POST-TEMPORARY SOLUTION STATUS REPORT NO. 9
FORMER GENERAL ELECTRIC FACILITY
50 FORDHAM ROAD, WILMINGTON, MA
RTN 3-0518

Prepared for:
Lockheed Martin Corporation

Prepared by:
AECOM Technical Services, Inc.

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Approved by:
Lockheed Martin Corporation

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ACRONYMS AND ABBREVIATIONS

AUL	activity and use limitation
AECOM	AECOM Technical Services, Inc.
BWSC	Bureau of Waste Site Cleanup
CH4	methane
CMR	Code of Massachusetts Regulations
EPL	Eastern Parking Lot
gal/ac/yr	gallons per acre per year
IDW	investigation derived waste
LNAPL	light non aqueous phase liquid
Lockheed Martin	Lockheed Martin Corporation
MassDEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan
MNA	monitored natural attenuation
NSZD	natural source zone depletion
No.	number
OMM	operation, maintenance, and/or monitoring
PIP	public involvement plan
RTN	release tracking number
TRC	TRC Companies, Inc.
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbons
WRT	Wilmington Realty Trust

SECTION 1
INTRODUCTION

AECOM Technical Services, Inc. has prepared this Post-temporary Solution Status Report Number 9 on behalf of Lockheed Martin Corporation in fulfillment of the requirements of post-temporary solution operation, maintenance, and/or monitoring under the Massachusetts Contingency Plan, 310 Code of Massachusetts Regulations 40.0897. This report also was prepared in accordance with the Temporary Solution Statement (AECOM Technical Services, Inc., 2017a) submitted in May 2017 for release tracking number 3-0518, which is located at the former General Electric Company Facility, 50 Fordham Road, Wilmington, Massachusetts (site). The site location is depicted on Figure 1-1.

This report is being submitted electronically via eDEP, the electronic filing site for the Massachusetts Department of Environmental Protection, along with the Comprehensive Response Action Transmittal Form and Phase 1 Completion Statement (Bureau of Waste Site Cleanup-108) and the Remedial Monitoring Report Form, which provide additional responsible party and licensed site professional certifications.

1.1 BACKGROUND

Contamination of the Stickney Well, a currently inactive public supply well for the Town of North Reading, was discovered in the late 1970s. Subsequent investigations of multiple surrounding properties, including the General Electric Company facility property, began in the early 1980s. On October 9, 1987, the Massachusetts Department of Environmental Protection classified the former General Electric Company facility as a priority disposal site, prior to the adoption of the Massachusetts Contingency Plan in 1988. Under the Massachusetts Contingency Plan (Massachusetts Department of Environmental Protection, 2014), the site is a Tier 1 Classified site, under release tracking number 3-0518, with four original operable units, as listed below and further defined in previous reports submitted to the Massachusetts Department of Environmental Protection.

- operable unit-1—Former Tank Farm source area (includes Pump House/Vault and Oil House) and adjacent Eastern Parking Lot
- operable unit-2—Former Tank Farm source area and downgradient groundwater plume both on- and off-property
- operable unit-3—Storm water/Wastewater Outfalls 001 and 002
- operable unit-4—Former Tank K Source Area and immediately downgradient groundwater plume

Areas relating to sediment at storm water/wastewater Outfalls 001 and 002 within operable unit-3 have been resolved and closed via a partial response action outcome (Class A-2) submitted in December 2004 by TRC Companies, Inc. (TRC Companies, Inc., 2004). The former Tank K area that comprised operable unit-4 has been resolved and closed via a partial response action outcome (Class A-2) dated November 9, 2010 (TRC Companies, Inc., 2010). The remaining two areas, operable unit-1 (petroleum contamination in former Tank Farm and Eastern Parking Lot areas) and operable unit-2 (chlorinated volatile organic compounds in former Tank Farm and downgradient groundwater plume), make up release tracking number 3-0518. Figure 1-2 depicts an overview of the disposal site, including relevant site features, and Figure 1-3 depicts all monitoring wells located within the site boundary, and in the general vicinity of the site.

A Tier 1A Permit was in place from 1999 until a remedy operation status opinion was filed on April 20, 2006 (TRC Companies, Inc., 2006). Lockheed Martin Corporation and AECOM Technical Services, Inc. determined on February 28, 2013, that the requirements to maintain remedy operation status were no longer being met, and therefore submitted the required remedy operation status termination notice and a Tier 1 Permit extension application on March 27, 2013, returning the site to Phase II/Phase III status of the Massachusetts Contingency Plan (AECOM Technical Services, Inc., 2013). On October 10, 2014, Lockheed Martin Corporation submitted a tier classification extension (AECOM Technical Services, Inc., 2014) that was approved by the Massachusetts Department of Environmental Protection, extending the tier classification deadline to May 3, 2017. On May 2, 2017, Lockheed Martin Corporation electronically submitted to the Massachusetts Department of Environmental Protection the required reports including a Phase II Comprehensive Site Assessment with a Method 3 Risk Characterization (AECOM Technical Services, Inc., 2017b), a Phase III Remedial Action Plan (AECOM Technical Services, Inc., 2017c), and a Temporary Solution Statement (AECOM Technical Services, Inc., 2017a). The Massachusetts Department of Environmental Protection acknowledged receipt of the reports on May 2, 2017, via electronic stamp on the Bureau of Waste Site Cleanup transmittal form. Currently, the site is in temporary solution status and, therefore, Post-temporary Solution Status and Remedial Monitoring Reports are required to be submitted to the Massachusetts Department of Environmental Protection every six months, by May 2 and November 2 each year, with evaluations of the temporary solution conducted every five years. The first five-year review submittal is due May 2, 2022.

Additional details related to release tracking number 3-0518 (comprehensive release history, site assessment, and completed remedial activities) can be found in reports previously submitted to the Massachusetts Department of Environmental Protection, specifically the Phase II Comprehensive Site Assessment (AECOM Technical Services, Inc., 2017b), Phase III Remedial Action Plan (AECOM Technical Services, Inc., 2017c), and Temporary Solution Statement (AECOM Technical Services, Inc., 2017a).

1.2 OBJECTIVE

The objective of this Post-temporary Solution Status Report Number 9 is to document the monitoring activities conducted at the site during the six-month reporting period of May 2 through November 1, 2021, in accordance with the operation, maintenance, and/or monitoring plan detailed in the Temporary Solution Statement submitted to the Massachusetts Department of Environmental Protection in May 2017. Additionally, field activities relating to natural source zone depletion measurements in the shallow light non-aqueous phase liquid area onsite are also presented in this report.

1.3 LIST OF CONTACTS

This section identifies the potentially responsible party, the licensed site professional-of-record, and the owner of the site.

Potentially Responsible Party:

Lockheed Martin Corporation
6801 Rockledge Drive – MP CCT246
Bethesda, MD 20817
Contact: Mr. Paul E. Calligan
Phone: (240) 687-1813

Licensed Site Professional-of-Record:

AECOM Technical Services, Inc.
250 Apollo Drive, Chelmsford, MA 01824
Contact: Mr. Daniel Folan (licensed site professional license number 1736)
Phone: (978) 905-2205

Current Property Owner:

Wilmington Realty Trust
424 Broadway;
Somerville, MA 02145
Contact: Mr. Gary Stanieich
Phone: (603) 860-5508

1.4 REPORT ORGANIZATION

This Post-temporary Solution Status Report is organized as follows:

- **Section 2—**provides a description of the type and frequency of monitoring and field activities conducted during this reporting period, including additional field measurements from 2018 and 2020.

- **Section 3—**presents a description and the results of the light non-aqueous phase liquid monitoring and product recovery, a discussion of the performance of the monitored natural attenuation relating to the light non-aqueous phase liquid, and a discussion of the remedial objectives related to the light non-aqueous phase liquid and the progress during the reporting period toward meeting these objectives.

- **Section 4—**presents a description and the results of the natural source zone depletion assessment related to the area of residual light non-aqueous phase liquid.

- **Section 5—**provides a description of the effective institutional controls in place at the site.

- **Section 6—**provides a description of conditions identified during the monitoring period, which may be affecting the performance of the remedial action.

- **Section 7—**provides a description of the schedule for future monitoring activities.

- **Section 8—**provides a description of significant modifications made to the monitoring program.

- **Section 9—**provides the conclusions and licensed site professional's opinion regarding this report.

- **Section 10—**provides a discussion of the public notification requirements for the site and copies of any required notifications.

- **Section 11—**provides a list of references.

SECTION 2
MONITORING AND FIELD ACTIVITIES

The Post-temporary Solution Operation, Maintenance, and/or Monitoring (OMM) Program continued during this reporting period in accordance with the preliminary monitoring plan presented in the Temporary Solution Statement submitted to the Massachusetts Department of Environmental Protection (MassDEP) on May 2, 2017, and the updated post-temporary solution OMM annual groundwater monitoring plans submitted to MassDEP on September 6, 2018 and in Post-temporary Solution Status Report Number 8 dated May 2, 2021. The activities completed as part of the OMM Program during this reporting period (May 2 through November 1, 2021) are discussed below. Additionally, field activities relating to natural source zone depletion (NSZD) measurements in the shallow light non-aqueous phase liquid (LNAPL) area from November 2018 and September 2020 are also discussed.

2.1 LIGHT NON-AQUEOUS PHASE LIQUID MONITORING AND PRODUCT RECOVERY

In accordance with the OMM Program, AECOM Technical Services, Inc. (AECOM) conducted quarterly LNAPL monitoring and product recovery from select monitoring wells in May and August 2021. These gauging events are typically conducted in June and September each year but the schedule was adjusted slightly to conduct the gauging during the last week of May and August based on resource availability and the fall groundwater sampling schedule. These gauging events are summarized below. Monitoring wells gauged during the reporting period are depicted on Figure 1-3, and Table 2-1 includes a summary of historical LNAPL gauging and removal data. A copy of the field records completed during the LNAPL gauging events are included in Appendix A. An evaluation of the LNAPL monitoring results is presented in Section 3.

2.1.1 May 2021 Gauging Event

On May 26, 2021, AECOM gauged seven overburden monitoring wells for the depth to groundwater and for the presence of LNAPL: AE-3, AE-4, CW-1, CW-2, GZA-102S, PZ-2S, and TRC-101. None of the wells had an absorbent sock at the time of gauging. LNAPL was not detected in any of the monitoring wells gauged. AECOM deployed a bailer in wells CW-1 and CW-2 to confirm the lack of measurable LNAPL in the wells. Based on the lack of measurable LNAPL, AECOM did not deploy any absorbent socks.

2.1.2 August 2021 Gauging Event

On August 31, 2021, AECOM gauged seven overburden monitoring wells for the depth to groundwater and for the presence of LNAPL: AE-3, AE-4, CW-1, CW-2, GZA-102S, PZ-2S, and TRC-101. None of the wells had an absorbent sock at the time of gauging. LNAPL was not detected in any of the monitoring wells gauged. Based on the lack of measurable LNAPL, AECOM did not deploy any absorbent socks.

2.2 GROUNDWATER MONITORING

In September 2021, AECOM conducted the annual groundwater monitoring in accordance with the OMM Program and with the updated post-temporary solution OMM groundwater monitoring plans submitted to MassDEP on September 6, 2018 and in Post-temporary Solution Status Report Number (No.) 8 submitted o MassDEP on May 2, 2021. The groundwater analytical results from the annual 2021 sampling have been received and are currently being evaluated. Details of the 2021 annual groundwater monitoring event along with a summary of the analytical results will be included in Post-temporary Solution Status Report No. 10, scheduled to be submitted to the MassDEP in May 2022.

2.3 INVESTIGATION-DERIVED WASTE MANAGEMENT

During the groundwater monitoring event completed in September 2021, five 55-gallon drums of purge water and decontamination rinse water were generated. AECOM properly containerized the investigation-derived waste (IDW) and is temporarily storing the containers at a central staging area on-site. In October 2021, AECOM characterized the IDW in accordance with Lockheed Martin Corporation (Lockheed Martin) procedures and has subcontracted Clean Harbors Environmental Services to transport and dispose the purge water IDW at a Lockheed Martin approved facility in November 2021. Copies of the waste manifest will be included in Post-temporary Solution Status Report No. 10 in May 2022.

2.4 NATURAL SOURCE ZONE DEPLETION DATA COLLECTION

In November 2018, September 2020, and September-October 2021, AECOM conducted additional data collection activities, outside the scope of the OMM Program, including temperature profiling and soil gas screening measurements as part of an initial assessment of NSZD.

NSZD was assessed using a multiple lines of evidence approach to evaluate and quantify NSZD rates. The NSZD assessment included the following components in November 2018, September 2020, and September-October 2021:

- Evaluation of soil gas composition in the vadose zone to determine concentrations of hydrocarbons and respiration and/or biogenic gases associated with NSZD processes; and
- Subsurface temperature profiling to identify zones of elevated temperature and temperature differentials associated with NSZD processes.

Data collection locations were selected with the objective of obtaining adequate spatial coverage across the footprint of residual LNAPL impacts in the subsurface. Details on data collection, analysis methodology, and results of the NSZD assessment are provided below. Monitoring wells measured as part of these activities are depicted on Figure 1-3. A copy of the field records from the NSZD data collection events are included in Appendix B. An evaluation of the NSZD measurement results is presented in Section 4.

2.4.1 Soil Gas Screening

Soil gas screening was completed using methods outlined by Sweeney and Ririe (2017) on November 15, 2018 at ten wells located within the known historical extent of LNAPL (AE-3, AE-4, CW-1, CW-2, GZA-102S, GZA-105S, PZ-2S, TRC-101, TRC-102, and TRC-103) and on September 22, 2020 and on September 29 and October 1, 2021 in six wells located within the known historical extent of LNAPL (AE-3, CW-1, CW-2, GZA-105S, PZ-2S, and TRC-101). Gas screening was initiated by inserting ¼-inch diameter polyethylene tubing through a gas-tight fitting at the top of the well casing at all wells. The base of the tubing extended into the screened interval of the well to approximately 1 foot above the water table. It is noted that at wells CW-1 and CW-2 the well screens extend up into the well vault. During the November 2018 and September 2020 soil gas screening events, the well screens were in direct communication with the atmosphere. Prior to the 2021 event, tape was wrapped around the PVC screen to limit communication with the atmosphere during soil gas screening.

Data was collected using a Minirae 3000 photoionization detector (PID) and Landtec GEM 5000 landfill gas meter to measure concentrations of volatile organic compounds (VOCs), oxygen, methane (CH_4), and carbon dioxide in soil gas. An activated carbon filter was used on the landfill gas meter intake to remove VOCs from the gas sample to prevent VOCs from triggering a false or elevated CH_4 reading. Soil gas was purged using the internal pump on the field gas analyzers, and readings were recorded every 30 seconds until stable concentrations were achieved, defined as 3 consecutive readings within 10 percent of each other with no consistent increasing or decreasing trend. Soil gas readings were recorded on field data logs, which are provided in Appendix B.

2.4.2 Temperature Profiling

Subsurface temperature profiles were recorded in existing wells at the site to determine whether thermal anomalies associated with biodegradation of LNAPL constituents could be identified. The data were recorded on November 14, 2018, September 21, 2020, and September 27 and 30, 2021, using a thermocouple array and hand-held digital thermocouple thermometer at the following wells:

- Background: Temperature profile measurements at well GZA-12, located upgradient of the known extent of LNAPL impacts, were recorded to assess background subsurface temperature distribution during all three measurement events.
- Source Zone: Temperature profile measurements were recorded at 11 wells on November 14, 2018 (AE-3, AE-4, CW-1, CW-2, GZA-102R, GZA-105D, GZA-105S, PZ-2S, TRC-101, TRC-102, and TRC-103), and at seven wells on September 21, 2020 and September 27 and 30, 2021 (AE-3, CW-1, GZA-102R, GZA-105D, PZ-2S, TRC-102, and TRC-103) to assess subsurface temperature distribution within the LNAPL source zone.

Temperature measurements were recorded in 1-foot increments from ground surface to the total depth of each well. For temperature measurements in wells with a total depth exceeding 9 feet below ground surface, measurements were made from the shallow intervals prior to lowering the array to deeper intervals to ensure that temperature readings in the vadose zone were not affected by groundwater adhering to the thermocouples. The top of the well(s) was sealed to limit heat exchange with the atmosphere during data collection, and sufficient time (a minimum of 15 minutes) was allowed for the temperature probe to reach equilibrium with the surrounding subsurface materials. Following the equilibration period, temperatures were recorded in 30 second intervals until three readings were within 0.2 degrees Celsius of each other, with no consistent increasing or decreasing trend.

Temperature and fluid level gauging data were recorded on field data logs, which are presented in Appendix B.

SECTION 3
LIGHT NON-AQUEOUS PHASE LIQUID MONITORING AND PRODUCT RECOVERY

This section presents the results of the light non-aqueous phase liquid (LNAPL) monitoring, including discussion of the performance of the monitored natural attenuation relating to the LNAPL, and of the LNAPL remedial objectives and the progress during the reporting period toward meeting these objectives.

3.1 LIGHT NON-AQUEOUS PHASE LIQUID FREE PRODUCT RECOVERY

AECOM Technical Services Inc. (AECOM) performs LNAPL free product recovery intermittently as detailed in the Temporary Solution Statement (AECOM, 2017a). AECOM did not deploy any absorbent socks during this monitoring period, as a measurable thickness of LNAPL greater than 0.1 foot was not detected in any monitoring wells gauged during the monitoring events completed in May and August 2021.

3.2 LIGHT NON-AQUEOUS PHASE LIQUID MONITORED NATURAL ATTENUATION PERFORMANCE

The sections below include details related to the presence of LNAPL at the site and the monitored natural attenuation (MNA) of site LNAPL.

3.2.1 Demonstration that Monitored Natural Attenuation is Occurring as Expected for Light Non-Aqueous Phase Liquid

During this reporting period, LNAPL was not detected at a measurable thickness greater than 0.1-foot in any monitoring well when gauged. These results are consistent with seasonal fluctuations observed since 2010, as the thicknesses and frequency of LNAPL detections have decreased overall. The presence of LNAPL over the past 10 years has been limited to wells CW-1 and CW-2 with an occasional sheen in well PZ-2S. Wells CW-1 and CW-2 are shallow wells installed within a former excavation immediately downgradient of where the bedrock surface dips to the east beneath the Eastern Parking Lot (EPL). The current conceptual site model indicates that the presence of LNAPL in these wells is typically observed during periods of low water levels which apparently allows small amounts of residual LNAPL to weep from petroleum-impacted bedrock into the wells. Table 2-1 includes a summary of the historical LNAPL measurements, and Figure 3-1 depicts the reduction of the LNAPL plume onsite from 1992 to the present.

Although the very limited LNAPL plume size has not changed significantly in some time, it continues to generate a dissolved plume of petroleum hydrocarbons. These extractable petroleum hydrocarbon and volatile petroleum hydrocarbon (VPH) fraction concentrations are meaningful indicators of natural source-zone depletion. Long-term changes in these concentrations will be monitored in wells adjacent to the LNAPL plume to determine the effect MNA has on the plume.

3.2.2 Change in Conditions Affecting Light Non-Aqueous Phase Liquid Monitored Natural Attenuation

During this reporting period, there have been no changes in conditions affecting LNAPL MNA. As shown on Figures 3-2 through 3-5, detectable LNAPL thicknesses generally coincide with lower water levels. The depths to water measured in monitoring wells during this reporting period are similar to past periods when little to no measurable LNAPL was detected.

3.2.3 Verification that the Light Non-Aqueous Phase Liquid Plume is not Expanding

Response actions have previously been performed to assess LNAPL mobility and to meet the requirements of 310 Code of Massachusetts Regulations (CMR) 40.1003(7)(b). Based on the extensive measurement and evaluation of the LNAPL present at the site, it is apparent that the LNAPL is stable, as defined at 310 CMR 40.0006. The LNAPL footprint is not expanding as shown on Figure 3-1, nor is LNAPL migrating through any subsurface strata or discharging to a surface water body, structure, or utility. The extent of LNAPL has been well defined and measured regularly, with successful product removal via three former recovery wells operating between 1992 and 2002 and through subsequent manual and passive measures from 1999 to present. LNAPL at the site has micro-scale mobility, as it continues to be observed in small amounts intermittently in wells CW-1 and CW-2 when the water table is depressed sufficiently for residual LNAPL to weep from bedrock into soil.

Graphs of the depth to groundwater compared to LNAPL thickness over time in wells CW-1, CW-2, PZ-2S, and TRC-201, are presented on Figures 3-2 through 3-5. These graphs show that, in general, greater LNAPL thickness tends to coincide with lower water levels. The amount of LNAPL recoverable during periods of low water levels has decreased over time due to the LNAPL removal efforts. As a result, LNAPL removal via passive measures is currently minimal. The lack of LNAPL in monitoring wells TRC-101, AE-03, AE-04, PZ-2S, and GZA-102S bounds the area around CW-1 and CW-2, where LNAPL is still periodically detected.

3.2.4 Verification of the Absence of Non-Stable Light Non-Aqueous Phase Liquid

Since December 2010, well CW-1 has had little evidence of LNAPL while CW-2 generally exhibits a sheen. Both wells have had periodic measurable LNAPL thickness generally ranging from 0.01 to 0.03 feet, with the thickest measurements of 0.12 feet in CW-1 observed in September 2016 and 0.08 feet in CW-2 in September 2015. The two thickest measurements were taken when the groundwater was the lowest observed on-site in over 10 years. During this reporting period, the depth to water was similar to past periods when little to no measurable LNAPL was detected. LNAPL has not been detected in TRC-101 since 2002. LNAPL has not been detected in wells AE-03 or AE-04 since their installation in 2012. It is apparent that the LNAPL remaining at the site is limited, stable, and only has micro-scale mobility at most, based on the behavior of the LNAPL in the wells.

3.2.5 Verification of Attainment of Remedial Objectives for Light Non-Aqueous Phase Liquid

The remedial objectives are being attained for LNAPL–continued monitoring and passive recovery (when possible) as detailed below and in the Temporary Solution Statement submitted to the Massachusetts Department of Environmental Protection (MassDEP) in May 2017. Given the intermittent presence of LNAPL in monitoring wells in the EPL area and the limited recoverability of LNAPL (approximately 2.81 gallons removed between December 2010 and September 2021) it has been demonstrated, in accordance with the MassDEP LNAPL Guidance (MassDEP, 2016b), that active LNAPL recovery is no longer feasible. However, based on recent gauging data, LNAPL with micro-scale mobility remains within the area adjacent to the former Tank Farm and EPL.

A remedial alternative evaluation was presented as Table 5-1 of the Phase III Remedial Action Plan (AECOM, 2017c) relating to residual petroleum contaminants at the aquifer capillary fringe in the former Tank Farm and EPL areas, where free product with micro-scale mobility has been observed. Continued monitoring of natural attenuation processes and passive recovery of product, if possible, was selected as the alternative remedial action for LNAPL present in these areas. These areas have been shown to have low levels of volatile organic compounds in groundwater and soils, but contain VPH, particularly the C9-C10 aromatic fraction, above standards in groundwater, in addition to free-phase LNAPL with micro-scale mobility.

The selected remedial alternative, which entails monitoring and passive removal of LNAPL (if present), is being performed and appears to be proceeding toward attainment of the remedial objectives for LNAPL.

SECTION 4
NATURAL SOURCE ZONE DEPLETION EVALUATION

This section presents the results of the temperature profiling and soil gas screening measurements conducted as part of the natural source zone depletion (NSZD) assessment from November 2018, September 2020, and September-October 2021.

4.1 NATURAL SOURCE ZONE DEPLETION ASSESSMENT RESULTS

A NSZD assessment utilizing both the temperature and soil gas screening methods was completed at the site to evaluate the rate of light non-aqueous phase liquid (LNAPL) depletion through the natural mechanisms of volatilization, dissolution, and biodegradation (ITRC, 2018). A detailed memorandum presenting the NSZD assessment, background, calculations, and results is included in Appendix C. Table 4-1 presents a summary of the NSZD rates. The results of the NSZD assessment are summarized below.

- Qualitative analysis indicates that NSZD processes are occurring, as demonstrated by:
  - Methane (CH_4) was detected in 82% of the soil gas measurements, indicating that methanogenesis is occurring near the base of the vadose zone and/or within the saturated zone at the site.
  - Measurable concentrations of VOCs were observed in 82% of soil gas measurements, including all measurements in 2020 and 2021, indicating LNAPL depletion through volatilization is occurring.
  - Carbon dioxide (CO_2), a product of aerobic biodegradation of hydrocarbons, was found at concentrations greater than atmospheric levels (approximately 0.04 percent by volume [vol%]) in all measurements.
  - Oxygen (O_2) concentrations were below atmospheric levels (approximately 20.9 vol%) for all measurements in 2020 and 2021, indicating O_2 utilization by aerobic microorganisms.
  - Temperatures higher than background were observed in the subsurface in all of the wells located within the zone of known historical extent of LNAPL impacts for all three NSZD measurement events.
- A quantitative analysis showed that NSZD rates ranged from approximately 100 to 2,800 gallons per acre per year (gal/ac/yr), with a median rate of approximately 670 gal/ac/yr,

based on rates from both methods, provided below. These NSZD rates are consistent with values typically reported in the literature, ranging from 300 to 7,700 gal/acre/yr with the middle 50% of the NSZD rates ranging from 700 to 2,800 gal/acre/yr (Garg et. al. 2017).

- LNAPL depletion rates estimated from the soil gas data ranged from approximately 100 to 970 gal/ac/yr, with an average value of approximately 440 gal/ac/yr.
- LNAPL depletion rates estimated from the temperature profiling ranged from approximately 420 to 2,800 gal/ac/yr, with an average value of approximately 1,400 gal/ac/yr.
- These estimated NSZD rates, although seemingly high for an old, weathered LNAPL body, are not unreasonable considering:
  - An LNAPL smear zone thickness of approximately 5 feet based on water table fluctuations tabulated in the memo in Appendix C;
  - Soil porosity of approximately 0.3, based on the range of porosity values estimated for coarse sands and gravels (0.25) and fine sands (0.35) observed within the smear zone depth interval (AECOM 2017b).
  - Given the above values for smear zone thickness and soil porosity, the median estimated depletion rate of 670 gal/acre/yr (approximately 0.002 $ft^3/ft^2/yr$) is equivalent to an annual reduction in LNAPL saturation of approximately 0.14 percent of pore space per year.
  - Historical fluid level gauging data at the site indicate that the extent of LNAPL in monitoring wells has gradually declined over time (see Figure 1 in Appendix C). This indicates that LNAPL saturation has gradually decreased to residual saturation levels, likely in the range of 2 to 19 percent of pore space (Brost and DeVaull, 2000), consistent with the small annual reduction in LNAPL saturation estimated from the NSZD results at the site.

4.2 NATURAL SOURCE ZONE DEPLETION ASSESSMENT CONCLUSION

Historical data and results of the NSZD evaluation support the selected remedial alternative outlined in the Phase III Remedial Action Plan (AECOM 2017c) that entails continued monitoring and removal of LNAPL in wells, when present. The NSZD rates are expected to fluctuate year to year with seasonal variation in groundwater elevations and temperature fluctuations within the area of residual LNAPL impacts onsite (approximately 0.5-0.7 acres). NSZD processes will continue to decrease the VOCs and VPH fraction concentrations in groundwater; however, it is unlikely that these levels will be reduced to below MassDEP GW-1 standards in the near future.

SECTION 5
DEMONSTRATION OF EFFECTIVE INSTITUTIONAL CONTROLS

The temporary solution for the site includes the implementation of an activity and use limitation (AUL) to eliminate the potential for future residential indoor air exposure/risk, contact with residual soil contamination, and potential contact with residual light non-aqueous phase liquid.

On July 13, 2015, Wilmington Realty Trust (WRT) placed an AUL on the portion of the site owned by WRT, encompassing Buildings 1, 1A, and 2. This AUL was established to prevent uses of the former General Electric Company property that would be inconsistent with maintaining a condition of No Substantial Hazard under the Massachusetts Contingency Plan (MCP). These prohibited uses include the following:

- Residential, school, playground, park, or daycare use; and
- Activities that would result in exposure to or the disturbance of potentially contaminated soils, bedrock, groundwater, and indoor air, unless appropriate precautions to prevent human exposure are taken, as described in the AUL.

In addition, the AUL imposes certain obligations and conditions to maintain a condition of "No Substantial Hazard," including maintenance of concrete floors, management of any excavated soil and/or bedrock under Soil Management Procedures set forth in 310 Code of Massachusetts Regulations (CMR) 40.0030, and appropriate management of any groundwater removed during dewatering activities. Lastly, any activities, which could result in exposure to or disturbance of soil, bedrock, or groundwater, must be conducted in accordance with some or all of the following, as determined by a licensed site professional:

- the performance standards for release abatement measures set forth by the MCP at 310 CMR 40.0440 (Massachusetts Department of Environmental Protection [MassDEP], 2014)
- the soil management procedures pursuant to 310 CMR 40.0030, the Similar Soils Provisions Guidance (WSC# 13-500; MassDEP, 2014)
- Construction of Buildings in Contaminated Areas (Policy WSC# 00 425; MassDEP, 2000a)

- applicable health and safety procedures outlined in 310 CMR 40.0018

The objectives of the AUL are being met and the institutional controls in place at the site are effectively maintaining a condition of “No Substantial Hazard.”

SECTION 6
CONDITIONS OR PROBLEMS AFFECTING THE REMEDIAL ACTION

No conditions or problems were identified during this reporting period that may have the potential to affect the remedial action.

SECTION 7
FUTURE MONITORING

The Post-temporary Solution Operation, Maintenance, and/or Monitoring Plan will continue to be implemented according to the schedule presented in Table 7-1, which includes activities described below to be completed up to submittal of the first five-year review of the temporary solution due in May 2022.

- Annual indoor air monitoring of on-site buildings during the heating season to monitor indoor air conditions. During this event, indoor air samples will be collected from approximately six to seven locations in Building 1, and potentially at up to four locations in Building 1A. Indoor air sampling is not conducted within Building 2 as the groundwater plume has not been documented beneath this area of the site. Samples will be collected following procedures contained in the Massachusetts Department of Environmental Protection (MassDEP) Vapor Intrusion Guidance Policy #WSC-16-435 dated October 14, 2016 (MassDEP, 2016a). One ambient air sample will be collected during each annual event. Samples will be analyzed for volatile organic compounds via TO-15 selective ion monitoring including Freon-113. Meteorological data will be obtained from a weather station within a few miles of the site. The results of each indoor air-sampling event will be presented in the May status report each year. The next indoor air-sampling event is scheduled to take place in 2022 with a target date of late January to early February depending on the nature of tenant operations within Building 1.

- Quarterly light non-aqueous phase liquid (LNAPL) gauging of seven monitoring wells (i.e., AE-03, AE-04, CW-1, CW-2, GZA-102S, PZ-2S, and TRC-101) located in the western portion of the Eastern Parking Lot to monitor the presence/absence of LNAPL in this area. If LNAPL thickness of greater than 0.1 feet is detected in a well, an absorbent sock will be deployed to absorb the LNAPL for subsequent disposal. Gauging events will be conducted each quarter with target dates of March, June, September, and December, annually, with the December and March results presented in May, and the June and September results presented in November. The next quarterly LNAPL gauging event is scheduled to take place in November 2021. The remedial alternative selected for LNAPL is monitored natural attenuation (MNA). To monitor the progress of LNAPL behavior more specifically, the dissolved phase petroleum hydrocarbon "halo" surrounding the LNAPL area will be evaluated over time. This will provide a leading indicator of the potential dissolution of LNAPL and subsequent natural degradation of the associated dissolved phase plume.

- Annual groundwater sampling of select monitoring wells for analysis of site chemicals of concern (i.e., chlorinated volatile organic compounds, 1,4-dioxane, petroleum hydrocarbons, and arsenic) and relevant MNA parameters in the overburden and bedrock groundwater. Each groundwater sampling event will include a site-wide water level measurement round. The next annual groundwater sampling event will be conducted in September 2022.

- Submittal of semiannual Post-temporary Solution Status and Remedial Monitoring Reports. The next semiannual report is due to the MassDEP in May 2022.

- Submittal of a periodic review of site conditions every five years to evaluate new technologies and their potential to achieve a permanent solution. The next five-year review of the temporary solution is due to the MassDEP in May 2022. Per the requirements for Public Involvement Activities under 310 CMR 40.1403, Lockheed Martin will send written notices of availability of the May 2022 post-temporary solution status report/5-year review submittal to the Chief Municipal Officer and Board of Health for the towns of Wilmington and North Reading. In addition, per the November 2000 Public Involvement Plan (PIP) for the Wilmington site, written notices of availability of the May 2022 post-temporary solution status report/5-year review submittal will be sent to the PIP mailing list. These written notices will be sent within seven days of the filing of the submittal to the MassDEP. A hard copy of the document will be sent to the repository located in the Town of North Reading Library and electronic copies will be uploaded to the LMC and MassDEP web sites.

SECTION 8
MODIFICATIONS TO THE MONITORING PROGRAM

During this monitoring period, no modifications were made to the monitoring program as presented in the May 2017 Temporary Solution Statement, or the updated post-temporary solution Operation Maintenance and/or Monitoring (OMM) groundwater monitoring plans submitted to Massachusetts Department of Environmental Protection (MassDEP) on September 6, 2018 and in Post-temporary Solution Status Report Number 8 submitted to MassDEP on May 2, 2021. Additional data was collected outside the scope of the OMM Program in November 2018, September 2020, and September-October 2021 to support the evaluation of natural source zone depletion.

SECTION 9
LICENSED SITE PROFESSIONAL OPINION AND CONCLUSIONS

Comprehensive response actions at the site are limited to active remedial monitoring that includes monitored natural attenuation under post-temporary solution status. It is AECOM Technical Services Inc.'s opinion that the performance standards outlined in 310 Code of Massachusetts Regulations 40.0897, and as presented in the Temporary Solution Statement submitted to the Massachusetts Department of Environmental Protection by AECOM Technical Services, Inc. in May 2017, are being accomplished. Based upon indoor air data collected to date, a critical exposure pathway or imminent hazard does not exist within Buildings 1 and 1A. Based upon light non-aqueous phase liquid gauging data collected during this reporting period, the existing light non-aqueous phase liquid has micro-scale mobility (can flow into a well); however, the light non-aqueous phase liquid is stable and not expanding. The NSZD evaluation supports the selected remedial alternative outlined in the Phase III Remedial Action Plan (AECOM 2017c) that entails continued monitoring and removal of LNAPL in wells, when present.

The seal and signature of the licensed site professional who prepared this Post-temporary Solution Status Report Number 7 are set forth on the applicable Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup transmittal forms (BWSC-108) submitted via eDEP.

SECTION 10
PUBLIC NOTIFICATION

The former General Electric Company facility is part of a joint multi-site Public Involvement Plan (PIP) with other potentially responsible parties that was prepared in 2000 by the Massachusetts Department of Environmental Protection (MassDEP). Because the site is a PIP site, additional regulatory requirements above the minimum requirements of the Massachusetts Contingency Plan (MCP) apply.

During the Post-temporary Solution period, Post-temporary Solution Status Reports are required by the MCP to be submitted every six months to the MassDEP. In accordance with the November 17, 2000 PIP (MassDEP, 2000b), these Status Reports are also required to be provided to the designated information repository established in the PIP (Flint Memorial Library, Town of North Reading). All members of the PIP mailing list, including the Chief Municipal Officer and Board of Health agent for the towns of Reading, North Reading, and Wilmington, were notified of the availability of this report by mail. A copy of the letter sent to the PIP mailing list concerning the availability of documents in the repository, as required under the PIP (MassDEP, 2000b), was included in the initial Post-temporary Solution Status Report (AECOM, 2017d) submitted to the MassDEP in November 2017. This PIP notice informed the mailing list of the availability of semiannual Post-temporary Solution Status Reports every six months from November 2017 through May 2022.

SECTION 11
REFERENCES

AECOM Technical Services, Inc., 2013. Remedy Operation Status Report, ROS (Remedy Operation Status) Termination, and Tier 1A Permit Extension, Former General Electric Site, 50 Fordham Road, Wilmington, MA. March 2013.

______, 2014. Tier Classification Extension Supporting Documentation, Former General Electric Site, 50 Fordham Road, Wilmington, MA, RTN (Release Tracking Number) 3-0518, October 10, 2014.

______, 2017a. Draft Temporary Solution Statement, Former General Electric Facility, 50 Fordham Road, Wilmington, MA, RTN 3-0518. May 2017.

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______, 2017c. Draft Phase III Remedial Action Plan, Former General Electric Facility, 50 Fordham Road, Wilmington, MA, RTN 3-0518. May 2017.

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______, 2014. Massachusetts Contingency Plan, 310 CMR 40.0000, December 31, 2007, Amended April 25, 2014 and June 20, 2014.

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______, 2016b. Light Non-Aqueous Phase Liquids (LNAPL) and the MCP: Guidance for Site Assessment and Closure, Policy #WSC-16-450. February 19, 2016.

TRC Companies, Inc., 2004. Phase IV As-Built and Final Inspection Report and Partial Response Action Outcome (RAO) Statement - Wetlands, Former GE (General Electric) Facility (RTN# 3-0518), Wilmington, Massachusetts. December 2004.

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______, 2010. Partial Response Action Outcome, Tank K Area, Former GE Facility (RTN 3-0518), Wilmington, Massachusetts. November 2010.

