ICLs)** micrograms per liter (µg/L)
benzene	5
methylene chloride (DCM)	5
tetrachloroethene (PCE)	5
trichloroethene (TCE)	5
1,1-dichloroethene (1,1-DCE)	7
cis-1,2-dichloroethene (cDCE)	70
trans-1,2-dichloroethene (tDCE)	100
vinyl chloride (VC)	2

Table 2: Groundwater Laboratory Data

TABLE D-1
GROUNDWATER LABORATORY DATA
Somersworth Sanitary Landfill Superfund Site, New Hampshire

Location	Date Sampled	QA/QC Sample Type	Depth (ft bgs)	Benzene (µg/L)	DCM (µg/L)	1,1-DCE (µg/L)	cDCE (µg/L)	tDCE (µg/L)	PCE (µg/L)	TCE (µg/L)	VC (µg/L)
B-12L	10-Nov-10	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
B-12R	25-Oct-10	--		10 U	10 U	10 U	38	10 U	10 U	1,000	10 U
	31-Oct-11	--		5.0 U	5.0 U	5.0 U	53	7.9	5.0 U	1,000	5.0 U
	09-Oct-12	--	0	1.1 U	0.90 U	1.6 U	42	7.1 J	1.9 U	1,100	1.2 U
	07-Oct-13	--	0	0.28 U	0.32 J	2.0 J	78	19	0.92 J	1,400	1.6 J
	03-Nov-14	--	0	1.0 U	1.0 U	1.0 J	52	12	0.92 J	1,200	1.0 U
B-13R	25-Oct-10	--		1.0 U	1.0 U	1.0 U	15	1.0 U	1.0 U	1.0 U	7.0
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	12	1.0 U	1.0 U	1.0 U	7.6
	09-Oct-12	--	0	0.44 J	0.11 J	0.16 U	14	0.32 J	0.19 U	0.64 J	5.2
	07-Oct-13	--	0	0.49 J	0.10 J	0.16 U	14	0.49 J	0.19 U	0.17 U	9.2 J
	04-Nov-14	--	0	0.51 J	1.0 U	1.0 U	18	0.18 J	1.0 U	0.71 J	4.7
B-13WT	25-Oct-10	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	0.11 U	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.29 J
	04-Nov-14	--	0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.26 J
B-2L	25-Oct-10	--		1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	2.2	0.090 U	0.26 J	6.0	0.14 U	0.92 J	9.2	5.3
	09-Oct-12	Field Duplicate	0	1.9	0.090 U	0.16 U	5.2	0.14 U	0.81 J	7.9	3.9
	07-Oct-13	--	0	0.97 J	0.090 U	0.16 U	1.5	0.14 U	0.19 U	0.17 U	1.9 J
	04-Nov-14	--	0	0.60 J	1.0 U	1.0 U	0.65 J	1.0 U	1.0 U	1.0 U	1.7
B-6R	09-Nov-10	--		5.0 U	5.0 U	5.0 U	210 J	6.3	5.0 U	5.0 U	180 J
B-8L	25-Oct-10	--		4.3	1.0 U	1.0 U	72	4.1	1.0 U	1.0 U	460
	31-Oct-11	--		4.2	1.0 U	1.0 U	54	3.2	1.0 U	1.0 U	440
	09-Oct-12	--	0	3.9	0.099 J	0.19 J	35	2.3	0.19 U	0.47 J	420
	07-Oct-13	--	0	4.0	0.18 U	0.32 U	20	1.3 J	0.38 U	0.34 U	510 J
	03-Nov-14	--	0	4.4	1.0 U	1.0 U	22	1.2	1.0 U	0.37 J	310
B-8R	25-Oct-10	--		1.0 U	1.0 U	1.0 U	220	2.0	1.0 U	6.6	37
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	220	2.0	1.0 U	6.3	42
	09-Oct-12	--	0	0.48 J	0.17 J	0.19 J	110	1.2	0.19 U	3.1	35
	07-Oct-13	--	0	0.65 J	0.18 J	0.31 J	140	1.5	0.19 U	4.9	51 J
	03-Nov-14	--	0	0.66 J	1.0 U	1.0 U	130	1.1	1.0 U	4.0	33
B-9R	25-Oct-10	--		1.0 U	1.0 U	1.0 U	87	1.0 U	1.0 U	1.0 U	9.6
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	84	1.0 U	1.0 U	1.0 U	9.8
	09-Oct-12	--	0	0.29 J	0.093 J	0.16 U	87	0.14 U	0.19 U	0.25 J	11
	11-Nov-13	--	0	0.32 J	1.0 U	1.0 U	84	0.44 J	1.0 U	1.0 U	9.4
	05-Nov-14	--	0	0.30 J	1.0 U	1.0 U	92	1.0 U	1.0 U	1.0 U	12
BRW-1	27-Oct-10	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	13	1.0 U
	01-Nov-11	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.5	1.0 U
	10-Oct-12	--	0	0.11 U	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.20 J	0.12 U
	08-Nov-13	--	0	1.0 U	1.0 U	1.0 U	0.81 J	1.0 U	1.0 U	4.3	1.0 U
	08-Jan-14	--	0	0.11 U	0.090 U	0.16 U	5.7	0.14 U	0.19 U	4.0	0.12 U
	04-Nov-14	--	0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.33 J	1.0 U
CTW-10U	07-Oct-13	--	0	3.7	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	1.2 J
CTW-10UA	27-Oct-10	--		4.2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		2.9	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	3.4	0.090 U	0.16 U	0.35 J	0.14 U	0.19 U	0.96 J	0.12 U
	04-Nov-14	--	0	3.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.25 J	1.0 U
CTW-21U	09-Nov-10	--		5.0	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	6.5
	31-Oct-11	--		4.8	1.0 U	1.0 U	11	2.3	1.0 U	1.0 U	14
	31-Oct-11	Field Duplicate		4.7	1.0 U	1.0 U	11	2.2	1.0 U	1.0 U	14
	08-Oct-12	--	0	4.1	0.090 U	0.16 U	110	7.7	0.19 U	1.3	110
	09-Oct-13	--	0	4.3	1.0 U	0.66 J	1,100	26	3.4	18	690 J
	29-Jul-14	--	0	2.9	1.0 U	1.0 U	900	7.4	1.0 U	0.68 J	240
	05-Nov-14	--	0	3.0	1.0 U	1.0 U	940	8.9	1.0 U	0.71 J	270
CTW-22U	27-Oct-10	--		6.8	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		7.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	08-Oct-12	--	0	5.4	0.11 J	0.16 U	0.72 J	4.0	0.19 U	0.17 U	0.13 J
	09-Oct-13	--	0	5.6	1.0 U	1.0 U	1.3	8.8	1.0 U	1.0 U	3.7 J
	29-Jul-14	--	0	4.1	1.0 U	1.0 U	45	2.0	1.0 U	1.0 U	45
	05-Nov-14	--	0	5.4	1.0 U	1.0 U	0.41 J	1.7	1.0 U	1.0 U	2.0
CTW-23L	26-Oct-10	--		7.8	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	29-Jul-14	--	0	6.5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CTW-23U	26-Oct-10	--		7.8	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		7.9	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	08-Oct-12	--	0	6.5	0.10 J	0.16 U	0.40 J	3.0	0.19 U	0.17 U	0.12 U
	09-Oct-13	--	0	5.5	1.0 U	1.0 U	9.7	13	1.0 U	0.37 J	21 J
	29-Jul-14	--	0	4.9	1.0 U	1.0 U	3.8	3.0	1.0 U	1.0 U	2.6
	05-Nov-14	--	0	6.1	1.0 U	1.0 U	0.14 J	2.1	1.0 U	1.0 U	1.0 U

TABLE D-1
GROUNDWATER LABORATORY DATA
Somersworth Sanitary Landfill Superfund Site, New Hampshire

Location	Date Sampled	QA/QC Sample Type	Depth (ft bgs)	Benzene (µg/L)	DCM (µg/L)	1,1-DCE (µg/L)	cDCE (µg/L)	tDCE (µg/L)	PCE (µg/L)	TCE (µg/L)	VC (µg/L)
CTW-24U	09-Nov-10	--		**5.1**	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	09-Nov-10	Field Duplicate		**5.1**	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	31-Oct-11	--		**6.8**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	**5.4**	**0.10 J**	0.16 U	**0.35 J**	**1.3**	0.19 U	0.17 U	**0.29 J**
	09-Oct-13	--	0	**6.3**	**0.14 J**	1.0 U	**76**	**7.1**	1.0 U	**1.1**	**140 J**
	29-Jul-14	--	0	**5.1**	1.0 U	1.0 U	**190**	**4.4**	1.0 U	**0.41 J**	**150**
	05-Nov-14	--	0	**5.3**	1.0 U	1.0 U	**0.37 J**	**1.4**	1.0 U	1.0 U	**2.5**
CTW-31U	26-Oct-10	--		**2.5**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	26-Oct-10	Field Duplicate		**2.0**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		**2.7**	1.0 U	1.0 U	**2.4**	1.0 U	1.0 U	1.0 U	**3.3**
	08-Oct-12	--	0	**2.2**	0.090 U	0.16 U	**1.3**	0.14 U	0.19 U	0.17 U	**0.41 J**
	08-Oct-13	--	0	**2.2**	1.0 U	1.0 U	**0.45 J**	1.0 U	1.0 U	1.0 U	1.0 UJ
	08-Oct-13	Field Duplicate	0	**2.0**	1.0 U	1.0 U	**0.44 J**	1.0 U	1.0 U	1.0 U	**2.3 J**
	05-Nov-14	--	0	**1.8**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CTW-32U	26-Oct-10	--		**4.1**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		**5.1**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	08-Oct-12	--	0	**4.5**	**0.20 J**	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.12 U
	08-Oct-13	--	0	**4.1**	1.0 U	1.0 U	**0.33 BJ**	1.0 U	1.0 U	1.0 U	1.0 U
	05-Nov-14	--	0	**3.7**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CTW-33L	26-Oct-10	--		**3.3**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CTW-33U	26-Oct-10	--		**5.0**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		**5.2**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	08-Oct-12	--	0	**4.4**	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.12 U
	08-Oct-13	--	0	**4.9**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	05-Nov-14	--	0	**0.27 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**5.0**
CTW-41U	09-Nov-10	--		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	Field Duplicate		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	08-Oct-12	--	0	**0.55 J**	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.12 U
	08-Oct-12	Field Duplicate	0	**0.56 J**	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.12 U
	08-Oct-13	--	0	**0.46 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**1.0 J**
	05-Nov-14	--	0	**0.42 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CTW-42U	26-Oct-10	--		**2.9**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		**2.4**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	08-Oct-12	--	0	**1.8**	0.090 U	0.16 U	**0.21 J**	0.14 U	0.19 U	0.17 U	0.12 U
	08-Oct-13	--	0	**1.7**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.40 J**	**2.5 J**
	05-Nov-14	--	0	**1.5**	1.0 U	1.0 U	**0.17 J**	1.0 U	1.0 U	1.0 U	**0.95 J**
CTW-43L	26-Oct-10	--		**6.0**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CTW-43U	26-Oct-10	--		**6.2**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		**6.1**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	08-Oct-12	--	0	**5.1**	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.12 U
	08-Oct-13	--	0	**5.1**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	05-Nov-14	--	0	**5.1**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CTW-50U	27-Oct-10	--		**2.9**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**1.1**
	31-Oct-11	--		**2.1**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	**1.9**	0.090 U	0.16 U	**0.33 J**	0.14 U	0.19 U	0.17 U	**0.82 J**
	07-Oct-13	--	0	**2.2**	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	**1.1 J**
	04-Nov-14	--	0	**2.0**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.86 J**
CTW-61U	27-Oct-10	--		**7.7**	1.0 U	1.0 U	**1.5**	**4.2**	1.0 U	1.0 U	**3.9**
	31-Oct-11	--		**6.3**	1.0 U	1.0 U	**1.2**	**4.9**	1.0 U	1.0 U	**3.4**
	09-Oct-12	--	0	**5.2**	0.090 U	0.16 U	**2.0**	**3.1**	0.19 U	0.17 U	**4.6**
	09-Oct-13	--	0	**5.8**	1.0 U	1.0 U	**20**	**9.4**	1.0 U	**1.0**	**55 J**
	29-Jul-14	--	0	**4.2**	1.0 U	1.0 U	**110**	**9.2**	1.0 U	**1.7**	**120**
	05-Nov-14	--	0	**5.4**	1.0 U	1.0 U	**250**	**18**	1.0 U	**3.7**	**260**
CTW-63U	27-Oct-10	--		**8.5**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		**8.4**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	**7.3**	**0.17 J**	0.16 U	0.11 U	**0.22 J**	0.19 U	0.17 U	0.12 U
	09-Oct-13	--	0	**7.2**	**0.38 J**	1.0 U	**0.15 J**	**0.41 J**	1.0 U	1.0 U	1.0 U
	29-Jul-14	--	0	**4.5**	1.0 U	1.0 U	1.0 U	**0.76 J**	1.0 U	1.0 U	1.0 U
	29-Jul-14	Field Duplicate	0	**4.6**	0.32 U	0.57 U	0.30 U	**0.88 J**	0.30 U	0.22 U	0.32 U
	05-Nov-14	--	0	**2.8**	1.0 U	1.0 U	1.0 U	**0.66 J**	1.0 U	1.0 U	1.0 U
FS-1	25-Oct-10	--		**2.5**	1.0 U	1.0 U	**1.8**	1.0 U	1.0 U	1.0 U	**3.4**
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	**4.6**	1.0 U	1.0 U	**6.5**	**3.5**
	09-Oct-12	--	0	**1.9**	0.090 U	0.16 U	**1.1**	0.14 U	0.19 U	**0.22 J**	**2.4**
	07-Oct-13	--	0	**1.8**	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	**2.5 J**
	04-Nov-14	--	0	**1.8**	1.0 U	1.0 U	**0.23 J**	1.0 U	1.0 U	1.0 U	**1.3**
FS-4	25-Oct-10	--		**2.9**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	**2.5**	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.12 U
	04-Nov-14	--	0	**2.3**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
FS-7	27-Oct-10	--		**3.6**	1.0 U	1.0 U	**80**	1.0 U	1.0 U	**7.4**	**23**
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	Field Duplicate		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	**2.6**	0.090 U	0.16 U	**24**	**0.33 J**	0.19 U	**1.3**	**12**
	07-Oct-13	--	0	**2.9**	0.090 U	0.16 U	**4.7**	**0.17 J**	0.19 U	0.17 U	**5.2 J**
	04-Nov-14	--	0	**2.4**	1.0 U	1.0 U	**9.2**	1.0 U	1.0 U	**0.31 J**	**7.8**

TABLE D-1
GROUNDWATER LABORATORY DATA
Somersworth Sanitary Landfill Superfund Site, New Hampshire

