EXPLANATION OF SIGNIFICANT DIFFERENCE # 2
to Record of Decision
Hassayampa Landfill Superfund Site
Maricopa County, Arizona
May 2016

I. INTRODUCTION

The Hassayampa Landfill Superfund Site (Site) is located in Maricopa County, west of the City of Buckeye, and approximately 40 miles west of Phoenix, Arizona (Figure 1). This Explanation of Significant Difference (ESD) #2 modifies the U.S. Environmental Protection Agency's (EPA) Record of Decision (ROD) signed August 6, 1992, and ESD #1 signed December 23, 2009. It updates the previously-established soil vapor performance standards (SVPSs) selected in ESD #1 and modifies the remedy to incorporate these new standards and clearly defines the Remedial Action Objectives (RAOs) for the Site. This ESD #2 does not modify the additional soil vapor treatment technologies that were allowed in ESD #1.

In 1992, EPA signed the ROD selecting remediation of the contamination in both groundwater and the vadose zone, including soil and soil vapor above the water table. The vadose zone component of the remedy included capping the entire 10-acre Site where hazardous wastes were disposed using an EPA-approved landfill cap, and performing soil vapor extraction (SVE) at all locations on the Site where soil vapor levels exceeded cleanup standards. The ROD specified that the SVPSs shall be at levels that are protective of groundwater quality; meaning that the migration of contaminants from the vadose zone to groundwater will not result in groundwater contamination that exceeds the groundwater cleanup standards. The purpose of the cap, designed to meet RCRA standards, was to prevent direct contact by site visitors with contaminated waste and soil left in place, reduce infiltration of water and potential leaching of contaminants, reduce the release of VOC vapors to the atmosphere, and improve the efficiency of the soil vapor extraction system.

SVPSs were initially developed in 1994 and referenced in a 1996 Soil Vapor Performance Standards Verification Plan for the Site. The SVE system operated for an estimated 18-months before it was shut down in September 1998, in part due to problems with the thermal oxidation treatment system. Between 2003 and 2004, EPA recognized that uncontrolled horizontal and vertical migration of volatile organic compounds (VOCs) in vapors in the subsurface soils were responsible for the increasing concentrations and extent of VOC contamination observed in the groundwater. These VOC concentrations were far above the groundwater cleanup standards. Following this discovery, in 2006, EPA directed the Hassayampa Steering Committee (HSC), the potentially responsible parties (PRPs) responsible for implementing the remedy, to restart SVE operations at the Site under a pilot study using a cryogenic treatment system.

In 2009, EPA signed ESD #1 establishing updated SVPSs and modifying the soil vapor treatment technologies to allow continued operation of the cryogenic treatment system and replacement of the system with a granulated activated carbon (GAC) treatment system when decreasing contaminant concentrations would make vapor phase carbon treatment feasible in the future.

By 2012, the SVPSs updated in 2009 under ESD #1 were largely met. However, the HSC continued to operate the SVE system because the SVE system was removing significant contaminant mass, VOC concentrations in groundwater remained above the groundwater cleanup standards, and discontinuing the SVE system had the potential to increase vapor transport of VOCs from soil to groundwater. Consequently, in 2015, the HSC proposed to again revise the SVPSs and in March 2016, the EPA approved an updated SVPS Report prepared by the HSC. The findings in that March 2016 updated SVPS Report form the basis for this ESD #2.

This ESD #2 is provided in accordance with Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendment and Reauthorization Act of 1986 (SARA), 42 U.S.C. Section 9617(c), and Section 300.435(c)(2)(i) (55 Fed. Reg. 8666, 8852 (March 8, 1990)) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This ESD #2 documents a significant change to a portion of the remedy selected in the ROD for the Site.