FIGURES

Figure 1-1 Site Location Map

Figure 1-2 Site Plan

Figure 1-3 Monitoring Well Locations

Figure 3-1 Tank Farm EPL Extent of LNAPL Impacts

Figure 3-2 CW 1 – Depth to Water versus LNAPL Thickness

Figure 3-3 CW 2 – Depth to Water versus LNAPL Thickness

Figure 3-4 PZ 2S – Depth to Water versus LNAPL Thickness

Figure 3-5 TRC 101 – Depth to Water versus LNAPL Thickness

AECOM

Former GE Facility
50 Fordham Road, Wilmington, MA

SITE LOCATION MAP

DATE: 10/10/2017

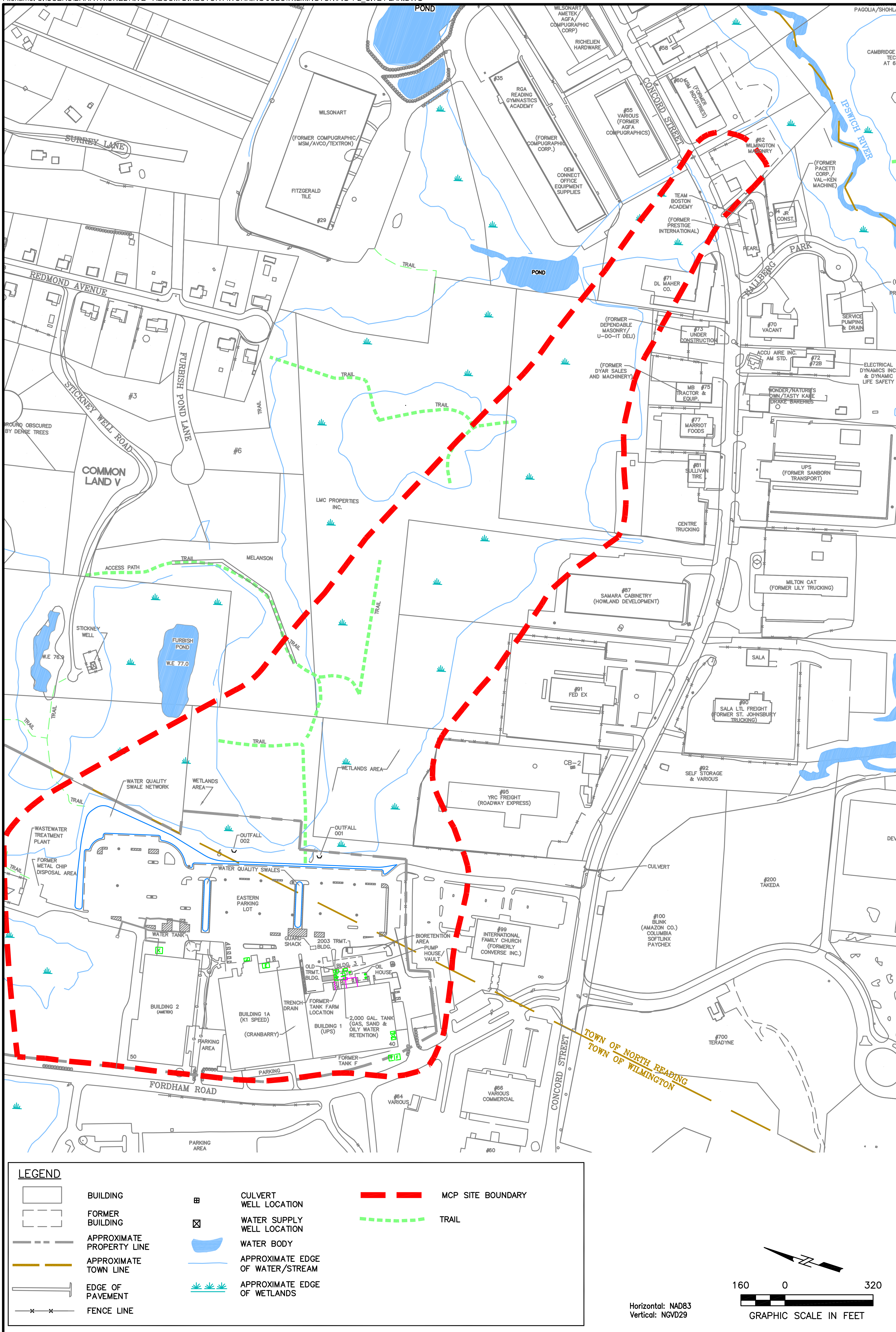
PROJECT: 60552044

FIGURE: 1-1

Path: L:\Gisprojects\Projects\Site-Location\MA\60267214 GE Wilmington\Fig 2 1 Site Location Map.mxd

Last saved by: BARRYK(2021-10-27) Last Plotted: 2021-10-27
Filename: C:\USERS\BARRYK\ONEDRIVE - AECOM DIRECTORY\WORKING JOBS\WILMINGTON\FIG 1-2_SITE PLAN.DWG

Project Management Initials: Designer: K.P.B. Checked: S.O. Approved: S.O. ANSI B 11" x 17"



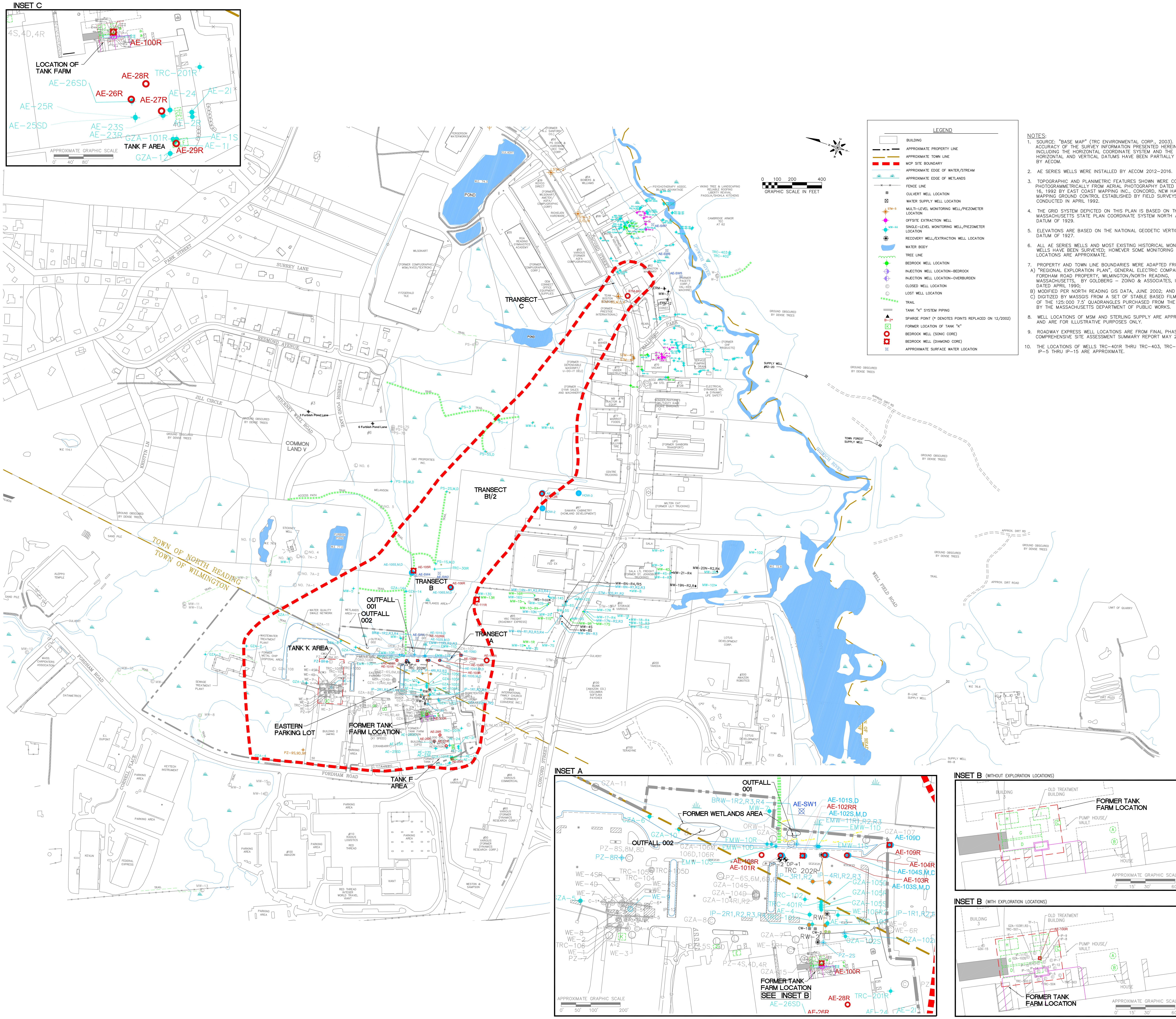
Former GE Facility - 50 Fordham Rd, Wilmington, MA
Lockheed Martin Corporation

SITE PLAN

AECOM

60552044 2021-10-27

FIGURE: 1-2



LEGEND

- BUILDING
- APPROXIMATE PROPERTY LINE
- APPROXIMATE TOWN LINE
- MCP SITE BOUNDARY
- APPROXIMATE EDGE OF WATER/STREAM
- APPROXIMATE EDGE OF WETLANDS
- FENCE LINE
- CULVERT WELL LOCATION
- WATER SUPPLY WELL LOCATION
- STM-5 MULTI-LEVEL MONITORING WELL/PIEZOMETER LOCATION
- OFFSITE EXTRACTION WELL
- MW-4A SINGLE-LEVEL MONITORING WELL/PIEZOMETER LOCATION
- RECOVERY WELL/EXTRACTION WELL LOCATION
- WATER BODY
- TREE LINE
- BEDROCK WELL LOCATION
- INJECTION WELL LOCATION–BEDROCK
- INJECTION WELL LOCATION–OVERBURDEN
- CLOSED WELL LOCATION
- LOST WELL LOCATION
- TRAIL
- TANK "K" SYSTEM PIPING
- B-2* SPARGE POINT (* DENOTES POINTS REPLACED ON 12/2002)
- FORMER LOCATION OF TANK "K"
- BEDROCK WELL (SONIC CORE)
- BEDROCK WELL (DIAMOND CORE)
- APPROXIMATE SURFACE WATER LOCATION

NOTES:

1. SOURCE: "BASE MAP" (TRC ENVIRONMENTAL CORP., 2003). THE ACCURACY OF THE SURVEY INFORMATION PRESENTED HEREIN, INCLUDING THE HORIZONTAL COORDINATE SYSTEM AND THE HORIZONTAL AND VERTICAL DATUMS HAVE BEEN PARTIALLY VERIFIED BY AECOM.
2. AE SERIES WELLS WERE INSTALLED BY AECOM 2012–2016.
3. TOPOGRAPHIC AND PLANIMETRIC FEATURES SHOWN WERE COMPILED PHOTOGRAMMETRICALLY FROM AERIAL PHOTOGRAPHY DATED APRIL 16, 1992 BY EAST COAST MAPPING INC., CONCORD, NEW HAMPSHIRE. MAPPING GROUND CONTROL ESTABLISHED BY FIELD SURVEYS CONDUCTED IN APRIL 1992.
4. THE GRID SYSTEM DEPICTED ON THIS PLAN IS BASED ON THE MASSACHUSETTS STATE PLAN COORDINATE SYSTEM NORTH AMERICAN DATUM OF 1929.
5. ELEVATIONS ARE BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1927.
6. ALL AE SERIES WELLS AND MOST EXISTING HISTORICAL MONITORING WELLS HAVE BEEN SURVEYED; HOWEVER SOME MONITORING WELL LOCATIONS ARE APPROXIMATE.
7. PROPERTY AND TOWN LINE BOUNDARIES WERE ADAPTED FROM:
   A) "REGIONAL EXPLORATION PLAN", GENERAL ELECTRIC COMPANY, 50 FORDHAM ROAD PROPERTY, WILMINGTON/NORTH READING, MASSACHUSETTS, BY GOLDBERG – ZOINO & ASSOCIATES, INC., DATED APRIL 1990;
   B) MODIFIED PER NORTH READING GIS DATA, JUNE 2002; AND
   C) DIGITIZED BY MASSGIS FROM A SET OF STABLE BASED FILM PRINTS OF THE 125:000 7.5' QUADRANGLES PURCHASED FROM THE USGS BY THE MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS.
8. WELL LOCATIONS OF MSM AND STERLING SUPPLY ARE APPROXIMATE AND ARE FOR ILLUSTRATIVE PURPOSES ONLY.
9. ROADWAY EXPRESS WELL LOCATIONS ARE FROM FINAL PHASE 2 COMPREHENSIVE SITE ASSESSMENT SUMMARY REPORT MAY 28, 2002.
10. THE LOCATIONS OF WELLS TRC-401R THRU TRC-403, TRC-505 AND IP-5 THRU IP-15 ARE APPROXIMATE.

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FIGURE: 1-3

MONITORING WELL LOCATIONS

Former GE Facility - 50 Fordham Rd, Wilmington, MA

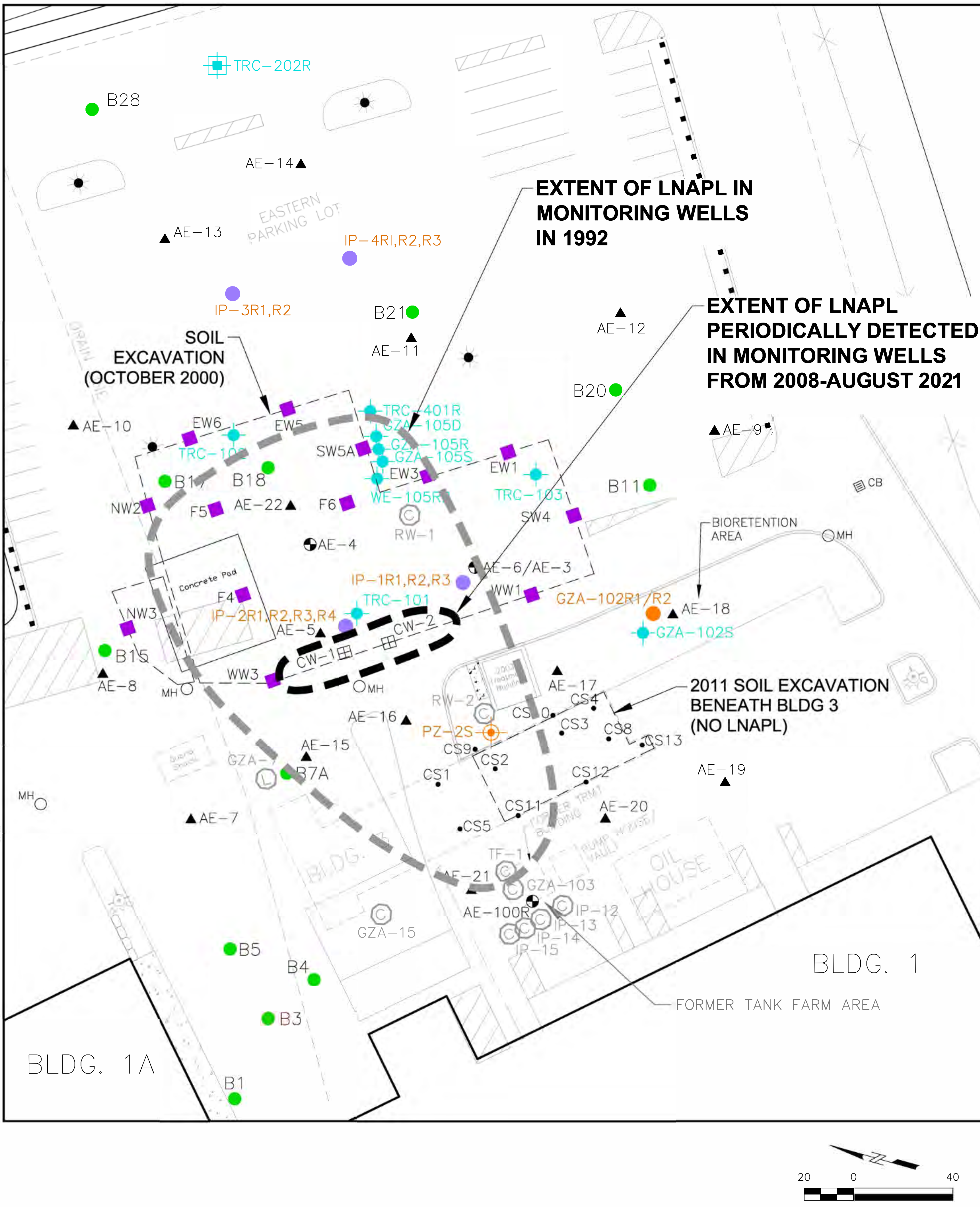
Lockheed Martin Corporation

Date: 2021-04-12

60552044

Filename: C:\USERS\BARRYK\ONEDRIVE - AECOM DIRECTORY\WORKING JOBS\WILMINGTON\FIG 1-2_SITE PLAN.DWG Last saved by: BARRYK Last Plotted: 2021-04-12

Project Management Initials: K.P.B. S.O. Designer: K.P.B. S.O. Checked: S.O. Approved: S.O. ARCH C 18" x 24"



LEGEND

- MONITORING WELL LOCATIONS
- 2012 SOIL BORING LOCATION
- 1999-2000 SOIL BORING LOCATION (APPROXIMATE)
- 2011 BUILDING 3 POST EXCAVATION SOIL SAMPLE LOCATION (APPROXIMATE)
- 2000 EPL POST EXCAVATION SOIL SAMPLE LOCATION (APPROXIMATE)
- CLOSED WELL LOCATION
- LOST WELL LOCATION
- APPROXIMATE EXTENT OF LNAPL IN 2008-2018 (CW-1, CW-2) [APPROX. 1,792.8 SQ. FT.]
- APPROXIMATE EXTENT OF LNAPL IN 1992 (TF-1, RW-1, RW-2, PZ-2S, GZA-105S, DP-5, DP-6) [APPROX. 19,574.3 SQ. FT.]

SOURCE:

1. EPL Soil Borings (B1, B4, B11, B15, B17, B18, B21, B28) from Phase III RAP Addendum Report (TRC, March 2000)
2. Post Excavation Soil Samples (floor and side walls) and Confirmatory Soil Boring Samples (B7A, B20) from Phase IV As-Built Construction and Final Inspection Report (TRC, January 2001)
3. Building 3 Post Excavation Soil Samples (CS-1 through CS-5, CS-8 through CS-12) from RAM Completion Report (TetraTech, March 2012)
4. Eastern Parking Lot Soil Borings (AE-4 through AE-22, excluding AE-12, -13, -14) from Phase II Comprehensive Site Assesment (AECOM, 2017)

Former GE Facility - 50 Fordham Rd, Wilmington, MA
Lockheed Martin Corporation

TANK FARM - EPL
EXTENT OF LNAPL IMPACTS

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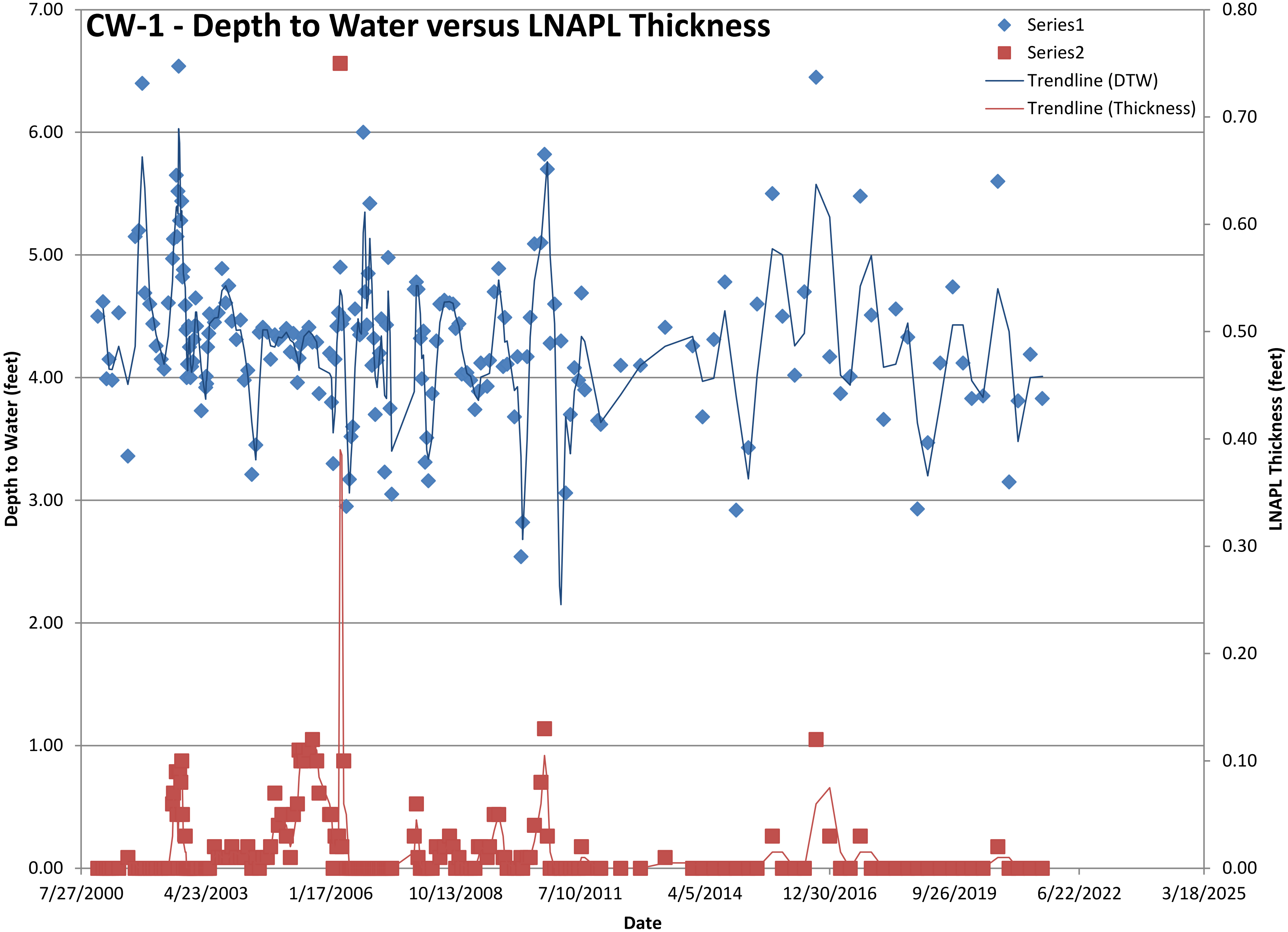
60552044 2021-09-20

FIGURE: 3-1

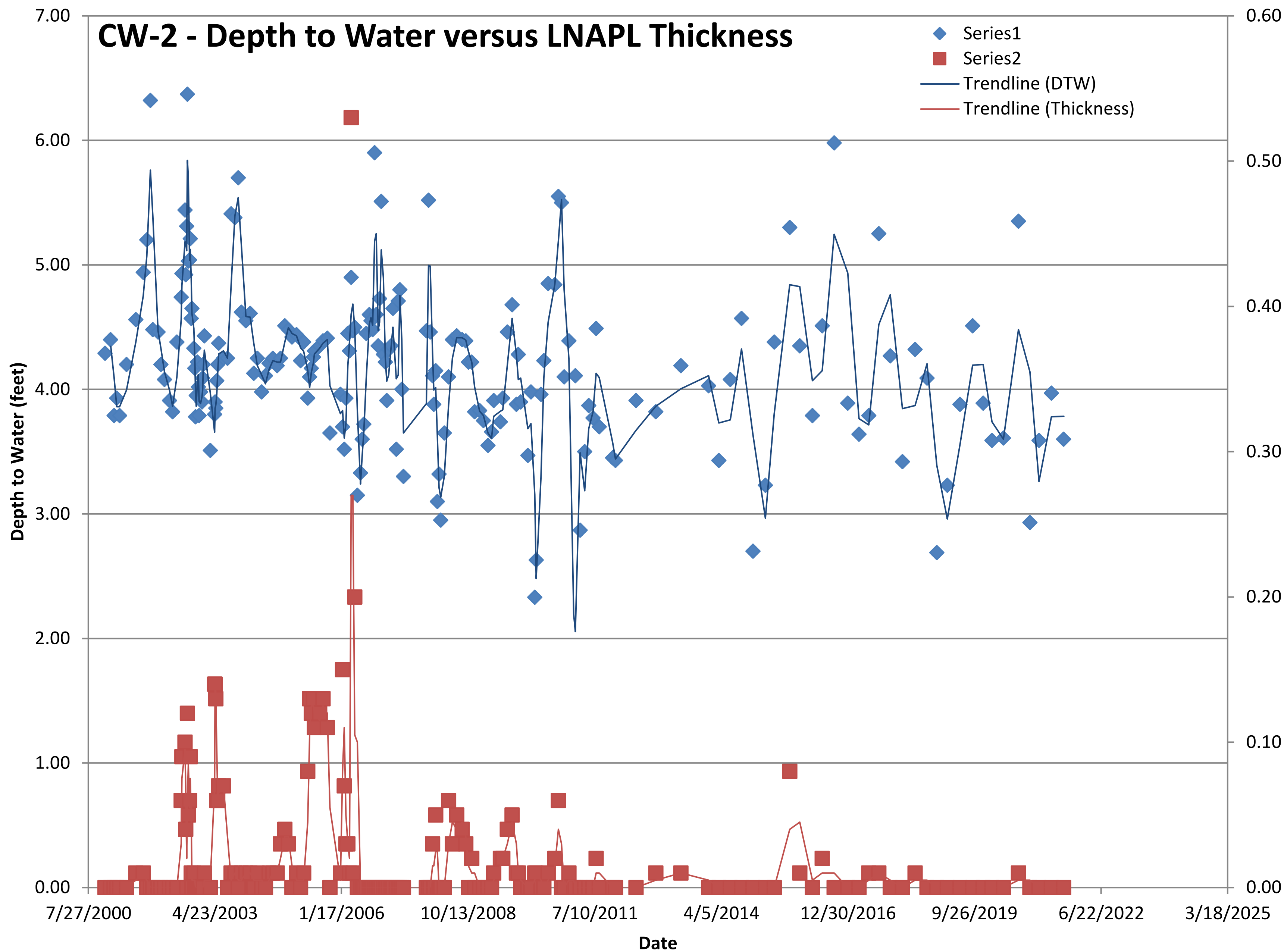


AECOM

Figure: 3-2

CW-1 - DEPTH TO WATER VS LNAPL THICKNESS

Former GE Facility - 50 Fordham Rd, Wilmington, MA
Client Lockheed Martin Corporation
60552044
9/28/2021

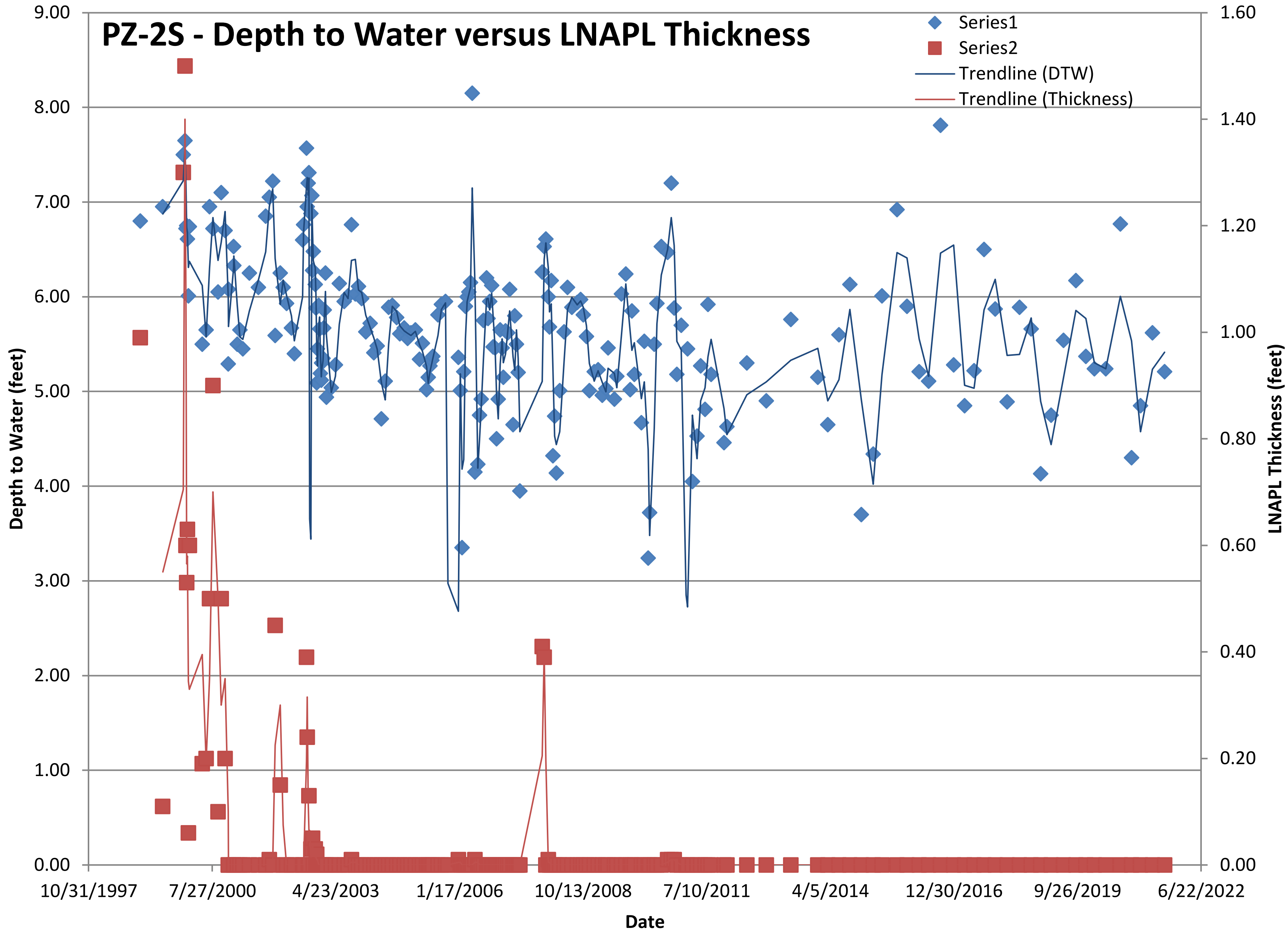


AECOM

Figure: 3-3

CW-2 - DEPTH TO WATER VS LNAPL THICKNESS

Former GE Facility - 50 Fordham Rd, Wilmington, MA
Client Lockheed Martin Corporation
60552044
9/28/2021



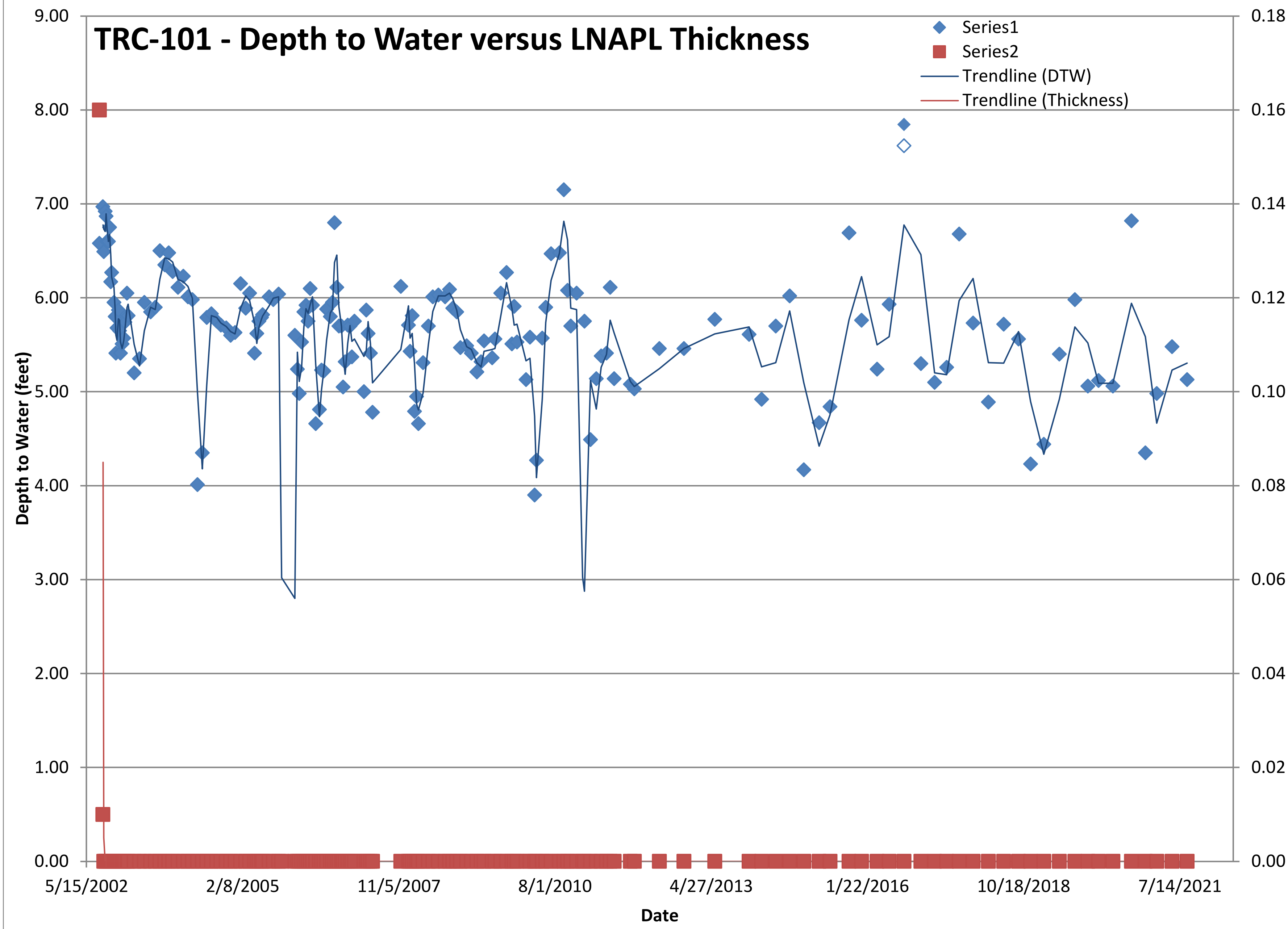
AECOM

Figure: 3-4

PZ-2S - DEPTH TO WATER VS LNAPL THICKNESS

Former GE Facility - 50 Fordham Rd, Wilmington, MA
Client Lockheed Martin Corporation
60552044

9/28/2021



AECOM

Figure: 3-5

TRC-101 - DEPTH TO WATER VS LNAPL THICKNESS

Former GE Facility - 50 Fordham Rd, Wilmington, MA
Client Lockheed Martin Corporation
60552044
9/28/2021

TABLES

Table 2-1
Summary of Historical LNAPL Gauging and Removal Results
Former GE Facility, 50 Fordham Road, Wilmington, MA

	PZ-2S				CW-1				CW-2				TRC-101				AE-3				AE-4				GZA-102S			
Date	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)
4/15/1994	(1)	(1)	0.85	(2)	(3)				(3)				(3)				(3)				(3)				NR	NR	0	NR
6/20/1994	(1)	(1)	0.22	(2)	(3)				(3)				(3)				(3)				(3)				NR	NR	0	NR
12/14/1994	(1)	(1)	0.39	(2)	(3)				(3)				(3)				(3)				(3)				NR	NR	0	NR
6/14/1995	(1)	(1)	0	(2)	(3)				(3)				(3)				(3)				(3)				NR	NR	0	NR
12/19/1995	(1)	(1)	0.25	(2)	(3)				(3)				(3)				(3)				(3)				NR	NR	0	NR
6/10/1996	(1)	(1)	0.21	(2)	(3)				(3)				(3)				(3)				(3)				NR	NR	0.1	NR
12/9/1996	(1)	(1)	0.83	(2)	(3)				(3)				(3)				(3)				(3)				NR	NR	0	NR
6/30/1997	(1)	(1)	0.17	(2)	(3)				(3)				(3)				(3)				(3)				NR	NR	0	NR
12/29/1997	(1)	(1)	0	(2)	(3)				(3)				(3)				(3)				(3)				NR	NR	0	NR
9/11/1998	(1)	(1)	0.15	(2)	(3)				(3)				(3)				(3)				(3)				NR	NR	0	NR
12/23/1998	6.8	5.81	0.99	(2)	(3)				(3)				(3)				(3)				(3)				NR	NR	0	NR
6/23/1999	6.95	6.84	0.11	(2)	(3)				(3)				(3)				(3)				(3)				NR	NR	0	NR
12/6/1999	7.5	6.2	1.3	0.2	(3)				(3)				(3)				(3)				(3)				6.52	NA	NA	0
12/20/1999	7.65	6.15	1.5	0.26	(3)				(3)				(3)				(3)				(3)				(9)			
12/29/1999	6.72	6.12	0.6	0.13	(3)				(3)				(3)				(3)				(3)				(9)			
1/4/2000	6.75	6.22	0.53	0.13	(3)				(3)				(3)				(3)				(3)				(9)			
1/10/2000	6.61	5.98	0.63	0.13	(3)				(3)				(3)				(3)				(3)				(9)			
1/18/2000(4)	6.01	5.95	0.06	0.13	(3)				(3)				(3)				(3)				(3)				(9)			
1/25/2000	6.74	6.14	0.6	0.13	(3)				(3)				(3)				(3)				(3)				(9)			
5/8/2000*	5.5	5.31	0.19	0.01	(3)				(3)				(3)				(3)				(3)				(9)			
6/9/2000	5.65	5.45	0.2	0.01	(3)				(3)				(3)				(3)				(3)				(9)			
7/7/2000	6.95	6.45	0.5	0.02	(3)				(3)				(3)				(3)				(3)				6.50	NA	NA	0
8/2/2000	6.72	5.82	0.9	0.04	(3)				(3)				(3)				(3)				(3)				(9)			
9/12/2000	6.05	5.95	0.1	0.01	(3)				(3)				(3)				(3)				(3)				(9)			
10/9/2000	7.1	6.6	0.5	0.03	(3)				(3)				(3)				(3)				(3)				(9)			
11/8/2000	6.7	6.5	0.2	0.01	NM				NM				(3)				(3)				(3)				(9)			
12/5/2000(5)	5.29	NA	0	0	NM				NM				NM				(3)				(3)				(9)			
12/7/2000	6.08(6)	NA	0	0	4.50(6)	NA	0	0.00	4.29(6)	NA	0	0.00	NM				(3)				(3)				(9)			
1/16/2001	6.53(6)	NA	0	0	NM				NM				NM				(3)				(3)				(9)			
1/19/2001	6.33(6)	NA	0	0	4.62	NA	0	0.00	4.4	NA	0	0.00	NM				(3)				(3)				(9)			
2/15/2001	5.5	NA	0	0	3.99(6)	NA	0	0.00	3.79(6)	NA	0	0.00	NM				(3)				(3)				(9)			
3/9/2001	5.65(6)	NA	0	0	4.15(6)	NA	0	0.00	3.93(6)	NA	0	0.00	NM				(3)				(3)				(9)			
4/01/2001	5.45	NA	0	0	3.98(6)	NA	0	0.00	3.79(6)	NA	0	0.00	NM				(3)				(3)				(9)			
5/24/2001	6.25	NA	0	0	4.53(6)	NA	0	0.00	4.2(6)	NA	0	0.00	NM				(3)				(3)				(9)			
8/6/2001	6.1	NA	0	0	3.36	3.35	0.01	0.00	4.56	4.55	0.01	0.00	NM				(3)				(3)				(9)			
10/4/2001	6.85	NA	0	0	5.15(6)	NA	0	0.00	4.94	4.93	0.01	0.00	NM				(3)				(3)				(9)			
11/1/2001	7.05	7.04	0.01	0	5.2	NA	0	0.00	5.2	NA	0	0.00	NM				(3)				(3)				(9)			
11/29/2001	7.22	NA	0	0	6.4	NA	0	0.00	6.32	NA	0	0.00	NM				(3)				(3)				(9)			
12/19/2001	5.59	5.14	0.45	0	4.69	NA	0	0.00	4.48	NA	0	0.00	NM				(3)				(3)				(9)			
1/9/2002	NA	NA	NA	0.26	NA	NA	0	0.00	NA	NA	0	0.00	NM				(3)				(3)				(9)			
1/29/2002	6.25	6.1	0.15	0	4.6	NA	0	0.00	4.46	NA	0	0.00	NM				(3)				(3)				(9)			
2/18/2002	LNAPL removed via vacuum extraction at PZ-2S, CW-1, and CW-2.												NM				(3)				(3)				(9)			
2/21/2002	Tank Farm System is turned off. Booms are removed from CW-1 and CW-2.												NM				(3)				(3)				(9)			
2/21/2002	6.1	NA	0	0	4.44	NA	0	0.00	4.2	NA	0	0.00	NM				(3)				(3)				(9)			
3/21/2002	5.93	NA	0	0	4.26	NA	0	0.00	4.08	NA	0	0.00	NM				(3)				(3)				(9)			
4/30/2002	5.67	NA	0	0	4.15	NA	0	0.00	3.91	NA	0	0.00	NM				(3)				(3)				(9)			
5/24/2002	5.4	NA	0	0	4.07	NA	0	0.00	3.82	NA	0	0.00	NM				(3)				(3)				(9)			
6/27/2002		NA	0	0	4.61	NA	0	0.00	4.38	NA	0	0.00	NM				(3)				(3)				(9)			
7/30/2002	6.60	NA	0	0	4.97(6)	4.91	0.06	0	4.74(6)	4.68	0.06	0	NM	NM	NA	0	(3)				(3)				(9)			

Notes:

LNAPL gauging results above from 1994 through 2011 collected by TRC or others. Data collection by AECOM started in 2012.

Bgs – Below ground surface.

NA – Not Applicable.

NM – Not Measured.

* LNAPL gauging at monitoring well PZ-2S was conducted on a semi-annual basis from April 1994 through May 2000. TRC then increased gauging frequency to monthly. MA DEP then requested that monthly LNAPL gauging continue at PZ-2S, CW-1, and CW-2 as part of the requirements of the Phase V O&M program, beginning December 2000.

(1) Not documented by Emcon.
(2) No recoverable LNAPL present.
(3) Well not installed.
(4) Water level meter may have been unreliable due to low temperature.
(5) Four-inch diameter well installed on November 30, 2000 to replace existing PZ-2S 0.5-inch diameter well.
(6) Noted a sheen on water surface.
(7) Product was detected with interface probe but not a measurable amount (product thickness < 0.01 ft)
(8) It is not understood why in November and December of 2011 that 3 gallons were indicated as removed from wells PZ-2S and TRC-101R when no LNAPL was detected. These 3 gallons are not included in approximate total LNAPL volume removed from these wells.

