ENVIRONMENTAL INVESTIGATION REPORT SCOFIELDTOWN PARK AREA STAMFORD, CONNECTICUT

Prepared for

City of Stamford
Stamford, Connecticut

Prepared by

TRC
Windsor, Connecticut

March 2010

ENVIRONMENTAL INVESTIGATION REPORT SCOFIELDTOWN PARK AREA STAMFORD, CONNECTICUT

Prepared for
City of Stamford
Stamford, Connecticut

Prepared by
TRC
Windsor, Connecticut

TRC Project No. 168936
March 2010

TRC
21 Griffin Road North
Windsor, Connecticut 06095
Telephone 860-298-9692
Facsimile 860-298-6399

TABLE OF CONTENTS

SECTION PAGE

1.0 INTRODUCTION 1
1.1 Overview 1
1.2 Objectives 1
1.3 Reporting 2

2.0 INVESTIGATION SCOPE AND PROCEDURES 3
2.1 Site Description 3
2.2 Previous Site Investigations and Regulatory History 4
2.2.1 Discussion of USEPA Reassessment Results 5
2.2.2 Discussion of Homeowner Wells Sampling 8
2.3 Scope of Work 10
2.4 Procedures 10
2.4.1 GPR Survey 10
2.4.2 Surface Water Sampling 11
2.4.3 Monitoring Well Installation 12
2.4.4 Ground Water Sampling 14

3.0 INVESTIGATION RESULTS 17
3.1 GPR Survey 17
3.2 Sampling Results 17
3.3 Quality Assurance/Quality Control Samples 20
3.4 Ground Water Elevation Survey 21

4.0 CONCLUSIONS 23
4.1 Environmental Conditions within the Landfill Area 23
4.2 Hydrogeologic Conditions 27
4.3 Environmental Conditions within Wetlands, Streams and Adjacent Areas 27
4.4 Recommendations for Future Actions 29
4.5 Immediate Considerations 31

TABLE OF CONTENTS
(Continued)

FIGURES

1 Area Location Map
2 Site Location Map
3 Sample Locations Map
4 Surface Water Results
5 Ground Water Results
6 Overburden Ground Water Contour Map – November 23, 2009
7 Bedrock Ground Water Contour Map – November 23, 2009
8 Bedrock Ground Water Contour Map – December 28, 2009

TABLES

1 Summary of Soil Sample Analytical Results
2 Summary of Surface Water Sample Analytical Results
3 Summary of Ground Water Sample Analytical Results
4 Well and Ground Water Table Elevations

APPENDICES

A Historical Photographs and Maps
B Chronology of Events
C Ground Penetrating Radar Survey Report
D Well Installation Logs
E Ground Water Sampling Logs
F Laboratory Results

1.0 INTRODUCTION

1.1 Overview

TRC Environmental Corporation (TRC) was retained by the City of Stamford to perform environmental site investigation activities at the Scofieldtown Park, the City of Stamford's Recycling/Composting Center and surrounding area located in the vicinity of the intersection of Scofieldtown Road and Rock Rimmon Road in Stamford, Connecticut (see Figure 1). The work was initiated in response to the detection of chlordane and dieldrin in private homeowner wells by the United Sates Environmental Protection Agency (USEPA) along Hannah's Road east of the study area. Additional testing initiated by the City of Stamford identified others wells in the area that were also impacted by chlordane and dieldrin. The investigation activities were designed to supplement the findings of the previous investigations conducted at the site by the USEPA and the Connecticut Department of Environmental Protection (CTDEP). This report documents the results of the TRC investigation completed to date and correlates the USEPA and CTDEP findings to TRC's data.

1.2 Objectives

The objective of this investigation was to obtain additional information regarding the former landfill present beneath the Scofieldtown Park and the City of Stamford's Recycling/Composting Center and to obtain surface water and ground water samples within the landfill and the adjacent residential area. Specifically, the investigation tasks were as follows:

- Complete a ground penetrating radar (GPR) survey of the former landfill area looking for clusters of buried drums or areas where buried metal tanks may be located. The USEPA had previously removed drums and identified empty drum carcasses in their studies.

- Collect and analyze surface water samples within the unnamed stream north of the former landfill and along Poorhouse Brook located to the east of the former landfill. This was done to supplement the findings of stream/wetland sediment sampling performed by the USEPA.

- Install overburden and bedrock ground water monitoring wells (with some soil sampling) in the area of the former landfill and at selected locations outside the landfill footprint and within the affected residential neighborhood. Three of these wells were located within the City right of way (ROW).Ground water had not been previously investigated by the USEPA and the CTDEP.

- Collect and analyze ground water samples from the newly installed wells.

- Evaluate well and ground water table elevations to determine ground water flow direction in the general area as little was known about the ground water hydrogeology of the area.

- Review previously collected data and evaluate conceptual site model using all soil, sediment, surface water and ground water data; and

- Present recommendations for future actions at the former landfill, including investigation (if necessary) and remedial actions needed to properly address potential contaminant exposure pathways associated with the site.

1.3 Reporting

The information regarding the investigation at the Scofieldtown Park is presented in this report. This document provides a summary of the work completed and the analytical results associated with the soil, surface water and ground water investigation. Section 1 of the report presents the introductory information, including the project background and objectives. Section 2 presents a summary of the project area and the scope of the work with procedures and methodologies. Section 3 presents a summary of the analytical results relating to each sampled media as well as the results of the ground water elevation evaluation. Section 4 presents the conclusions related to the scope of work and recommendations for future actions in the former landfill and park areas.

2.0 INVESTIGATION SCOPE AND PROCEDURES

This section provides a brief summary of the site and surrounding area as well as the detailed scope of work performed by TRC. Also included within this section is a description of the procedures employed to complete the scope of work. TRC's evaluation of the work previously performed by the USEPA and the CTDEP are covered in this section.

2.1 Site Description

Scofieldtown Park, the City of Stamford's Recycling/Composting Center and salt shed comprise the area that was a former municipal landfill which reportedly ceased operation in the early 1970s. The landfill is capped with soil cover and vegetation except in the active compost and salt shed areas where asphalt in present on the surface. The northerly and easterly slopes of the landfill are generally steep and there is evidence of erosion of the soil cover in those areas. Several scattered empty drum carcasses and other debris are evident at the surface of the eroded slopes. In all, the former landfill covered approximately 10 acres in a roughly triangular shape. The area extends from the intersection of Rock Rimmon Road to the west and Scofieldtown Road to the south and north/northeast to the wetland associated with a west to east flowing unnamed stream course which becomes Poorhouse Brook as it crosses Scofieldtown Road (see Figure 2). The unnamed stream passes through a small drain pipe beneath a narrow earthen berm crossing the stream on the north side of the former landfill.

At the time of the investigation, Scofieldtown Park, which covers approximately four acres directly north of the intersection, was closed to the public. The park, which slopes up from the south to north, is primarily grass covered with a basketball court, tennis courts and a playscape. A stream enters the site in the southwest corner via a pipe beneath Scofieldtown Road and empties into a small man-made pond. The pond has a discharge culvert which runs beneath the landfill and the compost facility to the north and discharges to the unnamed stream course east of the earthen berm. The City-run recycling/composting center, along with a salt storage shed located to the north of the park, encompasses the remaining areal extent of the former landfill. This portion of the site is situated approximately 10 feet higher than the park. Both the composting and recycling facilities are asphalt covered and extend to the top of the steep slopes on the north/northeast side of the site. From the top of the steep slope to the wetland and stream course the grade drops approximately 30 feet.

