



Hatch Mott
MacDonald

**Borough of Madison
Hartley Dodge Memorial Building**

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Madison Borough, Morris County, New Jersey

NJDEP SRP PI #008511

Case #91-02-20-1607-19; CTN #10416

HMM 366547

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1.0 Introduction

The Borough of Madison (the Borough) removed an underground storage tank (UST) in 1991 from their former police station facility at the Hartley Dodge Memorial building. The UST has stored gasoline and was removed as part of the Borough's UST management plan. A discharge of gasoline was noted and the New Jersey Department of Environmental Protection (NJDEP) assigned the discharge as Case #91-02-20-1607-19 under Site Remediation Program Preferred ID #008511. The Borough conducted remedial investigations and remedial actions to address soil and ground water contamination through 2008, but contamination remained.

The NJDEP issued the Borough a Notice of Deficiency on March 16, 2011. The Borough initially retained JM Sorge, Inc. (JM Sorge) to respond to the NJDEP's Notice of Deficiency. JM Sorge was the Licensed Site Remediation Professional (LSRP) between August 2011 and January 2016. During this period, JM Sorge addressed a number of deficiencies and conducted additional remedial investigations of soil and ground water. In 2016, the Borough retained Hatch Mott MacDonald to provide LSRP services, complete the remedial investigation, and submit the Remedial Investigation Report.

Hatch Mott MacDonald has prepared this Remedial Investigation Report on behalf of the Borough to document the remedial investigation activities conducted since March 2011. The Report meets the requirements of the Site Remediation Reform Act (SRRA) *N.J.S.A. 58:10C-1 et seq*, the Administrative Requirements for the Remediation of Contaminated Sites (ARRCS rules) *N.J.A.C. 7:26C*, and Technical Requirements for Site Remediation *N.J.A.C. 7:26E* (Tech Rules). The Remedial Investigation Report form is submitted electronically with the report. A Cover Certification form is included in Appendix A.

2.0 Physical Setting

This section includes brief descriptions of the Site and adjacent properties and summarizes regional and Site-specific hydrogeology.

2.1 Site Description

The Site is located at 50 Kings Road, Borough of Madison, in Morris County, New Jersey and is designated on the Madison Borough Tax Maps as Block 2802, Lot 1. The tax parcel is approximately 1.37 acres and includes one permanent structure; the Borough of Madison administrative building. The Site is zoned OSGU by the Borough of Madison Zoning Department for the preservation of open space or government-related uses. The Site location is depicted on Figure 1. The Site Layout with tax blocks and lots is depicted on Figure 2.

The Site is bound by:

- The intersection of Kings Road and Green Avenue to the north,
- Kings Road to the east/northeast,
- Residential properties to the south/southeast; and,
- Residential properties, a church, and public property to the west/southwest.

Additional features of the area include:

- New Jersey Transit Madison train station (Morris & Essex line), located approximately 150 feet to the northeast, across Kings Road

The Site slopes slightly to the east towards Kings Road and the New Jersey Transit Madison train station, with the topographic high point located in the western portion of the Site.

The Site is owned by the Borough of Madison.

2.2 Soils

NJDEP GeoWeb interface was utilized to review soil information for the Site. The Soils (SSURGO) data indicates that the Site consists of Urban land-Haledon complex, 3 to 8 percent slopes. More specifically:

Urban land-Haledon complex, 3 to 8 percent slopes (USHALB) – Urban land comprises 45 percent of this soil complex (paved surfaces, buildings, etc.). The Haledon component comprises 40 percent of this soil complex. The Haledon component occurs on ground moraines on glacial till plains. The parent material consists of coarse-loamy basal till derived from basalt. Depth to restrictive feature, fragipan: 16 to 30 inches. The natural drainage class is somewhat poorly drained. This soil does not meet hydric soil criteria.

As indicated in soil boring logs in Appendix B, the overburden soil consisted mainly of clay and silts with little sand and gravel.