Table 2-1
Summary of Historical LNAPL Gauging and Removal Results
Former GE Facility, 50 Fordham Road, Wilmington, MA

	PZ-2S				CW-1				CW-2				TRC-101				AE-3				AE-4				GZA-102S			
Date	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)
Monitoring Frequency Increased to Weekly																	(3)				(3)				(9)			
8/6/2002	6.76	NA	0	0	5.13(6)	5.06	0.07	0	4.93(6)	4.84	0.09	0	6.58	6.42	0.16	0	(3)				(3)				(9)			
8/9/2002	LNAPL removed via vacuum extraction at PZ-2S, CW-1, CW-2, and TRC-101.																(3)				(3)				(9)			
8/23/2002	NA	NA	0	0	NA	NA	0.003	0.05	NA	NA	0.003	0.025	NA	NA	0.001	0	(3)				(3)				(9)			
8/29/2002	7.57	7.18	0.39	0.13	5.65(6)	5.56	0.09	0.13	5.44	5.34	0.10	0.13	6.97	6.96	0.01	0	(3)				(3)				(9)			
9/4/2002	LNAPL removed via vacuum extraction at PZ-2S, CW-1, CW-2, and TRC-101.																(3)				(3)				(9)			
9/4/2002	6.95	6.71	0.24	0	5.15(6)	5.10	0.05	0.00	4.92	4.88	0.04	0	6.49	NA	0	0	(3)				(3)				(9)			
9/12/2002	7.20	NA	0	0	5.52(6)	NA	0	0	5.31	NA	0	0	6.92	NA	0	0	(3)				(3)				(9)			
9/18/2002	7.31	7.18	0.13	0.11	6.54(6)	6.45	0.09	0.04	6.37	6.25	0.12	0.05	6.87	NA	0	0	(3)				(3)				(9)			
9/25/2002	6.85(6)	6.85	0	0	5.28(6)	5.19	0.09	1.50	5.03	4.98	0.05	0.13	6.60	NA	0	0	(3)				(3)				(9)			
10/4/2002	6.88	6.85	0.03	0	5.28(6)	5.20	0.08	0.00	5.04	4.98	0.06	0.00	6.60	NA	0	0	(3)				(3)				(9)			
10/11/2002	7.07	7.04	0.03	0	5.44(6)	5.34	0.10	0.00	5.21	5.12	0.09	0.00	6.75	NA	0	0	(3)				(3)				(9)			
10/18/2002	6.28	6.23	0.05	0	4.82(6)	4.77	0.05	0.00	4.57	4.56	0.01	0.00	6.17	NA	0	0	(3)				(3)				(9)			
10/24/2002	6.48	NA	0	0	4.88(6)	NA	0	0	4.65(6)	NA	0	0	6.27	NA	0	0	(3)				(3)				(9)			
11/8/2002	6.13	6.10	0.03	0	4.59(6)	4.56	0.03	0	4.33	4.32	0.01	0	5.95	NA	0	0	(3)				(3)				(9)			
11/15/2002	5.88	NA	0	0	4.39(6)	NA	0	0	4.17	NA	0	0	5.80	NA	0	0	(3)				(3)				(9)			
11/20/2002	5.09	5.07	0.02	0.01	4.00(6)	NA	0	0	3.78(6)	NA	0	0	5.41	NA	0	0	(3)				(3)				(9)			
11/27/2002	5.45	NA	0	0	4.11(6)	NA	0	0	3.95(6)	NA	0	0	5.68	NA	0	0	(3)				(3)				(9)			
12/6/2002	5.91	NA	0	0	4.42(6)	4.42(7)	0	0	4.22(6)	NA	0	0	5.87	NA	0	0	(3)				(3)				(9)			
12/13/2002	5.66	NA	0	0	4.25(6)	NA	0	0	4.02(6)	4.02(7)	0	0	5.65	NA	0	0	(3)				(3)				(9)			
12/20/2002	5.19	NA	0	0	4.00(6)	NA	0	0	3.79(6)	NA	0	0	5.41	NA	0	0	(3)				(3)				(9)			
12/27/2002	5.12	NA	0	0	NM	NM	NM	0	NM	NM	NM	0	NM	NM	NM	0	(3)				(3)				(9)			
12/30/2002	5.30	NA	0	0	4.09(6)	NA	0	0	3.98(6)	NA	0	0	5.51	NA	0	0	(3)				(3)				(9)			
1/10/2003	5.35	NA	0	0	4.13(6)	NA	0	0	3.90(6)	NA	0	0	5.57	NA	0	0	(3)				(3)				(9)			
1/17/2003	5.67	NA	0	0	4.31(6)	NA	0	0	4.09(6)	4.09(7)	0	0	5.74	NA	0	0	(3)				(3)				(9)			
1/21/2003	5.86	NA	0	0	4.42(6)	NA	0	0	4.20(6)	4.20(7)	0	0	NA	NA	NA	NA	(3)				(3)				(9)			
1/30/2003	6.25	NA	0	0	4.65(6)	NA	0	0	4.43(6)	4.44	0.01	0	6.05	NA	0	0	(3)				(3)				(9)			
2/7/2003	4.94	NA	0	0	4.42	NA	0	0	NM	NM	NM	0	5.81	NA	0	0	(3)				(3)				(9)			
Monitoring Frequency Decreased to Monthly																	(3)				(3)				NM			
3/18/2003	5.04	NA	0	0	3.73(6)	NA	0	0	3.51(6)	NA	0	0	5.20	NA	0	0	(3)				(3)				NM			
4/21/2003	5.28	NA	0	0	3.92	NA	0	0	3.80	3.66	0.14	0	5.35	NA	0	0	(3)				(3)				NM			
4/25/2003	NM	NM	0	0	4.01	NA	0	0	3.90	3.76	0.14	0.5	NM	NM	0	0	(3)				(3)				NM			
4/30/2003	NM	NM	0	0	3.95	NA	0	0	3.85	3.72	0.13	0	NM	NM	0	0	(3)				(3)				NM			
4/30/2003	LNAPL removed via vacuum extraction at CW-1, and CW-2.																(3)				(3)				NM			
5/7/2003	NM	NM	0	0	4.25	NA	0	0	4.07	4.01	0.06	0	NM	NM	0	0	(3)				(3)				NM			
5/16/2003	NM	NM	0	0	4.36	NA	0	0	4.20	4.14	0.06	0	NM	NM	0	0	(3)				(3)				NM			
5/22/2003	6.14	NA	0	0	4.52	NA	0	0	4.37	4.30	0.07	0	5.95	NA	0	0	(3)				(3)				NM			
6/30/2003	5.95	NA	0	0	4.45	4.43	0.02	0	4.25	4.18	0.07	0	5.85	NA	0	0	(3)				(3)				NM			
7/31/2003	6.01	NA	0	0	4.53	4.52	0.01	0	4.25	NA	sheen	0	5.9	NA	0	0	(3)				(3)				NM			
8/29/2003	6.76	6.75	0.01	0	4.89	4.88	0.01	0	5.41	5.40	0.01	0	6.5	NA	0	0	(3)				(3)				NM			
9/29/2003	6.03	NA	sheen	0	4.61	4.6	0.01	0	5.38	5.37	0.01	0	6.35	NA	0	0	(3)				(3)				NM			
10/24/2003	6.11	NA	sheen	0	4.75	4.74	0.01	0	5.7	NA	sheen	0	6.48	NA	0	0	(3)				(3)				NM			
11/18/2003	5.98	NA	sheen	0	4.46	4.44	0.02	0	4.62	4.61	0.01	0	6.28	NA	0	0	(3)				(3)				NM			
12/23/2003	5.63	NA	sheen	0	4.31	4.30	0.01	0	4.55	4.54	0.01	0	6.11	NA	0	0	(3)				(3)				NM			
1/26/2004	5.72	NA	sheen	0	4.47	4.46	0.01	0	4.61	4.6	0.01	0	6.23	NA	0	0	(3)				(3)				NM			
2/25/2004	5.41	NA	sheen	0	3.98	3.99	0.01	0	4.13	4.13	sheen	0	6.01	NA	0	0	(3)				(3)				NM			
3/24/2004	5.48	NA	sheen	0	4.06	4.04	0.02	0	4.25	4.24	0.01	0	5.98	NA	0	0	(3)				(3)				NM			
4/26/2004	4.71	NA	sheen	0	3.21	NA	sheen	0	3.98	NA	sheen	0	4.01	NA	0	0	(3)				(3)				NM			
5/27/2004	5.11	NA	sheen	0	3.45	3.44	0.01	0	4.11	NA	sheen	0	4.35	NA	0	0	(3)				(3)				NM			

Notes:

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Bgs – Below ground surface.
NA – Not Applicable.
NM – Not Measured.
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(5) Four-inch diameter well installed on November 30, 2000 to replace existing PZ-2S 0.5-inch diameter well.
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(7) Product was detected with interface probe but not a measurable amount (product thickness < 0.01 ft)
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Table 2-1
Summary of Historical LNAPL Gauging and Removal Results
Former GE Facility, 50 Fordham Road, Wilmington, MA

Date	PZ-2S DTW (ft.)	PZ-2S DTP (ft.)	PZ-2S Thickness (ft.)	PZ-2S Volume Removed (gal.)	CW-1 DTW (ft.)	CW-1 DTP (ft.)	CW-1 Thickness (ft.)	CW-1 Volume Removed (gal.)	CW-2 DTW (ft.)	CW-2 DTP (ft.)	CW-2 Thickness (ft.)	CW-2 Volume Removed (gal.)	TRC-101 DTW (ft.)	TRC-101 DTP (ft.)	TRC-101 Thickness (ft.)	TRC-101 Volume Removed (gal.)
6/24/2004	5.89	NA	sheen	0	4.37	NA	sheen	0	4.21	4.2	0.01	0	5.79	NA	0	0
7/23/2004	5.91	NA	sheen	0	4.41	4.40	0.01	0	4.25	4.24	0.01	0	5.83	NA	0	0
8/27/2004	5.78	NA	sheen	0	4.37	4.36	0.01	0	4.19	4.18	0.01	0	5.75	NA	0	0
9/23/2004	5.61	NA	sheen	0	4.15	4.13	0.02	0	4.25	4.22	0.03	0	5.71	NA	0	0
10/27/2004	5.67	NA	sheen	0	4.35	4.28	0.07	0	4.51	4.47	0.04	0	5.68	NA	0	0
11/24/2004	5.56	NA	sheen	0	4.31	4.27	0.04	0	4.48	4.45	0.03	0	5.60	NA	0	0
12/22/2004	5.62	NA	sheen	0	4.34	4.29	0.05	0	4.42	NA	sheen	0	5.63	NA	0	0
1/27/2005	5.65	NA	sheen	0	4.40	4.37	0.03	0	4.44	4.43	0.01	0	6.15	NA	0	0
2/28/2005	5.34	NA	sheen	0	4.21	4.20	0.01	0	4.23	4.23	sheen	0	5.89	NA	0	0
3/25/2005	5.51	NA	sheen	0	4.36	4.31	0.05	0	4.38	4.35	0.01	0	6.05	NA	0	0
4/26/2005	5.02	NA		0	3.96	3.90	0.06	3	3.93	3.85	0.08	6	5.41	NA	0	0
4/26/2005	LNAPL removed via peristaltic pump at CW-1, and CW-2.															
4/26/2005	Gauging after LNAPL removal:				3.95	3.92	0.03		3.84	3.86	0.02					
5/1/2005	Installed 3 TB-400 Soakease Absorbent booms into both CW-1 and CW-2															
5/10/2005	5.15	NA		0	4.16	4.05	0.11	2.25	4.10	3.97	0.13	2.25	5.62	NA	0	0
5/10/2005	Removed and replaced 3 Soakease Absorbent booms in CW-1 and CW-2															
5/24/2005	5.27	NA		0	4.27	4.17	0.10	2.25	4.17	4.05	0.12	2.25	5.75	NA	0	0
5/24/2005	Removed and replaced 3 Soakease Absorbent booms in both CW-1 and CW-2															
6/10/2005	5.33	NA		0	4.32	4.21	0.11	2.25	4.26	4.13	0.13	2.25	5.79	NA	0	0
6/10/2005	Removed 3 Soakease Absorbent booms in both CW-1 and CW-2															
6/17/2005	5.37	NA		0	4.35	4.25	0.10	0	4.31	4.20	0.11	0	5.82	NA	0	0
7/5/2005	LNAPL removed via peristaltic pump at CW-1 and CW-2															
7/5/2005							0.01	10			0.04	3				
7/6/2005							0.05	0			0.07	0				
7/28/2005	5.81	NA		0	4.41	4.30	0.11	0	4.35	4.23	0.12	0	6.01	NA	0	0
8/24/2005	5.92	NA		0	4.29	4.41	0.12	0	4.39	4.26	0.13	0	5.98	NA	0	0
9/27/2005	5.95	NA		0	4.29	4.39	0.1	0	4.41	4.30	0.11	0	6.04	NA	0	0
10/17/2005	NA	NA		0	3.87	3.94	0.07	10	3.65	3.65	sheen	0	NA	NA	0	0
10/17/2005	LNAPL removed via peristaltic pump at CW-1															
1/9/2006	5.36	5.35	0.01	0	4.2	4.15	0.05	2.25	3.96	3.95	0.01	2.25	5.60	NA	NA	0
1/9/2006	Removed and replaced 3 Soakease Absorbent booms in CW-1 and CW-2															
1/9/2006	Gauging after LNAPL removal:				4.17	4.15	0.02		3.98	3.95	0.03					
1/25/2006	5.01	5.01	sheen	0	3.8	3.75	0.05	2.5	3.7	3.55	0.15	2.5	5.24	NA	NA	0
1/25/2006	Removed and replaced 3 Soakease Absorbent booms in CW-1 and CW-2															
1/25/2006	Gauging after LNAPL removal:				3.81	3.80	0.01		3.6	NA	sheen					
2/7/2006	3.35	NA	sheen	0	3.30	NA	sheen	1.5	3.52	3.45	0.07	1.5	4.98	NA	NA	0
2/7/2006	Removed and replaced 3 Soakease Absorbent booms in CW-1 and CW-2															
2/7/2006	Gauging after LNAPL removal:				3.52	3.5	0.02		3.3	NA	sheen					
2/21/2006	5.21	NA	sheen	0	4.15	4.12	0.03	0	3.93	3.9	0.03	0	5.53	NA	NA	0
3/8/2006	5.9	NA	sheen	0	4.42	4.4	0.02	0	4.45	4.42	0.03	0	5.85	NA	NA	0
3/21/2006	6	NA	sheen	0	4.53	4.5	0.03	0	4.31	4.3	0.01	0	5.92	NA	NA	0
4/4/2006	6.05	NA	sheen	0	4.90	4.15	0.75	2.25	4.9	4.37	0.53	2.25	5.75	NA	NA	0
4/4/2006	Removed and replaced 3 Soakease Absorbent booms in CW-1 and CW-2															
4/4/2006	Gauging after LNAPL removal:				4.25	4.15	0.1		4.6	4.37	0.23					
4/17/2006	6.15	NA	sheen	0	4.44	4.42	0.02	0	4.47	4.46	0.01	0	6.10	NA	NA	0
5/2/2006	8.15	NA	sheen	0	4.48	4.38	0.1	2.25	4.5	4.3	0.2	2.25	5.92	NA	NA	0
5/2/2006	Removed and replaced 3 Soakease Absorbent booms in CW-1 and CW-2															
5/2/2006	Gauging after LNAPL removal:				4.49	4.49	sheen		4.5	4.49	0.01					

Date	AE-3 DTW (ft.)	AE-3 DTP (ft.)	AE-3 Thickness (ft.)	AE-3 Volume Removed (gal.)	AE-4 DTW (ft.)	AE-4 DTP (ft.)	AE-4 Thickness (ft.)	AE-4 Volume Removed (gal.)	GZA-102S DTW (ft.)	GZA-102S DTP (ft.)	GZA-102S Thickness (ft.)	GZA-102S Volume Removed (gal.)
6/24/2004	(3)				(3)				NM			
7/23/2004	(3)				(3)				NM			
8/27/2004	(3)				(3)				NM			
9/23/2004	(3)				(3)				NM			
10/27/2004	(3)				(3)				NM			
11/24/2004	(3)				(3)				NM			
12/22/2004	(3)				(3)				NM			
1/27/2005	(3)				(3)				NM			
2/28/2005	(3)				(3)				NM			
3/25/2005	(3)				(3)				NM			
4/26/2005	(3)				(3)				NM			
4/26/2005	(3)				(3)				NM			
4/26/2005	(3)				(3)				NM			
5/1/2005	(3)				(3)				NM			
5/10/2005	(3)				(3)				NM			
5/10/2005	(3)				(3)				NM			
5/24/2005	(3)				(3)				NM			
5/24/2005	(3)				(3)				NM			
6/10/2005	(3)				(3)				NM			
6/10/2005	(3)				(3)				NM			
6/17/2005	(3)				(3)				NM			
7/5/2005	(3)				(3)				NM			
7/5/2005	(3)				(3)				NM			
7/6/2005	(3)				(3)				NM			
7/28/2005	(3)				(3)				NM			
8/24/2005	(3)				(3)				NM			
9/27/2005	(3)				(3)				NM			
10/17/2005	(3)				(3)				NM			
10/17/2005	(3)				(3)				NM			
1/9/2006	(3)				(3)				NM			
1/9/2006	(3)				(3)				NM			
1/9/2006	(3)				(3)				NM			
1/25/2006	(3)				(3)				NM			
1/25/2006	(3)				(3)				NM			
1/25/2006	(3)				(3)				NM			
2/7/2006	(3)				(3)				NM			
2/7/2006	(3)				(3)				NM			
2/7/2006	(3)				(3)				NM			
2/21/2006	(3)				(3)				NM			
3/8/2006	(3)				(3)				NM			
3/21/2006	(3)				(3)				NM			
4/4/2006	(3)				(3)				NM			
4/4/2006	(3)				(3)				NM			
4/4/2006	(3)				(3)				NM			
4/17/2006	(3)				(3)				NM			
5/2/2006	(3)				(3)				NM			
5/2/2006	(3)				(3)				NM			
5/2/2006	(3)				(3)				NM			

Notes:

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(4) Water level meter may have been unreliable due to low temperature.
(5) Four-inch diameter well installed on November 30, 2000 to replace existing PZ-2S 0.5-inch diameter well.
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Former GE Facility, 50 Fordham Road, Wilmington, MA

	PZ-2S				CW-1				CW-2				TRC-101				AE-3				AE-4				GZA-102S			
Date	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)
5/23/2006	4.15	4.14	0.01	0	2.95	NA	NA	2.25	3.15	NA	NA	2.25	4.66	NA	NA	0	(3)				(3)				NM			
5/23/2006	Removed and replaced 3 Soakease Absorbent booms in CW-1 and CW-2																(3)				(3)				NM			
5/23/2006	Gauging after LNAPL removal:				2.95		sheen		3.15		sheen						(3)				(3)				NM			
6/16/2006	4.23	NA	sheen	0	3.17	NA	NA	0	3.33	NA	sheen	0	4.81	NA	NA	0	(3)				(3)				NM			
6/29/2006	4.75	NA	sheen	0	3.52	NA	sheen	0	3.6	NA	NA	0	5.23	NA	NA	0	(3)				(3)				NM			
7/13/2006	4.92	NA	sheen	0	3.6	NA	sheen	0	3.72	NA	sheen	0	5.22	NA	NA	0	(3)				(3)				NM			
7/31/2006	5.75	NA	sheen	0	4.56	NA	sheen	0	4.45	NA	sheen	0	5.88	NA	NA	0	(3)				(3)				NM			
8/25/2006	6.2	NA	sheen	0	4.4	NA	sheen	0	4.6	NA	sheen	0	5.8	NA	NA	0	(3)				(3)				NM			
9/7/2006	5.77	NA	sheen	0	4.35	NA	sheen	0	4.55	NA	sheen	0	5.95	NA	NA	0	(3)				(3)				NM			
9/20/2006	5.95	NA	sheen	0	4.36	NA	sheen	0	4.48	NA	sheen	0	6.8	NA	NA	0	(3)				(3)				NM			
10/5/2006	6.12	NA	sheen	0	6	NA	sheen	0	5.9	NA	sheen	0	6.11	NA	NA	0	(3)				(3)				NM			
10/18/2006	5.47	NA	sheen	0	4.7	NA	sheen	0	4.6	NA	sheen	0	5.7	NA	NA	0	(3)				(3)				NM			
11/3/2006	5.46	NA	sheen	0	4.43	NA	sheen	0	4.35	NA	sheen	0	5.7	NA	NA	0	(3)				(3)				NM			
11/14/2006	4.5	NA	NA	0	4.85	NA	sheen	0	4.73	NA	sheen	0	5.05	NA	NA	0	(3)				(3)				NM			
11/28/2006	4.92	NA	NA	0	5.42	NA	sheen	0	5.51	NA	sheen	0	5.32	NA	NA	0	(3)				(3)				NM			
12/14/2006	5.65	NA	NA	0	4.10	NA	sheen	0	4.28	NA	sheen	0	5.71	NA	NA	0	(3)				(3)				NM			
12/29/2006	5.46	NA	NA	0	4.32	NA	sheen	0	4.22	NA	NA	0	5.70	NA	NA	0	(3)				(3)				NM			
1/9/2007	5.15	NA	NA	0	3.70	NA	NA	0	3.91	NA	sheen	0	5.37	NA	NA	0	(3)				(3)				NM			
1/25/2007	5.64	NA	NA	0	4.14	NA	sheen	0	4.32	NA	sheen	0	5.75	NA	NA	0	(3)				(3)				NM			
2/13/2007	5.62	NA	NA	0	4.20	NA	sheen	0	4.35	NA	NA	0	NM	NM	NM	0	(3)				(3)				NM			
2/28/2007	6.08	NA	NA	0	4.48	NA	sheen	1	4.65	NA	sheen	1	NM	NM	NM	0	(3)				(3)				NM			
3/27/2007	4.65	NA	NA	0	3.23	NA	sheen	0	3.52	NA	sheen	0	5.00	NA	NA	0	(3)				(3)				NM			
4/11/2007	5.8	NA	NA	0	4.43	NA	NA	0	4.71	NA	sheen	0	5.87	NA	NA	0	(3)				(3)				NM			
4/24/2007	5.50	NA	NA	0	4.98	NA	sheen	0	4.80	NA	NA	0	5.62	NA	NA	0	(3)				(3)				NM			
5/8/2007	5.20	NA	NA	0	3.75	NA	sheen	0	4.00	NA	NA	0	5.41	NA	NA	0	(3)				(3)				NM			
5/21/2007	3.95	NA	NA	0	3.05	NA	sheen	0	3.30	NA	NA	0	4.78	NA	sheen	0	(3)				(3)				NM			
11/19/2007	6.26	5.85	0.41	0	4.72	4.69	0.03	0	4.47	NA	sheen	0	6.12	NA	NA	0	(3)				(3)				NM			
12/5/2007	6.53	6.14	0.39	0	4.78	4.72	0.06	0	5.52	NA	sheen	0	NM	NM	NM	0	(3)				(3)				NM			
12/19/2007	6.61	NA	NA	0	4.72	4.71	0.01	0	4.46	NA	NA	0	NM	NM	NM	0	(3)				(3)				NM			
1/7/2008	6.00	5.99	0.01	0	4.32	NA	sheen	0	4.11	4.08	0.03	0	5.71	NA	NA	0	(3)				(3)				NM			
1/17/2008	5.68	NA	NA	0	3.99	NA	NA	0	3.88	NA	NA	0	5.43	NA	NA	0	(3)				(3)				NM			
1/31/2008	6.17	NA	sheen	0.35	4.38	NA	sheen	0.35	4.15	4.20	0.05	1.3	5.81	NA	NA	0	(3)				(3)				NM			
2/14/2008	4.32	NA	sheen	0	3.31	NA	sheen	0	3.10	NA	sheen	0	4.79	NA	NA	0	(3)				(3)				NM			
2/27/2008	4.74	NA	sheen	0	3.51	NA	sheen	0	3.32	NA	sheen	1.1	4.95	NA	NA	0	(3)				(3)				NM			
3/11/2008	4.14	NA	sheen	0	3.16	NA	sheen	0	2.95	NA	sheen	0	4.66	NA	NA	0	(3)				(3)				NM			
4/9/2008	5.01	NA	sheen	0	3.87	NA	sheen	0	3.65	NA	sheen[7]	0	5.31	NA	NA	0	(3)				(3)				NM			
5/13/2008	5.63	NA	NA	0	4.30	4.28	0.02	0	4.10	4.04	0.06	0	5.70	NA	NA	0	(3)				(3)				NM			
6/11/2008	6.10	NA	NA	0	4.60	4.59	0.01	0	4.40	4.37	0.03	1.1	6.01	NA	NA	0	(3)				(3)				NM			
7/16/2008	5.89	NA	NA	0	4.63	4.61	0.02	0	4.43	4.38	0.05	1.2	6.03	NA	NA	0	(3)				(3)				NM			
8/28/2008	5.94	NA	NA	0	4.61	4.58	0.03	0	4.40	4.36	0.04	1.4	6.01	NA	NA	0	(3)				(3)				NM			
9/25/2008	5.97	NA	NA	0	4.60	4.58	0.02	1.5	4.39	4.36	0.03	1.1	6.09	NA	NA	0	(3)				(3)				NM			
10/16/2008	5.81	NA	NA	0	4.40	NA	sheen	0.75	4.22	NA	sheen	0.75	5.89	NA	NA	0	(3)				(3)				NM			
11/11/2008	5.58	NA	NA	0	4.44	4.43	0.01	0	4.22	4.20	0.02	0	5.85	NA	NA	0	(3)				(3)				NM			
12/4/2008	5.01	NA	NA	0	4.03	NA	sheen	1	3.82	NA	sheen	0.5	5.47	NA	NA	0	(3)				(3)				NM			
1/13/2009	5.21	NA	NA	0	4.04	NA	sheen	0	3.83	NA	sheen	0	5.49	NA	NA	0	(3)				(3)				NM			
2/12/2009	5.23	NA	NA	0	3.98	NA	sheen	0	3.75	NA	sheen	0	5.41	NA	NA	0	(3)				(3)				NM			
3/19/2009	4.96	NA	NA	0	3.74	NA	sheen	0	3.55	NA	sheen	0	5.21	NA	NA	0	(3)				(3)				NM			
4/16/2009	5.03	NA	NA	0	3.89	3.87	0.02	0	3.66	NA	NA	0	5.32	NA	NA	0	(3)				(3)				NM			
5/4/2009	5.46	5.46[7]	0	0	4.12	4.10	0.02	0	3.91	3.90	0.01	0	5.54	NA	NA	0	(3)				(3)				NM			

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6/25/2009	4.92	NA	sheen	0	3.93	3.92	0.01	0	3.74	3.72	0.02	0	5.36	NA	NA	0	(3)				(3)				NM			
7/14/2009	5.16	NA	NA	0	4.14	4.12	0.02	0	3.93	3.91	0.02	0	5.56	NA	NA	0	(3)				(3)				NM			
8/20/2009	6.03	NA	NA	0	4.70	4.65	0.05	0	4.46	4.42	0.04	0	6.05	NA	NA	0	(3)				(3)				NM			
9/25/2009	6.24	NA	NA	0	4.89	4.84	0.05	1.5	4.68	4.63	0.05	1.1	6.27	NA	NA	0	(3)				(3)				NM			
10/30/2009	5.02	NA	NA	0	4.09	4.08	0.01	1.5	3.88	3.87	0.01	1.5	5.51	NA	NA	0	(3)				(3)				NM			
11/13/2009	5.85	NA	NA	0	4.49	4.48	0.01	0	4.28	4.27	<0.01	0	5.91	NA	NA	0	(3)				(3)				NM			
12/2/2009	5.18	NA	NA	0	4.11	NA	sheen	0	3.90	NA	sheen	0	5.53	NA	NA	0	(3)				(3)				NM			
1/29/2010	4.67	NA	NA	0	3.68	3.68 (7)	0	0	3.47	NA	sheen	0	5.13	NA	NA	0	(3)				(3)				NM			
2/22/2010	5.53	NA	NA	0	4.17	NA	sheen	0	3.98	NA	sheen	0	5.58	NA	NA	0	(3)				(3)				NM			
3/24/2010	3.24	NA	sheen	0	2.54	2.53	0.01	0	2.33	2.32	0.01	0	3.90	NA	NA	0	(3)				(3)				NM			
4/5/2010	3.72	NA	NA	0	2.82	2.82 (7)	0	0	2.63	2.62	0.01	0	4.27	NA	NA	0	(3)				(3)				NM			
5/12/2010	5.50	NA	NA	0	4.17	4.16	0.01	0	3.96	NA	sheen	0	5.57	NA	NA	0	(3)				(3)				NM			
6/4/2010	5.93	NA	NA	0	4.49	4.48	0.01	0	4.23	NA	sheen	0	5.90	NA	NA	0	(3)				(3)				NM			
7/8/2010	6.53	NA	NA	0	5.09	5.05	0.04	0	4.85	4.84	0.01	0	6.47	NA	NA	0	(3)				(3)				NM			
8/30/2010	6.47	6.46	0.01	0	5.10	5.02	0.08	0	4.84	4.82	0.02	0	6.48	NA	NA	0	(3)				(3)				NM			
9/27/2010	7.20	7.19	0.01	0	5.82	5.69	0.13	1.1	5.55	5.49	0.06	0.75	7.15	NA	NA	0	(3)				(3)				NM			
10/21/2010	5.88	5.87	0.01	0	5.70	5.67	0.03	1.5	5.50	NA	sheen	1.1	6.08	NA	NA	0	(3)				(3)				NM			
11/11/2010	5.18	NA	sheen	0	4.28	NA	NA	1.5	4.10	NA	NA	0	5.70	NA	NA	0	(3)				(3)				NM			
12/18/2010	5.70	NA	NA	0	4.60	4.60 (7)	0	0	4.39	4.38	0.01	0	6.05	NA	NA	0	(3)				(3)				NM			
1/26/2011	NA	NA	NA	0	NA	NA	NA	0	NA	NA	NA	0	NA	NA	NA	0	(3)				(3)				NM			
2/7/2011	5.45	NA	NA	0	4.3	NA	NA	0	4.11	NA	NA	0	5.75	NA	NA	0	(3)				(3)				NM			
3/17/2011	4.05	NA	NA	0	3.06	NA	NA	0	2.87	NA	film	0	4.49	NA	NA	0	(3)				(3)				NM			
4/23/2011	4.53	NA	NA	0	3.7	NA	NA	0	3.5	NA	NA	0	5.14	NA	NA	0	(3)				(3)				NM			
5/24/2011	5.27	NA	NA	0	4.08	NA	NA	0	3.87	NA	NA	0	5.38	NA	NA	0	(3)				(3)				NM			
6/28/2011	4.81	NA	NA	0	3.98	NA	NA	0.00	3.77	NA	sheen	0.00	5.41	NA	NA	0	(3)				(3)				NM			
7/21/2011	5.92	NA	NA	0	4.69	4.67	0.02	0.00	4.49	4.47	0.02	0.00	6.11	NA	NA	0	(3)				(3)				NM			
8/15/2011	5.18	NA	NA	0	3.90	NA	sheen	0.00	3.70	NA	NA	0.00	5.14	NA	NA	0	(3)				(3)				NM			
11/28/2011	4.46	NA	NA	1 (8)	3.65	NA	NA	0	3.45	NA	NA	0.00	5.08	NA	NA	1 (8)	(3)				(3)				NM			
12/22/2011	4.63	NA	NA	2 (8)	3.62	NA	NA	0	3.43	NA	sheen	0.00	5.03	NA	NA	2 (8)	(3)				(3)				NM			
5/31/2012	5.30	NA	NA	0	4.10	NA	NA	0	3.91	NA	sheen	0.00	5.46	NA	NA	0	(3)				(3)				NM			
11/5/2012	4.90	NA	NA	0	4.10	NA	NA	0	3.82	3.81	0.01	0.00	5.46	NA	NA	0	5.44	NA	NA	0	5.08	NA	NA	0	NM	NM	NA	NA
5/21/2013	5.76	NA	NA	0	4.41	4.40	0.01	0.00	4.19	4.18	0.01	0.00	5.77	NA	NA	0	5.80	NA	NA	0	5.42	NA	NA	0	5.87	NA	NA	0
12/27/2013	5.15	NA	NA	0	4.26	NA	NA	0	4.03	NA	NA	0.00	5.61	NA	NA	0	5.66	NA	NA	0	5.31	NA	NA	0	5.41	NA	NA	0
3/17/2014	4.65	NA	NA	0	3.68	NA	NA	0	3.43	NA	NA	0.00	4.92	NA	NA	0	5.10	NA	NA	0	4.75	NA	NA	0	4.78	NA	NA	0
6/16/2014	5.60	NA	NA	0	4.31	NA	NA	0	4.08	NA	NA	0.00	5.70	NA	NA	0	5.72	NA	NA	0	5.28	NA	NA	0	5.35	NA	NA	0
9/12/2014	6.13	NA	NA	0	4.78	NA	NA	0	4.57	NA	NA	0.00	6.02	NA	NA	0	6.22	NA	NA	0	5.80	NA	NA	0	6.15	NA	NA	0
12/12/2014	3.70	NA	NA	0	2.92	NA	NA	0	2.70	NA	NA	0.00	4.17	NA	NA	0	4.38	NA	NA	0	4.05	NA	NA	0	4.00	NA	NA	0
3/20/2015	4.34	NA	NA	0	3.43	NA	NA	0	3.23	NA	NA	0.00	4.67	NA	NA	0	4.96	NA	NA	0	4.51	NA	NA	0	4.65	NA	NA	0
5/29/2015	6.01	NA	NA	0	4.60	NA	NA	0	4.38	NA	NA	0.00	4.84	NA	NA	0	6.07	NA	NA	0	4.55	NA	NA	0	5.94	NA	NA	0
9/28/2015	6.92	NA	NA	0	5.50	5.47	0.03	0.00	5.30	5.22	0.08	0.75	6.69	NA	NA	0	6.92	NA	NA	0	6.50	NA	NA	0	6.83	NA	NA	0
12/17/2015	5.90	NA	NA	0	4.50	NA	NA	0.00	4.35	4.34	0.01	0.00	5.76	NA	NA	0	6.01	NA	NA	0	5.55	NA	NA	0	5.91	NA	NA	0
3/25/2016	5.21	NA	NA	0	4.02	NA	NA	0.00	3.79	NA	NA	0.00	5.24	NA	NA	0	5.45	NA	NA	0	4.89	NA	NA	0	5.22	NA	NA	0
6/10/2016	5.11	NA	NA	0	4.70	NA	NA	0.00	4.51	4.49	0.02	0.00	5.93	NA	NA	0	6.15	NA	NA	0	4.61	NA	NA	0	6.04	NA	NA	0
9/13/2016	7.81	NA	NA	0	6.45	6.33	0.12	0.75	5.98	NA	NA	0.00	7.62	NA	NA	0	7.79	NA	NA	0	7.39	NA	NA	0	7.66	NA	NA	0
12/30/2016	5.28	NA	NA	0	4.17	4.14	0.03	0.75	3.89	NA	NA	0.00	5.30	NA	NA	0	5.51	NA	NA	0	5.12	NA	NA	0	5.38	NA	NA	0
3/28/2017	4.85	NA	NA	0	3.87	NA	NA	0.00	3.64	NA	NA	0.00	5.10	NA	NA	0	5.30	NA	NA	0	4.78	NA	NA	0	5.05	NA	NA	0
6/13/2017	5.22	NA	NA	0	4.01	NA	NA	0.00	3.79	3.78	0.01	0.00	5.26	NA	NA	0	5.44	NA	NA	0	4.89	NA	NA	0	5.19	NA	NA	0
9/1/2017	6.50	NA	NA	0	5.48	5.45	0.03	0.00	5.25	5.24	0.01	0.00	6.68	NA	NA	0	6.89	NA	NA	0	6.30	NA	NA	0	7.26	NA	NA	0
11/30/2017	5.87	NA	NA	0	4.51	NA	NA	0.56	4.27	NA	NA	0.00	5.73	NA	NA	0	5.96	NA	NA	0	5.55	NA	NA	0	6.32	NA	NA	0

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(5) Four-inch diameter well installed on November 30, 2000 to replace existing PZ-2S 0.5-inch diameter well.
(6) Noted a sheen on water surface.
(7) Product was detected with interface probe but not a measurable amount (product thickness < 0.01 ft)
(8) It is not understood why in November and December of 2011 that 3 gallons were indicated as removed from wells PZ-2S and TRC-101R when no LNAPL was detected. These 3 gallons are not included in approximate total LNAPL volume removed from these wells.
(9) Well not measured, or data has not been located in historical TRC reports.

Table 2-1
Summary of Historical LNAPL Gauging and Removal Results
Former GE Facility, 50 Fordham Road, Wilmington, MA

	PZ-2S				CW-1				CW-2				TRC-101				AE-3				AE-4				GZA-102S			
Date	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)	DTW (ft.)	DTP (ft.)	Thickness (ft.)	Volume Removed (gal.)
3/7/2018	4.89	NA	NA	0	3.66	NA	NA	0.00	3.42	NA	NA	0.00	4.89	NA	NA	0	4.12	NA	NA	0	4.63	NA	NA	0	5.35	NA	NA	0
6/14/2018	5.89	NA	NA	0	4.56	4.55	0.01 (sheen)	0.00	4.32	4.31	0.01 (sheen)	0.00	5.72	NA	NA	0	6.99	NA	NA	0	5.49	NA	NA	0	6.35	NA	NA	0
9/17/2018	5.66	NA	NA	0	4.33	NA	NA	0.00	4.09	NA	NA	0.00	5.56	NA	NA	0	5.79	NA	NA	0	5.31	NA	NA	0	6.15	NA	NA	0
12/3/2018	4.13	NA	NA	0	2.93	NA	NA	0.00	2.69	NA	NA	0.00	4.23	NA	NA	0	4.36	NA	NA	0	4.02	NA	NA	0	4.52	NA	NA	0
2/25/2019	4.75	NA	NA	0	3.47	NA	NA	0.00	3.23	NA	NA	0.00	4.44	NA	NA	0	4.86	NA	NA	0	4.46	NA	NA	0	5.01	NA	NA	0
6/5/2019	5.54	NA	NA	0	4.12	NA	NA	0.00	3.88	NA	NA	0.00	5.40	NA	NA	0	5.58	NA	NA	0	5.02	NA	NA	0	5.89	NA	NA	0
9/13/2019	6.17	NA	NA	0	4.74	NA	NA	0.00	4.51	NA	NA	0.00	5.98	NA	NA	0	6.19	NA	NA	0	5.71	NA	NA	0	6.57	NA	NA	0
12/4/2019	5.37	NA	NA	0	4.12	NA	NA	0.00	3.89	NA	NA	0.00	5.06	NA	NA	0	5.50	NA	NA	0	5.09	NA	NA	0	5.61	NA	NA	0
2/11/2020	5.24	NA	NA	0	3.83	NA	NA	0.00	3.59	NA	NA	0.00	5.12	NA	NA	0	5.26	NA	NA	0	4.74	NA	NA	0	5.40	NA	NA	0
5/13/2020	5.24	NA	NA	0	3.85	NA	NA	0.00	3.61	NA	NA	0.00	5.06	NA	NA	0	5.28	NA	NA	0	4.67	NA	NA	0	5.54	NA	NA	0
9/8/2020	6.77	NA	NA	0	5.60	5.58	0.02	0.00	5.35	5.35	0.01	0.00	6.82	NA	NA	0	7.02	NA	NA	0	6.60	NA	NA	0	7.36	NA	NA	0
12/7/2020	4.30	NA	NA	0	3.15	NA	NA	0.00	2.93	NA	NA	0.00	4.35	NA	NA	0	4.58	NA	NA	0	4.27	NA	NA	0	4.76	NA	NA	0
2/17/2021	4.85	NA	NA	0	3.81	NA	NA	0.00	3.59	NA	NA	0.00	4.98	NA	NA	0	5.19	NA	NA	0	4.83	NA	NA	0	5.33	NA	NA	0
5/26/2021	5.62	NA	NA	0	4.19	NA	NA	0.00	3.97	NA	NA	0.00	5.48	NA	NA	0	5.66	NA	NA	0	5.04	NA	NA	0	5.95	NA	NA	0
8/31/2021	5.21	NA	NA	0	3.83	NA	NA	0.00	3.60	NA	NA	0.00	5.13	NA	NA	0	5.32	NA	NA	0	4.93	NA	NA	0	5.53	NA	NA	0
	gals removed (approx.):			2.1				58.23				44.24				0				0				0				0

Notes:

LNAPL gauging results above from 1994 through 2011 collected by TRC or others. Data collection by AECOM started in 2012.
Bgs – Below ground surface.
NA – Not Applicable.
NM – Not Measured.
NR – Not Recorded.
* LNAPL gauging at monitoring well PZ-2S was conducted on a semi-annual basis from April 1994 through May 2000. TRC then increased gauging frequency to monthly. MA DEP then requested that monthly LNAPL gauging continue at PZ-2S, CW-1, and CW-2 as part of the requirements of the Phase V O&M program, beginning December 2000.

(1) Not documented by Emcon.
(2) No recoverable LNAPL present.
(3) Well not installed.
(4) Water level meter may have been unreliable due to low temperature.
(5) Four-inch diameter well installed on November 30, 2000 to replace existing PZ-2S 0.5-inch diameter well.
(6) Noted a sheen on water surface.
(7) Product was detected with interface probe but not a measurable amount (product thickness < 0.01 ft)
(8) It is not understood why in November and December of 2011 that 3 gallons were indicated as removed from wells PZ-2S and TRC-101R when no LNAPL was detected. These 3 gallons are not included in approximate total LNAPL volume removed from these wells.
(9) Well not measured, or data has not been located in historical TRC reports.

Table 4-1
Summary of Natural Source Zone Depletion Rates
Former GE Facility, 50 Fordham Road, Wilmington, MA

Well ID	Measurement Year	NSZD Rate (gallons/acre/year)	
		Soil Gas Concentration Gradient	Biogenic Heat
AE-3	2020	590	420
	2021	250	1,800
CW-1	2020	550	2,500
	2021	100	1,600
CW-2	2020	520	NA
	2021	130	NA
GZA-102R	2020	NA	750
	2021	NA	600
GZA-105S/D	2020	540	1,300
	2021	170	1,300
PZ-2S	2020	970	≥ 940
	2021	530	≥ 700
TRC-101	2020	630	NA
	2021	260	NA
TRC-102	2020	NA	2,000
	2021	NA	2,800
TRC-103	2020	NA	1,000
	2021	NA	1,000
Minimum	**100**		
Maximum	**2,800**		
Median	**670**		

≥ only upward heat flux could be estimated from PZ-2S data, providing a lower-bound estimate of the total NSZD rate

Table 7-1
Post-Temporary Solution Operations, Maintenance, and Monitoring Schedule
Former GE Facility, 50 Fordham Road, Wilmington, MA

Year 2017

Month	January	February	March	April	May	June	July	August	September	October	November	December
Indoor Air Sampling Event				Completed			Completed					
Comprehensive Groundwater Sampling Event									Completed	Completed		
LNAPL Gauging and LNAPL Removal						Completed			Completed			Completed
Post-Temporary Solution Status Reports											Completed	
Five-Year Review of the Temporary Solution												

Year 2018

Month	January	February	March	April	May	June	July	August	September	October	November	December
Indoor Air Sampling Event		Completed										
Comprehensive Groundwater Sampling Event									Completed	Completed		
LNAPL Gauging and LNAPL Removal			Completed			Completed			Completed			Completed
Post-Temporary Solution Status Reports					Completed						Completed	
Five-Year Review of the Temporary Solution												

Year 2019

Month	January	February	March	April	May	June	July	August	September	October	November	December
Indoor Air Sampling Event		Completed										
Comprehensive Groundwater Sampling Event									Completed	Completed		
LNAPL Gauging and LNAPL Removal			Completed			Completed			Completed			Completed
Post-Temporary Solution Status Reports					Completed						Completed	
Five-Year Review of the Temporary Solution												

Year 2020

Month	January	February	March	April	May	June	July	August	September	October	November	December
Indoor Air Sampling Event		Completed										
Comprehensive Groundwater Sampling Event									Completed	Completed		
LNAPL Gauging and LNAPL Removal			Completed			Completed			Completed			Completed
Post-Temporary Solution Status Reports					Completed						Completed	
Five-Year Review of the Temporary Solution												

Year 2021

Month	January	February	March	April	May	June	July	August	September	October	November	December
Indoor Air Sampling Event		Completed										
Comprehensive Groundwater Sampling Event									Completed	Completed		
LNAPL Gauging and LNAPL Removal			Completed		Completed			Completed			To be Completed	
Post-Temporary Solution Status Reports					Completed						Completed	
Five-Year Review of the Temporary Solution												

Year 2022

Month	January	February	March	April	May
Indoor Air Sampling Event	To be Completed				
Comprehensive Groundwater Sampling Event					
LNAPL Gauging and LNAPL Removal			To be Completed		
Post-Temporary Solution Status Reports					To be Completed
Five-Year Review of the Temporary Solution					To be Completed

Completed
To be Completed

APPENDICES

Appendix A—LNAPL Field Records, May and August 2021

Appendix B—NSZD Field Records, November 2018, September 2020, and September-October 2021

Appendix C—NSZD Summary Memorandum, November 2021

APPENDIX A
LNAPL FIELD RECORDS, MAY AND AUGUST 2021

AECOM

Former GE Facility - Wilmington, MA

Building 3 - EPL LNAPL Gauging Record

Date: 5/26/2021

Weather: sunny 80s (F) Recorder: Dylan Potter (AECOM)

Gauging Information

Well	Time	Depth to LNAPL (ft btoc)	Depth to Water (ft btoc)	Depth to DNAPL (ft btoc)	Depth to Bottom (ft btoc)	Confirm Product w/ Bailer (Y/N/NA)	Product Removed (Y/N/NA)	Comments
AE-3	10:15	ND	5.66	ND	12.85	NA	NA	
AE-4	10:19	ND	5.04	ND	12.20	NA	NA	Silty bottom
CW-1	10:43	ND	4.19	ND	8.10	Y	NA	light sheen, petroleum odor, no product in bailer
CW-2	10:56	ND	3.97	ND	6.50	Y	NA	light sheen, petroleum odor, no product in bailer
GZA-102S	10:12	ND	5.95	ND	10.94	NA	NA	
PZ-2S	10:24	ND	5.62	ND	8.03	NA	NA	
TRC-101	10:21	ND	5.48	ND	10.01	NA	NA	

Gauging device (Mnfr./Model No.): Solinst 122

Note: If LNAPL is detected at thickness > 0.1 feet, insert absorbant sock and wire basket into well and secure tightly.

(Place spent socks, if used, in 5-gallon bucket within treatment building.)

Notes:

NA = Not Applicable

ND = Not Detected

NR = Not Recorded

ft btoc = feet below top of casing

AECOM

Former GE Facility - Wilmington, MA

Building 3 - EPL LNAPL Gauging Record

Date: 8/31/2021

Weather: Mostly sunny 80-85F

Recorder: Jillian Whiting & Michaela Fitzgerald & Scott Olson

Gauging Information

Well	Time	Depth to LNAPL (ft btoc)	Depth to Water (ft btoc)	Depth to DNAPL (ft btoc)	Depth to Bottom (ft btoc)	Confirm Product w/ Bailer (Y/N/NA)	Product Removed (Y/N/NA)	Comments
AE-3	16:05	ND	5.32	ND	12.62	NA	NA	
AE-4	16:15	ND	4.93	ND	12.19	NA	NA	
CW-1	17:19	ND	3.83	ND	NM	no	NA	
CW-2	17:25	ND	3.60	ND	NM	no	NA	see photo
GZA-102S	15:50	ND	5.53	ND	10.75	NA	NA	
PZ-2S	15:48	ND	5.21	ND	7.79	NA	NA	
TRC-101	16:08	ND	5.13	ND	9.89	NA	NA	

Gauging device (Mnfr./Model No.): Heron H.Oil oil/water interface probe (US Env.)

Note: If LNAPL is detected at thickness > 0.1 feet, insert absorbant sock and wire basket into well and secure tightly.

(Place spent socks, if used, in 5-gallon bucket within treatment building.)