This ESD #2 becomes part of the Administrative Record (AR) for the Site. The complete AR for the Site is available at the following locations:

Arizona Department of Environmental Quality
Phoenix Main Office
1110 W. Washington Street
Phoenix, Arizona 85007

U.S. EPA Records Center
75 Hawthorne Street, Suite 4035
San Francisco, California 94105

EPA provided a fifteen (15) working-day comment period to the Arizona Department of Environmental Quality (ADEQ). ADEQ comments on this ESD #2 are summarized in Section IV of this document, and included in the Site AR file. Pursuant to 40 C.F.R. Section 300.435(c)(2)(i), a formal public comment period is not required for this ESD #2, though the ESD will be available to the public in the Site AR and information repository, and a notice and brief summary of the ESD will be published in a major local newspaper of general circulation (Arizona Republic).

II. BACKGROUND

The following provides a brief background of the Site. Additional background information can be found in the ROD and the Site AR.

Site Location

The Site is located south of Interstate 10 and approximately eight miles west of the City of Buckeye in Maricopa County, Arizona (Figure 1). The Site is comprised of a 10-acre area located in the northeast portion of a closed landfill owned by Maricopa County. The entire landfill is 77 acres, of which 47 acres were used for the disposal of municipal and domestic solid waste.

Site Description/History

Maricopa County began operating the Hassayampa Landfill as a municipal landfill beginning in 1961. During an 18-month period from April 20, 1979 to October 28, 1980, hazardous wastes were disposed in unlined pits on the Site (Figure 2). This disposal occurred under a manifest

program operated by the Arizona Department of Health Services (ADHS) in response to an "extreme emergency" that resulted from an ADHS ban on the disposal of industrial waste at City of Phoenix landfills. When landfills along the Salt River were closed to industrial waste disposal due to flooding, industrial waste was transported and disposed of at the Site. ADHS used a manifest system to screen and track industrial waste deliveries to the landfill during this period. Under this program, a wide range of hazardous wastes was approved by ADHS for disposal at the Site, including up to 3.28 million gallons of liquid wastes and 4,150 tons of solid wastes. Manifests were used to document the volume and type of wastes and the names of the generators and transporters. The landfill pits were subsequently covered with native soil and restored to grade at the end of the 18-month period.

In 1981, ADHS constructed three groundwater monitoring wells at the Hassayampa Landfill. Samples collected from these wells were found to be contaminated with VOCs. In 1984, ADHS conducted an inspection of the Hassayampa Landfill and surrounding area. In response to ADHS's findings, EPA proposed adding the Hassayampa Landfill to the Superfund National Priorities List (NPL) on June 10, 1986. The Hassayampa Landfill was added to the NPL on July 22, 1987.

On February 19, 1988, nine of the major PRPs for the Site entered into an Administrative Consent Order with EPA to conduct the Remedial Investigation and Feasibility Study (RI/FS) under EPA oversight. In addition, there were more than 60 other PRPs who contributed funds toward the completion of the RI/FS, which was completed in June 1992. There were about 40 other PRPs, identified at the time, who did not participate in the RI/FS. In August 1992, EPA signed a ROD selecting a cleanup remedy for the Site. The remediation objective for soils and soil vapor in the 1996 Soil Vapor Performance Standards Verification Plan, was to ensure that "... the migration of contaminants from the vadose zone to groundwater will not result in groundwater contamination that exceeds the groundwater cleanup standards), as determined by site-specific analytic modeling."

On September 22, 1992, Special Notice letters for remedial design/remedial action (RD/RA) were issued to 121 PRPs. In November 1994, the United States and a subset of the PRPs, who formed the HSC, entered into a Consent Decree for remedial design/remedial action (RD/RA) at the Site. The HSC completed the construction of both the groundwater and soil vapor components of the remedy in 1996. Performance standards for both media were also documented in operations and maintenance (O&M) plans for both media. Since completion of both components of the remedy, the HSC has been responsible for the cleanup activities and the long-term O&M for the Site under the Consent Decree. The current Site layout including groundwater and soil vapor monitoring/remediation features are shown on Figures 1 and 2.