The immediate area surrounding the site consists primarily of residential neighborhoods to the south and east of Poorhouse Brook, a cemetery directly to the north across the wetland and woodlands to the west across Rock Rimmon Road. In addition to the residential developments, the Scofield Magnet school is located to the east of Scofieldtown Park between Scofieldtown Road and Poorhouse Brook as the brook flows in a southerly direction in this area. There are also two residential facilities, Scofield Manor, an assisted-living retirement facility and Smith House, a municipal nursing home located westerly along Scofieldtown and Rock Rimmon Roads, respectively, in the general vicinity of the former landfill. Poorhouse Brook flows north-south due east of the site and collects runoff and stream flow from the northerly unnamed stream and the unnamed stream flowing in a culvert beneath the site.

To supplement the information provided by the USEPA and to better understand the current configuration and history of the landfill and the surrounding area, TRC obtained a series of available aerial photographs dating back to 1934 and a series of historic topographic maps dating back to 1899. These photographs and maps are presented in Appendix A. A review of both the maps and the photographs shows the gradual progression of filling after the 1930's, as well as the change in the surrounding area land use from agricultural in the 1930's and 1940's to residential in the 1950's and 1960's.

2.2 Previous Site Investigations and Regulatory History

A significant amount of inspection and investigation has taken place at the site since 1980 when a complaint regarding the closed landfill was filed by a resident. A chronology of events, compiled by the City of Stamford, is located in Appendix B and it fully describes most of the actions of the CTDEP, the USEPA and the City. The following discussion briefly summarizes the major actions completed regarding the site, but does not discuss all of the events.

The following is a brief synopsis of the activities conducted by the various regulatory agencies and the City of Stamford since 1986. Detailed descriptions of the activities and data are contained in the December 23, 2008 USEPA report entitled "Final Site Reassessment Report for Scofieldtown Road Park" (2008 FSRR).

After the site was listed in the Comprehensive Environmental Response Compensation Liability Information System (CERCLIS) database in 1986, the USEPA began a series of assessments whose objective were to determine if the site should be placed on the National

Priority List (Superfund sites). The Preliminary Assessment was completed in August 1986. Five drums containing resin and resin powder, two drums containing heavy metal (copper, zinc and lead) sludge and ten empty drums containing similar residues were removed from the site in November 1987 by the City. The Final Site Inspection Report was completed in March 1988 at which time, the USEPA recommended that ground water and surface water sampling be conducted but none were performed as part of that investigation. Between 1988 and 1994, surface water samples were collected by the Connecticut Department of Health Services (CTDHS) (now known at the Department of Public Health), soil samples were collected by the City and 12 drinking water samples were collected by the CTDEP. Between 1994 and 2004 the USEPA completed a Site Inspection Prioritization, a drum removal evaluation and a Preliminary Site Assessment.

During this same period, the CTDEP collected additional drinking water samples and soil samples. In 2004, the USEPA initiated the Site Reassessment process.

In January 2007, the Superfund Technical Assessment and Response Team (START) completed another site reconnaissance of the site. Later in 2007, START, on behalf of the USEPA, performed a Preliminary Assessment/Site Inspection during which time samples were collected from two drums. Through the spring of 2008, START collected 20 surface soil samples on the site, 20 sediment samples from within the unnamed stream north of the former landfill area and Poorhouse Brook, and 18 drinking water samples from residential wells within the Scofieldtown Park area. The results of this sampling were documented in the 2008 FSRR completed by the USEPA in December 2008. Subsequent to the completion of this report, the USEPA issued a Site Investigation Closure Memorandum in August 2009. The memorandum stated that after completion of the Removal Site Evaluation, a removal action completed by the USEPA would not be appropriate and that the City was providing an appropriate response and would be completing a comprehensive investigation.

2.2.1 Discussion of USEPA Reassessment Results

Surface Soil Samples

In March of 2008, the USEPA collected twenty surface soil samples from 19 locations across the site, including 11 samples from the northern and eastern slope area of the former landfill, seven from within the Scofieldtown Park portion of the site and two samples from an

area across Rock Rimmon Road. These final two samples were collected as background samples. The laboratory analysis of the 18 samples collected on the former landfill site identified several different types of contaminants.

- Volatile organic compounds (VOCs) were reported in eight samples with a majority of those samples present within the park area. These VOCs included low levels of both aromatic hydrocarbons (associated with petroleum) and chlorinated hydrocarbons (associated with solvents).

- Twelve of the samples contained reported concentrations of semi-volatile organic compounds (SVOCs). These samples were located in both the park area and at several locations along the former landfill slope. The majority of the SVOCs reported to be present were those known as polynuclear aromatic hydrocarbons (PAHs) which are commonly associated with heavier petroleum products such as bitumen and tar, commonly a component of road paving material.

- Fifteen of the samples were reported to contain concentrations of pesticides, including 4,4-DDT, 4,4-DDD, 4,4-DDE, alpha and gamma chlordane, and technical chlordane. Fourteen of the fifteen samples contained 4,4-DDT or one of its breakdown products, 4,4-DDD or 4,4-DDE. Concentrations of alpha, gamma or technical chlordane were reported in 11 of the samples. It should be noted that technical chlordane is a mix of chlordane with other similar compounds.

- PCBs were reported to be present in eight samples with the majority of these samples located within the park area.

- Concentrations of a variety of inorganic compounds (metals and cyanide) were reported in all the samples.

The USEPA compared the results of their soil sampling to the CTDEP's Remediation Standards Regulation (RSRs) criteria (CT RCSA 22a-133K-1 through 3) for direct human exposure to the soil. The Direct Exposure Criteria (DEC) have both residential (RDEC) and industrial/commercial (I/CDEC) standards (less stringent than RDEC). **The results of the USEPA's surface soil sampling indicated that compounds that exceeded their respective RDEC include: several PAHs in five samples along the northern and eastern slopes of the former landfill and within the park area; PCBs in four samples (one on the northern slope and three within the park); technical chlordane from one sample from within the park area and lead in one sample from the northern slope.**

The earlier surface soil sampling performed by the City in June 1989, the USEPA in February/March 1986 and the CTDEP in October 1997 are described in the 2008 FSRR. The

information on the locations of the samples and corresponding analytical results are not provided as the actual reports on those sampling events were not available. The 2008 FSRR provides the maximum concentration of each constituent detected. The degradation of many constituents and the changes that may have occurred to the site during this time will have been altered from current conditions. TRC, therefore, only relied on the older data as an indication of expected constituents and for comparison to the TRC surface and ground water sample analytical constituents detected. The March 2008 USEPA surface soil samples generally found the same constituents that were detected in these earlier sampling events.

Sediment Samples

In April of 2008, START collected 20 sediment samples from various locations including seven from the unnamed stream north of the former landfill, four from within the wetlands north of the former landfill, five samples from Poorhouse Brook on the east side of Scofieldtown Road, two samples from the bottom of the unnamed pond within the park area and two from wetlands on the west side of Rock Rimmon Road (background samples). Within the 20 samples collected on or near the former landfill site, several different types of contaminants were identified from the laboratory analysis.

- VOCs were reported in four samples; three from within the unnamed stream and one within Poorhouse Brook. These VOCs included low levels of aromatic hydrocarbons (associated with petroleum).