Notes:

NA = Not Applicable

ND = Not Detected

NR = Not Recorded

ft btoc = feet below top of casing

APPENDIX B
NSZD FIELD RECORDS, NOVEMBER 2018, SEPTEMBER 2020, AND SEPTEMBER-OCTOBER 2021

NSZD FIELD RECORDS – NOVEMBER 2018

Temperature Profiling Log

Well ID:	GZA-12	Depth to Water (ft btoc):	7.89
TOC Elevation (ft amsl):	87.62	Depth to NAPL (ft btoc):	None
Ground Elevation (ft amsl):	88.05	Date of Measurement:	11.14.18
TOC - Ground Offset (ft):	-0.43	Ambient Air Temperature (°F):	35.0
Total Depth (ft bgs):	24.50	Weather Conditions:	Sunny, cold 30's, windy
Top of Screen (ft bgs):	9.50	Time Thermocouples Deployed:	~~0750~~ 0810

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
0825	1.57	10.57	2.00	J	49.1	49.1	49.1
0841	2.57		3.00	I	~~[illegible]~~ 51.6	51.6	51.6
0826	3.57		4.00	H	53.5	53.5	53.5
0828	4.57		5.00	G	55.6	55.7	55.65
0829	5.57		6.00	F	57.5	57.5	57.5
0840	6.57		7.00	E	58.3	58.1	58.2
0831	7.57		8.00	D	59.7	59.5	59.6
0832	8.57		9.00	C	59.8	59.7	59.75
0833	9.57		10.00	B	60.3	60.3	60.3
0834	10.57	19	11.00	A	60.9	60.9	60.9
0916 ~~0854~~	11.57	~~20.57~~	12.00	J	61.2 ~~[illegible] 59.6~~	~~59.0~~ 61.2	~~59.6~~ 61.2
0932	12.57		13.00	I	61.5	61.3	61.4
0917 ~~0858~~	13.57		14.00	H	~~60.2~~ 61.2	~~60.1~~ 60.9	~~60.15~~ 61.05
0918 ~~0901~~	14.57	~~23.57~~	15.00	G/J	~~60.6~~ 61.1	~~60.5~~ 60.9	~~60.55~~ 61.0
0920 ~~0902~~	15.57		16.00	F/I	~~60.7~~ 61.2	~~60.3~~ 61.1	~~60.5~~ 61.15
0934	16.57		17.00	E/H	61.3	61.2	61.25
0922 ~~0904~~	17.57		18.00	D/G	~~61.3~~ 60.9	~~61.0~~ 60.5	~~61.15~~ 60.7
0923 ~~0906~~	18.57		19.00	C/F	~~61.1~~ 60.9	~~60.7~~ 60.6	~~60.9~~ 60.75
0924 ~~0908~~	19.57		20.00	B/E	~~60.4~~ 60.3	~~60.0~~ 60.1	~~60.2~~ 60.2
0925 ~~0909~~	20.57		21.00	A/D	~~60.4~~ 60.0	~~60.1~~ 59.6	~~60.25~~ 59.8
0944	21.57	22.57	22.00	C	59.9	59.9	59.9
0945	22.57		23.00	B	59.9	59.7	59.8
0948	23.57		24.00	A	59.5	59.3	59.4

Temperature Profiling Log

Well ID:	GZA-102R~~2~~1 (July 2017 on)	Depth to Water (ft btoc):	4.78
TOC Elevation (ft amsl):	? ~~83.09~~ 83.08	Depth to NAPL (ft btoc):	NONE
Ground Elevation (ft amsl):	~~81.84~~ 81.84	Date of Measurement:	11.14.18
TOC - Ground Offset (ft):	~~1.25~~ 1.24	Ambient Air Temperature (°F):	35.0
Total Depth (ft bgs):	~~28.32~~ 15.74	Weather Conditions:	Sunny, V-cold 30's, windy
Top of Screen (ft bgs):	~~24.24~~ 14.24	Time Thermocouples Deployed:	1012

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1025	3.25	12.25	2.00	J	49.9	50.1	50.0
1040	4.25		3.00	I	49.5	49.6	49.55
1027	5.25		4.00	H	53.1	53.2	53.15
1028	6.25		5.00	G	56.4	56.3	56.35
1030	7.25		6.00	F	58.9	58.8	58.85
1042	8.25		7.00	E	59.6	59.7	59.65
1032	9.25		8.00	D	61.7	61.7	61.7
1033	10.25		9.00	C	62.7	62.7	62.7
1034	11.25		10.00	B	62.9	62.8	62.85
1036	12.25	21	11.00	A	63.0	62.9	62.95
1055	13.25	~~22.25~~	12.00	J	63.7	63.7	63.1
1057	14.25		13.00	I	63.5	63.5	63.5
1059	15.25		14.00	H	63.2	63.3	63.25
	16.25		15.00	G			
	17.25		16.00	F			
	18.25		17.00	E			
	19.25		18.00	D			
	20.25	29.25	19.00	C/J			
	21.25		20.00	B/I			
	22.25		21.00	A/H			
	23.25		22.00	G			
	24.25		23.00	F			
	25.25		24.00	E			
	26.25		25.00	D			
	27.25		26.00	C			
	28.25		27.00	B			
	29.25		28.00	A			

15.45 (ft TOC) – restriction at this depth. Could be on well GZA-102R1 and NOT R2

CONFIRMED WELLS MISLABELED ONSITE THIS IS GZA102R1

Temperature Profiling Log

Well ID:	E2A-105D	Depth to Water (ft btoc):	3.96' PVC
TOC Elevation (ft amsl):	81.82	Depth to NAPL (ft btoc):	NONE
Ground Elevation (ft amsl):	82.09	Date of Measurement:	11.14.18
TOC - Ground Offset (ft):	-0.27	Ambient Air Temperature (°F):	~~30.8~~ 34.8
Total Depth (ft bgs):	26.00	Weather Conditions:	Sunny, 30s, v. windy
Top of Screen (ft bgs):	16.00	Time Thermocouples Deployed:	1128

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1145	1.71	10.71	2.00	J	50.2	50.3	50.25
1204	2.71		3.00	I	54.1	54.4	54.25
1148	3.71		4.00	H	58.7	58.8	58.75
1151	4.71		5.00	G	62.7	62.9	62.8
1152	5.71		6.00	F	62.9	63.0	62.95
1206	6.71		7.00	E	63.3	63.8	63.4
1154	7.71		8.00	D	63.9	63.9	63.9
1156	8.71		9.00	C	63.5	63.5	63.5
1158	9.71		10.00	B	63.2	63.9	63.55
1200	10.71		11.00	A	65.4	65.5	65.45
1210	11.71	19.71	12.00	J	65.3	65.5	65.4
1222	12.71		13.00	I	65.1	65.1	65.1
1212	13.71		14.00	H	65.5	65.9	65.7
1213	14.71		15.00	G	65.7	65.9	65.8
1214	15.71		16.00	F	65.6	65.9	65.75
1224	16.71		17.00	E	65.6	65.7	65.65
1216	17.71		18.00	D	65.6	65.6	65.6
1218	18.71		19.00	C	65.7	65.7	65.7
1219	19.71		20.00	B	65.3	65.3	65.3
1221	20.71		21.00	A	65.3	65.1	65.2
1226	21.71		22.00	C	64.7	64.7	64.7
1228	22.71		23.00	B	63.9	63.9	63.9
1229	23.71		24.00	A	63.2	63.2	63.2

10.71

Temperature Profiling Log

Well ID:	GZA-105R	Depth to Water (ft btoc):	
TOC Elevation (ft amsl):	81.80	Depth to NAPL (ft btoc):	
Ground Elevation (ft amsl):	82.06	Date of Measurement:	11-14-18
TOC - Ground Offset (ft):	-0.26	Ambient Air Temperature (°F):	
Total Depth (ft bgs):	36.50	Weather Conditions:	
Top of Screen (ft bgs):	34.50	Time Thermocouples Deployed:	

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
	1.74	10.74	2.00	J			
	2.74		3.00	I			
	3.74		4.00	H			
	4.74		5.00	G			
	5.74		6.00	F			
	6.74		7.00	E			
	7.74		8.00	D			
	8.74		9.00	C			
	9.74		10.00	B			
	10.74		11.00	A			
	11.74	20.74	12.00	J			
	12.74		13.00	I			
	13.74		14.00	H			
	14.74		15.00	G			
	15.74		16.00	F			
	16.74		17.00	E			
	17.74		18.00	D			
	18.74		19.00	C			
	19.74		20.00	B			
	20.74		21.00	A			
	21.74	30.74	22.00	J			
	22.74		23.00	I			
	23.74		24.00	H			
	24.74		25.00	G			
	25.74		26.00	F			
	26.74	35.74	27.00	E/J			
	27.74		28.00	D/I			
	28.74		29.00	C/H			
	29.74		30.00	B/G			
	30.74		31.00	A/F			
	31.74		32.00	E			
	32.74		33.00	D			
	33.74		34.00	C			
	34.74		35.00	B			
	35.74		36.00	A			

unable to get thermo wire/skinny Dipper into well (too small diameter)

Temperature Profiling Log

Well ID:	TRC-102	Depth to Water (ft btoc):	3.38
TOC Elevation (ft amsl):	81.21	Depth to NAPL (ft btoc):	None
Ground Elevation (ft amsl):	81.64	Date of Measurement:	11.14.18
TOC - Ground Offset (ft):	-0.43	Ambient Air Temperature (°F):	36
Total Depth (ft bgs):	12.25	Weather Conditions:	Sunny, 30's, v. windy
Top of Screen (ft bgs):	2.25	Time Thermocouples Deployed:	1242

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1255	1.57	10.57	2.00	J	52.3	52.3	52.3
1306	2.57		3.00	I/J	~~[illegible]~~ 55.5	55.8	55.8
1256	3.57		4.00	H/I	59.7	59.7	59.7
1257	4.57		5.00	G/H	60.7	60.7	60.7
1259	5.57		6.00	F/G	60.3	60.1	60.2
1307	6.57		7.00	E/F	61.5	61.6	61.5
1300	7.57		8.00	D/E	63.4	63.0	63.2
1301	8.57		9.00	C/D	63.7	63.5	63.6
1302	9.57		10.00	B/C	64.5	64.5	64.5
1303	10.57	~~[illegible]~~	11.00	A/B	65.1	~~[illegible]~~ 64.9	65.0
1308	11.57	~~[illegible]~~ 11.57	12.00	A	65.7	65.4	65.55

Temperature Profiling Log

Well ID:	TRC-103	Depth to Water (ft btoc):	4.13
TOC Elevation (ft amsl):	82.02	Depth to NAPL (ft btoc):	NONE
Ground Elevation (ft amsl):	82.42	Date of Measurement:	11.14.18
TOC - Ground Offset (ft):	-0.40	Ambient Air Temperature (°F):	35
Total Depth (ft bgs):	11.25	Weather Conditions:	Sunny, 30's, v. windy
Top of Screen (ft bgs):	1.25	Time Thermocouples Deployed:	1322

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1335	1.60	10.60	2.00	J	52.1	52.1	52.1
1345	2.60		3.00	I	54.7	54.3	54.5
1336	3.60		4.00	H	58.0	57.9	57.95
1337	4.60		5.00	G	62.6	62.5	62.5
1338	5.60		6.00	F	63.9	63.7	63.8
1346	6.60		7.00	E	63.9	63.7	63.8
1339	7.60		8.00	D	64.2	63.7	63.95
1341	8.60		9.00	C	64.8	64.4	64.6
1342	9.60		10.00	B	63.5	63.4	63.45
1343	10.60		11.00	A	65.5	65.1	65.3

Temperature Profiling Log

Well ID:	AE-4	Depth to Water (ft btoc):	4.22
TOC Elevation (ft amsl):	82.03	Depth to NAPL (ft btoc):	None
Ground Elevation (ft amsl):	82.29	Date of Measurement:	11-14-18
TOC - Ground Offset (ft):	-0.26	Ambient Air Temperature (°F):	35
Total Depth (ft bgs):	14.00	Weather Conditions:	Sunny, 30's, v windy
Top of Screen (ft bgs):	3.00	Time Thermocouples Deployed:	1356

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1410	1.74	10.74	2.00	J	52.6	52.1	52.35
1423	2.74		3.00	I	55.5	55.0	55.25
1413	3.74		4.00	H	59.2	58.7	59.95
1416	4.74	13.74	5.00	G/J	64.3	64.1	64.2
1417	5.74		6.00	F/I	65.8	65.4	65.6
~~[illegible]~~ 1424	6.74		7.00	E/H	65.0	64.6	64.8
1418	7.74		8.00	D/G	65.3	65.3	65.3
1419	8.74		9.00	C/F	66.5	66.1	66.3
1421	9.74		10.00	B/E	66.1	65.9	66.0
1422	10.74		11.00	A/D	66.4	66.0	66.2
1428	11.74		12.00	B	66.4	66.1	66.25
1429	12.46		13.00	A	67.5	67.1	67.3
	~~13.74~~		~~14.00~~	~~A~~ 2			

Could not go deep than 12.46.

Temperature Profiling Log

Well ID:	AE-3	Depth to Water (ft btoc):	4.52
TOC Elevation (ft amsl):	82.41	Depth to NAPL (ft btoc):	NONE
Ground Elevation (ft amsl):	82.65	Date of Measurement:	11-14-18
TOC - Ground Offset (ft):	-0.24	Ambient Air Temperature (°F):	35
Total Depth (ft bgs):	15.00	Weather Conditions:	Sunny, 30's, v. windy
Top of Screen (ft bgs):	3.00	Time Thermocouples Deployed:	1438

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1448	1.76	10.76	2.00	J	51.4	51.7	51.55
1459	2.76		3.00	I	53.9	54.0	53.95
1449	3.76		4.00	H	57.8	57.6	57.7
1450	4.76		5.00	G	62.6	62.3	62.45
1451	5.76	14.76	6.00	F/J	62.1	62.1	62.1
1501	6.76		7.00	E/I	62.0	61.9	61.95
1453	7.76		8.00	D/H	62.3	62.5	62.4
1455	8.76		9.00	C/G	63.7	63.5	63.6
1456	9.76		10.00	B/F	63.7	63.4	63.55
1457	10.76		11.00	A/E	63.3	63.1	63.2
1503	11.76		12.00	~~D~~ B	63.1	63.1	63.1
1505	12.75		13.00	~~C~~ A	63.7	63.7	63.7
	~~13.76~~		~~14.00~~	B			
	14.76		15.00	A			

Bottom at 12.75

Temperature Profiling Log

Well ID:	TRC-101	Depth to Water (ft btoc):	4.50
TOC Elevation (ft amsl):	82.18	Depth to NAPL (ft btoc):	NONE
Ground Elevation (ft amsl):	82.54	Date of Measurement:	11.14.18
TOC - Ground Offset (ft):	-0.36	Ambient Air Temperature (°F):	34
Total Depth (ft bgs):	10.50	Weather Conditions:	Sunny, 30's, ↓ windy
Top of Screen (ft bgs):	1.50	Time Thermocouples Deployed:	1515

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1535	1.64	9.64	2.00	I	53.0	52.8	52.9
1527	2.64		3.00	H	54.3	54.5	54.4
1529	3.64		4.00	G	57.1	57.0	57.05
1530	4.64		5.00	F	62.0	61.9	61.95
1536	5.64		6.00	E	62.1	62.1	62.1
1531	6.64		7.00	D	62.7	62.7	62.7
1532	7.64		8.00	C	63.6	63.6	63.6
1533	8.64		9.00	B	63.7	63.7	63.7
1534	9.64		10.00	A	63.8	63.7	63.75

Temperature Profiling Log

Well ID:	PZ-2S (July 2017 on)	Depth to Water (ft btoc):	4.89
TOC Elevation (ft amsl):	82.81	Depth to NAPL (ft btoc):	NONE
Ground Elevation (ft amsl):	83.25	Date of Measurement:	11-14-18
TOC - Ground Offset (ft):	-0.44	Ambient Air Temperature (°F):	32
Total Depth (ft bgs):	8.55	Weather Conditions:	Cloudy, 30's, v. windy
Top of Screen (ft bgs):	3.55	Time Thermocouples Deployed:	1546

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1558	1.56	7.56	2.00	G	46.8	46.7	46.75
1559	2.56		3.00	F	50.4	50.3	50.35
1605	3.56		4.00	E	54.1	53.9	54.0
1600	4.56		5.00	D	56.8	56.7	56.75
1601	5.56		6.00	C	56.9	56.8	56.85
1602	6.56		7.00	B	~~[illegible]~~ 57.0	56.9	56.95
1603	7.56		8.00	A	56.9	56.8	56.85

Temperature Profiling Log

Well ID:	CW-2	Depth to Water (ft btoc):	2.96
TOC Elevation (ft amsl):	80.73	Depth to NAPL (ft btoc):	None
Ground Elevation (ft amsl):	82.47	Date of Measurement:	11-14-18
TOC - Ground Offset (ft):	-1.74	Ambient Air Temperature (°F):	30
Total Depth (ft bgs):	8.10	Weather Conditions:	Dusk, cold, v. windy
Top of Screen (ft bgs):	1.70	Time Thermocouples Deployed:	1617

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1627	0.26	6.26	2.00	G	52.4	52.5	52.45
1628	1.26		3.00	F	55.9	56.1	56.0
1634	2.26		4.00	E	61.4	61.3	61.35
1629	3.26		5.00	D	61.5	61.4	61.45
1630	4.26		6.00	C	61.5	61.5	61.5
1631	5.26		7.00	B	61.7	61.6	61.65
1632	6.26		8.00	A	62.4	62.3	62.35

Temperature Profiling Log

Well ID:	CW-1	Depth to Water (ft btoc):	3.21
TOC Elevation (ft amsl):	80.94	Depth to NAPL (ft btoc):	NONE
Ground Elevation (ft amsl):	82.47	Date of Measurement:	11.14.18
TOC - Ground Offset (ft):	-1.53	Ambient Air Temperature (°F):	30
Total Depth (ft bgs):	9.40	Weather Conditions:	Dark, cold, v. windy
Top of Screen (ft bgs):	1.40	Time Thermocouples Deployed:	1644

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F)		
					Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1656	0.47	7.47	2.00	H	45.6	45.7	45.65
1658	1.47		3.00	G	53.0	53.0	53.0
1704	2.47		4.00	F	55.1	55.3	55.2
1710	3.47		5.00	E	60.8	60.9	60.85
1705	4.47		6.00	D	60.9	61.0	60.95
1706	5.47		7.00	C	61.3	61.3	61.3
1707	6.47		8.00	B	62.0	62.0	62.0
1708	7.47		9.00	A	62.1	61.9	62.0

Temperature Profiling Log

Well ID:	GZA-105S	Depth to Water (ft btoc):	4.11
TOC Elevation (ft amsl):	81.89	Depth to NAPL (ft btoc):	NONE
Ground Elevation (ft amsl):	82.11	Date of Measurement:	11-14-18
TOC - Ground Offset (ft):	0.22	Ambient Air Temperature (°F):	30
Total Depth (ft bgs):	14.00	Weather Conditions:	Dark, cold, v. windy
Top of Screen (ft bgs):	4.00	Time Thermocouples Deployed:	1729

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1739	2.22	11.22	2.00	J	46.2	46.8	46.5
1748	3.22		3.00	I	53.1	53.5	53.3
1740	4.22		4.00	H	62.7	62.5	62.6
1741	5.22		5.00	G	62.7	62.7	62.7
1742	6.22		6.00	F	62.9	63.3	63.1
1749	7.22		7.00	E	63.6	63.8	63.7
1743	8.22		8.00	D	65.1	65.1	65.1
1744	9.22		9.00	C	64.7	64.7	64.7
1745	10.22		10.00	B	65.3	65.3	65.3
1746	11.22		11.00	A	65.9	66.1	66.0
1750	12.22		12.00	B	65.7	65.8	65.75
1751	13.22		13.00	A	66.1	66.0	66.15
			[illegible]				

Temperature Profiling Log

DID NOT TEMP. PROFILE

Well ID:	GZA-102S	Depth to Water (ft btoc):	4.71
TOC Elevation (ft amsl):	82.82	Depth to NAPL (ft btoc):	
Ground Elevation (ft amsl):	81.89	Date of Measurement:	
TOC - Ground Offset (ft):	.93	Ambient Air Temperature (°F):	
Total Depth (ft bgs):	10.70	Weather Conditions:	
Top of Screen (ft bgs):	1.70	Time Thermocouples Deployed:	

stickup

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F)		
					Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA*

Sampler: JKH/BTR

Proj. No.: 60552044.35

Date: 11-15-18

Weather Observations: Cloudy, 20's

WELL ID: GZA-102S

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 1.5 (inches)

Depth to Top of Screen 2.63 (feet TOC)

Depth to LNAPL NONE (feet TOC)

Depth to Water: 4.95 (feet TOC)

Depth to Tubing Opening: 4' (feet TOC)

Total Depth of Well 11.63 (feet TOC)

Purge Volume: ______ L (calculated)

Gas Purging/Sampling Equipment: PID, GEM 5000 Or Other: PID: 0.0ppm

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm$_v$	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)
~~0845~~ 0845	Begin purging					
0845:30	22.6	0.2	0	0.1	30.45	
0846	22.6	0.2	0	0.1	"	
0846:30	22.6	0.2	0	0.1	"	
0847	22.6	0.2	0	0.1	"	
0847:30	22.6	0.2	0	0.1	"	
0848	22.6	0.1	0	0.1	"	
0848:30	22.6	0.1	0	0.1	"	
0849	22.6	0.1	0	0.1	"	
0849:30	22.6	0.1	0	0.1	"	
0850	22.6	0.1	0	0.1	"	
	END OF TEST: All results stable					

Comments:

BTU:

PID (before and after purging) ppm$_v$: 0.0ppm / 0.0ppm

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA*

Sampler: JKH/BTR

Proj. No.: 60552044.35

Date: 11-15-18

Weather Observations: cloudy, 20's

WELL ID: GZA-105S

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 1.5 (inches)
Depth to Top of Screen 3.78 (feet TOC)
Depth to LNAPL NONE (feet TOC)
Depth to Water: 4.29 (feet TOC)
Depth to Tubing Opening: (feet TOC)
Total Depth of Well 13.78 (feet TOC)

Purge Volume: ______ L (calculated)

Gas Purging/Sampling Equipment: PID / GEM 5000 Or Other:

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)
0910:30	22.5	0.7	0	0.2	35.41	
0911	22.3	0.8	0	0.2	"	
0911:30	22.2	0.8	0	0.2	"	
0912	22.2	0.8	0	0.2	"	
0912:30	22.2	0.8	0	0.2	"	
0913	22.2	0.9	0	0.2	"	
0913:30	22.3	0.8	0	0.2	"	
0914	22.3	0.8	0	0.2	"	
0914:30	22.3	0.8	0	0.2	"	
0915	22.3	0.8	0	0.2	"	
0915:30	22.3	0.7	0	0.2	"	
0916	22.4	0.7	0	0.2	"	
0916:30	22.4	0.7	0	0.2	"	
	Parameters stable - END OF TEST					

Comments:

BTU:

PID (before and after purging) ppm_v: 12.2 / 2.8 ppm

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA*　　Sampler: JKH/BTR

Proj. No.: 60552044.35　　Date: 11·15·18　　Weather Observations: Cloudy, 20's

WELL ID: TRC-102

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 1.25 (inches)
Depth to Top of Screen: 1.82 (feet TOC)
Depth to LNAPL: NONE (feet TOC)
Depth to Water: 3.64 (feet TOC)
Depth to Tubing Opening: 2.64 (feet TOC)
Total Depth of Well: 11.82 (feet TOC)

Purge Volume: ______ L (calculated)

Gas Purging/Sampling Equipment: MiniRae 3000 PID / GEM 5000 Or　　Other: ______

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)
0935	22.3	0.7	0	0.1	30.41	
0935:30	22.0	0.6	0	0.1	30.41	
0936	22.2	0.6	0	0.1	"	
0936:30	22.2	0.5	0	0.1	"	
0937	22.2	0.5	0	0.1	"	
0937:30	22.2	0.5	0	0.1	"	
0938	22.2	0.4	0	0.1	"	
0938:30	22.2	0.4	0	0.1	"	
0939	22.2	0.4	0	0.1	"	
0939:30	22.2	0.4	0	0.1	"	
0940	22.2	0.4	0	0.1	"	
	END OF	TEST	/ Parameters	stable		

Comments:

BTU:

PID (before and after purging) ppm_v: 0.0 / 0.0 ppm

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA* Sampler: JKH/BTR

Proj. No.: 60552044.35 Date: 11-15-18 Weather Observations: cloudy, 20's

WELL ID: TRC-103

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 1.25 (inches)
Depth to Top of Screen 0.85 (feet TOC)
Depth to LNAPL NONE (feet TOC)
Depth to Water: 4.37 (feet TOC)
Depth to Tubing Opening: 3.37 (feet TOC)
Total Depth of Well 10.85 (feet TOC)

Purge Volume: ______ L (calculated)

Gas Purging/Sampling Equipment: MiniRae 3000 PID / GEM 5000 Or Other: ______

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)
0953:30	22.0	0.4	0	0.1	30.48	
0954	22.0	0.4	0	0.1	30.41	
0954:30	22.1	0.3	0	0.1	"	
0955	22.1	0.3	0	0.1	"	
0955:30	22.2	0.3	0	0.1	"	
0956	22.2	0.2	0	0.1	"	
0956:30	22.2	0.2	0	0.1	"	
0957	22.2	0.2	0	0.1	"	
0957:30	22.2	0.2	0	0.1	"	
0958	22.2	0.2	0	0.1	"	
0958:30	22.2	0.2	0	0.1	"	
	Parameters stable - END OF TEST					

Comments:

BTU:

PID (before and after purging) ppm_v: 0.0 / 0.0

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA* Sampler: JKH/BTR

Proj. No.: 60552044.35 Date: 11·15·18 Weather Observations: Cloudy, 20's

WELL ID: AE-4

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 2 (inches)
Depth to Top of Screen: 2.74 (feet TOC)
Depth to LNAPL: NONE (feet TOC)
Depth to Water: 4.38 (feet TOC) Purge Volume: ______ L (calculated)
Depth to Tubing Opening: 3.58 (feet TOC)
Total Depth of Well: 13.74 (feet TOC)

Gas Purging/Sampling Equipment: MiniRae 3000 PID / GEM 5000 Or Other: ______

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)
1009:30	22.1	0.6	0	0.1	30.37	0.5-1 L/min
1010	22.0	0.6	0	0.1	"	
1010:30	22.0	0.6	0	0.1	"	
1011	22.0	0.6	0	0.1	"	
1011:30	22.0	0.6	0	0.1	"	
1012	22.1	0.5	0	0.1	"	
1012:30	22.1	0.5	0	0.1	"	
1013	22.1	0.5	0	0.1	"	
1013:30	22.1	0.5	0	0.1	"	
1014	22.1	0.5	0	0.1	"	
1014:30	22.1	0.4	0	0.1	"	
1015	22.1	0.4	0	0.1	"	
1015:30	22.1	0.4	0	0.1	"	
	END OF TEST - Parameters stable					

Comments:

BTU:

PID (before and after purging) ppm_v: 0.0 / 0.0

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA* Sampler: JKH/BTR

Proj. No.: 60552044.35 Date: 11.15.18 Weather Observations: Cloudy, 20's

WELL ID: AE-3

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 2 (inches)
Depth to Top of Screen: 2.76 (feet TOC)
Depth to LNAPL: NONE (feet TOC)
Depth to Water: 4.74 (feet TOC) Purge Volume: ______ L (calculated)
Depth to Tubing Opening: 3.74 (feet TOC)
Total Depth of Well: 14.76 (feet TOC)

Gas Purging/Sampling Equipment: MiniRae 3000 PID/GEM 5000 Or Other: ______

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)
1028	19.9	3.6	0	0.1	30.87	0.5-1L/min
1028:30	19.2	4.1	0	0.1	"	
1029	18.7	4.5	0	0.1	"	
1029:30	18.5	4.8	0	0.1	"	
1030	18.2	5.2	0	0.1	"	
1030:30	17.9	5.4	0	0.1	"	
1031	17.8	5.5	0	0.1	"	
1031:30	17.7	5.6	0	0.1	"	
1032	17.7	5.6	0	0.1	"	
1032:30	17.8	5.5	0	0.1	"	
1033	18.1	5.3	0	0.1	"	
1033:30	18.4	5.1	0	0.1	"	
1034	18.6	4.9	0	0.1	"	
1034:30	18.7	4.7	0	0.1	"	
1035	18.9	4.6	0	0.1	"	
1035:30	19.2	4.3	0	0.1	"	
1036	19.3	4.2	0	0.1	"	
1036:30	19.5	4.0	0	0.1	"	
1037	19.7	3.8	0	0.1	"	
1037:30	19.8	3.7	0	0.1	"	
1038	19.9	3.6	0	0.1	"	

Parameters w/in 10% of 3 consecutive readings
END OF TEST

Comments:

BTU:

PID (before and after purging) ppm_v: 101.2/62.7

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA* Sampler: JKH/BTR

Proj. No.: 60552044.35 Date: 11.15.18 Weather Observations: Cloudy, 20's

WELL ID: TRC-101

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 1.25 (inches)
Depth to Top of Screen: 1.14 (feet TOC)
Depth to LNAPL: NONE (feet TOC)
Depth to Water: 4.28 (feet TOC)
Depth to Tubing Opening: 3.28 (feet TOC)
Total Depth of Well: 10.14 (feet TOC)

Purge Volume: ______ L (calculated)

Gas Purging/Sampling Equipment: MiniRae 3000 PID/GEM 5000 Or Other: ______

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)
1108:30	6.6	4.5	0	8.7	30.36	0.5-1L/min
1109	7.7	4.0	0	7.5	"	
1109:30	10.4	3.3	0	6.1	"	
1110	12.8	2.7	0	4.8	"	
1110:30	14.6	2.2	0	3.9	"	
1111	16.4	1.8	0	2.9	"	
1111:30	17.6	1.5	0	2.4	"	
1112	18.3	1.3	0	2.1	"	
1112:30	18.8	1.1	0	1.7	"	
1113	19.2	1.0	0	1.5	"	
1113:30	19.6	0.9	0	1.3	"	
1114	19.9	0.9	0	1.2	"	
1114:30	20.2	0.8	0	1.0	"	
1115	20.3	0.8	0	1.0	"	
1115:30	20.4	0.7	0	0.9	"	
1116	20.6	0.7	0	0.8	"	
1116:30	20.7	0.7	0	0.8	"	
	END	OF TEST				
	Parameters w/in		10% of 3	consecutive	readings	

Comments: ______

BTU: ______

PID (before and after purging) ppm_v: 52.7/5.9 ppm

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA* Sampler: JKH/BTR

Proj. No.: 60552044.35 Date: 11.15.18 Weather Observations: Cloudy, cold 20's

WELL ID: PZ-2S

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 4 (inches)
Depth to Top of Screen 3.11 (feet TOC)
Depth to LNAPL NONE (feet TOC)
Depth to Water: 4.51 (feet TOC) Purge Volume: ______ L (calculated)
Depth to Tubing Opening: ______ (feet TOC)
Total Depth of Well 8.11 (feet TOC)

Gas Purging/Sampling Equipment: MiniRae 3000/GEM 5000 Or Other: ______

Field Measurements 21.8 ambient

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)
1227	21.0	0.6	0	0.1		0.5-1 L/min
1227:30	21.0	0.6	0	0.1		
1228	21.0	0.6	0	0.1		
1228:30	21.0	0.6	0	0.1		
1229	21.0	0.6	0	0.1		
1229:30	21.0	0.6	0	0.1		
1230	21.0	0.6	0	0.1		
1230:30	21.0	0.6	0	0.1		
1231	21.0	0.6	0	0.1		
1231:30	21.0	0.6	0	0.1		

Comments:

BTU:

PID (before and after purging) ppm_v: 1.7ppm/0.4 ppm

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA* Sampler: JKH / BTR

Proj. No.: 60552044.35 Date: 11.15.18 Weather Observations: Cloudy, 20's

WELL ID: CW-2

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 8 (inches)
Depth to Top of Screen: 0 (feet TOC)
Depth to LNAPL: NONE (feet TOC)
Depth to Water: 3.05 (feet TOC)
Depth to Tubing Opening: 2.05 (feet TOC)
Total Depth of Well: 6.36 (feet TOC)

Purge Volume: ______ L (calculated)

Gas Purging/Sampling Equipment: MiniRae 3000 PID / GEM 5000 Or Other: ______

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)
1155:30	21.5	0.7	0	0.1	30.37	
1156	21.5	0.7	0	0.1	"	
1156:30	21.4	0.7	0	0.1	"	
1157	21.4	0.7	0	0.1	"	
1157:30	21.4	0.7	0	0.1	"	
1158	21.3	0.8	0	0.1	"	
1158:30	21.3	0.8	0	0.2	"	
1159	21.3	0.8	0	0.2	"	
1159:30	21.3	0.8	0	0.2	"	
1200	21.3	0.8	0	0.2	"	
1200:30	21.3	0.8	0	0.2	"	

Comments: PVC screen all the way to TOC - NO solid riser pipe

BTU:

PID (before and after purging) ppm_v: 133.6 ppm / 121.8 ppm

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA* Sampler: JKH / BTR

Proj. No.: 60552044.35 Date: 11·15·18 Weather Observations: Cloudy, 20's

WELL ID: CW-1

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 8 (inches)
Depth to Top of Screen: 0 (feet TOC)
Depth to LNAPL: NONE (feet TOC)
Depth to Water: 3.30 (feet TOC) Purge Volume: ______ L (calculated)
Depth to Tubing Opening: 2.80 (feet TOC)
Total Depth of Well: 7.87 (feet TOC)

Gas Purging/Sampling Equipment: MiniRae 3000 PID / GEM 5000 Or Other: ______

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)
1143	21.8	0.4	0	0.1	30.35	0.5-1 L/min
1143:30	21.8	0.5	0	0.1	"	
1144	21.8	0.5	0	0.1	"	
1144:30	21.8	0.5	0	0.1	"	
1145	21.8	0.5	0	0.1	"	
1145:30	21.7	0.5	0	0.1	"	
1146	21.7	0.5	0	0.1	"	
1146:30	21.7	0.5	0	0.1	"	
1147	21.7	0.5	0	0.1	"	
1147:30	21.7	0.5	0	0.1	"	
1148	21.7	0.5	0	0.1	"	
	END	OF TEST				

Comments: PVC Well Screen comes all the way to TOC; no solid PVC Riser pipe

BTU:

PID (before and after purging) ppm_v: 69.0 / 17.1 ppm

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA* Sampler: JKH/BTR

Proj. No.: **60552044.35** Date: 11.15.18 Weather Observations: cloudy, 20's

WELL ID: AE-1S

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 2 (inches)
Depth to Top of Screen 6.57 (feet TOC)
Depth to LNAPL NONE (feet TOC)
Depth to Water: 6.56 (feet TOC)
Depth to Tubing Opening: 5.56 (feet TOC)
Total Depth of Well 16.57 (feet TOC)

Purge Volume: ________ L (calculated)

Gas Purging/Sampling Equipment: MiniRae 3000/ & GEM 5000 Or Other: ________

Ambient 22.0 **Field Measurements**

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)
1252:30	17.5	4.9	0	0.1		
1253	17.0	4.9	0	0.1		
1253:30	17.0	4.8	0	0.1		
1254	17.1	4.7	0	0.1		
1254:30	17.1	4.7	0	0.1		
1255	17.2	4.6	0	0.1		
1255:30	17.3	4.5	0	0.1		
1256	17.4	4.4	0	0.1		
1256:30	17.5	4.3	0	0.1		
1257	18.1	3.5	0	0.1		
1257:30	20.2	1.8	0	0.1		

Comments:

BTU:

PID (before and after purging) ppm_v: 0.0 / 0.0

AECOM

Low Volume Purge Field Data Sheet

Site: Former GE, Wilmington, MA   Sampler: JKH/BTR

Proj. No.: ______   Date: 11-15-18   Weather Observations: Cloudy, 20's

WELL ID: GZA-12

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 1.5 (inches)
Depth to Top of Screen: ______ (feet TOC)
Depth to LNAPL: — (feet TOC)
Depth to Water: 7.72 (feet TOC)
Depth to Tubing Opening: 6.72 (feet TOC)
Total Depth of Well: ______ (feet TOC)

Well screen fully submerged

Purge Volume: ______ L (calculated)

Gas Purging/Sampling Equipment: MiniRae 3000 PID/ GEM 5000   Or   Other: ______

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm$_v$	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)
	TEST TO SEE IF GEM 5000 shuts down					
1310	Start GEM 5000 and will see if it shuts down					
	22.3	0.2	0	0.1		
	22.3	0.2	0	0.1		
	22.3	0.2	0	0.1		
	22.3	0.2	0	0.1		
	22.3	0.2	0	0.1		
	22.3	0.2	0	0.1		
	22.3	0.2	0	0.1		
1330		GEM 5000 Did NOT shut down				
		Attempted to block intake w/ finger and this, too, did NOT shut GEM 5000 down. So it appears that is no safety mechanism to shut down when no air.				