Location	Date Sampled	QA/QC Sample Type	Depth (ft bgs)	Benzene (µg/L)	DCM (µg/L)	1,1-DCE (µg/L)	cDCE (µg/L)	tDCE (µg/L)	PCE (µg/L)	TCE (µg/L)	VC (µg/L)
FS-9A	25-Oct-10	--		5.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		4.6	1.0 U	1.0 U	8.6	1.6	1.0 U	1.0 U	18
	09-Oct-12	--	0	4.4	0.090 U	0.16 U	0.12 J	1.3	0.19 U	0.17 U	0.12 U
	07-Oct-13	--	0	4.6	0.090 U	0.17 J	110	4.8	0.19 U	2.1	170 J
	30-Jul-14	--	0	4.3	1.0 U	1.0 U	7.6	1.3	1.0 U	1.0 U	12
	04-Nov-14	--	0	4.2	1.0 U	1.0 U	33	2.9	1.0 U	0.19 J	68
OB-101R	10-Nov-10	--		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	0.11 U	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.12 U
	07-Oct-13	--	0	0.11 U	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.16 J
OB-101U	10-Nov-10	--		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	0.11 U	0.090 U	0.16 U	0.23 J	0.14 U	0.19 U	0.17 U	0.12 U
	07-Oct-13	--	0	0.11 U	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.26 J
OB-15R	25-Oct-10	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	01-Nov-11	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	0.11 U	0.090 U	0.16 U	0.19 J	0.14 U	0.19 U	0.33 J	0.12 U
	07-Oct-13	--	0	0.11 U	0.19 J	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.12 J
	04-Nov-14	--	0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.23 J	1.0 U
OB-16R	25-Oct-10	--		1.0 U	1.0 U	1.0 U	1.5	1.0 U	1.0 U	1.0 U	1.0 U
	01-Nov-11	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	05-Nov-12	--		0.41 J	0.090 U	0.16 U	0.83 J	0.14 U	0.38 J	0.30 J	0.15 J
	07-Oct-13	--	0	0.11 U	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.12 U
	04-Nov-14	--	0	1.0 U	1.0 U	1.0 U	2.6	1.0 U	1.0 U	1.0 U	1.0 U
OB-16U	09-Nov-10	--		5.0 U	5.0 U	5.0 U	56	5.0 U	6.3	11	7.9
	01-Nov-11	--		2.6	1.0 U	1.0 U	65	1.0 U	4.6	11	8.5
	10-Oct-12	--	0	2.9	0.090 U	0.16 U	1.6 J	0.14 U	0.19 U	0.28 J	0.29 J
	08-Oct-13	--	0	2.8	1.0 U	0.49 J	170	2.1	11	17	.35 J
	03-Nov-14	--	0	1.0 U	1.0 U	1.0 U	100	0.79 J	6.6	17	2.5
OB-17U	09-Nov-10	--		6.6	5.0 U	5.0 U	11	5.0 U	5.0 U	5.0 U	11
	01-Nov-11	--		3.5	1.0 U	1.0	1,900	35	1.1	8.8	200
	10-Oct-12	--	0	2.2 J	1.2 U	2.0 U	1,400	18	2.4 U	2.2 U	180
	09-Oct-13	--	0	2.9	1.0 U	1.3 J	1,700	32	2.6	13	250 J
	30-Jul-14	--	0	4.1 J	5.0 U	5.0 U	1,000	7.8	5.0 U	6.4	190
	04-Nov-14	--	0	1.0 U	1.0 U	1.3	1,900	32	2.7	.15	200
	04-Nov-14	Field Duplicate	0	3.2	1.0 U	1.4	2,000	32	2.8	14	220
OB-21RA	25-Oct-10	--		1.0 U	1.0 U	1.0 U	4.4	1.0 U	1.0 U	6.4	3.3
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	4.5	1.0 U	1.0 U	6.6	3.5
	05-Nov-12	--		0.43 J	0.090 U	0.30 J	5.1	0.51 J	0.19 U	6.3	4.3
	07-Oct-13	--	0	0.45 J	0.090 U	0.27 J	4.5	0.45 J	0.19 U	5.3	4.1 J
	04-Nov-14	--	0	0.39 J	1.0 U	1.0 U	4.3	0.16 J	1.0 U	4.7	2.9
OB-22R	25-Oct-10	--		2.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7
	31-Oct-11	--		1.9	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.3
	09-Oct-12	--	0	1.8	0.090 U	0.16 U	0.61 J	0.14 U	0.19 U	0.17 U	1.4
	07-Oct-13	--	0	1.7	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	1.8 J
	04-Nov-14	--	0	1.5	1.0 U	1.0 U	0.62 J	1.0 U	1.0 U	1.0 U	1.4
OB-23R	25-Oct-10	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	0.19 J	0.15 J	0.16 U	0.28 J	0.14 U	0.19 U	0.86 J	0.31 J
	07-Oct-13	--	0	1.0	0.16 J	0.19 J	1.4	0.14 U	0.19 U	2.6	1.9 J
	04-Nov-14	--	0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
OB-24R	10-Nov-10	--		5.0 U	5.0 U	8.4	120	8.1	5.0 U	440	10
	01-Nov-11	--		1.0 U	1.0 U	3.9	68	4.1	1.0 U	190	11
	08-Oct-12	--	0	0.33 J	0.27 J	4.4	74	4.6	0.48 U	210	6.0
	08-Oct-13	--	0	0.26 J	0.10 J	4.0	67	4.2	1.0 U	140	8.5 J
	18-Nov-14	--	0	0.25 J	0.37 J	4.8	73	4.9	1.0 U	180	5.1
OB-4R	25-Oct-10	--		1.0 U	1.0 U	1.0 U	1.9	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	0.11 U	0.090 U	0.16 U	2.1	0.14 U	0.19 U	0.29 J	0.12 J
	05-Nov-14	--	0	1.0 U	1.0 U	1.0 U	1.9	1.0 U	1.0 U	0.17 J	1.0 U
OB-4U	25-Oct-10	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	0.11 U	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.12 U
	05-Nov-14	--	0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
OB-5R	25-Oct-10	--		2.0 U	2.0 U	2.0 U	410	2.0 U	2.0 U	3.0	84
	31-Oct-11	--		1.1	1.0 U	1.0 U	410	1.0 U	1.0 U	3.1	89
	09-Oct-12	--	0	1.0	0.18 J	0.53 J	400	0.94 J	0.19 U	2.7	100
	11-Nov-13	--	0	1.3 J	1.0 U	1.0 U	460	1.8 J	1.0 U	2.4 J	140
	05-Nov-14	--	0	1.4	1.0 U	0.49 J	450	1.1	1.0 U	2.9	130
OB-5U	25-Oct-10	--		3.1	1.0 U	1.0 U	14	1.0 U	1.0 U	1.1	19
	31-Oct-11	--		2.5	1.0 U	1.0 U	20	1.0 U	1.0 U	1.8	17
	09-Oct-12	--	0	2.0	0.090 U	0.16 U	13	0.29 J	0.19 U	1.1	13
	11-Nov-13	--	0	1.9	1.0 U	1.0 U	11	1.0 U	1.0 U	0.68 J	11
	05-Nov-14	--	0	2.3	1.0 U	1.0 U	4.8	1.0 U	1.0 U	0.30 J	9.5

TABLE D-1
GROUNDWATER LABORATORY DATA
Somersworth Sanitary Landfill Superfund Site, New Hampshire

Location	Date Sampled	QA/QC Sample Type	Depth (ft bgs)	Benzene (µg/L)	DCM (µg/L)	1,1-DCE (µg/L)	cDCE (µg/L)	tDCE (µg/L)	PCE (µg/L)	TCE (µg/L)	VC (µg/L)
OB-6R	25-Oct-10	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	210	1.8	1.0 U	6.0	36
	09-Oct-12	--	0	0.11 U	0.090 U	0.16 U	0.13 J	0.14 U	0.19 U	0.17 U	0.81 J
	03-Nov-14	--	0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
OB-6U	25-Oct-10	--		1.0 U	1.0 U	1.1	120	1.7	1.2	81	24
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	110	1.1	2.0	77	19
	09-Oct-12	--	0	0.63 J	0.090 U	1.1	120	2.3	0.37 J	77	25
	07-Oct-13	--	0	0.65 J	0.090 U	0.93 J	90	1.2	0.86 J	66	26 J
	03-Nov-14	--	0	1.0 U	1.0 U	0.71 J	100	5.7	1.0 U	46	1.0 U
OB-7R	10-Nov-10	--		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	01-Nov-11	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	05-Nov-12	--		0.11 U	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.12 U
	03-Nov-14	--	0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
OB-7U	25-Oct-10	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	0.11 U	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.12 U
	03-Nov-14	--	0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
OB-9R	27-Oct-10	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	31-Oct-11	--		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	09-Oct-12	--	0	0.11 U	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.47 J	0.12 U
	07-Oct-13	--	0	0.11 U	0.090 U	0.16 U	0.11 U	0.14 U	0.19 U	0.17 U	0.19 J
	03-Nov-14	--	0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PS-1R	27-Oct-10	--		3.0	1.0 U	1.0 U	74	1.6	1.0 U	1.9	83
	31-Oct-11	--		2.0	1.0 U	1.0 U	26	1.0 U	1.0 U	1.3	38
	09-Oct-12	--	0	1.2	0.090 U	0.16 U	6.8	0.40 J	0.19 U	0.49 J	12
	07-Oct-13	--	0	1.7	0.090 U	0.16 U	6.1	0.53 J	0.19 U	0.17 U	12 J
	04-Nov-14	--	0	0.21 J	1.0 U	1.0 U	0.17 J	1.0 U	1.0 U	1.0 U	0.34 J

Notes:

(1) - samples OB-6U and B-8L and samples OB-6R and B-8R are believed to have been switched in the field for the October 2005 sampling event.
The data has been switched in the table to reflect this. Future sampling will confirm if this error did occur.

µg/L - micrograms per litre
E - result exceeded calibration range
J - indicates estimated value
U - compound not detected; associated value is the quantitation limit
R - unreliable data; not used in calculations
-- - compound not analyzed for
1,1-DCE - 1,1-dichloroethene
cDCE - cis-1,2-dichloroethene
tDCE - trans-1,2-dichloroethene
DCM - methylene chloride
PCE - tetrachloroethene
TCE - trichloroethene
VC - vinyl chloride
PDB - passive diffusion bag

Table 3: Soil Gas Monitoring Field Measurement Data

TABLE 3.1
SOIL GAS MONITORING FIELD MEASUREMENT DATA
Somersworth Sanitary Landfill Superfund Site, New Hampshire

Soil Gas Probe I.D.	Date Sampled	Cumulative Volume Removed (Litres)	PID Reading[*1] (ppm)	Methane[*2] (%)	Carbon Dioxide[*2] (%)	Oxygen[*2] (%)	Hydrogen Sulfide[*2,*6] (ppm)
SGP-01a	27-Oct-10	1	0.1	0	4.4	16	1
	27-Oct-10	2	0.2	0	4.9	15.3	1
	27-Oct-10	3	0.2	0	5.1	15	1
	17-Nov-11	1	0	0	7.2	12	0
	17-Nov-11	2	0	0.2	8.3	10.3	0
	17-Nov-11	3	0	0	8.5	10	0
	9-Nov-12	1.00	0.600	0.200	3.20	17.5	0.00
	9-Nov-12	2.00	0.600	0.200	5.70	14.7	0.00
	9-Nov-12	3.00	0.700	0.200	5.90	14.6	0.00
	6-Nov-14	1.00	0.00	0.00	3.00	18.2	0.00
	6-Nov-14	2.00	0.00	0.00	3.10	18.3	0.00
	6-Nov-14	3.00	0.00	0.00	3.10	18.2	0.00
SGP-02	27-Oct-10	1.3	0.2	0.1	4.6	16.1	0
	27-Oct-10	2.6	0.2	0.1	5.4	15.1	0
	27-Oct-10	3.9	0.2	0.1	5.9	14.5	0
	17-Nov-11	1	0	0	4.2	16.8	0
	17-Nov-11	1.9	0	0	4.4	16.4	0
	17-Nov-11	2.9	0	0	4.4	16.5	0
	5-Nov-12	1.00	0.600	0.00	5.00	16.2	8.00
	5-Nov-12	1.90	0.600	0.00	5.30	16.1	0.00
	5-Nov-12	2.90	0.600	0.00	5.40	16.1	0.00
	6-Nov-14	1.00	0.00	0.00	5.20	14.7	0.00
	6-Nov-14	1.90	0.00	0.00	4.90	14.0	0.00
	6-Nov-14	2.90	0.00	0.00	4.30	15.6	0.00
SGP-04	27-Oct-10	2.1	0.1	0.1	4.9	15.9	0
	27-Oct-10	4.2	0.3	0.1	5.5	14.5	0
	27-Oct-10	6.3	0.2	0.1	6.1	14.2	0
	17-Nov-11	1.5	0	0.2	1.3	20	0
	17-Nov-11	3	0	0	1.4	19.9	1
	17-Nov-11	4.5	0	0	1.2	20.1	0
	9-Nov-12	1.50	0.700	0.100	1.40	19.9	0.00
	9-Nov-12	3.00	0.500	0.100	1.30	20.0	0.00
	9-Nov-12	4.50	0.500	0.200	1.30	20.0	0.00
	6-Nov-14	2.10	0.00	0.00	1.90	19.5	0.00
	6-Nov-14	4.20	0.00	0.00	2.30	19.8	0.00
	6-Nov-14	6.30	0.00	0.00	2.50	19.4	0.00
SGP-05	26-Oct-10	1.7	0.3	0	6.6	13.7	0
	26-Oct-10	3.4	0.2	0	9.9	6.9	0
	26-Oct-10	5.1	0.2	0	10.8	6.4	0
	17-Nov-11	1.7	0	0.2	14.4	5	2
	17-Nov-11	3.4	0	0.4	16.5	2.3	1
	17-Nov-11	5.1	0	0.4	17	2	0
	5-Nov-12	1.70	2.30	0.00	12.3	8.30	0.00
	5-Nov-12	3.40	2.90	0.00	14.8	4.70	0.00
	5-Nov-12	5.10	3.00	0.00	15.1	4.60	0.00
	6-Nov-14	1.70	0.00	0.00	6.60	6.90	0.00
	6-Nov-14	3.40	0.00	0.00	9.90	13.7	0.00
	6-Nov-14	5.10	0.00	0.00	10.8	6.40	0.00
SGP-07	27-Oct-10	1	0.3	0	6.2	14.3	0
	27-Oct-10	1.9	0.3	0	7.1	14	0
	27-Oct-10	2.9	0.3	0	7.2	13.8	0
	17-Nov-11	1.3	0	0.2	12.8	5.6	1
	17-Nov-11	2.6	0	0.1	13.1	5.2	0
	17-Nov-11	3.9	0	0	13	5	0
	5-Nov-12	1.30	0.600	0.00	9.30	10.3	0.00
	5-Nov-12	2.60	0.600	0.00	9.00	10.2	0.00
	5-Nov-12	3.90	0.600	0.00	8.90	10.2	0.00
	6-Nov-14	1.30	0.00	0.00	5.20	15.5	0.00
	6-Nov-14	2.60	0.00	0.00	5.00	15.4	0.00
	6-Nov-14	3.90	0.00	0.00	5.30	15.2	0.00

TABLE 3.1
SOIL GAS MONITORING FIELD MEASUREMENT DATA
Somersworth Sanitary Landfill Superfund Site, New Hampshire

Soil Gas Probe I.D.	Date Sampled	Cumulative Volume Removed (Litres)	PID Reading[*1] (ppm)	Methane[*2] (%)	Carbon Dioxide[*2] (%)	Oxygen[*2] (%)	Hydrogen Sulfide[*2,*6] (ppm)
SGP-08	27-Oct-10	1.5	0.1	0.1	7.4	14	0
	27-Oct-10	3	0.3	0	10.2	11.7	0
	27-Oct-10	4.5	0.3	0	11	10.6	0
	17-Nov-11	2.1	0	10.3	23.2	2.2	1
	17-Nov-11	4.2	0	10.8	25.5	1.2	0
	17-Nov-11	6.3	0	10.4	25.1	1.1	0
	5-Nov-12	2.10	0.200	1.00	15.9	6.20	0.00
	5-Nov-12	4.20	0.00	1.20	14.4	4.70	0.00
	5-Nov-12	6.30	0.00	2.10	17.5	4.50	0.00
	6-Nov-14	2.10	1.70	0.00	12.1	11.4	0.00
	6-Nov-14	4.20	1.70	0.00	10.6	9.60	0.00
	6-Nov-14	6.30	1.60	0.00	11.9	10.0	0.00
SGP-09	27-Oct-10	1.4	0	0	3.4	18.3	0
	27-Oct-10	2.8	0	0	3.8	18.1	0
	27-Oct-10	4.2	0	0	4.1	18	0
	17-Nov-11	1.4	0	0	4.1	19.5	0
	17-Nov-11	2.8	0	0	1.7	20.3	0
	17-Nov-11	4.2	0	0	2.6	19.6	0
	9-Nov-12	1.40	0.300	0.00	3.10	18.4	0.00
	9-Nov-12	2.80	0.300	0.00	3.30	18.4	0.00
	9-Nov-12	4.20	0.300	0.00	3.40	18.4	0.00
	6-Nov-14	1.40	0.00	0.00	2.30	19.4	0.00
	6-Nov-14	2.80	0.00	0.00	2.70	19.1	0.00
	6-Nov-14	4.20	0.00	0.00	3.00	18.8	0.00
SGP-10	27-Oct-10	1.4	0	0	1.5	19.5	0
	27-Oct-10	2.8	0	0	1.3	19.7	0
	27-Oct-10	4.2	0	0	1.5	19.6	0
	17-Nov-11	1.4	0	0	1.3	19.7	0
	17-Nov-11	2.8	0	0	1.4	19.4	0
	17-Nov-11	4.2	0	0	1.4	19.4	0
	9-Nov-12	1.40	0.200	0.200	1.20	20.1	0.00
	9-Nov-12	2.80	0.300	0.200	1.30	19.9	0.00
	9-Nov-12	4.20	0.400	0.200	1.30	20.0	0.00
	6-Nov-14	1.40	0.00	0.00	1.00	20.0	0.00
	6-Nov-14	2.80	0.00	0.00	1.30	19.7	0.00
	6-Nov-14	4.20	0.00	0.00	1.20	19.9	0.00
SGP-11	27-Oct-10	1.7	0	0	1.6	19.3	0
	27-Oct-10	3.4	0	0	1.8	19.4	0
	27-Oct-10	5.1	0	0	1.8	19.3	0
	17-Nov-11	1.7	0	0	0.8	20.3	0
	17-Nov-11	3.4	0	0	1.4	19.6	0
	17-Nov-11	5.1	0	0	1.9	18.9	0
	9-Nov-12	1.70	0.400	0.200	2.20	18.3	0.00
	9-Nov-12	3.40	0.400	0.200	2.50	18.1	0.00
	9-Nov-12	5.10	0.400	0.200	2.60	17.9	0.00
SGP-12a	27-Oct-10	1.8	0.1	0	1.5	19.6	0
	27-Oct-10	3.6	0.2	0	1.8	19.4	0
	27-Oct-10	5.4	0.2	0	2	19.3	0
	17-Nov-11	1.8	0	0	1	20.2	0
	17-Nov-11	3.6	0	0	1.2	19.9	0
	17-Nov-11	5.4	0	0	1.3	19.8	0
	5-Nov-12	1.80	0.700	0.00	0.800	20.6	1.00
	5-Nov-12	3.60	0.700	0.00	1.70	19.4	0.00
	5-Nov-12	5.40	0.700	0.00	1.80	19.4	0.00
	6-Nov-14	1.80	0.00	0.00	2.00	19.5	0.00
	6-Nov-14	3.60	0.00	0.00	1.60	19.7	0.00
	6-Nov-14	5.40	0.00	0.00	2.20	19.3	0.00