III. DESCRIPTION OF SIGNIFICANT DIFFERENCE

After reviewing the protectiveness of the Site remedy, EPA, in coordination with ADEQ, determined that updating the 2009 SVPSs, which take into account the impact of soil vapor transport on groundwater, is necessary to protect human health and the environment in the long-term. The history of the SVPS and rationale for the new SVPSs and the effectiveness of the new SVPSs in meeting Site remediation goals are discussed below. In addition, EPA clarified the RAOs for the Site, which were not clearly defined in the 1992 ROD, although described as *remediation objectives* in subsequent Site-related documents.

Soil Vapor Performance Standards (SVPS)

1994 SVPS

Prior to the construction and operation of the original SVE system, SVPSs were developed in 1994 for the Site using computer modeling (SESOIL coupled with groundwater mixing cell model MIXMODEL and the HELP model). The SVPSs were established in the Vadose Zone Analytical Modeling Report, approved by EPA in September 1994, and incorporated into the 1996 Soil Vapor Performance Standards Verification Plan as "Soil Vapor Performance Standard Curves," not as specific numerical values. Following shutdown of the original SVE system in 1998, in accordance with the 1994 SVPSs, concentrations of VOCs in groundwater monitoring wells exhibited increasing trends. This was accompanied by a lateral expansion of the plume in shallow ("Unit A") groundwater by 2002, including upgradient groundwater well MW-11UA and east sentinel well MW-12UA. In 2004, based on these conditions, EPA concluded that the 1994 soil vapor performance goals were not protective of groundwater and the SVE system was restarted in March of 2006.

2009 SVPSs

The 2009 SVPSs were developed because the 1994 SVPSs were determined by EPA to not be protective, based on spreading groundwater and soil vapor contamination. The 2009 SVPSs were developed by the HSC primarily using the Arizona Minimum Groundwater Protection Levels (GPLs) for organic contaminants from ADEQ's guidance document, *A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality*. For compounds in which Arizona had not published a Minimum GPL, EPA calculated SVPSs using EPA's July 1996 "Soil Screening Guidance: User's Guide." This guidance provided the methodology to calculate Site-specific Soil Screening Levels (SSLs) for allowable total soil concentrations of VOCs. In collaboration with CH2M Hill, EPA's contractor at the time, HSC performed additional calculations to convert the soil concentrations to soil vapor concentrations at equilibrium conditions, which were then summarized in the January 2009 HSC Report, *Restarted Soil Vapor Extraction System Optimization and Closure Protocols*. Based on that report, EPA modified the remedy in the December 2009 ESD #1 to include the updated SVPSs. Although the 2009 SVPSs were largely met by 2013, mass removal rates by the SVE system of 1,000 pounds/month of VOCs demonstrated that significant contaminant mass of VOCs remained in the subsurface soils that could impact the groundwater. The purpose of the vadose zone soil vapor remedy is to prevent migration (by leaching or vapor transport) of contaminants to the groundwater. The high concentrations of VOCs still present in the groundwater and soil vapor indicated that this cleanup objective was not being met. Therefore, EPA, in consultation with ADEQ, determined that the SVPSs needed to be updated again. EPA has determined that the 2009 SVPSs were not protective over the long term because they were developed under the premise that leaching from the vadose zone was the primary transport mechanism, and did not account for vapor phase transport of VOCs to groundwater.

2016 SVPS

Following the decision to update the 2009 SVPSs, alternate methods for calculation of the SVPSs were evaluated. After discussions with the HSC, EPA and ADEQ recommended the use of a soil vapor modeling tool developed by Department of Energy (DOE) Pacific Northwest National Laboratory specifically for arid sites, like Hassayampa. The Soil Vapor Extraction End-State Tool (SVEET) was then modified with site-specific data, through a consultation

process with the HSC, EPA, ADEQ and DOE, to be tailored to the Site's conditions. The SVEET model simulates transport processes that could impact groundwater, including leaching and vapor transport. The SVEET model considers both the three-dimensional (3-D) contaminant loading on the water table and the 3-D advective transport and dispersion of the dissolved contamination to a compliance point. The tool was designed to evaluate if a site has met vadose zone goals. For these reasons, EPA concluded that the SVEET model was the best available tool for developing SVPSs for the Site to meet the soil RAO.