Comments: ______

BTU:

PID (before and after purging) ppm$_v$: 0.0/

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA*　　Sampler: ____

Proj. No.: **60552044.35**　　Date: ____　　Weather Observations: ____

WELL ID: GZA-102R1

SCREEN SUBMERGED

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 0.5 (inches)
Depth to Top of Screen: 15.48 (feet TOC)
Depth to LNAPL: NA (feet TOC)
Depth to Water: 11/14 4.78 (feet TOC)
Depth to Tubing Opening: NA (feet TOC)
Total Depth of Well: 16.98 (feet TOC)

Purge Volume: ____ L (calculated)

Gas Purging/Sampling Equipment: ____　　Or　　Other: ____

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)

Comments: ____

BTU: ____

PID (before and after purging) ppm_v: ____

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA* Sampler: ______

Proj. No.: **60552044.35** Date: ______ Weather Observations: ______

WELL ID: GZA-102R2

SCREEN SUBMERGED

Casing Diameter: 0.5 (inches)
Depth to Top of Screen 25.49 (feet TOC)
Depth to LNAPL ______ (feet TOC)
Depth to Water: ______ (feet TOC)
Depth to Tubing Opening: ______ (feet TOC)
Total Depth of Well 29.57 (feet TOC)

Purge Volume: ______ L (calculated)

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Gas Purging/Sampling Equipment: ______ Or Other: ______

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)

Comments: ______

BTU: ______

PID (before and after purging) ppm_v: ______

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA* Sampler: ____________

Proj. No.: **60552044.35** Date: ________ Weather Observations: ____________

WELL ID: GZA-105D

SCREEN SUBMERGED

Casing Diameter:	1.5	(inches)
Depth to Top of Screen	15.73	(feet TOC)
Depth to LNAPL	NA	(feet TOC)
Depth to Water: 10/14	3.96	(feet TOC)
Depth to Tubing Opening:	NA	(feet TOC)
Total Depth of Well	25.73	(feet TOC)

Purge Volume: ________ L (calculated)

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Gas Purging/Sampling Equipment: ____________ Or Other: ____________

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)

Comments: ____________

BTU:

PID (before and after purging) ppm_v:

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility, Wilmington, MA* Sampler: ______

Proj. No.: **60552044.35** Date: ______ Weather Observations: ______

WELL ID: GZA-105R

SCREEN SUBMERGED

Casing Diameter:	0.5	(inches)
Depth to Top of Screen	34.24	(feet TOC)
Depth to LNAPL	X	(feet TOC)
Depth to Water:	X	(feet TOC)
Depth to Tubing Opening:	X	(feet TOC)
Total Depth of Well	36.24	(feet TOC)

Purge Volume: ______ L (calculated)

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Gas Purging/Sampling Equipment: ______ Or Other: ______

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)

Comments: ______

BTU:

PID (before and after purging) ppm_v:

NSZD FIELD RECORDS – SEPTEMBER 2020

AECOM

Low Volume Purge Field Data Sheet

Site: ***Former GE Facility - Wilmington, MA*** Sampler: ***Dylan Potter***

Proj. No.: **60552044** Date: 9/22/2020 Weather Observations: 62.1 F

WELL ID: AE-3

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 2 (inches)
Depth to Top of Screen 2.76 (feet TOC)
Depth to LNAPL ND (feet TOC)
Depth to Water: 6.95 (feet TOC) Purge Volume: ______ L (calculated)
Depth to Tubing Opening: 6.5 (feet TOC)
Total Depth of Well 12.61 (feet TOC from May-2020)

Gas Purging/Sampling Equipment: PID: Ion Tiger SN:100-1474
4-Gas Meter: GEM2000 SN: GMO7304

Field Measurements

Time hh:mm:ss	*O_2 (vol%)*	*CO_2 (vol%)*	*H_2S ppm_v*	*CH_4 (vol%)*	*Relative Pressure (IWC)*	*Soil Gas Purge Rate (L/min)*	*PID (ppm)*
11:35:30 AM	0.8	20.4	ND	28.4	NM	-	113.6
11:40:00 AM	0.4	20.5	ND	29.7	NM	-	119.5
11:40:30 AM	0.4	20.4	ND	30.2	NM	-	121.9
11:45:00 AM	0.6	20	ND	30.5	NM	-	123
11:45:30 AM	0.5	20.1	ND	30.7	NM	-	124.9
11:50:00 AM	0.4	20.1	ND	31.3	NM	-	125.4
11:55:30 AM	0.5	20	ND	31.3	NM	-	125.5
12:00:00 AM	0.5	20	ND	31.3	NM	-	125.9

Comments:

BTU:

PID (before and after purging) ppm_v:

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility - Wilmington, MA* Sampler: *Dylan Potter*

Proj. No.: **60552044** Date: 9/22/2020 Weather Observations: 67.0 F

WELL ID: CW-1

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 8 (inches)
Depth to Top of Screen 0 (feet TOC)
Depth to LNAPL 5.69 (feet TOC)
Depth to Water: 5.7 (feet TOC) Purge Volume: ______ L (calculated)
Depth to Tubing Opening: 5.2 (feet TOC)
Total Depth of Well 7.87 (feet TOC from May-2020)

Gas Purging/Sampling Equipment: PID: Ion Tiger SN:100-1474
4-Gas Meter: GEM2000 SN: GMO7304

Field Measurements

Time hh:mm:ss	*O_2 (vol%)*	*CO_2 (vol%)*	*H_2S ppm_v*	*CH_4 (vol%)*	*Relative Pressure (IWC)*	*Soil Gas Purge Rate (L/min)*	*PID (ppm)*
4:05:30 PM	3.1	11.9	ND	1.1	NM	-	1297
4:06:00 PM	3.1	12	ND	1.7	NM	-	1306
4:06:30 PM	3.3	11.8	ND	2.2	NM	-	1304
4:07:00 PM	3.2	11.9	ND	2.3	NM	-	1305
4:07:30 PM	3.6	11.8	ND	2.6	NM	-	-
4:08:00 PM	3.8	11.5	ND	2.7	NM	-	-
4:08:30 PM	4.3	11.2	ND	2.9	NM	-	-
4:09:00 PM	4.6	10.6	ND	3.1	NM	-	-
4:09:30 PM	4.8	10.6	ND	3.3	NM	-	-
4:10:00 PM	4.7	10.6	ND	3.3	NM	-	-
4:10:30 PM	4.8	10.7	ND	3.5	NM	-	-

Comments:

BTU:

PID (before and after purging) ppm_v:

AECOM

Low Volume Purge Field Data Sheet

Site: ***Former GE Facility - Wilmington, MA*** Sampler: ***Dylan Potter***

Proj. No.: **60552044** Date: 9/22/2020 Weather Observations: 66.0 F

WELL ID: CW-2

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 8 (inches)
Depth to Top of Screen: 0 (feet TOC)
Depth to LNAPL: 5.46 (feet TOC)
Depth to Water: 5.48 (feet TOC) Purge Volume: ______ L (calculated)
Depth to Tubing Opening: 5 (feet TOC)
Total Depth of Well: 6.36 (feet TOC from May-2020)

Gas Purging/Sampling Equipment: PID: Ion Tiger SN:100-1474
4-Gas Meter: GEM2000 SN: GMO7304

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)	PID (ppm)
4:30:30 PM	4.4	11.4	ND	2.2	NM	-	1300
4:31:00 PM	4.1	11.3	ND	2.7	NM	-	1311
4:31:30 PM	4.3	11.4	ND	3	NM	-	1316
4:32:00 PM	4.2	11.3	ND	3.3	NM	-	1317
4:32:30 PM	4.3	11.3	ND	3.6	NM	-	1312
4:33:00 PM	4.4	11.3	ND	3.8	NM	-	1314
4:33:30 PM	4.5	11.1	ND	3.9	NM	-	-
4:34:00 PM	4.6	11	ND	4.2	NM	-	-
4:34:30 PM	4.7	11	ND	4.3	NM	-	-
4:35:00 PM	4.6	11	ND	4.4	NM	-	-
4:35:30 PM	4.8	11	ND	4.4	NM	-	-
4:36:00 PM	4.8	10.9	ND	4.6	NM	-	-
4:36:30 PM	5	10.8	ND	4.7	NM	-	-
4:37:00 PM	5	10.8	ND	4.7	NM	-	-
4:37:30 PM	5.1	10.7	ND	4.9	NM	-	-
4:38:00 PM	5	10.7	ND	4.9	NM	-	-

Comments:

BTU:

PID (before and after purging) ppm_v:

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility - Wilmington, MA* Sampler: *Dylan Potter*

Proj. No.: **60552044** Date: 9/22/2020 Weather Observations: 61.1 F

WELL ID: GZA-105S

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 1.5 (inches)
Depth to Top of Screen 3.78 (feet TOC)
Depth to LNAPL ND (feet TOC)
Depth to Water: 6.41 (feet TOC) Purge Volume: ______ L (calculated)
Depth to Tubing Opening: 5.9 (feet TOC)
Total Depth of Well 13.78 (feet TOC from Nov-2018)

Gas Purging/Sampling Equipment: PID: Ion Tiger SN:100-1474
4-Gas Meter: GEM2000 SN: GMO7304

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)	PID (ppm)
11:04:30 AM	0.7	13.5	ND	4.3	NM	-	453.1
11:05:00 AM	0	13.6	ND	5.7	NM	-	456.6
11:05:30 AM	0	13.6	ND	6.4	NM	-	460.4
11:06:00 AM	0	13.7	ND	7.0	NM	-	460.3
11:06:30 AM	0	13.7	ND	7.5	NM	-	459.9
11:07:00 AM	0	13.7	ND	7.7	NM	-	-
11:07:30 AM	0	13.8	ND	8.4	NM	-	-
11:08:00 AM	0	13.6	ND	8.6	NM	-	-
11:08:30 AM	0	13.6	ND	8.9	NM	-	-
11:09:00 AM	0	13.7	ND	9.3	NM	-	-
11:09:30 AM	0	13.6	ND	9.4	NM	-	-
11:10:00 AM	0	13.6	ND	9.5	NM	-	-
11:10:30 AM	0	13.7	ND	9.4	NM	-	-

Comments:

BTU:

PID (before and after purging) ppm_v:

AECOM

Low Volume Purge Field Data Sheet

Site: ***Former GE Facility - Wilmington, MA*** Sampler: ***Dylan Potter***

Proj. No.: **60552044** Date: 9/22/2020 Weather Observations: 65.2 F

WELL ID: PZ-2S

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 4 (inches)
Depth to Top of Screen 3.11 (feet TOC)
Depth to LNAPL ND (feet TOC)
Depth to Water: 6.82 (feet TOC) Purge Volume: ______ L (calculated)
Depth to Tubing Opening: 6.3 (feet TOC)
Total Depth of Well 8.11 (feet TOC from May-2020)

Gas Purging/Sampling Equipment: PID: Ion Tiger SN:100-1474
4-Gas Meter: GEM2000 SN: GMO7304

Field Measurements

Time hh:mm:ss	*O_2 (vol%)*	*CO_2 (vol%)*	*H_2S ppm_v*	*CH_4 (vol%)*	*Relative Pressure (IWC)*	*Soil Gas Purge Rate (L/min)*	*PID (ppm)*
3:35:30 PM	15.5	3.7	ND	0.9	NM	-	0
3:36:00 PM	15.5	3.6	ND	0.8	NM	-	0
3:36:30 PM	15.7	3.6	ND	0.8	NM	-	0
3:37:00 PM	15.8	3.5	ND	0.7	NM	-	-
3:37:30 PM	15.9	3.5	ND	0.7	NM	-	-
3:38:00 PM	15.9	3.4	ND	0.6	NM	-	-
3:38:30 PM	15.9	3.4	ND	0.6	NM	-	-
3:39:00 PM	15.9	3.4	ND	0.6	NM	-	-

Comments:

BTU:
PID (before and after purging) ppm_v:

AECOM

Low Volume Purge Field Data Sheet

Site: *Former GE Facility - Wilmington, MA*   Sampler: *Dylan Potter*

Proj. No.: **60552044**   Date: 9/22/2020   Weather Observations: 68.7 F

WELL ID: TRC-101

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 1.25 (inches)
Depth to Top of Screen 1.14 (feet TOC)
Depth to LNAPL ND (feet TOC)
Depth to Water: 6.71 (feet TOC)   Purge Volume: ______ L (calculated)
Depth to Tubing Opening: 6.1 (feet TOC)
Total Depth of Well 10.14 (feet TOC from May-2020)

Gas Purging/Sampling Equipment: PID: Ion Tiger SN:100-1474
4-Gas Meter: GEM2000 SN: GMO7304

Field Measurements

Time hh:mm:ss	O_2 (vol%)	CO_2 (vol%)	H_2S ppm_v	CH_4 (vol%)	Relative Pressure (IWC)	Soil Gas Purge Rate (L/min)	PID (ppm)
2:51:30 PM	0.3	17.1	7	32.3	NM	-	614.8
2:52:00 PM	0	16.7	6	33.1	NM	-	626.5
2:52:30 PM	0	15.2	3	32.2	NM	-	635
2:53:00 PM	0.2	12.8	0	27.7	NM	-	637.6
2:53:30 PM	1.5	10	ND	21.9	NM	-	637.5
2:54:00 PM	3.9	7.8	ND	19.0	NM	-	637.2
2:54:30 PM	6.5	6.5	ND	17.1	NM	-	-
2:55:00 PM	8.8	5.6	ND	15.5	NM	-	-
2:55:30 PM	10.5	4.8	ND	13.7	NM	-	-
2:56:00 PM	10.8	4.7	ND	13.5	NM	-	-
2:56:30 PM	11	4.5	ND	12.7	NM	-	-
2:57:00 PM	11.2	4.3	ND	12.4	NM	-	-
2:57:30 PM	11	4.3	ND	12.1	NM	-	-
2:58:00 PM	11.5	4.3	ND	12	NM	-	-
2:58:30 PM	11.6	4.2	ND	11.3	NM	-	-
2:59:00 PM	11.7	4.1	ND	10.9	NM	-	-
2:59:30 PM	11.9	4	ND	10.7	NM	-	-
3:00:00 PM	12	4	ND	10.4	NM	-	-
3:00:30 PM	12.1	4	ND	10	NM	-	-
3:01:00 PM	12.1	3.9	ND	9.9	NM	-	-
3:01:30 PM	12.2	3.9	ND	9.5	NM	-	-
3:02:00 PM	12.4	3.8	ND	9.2	NM	-	-
3:02:30 PM	12.4	3.8	ND	9.1	NM	-	-
3:03:00 PM	12.6	3.8	ND	8.8	NM	-	-
3:03:30 PM	12.7	3.8	ND	8.5	NM	-	-
3:04:00 PM	12.9	3.7	ND	8.5	NM	-	-
3:04:30 PM	12.9	3.7	ND	8.4	NM	-	-

Comments: ______

BTU:
PID (before and after purging) ppm_v:

Temperature Profiling Log

Well ID:	AE-3	Date:	9/21/20
TOC Elevation (ft amsl):	82.41	Depth to NAPL (ft btoc):	ND
Ground Elevation (ft amsl):	82.65	Depth to Water (ft btoc):	
TOC - Ground Offset (ft):	~~-0.24~~ -0.17	Ambient Air Temperature (°F):	57.6
Total Depth (ft bgs):	15.00	Weather Conditions:	sunny, breezy
Top of Screen (ft bgs):	3.00	Time Thermocouples Deployed:	1737

(sump 13 - 15 ft bgs)

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1751	~~-0.24~~ -0.17	9.73	0.00	J	63.6	~~62.8~~ 63.2	
1803	~~0.76~~ 0.83	10.73	1.00	I/J	69.9	70.3	
1752	~~1.76~~ 1.83		2.00	H	72.5	72.6	
1753	~~2.76~~ 2.83		3.00	G	75.4	75.5	
1754	~~3.76~~ 3.83		4.00	F	76.2	76.3	
1805	~~4.76~~ 4.83	10.73	5.00	E/F	76.5	76.5	
1755	~~5.76~~ 5.83		6.00	D	76.7	76.7	
1756	~~6.76~~ 6.83		7.00	C	76.4	76.5	
1757	~~7.76~~ 7.83		8.00	B	75.8	75.9	
1758	~~8.76~~ 8.83		9.00	A	75.3	75.3	
1806	~~9.76~~ 9.83	10.73	10.00	D/(A)	74.4	74.6	
1810 10.78	~~10.76~~ ~~10.83~~	~~[illegible]~~	11.00	~~C~~ B	73.6	73.8	
1811 11.78	~~11.76~~ ~~11.83~~		12.00	~~B~~ A	73.1	73.1	
	~~12.76~~ ~~12.83~~		~~13.00~~	~~A~~	[illegible]		

12.68 - DTB

Temperature Profiling Log

Well ID:	CW-1	Date:	9/21/20
TOC Elevation (ft amsl):	80.94	Depth to NAPL (ft btoc):	5.64
Ground Elevation (ft amsl):	82.47	Depth to Water (ft btoc):	5.65
TOC - Ground Offset (ft):	-1.53	Ambient Air Temperature (°F):	53.9
Total Depth (ft bgs):	9.40	Weather Conditions:	Sunset
Top of Screen (ft bgs):	1.40	Time Thermocouples Deployed:	1818

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Temperature (°F) Channel 2 (T2)	Temperature (°F) Average Temp T1 & T2
1835	-1.53	~~6.11~~	0.00	(G)/J	62.9	62.7	
1836	-0.53	5.87	1.00	(F)/I	63.5	63.3	
1853	0.47	8.37	2.00	E/(H)	73.2	73.5	
1837	1.47	5.45	3.00	(D)/G	75.2	75.2	
1838	2.47	↓	4.00	(C)/F	~~76.5~~ 77.0	76.5	
1839	3.47	↓	5.00	(B)/E	77.6	77.6	
1840	4.47	↓	6.00	(A)/D	77.8	78.0	
1845	5.47	8.37	7.00	C	78.1	78.3	
in H2O ↓ 1846	6.47	↓	8.00	B	76.7	76.9	
1847	7.47	↓	9.00	A	75.6	75.6	

Top of PVC slip cap 0.12' above casing · factored into Depth calculations

Temperature Profiling Log

Well ID:	GZA-12	Date:	9/21/20
TOC Elevation (ft amsl):	87.62	Depth to NAPL (ft btoc):	NP
Ground Elevation (ft amsl):	88.05	Depth to Water (ft btoc):	11.24
TOC - Ground Offset (ft):	-0.43	Ambient Air Temperature (°F):	59.3 / 60.0 (0945)
Total Depth (ft bgs):	24.50	Weather Conditions:	Sunny, dry
Top of Screen (ft bgs):	9.50	Time Thermocouples Deployed:	0952

Deployed Thermocouples at 0952, 1010 - move down 5 feet, 1103 - move down 5 feet, 1123 - move to bottom, 1132 - adjust to grab readings at 15 and 20 ft

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1026	-0.43	~~[illegible]~~ 9.47	0.00	J	61.4	61.4	
—	0.57		1.00	I	OL	OL	
~~66.7~~ 1028	1.57		2.00	H	66.7	66.4	
1029	2.57		3.00	G	67.5	67.6	
1031	3.57	14.47	4.00	F	67.9	68.0	
~~1033~~ 1052	4.57	~~14.90~~	5.00	E - J	~~66.8~~ 66.8	66.9	
1032	5.57		6.00	D	67.6	67.5	
1034	6.57		7.00	C	66.8	67.0	
1036	7.57		8.00	B	66.3	66.4	
1037	8.57	~~8.47~~	9.00	A	65.7	65.7	
1113	9.57	~~14.90~~	10.00	E - J	64.3	64.0	
1055	10.57	19.47	11.00	D	63.7	63.4	
1058 (in H_2O →)	11.57		12.00	C	62.6	62.6	
1100	12.57		13.00	B	62.2	62.1	
1102	13.57	22.47	14.00	A	61.8	61.5	
1139	14.57	~~22.90~~	15.00	H ~~E-J~~	60.0	60.0	
1116	15.57		16.00	D	60.3	59.9	
1118	16.57		17.00	C	60.0	59.9	
1119	17.57		18.00	B	59.1	59.0	
1121	18.57		19.00	A	58.2	58.4	
1147	19.57		20.00	C ~~E-J~~	58.0	57.6	
1132	20.57		21.00	D	57.5	57.5	
1130	21.57		22.00	C	56.9	56.8	
1128	22.57		23.00	B	56.3	56.1	
1127	23.57		24.00	A	56.0	56.0	

Ground surface - Port J at 9.90' on tape
- Top of PVC at 9.47 on tape

Temperature Profiling Log

Well ID:	PZ-2S (July 2017 on)	Date:	9/21/20
TOC Elevation (ft amsl):	82.81	Depth to NAPL (ft btoc):	ND
Ground Elevation (ft amsl):	83.25	Depth to Water (ft btoc):	6.77
TOC - Ground Offset (ft):	-0.44	Ambient Air Temperature (°F):	61.7
Total Depth (ft bgs):	8.55	Weather Conditions:	sunny, breezy
Top of Screen (ft bgs):	3.55	Time Thermocouples Deployed:	1655

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1715	-0.44	7.46	0.00	H	61.6	61.7	
1716	0.56		1.00	G	67.0	67.0	
1717	1.56		2.00	~~E~~ ~~H~~ F	68.0	68.0	
1725	2.56	6.46	3.00		69.8	69.8	
1718	3.56		4.00	D	70.6	70.7	
1719	4.56		5.00	C	71.2	71.2	
1720	5.56		6.00	B	71.2	71.3	
1721	6.56		7.00	A	71.1	71.2	
1731	~~7.00~~ 7.00		~~8.00~~ 7.44	A	70.8	70.9	
	~~8.56~~		~~9.00~~	~~A~~			

Temperature Profiling Log

Well ID:	GZA-105D	Date:	9/21/20
TOC Elevation (ft amsl):	81.82	Depth to NAPL (ft btoc):	NM
Ground Elevation (ft amsl):	82.09	Depth to Water (ft btoc):	6.33
TOC - Ground Offset (ft):	-0.27	Ambient Air Temperature (°F):	69.4
Total Depth (ft bgs):	~~20.00~~ 25	Weather Conditions:	Sunny, breezy
Top of Screen (ft bgs):	~~16.00~~ 15	Time Thermocouples Deployed:	1356, ~~1423~~,

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1410	-0.27	9.63	0.00	J	68.8	69.1	
~~1412~~	0.73		1.00	I	~~70~~		
1412	1.73		2.00	H	70.4	70.6	
1417	2.73		3.00	G	73.3	73.4	
1418	3.73		4.00	F	74.1	74.1	
1433	4.73	14.63	5.00	E - J	73.9	73.8	
1420	5.73		6.00	D	74.1	74.4	
M H2O 1421	6.73		7.00	C	73.0	73.0	
1422	7.73		8.00	B	72.2	72.2	
1423	8.73		9.00	A	71.9	71.7	
1437	9.73	19.63	10.00	E - J	70.4	70.3	
1431	10.73		11.00	D	69.6	69.7	
1430	11.73		12.00	C	68.6	68.7	
1429	12.73		13.00	B	67.4	67.6	
1428	13.73		14.00	A	66.6	66.7	
~~1442~~ 1457	14.73	24.63	15.00	E - J	~~62.6~~ 64.2	~~62.5~~ 64.2	
1438	15.73		16.00	D	64.3	64.4	
1439	16.73		17.00	C	63.5	63.4	
1440	17.73		18.00	B	62.6	62.5	
1441	18.73		19.00	A	61.7	61.8	
1515	19.73	23.63	20.00	D ~~E-J~~	60.9	61.1	
1458	20.73		21.00	D	60.6	60.6	
1459	21.73		22.00	C	60.3	60.2	
1500	22.73		23.00	B	59.5	59.5	
1501	23.73		24.00	A	58.4	58.3	
—	24.73	—	25.00	B	—	—	
—	25.73	—	26.00	A	—	—	
	BOTTOM OF WELL MEASURED TO BE 25.01 FT BGS						

Temperature Profiling Log

Well ID:	GZA-102R2 (July 2017 on)	Date:	9/21/2020
TOC Elevation (ft amsl):	83.09	Depth to NAPL (ft btoc):	NM
Ground Elevation (ft amsl):	81.84	Depth to Water (ft btoc):	7.34
TOC - Ground Offset (ft):	1.25	Ambient Air Temperature (°F):	63.2
Total Depth (ft bgs):	28.32	Weather Conditions:	sunny, breezy
Top of Screen (ft bgs):	24.24	Time Thermocouples Deployed:	1220, ~~1252~~,

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1240	1.25	11.15	0.00	J	66.4	66.6	
NM	2.25		1.00	I	NM	NM	
1241	3.25		2.00	H	67.0	67.0	
1243	4.25		3.00	G	69.0	68.7	
1246	5.25		4.00	F	70.1	70.2	
1311	6.25	16.15	5.00	E - J	70.5	70.3	
1247	7.25		6.00	D	70.4	70.6	
in H2O - 1249	8.25		7.00	C	70.0	70.4	
1250	9.25		8.00	B	69.7	69.7	
1252	10.25		9.00	A	68.8	68.7	
	11.25		10.00	E - J			
1310	12.25		11.00	D	67.2	67.0	
1308	13.25		12.00	C	66.2	66.0	
1307	14.25		13.00	B	65.3	65.1	
1306	15.25		14.00	A	64.3	64.6	
	16.25		15.00	E - J			
	17.25		16.00	D			
	18.25		17.00	C			
	19.25		18.00	B			
	20.25		19.00	A			
	21.25		20.00	E - J			
	22.25		21.00	D			
	23.25		22.00	C			
	24.25		23.00	B			
	25.25		24.00	A			
	26.25		25.00	E - J			
	27.25		26.00	D			
	28.25		27.00	C			
	29.25		28.00	B			
	30.25		29.00	A			

NOTE: Can't get probes below 18' btoc

SEE NEXT PAGE OF NOTES FOR RE-DO OF GZA-102R2 TEMP PROFILE

Temperature Profiling Log

Well ID:	TRC-102	Date:	9/21/20
TOC Elevation (ft amsl):	81.21	Depth to NAPL (ft btoc):	ND
Ground Elevation (ft amsl):	81.64	Depth to Water (ft btoc):	5.72
TOC - Ground Offset (ft):	-0.43	Ambient Air Temperature (°F):	67.1
Total Depth (ft bgs):	12.25	Weather Conditions:	sunny
Top of Screen (ft bgs):	2.25	Time Thermocouples Deployed:	1523

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Temperature (°F) Channel 2 (T2)	Average Temp T1 & T2
1545	-0.43	9.47	0.00	J	~~6~~ 69.7	70.0	
	0.57		1.00	I			
1537	1.57		2.00	H	72.5	72.8	
1538	2.57		3.00	G	75.2	75.2	
1539	3.57		4.00	F	75.9	75.5	
1552	4.57	11.47	5.00	~~E H~~ G	75.2	75.4	
1540	5.57		6.00	D	75.6	75.4	
in H_2O 1541	6.57		7.00	C	74.0	74.1	
1542	7.57		8.00	B	72.8	72.8	
1543	8.57		9.00	A	71.2	70.8	
1553	9.57		10.00	~~2~~ B	70.7	70.7	
1554	10.57		11.00	~~1~~ A	69.2	68.8	
—	11.57	—	12.00	A	—	—	DTW = 12' BTOC
	~~MEASURED DTW = 12 ft B~~						
GZA-102R2	DTP = ND,	DTW = 11.27			Ambient T = 70.4	Weather: Sunny	Thermocouples deployed: 0715
0852	1.25	11.15	0	J	68.8	69.2	
~~0855~~	2.25	↓	1	I			
0855	3.25		2	H	65.4	65.4	
0856	4.25	↓	3	G	66.7	66.8	
0857	5.25		4	E	68.2	68.5	
0921	6.25	16.15	5	J	67.8	68.0	
0858	7.25	11.15	6	D	69.4	69.4	
0859	8.25	↓	7	C	68.0	68.3	
0900	9.25		8	B	68.2	68.2	
0901	10.25	↓	9	A	67.6	67.7	
0932	11.25	21.15	10	J	66.9	66.9	
0922	12.25	16.15	11	D	66.7	66.8	
0923	13.25	↓	12	C	65.5	65.7	
0924	14.25		13	B	64.8	64.9	
0925	15.25	↓	14	A	64.2	64.2	
0947	16.25	24.15	15	H ~~3~~	63.1	63.2	
0933	17.25	21.15	16	D	63.9	63.6	
0934	18.25	↓	17	C	62.9	63.0	
0935	19.25		18	B	62.2	62.2	
0936	20.25	↓	19	A	61.4	61.4	
0948	21.25	24.15	20	B	60.4	60.4	
0950	22.25	24.15	21	~~B~~ A	60.1	59.4	
0955	23.25	25.15	22	~~C~~ A	59.4	59.3	
~~23.70~~	~~24.25~~	~~25.60~~	~~23~~	~~B~~ A	DTB = 25.30	from Top of PVC	
	25.25	↓	24	A			
	26.25		25	J			
	27.25		26	D			
	28.25		27	C			
	29.25		28	B			
	30.25		29	A			

NOTE:
This is the start of where Dylan Potter re-did the Temp Profile at GZA-102R2 to get to full depth of the well, I believe on 9/24/2020.

Temperature Profiling Log

Well ID:	TRC-103	Date:	9/21/20
TOC Elevation (ft amsl):	82.02	Depth to NAPL (ft btoc):	ND
Ground Elevation (ft amsl):	82.42	Depth to Water (ft btoc):	6.00
TOC - Ground Offset (ft):	-0.40	Ambient Air Temperature (°F):	65.7
Total Depth (ft bgs):	11.25	Weather Conditions:	sunny, breezy
Top of Screen (ft bgs):	1.25	Time Thermocouples Deployed:	1600

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (°F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
1623	-0.40		0.00	J	76.8	77.0	
	0.60		1.00	I			
1624	1.60		2.00	H	74.4	74.6	
1625	2.60		3.00	G	76.7	76.8	
1626	3.60		4.00	F	77.6	77.6	
1636	4.60		5.00	F ~~E-0~~	78.0	78.0	
in H2O ↓ 1627	5.60		6.00	D	77.9	78.0	
1628	6.60		7.00	C	77.3	77.4	
1629	7.60		8.00	B	76.9	76.4	
1630	8.60		9.00	A	75.5	75.5	
1638	9.60		10.00	~~B~~ A	74.6	74.8	
1641	~~10.60~~ 10.40		11.00	A	74.5	74.5	

NSZD FIELD RECORDS – SEPTEMBER – OCTOBER 2021

AECOM

Low Volume Purge Field Data Sheet

Site: ***Wilmington, MA*** Sampler: ***A Grossman***

Proj. No.: **60552044** Date: 10/1/2021 Weather Observations: 50s, Sunny

WELL ID: GZA-105S

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 1.5 (inches)
Depth to Top of Screen 3.78 (feet TOC)
Depth to LNAPL ND (feet TOC)
Depth to Water: 5.01 (feet TOC) Purge Volume: ______ L (calculated)
Depth to Tubing Opening: 4.5 (feet TOC)
Total Depth of Well 13.78 (feet TOC)

Gas Purging/Sampling Equipment: PID: Ion Sci Tiger SN:1000-1348
4-Gas Meter: GEM5000 SN: G502410

Field Measurements

Time hh:mm:ss	*O_2 (vol%)*	*CO_2 (vol%)*	*H_2S ppm_v*	*CH_4 (vol%)*	*Relative Pressure (IWC)*	*Soil Gas Purge Rate (L/min)*
10:04:00 AM	14.4	6.1	1	1.2		
10:04:30 AM	14.2	5.4	1	0.1		
10:05:00 AM	14.1	5.5	1	0.1		
10:05:30 AM	14.6	5.7	1	0.0		
10:06:00 AM	15.1	4.7	1	0.0		
10:06:30 AM	15.6	4.4	1	0.0		
10:07:00 AM	15.9	4	1	0.0		
10:07:30 AM	16.2	3.7	1	0.0		
10:08:00 AM	16.4	3.5	1	0.0		
10:08:30 AM	16.5	3.3	1	0.0		
10:09:00 AM	16.6	3.2	1	0.0	0.087	
10:09:30 AM						
10:10:00 AM						
10:10:30 AM						

Comments:

BTU:

PID (after purging) ppm_v: 162.8

AECOM

Low Volume Purge Field Data Sheet

Site: ***Wilmington, MA*** Sampler: ***A Grossman***

Proj. No.: **60552044** Date: 9/29/2021 Weather Observations: 50s, Sunny

WELL ID: AE-3

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter:	2	(inches)
Depth to Top of Screen	2.76	(feet TOC)
Depth to LNAPL	ND	(feet TOC)
Depth to Water:	5.27	(feet TOC)
Depth to Tubing Opening:	4.5	(feet TOC)
Total Depth of Well	12.61	(feet TOC)

Purge Volume: ______ L (calculated)

Gas Purging/Sampling Equipment: PID: Ion Sci Tiger SN:1000-1348
4-Gas Meter: GEM5000 SN: G502410

Field Measurements

Time *hh:mm:ss*	O_2 *(vol%)*	CO_2 *(vol%)*	H_2S *ppm*$_v$	CH_4 *(vol%)*	*Relative Pressure (IWC)*	*Soil Gas Purge Rate (L/min)*
10:16:00 AM	20.5	0.4	1	9		
10:16:30 AM	18.5	3.4	1	9.6		
10:17:00 AM	6.3	4.5	0	9.7		
10:17:30 AM	15.9	5.2	0	11.3		
10:18:00 AM	14.9	6.4	0	13.3		
10:18:30 AM	14	7.7	0	14.7		
10:19:00 AM	13.4	8.6	0	15.5		
10:19:30 AM	12.9	12.8	0	16.1		
10:20:00 AM	12.5	9.6	0	16.3		
10:20:30 AM	12.4	10.0	0	16.5		
10:21:00 AM	12.2	10.1	0	16.4	0.481	

Comments:

BTU:

PID (after purging) ppm$_v$: 50.3

AECOM

Low Volume Purge Field Data Sheet

Site: ***Wilmington, MA*** Sampler: ***A Grossman***

Proj. No.: **60552044** Date: 10/1/2021 Weather Observations: 50s, Sunny

WELL ID: TRC-101

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter:	1.25	(inches)
Depth to Top of Screen	1.14	(feet TOC)
Depth to LNAPL	ND	(feet TOC)
Depth to Water:	5.27	(feet TOC)
Depth to Tubing Opening:	4.5	(feet TOC)
Total Depth of Well	10.14	(feet TOC)

Purge Volume: ________ L (calculated)

Gas Purging/Sampling Equipment: PID: Ion Sci Tiger SN:1000-1348
4-Gas Meter: GEM5000 SN: G502410

Field Measurements

Time hh:mm:ss	*O_2 (vol%)*	*CO_2 (vol%)*	*H_2S ppm_v*	*CH_4 (vol%)*	*Relative Pressure (IWC)*	*Soil Gas Purge Rate (L/min)*
10:54:00 AM	13.7	0.1	3	0		
10:54:30 AM	20.2	2.4	3	2.5		
10:55:00 AM	11.4	4.4	3	11.9		
10:55:30 AM	11.4	4.8	3	11.4		
10:56:00 AM	21	4.4	3	10.5		
10:56:30 AM	12.4	4.2	3	10.0		
10:57:00 AM	12.4	4.1	3	10.0	0.022	

Comments:

BTU:

PID (after purging) ppm_v: 288.6

AECOM

Low Volume Purge Field Data Sheet

Site: ***Wilmington, MA*** Sampler: ***A Grossman***

Proj. No.: **60552044** Date: 10/1/2021 Weather Observations: 50s, Sunny

WELL ID: PZ-2S

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter:	4	(inches)
Depth to Top of Screen	3.11	(feet TOC)
Depth to LNAPL	ND	(feet TOC)
Depth to Water:	5.44	(feet TOC)
Depth to Tubing Opening:	5	(feet TOC)
Total Depth of Well	8.11	(feet TOC)

Purge Volume: ______ L (calculated)

Gas Purging/Sampling Equipment: PID: Ion Sci Tiger SN:1000-1348
4-Gas Meter: GEM5000 SN: G502410

Field Measurements

Time *hh:mm:ss*	*O_2* *(vol%)*	*CO_2* *(vol%)*	*H_2S* *ppm_v*	*CH_4* *(vol%)*	*Relative Pressure* *(IWC)*	*Soil Gas Purge Rate* *(L/min)*
12:45:00 PM	19.6	0.4	3	0.1		
12:45:30 PM	19	1.0	3	0		
12:46:00 PM	18.9	0.9	3	0		
12:46:30 PM	18.9	0.9	3	0		
12:47:00 PM	18.9	0.8	3	0		
12:47:30 PM	18.9	0.8	3	0		
12:48:00 PM	18.7	0.9	3	0		
12:48:30 PM	18.4	0.8	3	0		
12:49:00 PM	18.8	0.8	3	0		
12:49:30 PM	18.7	0.8				
12:50:00 PM						

Comments:

BTU:

PID (after purging) ppm_v: 103.2

AECOM

Low Volume Purge Field Data Sheet

Site: *Wilmington, MA* Sampler: *A Grossman*

Proj. No.: **60552044** Date: 10/1/2021 Weather Observations: 50s, Sunny

WELL ID: CW-1

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 8 (inches)
Depth to Top of Screen 0 (feet TOC)
Depth to LNAPL ND (feet TOC) (visible sheen)
Depth to Water: 4.02 (feet TOC) Purge Volume: ______ L (calculated)
Depth to Tubing Opening: 5.5 (feet TOC)
Total Depth of Well 7.87 (feet TOC)

Gas Purging/Sampling Equipment: PID: Ion Sci Tiger SN:1000-1348
4-Gas Meter: GEM5000 SN: G502410

Field Measurements

Time hh:mm:ss	*O_2 (vol%)*	*CO_2 (vol%)*	*H_2S ppm_v*	*CH_4 (vol%)*	*Relative Pressure (IWC)*	*Soil Gas Purge Rate (L/min)*
1:04:00 PM	19.7	0.4	4			
1:04:30 PM	18.2	0.8	8	0.0		
1:05:00 PM	18	1.1	6	0.0		
1:05:30 PM	17.9	1.3	4	0.0		
1:06:00 PM	17.8	1.4	4	0.0		
1:06:30 PM	17.9	1.5	4	0.0		
1:07:00 PM	17.5	1.6	4	0.0		
1:07:30 PM	17.6	1.7	4	0.0		
1:08:00 PM	17.6	1.7	4	0.0	0.022	
1:08:30 PM						
1:09:00 PM						

Comments:
Aquaseal tape placed around PVC screen inside manhole to reduce direct connection to atmosphere
BTU:
PID (after purging) ppm_v: 501.6

AECOM

Low Volume Purge Field Data Sheet

Site: ***Wilmington, MA*** Sampler: ***A Grossman***

Proj. No.: **60552044** Date: 10/1/2021 Weather Observations: 50s, Sunny

WELL ID: CW-2

Tubing Volume Factors	
Inner Diameter (inches)	mL/foot
0.25	9.7
0.375	21.7
0.5	38.6
0.625	60.3

Casing Diameter: 8 (inches)
Depth to Top of Screen 0 (feet TOC)
Depth to LNAPL ND (feet TOC) (visible Sheen)
Depth to Water: 3.79 (feet TOC) Purge Volume: ______ L (calculated)
Depth to Tubing Opening: 3 (feet TOC)
Total Depth of Well 10.36 (feet TOC)

Gas Purging/Sampling Equipment: PID: Ion Sci Tiger SN:1000-1348
4-Gas Meter: GEM5000 SN: G502410

Field Measurements

Time hh:mm:ss	*O_2 (vol%)*	*CO_2 (vol%)*	*H_2S ppm_v*	*CH_4 (vol%)*	*Relative Pressure (IWC)*	*Soil Gas Purge Rate (L/min)*
12:21:00 PM	19.2	2.7	3	1.3		
12:21:30 PM	16.4	2.4	6	0.2		
12:22:00 PM	16.9	2.1	4	0.1		
12:22:30 PM	16.9	2	3	0.1		
12:23:00 PM	16.8	2.1	3	0.0		
12:23:30 PM	16.9	2.1	3	0.0	0.017	
12:24:00 PM						

Comments:
Aquaseal tape placed around PVC screen inside manhole to reduce direct connection to atmosphere
BTU:
PID (after purging) ppm_v: 190.2

Temperature Profiling Log

Well ID:	**AE-3**	Date:	9/27/2021
TOC Elevation (ft amsl):	82.41	Depth to NAPL (ft btoc):	NP
Ground Elevation (ft amsl):	82.65	Depth to Water (ft btoc):	5.41
TOC - Ground Offset (ft):	-0.24	Ambient Air Temperature (°F):	72.6
Total Depth (ft bgs):	15.00	Weather Conditions:	Drizzle, 70s
Top of Screen (ft bgs):	3.00	Time Thermocouples Deployed:	13:20

(sump 13 - 15 ft bgs)

Time (hh:mm)	**Sensor Depth (ft btoc)**	**Depth on IP Tape (ft btoc)**	**Sensor Depth (ft bgs)**	**Sensor ID**	**Temperature (°F) Channel 1 (T1)**	**Channel 2 (T2)**	**Average Temp T1 & T2**
13:42	-0.24	8.73	0.00	J	72.5	72.5	72.5
13:43	0.76	8.73	1.00	I	75.3	75.3	75.3
13:45	1.76	8.73	2.00	H	76.5	76.7	76.6
13:48	2.76	8.73	3.00	G	76.8	77.0	76.9
13:50	3.76	8.73	4.00	F	76.2	76.3	76.25
14:03	4.76	10.73	5.00	G/E	75.4	75.4	75.4
14:04	5.76	10.73	6.00	F	74.1	74.2	74.15
14:14	6.76	11.73	7.00	F	73.8	73.8	73.8
13:51	7.76	8.73	8.00	B	73.3	73.3	73.3
13:53	8.76	8.73	9.00	A	71.6	71.7	71.65
14:06	9.76	10.73	10.00	B	70.9	71.1	71.0
14:08	10.76	10.73	11.00	A	70.3	70.4	70.35
14:12	11.76	11.73	12.00	A	69.9	70.0	69.98
8/31 DTB = 12.62							
Weights on bottom of probe add 0.3'							
TOC - ground offset measured in field = 0.17							

Temperature Profiling Log

Well ID:	**CW-1**	Date:	9/30/2021
TOC Elevation (ft amsl):	80.94	Depth to NAPL (ft btoc):	NP
Ground Elevation (ft amsl):	82.47	Depth to Water (ft btoc):	3.96 [4.41 with cap]
TOC - Ground Offset (ft):	-1.53	Ambient Air Temperature (°F):	61.4
Total Depth (ft bgs):	9.40	Weather Conditions:	Cloudy, breezy, 60s
Top of Screen (ft bgs):	1.40	Time Thermocouples Deployed:	13:00

Time (hh:mm)	**Sensor Depth (ft btoc)**	**Depth on IP Tape (ft btoc)**	**Sensor Depth (ft bgs)**	**Sensor ID**	**Temperature (°F)**		
					Channel 1 (T1)	**Channel 2 (T2)**	**Average Temp T1 & T2**
13:10	-1.53	5.97	0.00	H	66.9	67.2	
13:11	-0.53	5.97	1.00	G	64.4	64.5	
13:12	0.47	5.97	2.00	F	71.4	71.6	
13:25	1.47	8.97	3.00	H	73.6	73.5	
13:26	2.47	8.97	4.00	G	74.8	74.9	
13:27	3.47	8.97	5.00	F	74.8	74.8	
13:30	4.47	12.97	6.00	H	75.1	75.2	
13:31	5.47	12.97	7.00	G	74.1	74.0	
13:32	6.47	12.97	8.00	F	73.2	73.2	
13:38	7.47	13.97	9.00	F	72.8	72.7	
*Fold probe over loosely to use working ports H-F							
F at 5' on tape							
G at 6' on tape							
H at 7' on tape							

Temperature Profiling Log

Well ID:	**GZA-102R2 (July 2017 on)**	Date:	9/30/2021
TOC Elevation (ft amsl):	83.09	Depth to NAPL (ft btoc):	NP
Ground Elevation (ft amsl):	81.84	Depth to Water (ft btoc):	6.00
TOC - Ground Offset (ft):	1.25	Ambient Air Temperature (^oF):	59.3
Total Depth (ft bgs):	28.32	Weather Conditions:	Cloudy, breezy, 60s
Top of Screen (ft bgs):	24.24	Time Thermocouples Deployed:	11:20

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (^oF) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
11:34	1.25	10.15	0.00	J	62.7	62.8	
12:06	2.25	11.15	1.00	J	65.2	65.2	
11:35	3.25	10.15	2.00	H	66.7	66.6	
11:36	4.25	10.15	3.00	G	67.9	68.0	
11:37	5.25	10.15	4.00	F	69.6	69.6	
12:05	6.25	11.15	5.00	F	69.8	69.8	
12:15	7.25	14.15	6.00	H	70.2	70.1	
12:16	8.25	14.15	7.00	G	69.9	70.0	
11:38	9.25	10.15	8.00	B	69.1	69.3	
12:04	10.25	11.15	9.00	B	69.4	69.5	
	11.25	10.15	10.00	H			
	12.25	18.15	11.00	G			
12:17	13.25	14.15	12.00	B	66.8	66.7	
	14.25	21.15	13.00	H			
	15.25	21.15	14.00	G			
	16.25	21.15	15.00	F			
	17.25	18.15	16.00	B			
	18.25	25.15	17.00	H			
	19.25	25.18	18.00	G			
	20.25	21.15	19.00	B			
	21.25	28.15	20.00	H			
	22.25	28.15	21.00	G			
	23.25	28.15	22.00	F			
	24.25	25.15	23.00	B			
	25.25	26.15	24.00				
	26.25	27.15	25.00				
	27.25	28.15	26.00	B			
	28.25		27.00				
	29.25		28.00				
	30.25		29.00				

Note: Unable to get probe deeper in well. Tried for one hour. Probe getting stuck, likely on well screen or coupling.

Temperature Profiling Log

Well ID:	GZA-105D	Date:	9/30/2021
TOC Elevation (ft amsl):	81.82	Depth to NAPL (ft btoc):	NP
Ground Elevation (ft amsl):	82.09	Depth to Water (ft btoc):	4.84
TOC - Ground Offset (ft):	-0.27	Ambient Air Temperature (^oF):	58.1
Total Depth (ft bgs):	26.00	Weather Conditions:	Sunny, 60s
Top of Screen (ft bgs):	16.00	Time Thermocouples Deployed:	10:11

					Temperature (^oF)		
Time (hh:mm)	**Sensor Depth (ft btoc)**	**Depth on IP Tape (ft btoc)**	**Sensor Depth (ft bgs)**	**Sensor ID**	**Channel 1 (T1)**	**Channel 2 (T2)**	**Average Temp T1 & T2**
10:22	-0.27	6.66	0.00	H	57.6	57.7	
10:24	0.73	6.66	1.00	G	65.5	65.5	
10:25	1.73	6.66	2.00	F	71.9	72.0	
10:35	2.73	9.66	3.00	H	72.9	72.7	
10:36	3.73	9.66	4.00	G	74.2	74.4	
10:37	4.73	9.66	5.00	F	74.6	74.6	
10:26	5.73	6.66	6.00	B	74.7	74.6	
10:27	6.73	6.66	7.00	A	74.2	74.3	
10:43	7.73	16.66	8.00	J	73.6	73.8	
10:33	8.73	9.66	9.00	B	73.2	73.2	
10:32	9.73	9.66	10.00	A	72.9	72.8	
10:43	10.73	16.66	11.00	G	72.4	72.4	
10:42	11.73	16.66	12.00	F	71.8	71.8	
10:50	12.73	19.66	13.00	H	70.9	71.0	
10:51	13.73	19.66	14.00	G	70.0	70.1	
10:52	14.73	19.66	15.00	F	69.2	69.2	
10:41	15.73	16.66	16.00	B	68.3	68.3	
10:40	16.73	16.66	17.00	A	67.5	67.7	
11:01	17.73	22.66 ?	18.00	F	66.6	66.6	
10:53	18.73	19.66	19.00	B	65.9	65.9	
10:54	19.73	19.66	20.00	A	645.5	65.4	
11:15	20.73	21.66	21.00	B	64.7	64.7	
11:02	21.73	22.66	22.00	B	64.1	64.0	
11:03	22.73	22.66	23.00	A	63.4	63.5	
11:08	23.73	23.66	24.00	A	62.8	62.9	
DTB = 24.3?							