2.3 Geology and Hydrogeology

The Site is located in the Newark Basin Physiographic Province. Surficial geology consists of late Wisconsinan terminal moraine deposits (Rahway till, Qwmtr) from the late Pleistocene. The lithology of Rahway till is described as glacial till forming morainic ridges and knolls as much as 200 feet thick deposited directly from glacial ice along the terminal ice margin during the late Wisconsinan glaciation. Bedrock geology consists of the Boonton Formation (Jb). The lithology of the Boonton Formation is described as fine-grained sandstone, siltstone, and mudstone; minor dolomitic siltstone and shale.

Based on soil borings installed in 2016, the soils to 50 feet below ground surface (bgs) can be described as a glacial till consisting of predominantly silty clay or clayey silt with fine gravel. Based on water supply well logs, the till and glaciolacustrine deposits may be up to 100 feet thick. Coarser sediments of the Buried Valley Aquifer, believed to be present at this location under the till, were not encountered.

The depth to ground water at the location of former UST 0013 is approximately 3 feet bgs. Shallow groundwater flow has been documented to be in an east southeasterly direction (see Groundwater Contour Map from 2001 provided in Appendix C). The ground water may be under perched conditions in this area as a monitoring well installed 160 feet west of the former UST encountered ground water approximately 40 feet below surface.

2.4 Hydrology

The following surface water features were identified by the NJDEP NJ-GeoWeb Streams GIS Layer: Spring Garden Brook (FW2-NT) located approximately 1,500 feet to the east-southeast; and an un-named pond located approximately 2,300 feet to the east-northeast.

According to the NJDEP NJ-GeoWeb Wetlands (2012) GIS Layer, no wetlands are mapped within at least three quarters of a mile of the Site.

2.5 Topography and Drainage

The Site is situated approximately between 260 to 250 feet in elevation (above mean sea level). The Site slopes from west to east. Surface water is anticipated to drain generally to the east, in the direction of Spring Garden Brook.

3.0 Areas of Concern Summary

3.1 Areas of Concern

A Preliminary Assessment Report was not prepared for this case as the objective was to address known areas of concern. The areas of concern include former underground storage tanks, and ground water contamination that was impacted by discharges from the one UST. A description of each AOC and its current status is provided below.

AOC 1 – Former UST 0013

The UST was abandoned in place in 1982. Upon removal on January 20, 1991, it was noted to have holes at the northern end of the tank. Three cubic yards of contaminated soil was removed. Additional excavation was restricted by surface structures. The discharge was reported to the NJDEP as Case #91-02-20-1607-19. Additional soil sampling was conducted by 1997, and an institutional control was proposed for the residual contamination. Additional remedial investigation was required.

AOC 2 – Former UST 0015

The UST was removed on February 19, 1991. A discharge was observed, and eight cubic yards of contaminated soil was removed. The discharge was reported to the NJDEP as Case #91-02-19-1336-50. Two monitoring wells were installed and no ground water contamination was noted. The NJDEP issued a No Further Action on April 29, 1992 according to NJDEP Data Miner). The wells were abandoned on August 13, 1992. This AOC does not warrant any further remedial investigations or actions.

AOC 3 – Former UST 0014

The UST was removed on June 11, 1996. The steel tank was reported in good condition but a surface spill had occurred at the fill pipe and 114 tons of contaminated soil was removed from east end. Ten post-excitation samples were collected. Samples S-7 (4.5 feet bgs) and S-8 (5 feet bgs) exceeded the Impact to Ground Water Soil Cleanup Criterion for xylenes (10 ppm). The NJDEP stated in their March 24, 1999 letter (copy provided in Appendix C) that no further soil investigation was required as there was no impact to ground water. This AOC does not warrant any further remedial investigations or actions.

AOC 4 – Former USTs 0011 and 0012

The two USTs were removed on December 9, 1993. A discharge was reported to the NJDEP as Case #93-12-09-0754-09. No information was available regarding the UST removals, the condition of the tanks, or the soil results.

The NJDEP issued a No Further Action on August 16, 1995 (copy provided in Appendix C). This AOC does not warrant any further remedial investigations or actions.