- Twelve of the samples contained reported concentrations of SVOCs. These samples were located in the unnamed stream, the wetlands to the north, Poorhouse Brook and the on-site pond. As with the surface soil samples, the majority of the SVOCs reported to be present were PAHs.

- Sixteen of the samples were reported to contain concentrations of pesticides, including 4,4-DDT, 4,4-DDD, 4,4-DDE, alpha and gamma chlordane, and dieldrin. All sixteen of the samples contained 4,4-DDT or one of its breakdown products, 4,4-DDD or 4,4-DDE. Concentrations of chlordane were reported in six of the samples and dieldrin was reported to be present in one sample.

- PCBs were reported to be present in four samples with three of these samples collected from the unnamed stream and one sample from within the unnamed pond in the park area.

- Concentrations of a variety of inorganic compounds (metals and cyanide) were reported in eleven of the samples.

The USEPA compared the results of their sediment sampling to the National Oceanic and Atmospheric Administration's (NOAA) Screening Quick Reference Tables (SQuiRTs) Threshold Effects levels (TEL) and Probable Effects Level (PEL) values in freshwater sediment. These values represent the levels at which adverse affects to benthic organisms are expected. These values are generally used for screening purposes only and are considered very conservative. As such, many reported concentrations of analytes were identified as exceeding SQuiRTs TELs and PELs. To obtain a more accurate comparison with regard to direct human exposure to the sediment, TRC reviewed the sediment results and compared them to RDEC and I/CDEC standards. With this comparison, **the results of the USEPA's sediment sampling indicated that compounds that exceeded their respective RDEC include: several PAHs in two samples within the unnamed stream and arsenic in three samples within the unnamed stream.**

The earlier sediment sampling performed by the CTDHS in March 1987 and the USEPA in May 1995 are described in the surface water pathway section of the 2008 FSRR. All nine samples were collected from the unnamed stream, but the locations are not provided. The 2008 FSRR provides the maximum concentration of each constituent detected. The dynamic nature of stream environments and the degradation of many constituents will cause the earlier results to differ from the current conditions. TRC, therefore, only relied on the older data as an indication of expected constituents and for comparison to TRC surface water sample analytical constituents detected. The April 2008 USEPA sediment sample results generally found the same constituents that were detected in the earlier sampling events.

It should be noted that the USEPA collected samples from residential drinking water wells within the neighborhoods to the east of the landfill, but did not collect any other ground water samples from the area.

2.2.2 Discussion of Homeowner Wells Sampling

Sampling of the private drinking water wells east of the site began in 1989 with the CTDEP collecting 12 drinking water samples along Scofieldtown Road, Hannah's Road, Brookdale Road and Brookdale Drive. The CTDEP concluded that, based on the data collected,

it did not appear that the Scofieldtown Road Park property was impacting the surrounding drinking water supply. Additional samples from homes at 24, 27, 37 and 63 Hannah's Road were obtained by the CTDEP in September of 1992 and the CTDEP concluded that none of the wells were unsafe for consumption. **The CTDEP collected a sample from 29 Hannah's Road in February 1997 and found chlordane and dieldrin exceeding state drinking water action levels.** During the March 2008 reassessment completed by the USEPA, 13 wells were sampled along Hannah's and Brookdale Roads and tested for VOCs, SVOCs, pesticides, PCBs, TAL metals and cyanide. It was noted that wells at 27 and 29 Hannah's Road had water filtration systems. **Dieldrin was found exceeding CTDPH drinking water standards pre-treatment at 27 and 29 Hannah's Road and at 24 Hannah's Road. Dieldrin was not detected in post-treatment samples at 27 and 29 Hannah's Road. Chlordane was detected in one well, but below the CTDPH drinking water standards.** The City began a well testing program of the area in August of 2009 to determine the extent of the chlordane and dieldrin while TRC performed an assessment of potential migration of contaminants from the landfill site. Sampling of the area expanded and continued as this site investigation was commenced and as the City began a water main installation program bringing water supplied by the Aquarion Company to the homes east of the landfill site.

TRC utilized the data collected by the City to locate two of the proposed monitoring wells within the impacted residential areas. As the water main work was completed and homeowner's wells were abandoned, the City also provided TRC with general data with respect to well and ground water table elevations in these areas. TRC used this information to confirm the results of current hydrogeologic investigation.

With respect to the landfill, the EPA's Preliminary Assessment (PA) process contained the critical elements of a Phase I Environmental Site Assessment. Available records were reviewed, the site was inspected and areas of concern were documented. After the EPA PA was complete, these data were supplemented by the City with its own records review of the landfill and its operation and TRC's review of historical sources including aerial photographs dating back to 1934 and historical topographic maps dating back to 1898. This material was more than sufficient to evaluate the uses of the site and activities and identify the areas of concern.

2.3 Scope of Work

The scope of work described in this report, as outlined in the October 16, 2009 proposal for the Scofieldtown Park area, was designed to augment data regarding the environmental quality of soil and ground water within and potentially affected by the landfill area. The investigation consisted of the following tasks:

- A geophysical survey in the area of Scofieldtown Park and the leaf composting facility completed using GPR to provide an areal and vertical extent of the fill in the area.

- The collection and analysis of five surface water samples from the surface water bodies within and near the park. Specifically, one surface water sample was obtained from the unnamed pond on the grounds of Scofieldtown Park, two surface water samples were collected from the unnamed stream, one surface water sample was obtained from Poorhouse Brook and one surface water sample was obtained from the unnamed pond located south of Alma Rock Road.

- The installation of thirteen ground water monitoring wells at nine locations both on and around the periphery of the site. At four locations, the monitoring wells were installed in nested pairs with a shallow unconsolidated overburden well and a cased bedrock well comprising each pair. At three locations, ground water was not present in the overburden and only bedrock wells were installed. At two locations within the landfill, only bedrock wells were installed. Specific details on the well installation are presented in Section 2.2.3.

- The collection and analysis of ground water samples from all installed monitoring wells.

- The evaluation of the results generated during this investigation in conjunction with the data obtained by the USEPA during their 2008 FRRS.

2.4 Procedures

2.4.1 GPR Survey

TRC subcontracted Subsurface Information Surveys, Inc. (SIS) to complete the GPR survey of the known former landfill area. The geophysical survey was completed by a technician from SIS using a subsurface interface radar system (SIR-3000 and SIR-2000) between October 26 and November 3, 2009. The system consisted of a power supply, graphic recorder, video display unit, computer and transmitting/receiving antenna. SIS used a subsurface interface radar and computer with a depth setting of 30 feet to locate any existing and unknown anomalies. A

grid spacing of 25 feet maximum in both north/south and east/west traverses was used during the survey.

The survey was conducted in three areas including the composting area on the northern half of the former landfill, the recycling area to the southwest and the park on the southeast. Traverses were conducted around all surface obstructions.

The details of the survey are documented in the SIS report located in Appendix C.

