Presidio Trust

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January 17, 2020

Mr. Jeff White
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, California 94612

Subject: Revised Feasibility Study and Corrective Action Plan
Fuel Distribution System, Section BR11-1
Buildings 127A, 127B, and 128A
Riley Avenue, Presidio of San Francisco, San Francisco, California

Dear Mr. White:

Enclosed is the *Revised Feasibility Study and Corrective Action Plan* (*Revised FS/CAP*) for FDS Section BR11-1, Buildings 127A, 127B, and 128A prepared by TRC Solutions, Inc., on behalf of the Presidio Trust (Trust). This *Revised FS/CAP* addresses Water Board's comments[1] dated December 13, 2019 on the previously submitted FS/CAP[2] dated October 31, 2019. The *Revised FS/CAP* presents an evaluation of corrective action alternatives addressing residual soil, groundwater, and soil vapor impacts and the recommended corrective action plan and was prepared .

The Trust looks forward to RWQCB review and approval of the *Revised FS/CAP*. Should you have questions or need additional information, please contact me at (415) 561-5421.

Sincerely,

Nina Larssen
Remediation Program Manager

cc: Alfonso Ang, TRC
Justin Hanzel-Durbin, TRC
Sally Schoemann, TRC
Luke Shannon, TRC

Attachment:
Revised Feasibility Study and Corrective Action Plan, Fuel Distribution System, Section BR11-1, Buildings 127A, 127B, and 128A, Riley Avenue, Presidio of San Francisco, San Francisco, California

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[1] RWQCB. 2019. Water Board Review of the October 31, 2019 Feasibility Study and Corrective Action Plan Report, Riley Avenue Site, Building Units 127A. 127B, and 128A, Fuel Distribution System Section BR11-1, Presidio of San Francisco, California. December 13.
[2] TRC. 2019. Feasibility Study and Corrective Action Plan, Fuel Distribution System Section BR11-1, Buildings 127A. 127B, and 128A, Riley Avenue, Presidio of San Francisco, San Francisco, California. October 31

REVISED FEASIBILITY STUDY AND CORRECTIVE ACTION PLAN

Fuel Distribution System | Section BR11-1
Buildings 127A, 127B, and 128A

Riley Avenue, Presidio of San Francisco
San Francisco, California

January 17, 2020

Prepared by:
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PROFESSIONAL CERTIFICATION

Revised Feasibility Study and Corrective Action Plan
Fuel Distribution System | Section BR11-1
Buildings 127A, 127B, and 128A
Riley Avenue, Presidio of San Francisco, San Francisco, California

This document was prepared by the staff of TRC Solutions, Inc. (TRC), under the supervision of a professional engineer whose seal and signature appear hereon. The findings, recommendations, specifications, and/or professional opinions presented in this document were prepared in accordance with generally accepted professional geology and engineering practices, and within the scope of the project. There is no other warranty, either express or implied.

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and attachments and that, based on my knowledge and on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete.

Alfonso Ang, PE C81007
Senior Engineer / Project Manager

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Abbreviations and Acronyms

ARAR	applicable and relevant requirements
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylenes
CAP	corrective action plan
CAO	corrective action objective
CCR	Construction Completion Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chemical of concern
CSM	conceptual site model
CUL	cleanup level
DTSC	Department of Toxic Substances
EKI	Erler & Kalinowski, Inc.
EPA	Environmental Protection Agency
ESL	Environmental Screening Level
FDS	Fuel Distribution System
ft	feet
FS	Feasibility Study
Revised FS/CAP	Feasibility Study/Corrective Action Plan
GRA	general response actions
IC	institutional controls
IT	IT Corporation
LUC	Land Use Control
LUCMRR	Land Use Controls Master Reference Report
LUN	Land Use Notification
MNA	monitored natural attenuation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Protection Act
NFA	no further action
NHPA	National Historic Preservation Act
Presidio	Presidio of San Francisco
RWQCB	Regional Water Quality Control Board
Site	former FDS Section BR11-1
SSVS	sub slab ventilation system
SVE	soil vapor extraction
TPH-d	total petroleum hydrocarbons as diesel
TPH-g	total petroleum hydrocarbons as gasoline
TPH-mo	total petroleum hydrocarbons as motor oil
Trust	Presidio Trust
TRC	TRC Solutions, Inc.
US	United States
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VI	vapor intrusion
VMS	vapor mitigation system

EXECUTIVE SUMMARY

This report presents a Revised Feasibility Study and Corrective Action Plan (Revised FS/CAP) for the former Fuel Distribution System (FDS) Section BR11-1 of the Presidio of San Francisco (Presidio). This Revised FS/CAP was prepared by TRC Solutions, Inc. (TRC), on behalf of the Presidio Trust (Trust). This Revised FS/CAP presents a comparison of alternatives to address residual soil, groundwater, and soil vapor impacts and presents a recommended corrective action plan.

Former FDS Section BR11-1 (the Site) is in the Main Post Area of the Presidio of San Francisco, in San Francisco, California (**Figure 1**). FDS Section BR11-1 formerly serviced fuel oil to the boilers in the basements of residential buildings located on the west side of Riley Avenue, including units 127A, 127B, and 128A. Site contaminants of concern (COCs) are composed of chemical compounds found in the fuel oils. Historic releases from the subsurface FDS Section BR11-1 piping are the focus of the remedial efforts underway. The current and planned land use is residential.

Corrective action objectives (CAOs) are based on site-specific COCs, impacted media, COC migration pathways, and risk to human and environmental receptors. The CAOs for the Site include:

<u>CAO #1</u>: Mitigate soil impacted with total petroleum hydrocarbon as diesel (TPH-d), total petroleum hydrocarbon as gasoline (TPH-g) and naphthalene, to prevent exposure to human and environmental risk receptors (e.g. future residents, construction and maintenance workers, etc.) in units 127A, 127B and 128A.

<u>CAO #2</u>: Mitigate groundwater impacted with TPH-d, TPH-g and naphthalene, to prevent exposure to human and environmental risk receptors (e.g. future residents, construction and maintenance workers, etc.).