Temperature Profiling Log

Well ID:	GZA-12	Date:	9/30/2021
TOC Elevation (ft amsl):	87.62	Depth to NAPL (ft btoc):	NP
Ground Elevation (ft amsl):	88.05	Depth to Water (ft btoc):	8.73
TOC - Ground Offset (ft):	-0.43	Ambient Air Temperature (^oF):	57.4
Total Depth (ft bgs):	24.50	Weather Conditions:	Sunny, 50s
Top of Screen (ft bgs):	9.50	Time Thermocouples Deployed:	8:30

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (^oF) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
8:40	-0.43	8.50	0.00	J	56.6	56.7	
9:02	0.57	9.80	1.00	J	62.8	63.0	
8:44	1.57	8.50	2.00	H	69.6	69.9	
8:46	2.57	8.50	3.00	G	70.3	70.5	
8:47	3.57	8.50	4.00	F	70.4	70.4	
9:03	4.57	9.50	5.00	F	69.0	69.0	
9:11	5.57	11.50	6.00	G	68.5	68.5	
9:12	6.57	11.50	7.00	F	67.1	67.4	
8:49	7.57	8.50	8.00	B	67.5	67.6	
8:50	8.57	8.50	9.00	A	66.8	66.8	
9:00	9.57	9.50	10.00	A	65.7	65.7	
9:15	10.57	11.50	11.00	B	65.5	65.6	
9:16	11.57	11.50	12.00	A	65.0	64.9	
9:24	12.57	18.50	13.00	G	64.3	64.3	
9:25	13.57	18.50	14.00	F	63.5	63.7	
9:35	14.57	20.50	15.00	G	62.6	62.8	
9:36	15.57	20.50	16.00	F	62.4	62.3	
9:45	16.57	22.50	17.00	G	61.8	61.7	
9:27	17.57	18.50	18.00	B	61.5	61.5	
9:28	18.57	18.50	19.00	A	60.7	60.8	
9:37	19.57	20.50	20.00	B	60.3	60.3	
9:38	20.57	20.50	21.00	A	59.7	59.6	
9:47	21.57	22.50	22.00	B	59.1	59.1	
9:49	22.57	22.50	23.00	A	58.1	58.5	
9:55	23.57	23.50	24.00	A	57.9	57.8	

Temperature Profiling Log

Well ID:	**PZ-2S (July 2017 on)**	Date:	9/30/2021
TOC Elevation (ft amsl):	82.81	Depth to NAPL (ft btoc):	NP
Ground Elevation (ft amsl):	83.25	Depth to Water (ft btoc):	5.37
TOC - Ground Offset (ft):	-0.44	Ambient Air Temperature (^{o}F):	61.2
Total Depth (ft bgs):	8.55	Weather Conditions:	Cloudy, Breezy, 60s
Top of Screen (ft bgs):	3.55	Time Thermocouples Deployed:	13:50

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (^{o}F) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
14:00	-0.44	6.56	0.00	H	58.5	58.7	
14:01	0.56	6.56	1.00	G	64.2	64.3	
14:02	1.56	6.56	2.00	F	66.7	66.9	
14:10	2.56	9.56	3.00	H	68.4	68.4	
14:12	3.56	9.56	4.00	G	69.5	69.6	
14:13	4.56	9.56	5.00	F	70.2	70.2	
14:20	5.56	12.56	6.00	H	69.9	70.1	
14:21	6.56	12.56	7.00	G	70.0	69.8	
14:22	7.56	12.56	8.00	F	69.4	69.5	
	8.56		9.00	F			

Temperature Profiling Log

Well ID:	TRC-102	Date:	9/27/2021
TOC Elevation (ft amsl):	81.21	Depth to NAPL (ft btoc):	NP
Ground Elevation (ft amsl):	81.64	Depth to Water (ft btoc):	4.27
TOC - Ground Offset (ft):	-0.43	Ambient Air Temperature (^oF):	72.9
Total Depth (ft bgs):	12.25	Weather Conditions:	Sunny, 70s
Top of Screen (ft bgs):	2.25	Time Thermocouples Deployed:	15:35

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (^oF) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
15:56	-0.43	8.48	0.00	J	76.0	76.2	
16:20	0.57	9.48	1.00	J	76.6	76.6	
15:59	1.57	8.48	2.00	H	76.7	76.7	
16:00	2.57	8.48	3.00	G	76.8	76.9	
16:02	3.57	8.48	4.00	F	76.3	76.1	
16:23	4.57	9.48	5.00	F	75.2	75.2	
16:38	5.57	11.48	6.00	G	74.4	74.6	
16:36	6.57	11.48	7.00	F	73.6	73.6	
16:04	7.57	8.48	8.00	B	72.3	72.5	
16:06	8.57	8.48	9.00	A	71.1	71.1	
16:28	9.57	9.48	10.00	C	70.0	70.1	
16:36	10.57	11.48	11.00	B	68.8	68.7	
16:38	11.57	11.48	12.00	A	67.6	67.6	

Temperature Profiling Log

Well ID:	TRC-103	Date:	9/27/2021
TOC Elevation (ft amsl):	82.02	Depth to NAPL (ft btoc):	NP
Ground Elevation (ft amsl):	82.42	Depth to Water (ft btoc):	5.04
TOC - Ground Offset (ft):	-0.40	Ambient Air Temperature (^oF):	75.3
Total Depth (ft bgs):	11.25	Weather Conditions:	Sunny, 70s-80s
Top of Screen (ft bgs):	1.25	Time Thermocouples Deployed:	14:27

Time (hh:mm)	Sensor Depth (ft btoc)	Depth on IP Tape (ft btoc)	Sensor Depth (ft bgs)	Sensor ID	Temperature (^oF) Channel 1 (T1)	Channel 2 (T2)	Average Temp T1 & T2
14:43	-0.40	8.51	0.00	J	80.1	80.1	80.1
14:44	0.60	8.51	1.00	I	74.8	74.8	74.8
14:46	1.60	8.51	2.00	H	77.4	77.4	77.4
14:48	2.60	8.51	3.00	G	77.8	77.8	77.8
14:49	3.60	8.51	4.00	F	77.2	77.3	77.25
15:04	4.60	10.51	5.00	G	77.0	77.0	77.0
15:05	5.60	10.51	6.00	F	75.9	75.8	78.85
15:15	6.60	7.51	7.00	B	75.0	75.2	75.1
14:51	7.60	8.51	8.00	B	74.4	74.6	74.5
14:52	8.60	8.51	9.00	A	73.7	73.6	73.65
15:00	9.60	10.51	10.00	B	73.1	73.1	73.1
15:02	10.60	10.60	11.00	A	72.3	72.3	72.3
DTB = 11.10							

APPENDIX C
NSZD SUMMARY MEMORANDUM, NOVEMBER 2021

AECOM

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Project name:
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Project ref:
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From:
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Date:
November 2, 2021

To:
Lockheed Martin Corporation

CC:
Jonathon Smith, Steven Gaito, Dan Folan, Scott Olson- AECOM

Memo

Subject: Natural Source Zone Depletion Assessment

AECOM has prepared this memorandum to summarize the results of natural source zone depletion (NSZD) assessment activities completed at the former General Electric site at 50 Fordham Road in Wilmington, Massachusetts (site). The assessment has been completed to provide estimated rates of light non-aqueous phase liquid (LNAPL) mass reduction through NSZD processes in support of future LNAPL management decisions at the site.

NSZD Background

NSZD describes the combination of naturally occurring processes that decrease the mass of non-aqueous phase liquid (NAPL) in the subsurface over time. The mechanisms responsible for NAPL depletion include volatilization, dissolution, and biodegradation (ITRC 2018). The significance of these mechanisms is related to the NAPL composition (e.g., the volatility, solubility, and biodegradability of NAPL constituents), and the site setting. The site setting considerations are related to geochemistry, microbial ecology, and subsurface characteristics that control movement of soil gas and groundwater into and out of the source zone.

The efficacy of natural attenuation of petroleum hydrocarbons in groundwater has been well established since the early 1990s (NRC 1993; Rice et al. 1995). While there has long been evidence that microbiological degradation processes responsible for natural attenuation in dissolved phase plumes were also occurring within LNAPL source zones to ‘weather’ or change the composition of LNAPLs (e.g., Christensen and Larsen 1993), there was a common historical perception that biodegradation of the source material itself was limited (Lyman et al. 1992; Newell et al. 1995). More recent research on NSZD at petroleum LNAPL sites (e.g., Johnson et al. 2006; Garg et al. 2017; CRC CARE 2020a) has demonstrated that the rate of natural LNAPL depletion is often on the order of hundreds, to thousands of gallons of LNAPL per acre per year (gal/ac/yr). The observation of natural depletion rates of this magnitude has highlighted the significance of NSZD in LNAPL conceptual site model (LCSM) development and site management decision making (e.g., Mahler et al. 2012; Lundy 2014). NSZD measurements are more frequently being collected to better understand the relative benefit of active LNAPL remediation alternatives at LNAPL sites, and can provide an alternative or supplement to approaches such as skimming or bailing of LNAPL (ITRC 2018; CL:AIRE 2019; CRC CARE 2020b).

Increased focus on NSZD in recent years has led to the development of guidance on data collection and interpretation approaches by several institutions around the world (ITRC 2009; ITRC 2018; API 2017; CRC CARE 2018; CL:AIRE 2019). Several methods have been developed to evaluate NSZD rates (API 2017, ITRC 2018). While methods have been developed to estimate relative hydrocarbon mass losses based on changes in LNAPL composition (Douglas et al., 1996; Lundy 2014; DeVaull et al., 2020), the prevailing methods for quantifying NSZD rates rely on mass and/or energy balance approaches, and involve measurements of the flux of electron acceptors (e.g., oxygen) into the source zone (Johnson et al., 2006), and/or measuring the flux of petroleum degradation products such as carbon dioxide (Sihota et al., 2011; McCoy et al., 2014) or excess heat

(Sweeney and Ririe, 2014; Warren and Bekins, 2015) out of the LNAPL source zone resulting from biodegradation. The overall rate of depletion is expressed in terms of mass or volume of hydrocarbon degraded per unit area, per unit time (e.g., gallons per acre, per year – gal/acre/yr).

NSZD Field Data Collection

NSZD was assessed using a multiple lines of evidence approach to evaluate and quantify NSZD rates. The NSZD assessment included the following components in November 2018, September 2020, and late September and early October 2021:

- Evaluation of soil gas composition in the vadose zone to determine concentrations of hydrocarbons and respiration and/or biogenic gases associated with NSZD processes; and
- Subsurface temperature profiling to identify zones of elevated temperature and temperature differentials associated with NSZD processes.

Data collection locations were selected with the objective of obtaining adequate spatial coverage across the footprint of residual LNAPL impacts in the subsurface as shown in **Figure 1**. Details on data collection, analysis methodology, and results of the NSZD assessment are provided in the following sections.

Soil Gas Screening

Soil gas screening was completed using methods outlined by Sweeney and Ririe (2017) on November 15, 2018 at ten wells located within the known historical extent of LNAPL (AE-3, AE-4, CW-1, CW-2, GZA-102S, GZA-105S, PZ-2S, TRC-101, TRC-102, and TRC-103) and in six wells located within the known historical extent of LNAPL (AE-3, CW-1, CW-2, GZA-105S, PZ-2S, and TRC-101) on September 22, 2020 and from September 29 through October 1, 2021, as shown in **Figure 1**. Gas screening was initiated by inserting ¼-inch diameter polyethylene tubing through a gas-tight fitting at the top of the well casing at all wells. The base of the tubing extended into the screened interval of the well to approximately 1 foot above the water table. It is noted that at wells CW-1 and CW-2 the screens extend up into the well vault. During the November 2018 and September 2020 soil gas screening events, the well screens were in direct communication with the atmosphere. Prior to the 2021 event, tape was wrapped around the PVC screen to limit communication with the atmosphere during soil gas screening.

Data was collected using a Minirae 3000 photoionization detector (PID) and Landtec GEM 5000 landfill gas meter to measure concentrations of volatile organic compounds (VOCs), oxygen (O_2), methane (CH_4), and carbon dioxide (CO_2) in soil gas. An activated carbon filter was used on the landfill gas meter intake to remove VOCs from the gas sample to prevent VOCs from triggering a false or elevated CH_4 reading. Soil gas was purged using the internal pump on the field gas analyzers, and readings were recorded every 30 seconds until stable concentrations were achieved, defined as 3 consecutive readings within 10 percent of each other with no consistent increasing or decreasing trend. Soil gas readings were recorded on field data logs, which are provided in **Attachment 1**.

Temperature Profiling

Subsurface temperature profiles were recorded in existing wells at the site to determine whether thermal anomalies associated with biodegradation of LNAPL constituents could be identified. The data were recorded on November 14, 2018, September 21, 2020, and September 27-30, 2021 using a thermocouple array and hand-held digital thermocouple thermometer (see **Figure A**, below) at the following eight wells. Monitoring well locations are shown in **Figure 1** with the exception of background well GZA-12 which is located near the southwest corner of Building 1.

- Background: Temperature profile measurements at well GZA-12, located upgradient of the known extent of LNAPL impacts, were recorded to assess background subsurface temperature distribution.
- Source Zone: Temperature profile measurements were recorded at 11 wells on November 14, 2018 (AE-3, AE-4, CW-1, CW-2, GZA-102R, GZA-105D, GZA-105S, PZ-2S, TRC-101, TRC-102, and TRC-103), and at 7 wells (AE-3, CW-1,

GZA-102R, GZA-105D, PZ-2S, TRC-102, and TRC-103) on September 21, 2020 and from September 27 through 30, 2021 to assess subsurface temperature distribution within the LNAPL source zone.

Figure A. Thermocouple Array and Thermometer.

Temperature measurements were recorded in 1-foot increments from ground surface to the total depth of each well. For temperature measurements in wells with a total depth exceeding 9 feet below ground surface (ft bgs), measurements were made from the shallow intervals prior to lowering the array to deeper intervals to ensure that temperature readings in the vadose zone were not affected by groundwater adhering to the thermocouples. The top of the well(s) was sealed to limit heat exchange with the atmosphere during data collection, and sufficient time (a minimum of 15 minutes) was allowed for the temperature probe to reach equilibrium with the surrounding subsurface materials. Following the equilibration period, temperatures were recorded in 30 second intervals until three readings were within 0.2 degrees Celsius (˚C) of each other, with no consistent increasing or decreasing trend, were obtained.

Temperature and fluid level gauging data were recorded on field data logs, which are presented in **Attachment 2**. Temperature profiles recorded in September 2020 and September 2021 were used to construct vertical profiles of temperature with depth for each well to identify thermal anomalies (i.e., zones of elevated temperature relative to background conditions) associated with LNAPL depletion processes. Temperature profiles, along with fluid level gauging data (i.e., depth to water, and if present, depth to LNAPL), and well construction details are presented in attached **Figure 2** through **Figure 17**. Where available, results of soil headspace screening using a photoionization detector (PID) are also included to convey the approximate distribution of hydrocarbon impacts in the soil profile.

Data Analysis and Results

Stoichiometry and Conversion Factors

The methods utilized to estimate NSZD rates at the site rely on stoichiometric relationships derived from the prevailing biodegradation reactions that are observed at most LNAPL sites. Following Johnson et al. (2006) and Garg et al. (2017), the dominant biodegradation reactions involved in NSZD are assumed to be methanogenesis (**Equation 1**) followed by aerobic oxidation of methane (**Equation 2**), or direct aerobic oxidation of hydrocarbon constituents that comprise the LNAPL (**Equation 3**), as indicated below, where "a" and "b" represent the number of carbon and hydrogen atoms in a given hydrocarbon compound, respectively.

$$C_aH_b + \left(a - \frac{b}{4}\right) \cdot H_2O \rightarrow \left(\frac{a}{2} + \frac{b}{8}\right) \cdot CH_4 + \left(\frac{a}{2} - \frac{b}{8}\right) \cdot CO_2$$ **Equation 1**

$$\left(\frac{a}{2} + \frac{b}{8}\right) \cdot (CH_4 + 2 \cdot O_2 \rightarrow CO_2 + 2 \cdot H_2O)$$ **Equation 2**

$$C_aH_b + \left(a + \frac{b}{4}\right) \cdot O_2 \rightarrow a \cdot CO_2 + \left(\frac{b}{2}\right) \cdot H_2O$$ **Equation 3**

These equations provide a basis for estimating NSZD rates by measuring the flux of oxygen (O_2) into a source zone, or by measuring the flux of hydrocarbon degradation products such as carbon dioxide (CO_2) out of the source zone. Additionally, the change in enthalpy, or heat of reaction, can be calculated from the internal energy of the products and reactants in **Equations 1 to 3**. The heat of reaction can then be used to convert measurements of subsurface heat flux associated with LNAPL degradation into NSZD rates.

Whether degradation occurs through methanogenic degradation followed by methane oxidation (**Equation 1** followed by **Equation 2**) or through direct aerobic oxidation (**Equation 3**), the reactants and products are ultimately the same. The stoichiometric relationships can be expressed in terms of the mass of hydrocarbon degraded per unit mass of O_2 consumed, the mass of hydrocarbon degraded per unit mass of CO_2 produced, or the amount of heat energy released per unit mass of hydrocarbon degraded. LNAPL at the site has been identified as Stoddard solvent (Mineral Spirits), a mixture of hydrocarbons in the C_7 to C_{12} range, including straight and branched chain paraffins, naphthenes, and aromatic compounds (Speight, 2009). NSZD rates were calculated using octane (C_8H_{18}) as a representative hydrocarbon compound for the Stoddard solvent. The resulting stoichiometric coefficient for aerobic oxidation of the hydrocarbon (S_{O_2}; 0.29 g-C_8H_{18}/g-O_2) and heat released to the subsurface (ΔH_{rxn}; 47.9 kJ/g-C_8H_{18}) were calculated using molecular weights and standard heat of formation for each of the compounds represented in Equations 1 and 3, presented in **Table A** (Haynes, 2012).

The stoichiometric coefficients for O_2 utilization and heat released from biodegradation are relatively invariant for a broad range of hydrocarbons on a mass basis. Thus, while C_8H_{18} was used to represent the Stoddard solvent LNAPL for this assessment, the use of alternative representative hydrocarbon compounds would not significantly impact the results for any of the three methods utilized. For example, a comparison of the heat released from oxidation (or methanogenic degradation followed by methane oxidation) for a number of aliphatic and aromatic hydrocarbon compounds is presented in **Figure B**.

Table A. Molecular Weights and Standard Enthalpy of Formation for Constituents Involved in NSZD Biodegradation Reactions.

Constituent	Molecular Weight (g/mol)	Standard Enthalpy of Formation (kJ/mol)
Octane (C_8H_{18})	114.2	-250.1
Water (H_2O)	18.0	-285.8
Carbon Dioxide (CO_2)	44.0	-393.5
Oxygen (O_2)	32.0	0.0
Methane (CH_4)	16.0	-74.6

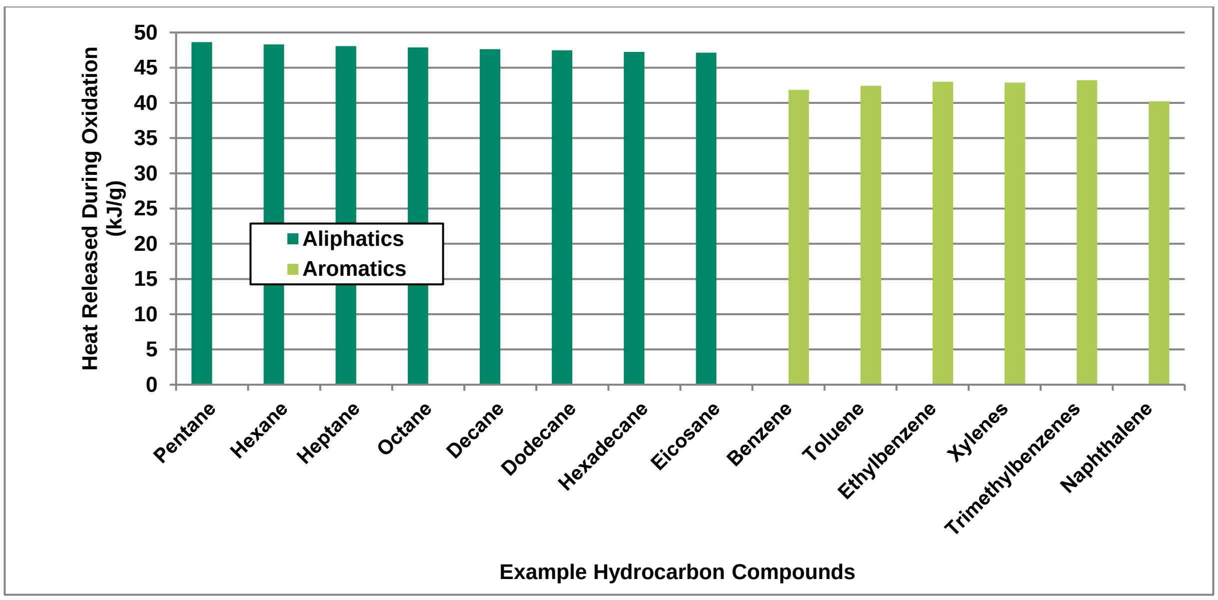

Figure B. Heat of Reaction for Various Hydrocarbon Compounds.

All LNAPL depletion rates were converted into equivalent volumetric LNAPL depletion rates were calculated using an LNAPL density (ρ_n) of 0.77 grams per milliliter (g/mL) (Air Force, 1989).

Soil Gas Screening

Qualitative Evaluation of Soil Gas Screening Results

Biodegradation of LNAPL constituents generally consumes O_2 and produces CO_2 and CH_4 (Equations 1-3). The soil gas screening results therefore provide a qualitative line of evidence that NSZD is occurring at the site, for example:

- CH_4 was detected in 82% of soil gas samples (**Table B**), indicating that methanogenesis is occurring near the base of the vadose zone and/or within the saturated zone at the site.
- Measurable concentrations of VOCs were observed in 82% of soil gas samples, and in all samples collected in 2020 and 2021 (**Table B**), indicating LNAPL depletion through volatilization is occurring.
- CO_2, a product of aerobic biodegradation of hydrocarbons, was found at concentrations greater than atmospheric levels (approximately 0.04 percent by volume [vol%]) at all sample locations during each measurement event.
- O_2 concentrations were below atmospheric levels (approximately 20.9 vol%) for all samples collected during the 2020 and 2021 events, indicating O_2 utilization by aerobic microorganisms.

Table B: Summary of Soil Gas Composition

Well ID	Date	Tubing Depth (ft bgs)	O_2 (vol%)	CO_2 (vol%)	CH_4 (vol%)	PID/VOCs (ppm_v)
AE-3	Nov. 2018	4.0	17.7	5.6	0.1	101.2
	Sep. 2020	6.7	0.5	20.0	31.3	125.9
	Sep. 2021	4.7	12.2	10.1	16.4	50.3
AE-4	Nov. 2018	3.6	22.0	0.6	0.1	0.0
CW-1	Nov. 2018	3.8	21.7	0.5	0.1	69.0
	Sep. 2020	6.7	3.2	11.9	2.3	1,305
	Oct. 2021	5.0	17.6	1.7	0.0	501.6
CW-2	Nov. 2018	3.8	21.3	0.8	0.2	133.6
	Sep. 2020	6.7	4.2	11.3	3.3	1,317
	Oct. 2021	4.7	16.9	2.1	0.0	190.2
GZA-102S	Nov. 2018	3.1	22.6	0.2	0.1	0.1
GZA-105S	Nov. 2018	3.5	22.2	0.9	0.2	12.2
	Sep. 2020	6.1	0.0	13.7	9.4	459.9
	Oct. 2021	4.7	16.6	3.2	0.0	162.8
PZ-2S	Nov. 2018	4.0	21.0	0.6	0.1	1.7
	Sep. 2020	6.7	15.5	3.7	0.9	0.0
	Oct. 2021	5.4	18.7	0.8	0.0	103.2
TRC-101	Nov. 2018	3.6	6.6	4.5	8.7	52.7
	Sep. 2020	6.5	0.2	12.8	27.7	637.6
	Oct. 2021	4.8	11.4	4.8	11.4	288.6
TRC-102	Nov. 2018	3.1	22.2	0.6	0.1	0.0
TRC-103	Nov. 2018	3.8	22.0	0.4	0.1	0.0

Of the three events completed, the NSZD signal is strongest in the soil gas composition data from the September 2020 event, when the water table was lowest, and weakest during the November 2018 event, when the water table was highest. The relationship between water table elevation and NSZD signal likely reflects the distribution of residual LNAPL in the smear zone in the interval of historical water table fluctuations. The statistical distribution of groundwater elevation from 1998 through 2021 are shown by month in box and whisker plots in **Figure C**. Groundwater elevations measured during each of the soil gas monitoring events are shown for comparison to historical distribution data.

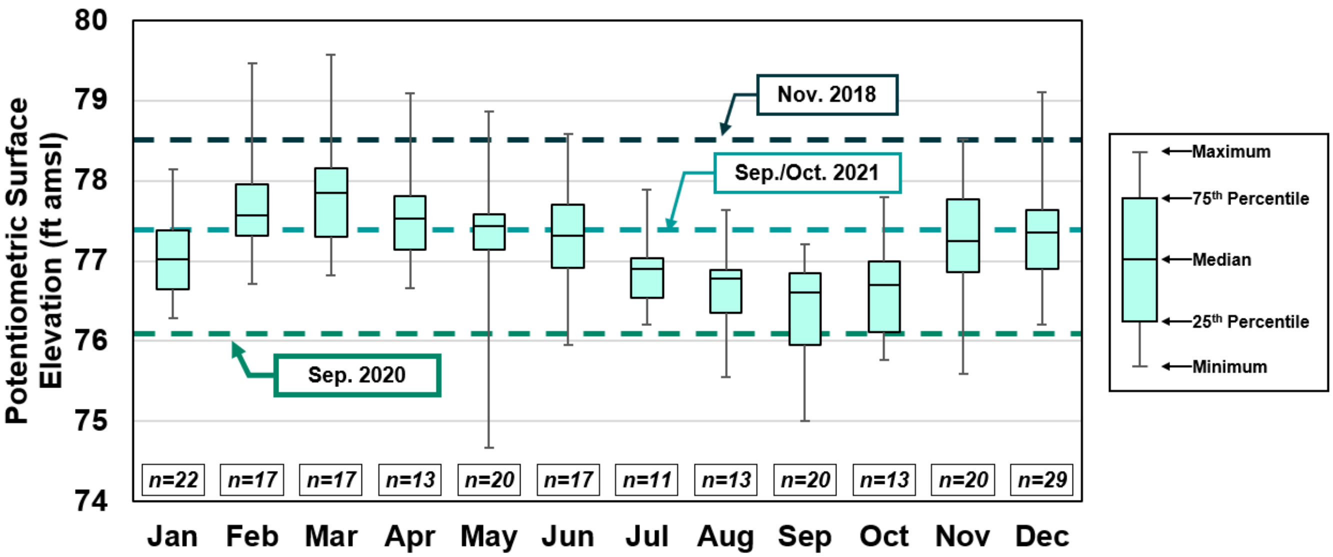

Figure C. Statistical Distribution of Potentiometric Surface Elevation at well PZ-2S from 1998 through 2021

Water table conditions observed during the November 2018 event were near historical high values, and most of the LNAPL smear zone was likely submerged. Under this condition, the interfacial area of the residual LNAPL available for aerobic biodegradation above the water table and capillary fringe is limited. Additionally, under transient rising and higher water table conditions, it is likely that some fraction of the CO_2 and CH_4 produced by biodegradation of petroleum hydrocarbons in the smear zone may be trapped, or may partition into groundwater until concentrations of dissolved gases build up enough to promote degassing and ebullition to the vadose zone (Amos et al., 2005). Thus, while soil gas composition data collected during each event exhibit qualitative evidence of NSZD, the results from the November 2018 event were not evaluated quantitatively to estimate biodegradation rates.

Quantitative Evaluation of Soil Gas Screening Results

Assuming gas transport in the subsurface can be adequately represented as a steady state, one-dimensional (vertical) diffusion process, the mass flux of O_2 into the subsurface can be estimated using Fick's first law (Johnson et al. 2006; API 2017):

$$J_{O2} = D_{O2}^{eff} \cdot \frac{\Delta C_{O2}}{\Delta z}$$ **Equation 4**

Where

J_{O2} is the mass flux of O_2 into the subsurface

$\frac{\Delta C_{O2}}{\Delta z}$ is the soil gas O_2 concentration gradient (g/m^4), and

D_i^{eff} is the effective gas diffusion coefficient (m^2/s).

Soil gas composition profile data collected from monitoring wells screened into the unsaturated zone provide a direct measurement of vertical concentration gradients between the atmosphere and the depth of measurement (Sweeney and Ririe 2017; Sookhak Lari et al. 2017). Vertically integrated effective gas diffusion coefficients (gas diffusivity values) were estimated for each location as a series of the individual soil layer diffusion coefficients from the ground surface to depth "d", which represents the depth of the aerobic/anaerobic horizon using the Millington-Quirk expression (Millington and Quirk 1961) as a function of soil total porosity (θ_T) and soil gas saturations (S_g), as described in Johnson et al. (2006). Values for soil porosity and gas saturation were estimated by matching soil descriptions from boring logs to literature values for gravels, sands, silts, and clays from ITRC (2018) and Carsell and Parrish (1988), and for asphalt concrete from Peng et al. (2012).

O_2 mass flux values were converted into equivalent hydrocarbon depletion rates (R_{NSZD}) in units of gallons per acre, per year (gal/ac/yr) using the stoichiometric coefficient and LNAPL density values described above, using **Equation 5**:

$$R_{NSZD} = \frac{S_{O2} \cdot J_{O2}}{\rho_n}$$ **Equation 5**

LNAPL depletion rates estimated from the September 2020 soil gas data ranged from approximately 520 to 970 gal/ac/yr, with an average value of approximately 630 gal/ac/yr, and rates estimated from the September/October 2021 data ranged from approximately 100 to 530 gal/ac/yr, with an average value of approximately 240 gal/ac/yr. A summary of input parameters and calculated LNAPL depletion rates for the 2020 and 2021 events are presented in attached Table 1 and Table 2, respectively, and rates are summarized below in **Table D**.

Temperature Profiling

The biologically mediated NSZD processes that destroy hydrocarbons and alter the composition of soil gas also release heat. The foundation for evaluating hydrocarbon biodegradation rates from measurements of increased temperature in the subsurface was established decades ago (Mohr and Merz, 1995), and has been more recently expanded as a tool for monitoring remediation performance (Subramanian et al., 2011) and NSZD (Ririe et al., 2013; Sweeney and Ririe, 2014; Warren and Bekins, 2015). The heat released from biodegradation creates temperature gradients in subsurface materials in zones where microbial degradation is occurring, and the overall heat transfer in the subsurface can be conceptualized as the superposition of heat flux from LNAPL depletion and background heat transport processes. The method utilized for calculating NSZD rates from subsurface temperature measurements requires knowledge of background temperature distribution to identify zones of elevated temperature associated with NSZD. The temperature increase from NSZD at a given depth and time of year is calculated using **Equation 6**:

$$\Delta T_{NSZD}(z,t)=T_{SZ}(z,t)-T_{BKGD}(z,t)$$ **Equation 6**

Where,

$\Delta T_{NSZD}(z,t)$ = The difference in temperature at depth "z" and time "t" attributable to NSZD (°C)

$T_{SZ}(z,t)$ = Temperature at depth "z" and time "t" within the LNAPL source zone (°C)

$T_{BKGD}(z,t)$ = Background temperature at depth "z" and time "t" outside of the LNAPL source zone (°C)

Background Temperature Model

Estimation of temperature increase attributable to NSZD can often be achieved through direct comparison of temperatures in source zone wells with temperatures collected at a background location. Ideally, "background" locations should be geologically similar to source zone locations with similar ground surface cover and exposure to solar radiation, but without the presence of LNAPL. For this assessment, location-specific background profiles were developed to account for differences in heat transport properties (i.e., thermal diffusivity) of shallow subsurface materials across the site. Local air temperature data for 2018 through 2021 obtained from Hanscom Airfield were used as inputs to predict subsurface temperatures, similar to models described by DeVries (1963), and Sweeney and Ririe (2014).

Location-specific background temperature distribution was modelled assuming that transient heat transport into and out of the subsurface occurs through conduction as a function of periodic temperature fluctuations at the air-soil interface and thermal diffusivity of subsurface materials (de Vries, 1963; Monteith, 1973; Sweeney and Ririe, 2014). While many of these models utilize a single sinusoidal function to approximate annual variability in temperature at the soil-atmosphere interface, the model used for this evaluation used the first two harmonics of a Fourier series to account for asymmetry in air temperatures, for example between summer and winter (Lemmela et al., 1981; Arguez and Applequist, 2013).

Surface Boundary Condition

Daily air temperature data was used to approximate annual variability in temperature at the soil-atmosphere interface (z=0) as a function of time (t) using **Equation 7**.

$$T(z=0,t)=T_m+\sum_k[S_k\cdot\sin(\omega_k\cdot t)+C_k\cdot\cos(\omega_k\cdot t)]=T_m+\sum_k[A_k\cdot\cos(\omega_k\cdot t-\varphi_k)]$$ **Equation 7**

Where T_m is the mean annual soil temperature (°C) determined using **Equation 8**, and ω_k is the angular frequency of the k^{th} harmonic $\left(\frac{2\cdot\pi\cdot k}{n}\right)$ in units of radians per day. Amplitude coefficients S_k, C_k, and A_k were determined using Fourier analysis techniques (**Equations 9, 10 and 11**, respectively), and the phase angle (φ_k) was determined using **Equation 12**.

$$T_m=\bar{T}_{air}+\Delta T_m$$ **Equation 8**

Where $\bar{T}_{air}$ is the annual average air temperature (°C) and ΔT_m is the difference between mean annual subsurface temperature and mean annual air temperature (°C), as described by Wu and Nofziger (1999) and Baggs (1983). Review of subsurface temperature data indicated a value of approximately 5 ˚C for ΔT_m at the site, similar to the temperature offset observed between mean air and subsurface temperature beneath asphalt cover observed from subsurface temperature monitoring research in Prague (Bodri and Cermak, 2007).

$$S_k=\frac{2}{n}\cdot\sum_{t=1}^{n}T_t\cdot\sin(\omega_k\cdot t)$$ **Equation 9**

$$C_k=\frac{2}{n}\cdot\sum_{t=1}^{n}T_t\cdot\cos(\omega_k\cdot t)$$ **Equation 10**

$$A_k=\sqrt{S_k^2+C_k^2}$$ **Equation 11**

$$\varphi_k=tan^{-1}\left(\frac{S_k}{C_k}\right)$$ **Equation 12**

Where,

n = The number of daily temperature readings used to define the annual fluctuation (365), and

T_t = Average air temperature on day “n” (°C)

A chart showing measured and modelled daily mean air temperature is provided in **Figure D**, below. While there is significant variability in the day-to-day air temperature that is not captured by the model, the amplitude of these short-term variations decreases exponentially with depth in the subsurface due to the diffusive nature of heat conduction (Bodri and Cermak, 2007). As a result, shorter period (higher frequency) temperature fluctuations at the ground surface attenuate quickly, and the smooth air temperature model adequately reflects the longer period variability that is transmitted to subsurface depths greater than a few feet, being evaluated for this study.

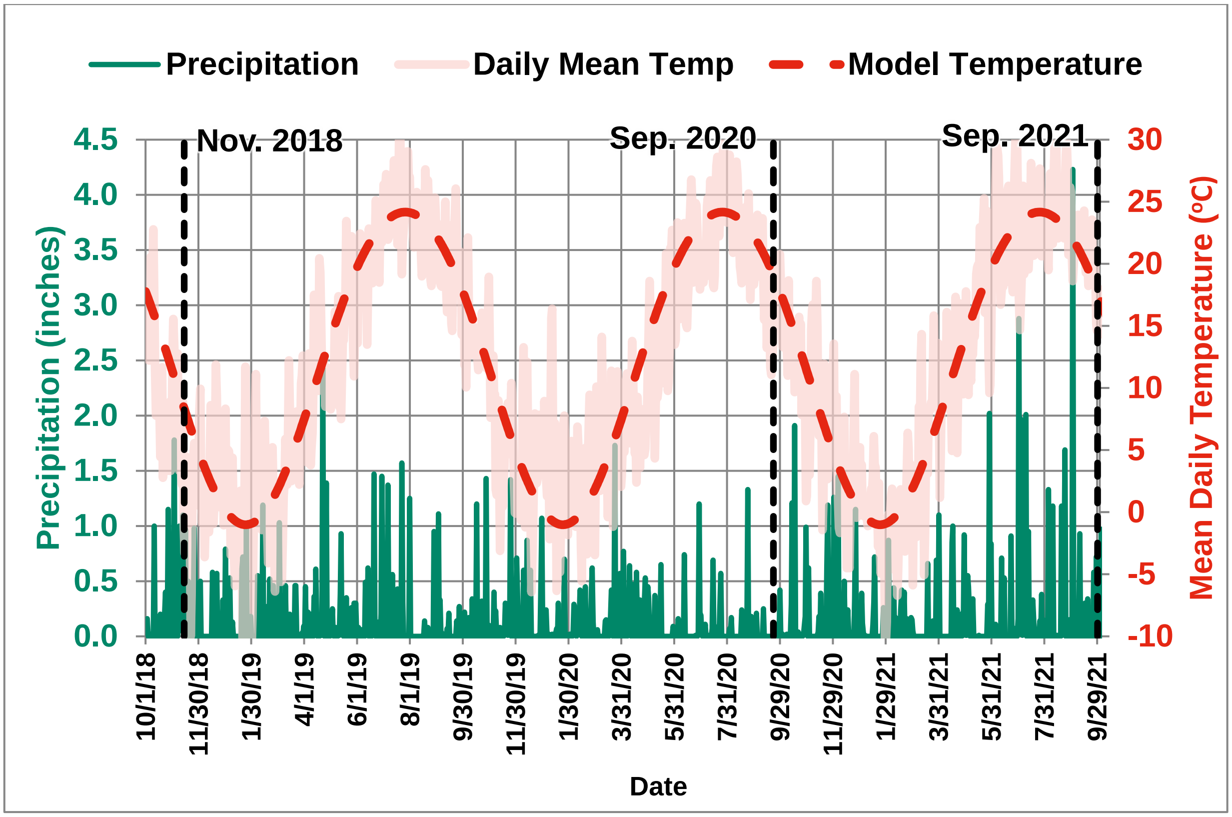

Figure D. Atmospheric Air Temperature Model (Equation 7)

Subsurface Temperature Model

The equation for one-dimensional, transient heat conduction in the subsurface as a function of depth (z) and time (t) is presented in **Equation 13** (Carslaw and Jaeger, 1959):

$$\frac{\partial T(z,t)}{\partial t} = \alpha \cdot \frac{\partial^2 T(z,t)}{\partial z^2}$$ **Equation 13**

Where α is the thermal diffusivity of the subsurface conductive medium, equal to the ratio of the thermal conductivity to volumetric heat capacity with units of square meters per second (m^2/s). Partitioning the subsurface into layers with different thermal diffusivities, **Equation 13** can be re-written as **Equation 14** for each soil layer (Alvala et al, 1996), where α_j is the thermal diffusivity of j^{th} soil layer.

$$\frac{\partial T(z,t)}{\partial t} = \alpha_j \cdot \frac{\partial^2 T(z,t)}{\partial z^2}$$ **Equation 14**

The solution to **Equation 14** satisfying the boundary condition (**Equation 7**) was used to calculate background temperature distribution in the subsurface (**Equation 15**).

$$T(z,t) = T_m + \sum_k \left[A(\omega_k, z) \cdot \cos\left(\omega_k \cdot t - \varphi_k - \frac{z}{D_j}\right) \right]$$ **Equation 15**

Where $A(\omega_k,z)$ is the amplitude of the k^{th} harmonic as a function of depth, determined using **Equation 16**, and D_j is the damping depth for the kth harmonic in layer j, calculated using **Equation 17**.

$$A(\omega_k, z) = A(z = 0) \cdot e^{-z/D_j}$$ **Equation 16**

$$D_j = \sqrt{\frac{2 \cdot \alpha_j}{\omega_k}}$$ **Equation 17**

Qualitative Evaluation of Temperature Data

Temperatures higher than background were observed in the subsurface in all of the wells located within the zone of known historical extent of LNAPL impacts for all three NSZD measurement events (**Table C**). This observation is consistent with the soil gas data interpretation, indicating that biodegradation is occurring. Also, similar to the soil gas data, there appears to be a relationship between the depth of the maximum temperature above background. For the temperature data, the depth of the maximum temperature difference relative to background occurs at shallower depths during periods of higher water table elevation. This suggests that heat produced from oxidation of petroleum hydrocarbons near the base of the smear zone when the water table is lower may be carried upward as the water table rises, giving the appearance of a larger magnitude thermal gradient during periods of higher potentiometric surface elevation. Given that a large precipitation event occurred prior to the November 2018 data collection event, resulting in near historical high potentiometric surface elevation at the site, the November 2018 data were not utilized to estimate biodegradation rates.

Table C: Summary of Maximum Temperature Difference Relative to Background

Well ID	Date	Maximum ΔT (°C)	Depth of Max. ΔT (°C)
AE-3	Nov. 2018	3.6	5.0
	Sep. 2020	0.5	6.5
	Sep. 2021	1.7	3.0
AE-4	Nov. 2018	3.6	5.0
CW-1	Nov. 2018	2.6	5.0
	Sep. 2020	2.6	7.0
	Sep. 2021	1.7	6.0
CW-2	Nov. 2018	2.8	4.0
GZA-102R	Nov. 2018	1.8	5.0
	Sep. 2020	0.7	7.0
	Sep. 2021	0.7	7.0
GZA-105D	Nov. 2018	2.9	5.0
	Sep. 2020	2.3	6.0
	Sep. 2021	1.9	6.0
GZA-105S	Nov. 2018	3.5	4.0
PZ-2S	Nov. 2018	3.4	5.0
	Sep. 2020	3.2	8.0
PZ-2S	Sep. 2021	2.1	7.0
TRC-101	Nov. 2018	2.3	5.0
TRC-102	Nov. 2018	1.6	4.0
	Sep. 2020	1.9	7.0
	Sep. 2021	2.8	3.0
TRC-103	Nov. 2018	2.7	5.0
	Sep. 2020	1.5	7.0
	Sep. 2021	1.7	3.0

Quantitative Evaluation of Temperature Data

Using the well-specific background model, the upward and downward conductive heat flux away from the depth at which the maximum temperature difference was observed at each source zone monitoring location was calculated using Fourier's law of heat conduction. The upward and downward heat flux are then added to calculate the total conductive heat flux attributable to biodegradation (**Equation 18**):

$$q_T = K_u \cdot \left(\frac{\Delta T}{\Delta z}\right)_u + K_d \cdot \left(\frac{\Delta T}{\Delta z}\right)_d$$ **Equation 18**

Where,

q_T = Total conductive heat flux upward and downward from the depth of the maximum observed increase in temperature relative to background (watts per square meter - W/m^2)

K_u = Effective thermal conductivity of subsurface materials from depth of maximum observed increase in temperature to ground surface (watts per meter, per Kelvin - W/m/K)

K_d = Effective thermal conductivity of subsurface materials from depth of maximum observed increase in temperature to total depth of temperature measurement (W/m/K)

$\left(\frac{\Delta T}{\Delta z}\right)_u$ = Upward temperature gradient (°C/m)

$\left(\frac{\Delta T}{\Delta z}\right)_d$ = Downward temperature gradient (°C /m)

Conductive heat flux from biodegradation was estimated for source zone locations using literature values of thermal conductivity (K) for each of the following subsurface materials encountered at the site:

- 0.7 W/m/K for vadose zone soils based on average values for soil types encountered at the site with water saturations between 0 and 50 percent pore space (Monteith, 1973); and
- 1.3 W/m/K for 'water-saturated' soils below the water table (Monteith, 1973).