TABLE 3.1
SOIL GAS MONITORING FIELD MEASUREMENT DATA
Somersworth Sanitary Landfill Superfund Site, New Hampshire

Soil Gas Probe I.D.	Date Sampled	Cumulative Volume Removed (Litres)	PID Reading[*1] (ppm)	Methane[*2] (%)	Carbon Dioxide[*2] (%)	Oxygen[*2] (%)	Hydrogen Sulfide[*2,*6] (ppm)
SGP-13a	27-Oct-10	1.6	0.2	0	4.1	14.1	0
	27-Oct-10	3.2	0.2	0	4.4	13.8	0
	27-Oct-10	4.8	0.2	0	4.5	13.8	0
	17-Nov-11	1.6	0	0.6	5.4	14.6	0
	17-Nov-11	3.2	0	0	7.8	11.1	1
	17-Nov-11	4.8	0	0	7.7	11	0
	5-Nov-12	1.60	0.800	0.00	4.60	16.9	0.00
	5-Nov-12	3.20	0.900	0.00	6.40	14.7	0.00
	5-Nov-12	4.80	0.700	0.00	7.30	14.2	0.00
	6-Nov-14	1.60	0.00	0.00	6.90	13.6	0.00
	6-Nov-14	3.20	0.00	0.00	6.30	14.0	0.00
	6-Nov-14	4.80	0.00	0.00	7.00	13.0	0.00
SGP-14	26-Oct-10	2.3	0	0	5.3	13.8	1
	26-Oct-10	4.5	0.2	0	6	12.7	0
	26-Oct-10	6.8	0.2	0	6.1	12.3	0
	17-Nov-11	2.3	0	0.1	7.3	11	0
	17-Nov-11	4.5	0	0	8	10.2	1
	17-Nov-11	6.8	0	0	8	10.3	1
	5-Nov-12	2.30	0.700	0.00	8.20	10.6	0.00
	5-Nov-12	4.50	0.800	0.00	8.50	10.1	0.00
	5-Nov-12	6.80	0.800	0.00	8.60	10.2	0.00
SGP-15	27-Oct-10	1.8	0.1	0	2.6	19	0
	27-Oct-10	3.6	0.1	0	3.3	18.5	1
	27-Oct-10	5.4	0.2	0	4.1	18.2	0
	19-Dec-12	1.80	0.100	0.00	0.800	20.0	0.00
	19-Dec-12	3.60	0.00	0.00	2.00	20.0	0.00
	19-Dec-12	5.40	0.00	0.00	2.20	20.3	0.00
	6-Nov-14	1.80	0.00	0.00	3.50	18.1	1.00
	6-Nov-14	3.60	0.00	0.00	3.90	18.7	0.00
	6-Nov-14	5.40	0.00	0.00	4.00	17.9	0.00
SGP-16	27-Oct-10	1.7	0.1	0	3.3	14.5	0
	27-Oct-10	3.4	0.1	0	4.2	14.1	0
	27-Oct-10	5.1	0.1	0	4.4	14	0
	19-Dec-12	1.70	0.100	0.00	0.900	19.2	0.00
	19-Dec-12	3.40	0.100	0.00	0.900	19.2	0.00
	19-Dec-12	5.10	0.100	0.00	1.00	19.1	0.00

Notes:

[*1] - Total VOCs measured using a photo ionization detector (PID)

[*2] - CH_4, CO_2, O_2 and H_2S measurements made using a Lanteck Gem 500 landfill gas monitoring instrument

[*3] - SGP-01 was abandoned in June 2001 and replaced with SGP-1a October 31, 2001

[*4] - SGP-12 was damaged in June 2002 and replaced in January 2003 with SGP-12A

[*5] - SGP-13 was damaged in December 2002 and replaced in January 2003 with SGP-13A

[*6] - Negative readings on instrument were sometimes recorded - meter calibration rechecked and readings confirmed but readings suspect due to possible meter malfunction.

-- - not available

NM(3) - well not accessible

% - percent

CH_4 - methane

CO_2 - carbon dioxide

H_2S - hydrogen sulfide

O_2 - oxygen

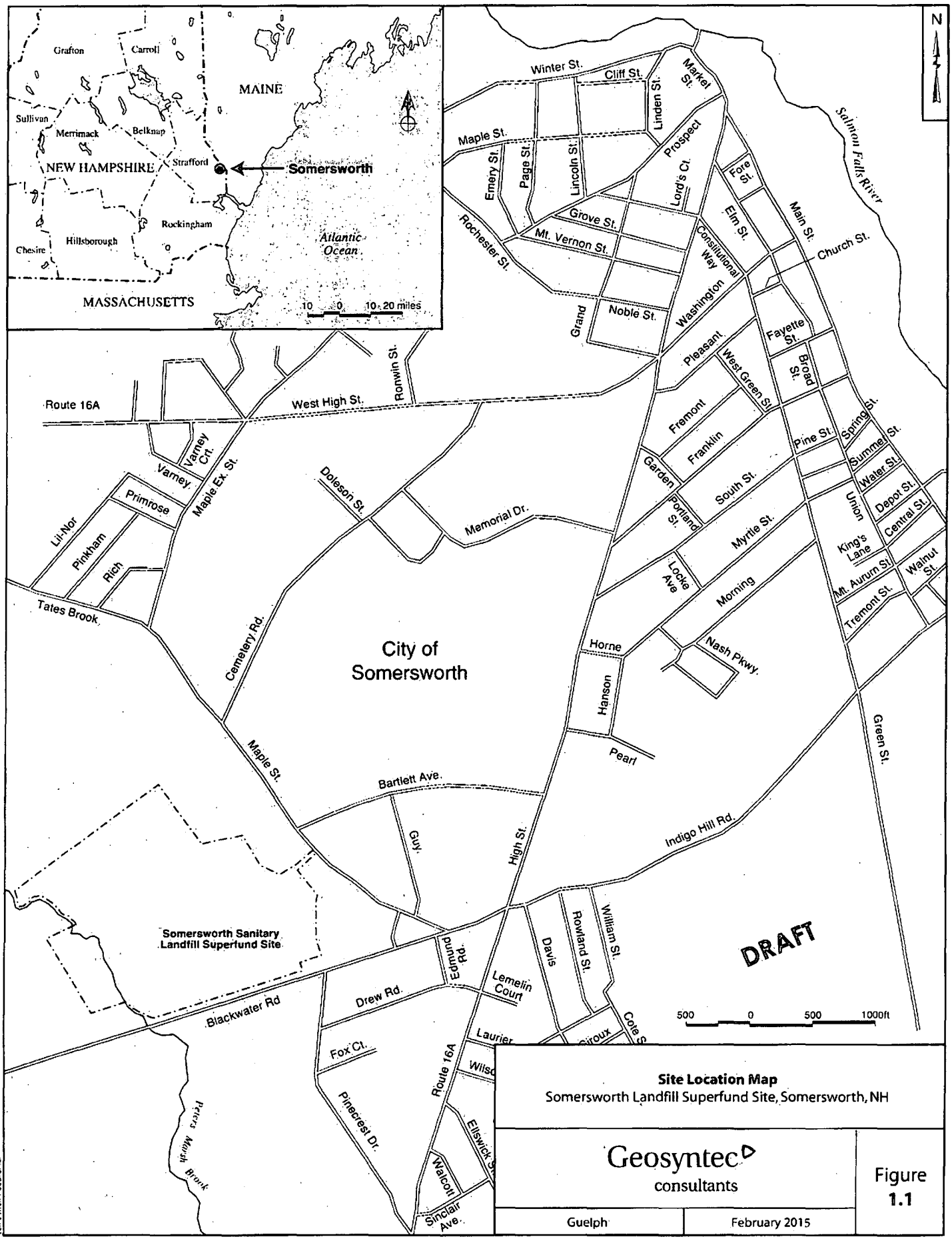
ppm - parts per million by volume

SGP - soil gas probe

VOCs - volatile organic compounds

---[1] - H_2S Analyser broke during sampling

Figure 1: Site Location



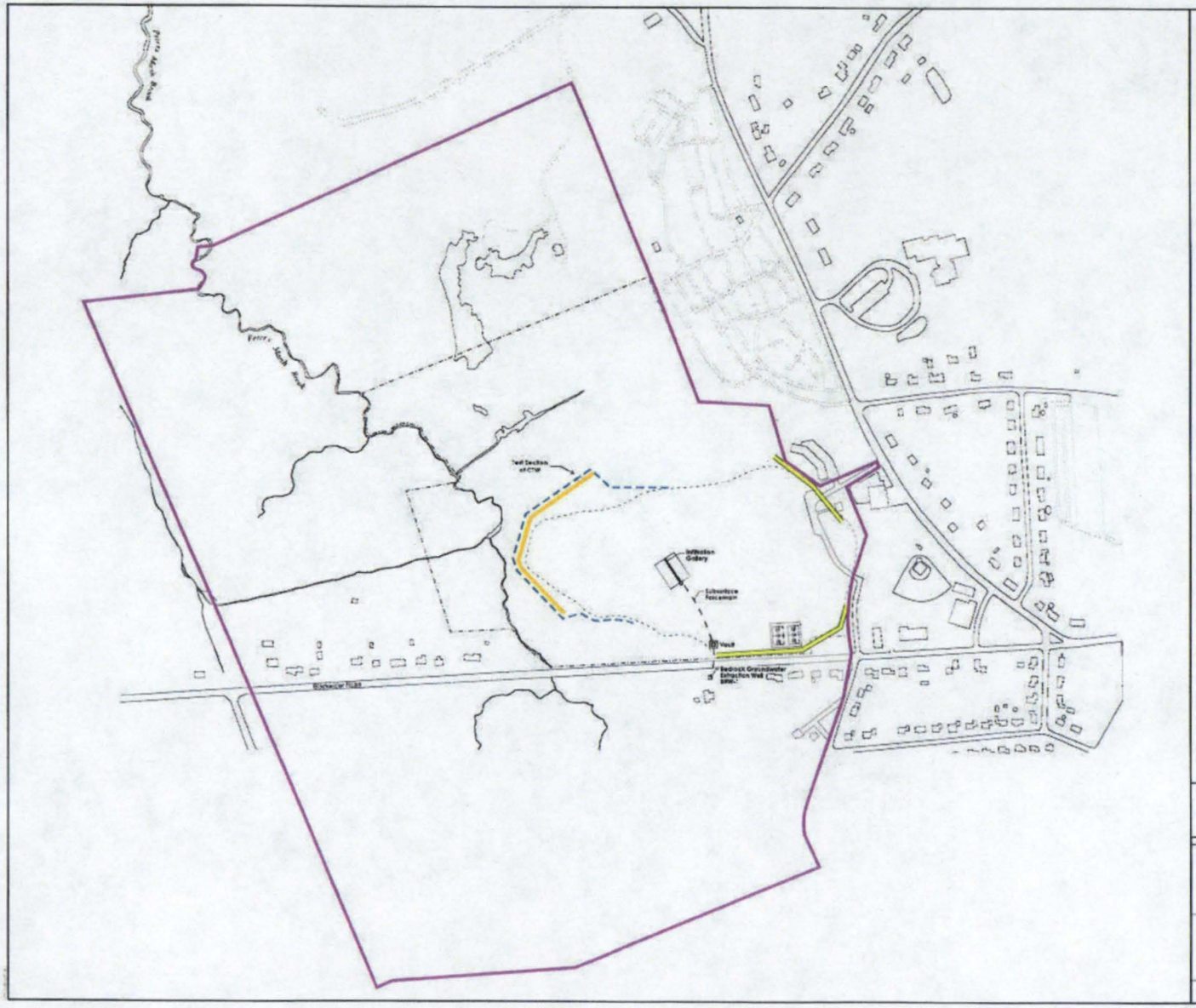
Site Location Map
Somersworth Landfill Superfund Site, Somersworth, NH

Geosyntec consultants

Guelph | February 2015

Figure **1.1**

Figure 2: Site Plan



N

DRAFT

Legend

- Boundary of Groundwater Management Zone
- Chemical Treatment Wall (CTW)
- Landfill Gas Venting Trench
- City of Somersworth Property Boundary
- Approximate Extent of Waste Area
- Point of Compliance

100 0 100 200 300ft

Site Layout
Somersworth Landfill Superfund Site, Somersworth, NH

Geosyntec consultants

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Figure **1.2**

Figure 3: Site Monitoring Network

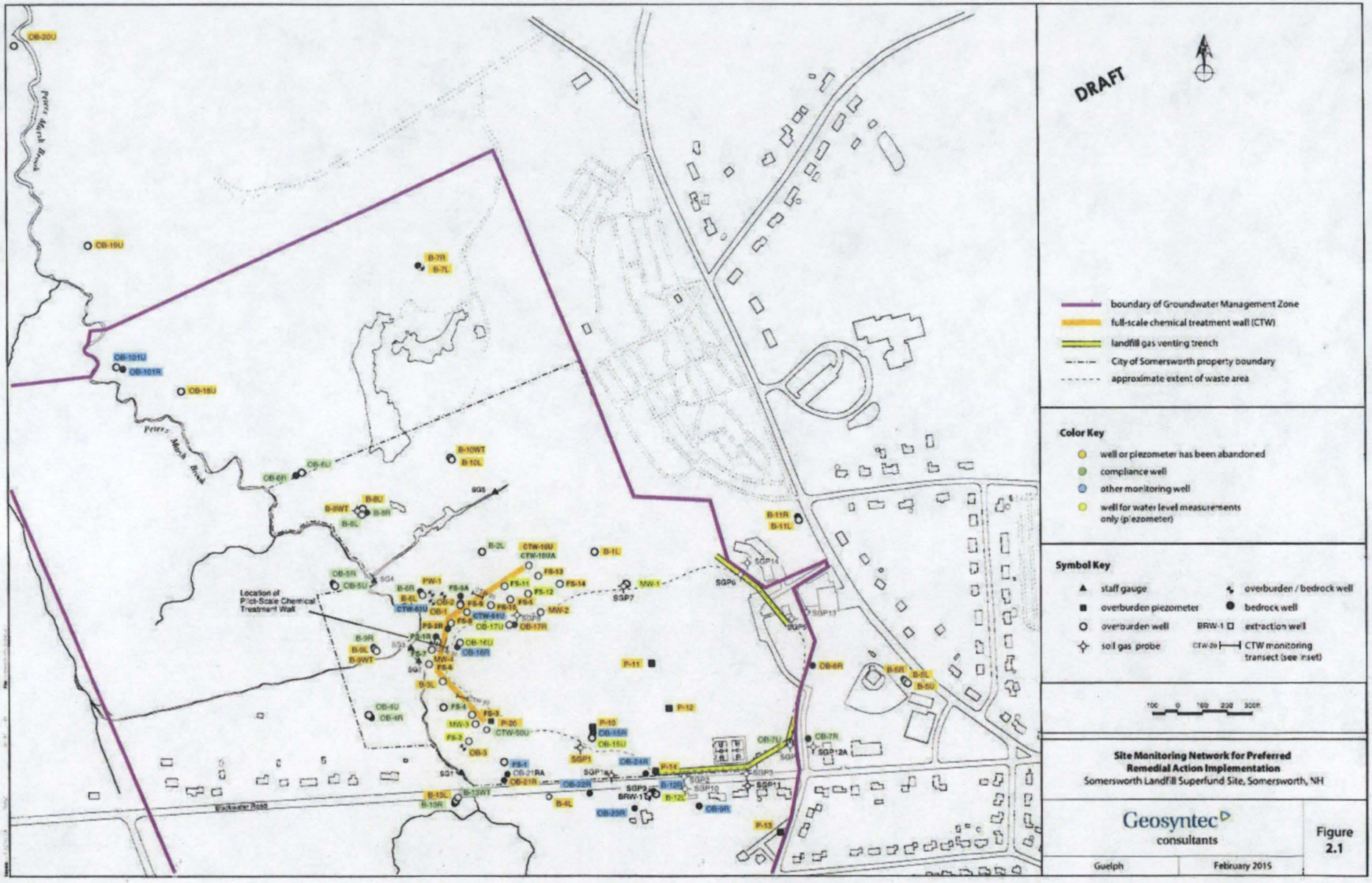
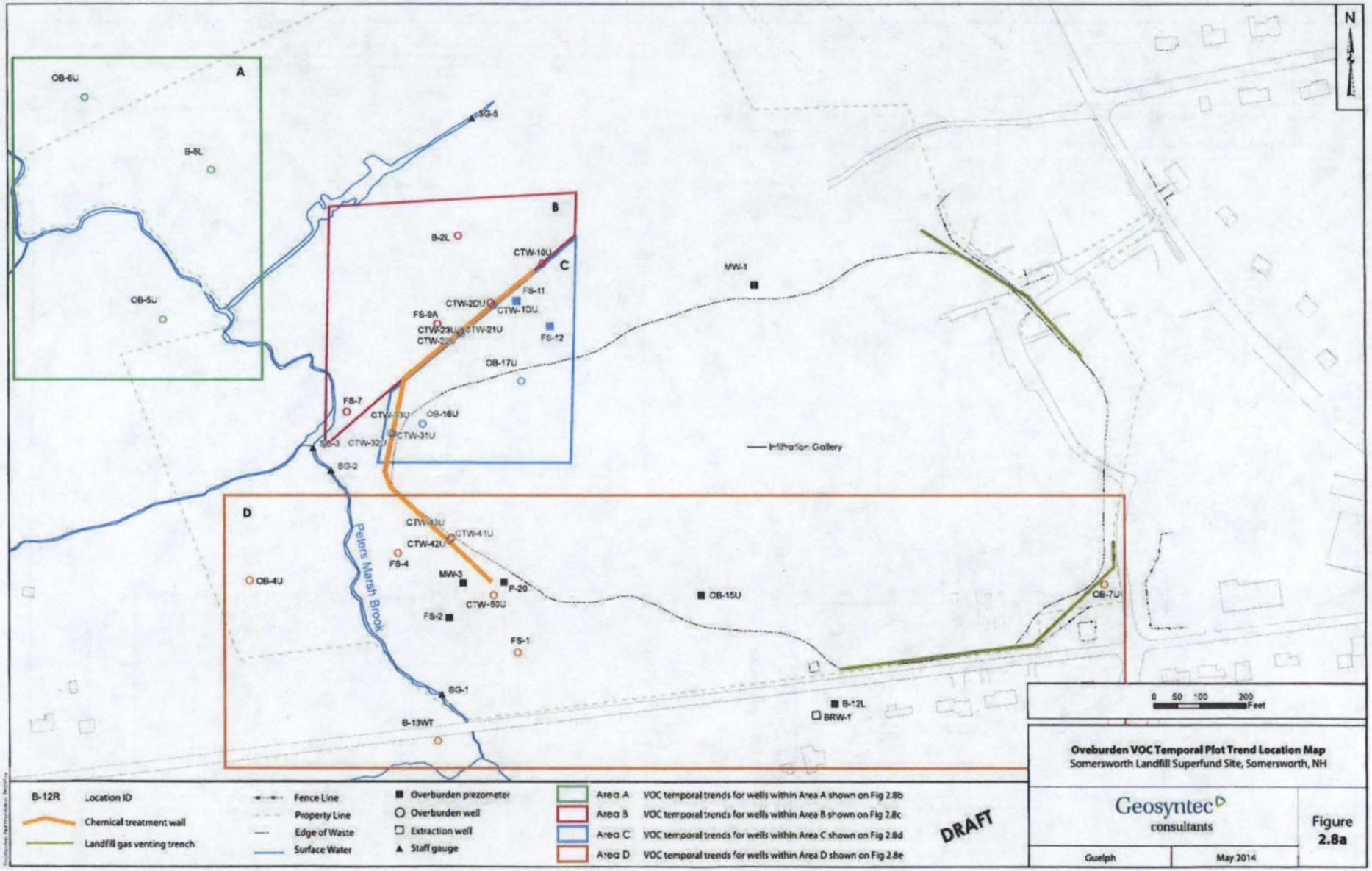