<u>CAO #3</u>: Mitigate soil vapor impacted with TPH-d, TPH-g, benzene, ethylbenzene and methane, to prevent exposure to human and environmental risk receptors via vapor intrusion (VI) into overlying Buildings 127A, 127B, and 128A.

Based on the Site's land use, COCs and impacted media, applicable and relevant requirements (ARARs), risk pathways for human and environmental receptors, and the established CAOs, viable technologies for each type of impacted media were screened and evaluated using Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) standardized Revised FS/CAP criteria. The technologies that passed the initial screening process and detailed analyses were retained and combined into final corrective action plan (CAP) alternatives. The final three CAP alternatives include:

<u>Alternative 1 – No Action</u>: No remediation measures would occur under this alternative. As required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 Code of Federal Regulations (CFR) 300.420(e)(6), this alternative was retained for detailed analysis as a baseline for comparison with other alternatives.

<u>Alternative 2 – Vapor Mitigation System at 127B, Vapor Mitigation via existing concrete slabs at 127A and 128A, Soil Capping, Groundwater Monitoring, and Institutional Controls (ICs)</u>: This alternative consists of implementing mitigation technologies including: (1) The installation of a vapor mitigation system (VMS) beneath the basement of Building 127B (to address soil vapor

intrusion) and preservation of Building 127A and 128A basement concrete slabs; (2) Soil capping in the form of a concrete slab in the basement of 127B, and existing landscaped and hardscaped areas outside Building 127A/B (to mitigate residual soil contamination risks) and; (3) Long-term institutional controls (ICs) in the form of land use controls (LUCs) under the Presidio Trust Land Use Controls Master Reference Report (LUCMRR) (EKI, 2009). Protocols for maintenance of mitigation measures, and intrusive work within and below the cap, would be outlined in a post-mitigation Construction, Operation and Maintenance Plan. Annual monitoring of groundwater is included in this alternative.

<u>Alternative 3 – Vapor Mitigation System at Building 127B, Vapor Mitigation via existing concrete slabs at 127A and 128A, Soil Capping, Soil Capping, Groundwater Monitoring, ICs, and “Hot Spot” Excavation of Residual Soil Impacts in the Front Yard of Building 127B</u>: This alternative consists of the proposed corrective actions outlined in Alternative 2 plus the removal of impacted soil in the southeast of Building 127B. Impacted soil in the “hot spot” area will be excavated and transported for offsite disposal at a licensed landfill facility. Under this alternative, the VMS system and ICs will be retained to address the soil vapor intrusion risk beneath Building 127A and 127B, and for residual soil contamination beneath Buildings 127A, 127B, and 128A. Similar to Alternative 2, annual monitoring of groundwater is included in this alternative.

Based on the technology screening and detailed comparative analysis presented in this Revised FS/CAP, the Trust has identified Alternative 2 – VMS at Building 127B, Soil Capping, Groundwater Monitoring, and ICs, as the selected alternative because it is protective of human health and the environment, meets Site-specific ARARs, achieves the goals outlined in the CAOs, represents a cost effective alternative, and is compatible with the current and future land use for the Site.

1.0 PURPOSE AND SCOPE

This report presents a Revised Revised FS/CAP for the former FDS Section BR11-1 site at the Presidio of San Francisco. This Revised Revised FS/CAP was prepared by TRC, on behalf of the Trust. This Revised Revised FS/CAP summarizes the processes used to develop and evaluate alternatives to address residual soil, groundwater, and soil vapor impacts identified at the project site and to describe the implementation of the recommended corrective action measures. The Revised FS/CAP addresses Regional Water Quality Control Board (RWQCB) comments dated December 13, 2019 (RWQCB, 2019d) on the previously submitted FS/CAP (TRC, 2019e). A copy of the comments is included as Attachment B.

This Revised Revised FS/CAP presents an overview of the site-specific conditions, COCs, media impacted, delineation of contaminant releases, conceptual site model (CSM), and established contaminant screening levels and cleanup goals. CAOs are defined to address the impacted media and mitigate potential threats to human and environmental receptors.

The primary focus of this Revised Revised FS/CAP is to present an evaluation of appropriate remedial technologies, perform a detailed analysis of the retained technologies (using CERCLA-standardized Revised FS/CAP evaluation criteria), provide a comparison of viable remedial options, and develop a recommended remedial approach that is designed to address the impacted media and mitigate the risks to human and environmental receptors.

Based on the Site's land use, COCs, impacted media, ARARs, risk pathways for human and environmental receptors, and the established CAOs, viable technologies for each type of impacted media were combined into three final remedial approach alternatives to be considered for a final CAP. The three alternatives were compared to identify the most practical and effective corrective action approach. Lastly, an overview of the implementation for the recommended CAP and a long-term monitoring plan are presented.

2.0 SITE DESCRIPTION

2.1 Site Location

The Site is located at the Presidio of San Francisco (Presidio) in San Francisco, California, within the Main Post Area and includes Buildings 127A, 127B, and 128A on Riley Avenue (**Figure 1**).

2.2 Historic Use

The former FDS Section BR11-1 consisted of subsurface fuel oil distribution lines, which were used to service boilers in the basements of residential buildings on the west side of Riley Avenue, including units 127A, 127B, and 128A (**Figure 2**). A 1,500-gallon capacity UST located southwest of building 127B was removed in 1978 and received a no further action (NFA) from the Regional Water Quality Control Board (RWQCB) in 2013 (RWQCB, 2013).

2.3 Chemicals of Concern

The COCs are composed of chemical compounds associated with the fuel oil historically used on Site. Based on site investigations performed to date, the following COCs have been identified in soil, groundwater, and soil vapor.

- **Soil**: TPH-d, TPH-g, and naphthalene have been detected above environmental screening levels (ESLs) in soil.
- **Groundwater:** TPH-d, TPH-g, and naphthalene have been detected above current Site ESLs. Additional contaminants detected include total petroleum hydrocarbons as motor oil (TPH-mo) and bunker c oil (TPH-bc).
- **Soil Vapor:** TPH-d, TPH-g, benzene, ethylbenzene, and methane are identified above Site ESLs (identified in soil vapors below Buildings 127A and 127B).