AOC 5 – Ground Water

Ground water contamination was noted at MW-1 adjacent to the former UST 0013 location. Additional wells were installed to delineate, and contamination was noted at MW-4 that was installed downgradient of UST 0014 (AOC 3). UST 0014 was removed, and ground water has been clean at MW-4 since 2000. In the UST 0013 source area, remedial actions consisted of ORC injection (210 pounds on 5/9/2000; 90 pounds on 11/10/2000). Additional remedial investigation was required for horizontal and vertical delineation.

AOC 6 – Indoor Air at Former UST 0013

In the March 16, 2011 Notice of Deficiency, the NJDEP requested a vapor intrusion investigation. Additional remedial investigation was required to assess potential impact to indoor air quality.

In summary, AOCs 1 and 5 required further remedial investigations to define the extent of the contamination. AOC 6 required a site investigation to determine if indoor air had been impacted by the discharge.

3.2 Previous Remedial Investigations and Actions (AOCs 1 and 5)

Information available from UST registration forms indicated that UST 0013 was installed in 1937 and was last used in 1982. The Borough removed the tank on February 20, 1991 under closure approval TMS #C90-0059. Upon removal, holes were noted in the northern end of the tank, and contaminated soil removal was limited by the structural surface (granite blocks on edge cemented into one foot of concrete). A monitoring well (MW-1) was installed to assess ground water quality, which was determined to be contaminated. The results were presented in the Tank Closure Summary Report (May 1991, Killam Associates).

The Borough retained Environmental Engineering Corporation (EEC) to conduct the remedial investigation. EEC collected a number of soil samples and installed six monitoring wells (MW-2 to MW-7), and collected ground water samples. EEC submitted the following major remedial investigation reports:

Site Investigation Report/Remedial Investigation Report (November 1992, EEC)

Remedial Action Workplan (April 1996, EEC)

Remedial Action Workplan Addendum (October 1996, EEC)

EEC proposed a deed notice for the soil contamination and a Classification Exception Area (CEA) for ground water contamination. The NJDEP, in their January 30, 1997 letter (copy provided in Appendix C), would not consider an institutional control for the soils as it represented a source of ground water contamination and no

decreasing contaminant concentration trends were noted in ground water. Between 1997 and 1999, EEC submitted numerous ground water monitoring reports. EEC prepared a Remedial Action Workplan Addendum letter (September 27, 1999) that proposed soil excavation followed by a CEA. On January 24, 2000, EEC revised the remedial action approach in a phone conference with the NJDEP: soil excavation would not be conducted due to the disruption to the surface cover; and oxygen release compounds (ORC) would be injected in the source area to stimulate biodegradation. A formal proposal to inject ORC was submitted to the NJDEP on March 23, 2000.

EEC proceeded with the injection of ORC following approval of the NJDEP permit-by-rule on April 24, 2000. Injections included 210 pounds on May 9, 2000 and 90 pounds on November 10, 2000. Ground water compliance monitoring was conducted by EEC following the ORC injection until 2007. EEC's assessment on the efficacy of the ORC injection was not favorable as they again proposed soil removal in their October 2002 Semi-Annual Groundwater Monitoring Report. The historical ground water sample results through 2007 are provided in Appendix C.

At some point after the 2007 monitoring event, monitoring wells MW-1, MW-2, MW-4, MW-5, MW-6, MW-7 and injection wells IW-1 and IW-4 were abandoned by the Borough in response to a NJDEP request. Well decommissioning forms are not available for the well closures. Remedial Investigation work did not resume until the NJDEP Notice of Deficiency was issued on March 16, 2011.

4.0 Technical Overview of Remedial Investigation

This Remedial Investigation Report summarizes activities conducted at the Site since 2011 as a result of the Notice of Deficiency letter that the NJDEP issued on March 16, 2011. The remedial investigation work completed between 2011 and 2015 was conducted by JM Sorge. This work consisted of soil and ground water sampling in 2011 and 2013, and indoor air sampling in 2012. The work completed in 2016 was conducted by Hatch Mott MacDonald. As Hatch Mott MacDonald prepared this report, the work conducted prior to our assuming responsibility is based solely on information provided. A sample summary table for all samples collected from 2011 onwards is provided as Table 1. Soil sample results are provided in Appendix D and ground water sample results are provided in Appendix E. Soil boring logs are provided in Appendix B.