Specifically, SVEET is a spreadsheet-based calculation tool developed to estimate the impact of vadose zone contamination on the contaminant concentration in groundwater at a downgradient groundwater "compliance well." A Site-specific analytical approach was used to calculate appropriate SVPS values for the Site. Except for Freon-113, SVPS values were calculated using the established SVEET software, as modified by the developers. The Freon-113 SVPS had to be calculated using a Henry's Law partitioning relationship. The modified, Site-specific SVEET (version 1.0.H2 developed specifically for the Site) accounts for additional contaminants of concern (COCs), a broader range of input source strength values, and Site-specific porosity and bulk density. The SVEET methodology is described in detail in a February 2016 HSC Report, *Updated Soil Vapor Performance Standards.*

In the SVEET approach, information about the properties and physical layout of the vadose zone, groundwater, and vadose zone contaminant source are gathered to describe the Site setting. The SVEET software uses this information to estimate the groundwater contaminant concentration at a selected downgradient location. Thus, it is possible to estimate the vapor-phase source concentration that corresponds to a selected groundwater contaminant concentration goal at a specified location. For the purpose of this ESD #2, establishing updated SVPSs for the vadose zone component of the remedy to guide operation of the SVE system, vapor concentrations in the primary vadose zone source area were back-calculated so that VOC concentrations in groundwater would not exceed the groundwater performance standards at the downgradient Site boundary (see Figure 2).

The new 2016 SVPSs, as compared to the 2009 SVPSs, are shown on Table 1. The updated SVPSs will ensure that the soil vapor remedy is protective of human health and the environment, and will ensure the long-term cleanup of the groundwater at the Site. Updating the SVPSs is significant change to the remedy because it substantially alters the performance standards for the soil vapor component of the remedy. However, updating the SVPSs does not fundamentally change the selected soil vapor remedy requiring soil vapor treatment to meet soil vapor cleanup standards.

Site Remedy and RAOs

This ESD #2 expands on the selected remedy for each of the media components by presenting a clear statement of the RAOs for the Site. RAOs describe what the proposed site cleanup is expected to accomplish. The RAOs also facilitate the Five Year Review (FYR) determination of protectiveness of human health and the environment.

The 1992 ROD and the 2009 ESD #1 selected the remedies for each of the media components (groundwater, soils and soil vapor) at the Site. However, at the time, these decision documents did not expressly define the related RAOs. The remedies selected in the 1992 ROD and the 2009 ESD #1 are as follows:

Groundwater Remedy

- Remediate groundwater and vadose zone (including soil and soil vapor above the water table) contamination,
- Extract contaminated groundwater, treat the water using air stripping technology
- Reinject treated groundwater and continue groundwater monitoring to measure effectiveness of the remedy
- Meet Federal Maximum Contaminant Levels (MCLs), the selected groundwater cleanup standard; and meet the State of Arizona Health Based Guidance Levels (HBGLs) for contaminants with no MCLs.
- Meet the groundwater cleanup standards at all points within the contaminated aquifer.
- For the groundwater treatment systems, perform vapor phase carbon adsorption as necessary to meet Federal, State and County regulations pertaining to air emissions.

Soils/Soil Vapor Remedy

- Install a cap on the Site that meets the substantive and maintenance requirements of the Resource Conservation and Recovery Act (RCRA).
- Perform soil vapor extraction at all locations where soil vapor levels exceed cleanup standards.
- Establish soil vapor cleanup standards (through site-specific analytic modeling) that are protective of groundwater quality (meaning that the migration of contaminants from the vadose zone to groundwater will not result in groundwater contamination that exceeds the groundwater cleanup standards).
- Implement access and deed restrictions.
- For the soil vapor treatment systems, perform vapor phase carbon adsorption as necessary to meet Federal, State and County regulations pertaining to air emissions.