Screening levels for soil and groundwater are based on the Presidio Cleanup Levels (CULs), which were established in the *Development of Presidio-Wide Cleanup Levels for Soil, Sediment, Groundwater, and Surface Water* (Presidio-wide Cleanup Levels document) (EKI, 2002), as amended, and the RWQCB Tier 1 and Residential ESLs (RWQCB, 2019a). Screening levels for impacted media are summarized in **Table 1** to **Table 4**.

2.4 Previous Investigation and Remedial Action

A summary of the previous investigations and remedial actions performed to date are summarized below.

Table 2.4 – Previous Investigation and Remedial Action

Year	Previous Investigation and Remedial Action
1978	Tank 127 UST removed
1996 – 1999	Removal of FDS pipelines throughout the Presidio
2006	FDS Closure Certification Report submitted (for 27 Sections, Phase I, including BR11-1)

Table 2.4 – Previous Investigation and Remedial Action

Year	Previous Investigation and Remedial Action
2009	RWQCB issued No Further Action (NFA) determination (for all 27 Sections)
2013	RWQCB issued NFA for Tank 127
May 2017	Soil impacts discovered by the Trust beneath basement floor of Building 127B
June 2017	Interim soil clean-up actions performed in basement of Building 127B
July 2017	Trust notify RWQCB of the discovery and RWQCB re-opens case for FDS Section BR11-1
October 2017 – July 2018	Soil, groundwater, and soil vapor impacts characterized
November 2017	Interim soil remediation and soil vapor mitigation measures performed at 127B
June 2018 – October 2018	Soil vapor intrusion investigations and RWQCB NFA determinations for soil vapor for Buildings 127A, 128A/B, and 129A/B
July 2018 – April 2019	Quarterly groundwater monitoring performed
March 2019	Vapor mitigation system (VMS) installed in Building 127B
April 2019	First post-construction soil vapor intrusion confirmation sampling at 127B
October 2019	Second post-construction soil vapor intrusion confirmation sampling at 127B

The FDS was substantially removed by the U.S. Army between 1996 and 1999. Documentation of the removal activities and associated confirmation sampling is presented in the three-volume report titled, *Fuel Distribution System Closure Report, Presidio of San Francisco, California*, prepared by IT Corporation (IT) and dated May, 1999 (IT, 1999).

On January 27, 2006, the Presidio Trust submitted the *FDS Closure Certification Report – Phase 1* to the RWQCB requesting closure of 27 FDS sections, including Section BR11-1 (Trust, 2006). On September 16, 2009, the RWQCB determined that NFA was required (RWQCB, 2009).

In May 2017, soil contaminated with TPH-d was discovered during maintenance work in the basement of residential Building 127B. The Trust implemented interim remedial measures in accordance with the established *Petroleum Contingency Plan* (EKI, 2004), including initial soil and groundwater sampling to characterize the area of impact, limited excavation of impacted soil, placement of oxygen release compound within the excavation, and backfill with clean soil.

The Trust notified the RWQCB of the discovery and interim remedial actions taken on July 19, 2017. Based on the information provided by the Trust, the RWQCB re-opened FDS Section BR11-1 in an email dated July 20, 2017 (RWQCB, 2017a).

In October 2017, the Trust performed soil, sub-slab vapor, and groundwater sampling in accordance with the September 14 Work Plan (TRC, 2017a) and the revised soil and soil vapor investigation approach for Building 128A. The results of the investigation were submitted to the RWQCB in an *Interim Update Report* (TRC, 2017b).

On November 13, 2017, the Trust implemented interim measures at Building 127B. The interim measures consisted of the installation of a 15-mil, Stego® vapor barrier over the entire exposed basement floor and 4-inch ventilation fan. The fan exhaust was routed to the outside of the building through the existing chimney flue. The 100 cubic feet per minute nominally rated ventilation fan is set to automatically run for 1.5 hours with 1-hour off intervals. The Stego® vapor barrier was removed in April 2018 to allow installation of permeable gravel layer and provide a dry, stable walking surface. The vapor barrier was not replaced, but the ventilation fan remained in operation.

On November 29, 2017, the RWQCB issued a letter to the Trust requiring submittal of a soil vapor intrusion work plan for Buildings 127A, 128A, and 129B. A review of available building information including building information sheets and floor plans along with a building survey of Buildings 127A, 128A, and 129B on December 4, 2017, were performed to identify potential vapor migration pathways and select proposed sampling locations.

In December 2017 and March 2018, the Trust prepared and submitted workplans to investigate potential SVI in Buildings 127A, 128A, 129B from the abandoned FDS lines beneath the building (*VI Work Plan* and *Addendum*, TRC, 2017c and 2018a), and extent of soil and groundwater impacts resulting from the oil fuel release beneath 127B (*Supplemental Work Plan*, TRC, 2018b).

Between February and July 2018, the Trust implemented the *VI Work Plan* and *Supplemental Work Plan* and submitted investigation results in subsequent update reports and request for concurrence and no-further-action determination (TRC, 2018c, 2018d, and 2018e). Based on presented investigation results, the RWQCB issued SVI no-further-action (NFA) determinations for Buildings 128B and 129A (RWQCB, 2018a), 128A and 129B (RWQCB, 2018b) and 127A (RWQCB, 2018c) and provided comments on the *Supplemental Site Investigation Report* (TRC, 2018f) with regards to the extent of soil and groundwater impacts (RWQCB, 2019a).

In October 2018, January and April 2019, the Trust conducted the second, third, and fourth groundwater monitoring events.

In March 2019, the Trust submitted a Revised Vapor Mitigation System Design for Building 127B (TRC, 2019a) and received RWQCB concurrence on the design on March 8, 2019 (RWQCB, 2019b). Installation of the VMS system was completed on March 15, 2019 with the first of two scheduled post-construction samplings conducted between April 2 and 3, 2019 and the second between October 1 and 2, 2019.