2.4.2 Surface Water Sampling

Five locations were chosen for the collection of surface water samples. Figure 3 shows the surface water sampling locations. The sampling was conducted on October 26, 2009. The five sampling areas were located as follows: one in the unnamed stream west of the earthen berm (SW-1), one in the unnamed stream at the confluence of the unnamed stream and the stream carried by the underground culvert beneath the former landfill area (SW-2), one from the small pond located within the Scofieldtown Park portion of the site (SW-4), one immediately to the east of Scofieldtown Park Road in Poorhouse Brook (SW-3) and one from the Alma Rock Road pond (SW-5). The surface water samples were analyzed for volatile organic compounds (VOCs) from the Method 8260 CT list, semi-volatile organic compounds (SVOCs) from the Method 8270 CT list, extractable total petroleum hydrocarbons (ETPH), total metals from the CT RSRs list, polychlorinated biphenyls (PCBs) (Method 8082), pesticides (Method 8081B) and herbicides (Method 8051A). The surface water samples were placed on ice and kept cool for delivery to the laboratory following appropriate chain-of-custody procedures. The laboratory used to analyze all of the samples collected during this investigation was Complete Environmental Testing (CET) of Stratford, Connecticut, a Connecticut state-certified laboratory.

Surface water sample SW-1 was collected from the ponded area to the west of the earthen berm immediately upstream of the concrete culvert through which the unnamed stream drains to the east. No sediments were disturbed during the collection of the sample. The remaining surface water samples collected from the unnamed stream, Poorhouse Brook and the unnamed pond within the park were collected in a downstream to upstream order (SW-3, SW-2 and SW-4) so as to not have disturbed sediments impact any downstream samples. The surface water sample SW-5 from the unnamed pond to the south of Alma Rock Road was sampled last. The

surface water samples were collected from the surface of the water directly into laboratory-supplied containers. No additional equipment was used for the sampling.

The surface water samples collected were clear and odorless. The samples were collected several days subsequent to any significant rainfall event, and as such, the water was not carrying a high suspended sediment load.

2.4.3 Monitoring Well Installation

Eleven of the thirteen monitoring wells were installed at the site by Glacier Drilling Inc., of Durham, Connecticut from November 2nd to 12th, 2009. TRC personnel provided drilling oversight and field logging. The original scope of work proposed that overburden (OB) and bedrock (R) monitoring wells pairs be installed at eight locations both within the landfill and at locations in the area of interest around the former landfill. Monitoring well pairs were installed in the northwest corner of the recycling area near the salt shed (MW-1(OB) and MW-1(R)) in the northeast corner of the composting area (MW-2 (OB) and MW-2 (R)), within the Park area to the south (MW-3 (OB) and MW-3 (R)), and within the northern parking area of the Scofield Magnet School on the east side of Scofieldtown Road (MW-4(OB) and MW-4(R)). At the remaining three locations, ground water was not present within the overburden so only bedrock wells were installed at these locations. These locations included west of the former landfill across Rock Rimmon Road (MW-5 (R)), in the cul-de-sac of Very Merry Road to the east of the former landfill (MW-7(R)) and in the cul-de-sac of Alma Rock Road further to the east (MW-8(R)).

The well MW-6 pair was to be installed north of the landfill. However, due to access issues and based on results from the initial well sampling, the locations of these wells were moved to within the landfill area. Furthermore, instead of an additional clustered pair of wells as described above, two cased bedrock wells were installed from December 8th to 12th, 2009 by Glacier Drilling Inc. One well (MW-6(R)) was installed along the northern portion of the composting facility approximately halfway between the MW-1 and MW-2 well clusters. The second well (MW-9(R)) was installed near the southeast corner of the composting facility approximately halfway between the MW-2 and MW-3 well clusters.

The nested pairs consisted of a shallow unconsolidated overburden well and a cased bedrock well. The unconsolidated overburden well borings were drilled using hollow-stem auger methods. During the drilling of the overburden wells within the landfill, split-spoon

samples of the unconsolidated materials were collected within the borehole. One soil sample from each of the three boreholes was obtained from the sampler and submitted to the laboratory for analysis. The samples were chosen as follows: from location 1 – the 25-27' interval, from location 2 – the 30-32' interval and from location 3 – the 2-4' interval. The sampling intervals were chosen by the TRC field scientist based on factors relating to lithology, vapor screening, visual evidence and olfactory observations. Each sample was submitted to the laboratory for the same analytes as the surface water: VOCs, SVOCs, ETPH, total RSR metals, PCBs, pesticides and herbicides. Sampling handling and delivery to the laboratory (CET) was the same as for the surface water samples.

Each unconsolidated overburden well was constructed within the auger-drilled holes as the augers were withdrawn. Wells were constructed of two-inch inside-diameter PVC screen and riser pipe, clean dedicated filter pack sand around the screen, a bentonite pellet seal above the sand, and a steel stick-up or flush mount protective cover secured in place in concrete above each well. The bedrock monitoring wells were also drilled using hollow-stem auger methods until the bedrock surface was reached. Steel 4-inch diameter casing was then installed down the center of the hollow-stem augers to the rock surface. Using a roller bit and air-rotary techniques, the steel casing was advanced between five and ten feet into competent bedrock. Each steel casing was then grouted into the rock and allowed to set for a period of at least 24-hours. At the conclusion of the prescribed grout setup period, the bedrock wells were drilled through the grouted casing and constructed.

The three initial bedrock wells within the landfill area were drilled using rock coring methods with a HQ size core barrel outfitted with a diamond cutting head. Ten foot rock cores were collected from each of the three bedrock wells (MW-1(R), MW-2(R) and MW-3(R)) within the landfill boundary in order to assess the characteristics of the bedrock. The remaining six rock well locations (MW-4(R) – MW-9(R)) were drilled utilizing an air-hammer method of drilling. Well locations MW-4(R), MW-5(R) and MW-9(R) were air-hammered ten feet beyond the bottom of the grouted steel casing. Well locations MW-7(R) and MW-8(R) were each air-hammered approximately 30 feet beyond the bottom of the grouted steel casing in order to set the wells at the desired depths. Well location MW-6(R) was air-hammered 20 feet beyond the bottom of the grouted steel casing in order to achieve sufficient hydraulic connection to the

aquifer at this location. All bedrock wells were finished as open socket wells hydraulically isolated from the overburden by the grouted steel casing.

Following well installation, each well was developed by surging and pumping to remove fine-grained materials from the well and sand pack and to establish a good hydraulic connection between the well and the surrounding formation. Well completion logs for all installed wells are included in Appendix D.

During the well installations, observations were made in order to characterize the lithology of the overburden formation and the nature of the bedrock underlying the former landfill as well as the periphery locations. This information is also presented on the well logs in Appendix D. During the installation of the three initial well clusters within the boundaries of the former landfill, split-spoon samples were collected at five foot intervals in order to assess the vertical extent of the fill materials. Based on field descriptions, fill materials were identified down to depths of 32 feet below ground surface (bgs), 30 feet bgs and 22 feet bgs at well cluster locations MW-1, MW-2 and MW-3, respectively. Based on the surveyed ground elevations in these locations these depths of fill materials all correspond to approximately the same elevation at these three locations. In general, observed fill materials consisted of domestic and industrial wastes of various materials including metal, plastic, brick, glass, fabric, ash/slag and wood. The fill materials across the site are underlain primarily by fine-to-medium grained sand with varying amounts of silt and gravel. The thickness of this layer varies based upon the depth to the bedrock surface. Bedrock was encountered across the former landfill area at depths ranging from 37 feet bgs (MW-3(R)) to 68 feet bgs (MW-6(R)). The corresponding bedrock elevations for MW-1(R), MW-2(R) and MW-3(R) are all fairly consistent while the corresponding bedrock elevations for MW-6(R) and MW-9(R) are approximately 20 feet lower indicating a depression in the bedrock surface along the north central portion of the site. The bedrock recovered from the rock cores from well locations MW-1(R), MW-2(R) and MW-3(R) is a medium to dark gray fine-grained gneiss identified to be the Trap Falls Formation, an Ordovician-aged gneiss.