The selected remedies in the 1992 ROD were constructed and implemented by 1996. The remedy was constructed to meet the *remedial objectives* outlined in the Introduction of the Statement of Work (SOW) for the 1994 CD between EPA and the HSC. The purpose of these remedial objectives was to describe in broad terms the measures that were taken to protect public health and welfare. These same remedial objectives for both groundwater and soil vapor were then incorporated into the separate Performance Standards Verification Plans (PSV Plans) for groundwater and soils/soil vapor completed by the HSC in 1996, as follows:

Groundwater and Soils/Soil Vapor Remedial Objectives

- *Prevent or mitigate the continued release of hazardous substances, pollutants and contaminants to the underlying aquifers;*
- *Reduce the risks to human health associated with direct contact with hazardous substances, pollutants or contaminants from the Site;*
- *Reduce the risks to human health associated with inhalation of hazardous substances, pollutants and contaminants from the Site;*
- *Eliminate or minimize the threat posed to human health and the environment from current and potential migration of hazardous substances in the groundwater and subsurface and surface soil and sediment at the Site;*
- *Reduce concentrations of hazardous substances, pollutants and contaminants in the surface and subsurface soil, and in the groundwater at the Site to levels specified by all applicable or relevant and appropriate requirements (ARARs); and*

- *Reduce the volume, toxicity and mobility of hazardous substances, pollutants and contaminants at the Site.*

Although these remedial objectives have been used (since the 1994 CD) as the performance standards for construction of the remedy in 1996 and monitoring of the site in the intervening years, they were not formally incorporated into EPA's decision documents, and defined as the Site's RAOs. RAOs are cleanup objectives that may specify contaminants to be cleaned up, the cleanup standard, the area of cleanup, and the time required to achieve cleanup. RAOs clarify the administrative record for future decision-making, including determining when final cleanup is attained and conducting FYRs. The RAOs set forth in this ESD #2 are consistent with the intent of the 1992 ROD and the 1994 CD to protect human health and the environment, as follows:

Groundwater RAOs

- Prevent human exposure to groundwater contaminated by Site contaminants of concern (COCs) above maximum contaminant levels (MCLs) and, for contaminants that have no MCLs, above Health-Based Guidance Levels (HBGLs) established by Arizona.
- Restore ground water throughout the Site to concentrations at or below the MCLs and HBGLs for site COCs.

Soils/Soil Vapor RAOs

- Prevent human ingestion of or contact with soil or waste contaminated with Site COCs that represents an unacceptable exposure.
- Prevent leaching or vapor transport of COCs from soil and waste in the vadose zone to groundwater by attaining and maintaining soil vapor concentrations below SVPSs that are protective of groundwater quality and will not result in degradation of groundwater at concentrations above the MCLs or HBGLs at the Site boundary.

The HSC is responsible for implementing the remedy. The changes in this ESD #2 are not expected to result in any significant differences in the remedy's cost. Upon completion of this ESD #2, the HSC will incorporate these new SVPSs into an updated Performance Monitoring and Verification Plan (PMVP) for the Site. The HSC will also continue long-term operation and maintenance of this remedy until the RAOs are met in accordance with the current PMVPs and the HSC receives approval from EPA to turn off the soil vapor or the groundwater treatment systems.

IV. SUPPORT AGENCY COMMENTS

EPA provided ADEQ with a fifteen (15) work-day comment period on this ESD #2. The ADEQ concurred with this proposed ESD #2 in a letter dated March 29, 2016, and provides concurrence of the final ESD #2 via signature below.

V. AFFIRMATION OF STATUTORY DETERMINATIONS

This ESD #2 modifies the selected remedy by updating the SVPSs for the soil vapor component of the Site remedy, and documents that EPA believes these updated SVPSs will ensure that the groundwater cleanup standards can also be attained for the Site. EPA believes that by these changes, the selected remedy for the Site will remain protective of human health and the environment, will continue to comply with the applicable or relevant and appropriate federal and

state requirements for this remedial action, and will continue to be cost-effective. The modified remedy satisfies CERCLA Section 121.