2.5 Updated Conceptual Site Model

The historic petroleum releases from FDS Section BR11-1 is more than 20 years old since fuel lines were taken out of service by the US Army by 1996). As described in more detail below and in the Revised SSIR, fuel oil remains in soil below Buildings 127A, 127B, 128A, and below the front yard of Building 127B. Impacted environmental media from the release include soil, groundwater, and soil vapor. Maps showing the extent of residual soil impacts, groundwater impacts, and soil vapor impacts are presents in **Figures 3**, **4** and **5**, respectively.

Potential primary pathways for the migration of fuel oil constituents are, 1) volatilization of organic vapors released to the subsoil that can potentially enter into the building's basements exposing future residents or maintenance workers, 2) migration of the fuel oil through interstitial pore spaces, eventually reaching the groundwater surface as free product, and 3) dissolution into percolating rain or irrigation water or directly into groundwater, which could result in a plume of impacted groundwater.

The CSM for the Site was initially presented in Addendum 1 of the 2018 *Vapor Intrusion (VI) Work Plan* (TRC, 2018c). Since the date of submission of the *VI Work Plan*, the CSM was revised based on additional investigation of soil, soil vapor and groundwater, and further hydrogeologic analysis, as presented in the *Revised Supplemental Site Investigation Report* (Revised SSIR, TRC 2019b). The updated CSM is summarized below.

Extent of COCs in Soil

- Soil containing residual TPH-d has been found directly beneath the basements of Buildings 127A (inferred based on sub-slab vapor data), 127B, and 128A, as shown on **Figure 3**.
- Residual concentrations of TPH-d in soil were detected in subsurface soils to the southeast (in the front yard) of Building 127A and 127B, as shown on **Figure 3**. However, these soil impacts are confined laterally to the front yards and vertically from depths of 5 to 30 ft below ground surface (bgs).
- No soil contamination was detected in soil samples collected from 1 foot bgs down to 50 ft bgs southwest, northwest, or northeast of Building 127A and 127B. Similarly, no soil contamination was detected in samples collected from 3 ft to 50 ft bgs to the southeast, northeast, and northwest of Building 128A.
- Subsurface soils have generally been characterized as lean clay with interbedded sands down to 35 to 40 ft bgs at the southwest area of the Site beneath Buildings 127A and 127B, and increasing down to the northeast, to at least 50 ft bgs beneath Building 128A. Site lithology contains impermeable layers above bedrock, which create localized lenses of perched groundwater.
- Soil boring data indicates bedrock is encountered starting at 35 ft bgs beneath buildings 127A and 127B. No bedrock was encountered down to 50 ft bgs beneath 128A. Shallow soils around the basement walls and beneath the basement concrete slab are generally moist and, in some cases, perched water has been observed directly below and adjacent to the slab.
- Potential risk receptors to soil impacts include existing and future residential tenants and the occasional maintenance worker through direct contact with impacted soil, however, residual soil contamination is greater than two feet below the ground surface and exposure is mitigated by existing hardscape (concrete slabs) and landscaping (2 ft minimum depth of un-impacted soil). Therefore, there is very low potential for exposure of future residents or maintenance workers through this pathway.

Extent of COCs in Groundwater

- Groundwater samples containing TPH-d have been detected at two locations to the southeast of Building 127A and 127B, as shown on **Figure 4**. However, the impacts are not detected at downgradient locations and based on the length of time since the source release, the impacted groundwater is likely not mobile and may be shrinking (due to natural attenuation factors) in size.

- TPH-d detections in groundwater above screening levels were initially identified to the north, northeast and east of Building 127A, south of Building 127B, and southeast of Building 128A (at collection depths between 21 and 57 ft bgs), however, based on chromatograph review, the detected TPH-d in these locations is suspected to be primarily biogenic origin and not related to petroleum hydrocarbon products.
- The depth to groundwater ranges from 21 beneath Buildings 127A and 127B to 57 feet bgs beneath Building 128A .
- Based on water elevations, the potentiometric surface indicates a localized flow direction to the northeast, however, based on broader knowledge of the surrounding area, regional flow is likely to the north, with shallow groundwater eventually discharging to Crissy Marsh and the San Francisco Bay.
- Groundwater is not used as a source of water (potable or non-potable) for the Presidio and the nearest source of potable water for potable use is Lobos Creek, located approximately 1.27 miles southwest and upgradient from Riley Avenue.

Soil Vapor Migration

- An additional secondary source impact is contaminant vapors releasing from impacted subsurface soil. These vapors migrate through the vadose zone, through preferential paths of least resistance, and can exit through the soil-atmosphere boundary or into overlying buildings. Soil vapor intrusion (SVI) investigations have been conducted and indicate no unacceptable human health risk from SVI is present in Buildings 127A, 128A/B and 129A/B.
- Sub-slab sampling results indicate elevated concentrations of TPH-d and TPH-g in soil vapor samples collected beneath Building 127A, 127B, and 128A as shown on **Figure 5**. The reported residual sub-slab vapor concentrations beneath Buildings 127A (190,000 microgram per cubic meter [$\mu g/m^3$] TPH-g and 39,000 $\mu g/m^3$ TPH-d and 128A (210,000 $\mu g/m^3$ TPH-d) represent a potential vapor intrusion risk. However (as discussed further in Section 3.2), based on the investigative results (TRC, 2018d and 2018e), sub-slab concentrations below Building 127A and 128A have not resulted in an unacceptable risk to human health or ecological receptors.
- A VMS was installed as an interim measure in the basement of Building 127B (see **Figure 6A** and **Figure 6B** for details) in March 2019; the completion report documenting the VMS installation and first round of verification sampling (April 2019) was completed and submitted to the RWQCB in August 2019 (TRC, 2019c). A second round of verification sampling was completed in October 2019 and report submitted to RWQCB in November 2019 (TRC, 2019d). Based on the verification sampling, RWQCB provide concurrence that the installed VMS is effectively mitigating SVI and no unacceptable health risk to human health is currently present in Building 127B (RWQCB, 2019c).
- Based on the analytical results for the first round of verification sampling post-VMS installation, COC concentrations reported from outdoor air samples are higher than the established indoor air ESLs and are significantly higher than reported indoor air concentrations (TRC, 2019c).
- Based on the analytical results for the first round of verification sampling post-VMS installation, reported benzene concentrations in Building 127B are within documented

typical background indoor air concentrations for residences that are not known to be impacted by soil vapor intrusion and are similar to those reported in Buildings 127A, 128A, and 129B (TRC, 2019c).