2.4.4 Ground Water Sampling

Ground water samples were collected from each of the initial 11 monitoring wells on November 23 and 24, 2009. In addition, ground water samples were collected from the additional two wells on December 30, 2009. The water level at each monitoring well was

measured to the nearest 0.01 feet with an electronic water level indicator. To prevent cross contamination, the water level indicator was decontaminated between each well using laboratory-supplied, HPLC-grade, ASTM Type II water. Table 4 summarizes the ground water level measurements collected on November 23, 2009 and December 28, 2009.

Prior to ground water sampling, low flow techniques per the USEPA low-flow protocol were utilized to stabilize each well using a peristaltic (preferred low-flow method for shallow wells) or bladder pump outfitted with dedicated tubing for each well. The bladder pump was used for the wells with depths to ground water beyond the capabilities of the peristaltic pump. The ground water extracted during purging was monitored for pH, temperature, specific conductance, dissolved oxygen, total dissolved solids (TDS), oxidation reduction potential (ORP) and turbidity potential using a YSI 6920 multi-parameter flow-thru cell set-up. Ground water was purged until the monitored parameters had stabilized to within specified tolerances for at least three consecutive monitoring rounds. Ground water sample logs documenting the measured and observed purge conditions are provided in Appendix E. Purge rates were maintained below 500 milliliters (ml)/minute as prescribed by the low-flow protocol. In addition, wells were purged from the top of the water column moving downward to allow for the purging of the entire water column. Ground water sampling was conducted immediately upon stabilization of the well.

The ground water samples were placed on ice and kept cool for delivery to the laboratory following appropriate chain-of-custody procedures. All collected ground water samples were analyzed at CET for an expanded list of parameters based on additional information provided to TRC during a meeting with the City of Stamford Scofieldtown Task Force. These parameters included: VOCs, SVOCs, ETPH, total Target Analyte List (TAL) metals, PCBs, pesticides, herbicides, cyanide, alkalinity, gross alpha and gross beta.

On the date of sampling, the ground water was measured at depths ranging from approximately 4.37 to 32.89 feet below grade. All of the ground water samples were noted to be clear. The samples collected from the six wells comprising the three well clusters within the boundary of the former landfill all had a petroleum odor associated with them. The odor was more pronounced in the samples collected from the MW-1 well cluster, in particular, MW-1(OB). There were no field indications of any impacts (odor, discoloration, etc.) associated with

any of the ground water samples collected from the wells located on the school property, across Rock Rimmon Road or on Very Merry Road and Alma Rock Road.

3.0 INVESTIGATION RESULTS

This section of the report presents the results of the field investigations completed at the site.

3.1 GPR Survey

As stated in Section 2.0, the survey was conducted in three areas including the composting area on the northern half of the former landfill, the recycling area to the southwest and the park on the southeast. Although traverses were conducted around all surface obstructions, traverses were not conducted on the slopes of the landfill on the northern and eastern sides. The steepness of the slopes and the dense vegetation prevented equipment access to these areas.

Although the maximum depth of thirty feet was not reached due to interference from high organic content in the soil, the GPR survey was able to conclude the following about the materials to an approximate depth of 22 feet: "After reviewing the 90 DZT GPR RADAN files, we found no clustering of metallic anomalies characteristic of buried drums, parabolic features common to underground storage tanks, or any unusual anomalies not characteristic of the surrounding geological conditions."

3.2 Sampling Results

This section of the report provides a summary of the results of the soil and ground water sampling conducted as part of the investigation activities. The analytical results are summarized in Tables 1 through 3. The tables only show results where detections of constituents were reported. In addition to the tables, Figures 4 and 5 illustrate the results of the detected analysis with the locations of the surface water samples and the ground water monitoring wells. Supporting documentation, including the monitoring well construction diagrams and the low flow ground water sampling logs are included as Appendices D and E, respectively. The complete set of laboratory data and QA/QC are included as Appendix F.

Soil

Three soil samples (SB-1, SB-2 and SB-3 corresponding with the overburden wells 1, 2 and 3) were submitted from the former landfill area for laboratory analysis. The samples collected from borings SB-1 and SB-2 were obtained from depths greater than twenty-five feet below the ground surface. The sample collected from boring SB-3 was obtained from a

shallower interval (2-4 feet below ground surface). The sample collection interval was determined by the TRC scientist in the field based on screening for staining and odors. A petroleum odor was particularly noted to be present in sample SB-1.

The results, located on Table 1, indicated that two of the borings (SB-1 and SB-3) contained varying concentrations of VOCs, SVOCs (generally PAHs), ETPH, and metals with some exceedances of both the RDEC and the Pollutant Mobility Criteria (GA PMC) for areas where the ground water classification is identified as GA (presumed suitable for human consumption). Concentrations of PCBs were detected in the sample from SB-1 and a concentration (below regulatory criteria) of 4,4-DDD was detected in the sample from SB-3.

Surface Water

Five surface water samples were collected on October 26, 2009. These locations of the samples included: three areas in the unnamed stream that flows along the northern edge of the landfill (SW-1, SW-2 and SW-3), one within the small unnamed pond located in Scofieldtown Park (SW-4) and one from the unnamed pond located south of Alma Rock Road (SW-5). Sample SW-2 was collected from the culverted stream that enters the unnamed stream after flowing beneath the landfill. The locations of these samples are shown on Figure 3 and the results of the sampling are shown on Figure 4.

Concentrations of benzene, chlorobenzene and barium were reported to be present in sample SW-2, concentrations of barium and zinc were reported for sample SW-1 and barium only was reported in sample SW-3. No other analytes were reported above laboratory method detection limits. **The concentration of benzene (1.5 parts per billion (ppb)) in sample SW-2 exceeds the Human Health Criteria for consumption of water and organisms as defined in the CT Water Quality Standards.**

Ground Water

The thirteen ground water monitoring wells were sampled in November (eleven wells) and December 2009 (two wells). The ground water samples collected from these wells were submitted to the laboratory for the analyses described in Section 2.0. The analytical results of the low-flow ground water sampling are summarized on Table 3 and Figure 5 illustrates the results of the sampling with a map of the locations of the wells.

The results of the ground water sampling were compared to CTDEP RSR ground water remediation criteria including: the Ground Water Protection Criteria (GWPC), the Surface Water Protection Criteria (SWPC) and the Residential Volatilization Criteria (RVC). **Samples from the well located within the northwest of the former landfill area (MW-1(OB)) contained VOCs and ETPH generally related to petroleum hydrocarbons with the reported concentrations of benzene and ETPH exceeding the GWPC. The sample from well MW-1(OB) also contained concentrations of arsenic exceeding the SWPC and concentrations of barium over the GWPC. The samples from the other wells, including MW-1(R), within the former landfill contained lower concentrations of VOCs and one SVOC with the exception of the sample from well MW-2(R) which contained a concentration of vinyl chloride over both the GWPC and the RVC. It should also be noted that both wells MW-1 OB) and MW-1(R) located near the salt shed contained elevated levels of sodium.** There is no RSR standard for sodium.