DRAFT
Peters Marsh Brook
Location of Pilot-Scale Chemical Treatment Wall
Exchange Road
boundary of Groundwater Management Zone
full-scale chemical treatment wall (CTW)
landfill gas venting trench
City of Somersworth property boundary
approximate extent of waste area
Color Key
well or piezometer has been abandoned
compliance well
other monitoring well
well for water level measurements only (piezometer)
Symbol Key
staff gauge
overburden piezometer
overburden well
soil gas probe
overburden / bedrock well
bedrock well
BRW-1 extraction well
CTW-2a CTW monitoring transect (see inset)
100 0 100 200 300ft
Site Monitoring Network for Preferred Remedial Action Implementation
Somersworth Landfill Superfund Site, Somersworth, NH
Geosyntec consultants
Guelph
February 2015
Figure 2.1

Figure 4: Overburden VOC Temporal Trend Location Map and Annual Mean Trend Plots



Oveburden VOC Temporal Plot Trend Location Map
Somersworth Landfill Superfund Site, Somersworth, NH

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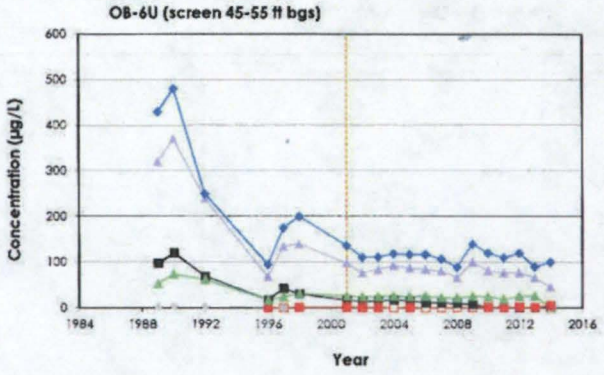
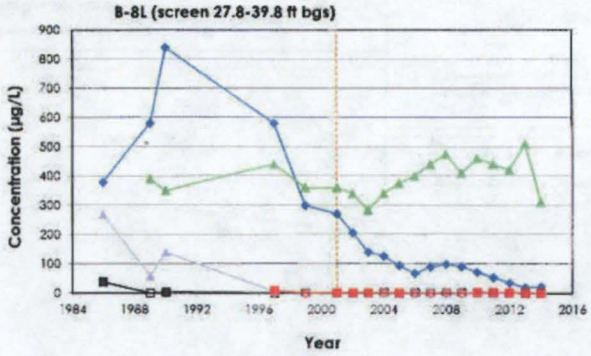
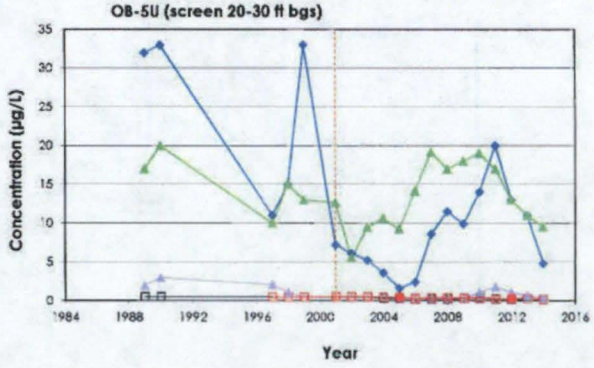
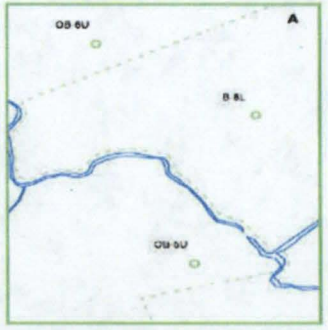
Figure **2.8a**









Legend for Graphs

- 1,1-Dichloroethene
- Trichloroethene
- trans-1,2-Dichloroethene
- Tetrachloroethene
- cis-1,2-Dichloroethene
- Vinyl Chloride
- - CTW construction complete

Notes:
Open symbol indicates all samples were non-detect
CTW - Chemical Treatment Well
ft bgs - feet below ground surface
µg/L - micrograms per liter
Annual mean chlorinated ethene concentrations were calculated using the fall data. When a field duplicate was conducted, the data for the duplicates were averaged first to obtain a single value for that sampling event, which was then used to calculate the mean for the year. For calculation, the method detection limit (MDL) was substituted for non-detects. If a sample was diluted the MDL was multiplied by the dilution factor.

Annual Mean VOC Temporal Trend Plots for Area A

Somersworth Landfill Superfund Site, Somersworth, NH

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Figure 2.8b

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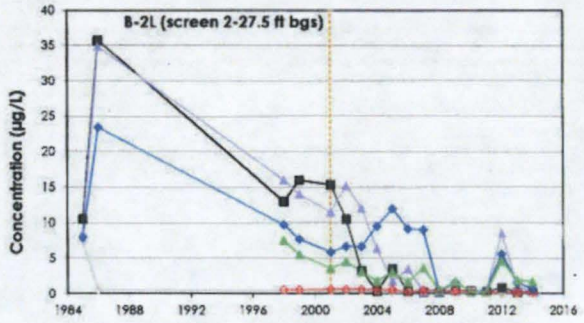

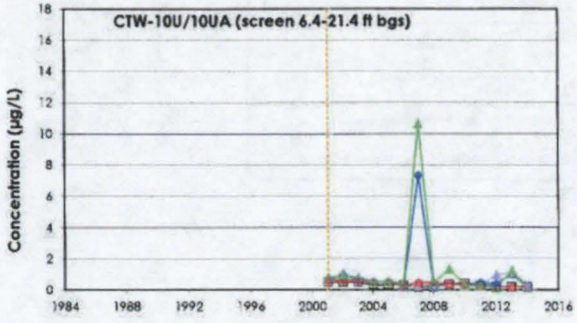

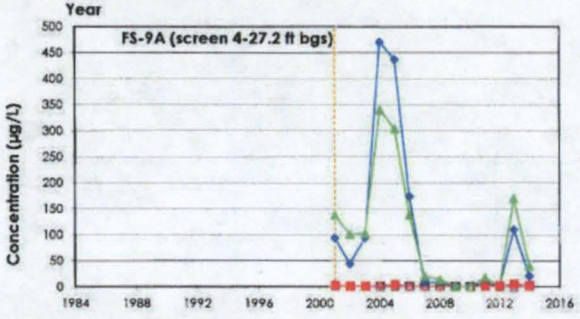

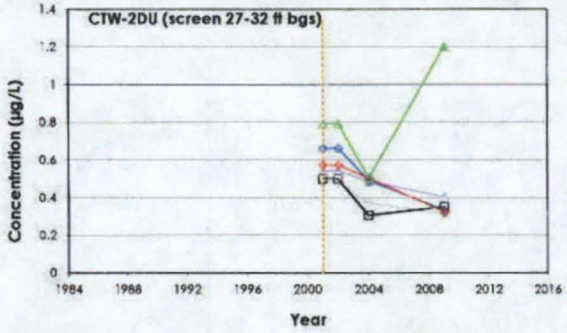

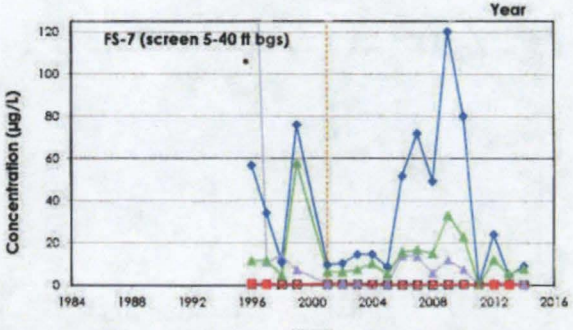

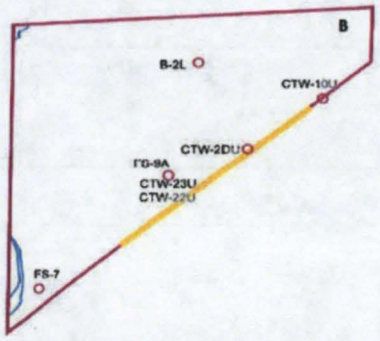

Legend for Graphs

- 1,1-Dichloroethene
- Tetrachloroethene
- Trichloroethene
- cis-1,2-Dichloroethene
- trans-1,2-Dichloroethene
- Vinyl Chloride
- - CTW construction complete

Notes:
Open symbol indicates all samples were non-detect
CTW - Chemical Treatment Well
ft bgs - feet below ground surface
µg/L - micrograms per liter
Annual mean chlorinated ethene concentrations were calculated using the full data. When a field duplicate was conducted, the data for the duplicates were averaged first to obtain a single value for that sampling event, which was then used to calculate the mean for the year. For calculation, the method detection limit (MDL) was substituted for non-detects. If a sample was diluted the MDL was multiplied by the dilution factor.

* 1997 Annual mean trichloroethene concentration is 237 µg/L.

Annual Mean VOC Temporal Trend Plots for Area B

Somersworth Landfill Superfund Site, Somersworth, NH

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Figure 2.8c

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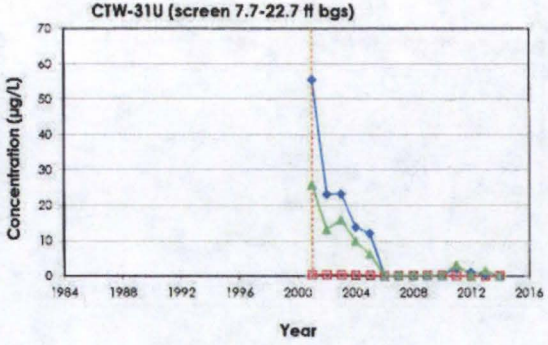

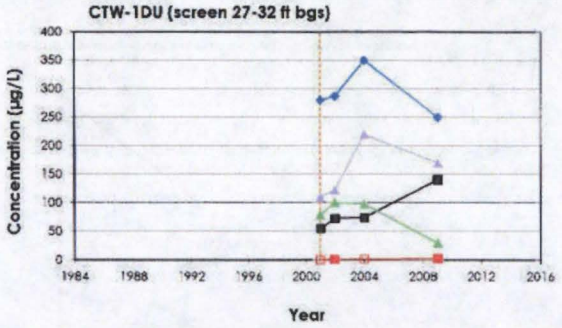

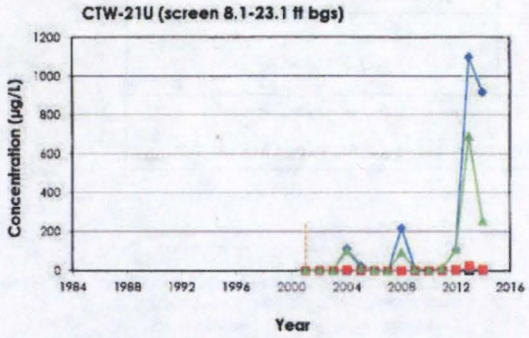

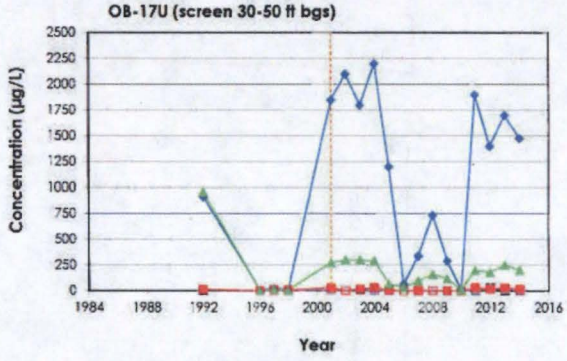

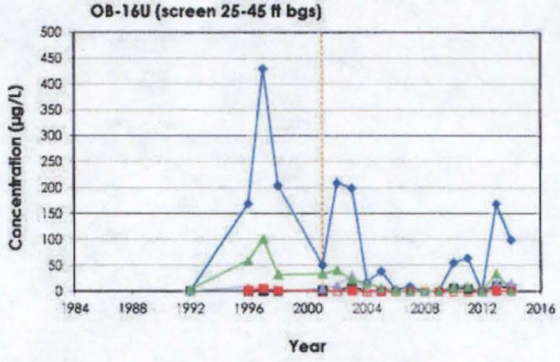

Legend for Graphs

- 1,1-Dichloroethene
- Trichloroethene
- trans-1,2-Dichloroethene
- Tetrachloroethene
- cis-1,2-Dichloroethene
- Vinyl Chloride
- - CTW construction complete

Notes:
Open symbol indicates non-detect annual means
Note different scale on graph for OB-17U
CTW - Chemical Treatment Well
ft bgs - feet below ground surface
ug/L - micrograms per liter
Annual mean chlorinated ethene concentrations were calculated using the fall data. When a field duplicate was conducted, the data for the duplicates were averaged first to obtain a single value for that sampling event, which was then used to calculate the mean for the year. This was done in order to not underestimate the annual mean in the event that there were a primary and duplicate non-detect result. For calculation, the method detection limit (MDL) was substituted for non-detects. If a sample was diluted the MDL was multiplied by the dilution factor.