3.0 ESTABLISHING CORRECTIVE ACTION OBJECTIVES

3.1 Applicable and Relevant or Appropriate Requirements (ARARs)

ARARs are environmental standards, criteria, or limits promulgated under federal or state law. Only those state standards that are promulgated, identified by the state in a timely manner, and are more stringent than federal requirements may be considered ARARs (40 CFR 300.400(g)(4)). During and following remediation, the environmental standards, criteria and limits that are applicable, relevant or appropriate for the work being performed will need to be met or waived.

ARARs typically fall into three categories: chemical-specific, action-specific, and location-specific. The ARARs identification process considers the following fundamental factors: (a) chemicals of concern; (b) type of environmental media affected; and (c) actual and potential use of affected media; each of these fundamental factors have been evaluated and the findings presented in this Revised FS/CAP report.

The primary objective of this Revised FS/CAP is to screen, compare and select the most appropriate remedial technologies for the impacted media on Site. As Riley Avenue is one of several sites across the Presidio portfolio and screening levels, as well as cleanup levels, have previously been established by the Presidio-wide Cleanup Levels Document and subsequent revisions, performing a full ARARs evaluation for the Riley Site would be of limited value; however, legal requirements under federal and state laws will be met during the project remediation and ongoing monitoring. The environmental standards that have already been applied to the Site are the primary standards used in developing the CAOs – i.e., cleanup levels and screening levels are based on the standards set , respectively, in the Presidio-wide Cleanup Levels Document (EKI, 2002, as amended) and the RWQCB's recently updated 2019 Tier 1/Residential/Construction Worker ESLs (RWQCB, 2019a); see **Table 1** to **Table 4** for a summary of the above referenced screening and cleanup values, which are considered the primary environmental ARARs for the site.

3.2 Risk Evaluation

Risk evaluations were performed based on the site-specific COCs, impacted media, risk pathways, and human and environmental receptors.

Relative to direct exposure of future residents or maintenance workers to impacted soil:

- Future residents are potentially at risk of exposure to COCs from the impacted soil below the basement of Building 127B; however, with the recent installation of a VMS system and new concrete slab, the direct exposure pathway is significantly reduced, and potentially eliminated.
- Impacted soil remains under Buildings 127A, 127B,and 128A, however, the existing basement concrete slabs act as a cap that prevents physical contact and direct exposure to future residents or maintenance workers.
- Potential risk of exposure to impacted soils to the southeast in the front yard of Building 127B is considered low due to the presence of an existing minimum 2-foot cap of clean soil, which prevents direct exposure to COCs; the 2-foot minimum depth of clean fill is documented based on boring logs across the site (e.g., SB004, SB005, SB007, BR11-

1SB010, BR11-1SB011, BR11-1SB012, BR11-1SB013, BR11-1GW01, etc.) (TRC, 2019b).

- Projects involving construction or sub-surface work are required to go through the Presidio Trust building or dig permit process, which notifies and requires adherence by project proponents to any LUC restrictions and requirements.
- Lease agreements prohibit tenants from undertaking any construction, modification, repair, planting, ground disturbance, or installation in or around the premises (The Presidio Residential Rules, Trust, 2014).

Therefore, based on the presence of concrete slabs in the basements of Buildings 127A,127B, and 128A, and the presence of a 2-foot clean soil cap and/or hardscape (e.g., concrete walkways) over the impacted soils in the exterior areas, and established administrative controls, human and environmental risk from impacted soils is considered low and mitigated under current conditions.

Relative to exposure to COCs in groundwater of future residents, maintenance workers or ecological receptors present in Crissy Field or San Francisco Bay:

- Groundwater investigations indicate a small plume of COCs in groundwater limited in extent and in the vicinity of Buildings 127A and 127B.
- Due to the length of time since the COC release took place and the relatively low concentrations of COCs in groundwater, impacted groundwater is limited in extent, relatively stable and may be shrinking due to natural attenuation factors.
- Relative to downgradient (off-site) receptors, groundwater is not a source of potable or non-potable water in the Presidio and concentrations in groundwater are below ESLs for ecological receptors (TRC, 2017d).

Because there are known residual soil and sub-slab vapor impacts below Buildings 127A,127B and 128A, potential exists for impacted soil vapor to enter the buildings. However, under current conditions, COCs detected in indoor air samples from Building 127A,127B, and 128A are within documented typical background indoor air concentrations for residences that are not known to be impacted by soil vapor intrusion (EPA/OSWER, 2011; MDEQ, 2012; MDEPBRWM, 2012) and significantly lower than reported outdoor concentrations (TRC, 2019b, 2019c, and 2019d).

In addition, interim soil vapor remedial measure, in the form of a VMS has been installed in Building 127B (**Figures 6A** and **6B**) consisting of a vapor barrier, vapor collection and venting system, and a new concrete slab (TRC, 2019c). Based on the vapor intrusion investigation results for Building 127A, 127B, and 128A, the effectiveness of the VMS installed in Building 127B, and existing concrete slabs in Buildings 127A and 128A, no unacceptable health risk to residents resulting from soil vapor intrusion is currently present.

3.3 Corrective Action Objectives (CAOs)

The Site-specific CAOs are media-specific goals for protecting human health and the environment from adverse chemical impacts resulting from releases of COCs. Considering the

COCs present, media impacted, risk paths and land use (current and future), the following CAOs have been developed for the Site:

CAO #1: Mitigate soil impacted with TPH-d, TPH-g, and naphthalene to prevent exposure to human and environmental risk receptors (e.g. future residents, construction and maintenance workers, etc.) at 127A, 127B and 128A.

CAO #2: Mitigate groundwater impacted with TPH-d, TPH-g, and naphthalene to prevent exposure to human and environmental risk receptors (e.g. future residents, construction and maintenance workers, etc.).

CAO #3: Mitigate soil vapor impacted with TPH-d, TPH-g, benzene, ethylbenzene, and methane to prevent exposure to human and environmental risk receptors from VI into Buildings 127A and 127B (e.g. future residents, construction and maintenance workers, etc.).