The samples from the wells (MW-4(OB) and MW-4(R)) at the Scofield Magnet School contained no analytes at concentrations over regulatory criteria. These results were similar to the well located off of Rock Rimmon Road (well MW-5(R)).

T**he sample from the well located in the Very Merry Road cul-de-sac (MW-7(R)) contained concentrations of 1,1,1,2 tetrachloroethane over the GWPC and the RVC, chlordane over the GWPC and the SWPC and dieldrin also over both the GWPC and the SWPC. The sample collected from well MW-8(R) located in the Alma Rock Road cul-de-sac also contained the same three compounds. The concentrations of 1,1,1,2 tetrachloroethane and chlordane exceeded both their GWPC and SWPC, while the concentration of dieldrin exceeded the GWPC.**

There were no concentrations of PCBs or cyanide reported in any of the well samples. Concentrations of several metals not considered “heavy metals” (including aluminum, calcium, iron, magnesium, manganese, potassium and sodium) were also reported for the all of the well samples. These metals are typically found in ground water and the concentrations of these metals were generally higher in the wells located within the landfill area than in those outside the site. The concentrations of some of these constituents exceed Secondary Maximum Contaminant Levels set by the USEPA, based on aesthetic considerations only and constituents that exceed these levels are not considered to present a risk to human health.

Gross alpha and gross beta analytical results for the well samples are also presented on Table 3. Two of the samples, MW-1 (OB) and its duplicate, contained percentages of solids too high rendering the samples unsuitable for analysis for both gross alpha and beta. **Gross alpha radioactivity was measured in the samples from wells MW-1 (R), MW-2 (R) and MW-2 (OB) with the measurement in the sample from MW-1 (R) exceeding the USEPA's maximum contaminant level (MCL) for gross alpha activity. Gross beta activity was measured in all of the analyzed samples with the measured activity exceeding the MCL for gross beta in wells Mw-6 and MW-9.**

3.3 Quality Assurance/Quality Control Samples

Quality assurance/quality control (QA/QC) samples including a trip blank, a field blank and a duplicate were collected and submitted for laboratory analysis during the ground water sampling portion of the investigation.

Blanks and a duplicate sample were collected in order to ascertain a measure of quality control during the sampling round. A trip blank is defined as a sample prepared at the laboratory which originates as analyte-free water which is placed in 40-ml Teflon-lined septum volatile organic vials, preserved with 1:1 hydrochloric acid (HCl) in the laboratory and shipped to the site in the sample cooler with sample containers. These vials are subsequently returned to the laboratory with the aqueous environmental samples for VOCs. The analyses are meant to evaluate the effect of ambient site conditions and sample shipment on sample integrity, and evaluate proper sample container preparation and handling techniques. One trip blank accompanied the aqueous samples to be analyzed for VOCs.

A field blank was collected to determine the effectiveness of the decontamination of sample collection equipment. The field blank was collected by pouring laboratory-supplied, HPLC-grade, ASTM Type II water over the decontaminated sample collection equipment (i.e., stainless steel spoon, stainless steel bowls, etc.) and into the appropriate sample containers. The field blank was collected at the beginning of the day's sampling events and accompanied the samples collected that day. The field blank was analyzed for the same analytical parameters as the sample matrix, labeled according to the proper chain-of-custody procedures, and stored and shipped or delivered with the collected samples.

A duplicate sample consisting of two separate samples taken from the same source was also collected and submitted to the laboratory for analysis. The procedure for collecting duplicate samples consisted of alternating the collection of the sample between the sample collection bottle and the duplicate collection bottle. The duplicate sample was sent as "blind" (unknown duplicate samples) to the laboratory responsible for the sample analysis.

The analytical results associated with the QA/QC samples are presented in Table 3 with the ground water samples. The QA/QC blank samples contained no reported concentrations of any analyte. The concentrations of contaminants reported to be contained within ground water sample (MW-1 OB) and its duplicate generally correlated very closely, with the exception of the ETPH value, which was four times higher in the duplicate than in the original sample. The explanation for this difference is likely related to the inherent heterogeneity in the collection of the two samples.

3.4 Ground Water Elevation Survey

All well locations were surveyed by the City of Stamford to obtain ground surface and ground water table elevations and these elevation were provided to TRC to complete an evaluation of the results. Table 4 documents the well locations, well elevations and ground water table elevations from measurements obtained on November 23, 2009 and December 28, 2009. Figures 6, 7 and 8, showing ground water elevations and flow contours for both the overburden and bedrock water table surfaces from water level measurements obtained on both dates, are presented in this report. The flow contours indicate that ground water flow within the landfill area is toward the north and east with discharge likely to the unnamed stream to the north and Poorhouse Brook to the east. Ground water contours east of Poorhouse Brook (based on the ground water elevation in the Very Merry cul-de-sac monitoring well (MW-7(R)) indicate that ground water in this area flows to the west, also toward Poorhouse Brook. The ground water elevation in the Alma Rock Road cul-de-sac well (MW-8(R)) is lower than the Very Merry Road ground water elevation. The well and ground water elevation data provided by the City for private wells abandoned during the water main installation were also reviewed to correlate what was known about the hydrogeology for the Hannah's Road, Very Merry Road and Alma Rock Road area. All of the data indicates that the ground water table appears to generally parallel the

ground topography with the Very Merry Road area representing both a topographic and ground water table elevation high point.

4.0 CONCLUSIONS

This report was prepared to document the results of an investigation performed in and around the former landfill area on Scofieldtown Road in Stamford, Connecticut. The investigation was primarily undertaken to obtain information regarding the quality of the surface water and ground water in the area of the landfill that would augment the information already collected by the USEPA regarding surface soil and sediment. The investigation was also designed to assess ground water hydrogeology and evaluate ground water flow patterns to assess if landfill leachate might impact ground water and surface water surrounding the former landfill area. The investigation program was also designed to identify the potential for buried drum clusters or tanks buried within the landfill that could pose a threat of future releases of concentrated contaminants.

Significant historical information regarding the operations and compliance history of the landfill had already been compiled by the USEPA. TRC obtained additional historical topographic maps and aerial photographs to aid in the current investigation. TRC also reviewed the 2008 FRRS prepared by the USEPA, which includes a compilation of all studies and records available from regulatory agencies. TRC also reviewed new data furnished by the City pertaining to homeowner well sampling and well survey records.

As stated in this report, the investigation consisted of the data review, a GPR survey conducted by a subcontractor, surface water sampling adjacent to the site, test boring logging of overburden and bedrock geology, soil sampling from three borings drilled within the landfill materials, ground water sampling from eleven wells placed within and near the site and two wells in the residential area to the east and a ground water table elevation survey of both the overburden and bedrock pieziometric surfaces.

The following presents conclusions that can be drawn from the complete body of information now known about this area.

4.1 Environmental Conditions within the Landfill Area

The GPR survey and the drilling of borings within the landfill provided some information regarding the subsurface conditions within the footprint of the former landfill. The results of the GPR survey did not indicate that clusters of buried drums, storage tanks or other large metal masses are present within the surveyed area to an approximate depth of 22 feet. While small or

individual pieces of metal may be present, this data suggests that no large scale dumping of drums or tanks was conducted within the former landfill. The field observations during the drilling indicated fill material and waste remnants typical of municipal solid waste, demolition debris and minor amounts of ash from waste burning. Only boring SB-1, located near the salt shed in the northwest corner of the site, was observed to have soil staining and petroleum odors within the subsurface materials.