4.1 Reliability of Data

Samples were analyzed by Hampton-Clarke Veritech of Fairfield, New Jersey (NJ Certification #07071), Accutest Laboratories of Dayton, New Jersey (NJ Certification #12129), and Aqua Pro-Tech Laboratories of Fairfield, New Jersey (NJ Certification #07010). The raw QA/QC data, case narratives and non-conformance summaries were reviewed. Based on this review, it was concluded that the results of the sampling events are useable and provide reasonable evidence of the limits and extent of contamination at the Site.

Following are descriptions of significant laboratory QA/QC non-conformance issues encountered for each sampling event and justification for using the data where appropriate.

October 28, 2011 (Hampton-Clarke Veritech, #1102832)

According to Hampton-Clarke Veritech, on Monday, October 31, 2011, the lab discovered that there was a loss of power to their Volatile Laboratory at 2 Madison cold storage facility due to the snowstorm. The cold storage for samples held at the 2 Madison location had exceeded the acceptable temperature range and the samples were immediately transferred to their Main Laboratory. During the transfer of samples from 2 Madison to the Main Lab, the electronic sample log was incomplete and this oversight was not realized until November 8, 2011. This affected samples AC62369-001 through -003 and -005 through -009. The impact of the loss of power is summarized for soil samples: 1) soil samples were collected in TerraCores - Closed System so there would be no loss of compounds by not maintaining the samples frozen. Some compounds can breakdown but EPA studies show this takes weeks and months at time periods that exceed the holding time; and 2) ground water samples were in closed system and no loss would be expected. The sample had to be run 20 times dilution to get the results within the Calibration Curve. No change in results would have been reported should the sample have been kept at 4 degrees C.

The Matrix Spike and/or Matrix Spike Duplicate for batches 12317 and 12588 had recoveries outside QC limits. However, since the associated Method Blank and Laboratory Control Sample were within control, no corrective action was necessary. The MS/MSD RPD is also outside the QC limits.

May 9, 2013 (Accutest JB36624)

Sample HD 8B, dilution was required due to sample matrix. Sample HD-8C, dilution was required due to high concentration of target compound.

May 10, 2013 (Accutest JB36772)

Sample HD-12A: For the petroleum contaminants of concern, Matrix Spike Recovery(s) for 1,2,3-Trichlorobenzene, 1,2,4-Trichlorobenzene, 1,2-Dichlorobenzene, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene, Isopropylbenzene, Methyl Acetate, Methyl Tert Butyl Ether, o-Xylene, Toluene were outside control limits due to matrix interference. Matrix Spike Duplicate Recovery(s) for 1,2,3-Trichlorobenzene, 1,2,4-Trichlorobenzene, 1,2-Dichlorobenzene, 1,3-Dichlorobenzene, 1,4-Dichlorobenzene, Isopropylbenzene, Methyl Acetate, Methyl Tert Butyl Ether, o-xylene were outside control limits due to acid preservation. Matrix Spike Duplicate Recovery(s) for m,p-Xylene, Xylene (total) were outside control limits. Probable cause was due to matrix interference.

May 24, 2013 (Accutest JB38019)

Volatiles by GCMS By Method SW846 8260B

Matrix: AQ Batch ID: V2D5066 - All samples were analyzed within the recommended method holding time. All method blanks for this batch meet method specific criteria. Sample(s) JB38019-3MS, JB38019-3MSD were used as the QC samples indicated. Blank Spike Recovery(s) for 1,1,2,2-Tetrachloroethane, Methyl Tert Butyl Ether are outside control limits.

Matrix: AQ Batch ID: V3A5169 - All samples were analyzed within the recommended method holding time.

All method blanks for this batch meet method specific criteria. Sample(s) JB37442-1MS, JB37442-1MSD were used as the QC samples indicated. Matrix Spike Recovery(s) for Methylene chloride are outside control limits. Probable cause due to matrix interference. RPD(s) for MSD for Chloromethane are outside control limits for sample JB37442-1MSD. Outside control limits due to matrix interference.