CAOs are an effective remedial management tool to capture Site COCs, impacted media, and corrective action goals associated with each exposure route. The CAOs also establish a framework for evaluating remedial technology alternatives that can potentially address the goals outlined by the CAOs. The remedial technology alternatives that have been evaluated in this Revised FS/CAP are presented in the following sections.

4.0 SCREENING OF POTENTIAL REMEDIAL ALTERNATIVES – SOIL

The screening of potential remedial alternatives for soil impacts involves three fundamental phases of evaluation: (1) General Response Actions: which outline standardized response actions that should be considered when remediating a site; (2) Identification of Potential Remedial Technologies: which evaluates technical implementability as a first step, then considers effectiveness, further implementability, and relative cost; and (3) Detailed Analysis of Retained Remedial Technologies: which involves an analysis of nine standardized CERCLA evaluation categories for each technology.

4.1 General Response Actions

General response actions (GRAs), which are media specific, may include treatment, containment, removal, disposal, or any combination of these. The GRAs that satisfy the Site-specific CAOs for soil impacts include: (1) no action; (2) institutional actions; (3) containment/removal; (4) in situ treatment; and (5) ex situ treatment/disposal.

No Action: Per the requirements of the NCP, the “no action” option is carried through the Feasibility Study (FS) to serve as a baseline for comparison to other remedial alternatives. No significant modification of existing conditions at the Site would be implemented.

Institutional Actions: The United States Environmental Protection Agency (USEPA) defines institutional controls as non-engineering measures, such as administrative and/or legal controls, that help to minimize the potential for human exposure to contamination and/or to protect the integrity of a remedy by limiting land or resource use. Based on known historic use and planned future use for the Site, institutional controls such as LUCs and LUN are a viable option.

Containment/Isolation: Capping of impacted soils is an option to eliminate the risk pathway for impacted soil that receptors may come in contact with – for the Riley Site, a minimum of 2 feet of clean fill material in landscape areas and concrete paving (basement slabs and outdoor walkways) already exist in-place and act as an effective cap. ICs would need to be implemented in combination with soil capping.

In Situ Treatment: In situ technologies such as chemical injection, thermal destruction, bioremediation, or soil solidification would be implementable and would potentially address the COCs in soil, however, due to the limited extent of impacts and high cost of mobilization and treatment using these technologies, application of in situ treatment technologies would be impractical and economically infeasible.

Ex Situ Treatment/Disposal: Ex situ treatment/disposal would remove the impacted soil from the Site by removing and transporting the material off site for disposal (i.e., landfilling) with or without pre-treatment such as stabilization prior to landfilling. For Site COCs, this option would include removal measures (i.e., excavation) and off-site transportation and disposal at a designated landfill facility without pre-treatment.

4.2 Identification of Potential Remedial Technologies

For each general response action discussed above, potential remedial technologies and process options for soil remediation were evaluated through a two-step screening process. In step one, process and technology options are evaluated based on technical implementability.

This is a general screening step to eliminate options that are not applicable on the basis of site geologic, hydrogeologic, chemical, physical access, or other Site-specific conditions. Technologies and process options that are potentially technologically implementable are then screened for effectiveness, further implementability, and relative cost. The results of this second-tier screening are summarized in **Table 5** and include: (1) monitored natural attenuation; (2) capping; (3) thermal desorption; (4) excavation/disposal with ICs and long-term site management. The technologies presented in **Table 5** were evaluated against each other for effectiveness, implementability, and cost. Based on these criteria, the technologies that were deemed most viable were retained for final comparison and are presented in the following section.

4.3 Detailed Analysis of Retained Remedial Action Technologies

In this section, the technologies that were retained for soil remediation have been compiled into remedial action alternatives for a detailed analysis. Based on the guidance established by CERCLA, consideration of technologies to remediate site impacts should be evaluated against nine standardized evaluation criteria. The alternatives retained for detailed analysis by the CERCLA-standardized evaluation criteria include:

Alternative 1: No-Action;

Alternative 2: Soil Capping with Institutional Controls; and

Alternative 3: Soil Capping, Institutional Controls, and Limited "Hot Spot" Excavation.

These alternatives are described in more detail below and then individually compared to the criteria.

4.3.1 Alternative 1 – No Action

The no action alternative is intended as a baseline against which other potential remedial actions may be compared. No remediation measures would occur under this alternative. As required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 Code of Federal Regulations (CFR) 300.420(e)(6), this alternative was retained for detailed analysis as a baseline for comparison with other alternatives.

Overall Protection of Human Health and the Environment: The no action alternative does not provide protection of human health or the environment in the long term.

Compliance with ARARs: The no action alternative does not meet Site ARARs, specifically with respect to Site COCs.

Long-Term Effectiveness and Permanence: The no action alternative does not provide long-term effectiveness or performance because future disturbance of the existing soil cap is uncontrolled.

Reduction of Toxicity, Mobility, or Volume: The no action alternative does not provide a reduction of toxicity, mobility, or volume of Site contaminants.

Short-Term Effectiveness: The current condition includes a minimum of two feet of soil cover or hardscape over impacted soil, such that in the short term the no action alternative is effective, however there would be no means to control the potential for future exposure of impacted soil.

Implementability: The no action alternative is implementable.

Cost: The no action alternative is not cost prohibitive.

Agency Acceptance: The no action alternative would not address the potential for future soil disturbance and as a result would not likely be acceptable by the lead regulatory agency.

Community Acceptance: The no action alternative would not address soil impacts and as a result would likely not gain community acceptance.

4.3.2 Alternative 2 – Capping with Institutional Controls

Alternative 2 includes soil capping in the form of a concrete slab in the basement of 127A, 127B, and 128A, and existing landscaped and hardscaped areas outside Building 127 (to mitigate residual soil contamination risks) and; long-term institutional controls (ICs) in the form of land use controls (LUC). Protocols for maintenance of mitigation measures, and intrusive work within and below the cap, would be outlined in a post-mitigation construction, Operation and Maintenance Plan.