With respect to the environmental quality of soil within the landfill, TRC reviewed the USEPA surface soil data as well as the soil data collected during TRC's investigation. Surface soil samples collected from the site by the USEPA in 2008 were documented to contain varying concentrations of SVOCs, metals and pesticides. VOCs and PCBs were also detected but in a fewer number of samples. The types of SVOCs found in the samples are likely related to the presence of fuel oil, tar, asphalt or coal. The metals detected in the samples are those that naturally occur in soil as well as metals more typically associated with industrial uses. The majority of the pesticides that were detected in the soils include 4,4-DDT and its breakdown products, 4,4-DDD and 4,4-DDE. Alpha, gamma and technical chlordane were also detected in some samples.

Constituents that exceeded their respective RDEC include: several PAHs in five samples along the northern and eastern slopes of the site and within the park area; PCBs in four samples (one on the northern slope and three within the park); and lead in one sample from the northern slope. The concentrations of PCBs detected in soil (maximum 36 mg/kg) and the fact that landfill operations ceased prior to April 18, 1978, would not subject the site to USEPA regulation 761 – Subpart D – Storage and Disposal Requirements under the Toxic Substances Control Act (TSCA).

With one exception, all pesticide concentrations within the soil samples collected by the USEPA in 2008 were below RDEC. **The concentration of technical chlordane in a sample collected from within the park area exceeded both the RDEC and I/CDEC.**

The compounds detected in TRC's subsurface soil sample results were similar to those found in the surface soil samples. **PAHs and ETPH were reported to be present in two of the samples at concentrations exceeding RDEC and GA PMC.** With the exception of a low concentration of 4,4-DDD reported in the soil sample collected from 2-4 feet below grade in boring SB-3, pesticides (including chlordane and dieldrin) were not present in the soil samples.

PCBs were reported in a concentration above RDEC in the sample from SB-1 which is similar to those concentrations detected in the surface soil samples.

The contaminants found in the soil and sediment across the site and wetlands areas are consistent with the use of the site as a former municipal solid waste landfill and its current use as an asphalt covered leaf composting/recycling facility. The concentrations of contaminants do not indicate the presence of a significant hazardous material. The scattered presence of PCBs in several landfill soil samples is consistent with former common disposal in municipal landfills of household white goods containing PCB capacitors.

Ground water quality within the footprint of the site is consistent with the soil data. Petroleum compounds were reported to be present in the overburden ground water sample collected from the monitoring well (MW-1(OB)) where these compounds were detected in the soil boring. Of these petroleum compounds only toluene (1.7 µg/l) was detected in the nested bedrock well MW-1(R). Other contaminants detected in soils within the site (PAHs and PCBs) generally have low solubility in water and adsorb readily to soil particles which is consistent with the observation of these compounds present in soil but not in the underlying ground water. **Pesticides, including chlordane and dieldrin, were not detected within any of the overburden and bedrock wells within the site.**

The detection of low concentrations of metals in the ground water is also consistent with their low mobility through soil. An exception to this is the detection of sodium at relatively high concentrations in wells MW-1(OB) (2,600,000 µg/l) and MW-1(R) (360,000 µg/l). The proximity of these wells to the existing salt shed would account for these results. The level of sodium, which essentially goes into solution as an ion, may be the result of former uncovered storage of road salt in this area of the site. Salt handling and storage practices should be reviewed to insure that future releases do not occur. The concentration of sodium in wells MW-2(OB) (65,000 µg/l) and MW-2(R) (57,000 µg/l) indicate that diffusion and dispersion is occurring rapidly as ground water migrates to the east. There is no regulated concentration for sodium.

The detection of relatively low concentrations of several VOCs in ground water at the wells across the site (with the exception of well MW-1(OB) where higher concentrations were reported) is consistent with the disposal of household and industrial waste at the site. The fact that the concentrations are relatively low suggests that small quantities of materials containing

these compounds were disposed of at the site and reinforces the results of the GPR survey findings of no clusters of buried drums or tanks.

The fact that the landfill operations ceased nearly 40 years ago suggests that ground water conditions associated with the former landfill have likely reached their plateau and it is expected that low levels of constituents will continue to leach into the ground water. The soil cover and grading of the site was not designed to minimize infiltration of rainfall and it is expected that modifications to the cap will minimize the continued relase of constituents to the ground water pathway. A well designed engineered cap (control) and drainage system will virtually eliminate all rainfall infiltration through the waste material.

The detection of chlordane, dieldrin and 1,1,1,2-tetrachloroethane in well MW-7(R) (Very Merry Road) and MW-8(R) (Alma Rock Road) above the GWPC confirm the data obtained by the City from the residential well sampling program. These two areas have been impacted by former uses of these constituents in these two areas and conditions may have been exacerbated by the fact that the soil overburden overlying the bedrock is thin. **The fact that none of these constituents were present in any of the eight overburden and bedrock monitoring well samples collected from the landfill site is clear evidence that the Scofieldtown Road landfill is not the source of these constituents found in the residential wells. It must also be pointed out that the presence of 1,1,1,2-tetrachloroethane above the RVC for ground water may pose a pathway of exposure via volatilization into air that is not addressed by connection to the potable water supply or on-site treatment of well water. The RVC for this constituent is 2 µg/l and it was detected at 23 µg/l in well MW-7(R) and 33µg/l in well MW-8(R).** Further evaluation of this finding is warranted to assess the extent and exposure risk. Factors such as depth to ground water, soil type, foundation construction and other site specific factors can affect vapor intrusion of VOCs to indoor living spaces and determine the possible need for passive or active vapor venting.

The presence of constituents within the shallow surface soils and underlying landfill material on the site exceeding direct human exposure criteria and pollutant mobility criteria warrants both immediate and future remedial actions discussed in detail as part of the recommendations.

4.2 Hydrogeologic Conditions

The wells installed during this investigation were located to provide as much information as possible about the ground water quality within the landfill and surrounding area, but also determine the ground water flow direction in both the overburden and bedrock aquifers. As the homeowners' wells in the surrounding area were known to be bedrock wells, it was critical to understand both aquifer systems as in some cases, bedrock and overburden flow may not mirror each other.

The surveyed elevations of all the wells indicated that the ground water flow for both the overburden and bedrock aquifers in the vicinity of the landfill is toward the east/northeast with surface discharge occurring along the unnamed stream and Poorhouse Brook. The four nested well pairs show good correlation between the overburden and bedrock aquifer systems associated with the site. Both overburden and bedrock pieziometric surfaces mirror each other closely in both elevation and flow direction. Ground water elevations (in the bedrock only, as TRC did not install overburden wells east of Poorhouse Brook) in the area east of Poorhouse Brook, based on TRC's well information and the information regarding the homeowners' abandoned wells, rise significantly to the east to a high point in the Very Merry Road area. This means that ground water from the crest of the hill on Very Merry Road flows westerly also discharging into Poorhouse Brook. The data also indicates that east of the Very Merry Road crest, the ground water flows again to the east into a different drainage basin as the ground water table elevation on Alma Rock Road is lower.

The ground water hydrogeological data collected to date indicates that the site has no impact on ground water quality east of Poorhouse Brook. The significant rise in the ground water table surface east of Poorhouse Brook would preclude ground water migration from the site and impact on residential wells in that area. The number of wells and nature of residential water use would not result in the lowering of the regional water table in the area to a level below Poorhouse Brook, which would be necessary to reverse the ground water flow direction.