Heat flux estimates were used to calculate equivalent LNAPL depletion rates based on stoichiometric relationships for the prevailing biodegradation reactions (**Equations 1-3**) along with the heat of reaction (determined using published data for the standard enthalpy of formation, **Table A**) using **Equation 19**:

$$R_{NSZD} = \frac{q_T}{\Delta H_{rxn} \cdot \rho_n}$$ **Equation 19**

Where R_{NSZD} is the NSZD rate in units of grams of LNAPL per square meter, per second (g/m^2/s), and ΔH_{rxn} is the heat of the biodegradation reaction (47.9 kJ/g). LNAPL depletion rates estimated from the September 2020 temperature profiling ranged from approximately 420 to 2,500 gal/ac/yr, with an average value of approximately 1,300 gal/ac/yr, and rates estimated from the September 2021 data ranged from approximately 600 to 2,800 gal/ac/yr, with an average value of approximately 1,500 gal/ac/yr. A summary of temperature profiling and soil gas results from 2020 and 2021 are presented in **Table D** (below) and temperature results are also included in attached **Figure 2** through **Figure 17**. For PZ-2S, the maximum background-corrected temperature was observed near the total depth of the well during the 2020 and 2021 events. Thus, only upward heat flux could be estimated from the PZ-2S data, providing a lower-bound estimate of the total NSZD rate.

Overall, estimated NSZD rates ranged from approximately 100 to 2,800 gal/ac/yr, with a median rate of approximately 670 gal/ac/yr (**Table D**). Estimated NSZD rates are influenced by several background parameters, including water table fluctuations. NSZD rates calculated from soil gas composition and temperature profile data vary based on water table elevation, and likely as a function of the rate of water table change. The methods utilized to calculate NSZD rates for this study rely on simplifying assumptions of steady-state, vertical (1-dimensional) mass and energy transport. However, water table fluctuations have the potential to temporarily move heat energy and trap (or release) soil gas. For the temperature-based NSZD calculations, rising water table conditions likely transport heat from oxidation of petroleum hydrocarbons deeper in the smear zone to shallower depths, due to the high heat capacity of water relative to soil minerals, giving the appearance of larger thermal gradients following periods of groundwater recharge. For the soil gas concentration gradient method, rising water table conditions are expected to submerge a portion of the LNAPL smear zone, making it less accessible for aerobic biodegradation. Additionally, over short time periods, CH_4 and CO_2 produced under anaerobic conditions within the submerged smear zone will likely remain in the aqueous phase until sufficient partial pressure is reached to promote degassing and ebullition, resulting in a temporary period of low apparent NSZD.

Table D. Summary of NSZD Rates for 2020 and 2021 by Method.

Well ID	Measurement Year	NSZD Rate (gal/ac/yr)	
		Soil Gas Concentration Gradient	Biogenic Heat
AE-3	2020	590	420
	2021	250	1,800
CW-1	2020	550	2,500
	2021	100	1,600
CW-2	2020	520	NA
	2021	130	NA
GZA-102R	2020	NA	750
	2021	NA	600
GZA-105S/D	2020	540	1,300
	2021	170	1,300
PZ-2S	2020	970	≥ 940
	2021	530	≥ 700
TRC-101	2020	630	NA
	2021	260	NA
TRC-102	2020	NA	2,000
	2021	NA	2,800
TRC-103	2020	NA	1,000
	2021	NA	1,800
Minimum	**100**		
Maximum	**2,800**		
Median	**670**		

≥ only upward heat flux could be estimated from PZ-2S data, providing a lower-bound estimate of the total NSZD rate

Conclusions

Both temperature and soil gas screening methods utilized to evaluate NSZD provide evidence that NSZD is occurring. Where both soil gas and temperature data were collected and utilized to estimate NSZD rates, values estimated from temperature data were generally higher (six of eight duplicate measurements in 2020 and 2021). However, there is reasonable agreement between estimates, which are generally within an order of magnitude of each other, consistent with literature suggesting that NSZD rate measurements typically have one order of magnitude precision (CRC CARE 2018). The NSZD rates estimated using the soil gas and temperature profiling methods are generally consistent with values typically reported in the literature. For example, Garg et al. (2017) reported results from 25 petroleum LNAPL sites with different geologic conditions, climate settings, and LNAPL types with NSZD rates ranging from 300 to 7,700 gal/acre/yr with the middle 50% of the NSZD rates ranging from 700 to 2,800 gal/acre/yr. The relative agreement between the soil gas and temperature profiling methods suggests that either or both methods are suitable for future NSZD measurement efforts at the site. Although the three NSZD measurement events completed to date have all occurred in the fall season, the measurements represent a large range of water table elevation conditions. Thus, it is likely that the range of LNAPL depletion rates estimated using different measurement methods under variable water table conditions provide some measure of the variability in overall, annual average NSZD rates at the site.

Historical data and results of the NSZD evaluation support the selected remedial alternative outlined in the Phase III Remedial Action Plan (AECOM 2017) that entails continued monitoring and removal of LNAPL in wells, when present. NSZD processes will continue to decrease the VOCs and VPH fraction concentrations in groundwater; however, it is unlikely that these levels will be reduced to below Massachusetts GW-1 standards in the near future.

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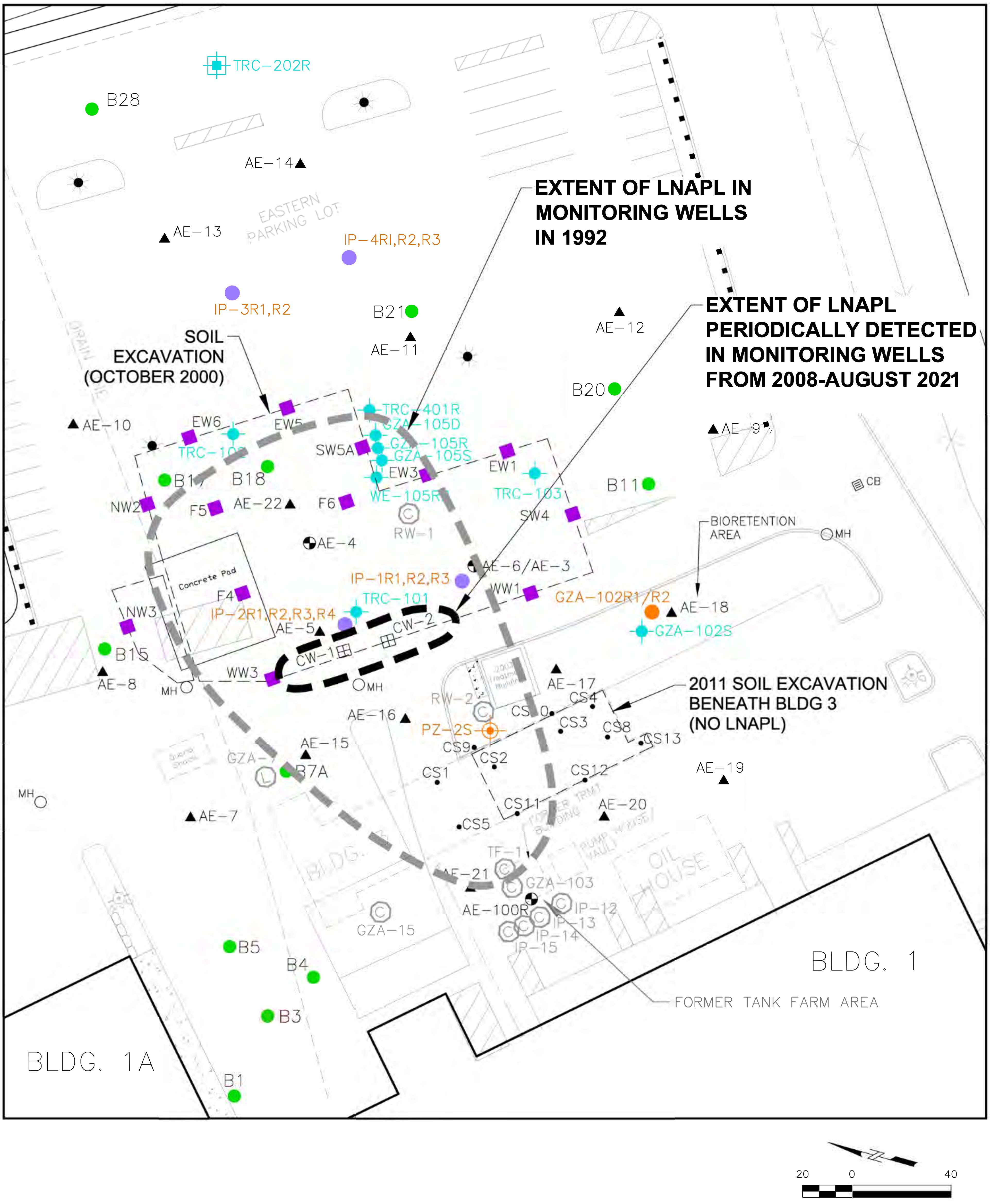
Figures



LEGEND

- MONITORING WELL LOCATIONS
- 2012 SOIL BORING LOCATION
- 1999-2000 SOIL BORING LOCATION (APPROXIMATE)
- 2011 BUILDING 3 POST EXCAVATION SOIL SAMPLE LOCATION (APPROXIMATE)
- 2000 EPL POST EXCAVATION SOIL SAMPLE LOCATION (APPROXIMATE)
- CLOSED WELL LOCATION
- LOST WELL LOCATION
- APPROXIMATE EXTENT OF LNAPL IN 2008-2018 (CW-1, CW-2) [APPROX. 1,792.8 SQ. FT.]
- APPROXIMATE EXTENT OF LNAPL IN 1992 (TF-1, RW-1, RW-2, PZ-2S, GZA-105S, DP-5, DP-6) [APPROX. 19,574.3 SQ. FT.]

SOURCE:

1. EPL Soil Borings (B1, B4, B11, B15, B17, B18, B21, B28) from Phase III RAP Addendum Report (TRC, March 2000)
2. Post Excavation Soil Samples (floor and side walls) and Confirmatory Soil Boring Samples (B7A, B20) from Phase IV As-Built Construction and Final Inspection Report (TRC, January 2001)
3. Building 3 Post Excavation Soil Samples (CS-1 through CS-5, CS-8 through CS-12) from RAM Completion Report (TetraTech, March 2012)
4. Eastern Parking Lot Soil Borings (AE-4 through AE-22, excluding AE-12, -13, -14) from Phase II Comprehensive Site Assesment (AECOM, 2017)

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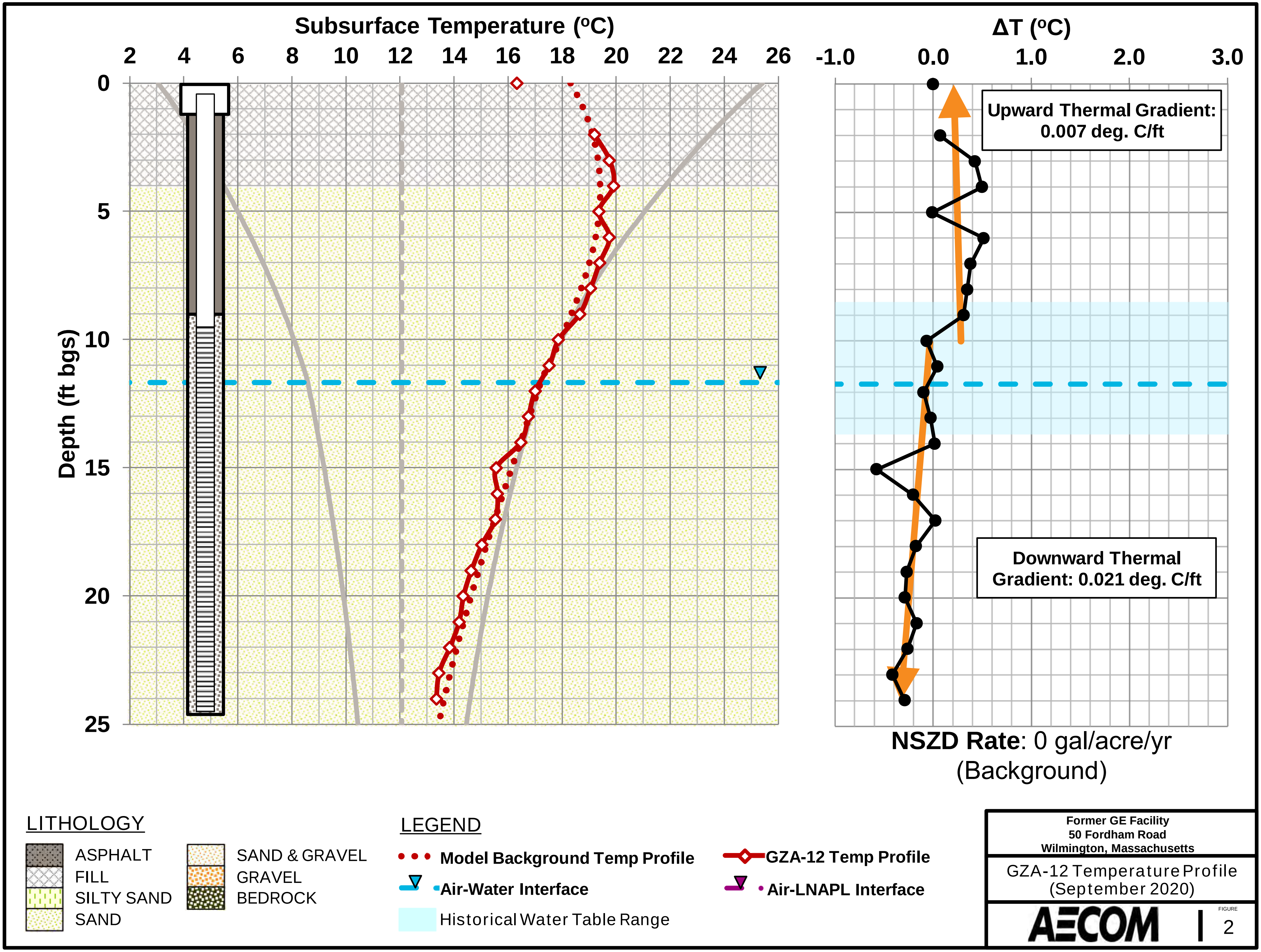
Lockheed Martin Corporation

TANK FARM - EPL
EXTENT OF LNAPL IMPACTS

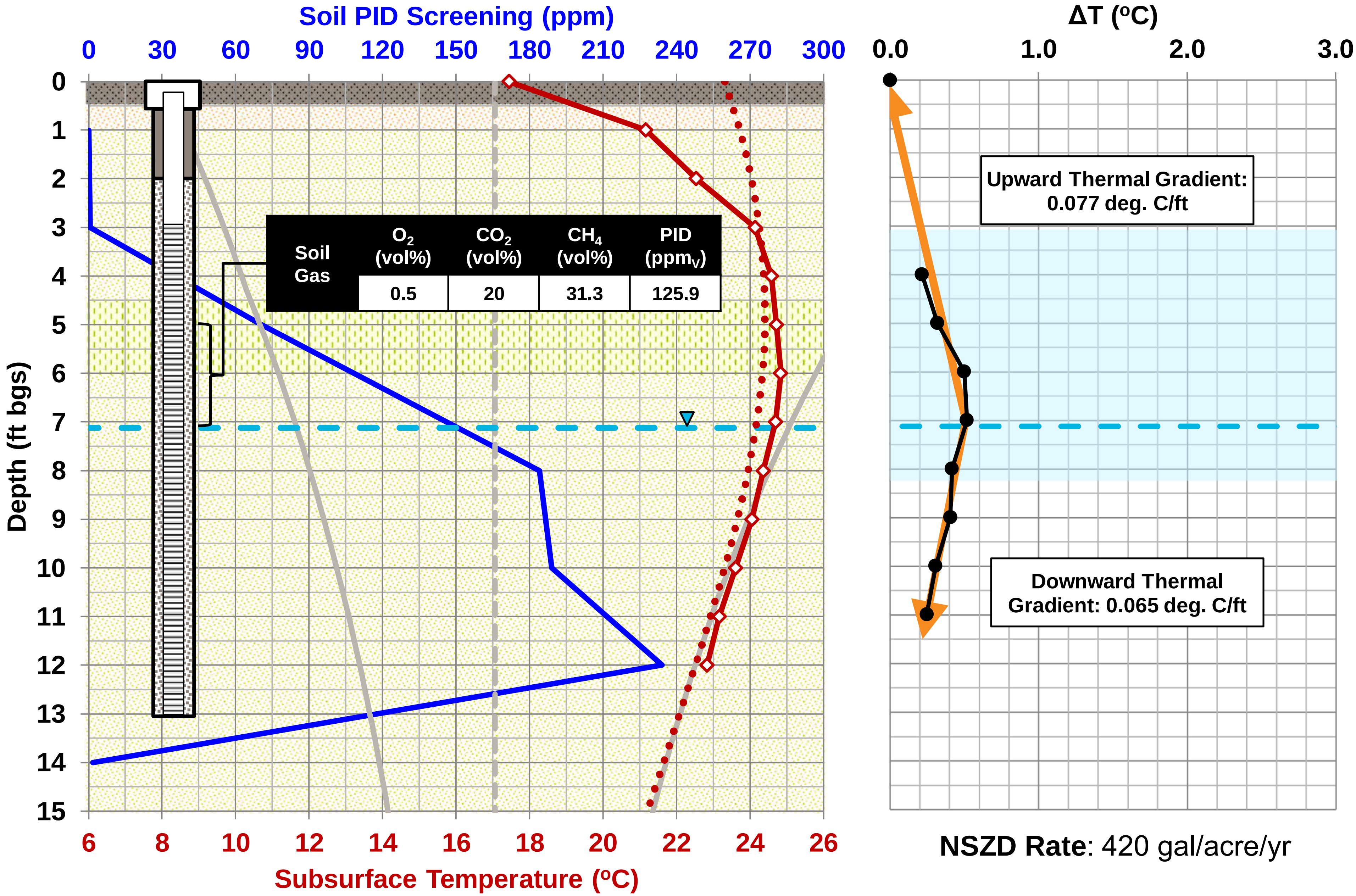
AECOM

60552044 2021-09-20

FIGURE: 1



Subsurface Temperature (ºC)
2
4
6
8
10
12
14
16
18
20
22
24
26
Depth (ft bgs)
0
5
10
15
20
25
ΔT (ºC)
-1.0
0.0
1.0
2.0
3.0
Upward Thermal Gradient: 0.007 deg. C/ft
Downward Thermal Gradient: 0.021 deg. C/ft
NSZD Rate: 0 gal/acre/yr
(Background)
LITHOLOGY
ASPHALT
FILL
SILTY SAND
SAND
SAND & GRAVEL
GRAVEL
BEDROCK
LEGEND
Model Background Temp Profile
GZA-12 Temp Profile
Air-Water Interface
Air-LNAPL Interface
Historical Water Table Range
Former GE Facility
50 Fordham Road
Wilmington, Massachusetts
GZA-12 Temperature Profile
(September 2020)
AECOM
FIGURE
2



Soil Gas	O_2 (vol%)	CO_2 (vol%)	CH_4 (vol%)	PID (ppm_V)
	0.5	20	31.3	125.9

LITHOLOGY

- ASPHALT
- FILL
- SILTY SAND
- SAND
- SAND & GRAVEL
- GRAVEL
- BEDROCK

LEGEND

- Model Background Temp Profile
- AE-3 Temp Profile
- Air-Water Interface
- Air-LNAPL Interface
- Historical Water Table Range

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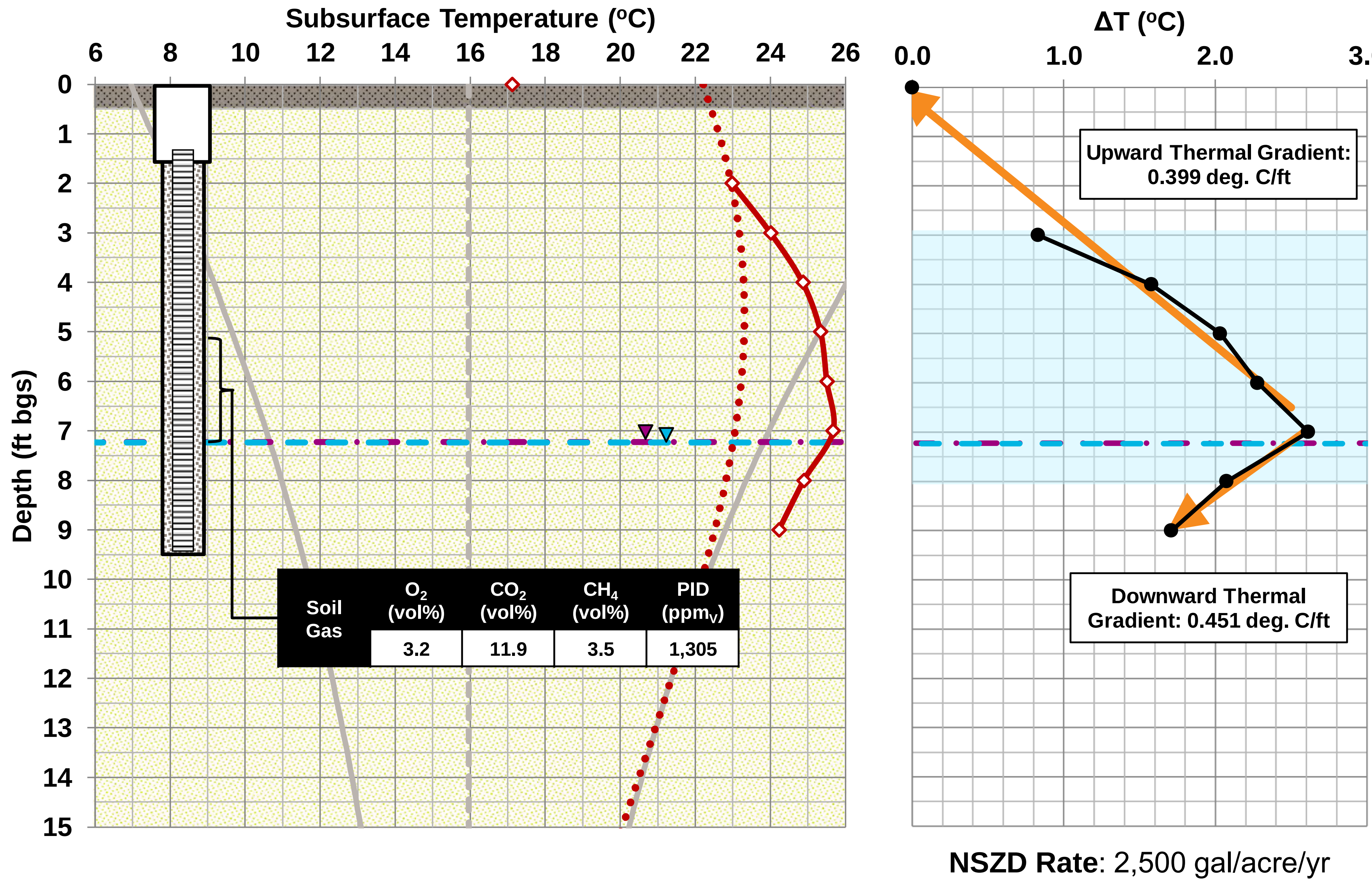
Wilmington, Massachusetts

AE-3 Temperature Profile
(September 2020)

AECOM

FIGURE
3



Soil Gas	O_2 (vol%)	CO_2 (vol%)	CH_4 (vol%)	PID (ppm_V)
	3.2	11.9	3.5	1,305

LITHOLOGY

- ASPHALT
- FILL
- SILTY SAND
- SAND
- SAND & GRAVEL
- GRAVEL
- BEDROCK

LEGEND

- Model Background Temp Profile
- CW-1 Temp Profile
- Air-Water Interface
- Air-LNAPL Interface
- Historical Water Table Range

Former GE Facility
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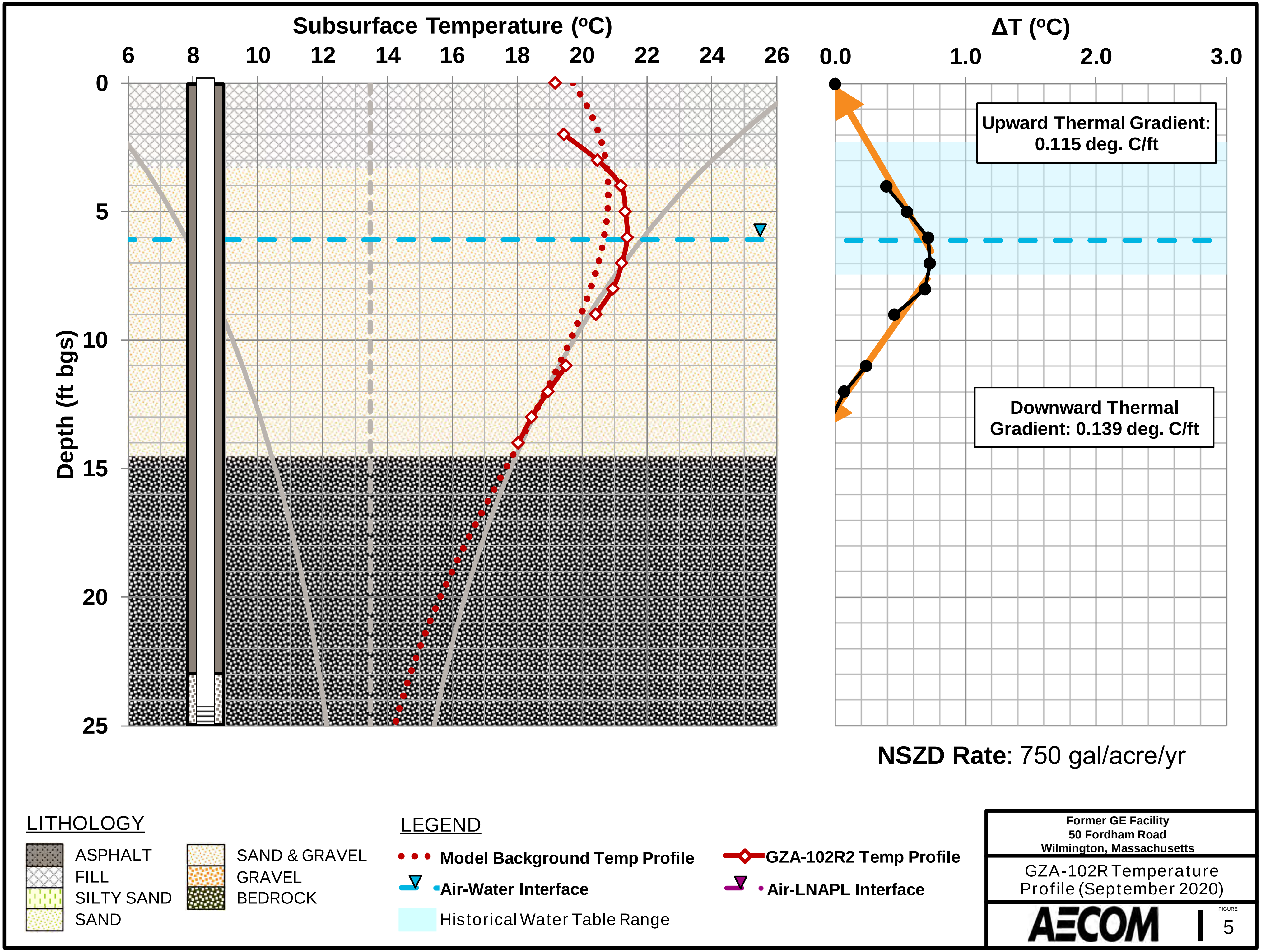
Wilmington, Massachusetts

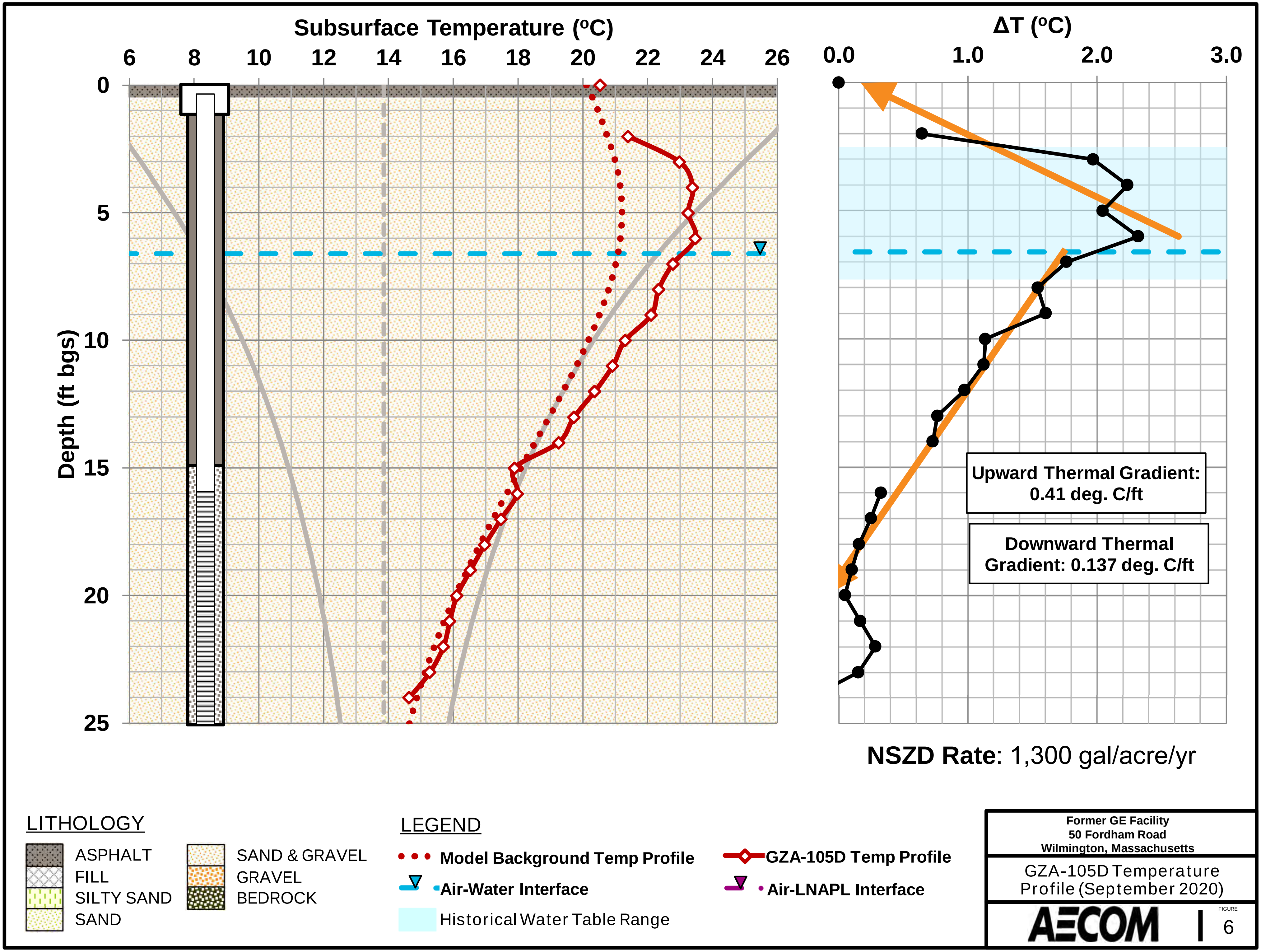
CW-1 Temperature Profile
(September 2020)

AECOM

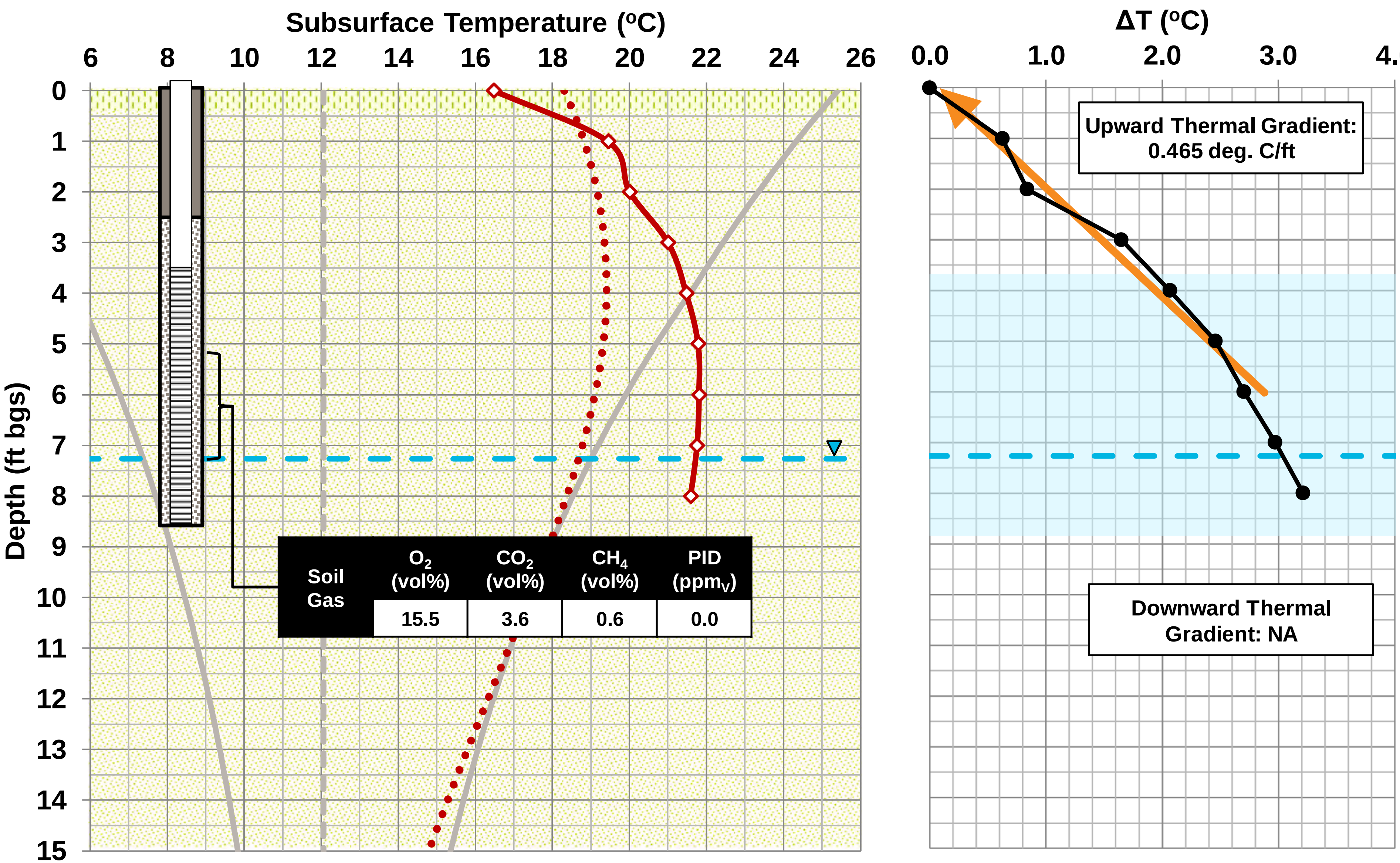
FIGURE
4



Subsurface Temperature (ºC)
6
8
10
12
14
16
18
20
22
24
26
ΔT (ºC)
0.0
1.0
2.0
3.0
0
5
10
15
20
25
Depth (ft bgs)
Upward Thermal Gradient: 0.115 deg. C/ft
Downward Thermal Gradient: 0.139 deg. C/ft
NSZD Rate: 750 gal/acre/yr
LITHOLOGY
ASPHALT
FILL
SILTY SAND
SAND
SAND & GRAVEL
GRAVEL
BEDROCK
LEGEND
Model Background Temp Profile
GZA-102R2 Temp Profile
Air-Water Interface
Air-LNAPL Interface
Historical Water Table Range
Former GE Facility
50 Fordham Road
Wilmington, Massachusetts
GZA-102R Temperature Profile (September 2020)
AECOM
FIGURE
5



Subsurface Temperature (ºC)
6
8
10
12
14
16
18
20
22
24
26
Depth (ft bgs)
0
5
10
15
20
25
ΔT (ºC)
0.0
1.0
2.0
3.0
Upward Thermal Gradient: 0.41 deg. C/ft
Downward Thermal Gradient: 0.137 deg. C/ft
NSZD Rate: 1,300 gal/acre/yr
LITHOLOGY
ASPHALT
FILL
SILTY SAND
SAND
SAND & GRAVEL
GRAVEL
BEDROCK
LEGEND
Model Background Temp Profile
GZA-105D Temp Profile
Air-Water Interface
Air-LNAPL Interface
Historical Water Table Range
Former GE Facility
50 Fordham Road
Wilmington, Massachusetts
GZA-105D Temperature Profile (September 2020)
AECOM
FIGURE
6



Soil Gas	O_2 (vol%)	CO_2 (vol%)	CH_4 (vol%)	PID (ppm_V)
	15.5	3.6	0.6	0.0

NSZD Rate: ≥ 900 gal/acre/yr

LITHOLOGY

- ASPHALT
- FILL
- SILTY SAND
- SAND
- SAND & GRAVEL
- GRAVEL
- BEDROCK

LEGEND

- **Model Background Temp Profile**
- **PZ-2S Temp Profile**
- **Air-Water Interface**
- **Air-LNAPL Interface**
- Historical Water Table Range

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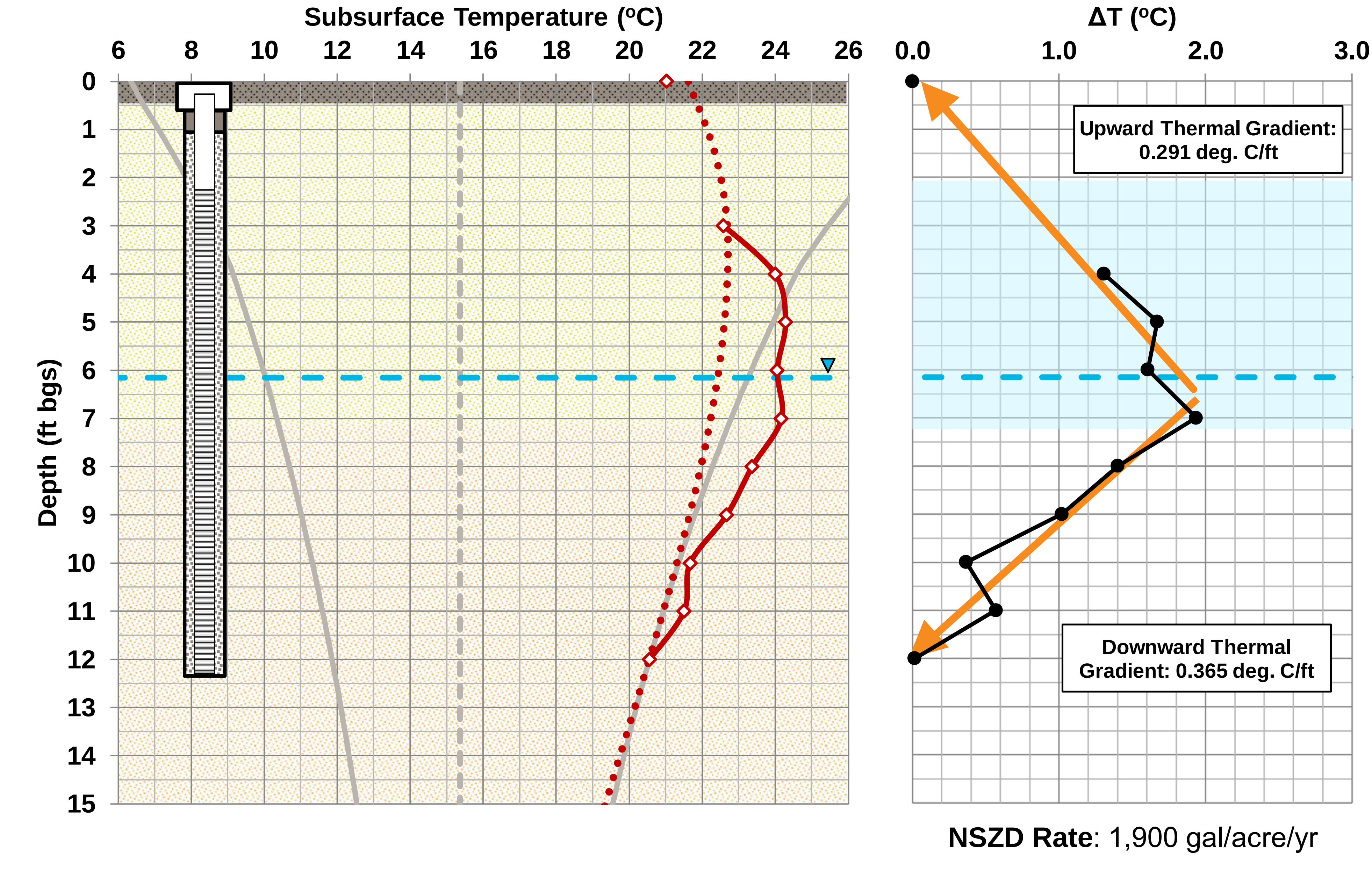
PZ-2S Temperature Profile (September 2020)