Overall Protection of Human Health and the Environment: Capping impacted soils and implementing ICs to prevent future exposure would eliminate the risk pathway for impacted soils and would meet the CAO for impacted soils.

Compliance with ARARs: Capping plus the implementation of ICs is an established method for mitigating impacted soil risk pathways and would meet applicable ARARs.

Long-Term Effectiveness and Permanence: Capping and implementing ICs would provide a long-term effective solution with ongoing performance because the approach would mitigate the contaminant risk, meet the CAO for soil, and will remain effective for an extended period of time.

Reduction of Toxicity, Mobility, or Volume: With capping and ICs, impacted soil concentrations and toxicity would be reduced, over time, by natural attenuation processes. Mobility will not be impacted and the cap with ICs will eliminate the risk path for exposure.

Short-Term Effectiveness: With this alternative, risk to human health and the environment would not increase in the short term (i.e., during construction) because the caps (soil and hardscape) are currently in-place and no impacted soil would need to be exposed or uncovered to implement this option.

Implementability: Capping and ICs are readily implementable, based on the site-specific conditions and the regulatory framework for the site.

Cost Effectiveness: This alternative is a cost-effective remedial approach because the caps are effectively already in place and costs associated with implementing ICs are primarily administrative.

Agency Acceptance: Capping of impacted soils is a commonly used approach for mitigation of petroleum-impacted soils when combined with institutional controls such that future disturbance is controlled; therefore, this alternative is anticipated to gain agency acceptance.

Community Acceptance: Community acceptance of this alternative is likely due to the mitigation of risk pathways and the relative low impact to the community.

4.3.3 Alternative 3 – Capping, Institutional Controls, and Limited "Hot Spot" Excavation

Alternative 3 adds an excavation component to the Alternative 2 approach. This alternative consists of the proposed corrective actions outlined in Alternative 2 plus the removal of impacted soil in the southeast of Building 127B. Impacted soil in the "hot spot" area will be excavated and transported for offsite disposal at a licensed landfill facility. Under this alternative, the ICs will be retained to address residual soil contamination beneath Buildings 127A, 127B, and 128A.

Overall Protection of Human Health and the Environment: Limited excavation of impacted soil, capping, and implementing ICs to prevent future exposure would eliminate the risk pathway for impacted soils and would meet the CAO for impacted soils; this alternative would provide adequate protection of human health and the environment.

Compliance with ARARs: Excavation, capping and implementing ICs is a widely used and proven approach for mitigating impacted soil risk pathways; this alternative would meet applicable ARARs.

Long-Term Effectiveness and Performance: Excavation, capping, and implementing ICs would provide a long-term effective solution with ongoing performance because the approach would mitigate the contaminant risk, meet the CAO for soil, and would remain effective for an extended period of time.

Reduction of Toxicity, Mobility, or Volume: This alternative would include excavation of impacted soil "hot spots" and would result in a reduction of volume due to impacted soil mass being physically removed from the Site.

Short-Term Effectiveness: With this alternative, risk to human health and the environment would increase in the short term (i.e., during construction) due to the excavation component; this is due to the temporary exposure created by performing "hot spot" excavations, as well as transportation and disposal of impacted material.

Implementability: This alternative is readily implementable from a technical perspective; there are no physical, environmental, or chemical Site-specific constraints that would prevent this alternative from being implemented.

Cost: The "hot spot" excavation component of this remedy is costly. This is due to the high cost of the construction equipment required to implement this approach, particularly in proximity to a historic building, as well as the transportation and disposal costs for excavated materials.

Agency Acceptance: This alternative is a commonly used approach for mitigation of petroleum-impacted sites when combined with institutional controls such that future disturbance is prevented; therefore, this alternative is anticipated to gain agency acceptance.

Community Acceptance: Community acceptance of this alternative would be likely, but would require public review and acceptance of the short-term impacts to the community during implementation.

5.0 SCREENING OF POTENTIAL REMEDIAL ALTERNATIVES – GROUNDWATER

The screening of potential remedial alternatives for groundwater impacts involves three fundamental phases of evaluation: (1) General response actions, which outline standardized response actions that should be considered; (2) Identification of potential remedial technologies, which evaluates technical implementability first, then considers effectiveness, implementability, and relative cost; and (3) Detailed analysis of retained remedial technologies, which involves an analysis of nine standardized CERCLA evaluation categories for each technology.

5.1 General Response Actions

GRAs for groundwater impacts include: (1) no action; (2) institutional actions; (3) monitoring; (4) containment/removal; (5) in situ treatment, and (6) ex situ treatment/disposal.

No Action: Per the requirements of the NCP, the "no action" option is carried through the FS to serve as a baseline for comparison to other remedial alternatives. No significant modification of existing conditions at the Site would be implemented.

Institutional Actions: The USEPA defines institutional controls as non-engineering measures, such as administrative and/or legal controls, that help to minimize the potential for human exposure to contamination and/or to protect the integrity of a remedy by limiting land or resource use. Based on known historic use and planned future use for the Site, institutional controls such as LUCs and LUN are a viable option.

Monitoring: Groundwater monitoring is a common practice used to further assess COC trends and natural attenuation processes. Groundwater monitoring would take place for a designated amount of time and with a predetermined frequency.

Containment/Removal: Removal is a viable option (via extraction of groundwater through pumping) and would be used with off-site disposal or ex situ treatment (described below).

In Situ Treatment: In situ technologies could be applied for impacted areas. However, due to the limited extent and stability of the groundwater plume, the lack of potential receptors, and the potential future natural attenuation, in situ treatment is not warranted at this Site.

Ex Situ Treatment/Disposal: Ex situ treatment/disposal of groundwater could be implemented in conjunction with removal measures (i.e., groundwater extraction). However, due to the limited extent of the groundwater plume and lack of long-term data to assess plume growth versus contraction, ex situ treatment is not warranted.

5.2 Identification of Potential Remedial Technologies

For each general response action discussed above, potential remedial technologies and process options for groundwater are evaluated through a two-step screening process. First, process and technology options are evaluated based on technical implementability. This is a general screening step to eliminate options that are not applicable on the basis of site geologic, hydrogeologic, chemical, physical access, or other Site-specific conditions.