VI. PUBLIC PARTICIPATION COMPLIANCE

EPA has presented these changes to the remedy in the form of an ESD because the changes are significant but not fundamental in nature. No public comment period is required for this ESD #2 because the changes are not fundamentally altering the selected remedy. In accordance with 40 C.F.R. Section 300.435(c) (2) (ii), this final ESD #2 and all relevant, supporting documents will be contained in the Administrative Record for the Site. A newspaper notification of this ESD #2 will also be published.

Approved By:

Tina LePage

5/17/2016

Tina LePage
Manager, Remedial Projects Section
Waste Programs Division
Arizona Department of Environmental Quality

Date

Approved By:

Angeles Herrera

6/1/2016

Angeles Herrera
Assistant Director, Superfund Division
U.S. EPA Region 9

Date

Figure 1

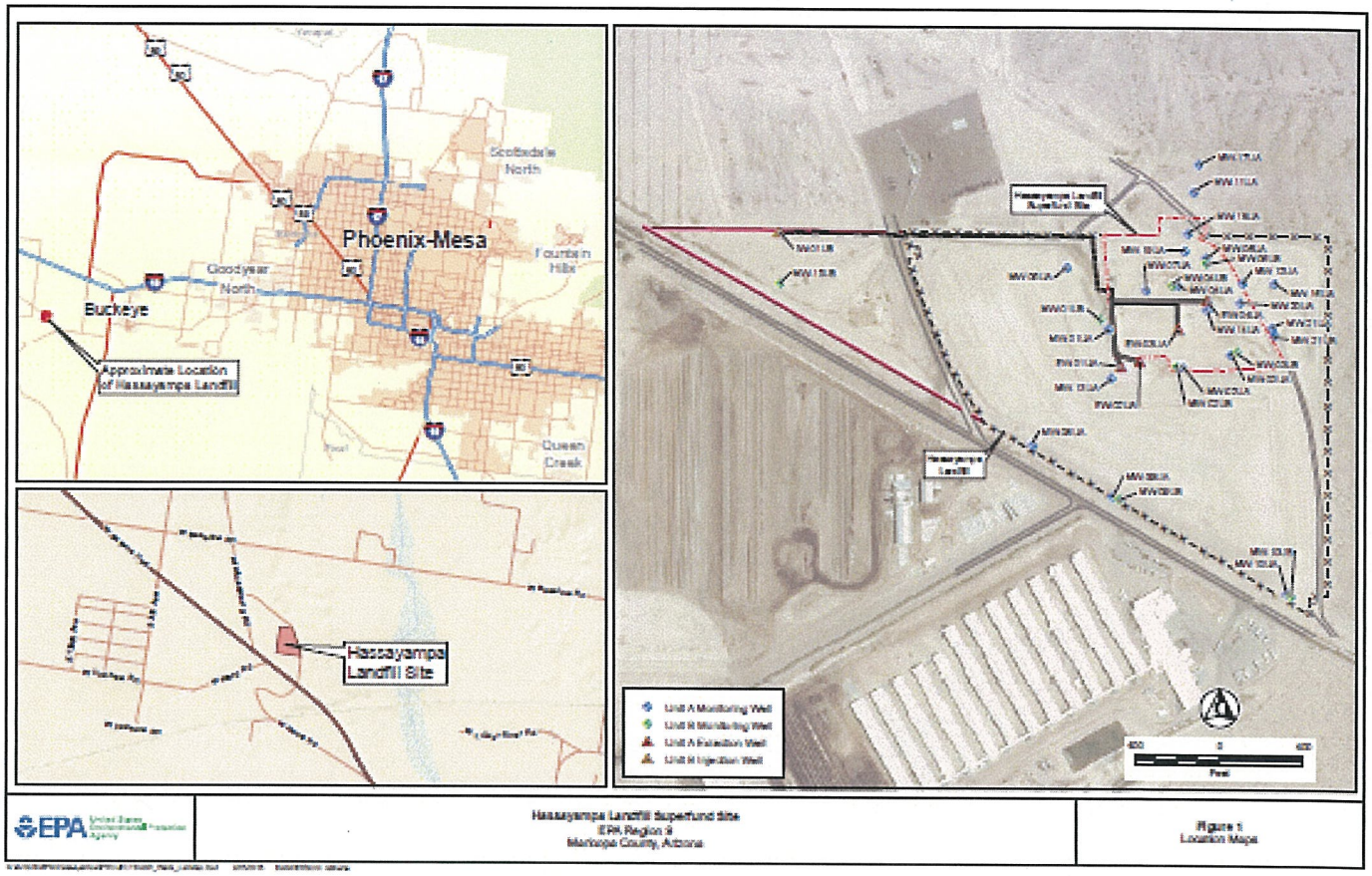
Phoenix-Mesa
Scottsdale North
Fountain Hills
Goodyear North
Buckeye
Approximate Location of Hassayampa Landfill
Queen Creek
Hassayampa Landfill Site
Hassayampa Landfill Superfund Site
Hassayampa Landfill
Unit A Monitoring Well
Unit B Monitoring Well
Unit A Extraction Well
Unit B Injection Well
EPA
Hassayampa Landfill Superfund Site
EPA Region 9
Maricopa County, Arizona
Figure 1
Location Maps