Annual Mean VOC Temporal Trend Plots for Area C

Somersworth Landfill Superfund Site, Somersworth, NH

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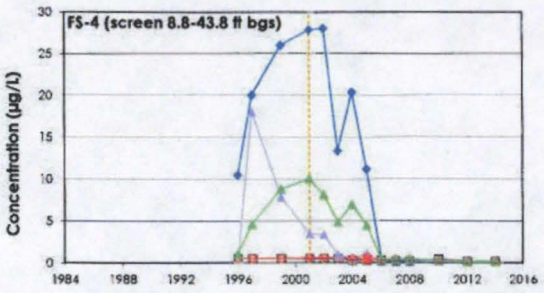
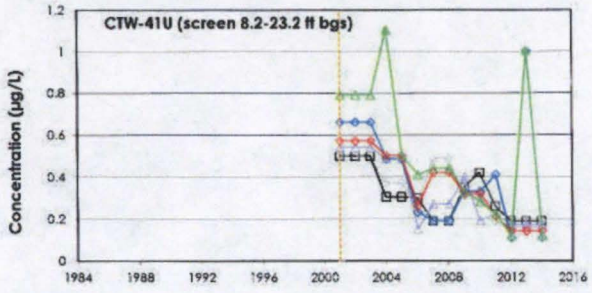
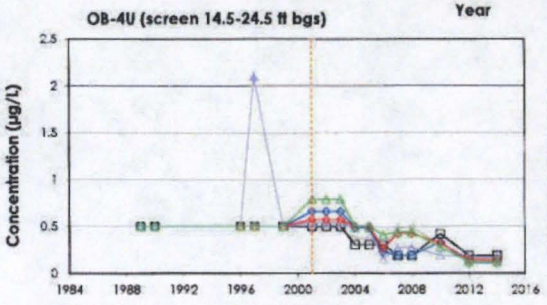
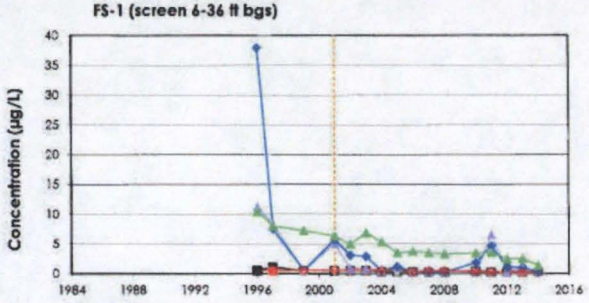
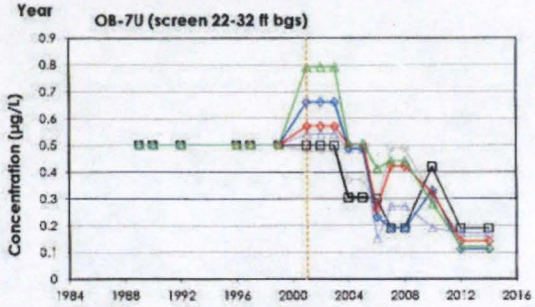
Figure 2.8d

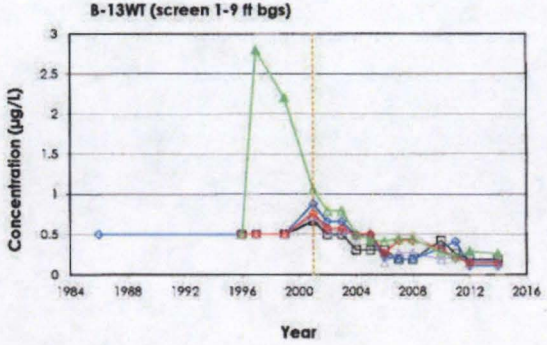


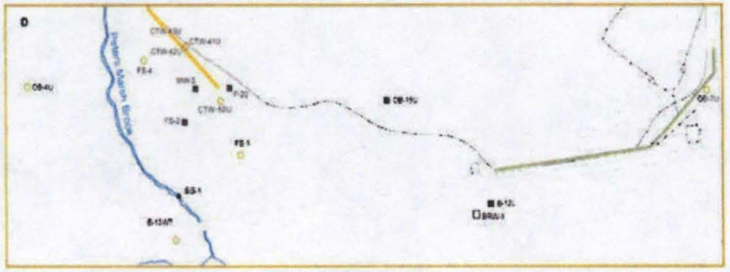












Legend for Graphs

- 1,1-Dichloroethene
- Trichloroethene
- trans-1,2-Dichloroethene
- Tetrachloroethene
- cis-1,2-Dichloroethene
- Vinyl Chloride
- CTW construction complete

Notes:
Open symbol indicates all samples were non-detect
CTW - Chemical Treatment Well
ft bgs - feet below ground surface
µg/L - micrograms per liter
Annual mean chlorinated ethene concentrations were calculated using the full data. When a field duplicate was conducted, the data for the duplicates were averaged first to obtain a single value for that sampling event, which was then used to calculate the mean for the year. For calculation, the method detection limit (MDL) was substituted for non-detects. If a sample was diluted the MDL was multiplied by the dilution factor.

Annual Mean VOC Temporal Trend Plots for Area D

Somersworth Landfill Superfund Site, Somersworth, NH

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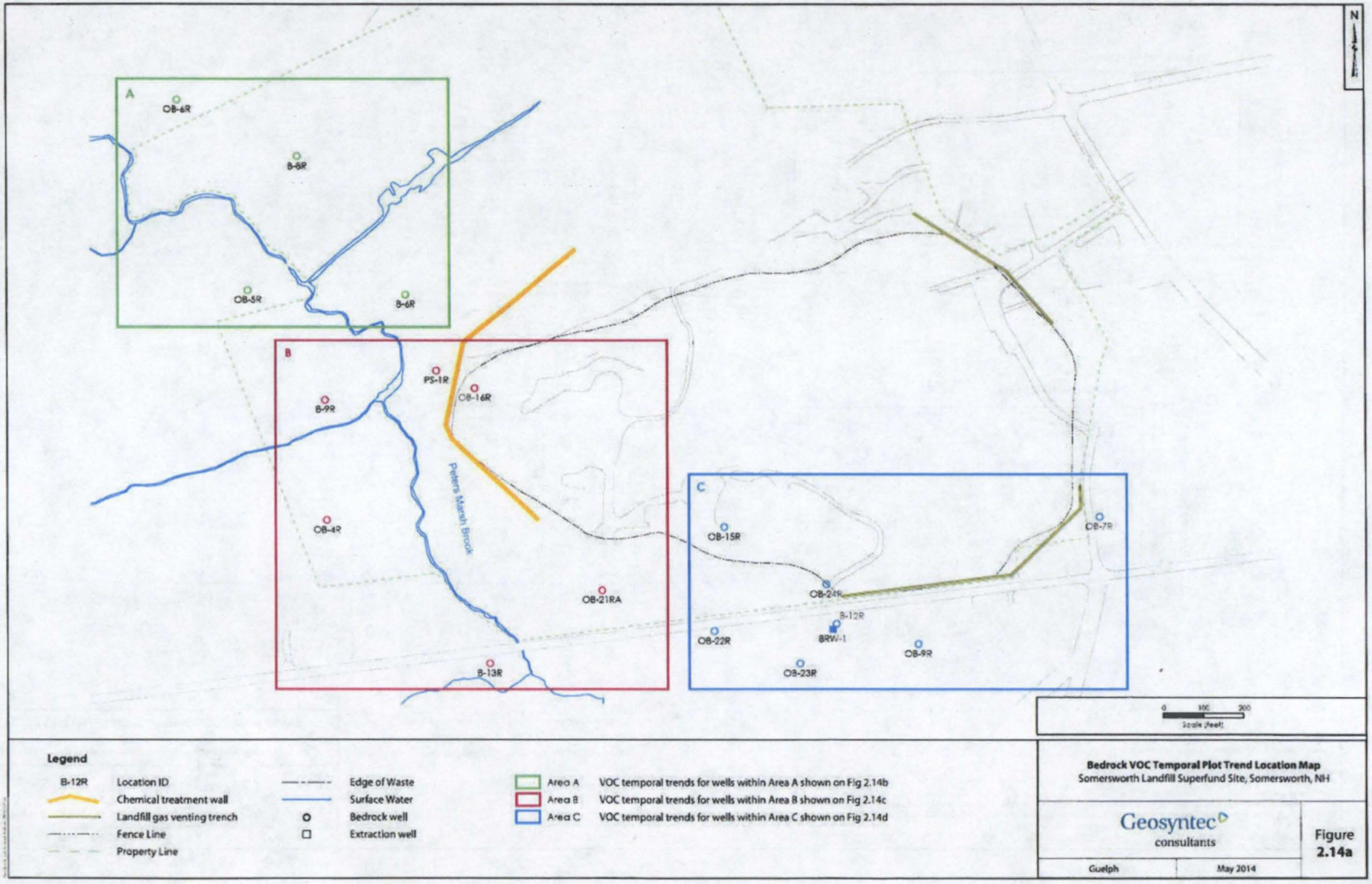
Figure 2.8e

Guelph | December 2014

Figure 5: Bedrock VOC Temporal Trend Location Map and Annual Mean Trend Plots



Bedrock VOC Temporal Plot Trend Location Map
Somersworth Landfill Superfund Site, Somersworth, NH

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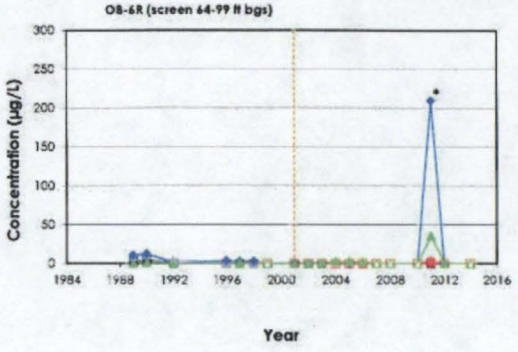
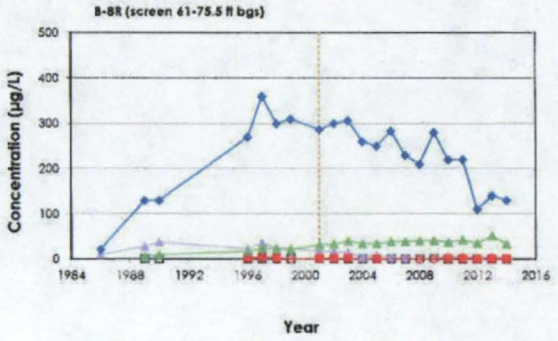
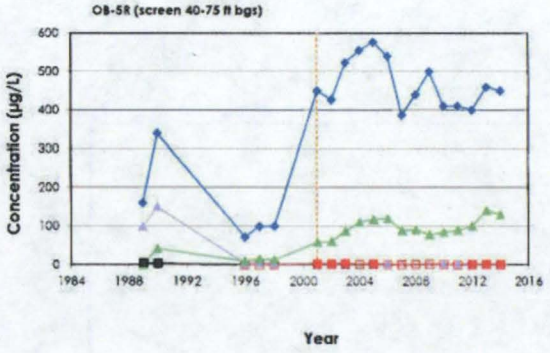
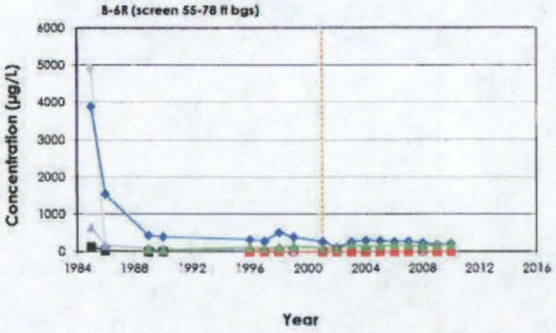
Guelph | May 2014

Figure **2.14a**









Legend for Graphs

- 1,1-Dichloroethene
- Trichloroethene
- trans-1,2-Dichloroethene
- Tetrachloroethene
- cis-1,2-Dichloroethene
- Vinyl Chloride

- CTW construction complete

Notes:
Open symbol indicates all samples were non-detect
CTW - Chemical Treatment Well
Note different scale on graph for B-6R
ft bgs - feet below ground surface
µg/L - micrograms per liter
Annual mean chlorinated ethene concentrations were calculated using the fall data. When a field duplicate was conducted, the data for the duplicates were averaged first to obtain a single value for that sampling event, which was then used to calculate the mean for the year. For calculation, the method detection limit (MDL) was substituted for non-detects. If a sample was diluted the MDL was multiplied by the dilution factor.
*Suspected sample labeling error.

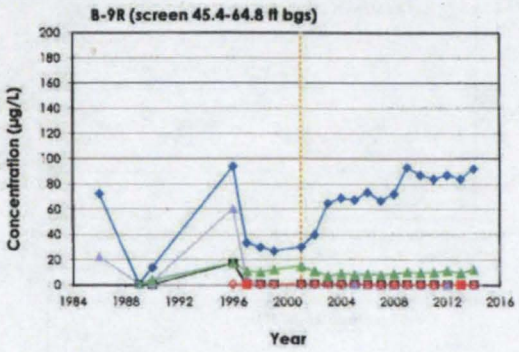
Annual Mean VOC Temporal Trend Plots for Area A

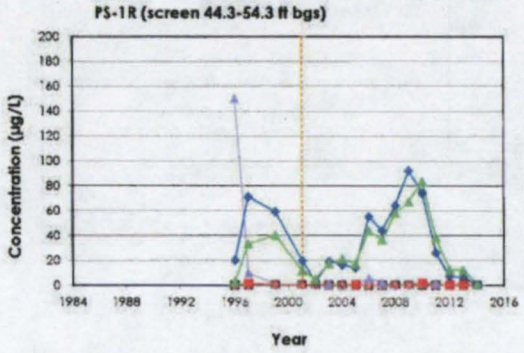
Somersworth Landfill Superfund Site, Somersworth, NH

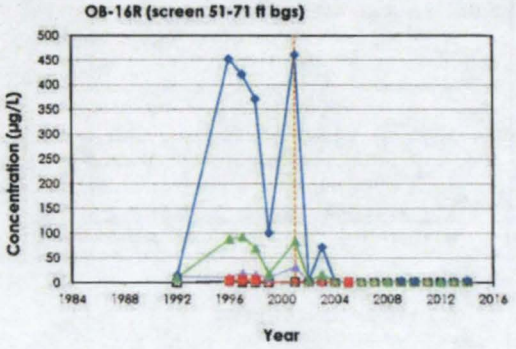
Geosyntec consultants

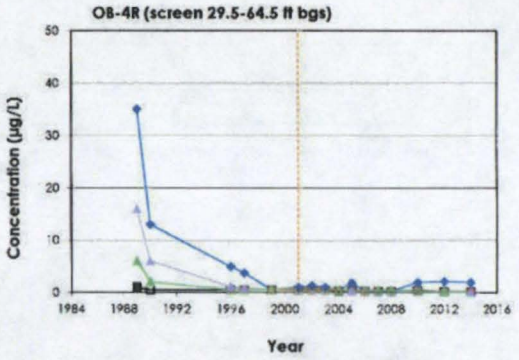
Figure 2.14b

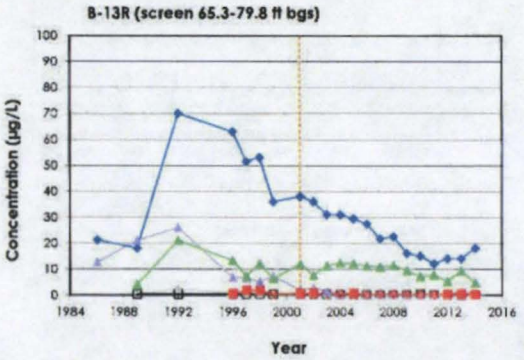
Guelph | December 2014

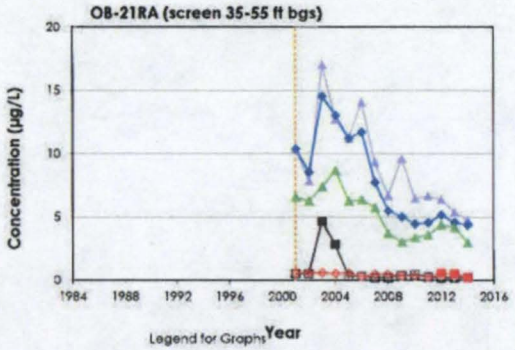


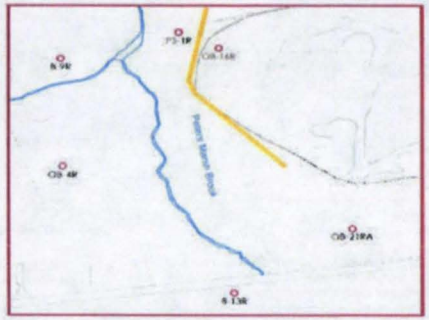












Legend for Graphs

- 1,1-Dichloroethene
- Trichloroethene
- trans-1,2-Dichloroethene
- Tetrachloroethene
- cis-1,2-Dichloroethene
- Vinyl Chloride
- CTW construction complete

Notes:
Open symbol indicates all samples were non-detect
CTW - Chemical Treatment Well
ft bgs - feet below ground surface
µg/L - micrograms per liter
Annual mean chlorinated ethene concentrations were calculated using the fall data. When a field duplicate was conducted, the data for the duplicates were averaged first to obtain a single value for that sampling event, which was then used to calculate the mean for the year. For calculation, the method detection limit (MDL) was substituted for non-detects. If a sample was diluted the MDL was multiplied by the dilution factor.