January 21, 2016 (Aqua Pro-Tech 6010573)

The blank spike, matrix spike and matrix spike duplicate recoveries for several compounds were outside of QC limits (high). However, these compounds were not detected in the samples, with the exception of acetone.

The matrix spike and matrix spike duplicate recoveries for several other compounds were outside of QC limits (low). However, these compounds passed QC criteria in the blank spike. The continuing calibration recoveries for several compounds were outside of QC limits (high and low). Due to matrix interference, the surrogate (toluene-d8) recovery for sample 6010573-05 was outside of QC limits (high). Due to matrix interference, the surrogate (4-bromofluorobenzene) recovery for sample 6010573-03 was outside of QC limits (low). The internal standard (1,4-dichlorobenzene) area for sample 6010573-03 was outside of QC limits (low).

March 7, 2016 (Aqua Pro-Tech #6030322)

Batch B6C1543: The matrix spike and spike duplicate recoveries for several compounds were outside of QC limits (low). The continuing calibration (S6C1615-CCV1) recovery for 1,2,3-Trichlorobenzene was outside of QC limits (low) and the recovery for Acetone was outside of QC limits (high). However, these compounds passed QC criteria in the blank spike.

Batch B6C1713: The matrix spike and spike duplicate recoveries for several compounds were outside of QC limits (low). However, these compounds passed QC criteria in the blank spike.

In summary, the data evaluation has concluded that the data are reliable.

4.2 Significant Events, Seasonal Fluctuations or Field Conditions

Field notes for field activities conducted by JM Sorge in 2011 and 2013 were not made available at the time of this report. No significant seasonal fluctuations or weather events were recorded during the time of October 28, 2011 sampling event; however, according to NOAA weather records (accessed at <http://www.ncdc.noaa.gov/>) a significant rainfall event occurred during the May 8-9, 2013 sampling event, with rainfall totaling over 0.7 inches.

No significant seasonal fluctuations, weather events, or unusual field conditions were experienced or encountered during the time of field activities in 2016. Field screening of soil was performed using a MiniRae 2000 photo-ionization detector.

4.3 Quality Assurance Project Plan (QAPP)

January 2016 soil and ground water sampling and March 2016 ground water sampling followed the May 2012 Tech Rules and 2005 Field Sampling Procedures Manual. A Site-specific QAPP is provided in Appendix F.

4.4 Applicable Remediation Standards

The NJDEP approved soil and ground water remediation standards in their partial Remedial Action Workplan approval of March 24, 1999 letter. The remediation standards were based on the Soil Cleanup Criteria (SCC) and Ground Water Quality Standards (GWQS) that existed at that time. This remedial investigation compared the results to the NJDEP-approved remediation standards, and the current Soil Remediation Standards (SRS) and GWQS where the changes are favorable as provided in the table below.

Compound	Residential Direct Contact (Soil)		Impact to Ground Water (Soil)		Ground Water Quality	
	1999 RDCSCC	2013 RDCSRS	1999 IGWSCC	2013 IGWSSL	1999 GWQC	2012 GWQS
Benzene	3	2	1	0.005	1	1
Ethylbenzene	1000	7800	100	13	700	700
Toluene	1000	6300	500	7	1000	600
Xylenes	410	12000	10	19	1000	1000

Note: Shaded cells represents the applicable remediation standard.

Please note that the Impact to Ground Water site-specific soil cleanup criteria were not applicable below the water table, which are all samples collected deeper than 3 feet below the ground.

4.5 AOC 1 – Soil Investigations

4.5.1 October 2011 Sampling Event

On October 28, 2011, six soil borings (HD-1 through HD-6) were installed. Eight soil samples were collected from five of the borings from depths ranging between 4.5 and 10 feet bgs. The samples were analyzed for volatile organic compounds (VOCs).

No samples had detections of contaminants in exceedance of applicable remediation standards. Please see Table 2 for the soil analytical results.