4.3 Environmental Conditions within Wetlands, Streams and Adjacent Areas

As a result of both the prior investigations and TRC's sampling, a significant amount of information is known about the environmental conditions of the wetlands and streams adjacent and downstream of the landfill. The sediment samples collected by the USEPA in 2008

exhibited similarities in contaminants and concentrations of contaminants with the surface soil sampling conducted at that time. The majority of the sediment samples contained SVOCs, metals and pesticides, with VOCs and PCBs detected at fewer locations. A majority of the samples contained one or more of the compounds 4,4-DDT, 4-4-DDE or 4,4-DDD, while fewer samples contained concentrations of chlordane and one sample contained a concentration of dieldrin. In all cases, the concentrations of pesticides and PCBs in sediment were below the RDEC. It was also observed that chlordane and dieldrin were not present in sediment samples collected in Poorhouse Brook.

Because of the high organic content of stream sediment and the low solubility of most of the contaminants found in this area, it is not unexpected to find that contaminants have adhered to the stream/wetland sediments. Other sources of contaminants (beside erosion from the site) such as road runoff and drainage from upstream areas may also be contributing to the concentrations found in the sediments. A detailed watershed analysis to determine other possible contributors to the stream/wetland sediment was outside the scope of the study performed by TRC. Down stream samples may be needed to further assess risk from sediment impact in the residential areas.

The widespread presence of 4,4-DDT, its breakdown products and to a lesser extent, chlordane and dieldrin in the surface soil and sediment is consistent with what is known of pesticide use in the 1950's and 1960's prior to the timeframe in which these chemicals were banned (4,4-DDT was banned in 1972 and chlordane was banned in 1983). 4,4-DDT is documented to have been applied over widespread areas via aerial spraying in the late 1950's in the northeast to control gypsy moth populations. It was also used commonly to treat agricultural areas, which based on historical aerial photographs, dominated this area of North Stamford. The presence of 4,4-DDT, 4,4-DDD and 4,4-DDE in wetland sediment well north of the site suggests that there was former widespread application of this family of pesticides. Chlordane and dieldrin were used extensively as a pesticide to control termites and ants as well as use as a turf pesticide for grub control. 1,1,1,2-Tetrachlorethane was used in the manufacture of pesticides and paints. Both chlordane and dieldrin would have been applied to the ground surface, are known to adhere strongly to soil particles, breakdown very slowly, remain in soil for many years and not easily dissolve in water. The sampling conducted at the site supports those conditions as these compounds are present in surface soil and sediment and to a much lesser extent in the deeper

soil. Despite their presence in the soil and sediment, these compounds are not present in the surface water and ground water at and near the site.

The results of the surface water sampling indicate that generally only concentrations of VOCs and metals in these samples. These results are consistent with the behavior of contaminants in sediment and water and confirm that the presence of the landfill discharging ground water and surface runoff has not had a significant impact to the water quality of the unnamed stream or Poorhouse Brook.

4.4 Recommendations for Future Actions

The regulations concerning landfill closure and post-closure care have changed significantly since this site was closed in the early 1970s. The permitting for new solid waste facilities and the closure/post-closure existing solid waste facilities is regulated under RSCA22A-209-1 through 16. The description of an existing solid waste area is regulated under RSCA 22a-109-7u. The operation and closure of this landfill pre-dated the above regulations and the regulations governing water discharge permitting for solid waste areas. The need to address closure, post-closure and groundwater associated with the site should be conducted in concert with the solid waste unit, water permitting unit and the remediation unit of the CTDEP. There are overlapping regulatory requirements that will need to be satisfied and coordinated within these units at CTDEP. Based upon TRC's familiarity with landfills and remediation services in Connecticut, we expect the following issues will need to be addressed:

Site Use Considerations

- Continued use of leaf composting operations
  - Permitting
  - Disruption during landfill closure
  - Stormwater management
  - Landfill cap protection
- Salt shed and other public works operations
  - Permitting
  - Stormwater management
  - Disruption during landfill closure
- Park
  - Continued use evaluation
  - Landscape design and park features
  - Stormwater management

Landfill Closure Considerations

- Eliminate direct exposure pathway via soil cover/landfill cap
- Eliminate groundwater pathway via low permeability landfill cap
- Assess need for landfill gas venting /control
- Site grading to manage surface runoff in accordance with State Water Quality Criteria.
- Slope stabilization to prevent erosion of slopes and ensure static and dynamic slope stability
- Vegetative cover selection and landscaping in non–traffic areas.
- Durable surfaces in traffic areas and cap protection
- Address contaminated sediments in the on–site pond/wetland/brook within the park area.
- Security and site access control.
- Fugitive dust control and monitoring during closure activities
- Temporary sedimentation and erosion controls during closure activities

Soil Management Considerations

- CTDEP General Permit for Contaminated Soil Management
  - Approval needed for stockpiles that exist over 45 days and contain more than 10,000 cubic yards of soil.
- Testing of soils for re-use
  - Soil testing frequency is should be conservative and at Licensed Environmental Professional's discretion
  - Unrestricted off-site use of soil may require approval from CTDEP
  - Conditional on-site reuse will require compliance with the RDEC or rendered inaccessible under asphalt or clean soil.

Groundwater Considerations

- Installation and monitoring of additional overburden and bedrock monitoring wells to refine the landfill leachate plume delineation and ensure surface discharge location.
- Ensure that the City of Stamford has control over the landfill leachate plume to the point of surface discharge and restrict groundwater use in this area.

Permitting Considerations

- CTDEP Solid Waste Disruption Permit
- Local Island Wetlands and Watercourses Permit
- Construction Stormwater Permit
- On–Site Activity and Landfill Stormwater Permit

Post–Closure Care Considerations

- Long–term groundwater monitoring and reporting
- Cap maintenance, inspection and reporting
- Post–closure financial assurance
- Landfill gas management, if necessary

- Stormwater sampling and permit compliance

4.5 Immediate Considerations

The presence of constituents in surface soil exceeding direct human exposure criteria is a concern mainly related to the park use and any activities that could disturb the surface soils. The presence of the asphalt in the recycling and compost areas reduces the risk of exposure in these locations. TRC recommends that the Scofieldtown Park remained closed pending resolution of this future use and the isolation of the non-compliant soils to prevent direct exposure. The use of the leaf composting area, salt shed and other public works related activities can continue as long as these activities do not disturb the surface soils, resulting in exposure to site workers. Aggressive dust control measures are recommended where vehicles can cause surface soils to become airborne fugitive dust.

DUE TO THE SIZE OF APPENDICES, THEY ARE NOT INCLUDED ON THE WEBSITE. BUT APPENDICES ARE AVAILABLE FOR VIEWING AT THE GOVERNMENT CENTER-7TH FLOOR, ENGINEERING BUREAU

TO MAKE ARRANGEMENT, PLEASE CONTACT JEFF BROWN AT 203 977-4493

APPENDIX A

HISTORICAL PHOTOGRAPHS AND MAPS

APPENDIX B

CHRONOLOGY OF EVENTS

APPENDIX C

GROUND PENETRATING RADAR SURVEY REPORT

APPENDIX D

WELL INSTALLATION LOGS

APPENDIX E

GROUND WATER SAMPLING LOGS

APPENDIX F

LABORATORY RESULTS