AECOM

FIGURE 7



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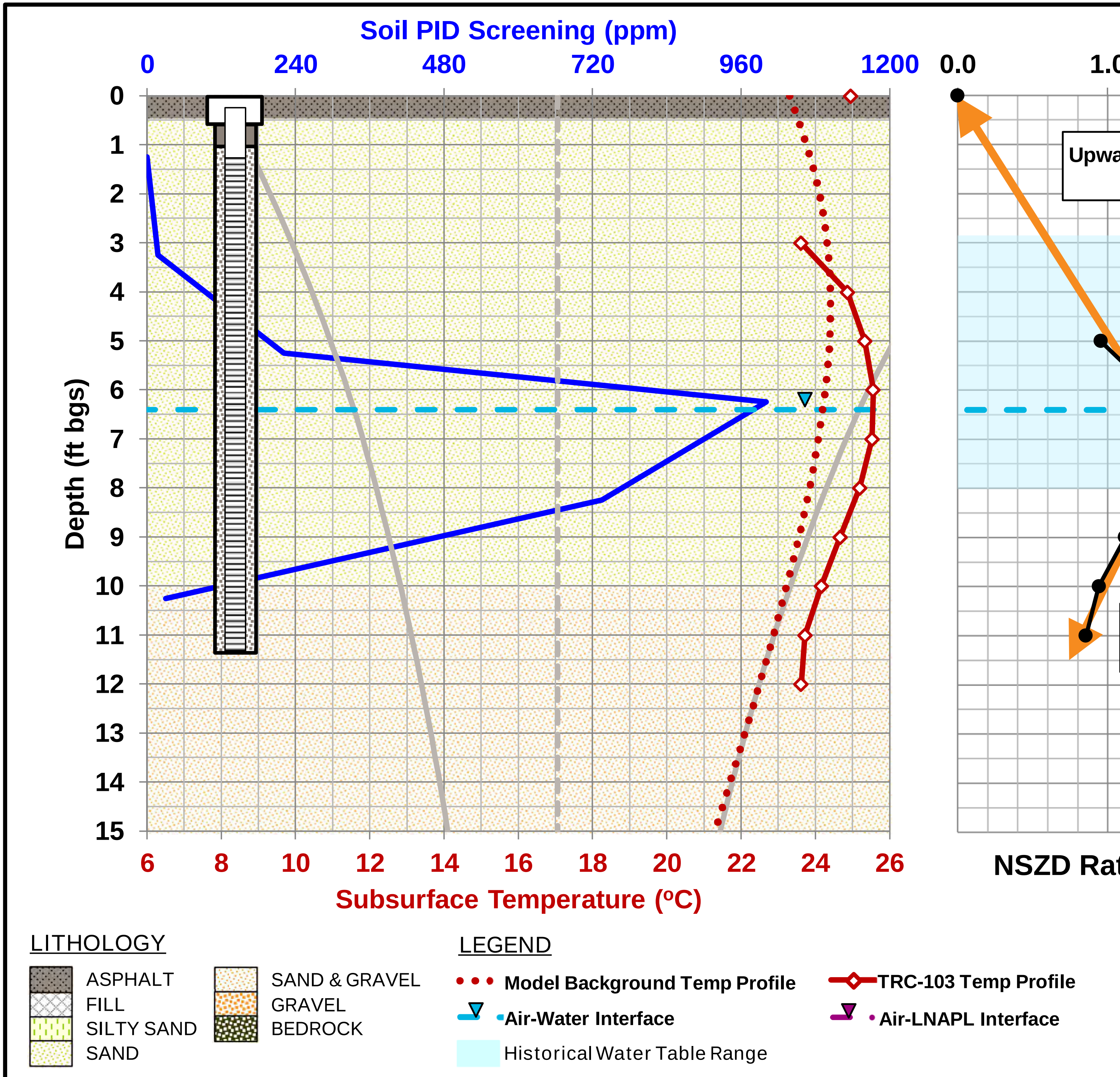
TRC-102 Temperature Profile
(September 2020)

AECOM | FIGURE 8



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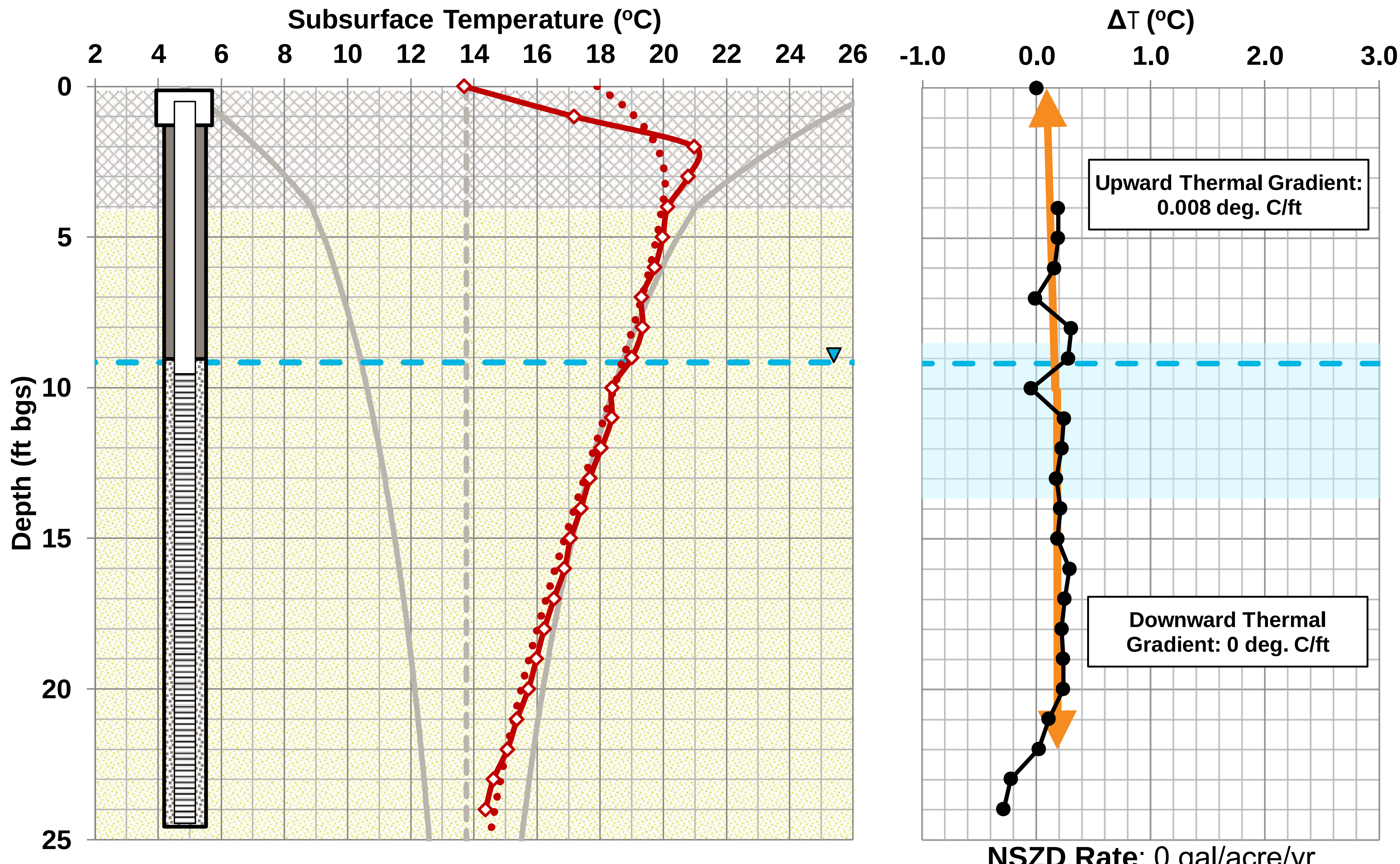
Wilmington, Massachusetts

TRC-103 Temperature Profile
(September 2020)

AECOM

FIGURE
9



NSZD Rate: 0 gal/acre/yr (Background)

LITHOLOGY

ASPHALT
FILL
SILTY SAND
SAND
SAND & GRAVEL
GRAVEL
BEDROCK

LEGEND

Model Background Temp Profile
GZA-12 Temp Profile
Air-Water Interface
Air-LNAPL Interface
Historical Water Table Range

Former GE Facility
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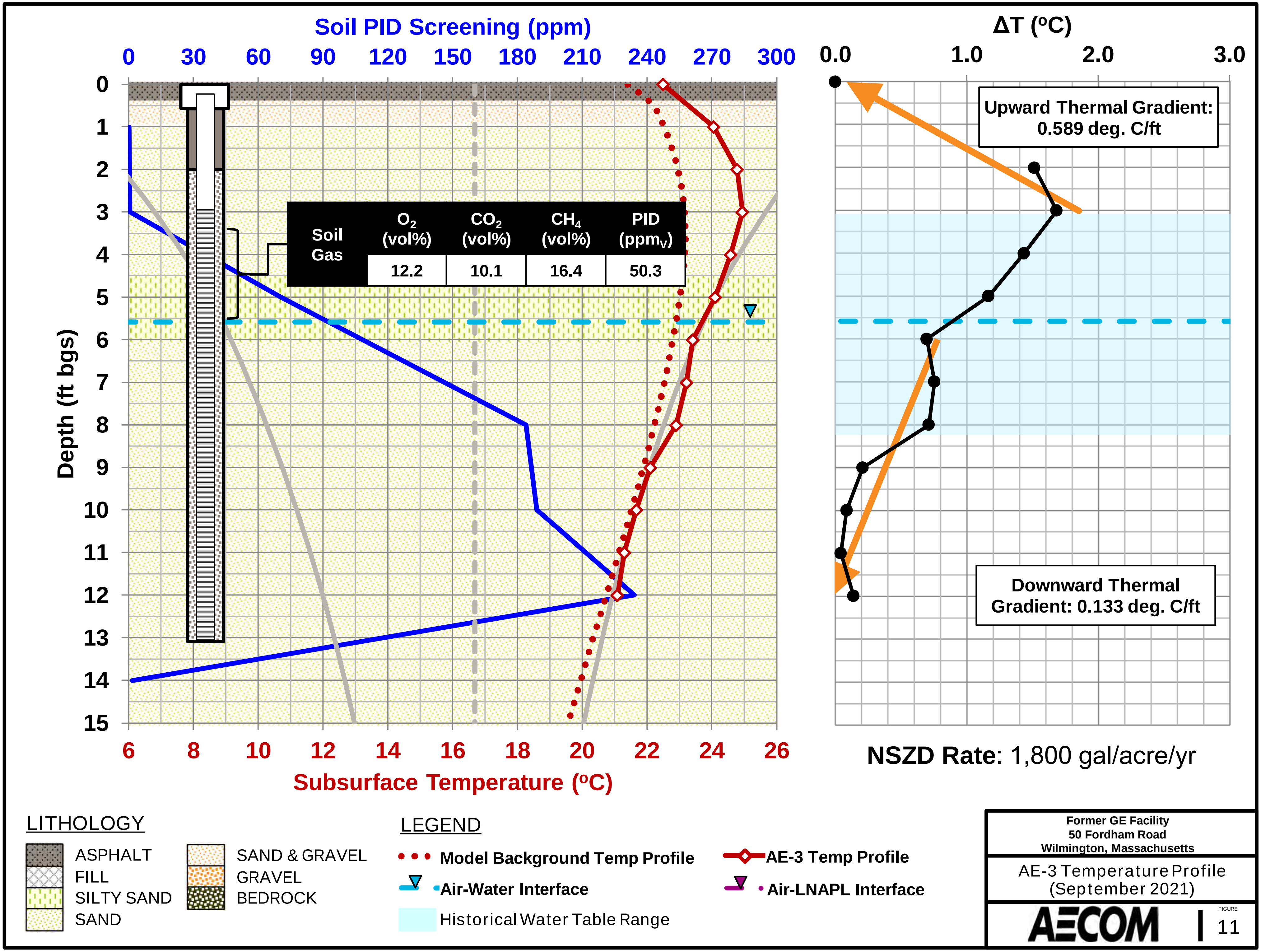
Wilmington, Massachusetts

GZA-12 Temperature Profile (September 2021)

AECOM

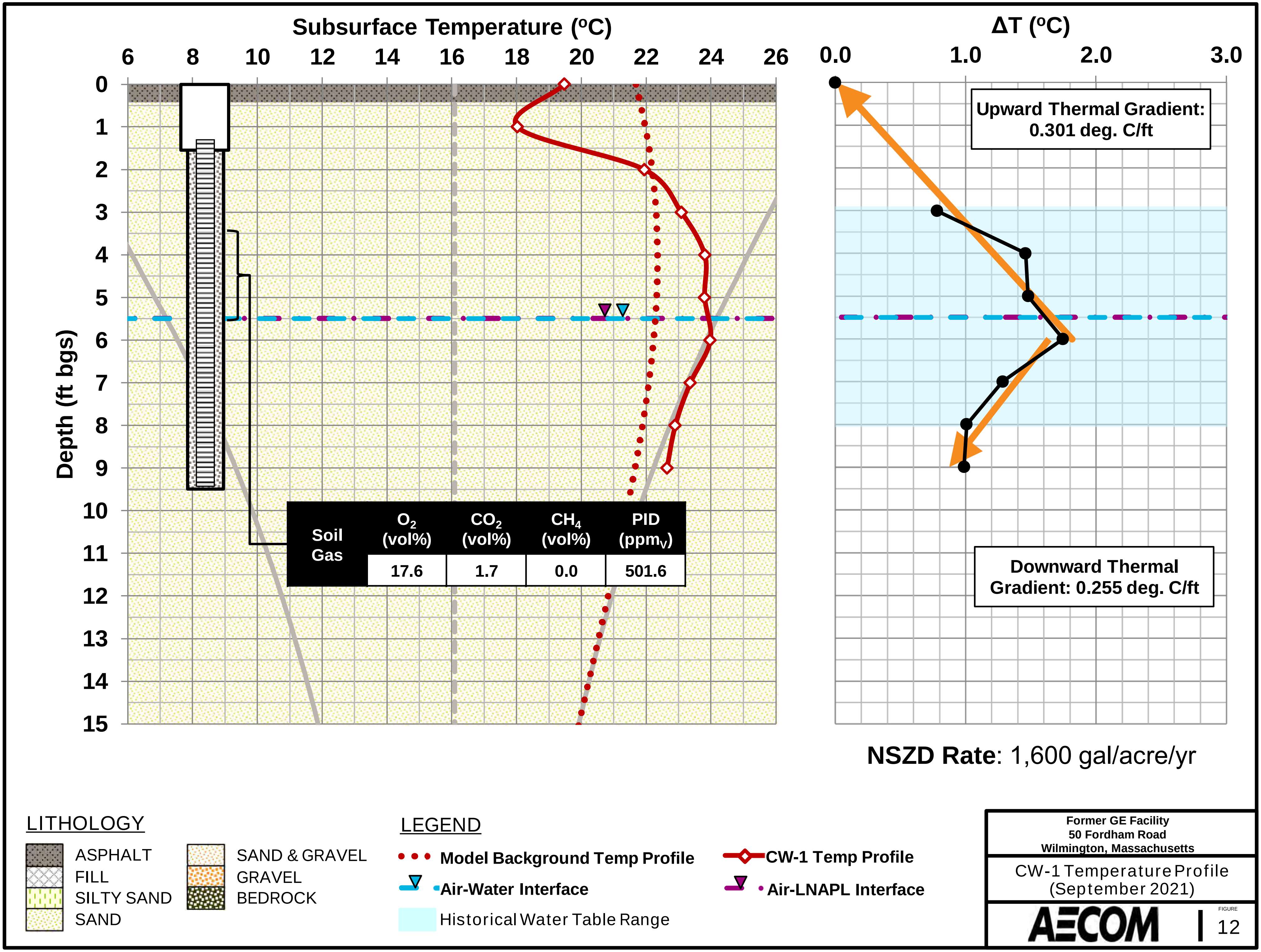
FIGURE 10



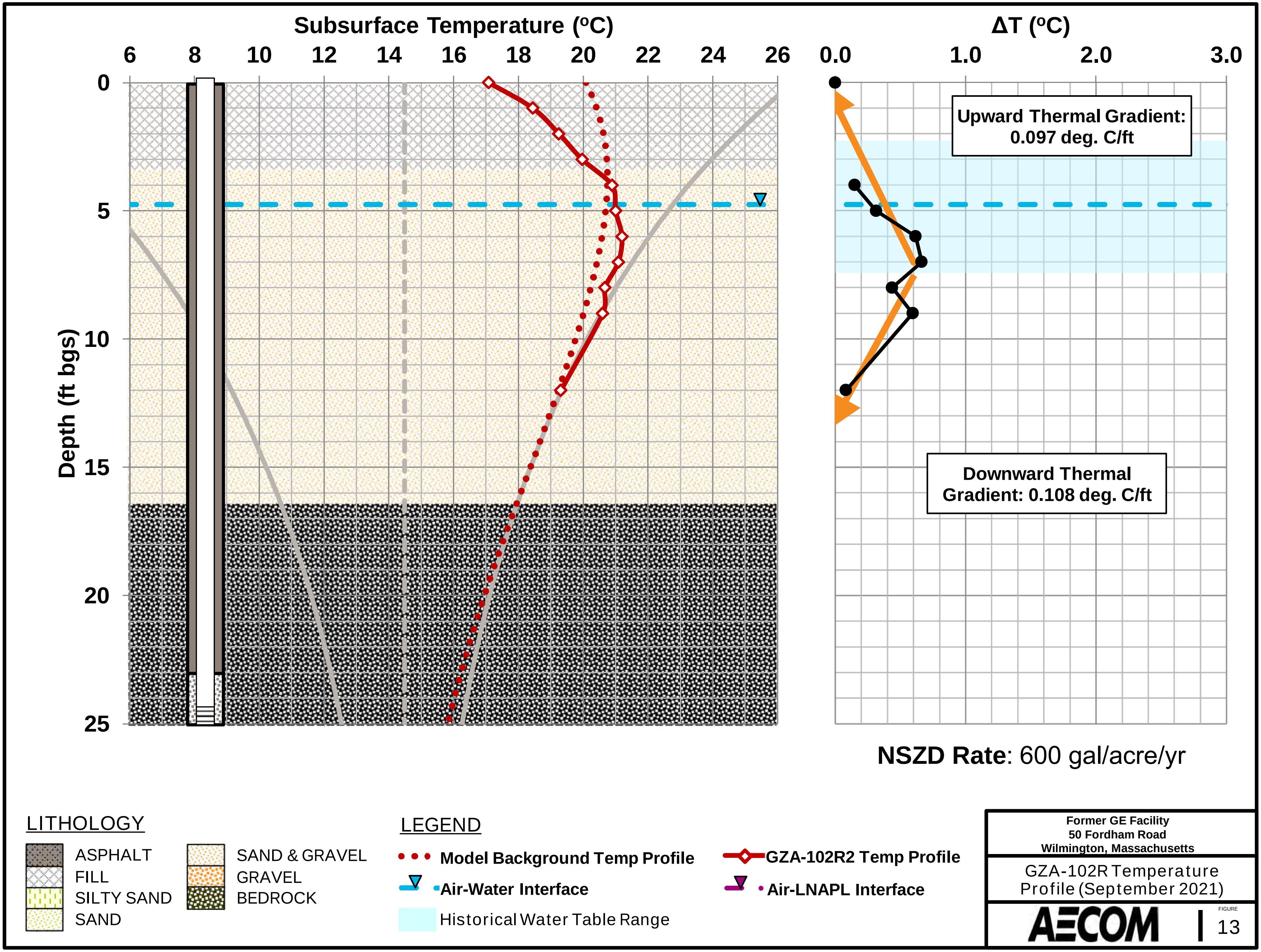
Former GE Facility
50 Fordham Road
Wilmington, Massachusetts

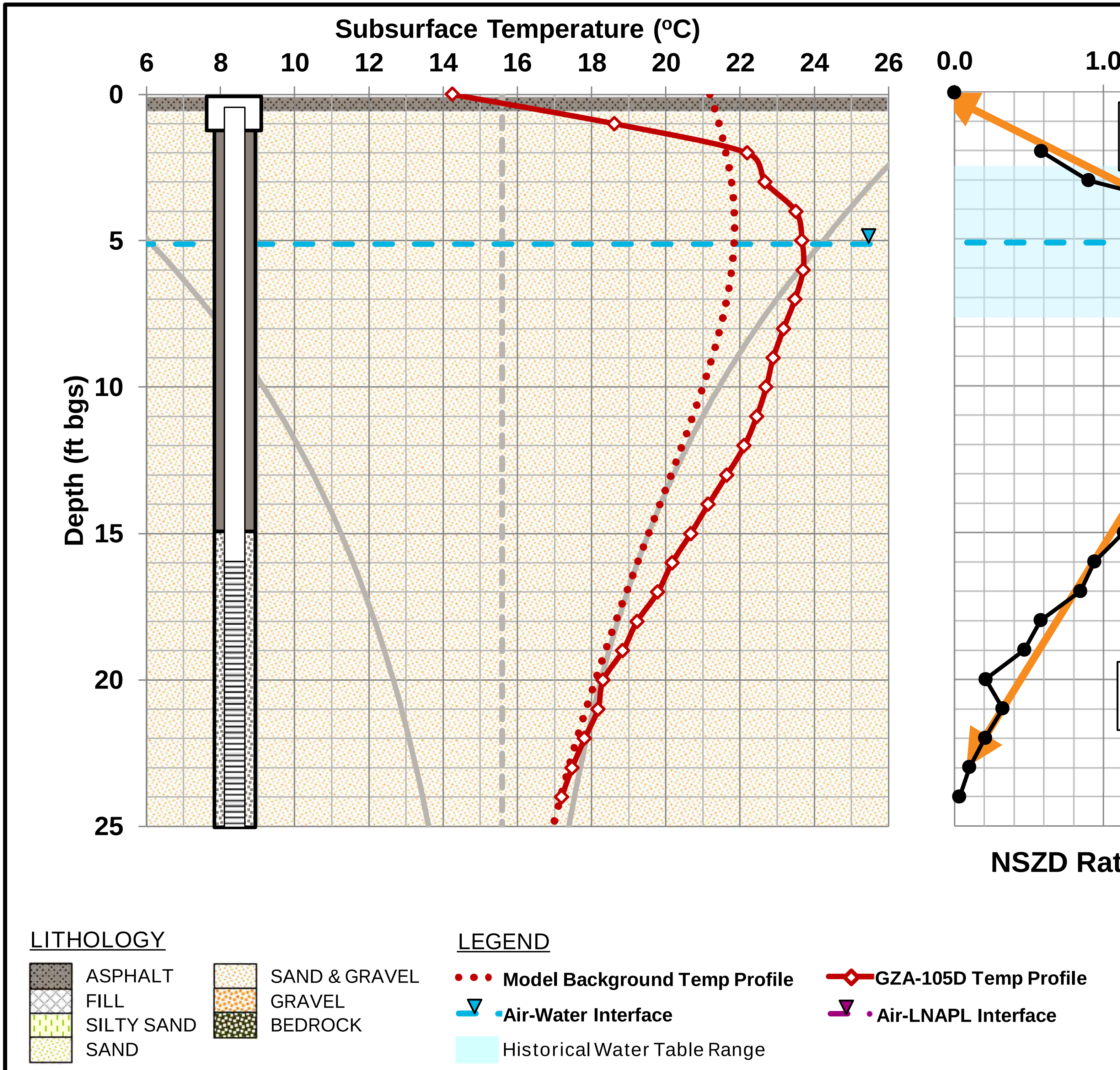
AE-3 Temperature Profile (September 2021)

AECOM | FIGURE 11



Subsurface Temperature (ºC)
6 8 10 12 14 16 18 20 22 24 26
Depth (ft bgs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
ΔT (ºC)
0.0 1.0 2.0 3.0
Upward Thermal Gradient: 0.301 deg. C/ft
Downward Thermal Gradient: 0.255 deg. C/ft
Soil Gas
O_2 (vol%)
CO_2 (vol%)
CH_4 (vol%)
PID (ppm_V)
17.6
1.7
0.0
501.6
NSZD Rate: 1,600 gal/acre/yr
LITHOLOGY
ASPHALT
FILL
SILTY SAND
SAND
SAND & GRAVEL
GRAVEL
BEDROCK
LEGEND
Model Background Temp Profile
CW-1 Temp Profile
Air-Water Interface
Air-LNAPL Interface
Historical Water Table Range
Former GE Facility
50 Fordham Road
Wilmington, Massachusetts
CW-1 Temperature Profile
(September 2021)
AECOM
FIGURE
12


Subsurface Temperature (ºC)
6 8 10 12 14 16 18 20 22 24 26
ΔT (ºC)
0.0 1.0 2.0 3.0
Depth (ft bgs)
0 5 10 15 20 25
Upward Thermal Gradient: 0.097 deg. C/ft
Downward Thermal Gradient: 0.108 deg. C/ft
NSZD Rate: 600 gal/acre/yr
LITHOLOGY
ASPHALT
FILL
SILTY SAND
SAND
SAND & GRAVEL
GRAVEL
BEDROCK
LEGEND
Model Background Temp Profile
GZA-102R2 Temp Profile
Air-Water Interface
Air-LNAPL Interface
Historical Water Table Range
Former GE Facility
50 Fordham Road
Wilmington, Massachusetts
GZA-102R Temperature Profile (September 2021)
AECOM
FIGURE
13

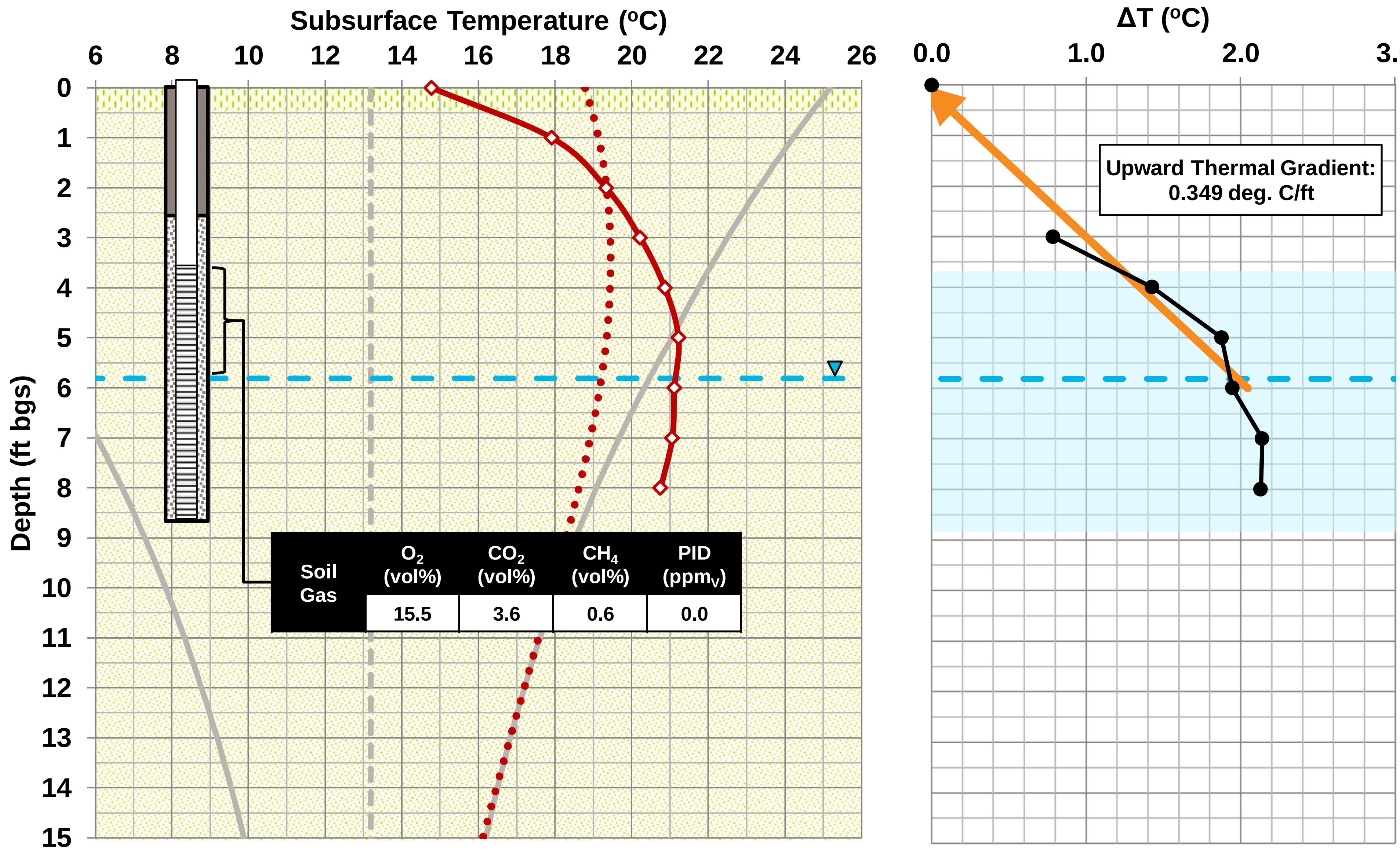


Former GE Facility
50 Fordham Road
Wilmington, Massachusetts

GZA-105D Temperature Profile (September 2021)

AECOM

FIGURE 14



NSZD Rate: 700 gal/acre/yr

LITHOLOGY

- ASPHALT
- FILL
- SILTY SAND
- SAND
- SAND & GRAVEL
- GRAVEL
- BEDROCK

LEGEND

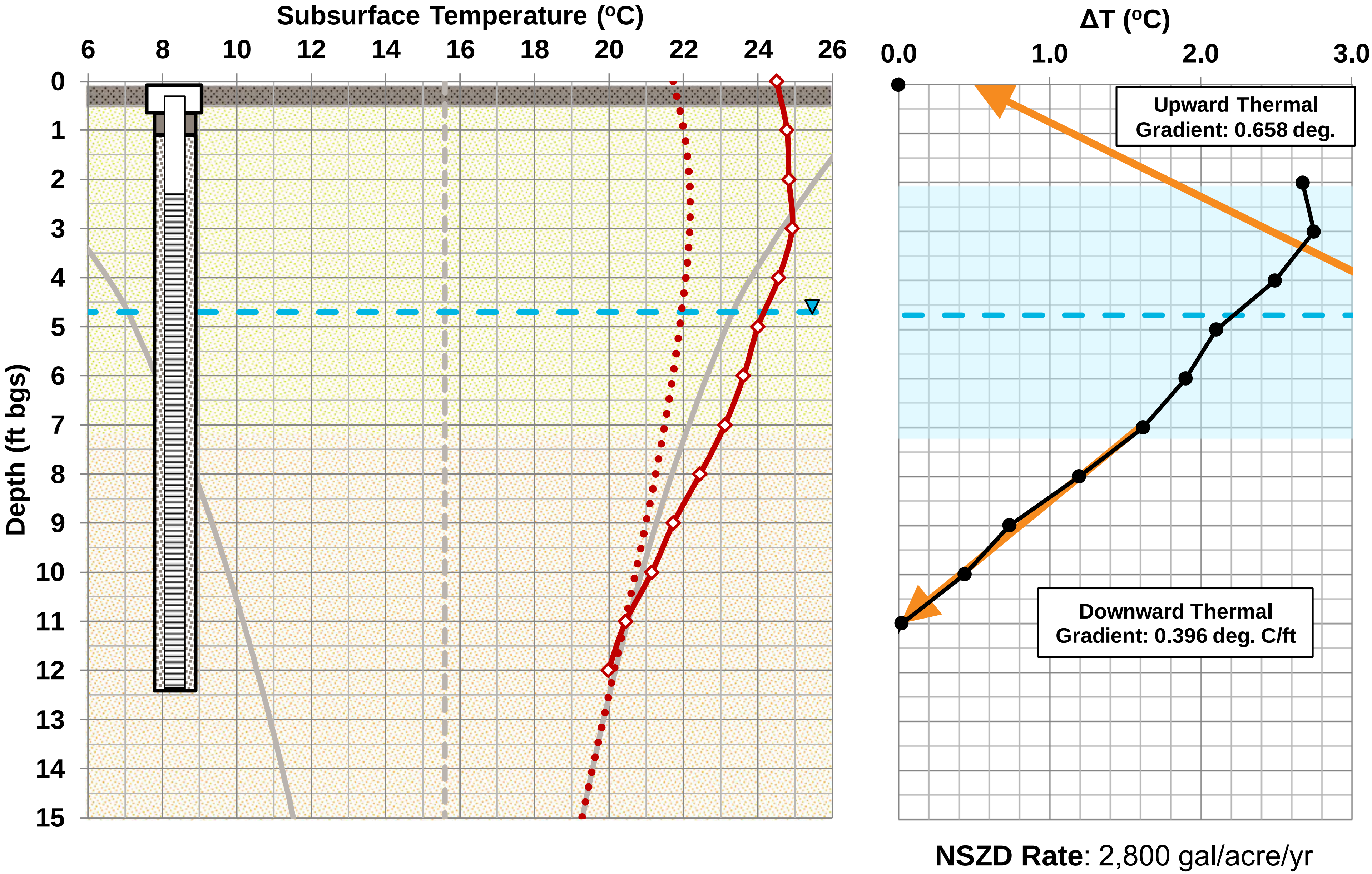
- **Model Background Temp Profile**
- **PZ-2S Temp Profile**
- **Air-Water Interface**
- **Air-LNAPL Interface**
- Historical Water Table Range

Former GE Facility
50 Fordham Road
Wilmington, Massachusetts

PZ-2S Temperature Profile
(September 2021)

AECOM

FIGURE
15



NSZD Rate: 2,800 gal/acre/yr

LITHOLOGY

- ASPHALT
- FILL
- SILTY SAND
- SAND
- SAND & GRAVEL
- GRAVEL
- BEDROCK

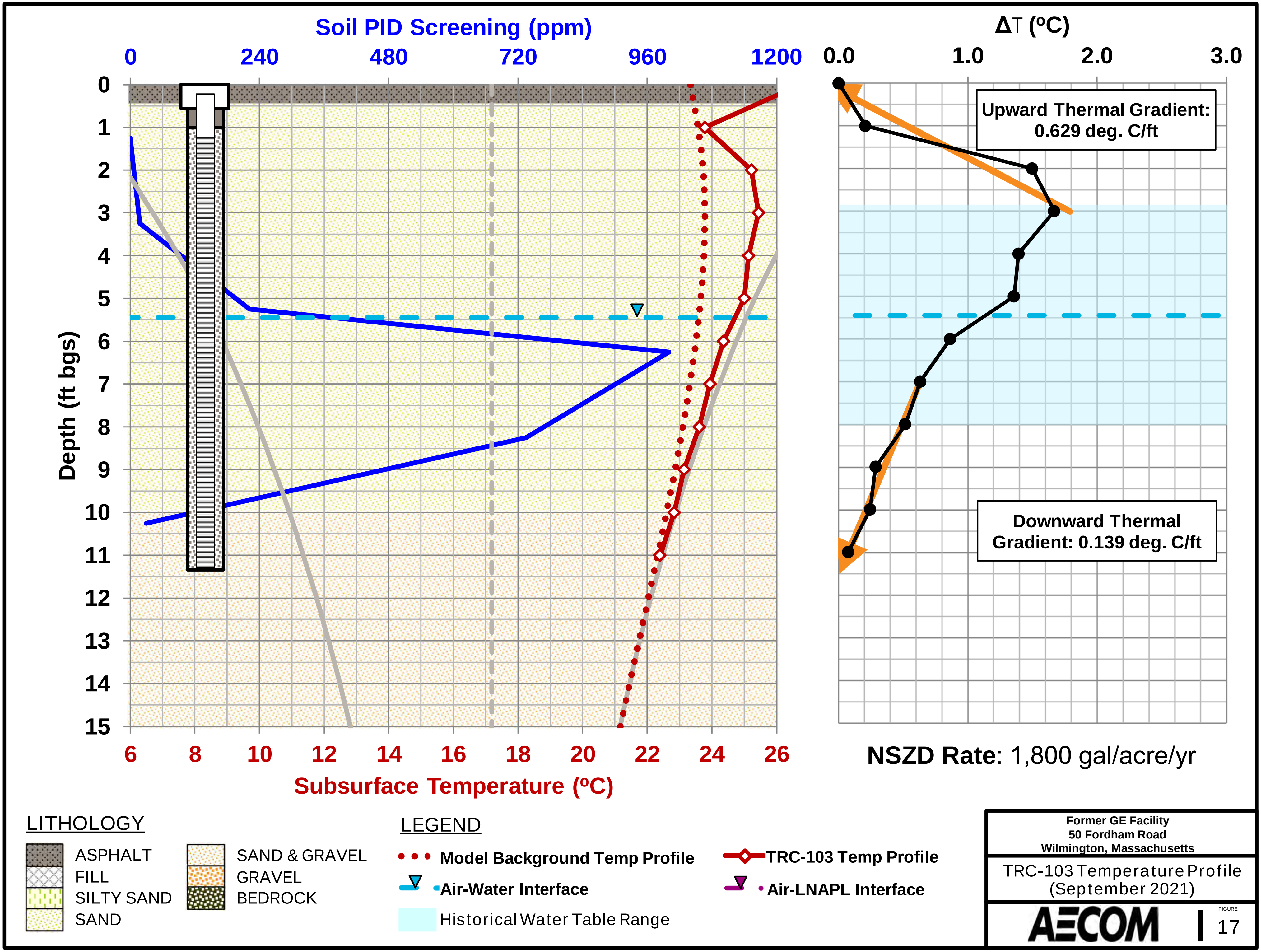
LEGEND

- **Model Background Temp Profile**
- **TRC-102 Temp Profile**
- **Air-Water Interface**
- **Air-LNAPL Interface**
- Historical Water Table Range

Former GE Facility
50 Fordham Road
Wilmington, Massachusetts

TRC-102 Temperature Profile
(September 2021)

AECOM | FIGURE 16



Soil PID Screening (ppm)
0
240
480
720
960
1200
ΔT (°C)
0.0
1.0
2.0
3.0
Upward Thermal Gradient: 0.629 deg. C/ft
Downward Thermal Gradient: 0.139 deg. C/ft
Depth (ft bgs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
6
8
10
12
14
16
18
20
22
24
26
Subsurface Temperature (°C)
NSZD Rate: 1,800 gal/acre/yr
LITHOLOGY
ASPHALT
FILL
SILTY SAND
SAND
SAND & GRAVEL
GRAVEL
BEDROCK
LEGEND
Model Background Temp Profile
TRC-103 Temp Profile
Air-Water Interface
Air-LNAPL Interface
Historical Water Table Range
Former GE Facility
50 Fordham Road
Wilmington, Massachusetts
TRC-103 Temperature Profile
(September 2021)
AECOM
FIGURE
17

Tables

Table 1 - NSZD Calculations based on Oxygen Profile Data (September 2020)
Former GE Facility
50 Fordham Rd, Wilmington, MA

Inputs are Red
Outputs are highlighted Yellow
Notes/Comments are highlighted blue

Supporting Data

Parameter	Value	Units	Comments / Notes
Oxygen Stoichiometric Coefficient - S_{O2}	**0.286**	kg-HC/kg-O_2	*Stoichiometry for aerobic oxidation of octane - C_8H_{18}*
NAPL Density - ρ_n	**0.770**	g/cm^3	*Air Force (1989). The Installation Restoration Program Toxicology Guide. Density @ 20° C.*
Oxygen (O_2) Molecular Weight	**32.0**	(g/mol)	*CRC Handbook of Chemistry and Physics, 93rd Edition*
Gas Constant - R	**0.08206**	atm·L/mol/K	*CRC Handbook of Chemistry and Physics, 93rd Edition*

NSZD Rate Estimation

Parameter	Location ID						Units
	GZA-105S	AE-3	TRC-101	PZ-2S	CW-1	CW-2	
Depth to Aerobic/Anaerobic Horizon or Sample Depth - d	**6.1**	**6.7**	**6.5**	**6.7**	**6.7**	**6.7**	ft
Effective Oxygen Diffusion Coefficient - D_{O2}	**2.9E-07**	**3.5E-07**	**3.6E-07**	**2.4E-06**	**3.8E-07**	**3.8E-07**	m^2/sec
Background O_2 Concentration - $C_{BG,d}$ Assume all oxygen utilization is related to presence of hydrocarbon source.	**20.9%**	**20.9%**	**20.9%**	**20.9%**	**20.9%**	**20.9%**	vol%
	0.28	**0.28**	**0.28**	**0.28**	**0.28**	**0.28**	kg-O_2/m^3-gas
Source Zone Oxygen Concentration at Depth - C_d	**0.0%**	**0.5%**	**0.2%**	**15.9%**	**3.2%**	**4.2%**	vol%
	0.00	**0.01**	**0.00**	**0.21**	**0.04**	**0.06**	kg-O_2/m^3-gas
Oxygen Concentration Gradient - $(C_{BG,d} - C_d)/d$	**0.15**	**0.13**	**0.14**	**0.03**	**0.11**	**0.11**	kg-O_2/m^4
Estimated Mass Depletion Rate - R_v	**0.39**	**0.42**	**0.45**	**0.70**	**0.39**	**0.37**	kg-HC/m^2/yr
	540	**590**	**630**	**970**	**550**	**520**	gal/acre/yr

Mean LNAPL Depletion Rate:	**630**
Standard Deviation:	**170**
Median LNAPL Depletion Rate:	**570**

Table 2 - NSZD Calculations based on Oxygen Profile Data (September 29 to October 1, 2021)
Former GE Facility
50 Fordham Rd, Wilmington, MA

Inputs are Red
Outputs are highlighted Yellow
Notes/Comments are highlighted blue

Supporting Data

Parameter	Value	Units	Comments / Notes
Oxygen Stoichiometric Coefficient - S_{O2}	0.286	kg-HC/kg-O_2	*Stoichiometry for aerobic oxidation of octane - C_8H_{18}*
NAPL Density - ρ_n	0.770	g/cm^3	*Air Force (1989). The Installation Restoration Program Toxicology Guide. Density @ 20^{o}C.*
Oxygen (O_2) Molecular Weight	32.0	(g/mol)	*CRC Handbook of Chemistry and Physics, 93rd Edition*
Gas Constant - R	0.08206	atm·L/mol/K	*CRC Handbook of Chemistry and Physics, 93rd Edition*

NSZD Rate Estimation

Parameter	Location ID						Units
	GZA-105S	AE-3	TRC-101	PZ-2S	CW-1	CW-2	
Depth to Aerobic/Anaerobic Horizon or Sample Depth - d	4.7	4.7	4.9	5.4	5.0	4.7	ft
Effective Oxygen Diffusion Coefficient - D_{O2}	2.1E-07	2.5E-07	2.8E-07	2.4E-06	2.9E-07	2.7E-07	m^2/sec
Background O_2 Concentration - $C_{BG,d}$ Assume all oxygen utilization is related to presence of hydrocarbon source.	20.9%	20.9%	20.9%	20.9%	20.9%	20.9%	vol%
	0.28	0.28	0.28	0.28	0.28	0.28	kg-O_2/m^3-gas
Source Zone Oxygen Concentration at Depth - C_d	14.1%	12.2%	12.4%	18.7%	17.6%	16.9%	vol%
	0.19	0.16	0.16	0.25	0.23	0.22	kg-O_2/m^3-gas
Oxygen Concentration Gradient - $(C_{BG,d} - C_d)/d$	0.06	0.08	0.08	0.02	0.03	0.04	kg-O_2/m^4
Estimated Mass Depletion Rate - R_v	0.12	0.18	0.19	0.38	0.07	0.09	kg-HC/m^2/yr
	170	250	260	530	100	130	gal/acre/yr

Mean LNAPL Depletion Rate:	**240**
Standard Deviation:	**160**
Median LNAPL Depletion Rate:	**210**