4.5.2 May 2013 Sampling Event

On May 9, 2013, six soil borings (HD-7 to HD-12) were installed. Fourteen soil samples were collected from the six borings from depths ranging between 5 and 28 feet bgs. The samples were analyzed for Target Compound List volatile organic compounds (TCL VO+15) and SPLP benzene.

Analytical results indicate that soil samples HD-7A 15.5-16 exhibited exceedances of VOCs in excess of the applicable remediation standards. Please see Table 2 for the soil analytical results.

The information generated between 2011 and 2013 determined that soil contamination above the applicable remediation standards needed to be delineated vertically and horizontally.

4.5.3 January 2016 Sampling Event

On January 21, 2016, two soil borings were installed by UniTech Drilling of Bridgewater, NJ (UniTech), a NJDEP licensed driller via a GeoProbe rig. The first soil boring was installed at the same location as HD-7, where soil contamination was present in the deepest sample at a depth of 28 feet bgs. One soil sample was collected at 39.5-40 feet bgs. A second boring (HD-13) was installed northeast of HD-7. Three soil samples were collected at depths corresponding to sample depths at HD-7 (15.5-16 feet bgs, 21.5-22 feet bgs; and 27.5-28 feet bgs). The samples were analyzed for TCL VO+15. See Figure 3 for soil sample locations and results.

The soil sample results determined that there was no soil contamination exceeding the applicable remediation standards. Please see Table 2 for soil analytical results.

4.6 AOC 5 – Ground Water Investigations

4.6.1 October 2011 Sampling Event

On October 28, 2011, JM Sorge collected one ground water sample from temporary well point TW-3. The sample was analyzed for VOC+10.

Analytical results revealed the presence of benzene, ethylbenzene, total xylenes, and tentatively identified compounds (TICs) in excess of the NJDEP Ground Water Quality Standards (GWQS). Please refer to Table 3 Ground Water Sample Results, and Figure 4 for the ground water sample results.

4.6.2 May 2013 Sampling Events

On May 8, 2013, JM Sorge installed a replacement well for MW-4 that had been abandoned post-2007 sampling. The replacement well (MW-4R) was installed to a depth of 15 feet bgs and screened from 2-15 feet. The monitoring well permit and record and provided in Appendix C.

On May 10, 2013, JM Sorge collected one (1) ground water sample from temporary well point TWP-1. The sample was analyzed for benzene, toluene, ethylbenzene, and total xylenes (BTEX) and tertiary butyl alcohol (TBA). Additional information regarding sampling activities and sample collection depth was not available at the time of this report.

Analytical results revealed the presence of benzene and total xylenes in excess of the NJDEP GWQS. Please refer to Table 3 and Figure 4 for the ground water sample results.

On May 24, 2013, JM Sorge collected ground water samples from monitoring wells MW-3 and MW-4R. The samples were analyzed for TCL VO+15 and TBA.

Analytical results were below the NJDEP GWQS. See Figure 4 for sample locations.

4.6.3 January 2016 Sampling Event

On January 21, 2016, one ground water grab sample (HD-7-TWP) was collected from HD-7 at a depth of 30 to 35 feet bgs. The sample was analyzed for TCL VOC+15 and TBA. See Figure 4 for the sample location.

Analytical results indicate that temporary well point ground water sample HD-7-TWP had exceedances of BTEX above NJDEP GWQS, as well as several VOC TICs with detected concentrations in excess of 500 ug/l. Please see Table 3 for the sample results.

4.6.4 March 2016 Sampling Event

On March 7, 2016, four soil borings were installed by Summit Drilling of Bridgewater, NJ via a sonic drill rig. All four soil boring locations were installed to a total depth of 50 feet bgs. One soil boring was installed at the same location as HD-7, where contamination was present in the sample at a depth of 35 feet bgs. This soil boring was extended to 50 feet, and a ground water sample was collected in the range of 45 to 50 feet bgs via temporary well point (HD-7 45-50). Three other soil borings, GWP-1, GWP-2, and GWP-3, were installed, side-gradient and down-gradient of the HD-7 location. Ground water samples were collected via temporary well point at GWP-1 and GWP-2. A ground water sample was not collected from GWP-3 due to insufficient volume and lack of any indication of contamination. The samples were analyzed for TCL VO+15. See Figure 4 for sample locations.