Annual Mean VOC Temporal Trend Plots for Area B

Somersworth Landfill Superfund Site, Somersworth, NH

Geosyntec consultants

Figure 2.14c

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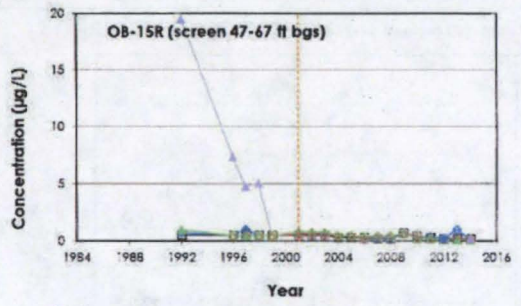
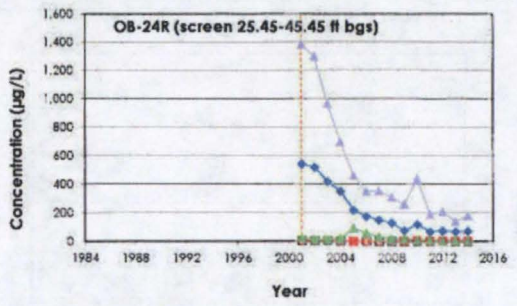
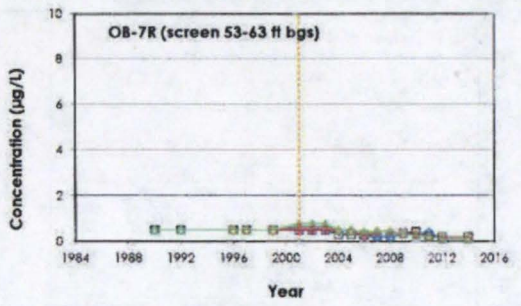
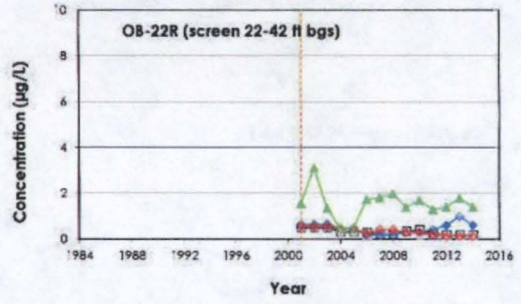
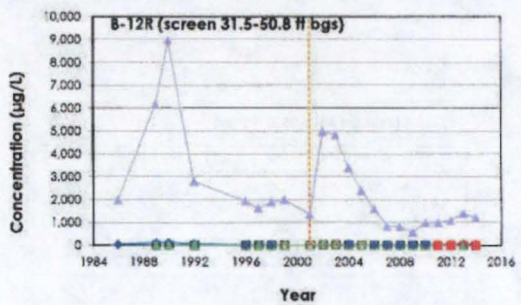
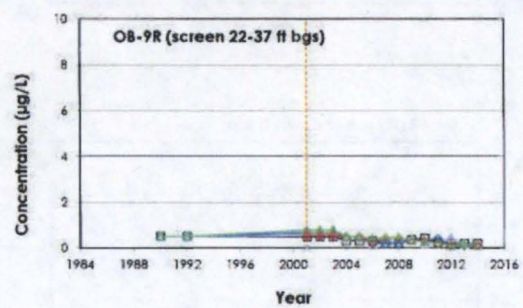


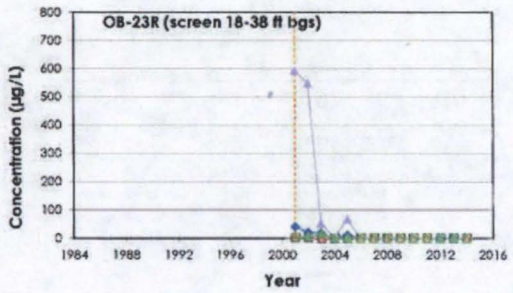


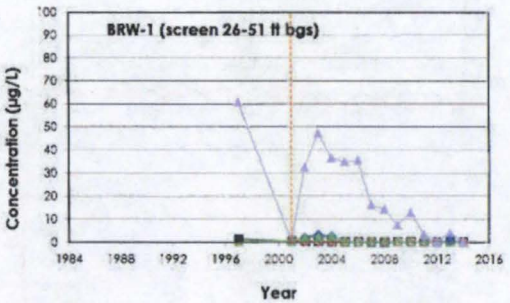


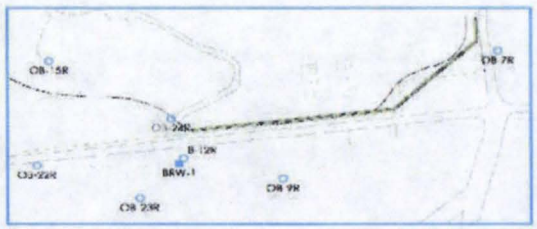












Legend for Graphs

- 1,1-Dichloroethene
- Tetrachloroethene
- Trichloroethene
- cis-1,2-Dichloroethene
- trans-1,2-Dichloroethene
- Vinyl Chloride
- - CTW construction complete

Notes:
Open symbol indicates non-detect annual means
CTW - Chemical Treatment Well
ft bgs - feet below ground surface
µg/L - micrograms per liter
Annual mean chlorinated ethene concentrations were calculated using the full data. When a field duplicate was conducted, the data for the duplicates were averaged first to obtain a single value for that sampling event, which was then used to calculate the mean for the year. This was done in order to not underestimate the annual mean in the event that there were a primary and duplicate non-detect result. For calculation, the method detection limit (MDL) was substituted for non-detects. If a sample was diluted the MDL was multiplied by the dilution factor.

Annual Mean VOC Temporal Trend Plots for Area C

Somersworth Landfill Superfund Site, Somersworth, NH

Geosyntec consultants

Guelph | December 2014

Figure 2.14d

Attachment A: Site Inspection Checklist and Photographs

Site Inspection Checklist

I. SITE INFORMATION	
Site name: Somersworth Sanitary Landfill Superfund Site	**Date of inspection:** July 21, 2015
Location and Region: Blackwater Road, City of Somersworth, Strafford County, New Hampshire	**EPA ID:** NHD980520225
Agency, office, or company leading the five-year review: EPA New England – Region 1, Office of Site Remediation and Restoration	**Weather/temperature:** Sunny/ 90°F

Remedy Includes: (Check all that apply)

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

Attachments: Site Photographs are included.

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Mr. Robert Belmore (Name) City Manager (Title) July 29, 2015 (Date)
   Interviewed by phone Phone no. 603-692-9502

   Problems, suggestions; Report attached No problems reported, see interview record in Attachment B of the Five Year Review Report.

2. **O&M staff** _____ (Name) _____ (Title) _____ (Date)
   Interviewed at site at office by phone Phone no. _____

   Problems, suggestions; Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

   Agency NHDES
   Contact Andrew Hoffman (Name) | Project Manager (Title) | July 21, 2012 (Date) | (603) 271- 6778 (Phone no.)

   Problems; suggestions; Report attached Some suggestions were offered. See interview record in Attchment B of the Five Year Review Report.

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

1. **O&M Documents**

O&M manual	Readily available	Up to date	■ N/A
As-built drawings	Readily available	Up to date	■ N/A
Maintenance logs	Readily available	Up to date	■ N/A

Remarks_____

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

3. **O&M and OSHA Training Records** Readily available ■ Up to date N/A
Remarks_____

4. **Permits and Service Agreements**

Air discharge permit	Readily available	Up to date	■ N/A
Effluent discharge	Readily available	Up to date	■ N/A
Waste disposal, POTW	Readily available	Up to date	■ N/A
Other permits_____	Readily available	Up to date	■ N/A

Remarks_____

5. **Gas Generation Records** Readily available Up to date ■ N/A
Remarks_____

6. **Settlement Monument Records** Readily available Up to date ■ N/A
Remarks_____

7. **Groundwater Monitoring Records** Readily available ■ Up to date N/A
Remarks_____

8. **Leachate Extraction Records** Readily available Up to date ■ N/A
Remarks_____

9. **Discharge Compliance Records**

Air	Readily available	Up to date	■ N/A
Water (effluent)	Readily available	Up to date	■ N/A

Remarks_____

10. **Daily Access/Security Logs** Readily available ■ N/A
Remarks _____

IV. O&M COSTS

1. **O&M Organization**
   State in-house — Contractor for State
   PRP in-house — ■ Contractor for PRP
   Federal Facility in-house — Contractor for Federal Facility
   Other_____

2. **O&M Cost Records**
   Readily available ■ Up to date
   ■ Funding mechanism/agreement in place
   Original O&M cost estimate _____
   See the System Operation/Operation and Maintenance discussion under Section A.3 of the Five Year Review Report.

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: None. See the System Operation/Operation and Maintenance discussion under Section A.3 of the Five Year Review Report.

V. ACCESS AND INSTITUTIONAL CONTROLS ■ Applicable N/A

A. Fencing

1. **Fencing damaged** Location shown on site map ■ N/A
   Remarks _____

B. Other Access Restrictions

1. **Signs and other security measures** ■ N/A
   Remarks _____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

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

Type of monitoring (*e.g.*, self-reporting, drive by) Notifications via mail to all new property owners within the GMZ established by the City Ordinance.
Frequency Annual
Responsible party/agency City of Somersworth

Contact	Mr. Robert Belmore	City Manager	July 29, 2012	(603) 692- 9502
	Name	Title	Date	Phone no.

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

2. **Adequacy** ■ ICs are adequate ICs are inadequate N/A
Remarks_____

D. General

1. **Vandalism/trespassing** Location shown on site map ■ No vandalism evident
Remarks_____

2. **Land use changes on site** ■ N/A
Remarks_____

3. **Land use changes off site** ■ N/A
Remarks_____

VI. GENERAL SITE CONDITIONS

A. Roads ■ Applicable N/A

1. **Roads damaged** Location shown on site map ■ Roads adequate N/A

B. Other Site Conditions N/A

VII. LANDFILL COVERS ■ Applicable N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map ■Settlement not evident
Areal extent_____ Depth_____
Remarks _____

2. **Cracks** Location shown on site map ■ Cracking not evident
Lengths_____ Widths_____ Depths_____
Remarks_____

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

4. **Holes** Location shown on site map ■ Holes not evident
Areal extent_____ Depth_____
Remarks_____

5. **Vegetative Cover** ■ Grass ■ Cover properly established ■ No signs of stress
Trees/Shrubs (indicate size and locations on a diagram)
Remarks_____

6. **Alternative Cover (armored rock, concrete, etc.)** ■ N/A
Remarks_____

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

8. **Wet Areas/Water Damage** ■ Wet areas/water damage not evident
Wet areas Location shown on site map Areal extent_____
Ponding Location shown on site map Areal extent_____
Seeps Location shown on site map Areal extent_____
Soft subgrade Location shown on site map Areal extent_____
Remarks_____

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

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

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

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

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

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

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

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

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

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

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

6. **Excessive Vegetative Growth** Type: Grass and weeds
Areal extent Approximately 120 square feet.
Remarks At the time of inspection overgrown vegetation was observed. This was reported to the PRPs which rectified the issue by clearing all the vegetation. See the last two photos showing the drainage channel before and after the clearing.

D. Cover Penetrations Applicable ■ N/A

1. **Gas Vents** Active **Passive**
■Properly secured/locked Functioning ■Routinely sampled ■Good condition
Evidence of leakage at penetration ■Needs Maintenance
N/A
Remarks Some of the vent (whirly-wind) caps were rusty and their movement was limited. All vent caps were inspected on July 27, 2015 and those for vents VP-1, VP-2, and VP-4 were replaced during the week of August 10, 2015.

2. **Gas Monitoring Probes**
Properly secured/locked ■Functioning ■Routinely sampled ■Good condition
Evidence of leakage at penetration Needs Maintenance N/A
Remarks Some of the probes (SGP-2 and SGP-5) were found unlocked. These probe casings were secured on July 27, 2015. SGP-13, which had been abandoned in place was properly decommissioned during the week of August 10, 2015.

3. **Monitoring Wells** (within surface area of landfill)
Properly secured/locked ■Functioning ■Routinely sampled ■Good condition
Evidence of leakage at penetration ■Needs Maintenance N/A
Remarks Wells BRW-1 and CTW-61U were found unlocked/not properly secured. All monitoring wells on-site were inspected and secured/locked on July 27, 2015. The cap on well BRW-1 was replaced during the week of August 10, 2015.

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

5. **Settlement Monuments** Located Routinely surveyed ■N/A
Remarks_____

E. Gas Collection and Treatment Applicable ■ N/A

1. **Gas Treatment Facilities**
   Flaring Thermal destruction Collection for reuse
   Good condition Needs Maintenance
   Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
   Good condition Needs Maintenance
   Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   Good condition Needs Maintenance
   Remarks_____

F. Cover Drainage Layer ■ Applicable N/A

1. **Outlet Pipes Inspected** Functioning ■ N/A
   Remarks_____

2. **Outlet Rock Inspected** ■ Functioning N/A
   Remarks_____

G. Detention/Sedimentation Ponds Applicable ■ N/A

1. **Siltation** Areal extent_____ Depth_____
   Siltation not evident
   Remarks_____

2. **Erosion** Areal extent_____ Depth_____
   Erosion not evident
   Remarks_____

3. **Outlet Works** Functioning
   Remarks_____

4. **Dam** Functioning
   Remarks_____

H. Retaining Walls Applicable ■ N/A

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

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

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

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

2. **Vegetative Growth** Location shown on site map
   Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

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

4. **Discharge Structure** Functioning
   Remarks_____

VIII. VERTICAL BARRIER WALLS Applicable ■ N/A

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

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

A. Treatment System ■Applicable N/A

1. **Treatment Train** (Check components that apply)
   Metals removal Oil/water separation Bioremediation
   Air stripping Carbon adsorbers
   Filters_____
   Additive (*e.g.*, chelation agent, flocculent)_____
   Others In-situ Zero-valent Iron Chemical Treatment Wall
   Good condition ■Needs Maintenance
   Sampling ports properly marked and functional
   Sampling/maintenance log displayed and up to date
   Equipment properly identified
   Quantity of groundwater treated annually_____
   Quantity of surface water treated annually_____
   Remarks The CTW-20 transect has shown periodic elevated concentrations of CEs at the downgradient side of the CTW. It is possible that pockets of limited iron content may be the cause; this is being investigated and is laid out as one of the issues/recommendations in the Five Year Review Report.

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ■ Good condition Needs Maintenance
   Remarks_____

3. **Tanks, Vaults, Storage Vessels**
   ■ Good condition Proper secondary containment Needs Maintenance
   Remarks_____

4. **Discharge Structure and Appurtenances**
   ■ Good condition Needs Maintenance
   Remarks_____

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

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

D. Monitoring Data

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

2. Monitoring data suggests:
   Groundwater plume is effectively contained ■ Contaminant concentrations are declining
   Remarks The extraction well (BRW-1) appears to have no hydraulic connection to the nearby bedrock wells. Therefore, containment of the localized bedrock plume cannot be confirmed at this time. This has been laid out as one of the issues/recommendations in the Five Year Review Report.

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   ■ Properly secured/locked ■ Functioning ■ Routinely sampled ■ Good condition
   ■ All required wells located Needs Maintenance N/A
   Remarks Technically the remedy is not considered Monitored Natural Attenuation (MNA) since it was established well before the MNA remedy concept was formally accepted by EPA. The remedy for this site is natural attenuation plus site monitoring.

X. OTHER REMEDIES

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

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

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

The remedy (a chemical treatment wall (CTW), a permeable landfill cover, the extraction of bedrock groundwater and infiltration of it on top of the landfill (to be treated by the CTW), landfill gas vent trench with passive ventilation, landfill gas monitoring plus monitored natural attenuation of the groundwater, and Institutional Controls), aims to prevent exposure to groundwater contaminated with chlorinated ethenes, contain the plume of contaminated groundwater and the migration of landfill gas, and treat the contaminated groundwater. The remedy appears to be effective and functioning as designed. However, the containment of the localized bedrock plume cannot be confirmed at this time. This has been laid out as an issue/recommendation in the Five Year Review Report.

Also, a portion of the CTW, the CTW-20 transect has shown periodic elevated concentrations of CEs at the downgradient side of the CTW. The cause for these anomalies is being investigated and it has also been laid out as an issue/recommendation in the Five Year Review Report.

B. Adequacy of O&M

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

The observations noted during the site inspection have no bearing on the current protectiveness of the remedy but they do have the potential to compromise it future protectiveness. However, all the deficiencies noted during the Site Inspection have been rectified, thus O&M at the Site is fully adequate.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

No such issues were observed.

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. None at this time.

SITE PHOTOGRAPHS

Area with replenished soils across the apartment complex and looking west.

U.S. National Guard Armory East of the Site.

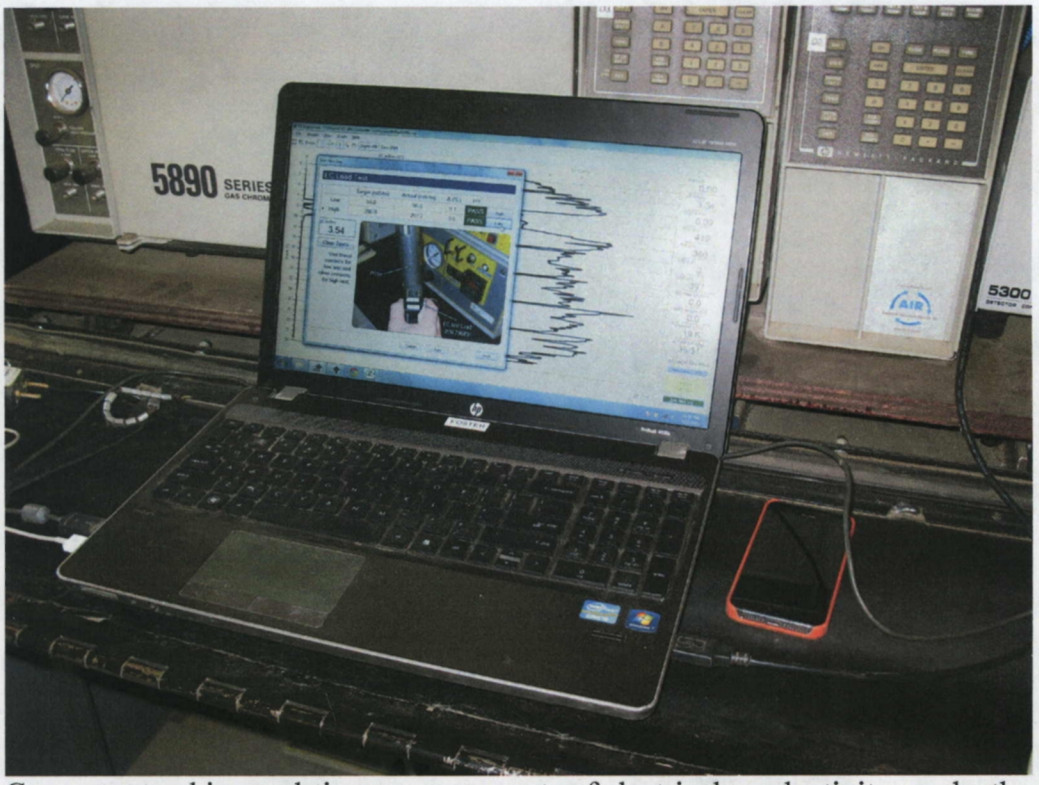
View of the Site facing southwest from the U.S. National Guard Armory.