Figure 2

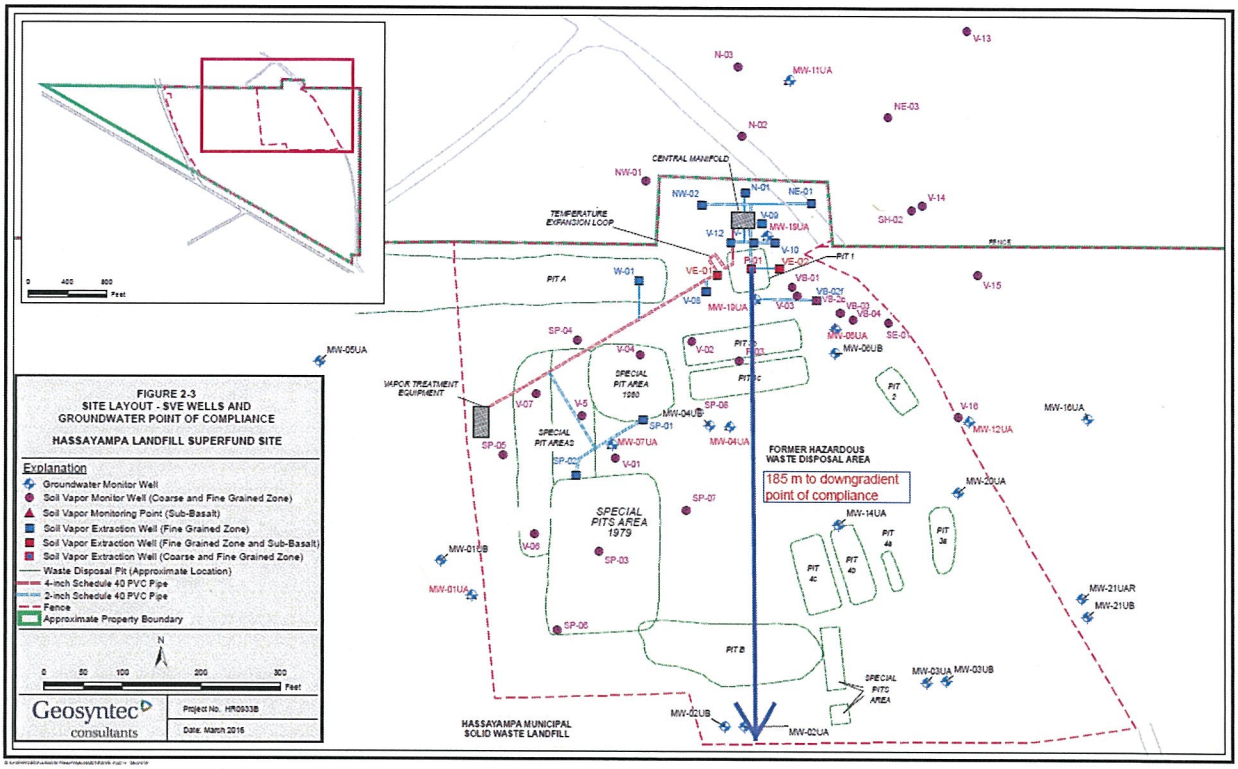
FIGURE 2-3
SITE LAYOUT - SVE WELLS AND
GROUNDWATER POINT OF COMPLIANCE
HASSAYAMPA LANDFILL SUPERFUND SITE
Explanation
Groundwater Monitor Well
Soil Vapor Monitor Well (Coarse and Fine Grained Zone)
Soil Vapor Monitoring Point (Sub-Basalt)
Soil Vapor Extraction Well (Fine Grained Zone)
Soil Vapor Extraction Well (Fine Grained Zone and Sub-Basalt)
Soil Vapor Extraction Well (Coarse and Fine Grained Zone)
Waste Disposal Pit (Approximate Location)
4-inch Schedule 40 PVC Pipe
2-inch Schedule 40 PVC Pipe
Fence
Approximate Property Boundary
0 50 100 200 300 Feet
Geosyntec consultants
Project No. HR0933B
Date: March 2016
0 400 800 Feet
CENTRAL MANIFOLD
TEMPERATURE EXPANSION LOOP
VAPOR TREATMENT EQUIPMENT
SPECIAL PIT AREA 1980
SPECIAL PIT AREAS
SPECIAL PITS AREA 1979
FORMER HAZARDOUS WASTE DISPOSAL AREA
185 m to downgradient point of compliance
HASSAYAMPA MUNICIPAL SOLID WASTE LANDFILL
PIT A
PIT B
PIT 1
PIT 2
PIT 3A
PIT 3B
PIT 4A
PIT 4B
PIT 4C
FENCE