Analytical results indicate that sample HD-7 45-50 had exceedances of benzene and bromodichloromethane. Sample GWP-1 (side-gradient) also exhibited an exceedance of bromodichloromethane at a similar concentration. GWP-2 did not exhibit any petroleum-related compounds in exceedance of the NJDEP GWQS. Please see Table 3 for the sample results.

Bromodichloromethane occurs in municipally-treated drinking water as a by-product of the chlorine disinfection process. The fact that it is present along with other trihalomethanes supports that it is related to the municipal water system.

Benzene was present at 55 ug/l in the sample from 45-50 feet at the HD-7. This exceeds the GWQS and does not represent vertical delineation. Therefore, the data from HD-7 (30-35) and HD-7 (45-50) were used to extrapolate the depth to where benzene would meet the GWQS of 1 ug/l. Based on extrapolation, the vertical extent of petroleum-related contamination is 61 feet bgs.

The remedial investigation completed the delineation of ground water contamination.

4.7 AOC 6 – Indoor Air at Former UST 0013

In the March 16, 2011 Notice of Deficiency, the NJDEP requested a vapor intrusion investigation. Indoor air samples were collected by JM Sorge on February 8, 2012 from two indoor locations. An outside ambient air sample was also collected. The results were submitted to the Borough and the NJDEP on February 29, 2012. The results indicated that there was no concern when compared to the Non-residential Generic Vapor Intrusion Indoor Air Screening Levels (March 2007). For this report, the results were compared to the March 2013 Residential and Non-residential Generic Vapor Intrusion Indoor Air Screening Levels and the conclusion that indoor air had not been impacted by the contaminated ground water remains the same. The information was submitted to the Borough and NJDEP is included in Appendix G.

4.8 Variance from the Technical Requirements

The remedial investigation varied from the Technical Requirements under NJAC 7:26-4.3(a) in that it used extrapolation to determine the vertical extent of ground water contamination. It also varies in that it does not propose to establish a ground water monitoring program until the remedial action has been selected. At that time, a monitoring well will be proposed to confirm and monitor the vertical extent of ground water contamination.

5.0 Updated Receptor Evaluation

This Remedial Investigation Report discusses the Updated Receptor Evaluation (RE) Report findings and recommended activities. An Initial Receptor Evaluation was previously submitted by JM Sorge in December 29, 2011. The Updated Receptor Evaluation is completed as a component of the remedial investigation; however, the Receptor Evaluation has additional submission requirements: the RE portion of this report will also be submitted to the municipal clerk and the local health department official. The updated Receptor Evaluation form and attachments are included in Appendix H.

5.1 Description of Contamination

A gasoline UST was removed from the Site in 1991. Some of the contaminated soil was excavated and removed from the Site; however, it is reported that due to surface structure constraints not all of the potentially impacted soils could be removed. Low concentrations of gasoline-related VOCs (specifically benzene, toluene, ethylbenzene, and xylenes – BTEX) remained based on post-excavation soil sampling results.

Data from 1991 through 2007 was previously reported to the NJDEP. The monitoring wells were abandoned at the request of the NJDEP. Additional ground water samples collected from 2011 through 2016 have delineated the extent of ground water contamination. BTEX and VOC TICs are present in concentrations exceeding the GWQS.

5.2 Land Use

There have been no updates to this section since the August 2012 submission by JM Sorge; eighteen (18) properties were identified within 200-feet of the Site. Eleven (11) residential properties, one (1) child care facility, and one (1) senior citizen center were identified within 200-feet of the Site. The remaining six (5) properties' land uses within 200-feet of the Site are not considered sensitive populations.

5.3 Ground Water Use

There are no updates to this section since the submission of the Initial Receptor Evaluation. A well search was completed on April 4, 2016 and confirms the wells provided in the original Receptor Evaluation.