Landfill gas vent with soil gas probe SGP-5 looking to the south-east.

Truck housing for the EC Probe computer and other field equipment.

EC Probing at CTW-20 Transect using a track mounted Geoprobe unit.

Detail of the EC Probe tip.



Computer tracking real-time measurements of electrical conductivity vs. depth.


Extraction system vault.

Drainage channel behind well OB-16R at the time of the site inspection.

Drainage channel with overgrown vegetation cleared on 08/03/2015.

Attachment B: Interview Record

INTERVIEW DOCUMENTATION FORM

The following is a list of individual interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

Name	Title/Position	Organization	Date
Mr. Robert Belmore	City Manager	City of Somersworth	07/29/2015
Mr. Andrew Hoffman, P.E.	Project Manager	NH DES	07/21/2015

INTERVIEW RECORD

Site Name: Somersworth Sanitary Landfill, Somersworth NH		**EPA ID No.:** NHD980520225
Subject: 3rd Five Year Review		**Time:** 11:20 AM **Date:** 7/21/2015
Type: Telephone Visit ♦ Other (On-site during inspection) **Location of Visit:** 1 Blackwater Road, Somersworth NH 03878		Incoming Outgoing

Contact Made By:

Name: Gerardo Millán-Ramos	**Title:** Remedial Project Manager	**Organization:** U.S. EPA Region 1

Individual Contacted:

Name: Mr. Andrew Hoffman	**Title:** Project Manager	**Organization:** NH DES
Telephone No: 603-271-6778 **Fax No:** 603 271-2181 **E-Mail Address:** ahoffman@des.state.nh.us	**Street Address:** 6 Hazen Drive **City, State, Zip:** Concord NH 03302-0095	

Summary Of Conversation

I interviewed Mr. Hoffman by asking the questions listed on page C-4 of the June 2001 Comprehensive Five Year Review Guidance. The following is a list of the questions and a summary of Mr. Hoffman's response.

1. What is your overall impression of the project (general sentiment)?

   It is a great remedy (the chemical treatment wall or CTW) for the site, given the Site's hydrogeology and suite of contaminants, however there are some recurring issues with the CTW and some other issues that we need to continue looking at. Namely the anomalies observed at the CTW-20 transect, the effectiveness of hydraulically containing bedrock groundwater via extraction well BRW-1, and the associated cleanup time-frames.

2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site?

   Yes, NHDES has visited the site to check on the condition of the infiltration gallery, it has held regular discussion with EPA regarding Annual Reports from the Work Settling Defendants, and has maintained regular contact with the City of Somersworth regarding the recordation of the AUR Notice and the solar project.

3. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so please give details.

   No, the only "violations" have been exceedances of the cleanup standards at monitoring wells downgradient to the CTW, as reported in the Annual Reports. NHDES has acknowledged these exceedances and is working with EPA to address them.

4. Do you feel well informed about the site's activities and progress?

   Yes, the City has kept NHDES well informed about the solar project and the AUR; the WSDs consultant, Geosyntec, submits the Annual Reports on-time and EPA regularly discusses with us technical and administrative issues, as needed.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

   Yes, for the Site's management and operation, a better estimate of the cleanup time-frame for the bedrock groundwater is needed. Consequently, it is important to further understand the hydrogeology near the source area to facilitate building a sound bedrock conceptual site model that will support current and future remedial decisions.

6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
   No, I do not. I just express my appreciation for you as a Project Manager and the State in being cooperative partners in this process. I appreciate the continued interaction and communication, and hope it continues into the future.

INTERVIEW RECORD

Site Name: Somersworth Sanitary Landfill, Somersworth NH		**EPA ID No.:** NHD980520225
Subject: 3rd Five Year Review	**Time:** 11:00 AM	**Date:** 07/21/2015
Type: ♦Telephone Visit Other **Location of Visit:**		Incoming ♦ Outgoing

Contact Made By:

Name: Gerardo Millán-Ramos	**Title:** Remedial Project Manager	**Organization:** U.S. EPA Region 1

Individual Contacted:

Name: Mr. Robert Belmore	**Title:** City Manager	**Organization:** City of Somersworth
Telephone No: 603-692-9502 **Fax No:** 603-692-9571 **E-Mail Address:** bbelmore@somersworth.com		**Street Address:** City of Somersworth, One Government Way **City, State, Zip:** Somersworth NH 03878

Summary Of Conversation

I called Mr. Belmore and interviewed him with the questions listed on page C-3 of the June 2001 Comprehensive Five Year Review Guidance. The following is a list of the questions and a summary of Mr. Belmore's response.

1. What is your overall impression of the project (general sentiment)?

   The sentiment of the group (Work Settling Defendants) is that it is a successful project. We are working well as a team and we are very optimistic about the Site's future. Aside from a few "hickups" that we will be able to address and rectify in a timely manner, we feel that the project meets all of our needs, protects the environment and the health of the community as a whole.

2. What effects have site operations had on the surrounding community?

   For the most part (except some abutters) the vast majority of the neighbors are unaware of the Site and thus unaffected. An example of the abutters were the residents of the apartment complex adjacent to the area where top soils was replenished. Everyone was informed during the entire field effort and negative effects were avoided.

3. Are you aware of any community concerns regarding the site or its operation and administration? If so please give details.

   None. .

4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so please give details.

   Not aware of any emergency responses related to the Site, nor any other incidents that could be qualified as vandalism or trespassing.

5. Do you feel well informed about the site's activities and progress?

   Yes. In so far as a lay person I feel very well informed and periodically we provide updates to the City Council so the elected officials are aware of interactions and progress of the Site.

Attachment C: Press Release about Five Year Review Notification

EPA United States Environmental Protection Agency

Newsroom
News Releases from Region 1

EPA Will Review 24 Hazardous Site Cleanups during 2015

Release Date: 01/05/2015
Contact Information: Emily Bender, 617-918-1037

EPA will review site clean ups and remedies at 20 Superfund Sites and oversee reviews at 4 Federal Facilities across New England this year by doing scheduled Five-Year Reviews at each site.

EPA conducts evaluations every five years on previously-completed clean up and remediation work performed at Superfund sites and Federal Facilities listed on the "National Priorities List" (aka Superfund sites) to determine whether the implemented remedies at the sites continue to be protective of human health and the environment. Further, five year review evaluations identify any deficiencies to the previous work and, if called for, recommend action(s) necessary to address them.

The Superfund Sites where EPA will begin Five Year Reviews in FY 2015 (October 1, 2014 through September 30, 2015) are below. Please note, the Web link provided after each site provides detailed information on the site status and past assessment and cleanup activity. The web link also provides contact information for the EPA Project Manager and Community Involvement Coordinator at each site. Community members and local officials are invited to contact EPA with any comments or current concerns about a Superfund Site or about the conclusions of the previous Five Year Review.

The Superfund Sites at which EPA is performing Five Year Reviews over the following several months include the following sites.

Connecticut

Durham Meadows, Durham
http://www.epa.gov/region1/superfund/sites/durham

Old Southington Landfill, Southington
http://www.epa.gov/region1/superfund/sites/oldsouthington

Raymark Industries, Stratford
http://www.epa.gov/region1/superfund/sites/raymark

Solvents Recovery Services of New England, Southington
http://www.epa.gov/region1/superfund/sites/srs

Maine

Brunswick Naval Air Station (Federal Facility), Brunswick
http://www.epa.gov/region1/superfund/sites/brunswick

Callahan Mining Corp., Brooksville
http://www.epa.gov/region1/superfund/sites/callahan

Eastland Woolen Mill, Corinna
http://www.epa.gov/region1/superfund/sites/eastland

Loring Air Force Base (Federal Facility), Limestone
http://www.epa.gov/region1/superfund/sites/loring

Pinette's Salvage Yard, Washburn
http://www.epa.gov/region1/superfund/sites/pinette

Saco Municipal Landfill, Saco
http://www.epa.gov/region1/superfund/sites/sacolandfill

Massachusetts

Atlas Tack Corp., Fairhaven
http://www.epa.gov/region1/superfund/sites/atlas

Cannon Engineering Corp., Bridgewater

Search this collection of releases | or search all news releases

Get news releases by email

View selected historical press releases from 1970 to 1998 in the EPA History website.

Recent additions

05/29/2015 On 20th Anniversary of Effort, EPA Gives Charles River a B+ and Publishes Live Water Quality Data
05/28/2015 EPA Awards $10.3 Million to Clean Up New England Brownfield Sites, Protect Health in Communities
05/27/2015 With Summer's Arrival, Reminder About Woonasquatucket River "Do's and Don'ts" and Update on EPA Efforts
05/26/2015 Company Provides Emergency Response Equipment for Fall River, Mass. following EPA Enforcement
05/20/2015 Claremont, N.H. Auto Dealer Settles with EPA for Oil Spill

http://www.epa.gov/region1/superfund/sites/cannon

Charles-George Reclamation Trust Landfill, Tyngsborough
http://www.epa.gov/region1/superfund/sites/charlesgeorge

Fort Devens (Federal Facility), Ayer, Harvard, Lancaster & Shirley
http://www.epa.gov/region1/superfund/sites/devens

Groveland Wells No. 1 & 2 Site, Groveland
http://www.epa.gov/region1/superfund/sites/groveland

Materials Technology Laboratory (US ARMY, Federal Facility), Watertown
http://www.epa.gov/region1/superfund/sites/arntl

New Bedford Harbor, New Bedford
www.epa.gov/nbh

PSC Resources, Palmer
http://www.epa.gov/region1/superfund/sites/psc

New Hampshire

Somersworth Sanitary Landfill, Somersworth
http://www.epa.gov/region1/superfund/sites/somersworth

South Municipal Water Supply Well (Five Year Review Addendum), Peterborough
http://www.epa.gov/region1/superfund/sites/southmuni

Troy Mills Landfill, Troy
http://www.epa.gov/region1/superfund/sites/troymills

Rhode Island

Stamina Mills Inc., North Smithfield
http://www.epa.gov/region1/superfund/sites/stamina

West Kingston Town Dump/URI Disposal Area, South Kingstown
http://www.epa.gov/region1/superfund/sites/wkingston

Vermont

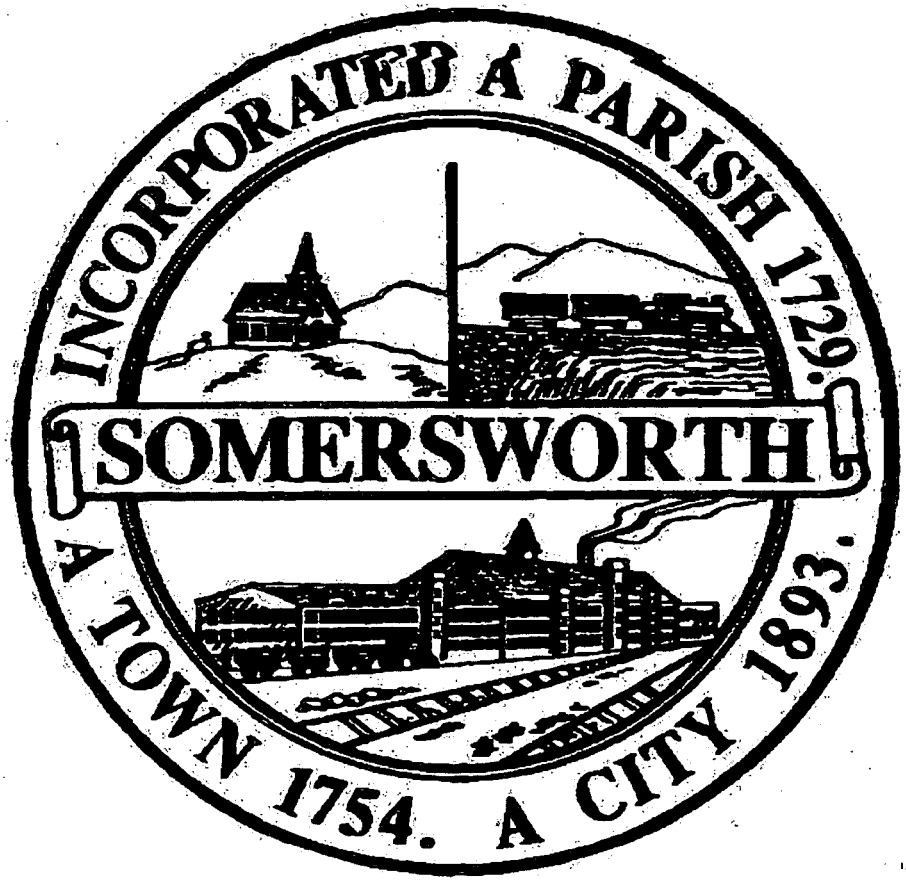
Burgess Brothers Landfill, Woodford and Bennington
http://www.epa.gov/region1/superfund/sites/burgess

Last updated on Wednesday, June 17, 2015 http://yosemite.epa.gov/opa/admpress.nsf/6d651d23f5a91b768525735900400c28/ff4ab719ca46f31385257dc4005889fd!OpenDocument

Attachment D: Groundwater Protection District Zoning Ordinance and GMZ map

CITY OF SOMERSWORTH, NEW HAMPSHIRE

CHAPTER 19 - ZONING ORDINANCE



ADOPTED BY SOMERSWORTH CITY COUNCIL - AUGUST 30,1989

AMENDED:

MARCH, 1990
AUGUST, 1990
SEPTEMBER, 1990
JANUARY, 1991
APRIL, 1991 MAY, 1991
SEPTEMBER, 1991
MAY, 1992
SEPTEMBER, 1992
JULY, 1993
SEPTEMBER, 1993
FEBRUARY, 1994
APRIL, 1994
JULY, 1994
FEBRUARY, 1995
OCTOBER, 1995
JANUARY, 1996
JULY 15, 1996
JUNE 2, 1997 APRIL 6, 1998
JUNE 1, 1998
JANUARY 18, 1999
OCTOBER 19,1999
JANUARY 10, 2000
APRIL 17, 2000
AUGUST 14, 2000
DECEMBER, 2000
MARCH, 2001
MAY 21, 2001
OCTOBER 7, 2002
OCTOBER 21, 2002
MAY 3, 2004
MARCH 21, 2005
SEPT 6, 2005
APRIL 17, 2006
SEPTEMBER 5 2006
APRIL 16,2007
AUG 13, 2007
JAN 22, 2008
OCT 6, 2008
NOV 17,2008
DEC 15, 2008
FEB 2, 2009
FEB 17, 2009
OCT 25, 2010
DEC 13, 2010
APR 4, 2011
AUG 15, 2011
SEP 17, 2012
MAR 18, 2013
JUL 15,2013
SEP 16, 2013
APR 21, 2014
MAY 5, 2014

CITY OF SOMERSWORTH

CHAPTER 19 – ZONING ORDINANCE

Amended March, 1990:
Pages 1, 2, 3,13,14, 52, 56,60 through 74. 83. 84; 85. Also, tables 4.A.1; 4.A.2; 4.A.3; 4.A.4; 4.A.5. Note #5; 5.A.1.;5.A.2.

Amended August, 1990:
Section 7, pages 16 thru 23.

Amended September, 1990:
Section 17, pages 63 thru 67. Table 5.A.1 and Table 5.A.1 Notes.

Amended January 7, 1991:
Section 20, page 89 - Zoning Board of Adjustment.

Amended April 1, 1991:
Section 18.C.4.e. - Political Signs.

Amended May 20, 1991:
Section 3.D., Page 5 - Commercial/Industrial District; Table of Uses, Tables 4.A.2; 4.A.3; 4.A.4; 4.A.5; 5.A.1.

Amended September 16, 1991:
Section 12, pages 46 thru 54 - Wetlands Conservation Overlay District.

Amended May 4, 1992:
Section 13, pages 53 thru 58 - Historic District.

Amended September 21, 1992:
Section 8, pages 24, 26 and 28 - Home Occupations.

Amended July 26, 1993:
Section 21, page 93 - Definitions; Table 4.A.4.

Amended September 7, 1993:
Section D.2., page 5 - Commercial/Industrial District.

Amended February 28, 1994:
Section 3. D.2., pages 5 & 6 - Commercial/Industrial District. Section 14, pages 60 thru 62 - Sexually Oriented Businesses (new). Section 18, page 71 on (19 pages) - Sign Regulations. Table of Uses - Table 4.A.5 (at end of chapter)

Amended April 4, 1994:
Table of Uses - Table 5.A.1 and Table 5.A.1 Notes.

Amended July 18, 1994:
Sections 11.B.4. & 11.B.5. (page 39); 11.B.8.f.& 11.B.9. (Pages 42 & 43); 11.c.(Pages 45 & 45A).

Amended February 21, 1995:
All pages renumbered to correspond with section numbers.
Table of Contents.
New Section added - "Section 15, Commercial Node District" (pages 15.1 thru 15.3).
Section 15 through Section 23 renumbered to Section 16 through Section 24.
Add Section 3.B.16. (page 3.3).
Add Section 3.D.8. (page 3.9).
Section 20.A.1. (page 20.1).
Section 20.B.3. (pages 20.1 & 20.2).
Section 20.B.3.h. (page 20.3).
Section 22 (pages 22.1 thru 22.9).
Tables 5.A.1&5.A.2

Amended October 2, 1995:
Added new Section 11 - Excavation of Earth Products (pages 11.1 to11.4)
Section 11 through Section 24 renumbered to Section 12 through Section 25.