Table 1

Updated Soil Vapor Performance Standards
Soil Vapor Extraction Endstate Tool (SVEET)
Hassayampa Landfill Superfund Site

Parameter	2016 Soil Vapor Performance Standard (µg/L)	2009 Soil Vapor Performance Standard (µg/L)
Acetone	10	1,040
Benzene	14	807
2-Butanone (MEK)	4	364
Chlorobenzene	287	14,300
Dichlorodifluoromethane (Freon 12)	184,658	See note 1
1,1-Dichloroethene	148	2,850
1,2-Dichloroethane	4	61.3
1,2-Dichloropropane	10	187
cis-1,2-Dichloroethene	184	4,810
trans-1,2-Dichloroethene	5	15,200
Dichloromethane (methylene chloride)	10	421
Tetrachloroethene	117	2,740
1,1,1-Trichloroethane[2]	3,070	2,300
Toluene	3,873	331,000
Trichloroethene	38	780
Trichlorofluoromethane (Freon 11)	188,370	7,800,000
Trichlorotrifluoroethane (Freon 113)	3,289,020	3,860,000,000
Xylenes	43,476	1,140,000
Vinyl Chloride	90	2,080

Notes:

1 – The 2009 soil vapor performance standard was calculated for dichlorofluoromethane (Freon 21) instead of dichlorodifluoromethane (Freon 12) as indicated by Table A-1 of the 1992 ROD.

2 – Measured vapor concentrations of 1,1,1-TCA will be converted in the vapor phase to an equivalent mass of 1,1-dichloroethene (1,1-DCE) resulting from abiotic degradation and will be added to the measured vapor concentration of 1,1-DCE for comparison to its SVPSs.