5.4 Vapor Intrusion

A vapor intrusion investigation was performed by JM Sorge in 2012. Two Indoor air samples and an outside ambient air sample were collected. The results indicated that there was no concern when compared to the March

2013 Residential and Non-residential Generic Vapor Intrusion Indoor Air Screening Levels. The conclusion that indoor air had not been impacted by the contaminated ground water remains the same.

5.5 Ecological Evaluation

There are no updates to this section since the submission of the Initial Receptor Evaluation, which recommended no further ecological investigations.

5.6 Conclusions

The soil and ground water contamination is limited to the Site. There are no environmentally sensitive natural resources on or adjacent to the Site. Therefore, there are no concerns for impact to receptors.

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6.0 FINDINGS AND RECOMMENDATIONS

Based on the findings of the remedial investigation activities conducted since 2011, remedial investigations are completed at the Site. The findings/recommendations of this remedial investigation are presented in this section.

6.1 AOC 1 – Former UST 0013

The extent of soil contamination has been delineated horizontally and vertically. The horizontal extent is limited to the local area of the former UST as shown on Figure 3. Vertical delineation determined that the soil contamination exceeding the RDCSRS extending to approximately 20 feet, with elevated PID readings recorded down to 50 feet.

This AOC will require remediation.

6.2 AOC 5 – Ground water at Former UST 0013

The water table is approximately three feet below ground surface, and migrates in an east-southeasterly direction. Ground water samples from the water table have been collected and analyzed since the removal of the UST in 1991. The overall trend has been a decrease in contaminant concentrations in the shallow ground water. The horizontal extent of ground water contamination has been delineated.

A ground water sample was collected at 30-35 feet bgs at the HD-7 location due to the high vapor readings observed in the soil. The results from this interval showed more contamination (e.g., benzene at 14,100 ug/l) than present in the shallow ground water, even when compared to historical results. Therefore, ground water samples were collected for vertical and horizontal delineation of the deeper ground water contamination. The other ground water samples did not detect any contamination. Therefore, the horizontal extent of contamination in ground water has also been delineated and is also local to the former UST.

The sample from 45-50 feet at the HD-7 contained benzene at 55 ug/l, still above the GWQS. Based on extrapolation, the vertical extent of benzene contamination is 61 feet bgs.

The presence of deeper ground water contamination as a result of a discharge of gasoline can be explained by the site geology and hydrogeology. The soils were predominantly glacial till consisting of predominantly silty clay or clayey silt with fine gravel. The till lacks primary permeability, but does have secondary permeability in vertical fractures that are the result of post-glacial isostatic rebound. The vertical fractures and the withdrawal of water from the underlying Buried Valley Aquifer created a vertical gradient downwards.

The March 2016 ground water sample results indicate the presence of bromodichloromethane in excess of the NJDEP GWQS, as well as the presence of other trihalomethanes as TICs. According to the Agency for Toxic Substances and Disease Registry, most bromodichloromethane is formed as a by-product when chlorine is added to water-supply systems. Bromodichloromethane is not known to cause adverse health effects in people. As bromodichloromethane is not a petroleum-related compound and does not pose a threat to human health or the environment at the Site, no additional investigation of bromodichloromethane is warranted at this time.

This AOC will require remediation for the gasoline impact.

Classification Exception Area (CEA) - Since petroleum-related compounds will remain in ground water above the GWQS in the vicinity of AOC-1, a CEA is proposed for the Site. The CEA will be established as an institutional control so that ground water use on the Site is restricted. The aerial extent of the proposed CEA is approximately 5,000 square feet (0.11 acres). The vertical extent of the proposed CEA is approximately 61 feet bgs. The CEA documentation is included in Appendix I.

6.3 AOC 6 – Indoor Air at Former UST 0013

In the March 16, 2011 Notice of Deficiency, the NJDEP requested a vapor intrusion investigation. Indoor air samples were collected and the results submitted to the Borough and the NJDEP on February 29, 2012. The results indicated that indoor air had not been impacted by the contaminated ground water.

This AOC does not warrant any further remedial investigations or actions.