Amended January 10, 1996:
Add Section 3.B. 15 (page 3.3).
Add new Section 16 - Recreation District (pages 16.1 thru 16.3).
Renumber all sections and pages after section 16 to reflect this change.
Section 24 (page 24.2).
Table 5.A. 1 Notes (page 8).

Amended July 15, 1996:
Delete Section 20 - Landscaping and Buffer Requirements, in its entirety.
Delete Section 22 - Circulation and Parking Regulations and replace with Section 21 – Circulation And Parking Regulations (page 21.1).
Renumber Section 23 through Section 26 to Section 22 through 25.

Amended June 2, 1997:
Section 8.D. (page 19:18)
Section 8.F.3. (page 19:18)
Section 8.F.6. (page 19:19) delete second paragraph
Table 4.A.3 & Note #6 (page 19:77)

Amended April 6, 1998:
Section 23 - Definitions (pages 68 and 70)
Table 4.A.3 and 4.A.5
Amended June 1, 1998:
Section 20 Sign Regulations - page 60.

Amended January 18, 1999:
Table 4.A.4 and 4.A.5

Amended October 19, 1999:

Added new Section 23 Naming of Public Streets and Rights of Way – pages 72-75

Renumbered Section 23 Definitions to Section 24 - pages 76-82. Renumbered Section 24 Administration & Enforcement to Section 25 - page 83. Renumbered Section 25 Interpretation, Conflicts & Separability to Section 26 - pages 84&85.

Amended January 10, 2000:
Section 8 Home Occupations - pages 18,19 & 21.
Section 10 Groundwater Protection District - pages 25 & 26.

Amended April 1, 2000:
Section 8 Home Occupations - pages 18,19 & 21.

Amended August 14, 2000:
Section 9 - Manufactured Housing District - pages 23 thru 24C. Table 4.A.5-pages 91 &92.

Amended December 11, 2000:
Section 12 - Flood Plain District - pages 32 thru 38A.

Amended March 19, 2001:
Section 3.A. - Districts - page 1.
Section 3.B.7. (deleted) - page 2.
Section 3.D.10. and 3.D.10.a. - (new) - page 7.
Section 24.NN. and 24.PP (delete) - page 79 and 80.
Tables 4.A.1. through 5.A.2 - pages 86 through 94.

Amended May 21, 2001:
Section 19.3.A. - Districts - page 1.
Section 19.3.B.14. - Purpose of Districts - page 3.
Section 19.3.D.11. - District Boundaries - page 7.
Section 19.3.D.12. - District Boundaries - pages 7 & 8.
Section 19.21. - Circulation & Parking Regulations - page 70.
Tables 4.A.1,4.A.2,4.A.3,4.A.4,4.A.5,5.A.1 - pages 85 thru 92.

Amended October 7, 2002:
Added new Section 24 Common Driveway Subdivision – pages 78 and 79.
Renumbered Section 24 thru Section 26 to Section 25 thru Section 27.

Amended October 21, 2002:
Table 4.A.3. – page 90

Amended 5/03/2004:
Section 7, Cluster Subdivision – pages 12 thru 17. Changed Cluster Subdivision to read Conservation Residential Development throughout Section.
Sections 20.D.2.a, 20.D.2.e, 20.D.2.f – page 68.

Section 20.D.4 – page 70.
Section 25, Definitions – pages 80 thru 84.
Added new Section 26, Telecommunication Facilities – pages 86 thru 93.
Amended Table of Uses (Table 4.A.3), page 98.
Amended Table of Uses (Table 4.A.5), pages 101 & 102.

Amended 3/21/2005:
Section 19.12.A. Flood Plain District, Applicability – page 34.
Section 19.14.H.2. Historic District, Appeal Process – page 52.
Section 19.20.B.13. Sign Regulations, Flashing Sign – page 61.
Section 19.20.C.2.e. Sign Regulations – page 63.
Section 19.20.C.4.a. Sign Regulations – Banner Signs – page 64.
Section 19.25.Y. Definitions, Dwelling Unit – page 82.
Section 19.25.DD. Definitions, Frontage – page 82.
Section 19.27.C. & 19.27.E. Administration & Enforcement – page 94.
Table 4.A.1. – page 96.

Amended 9/06/2005:
Section 19.25.JJ. Definitions, Height – page 83.
Table 5.A.2. – page 106.

Amended 4/17/2006:
Section 7, Conservation Residential Development – deleted in its entirety.
Section 24, Common Driveway Subdivision – deleted in its entirety.

Amended 9/05/2006:
Added New Section 29, Interim Growth Management Regulation, pages 88 & 89.

Amended 04/16/2007:
Section 25, Definitions, page 74.

Amended 04/16/2007:
Section 25, Definitions, page 75.

Amended 04/16/2007:
Table 5.A.1, Dimensional and Density Regulations, page 99.

Amended 08/13/2007:
Table 5.A.1, Dimensional and Density Regulations, Page 99.

Amended 01/22/2008:
Table 4.A.1, Table of Uses, Page, 90.
Table 4.A.2, Table of Uses, Page 91.
Table 4.A.3, Table of Uses, Page 92& 93.
Table 4.A.5, Table of Uses, Pages 95, 96 & 97.

Amended 10/06/2008:
Section 23 Naming of Public Streets and Rights of Way, Pages 69-71.

Amended 11/17/2008:
Replaced Section 29, Interim Growth Management Regulation in its entirety with new Section 29, Maximum Allowable Occupancy, Page 88.

Amended 12/15/2009:
Amend Section 19.3.D.8; Commercial Node District by deleting Section 19.3.D.8.a and Section 19.3.D.8.c and replacing with new Section 19.3.D.8.a and new Section 19.3.D.8.c, Page 7.

Amended 02/02/2009:
Replaced Section 20, Sign Regulation in its entirety with revised Section 20, Sign Regulations, pages 54-67.

Amended 02/17/2009:
Replaced Section 13, Wetlands Conservation Overlay District in its entirety with Revised Section 13, Riparian Wetland Buffer District Ordinance, pages 36-49.

Amended 10/25/2010:
Table 4.A.3 – Added OWHH to table and note #10 regarding OWHH's, page 104.

Amended 12/13/2010:
Amend Tables 4.A.3 and 4.A.4, pages 104 and 105.

Amended 04/04/2011:
Amend Section 13, Riparian and Wetland Buffer District Ordinance, pages 48.

Amended 08/15/2011:
Amend Section 19.3.D.1 District Boundaries, District, pages 3-4.

Amended 08/15/2011:
Amend Ordinance by replacing "Historic Mill"/"HD" with "MillYard District"/"MY" throughout; pages 58, 91, 99 and 100-112, including Table of uses.

Amended 08/15/2011:
Amend Section 19.3.B.3 Purpose of Districts, MillYard District, Page 3.

Amended 08/15/2011:
Amend Table of Uses 4.A.1, 4.A.2, 4.A.3, 4.A.4 and 4.A.5, pages 101-108.

Amended 09/17/2012:
Amend Table 5.A.1 Dimensional and Density Regulations, page 110-112.

Amended 03/18/2013:
Amend by adding new Section 30, pages 101-103.

Amended 07/15/2013:
Amend Chapter 19, Section 25 Definitions, page 87.

Amended 07/15/2013;
Amend Chapter 19, Table of Uses, Table 4.A.5, pages 111-113.

Passed 09/16/2013;
Add new Section 7, Conservation Subdivision Ordinance, pages 13-20.

Amended 04/21/2014
Amend Chapter 19, Table of Uses, Table 4.A.3.9, page116.
Amend Chapter 19, Table of Uses, Table 4.A.3.10, pages 116-117.

Added 05/05/2014
Amend Chapter 19, Table of Uses, Table 4.A.5, pages 121-122.

Amended 05/05/2014
Amend Chapter 19, Definitions, pages 19:97, 19:98 and 19:99.

Section 10 Groundwater Protection District

19.10.A. AUTHORITY. In accordance with New Hampshire Revised Statutes Annotated (RSA) Chapter 4-C:22 III, as the same may be subsequently amended, the City of Somersworth hereby adopts the following Groundwater Protection District.

19.10.B. PURPOSE. The purpose of this ordinance is, in the interest of public health, safety and general welfare, to protect, preserve and maintain the existing and potential groundwater supply and groundwater recharge areas within the known aquifer from adverse development, land use practices or depletion, and to allow for the restoration of degraded ground water by the establishment of a "Ground Water Management Zone".[1]

19.10.C. LOCATION.

19.10.C.1. The boundaries of the Groundwater Protection District shall be the outermost edge of the out wash deposits of the "Lily Pond Aquifer", as designated in the "Report on Aquifer Definition Lily Pond Aquifer Somersworth, New Hampshire," prepared by BCI Geonetics, Inc., and included in the Water Master Plan Update dated June1984. The Ground Water Management Zone is designated by the Ground Water Management Zone Overlay Map included in the Preferred Remedial Action 100% Design and Demonstration of Compliance Plan prepared by Beak International, Inc. and Geo Syntec Consultants International, Inc.[1]

19.10.C.2. When the actual boundary of the Groundwater Protection District is in dispute by any owner or abutter actually affected by said boundary, the Planning Board, at the owner/abutter's expense and request, may engage a professional geologist or hydrologist to determine more accurately the precise boundary of said Groundwater Protection District.

19.10.D. APPLICABILITY.

19.10.D.1. All land use activities and development conducted within the Groundwater Protection District shall be regulated by the standards established herein.

19.10.D.2. The standards established herein shall constitute the rules of an overlay zone and shall be superimposed over other zoning districts or portions thereof. The provisions herein shall apply in addition to all other applicable ordinances and regulations. In the event of a conflict between any provision herein and any other ordinance or regulation, the more restrictive requirement shall control.

19.10.E. DEFINITIONS.

19.10.E.1. Animal Feed Lots. A plot of land on which 25 livestock or more per acre are kept for the purpose of feeding.

19.10.E.2. Groundwater. Water in the subsurface zone at or below the water table in which all pore spaces are filled with water.

19.10.E.3. Groundwater Management Zone (GMZ). The subsurface volume in which ground water contamination associated with a discharge of a regulated contaminant is contained. (State of NH Groundwater Protection Rules - Env - WS410.)[2]

[1] Amended 1/10/2000.
[2] Passed 1/10/2000.

19.10.E.4. Hazardous and Toxic Materials. Those materials that pose a present or potential hazard to human health and the environment when improperly stored, transported or disposed of. These materials include those listed in the New Hampshire Hazardous Waste Regulations. Third Edition. Appendixes 1-4, 1985, New Hampshire Dept. of Environmental Services, Concord, as the same may be subsequently amended.

19.10.E.5 Impervious Surface. A surface covered by any material (such as pavement, cement, roofing) that prevents surface water from penetrating the soil directly.

19.10.E.6. Leachable Wastes. Waste materials including solid wastes, sewage, sludge, and agricultural wastes that are capable of releasing waterborne contaminants to the surrounding environment.

19.10.E.7. Solid Waste. Discarded solid material with insufficient liquid content to be free flowing. This includes but is not limited to rubbish, garbage, scrap materials, junk, refuse, inert fill material and landscape refuse.

19.10.F. PROHIBITED USES. The following uses are expressly prohibited from the Groundwater Protection District:

19.10.F.1. Within the Lily Pond Aquifer[1]

19.10.F.1.a. The disposal of solid waste including landfills and sewage lagoons, excepting disposal of stumps and brush;

19.10.F.1.b. Storage of road salt or other deicing chemicals except in a property constructed shelter for use on site;

19.10.F.1.c. Dumping of snow containing road salt or other deicng chemicals;

19.10.F.1.d. Motor vehicles service or repair shops;

19.10.F.1.e. Junk and salvage yards;

19.10.F.1.f. Animal feedlots;

19.10.F.1.g Commercial or industrial handling, disposal, storage or recycling of hazardous or toxic materials or wastes; and

19.10.F.1.h Underground storage or petroleum or any refined petrolcum product. All existing underground tanks, including those under 1,100 gallons, must be registered with the Somersworth Fire Department within six months of the enactment of this regulation. Existing tanks over 1,100 gallons are subject to Water Supply and Pollution Control Commission regulation, pursuant to New Hampshire Code of Administration No. W5411.

19.10.F.2. Within the Groundwater Management Zone:

19.10.F.2.a. The requirements, restrictions, and prohibition of the underlying Zoning District shall continue to apply to the extent that they are not inconsistent with the provision of this section; and[2]

19.10.F.2.b Pumping of ground water from any well, trench, sump or other structure for residential, irrigation, agricultural or industrial purpose is prohibited.[2]

19.10.G. SPECIAL CONDITIONS. The following conditions shall apply to all uses in the Groundwater Protection District:

[1] Added 1/10/2000.
[2] Passed 1/10/2000.

19.10.G.1. A lot shall not be rendered more than ten percent (10%) impervious. A proposed development plan which will incorporate a stormwater drainage plan, approved by the City of Somersworth Planning Board and prepared by a professional engineer certified to practice in the State of New Hampshire shall be provided. The plan shall provide for the on-site retention and percolation of all development generated stormwater runoff from a ten (10) year storm. Furthermore, the stormwater drainage plan shall provide for the filtering of parking area runoff to remove oil, gasoline and other impurities prior to retention and percolation of the runoff;

19.10.G.2. Development or land use activities proposed within the Groundwater Protection District shall be connected to the municipal sewage disposal system and the municipal water system;

19.10.G.3. Any use retaining less than thirty percent (30%) of lot area, regardless of size, in its natural vegetative state with no more than minor removal of existing trees and vegetation shall require a special permit;

19.10.G.4. Mining operations, including sand and gravel removal, shall require an Earth Removal Permit, pursuant to New Hampshire Revised Statutes Annotated Chapter 155-E, which is herein incorporated by reference. Such excavation or mining shall in no case be carried out within eight (8) vertical feet of the seasonal high water table; and

19.10.G.5. The storage of petroleum or related products in a freestanding fuel oil tank within or adjacent to a residential structure which is used for the normal heating of said structure shall be permitted pursuant to the conditions outlined in subsection H below, and all applicable state regulations. All tanks shall be protected from internal and external corrosion and shall be of a design approved by the Somersworth Fire Department. All freestanding tanks shall be placed on an impermeable surface such as a concrete pad. No tank may be abandoned in place. A tank shall be disposed of after emptied of all hazardous materials if it has been out of service for a period in excess of twelve (12) months. The product and the tank shall be disposed of by the property owner as directed by the Somersworth Fire Department and all applicable state laws. All leaking tanks must be emptied by the owner or operator within twelve (12) hours after detection of the leak and removed by the owner and/or operator as per above.

19.10.H. ADMINISTRATION.

19.10.H.1. Development or land use activities proposed within the Groundwater Protection District that require a special permit, as provided in subsection G above, shall be reviewed by both the Planning Board and the Somersworth Conservation Commission. The Planning Board shall either approve, conditionally approve or disapprove a special permit only after it determines that the proposed land use development and/or activities comply with the purpose of this regulation. In making such a determination, the Planning Board shall give consideration to the simplicity, reliability and feasibility of the control measures proposed and the degree of threat to groundwater quality if the control measures failed.

19.10.H.2. Development or land use activities proposed within the Groundwater Protection District that require subdivision or site plan approval from the Planning Board shall also be reviewed by the Somersworth Conservation Commission. The Planning Board and the Conservation Commission shall verify that the proposed activity will conform to the provisions of this regulation ordinance prior to action by the Planning Board to approve, conditionally approve or disapprove the application.

19.10.H.3. The Building Inspector shall not issue a building permit for development or land use activities until such time as he/she verifies that the proposed activity will conform to the provisions of this ordinance. The Building Inspector may consult with the Planning Board and/or Conservation Commission as he/she deems necessary.

19.10.H.4. Land use activities that do not require the receipt of Panning Board approval or building permits shall nonetheless be subject to the requirements and standards established herein.

19.10.H.5. A hydrogeologic study may be required by the Planning Board and/or the Conservation Commission to investigate the impacts a proposed development or land use activity will have on an existing or future groundwater supply. A qualified professional hydroiogist or geologist shall be chosen by the City of Somersworth and the applicant for approval shall pay any and all costs incurred.

19.10.H.6. For all freestanding fuel oil tanks as permitted per Section 7. F., the property owner shall file with the City of Somersworth the following information prior to the installation of a tank:

19.10.H.6.a. The size of the tank;

19.10.H.6.b The type of tank;

19.10.H.6.c. The type of material being stored and its quantity;

19.10.H.6.d. The location of each tank on the premises, complete with a sketch map; and

19.10.H.6.e. The age of each tank.

19.10.I. ENFORCEMENT. If the Planning Board and/or the Building Inspector finds that any of the requirements and standards established herein are in violation, the Building Inspector shall order the owner, in writing, to make such corrections as he/she deems necessary to bring the development and activities into compliance with the provisions of this ordinance. Such order shall be complied with within twenty-four (24) hours of the original notice to the owner. Where the owner fails to comply with the order of the Building Inspector, a fine of one hundred dollars ($100) per day, or the maximum amount which is authorized by statute, may be levied against said owner. The fine shall be retroactive and shall begin to accrue on the date on which the property owner receives written notice from the Building Inspector that he/she is in violation of this ordinance.

Groundwater Management Zone (GMZ)