Technologies and process options that are potentially technologically implementable are then screened for effectiveness, further implementability, and relative cost. The results of this second-tier screening are summarized in **Table 5** and include: (1) monitored natural attenuation (MNA); (2) groundwater extraction; (3) in situ bioremediation; (4) in situ chemical treatment; (5) and ICs with long-term site management. The technologies presented in **Table 5** were evaluated against each other for effectiveness, implementability, and cost. Based on these criteria, the technologies that were deemed most viable were retained for final comparison and are presented in the following section.

5.3 Detailed Analysis of Remedial Action Alternatives

In this section, the technologies that were retained for groundwater remediation are compiled into remedial action alternatives for a detailed analysis. Based on the guidance established by CERCLA, consideration of technologies to remediate site impacts should be evaluated against nine standardized evaluation criteria. The alternatives retained for detailed analysis by the CERCLA-standardized evaluation criteria include:

Alternative 1: No-Action; and

Alternative 2: Monitoring. Based on the results of the SSIR, monitoring is anticipated to be performed for five additional years on an annual basis, with a Five-Year Review report to recharacterize and evaluate the plume trends, and determine if continued groundwater monitoring is necessary. Proposed groundwater wells to monitor include, BR11-GW01, BR11-GW02, and BR11-GW03, with analytical testing to include site-specific COCs present in groundwater (See Section 2.3).

5.3.1 Alternative 1 – No Action

The no action alternative is intended as a baseline against which other potential remedial actions may be compared.

The no action alternative assumes no additional remedial activities occur on Site. Under this alternative, no new active control, remediation, or management would be performed, and no monitoring would occur.

Overall Protection of Human Health and the Environment: The no action alternative does not provide protection of human health or the environment.

Compliance with ARARs: The no action alternative does not meet Site ARARs, specifically with respect to Site COCs.

Long-Term Effectiveness and Permanence: The no action alternative does not provide long-term effectiveness or performance.

Reduction of Toxicity, Mobility, or Volume: The no action alternative does not provide a reduction of toxicity, mobility, or volume of Site contaminants. What about natural attenuation?

Short-Term Effectiveness: The no action alternative does not provide short-term effectiveness.

Implementability: The no action alternative is implementable.

Cost: The no action alternative is not cost prohibitive.

Agency Acceptance: The no action alternative would not address groundwater impacts and as a result would not likely be acceptable by the lead regulatory agency.

Community Acceptance: The no action alternative would not address soil impacts and as a result would likely not gain community acceptance.

5.3.2 Alternative 2 – Monitoring

Groundwater monitoring is used to further assess plume conditions such as plume growth or constraint, and to develop more comprehensive data sets for chemical conditions that drive natural attenuation processes. Due to the relatively limited data set for impacted groundwater constituents, additional groundwater monitoring is being evaluated in detail below.

Overall Protection of Human Health and the Environment: Groundwater monitoring would have a limited impact on providing additional protection for human health and the environment.

Compliance with ARARs: Depending on the rates of natural attenuation, groundwater monitoring may lead to compliance with ARARs, however, the timeline is unknown at this time and further monitoring would be required to fully assess the long-term timeline for cleanup via natural attenuation process.

Long-Term Effectiveness and Permanence: Depending on the rates of natural attenuation, groundwater monitoring may lead to long-term effectiveness and performance, however, the timeline is unknown at this time and further monitoring would be required to fully assess the long-term timeline for cleanup via natural attenuation process.

Reduction of Toxicity, Mobility, or Volume: Depending on the rates of natural attenuation, groundwater monitoring may lead to long-term effectiveness and performance, however, the timeline is unknown at this time and further monitoring would be required to fully assess the long-term timeline for cleanup via natural attenuation process.

Short-Term Effectiveness: Groundwater monitoring would have a limited impact on short-term effectiveness.

Implementability: Groundwater monitoring is implementable.

Cost Effectiveness: Groundwater monitoring is a cost effective approach.

Agency Acceptance: Groundwater monitoring is already established at this Site; therefore, this alternative is anticipated to gain agency acceptance.

Community Acceptance: No community concerns with continued groundwater monitoring are anticipated.

6.0 SCREENING OF POTENTIAL REMEDIAL ALTERNATIVES – SOIL VAPOR

The screening of potential remedial alternatives for soil vapor impacts involves three fundamental phases of evaluation: (1) General response actions, which outline standardized response actions that should be considered; (2) Identification of potential remedial technologies, which evaluates technical implementability first, then considers effectiveness, implementability, and relative cost; and (3) Detailed analysis of retained remedial technologies, which involves an analysis of nine standardized CERCLA evaluation categories for each technology.

6.1 General Response Actions

GRAs for soil vapor impacts include: (1) no action; (2) institutional actions; (3) monitoring; (4) containment/removal.

No Action: Per the requirements of the NCP, the “no action” option is carried through the FS to serve as a baseline for comparison to other remedial alternatives.

Institutional Actions: The USEPA defines institutional controls as non-engineering measures, such as administrative and/or legal controls, that help to minimize the potential for human exposure to contamination and/or to protect the integrity of a remedy by limiting land or resource use.

Monitoring: Soil vapor monitoring would take place for a designated amount of time. The monitoring program already in place would be modified to align with the selected remedy.

Containment/Removal: Containment/removal of soil vapors can be achieved using proven vapor mitigation technologies. These technologies seal the vapors below the indoor air zones and use various methods to collect and expel (and treat if needed) soil vapors into the atmosphere.

6.2 Identification of Potential Remedial Technologies

For each general response action discussed above, potential remedial technologies and process options for soil vapor are evaluated through a two-step screening process. First, process and technology options are evaluated based on technical implementability. This is a general screening step to eliminate options that are not applicable on the basis of site geologic, hydrogeologic, chemical, physical access, or other Site-specific conditions.

Technologies and process options that are potentially technologically implementable are then screened for effectiveness, further implementability, and relative cost. The results of this second-tier screening are summarized in **Table 5** and include: (1) soil vapor extraction (SVE); (2) installation of a vapor barrier; (3) installation of a sub-slab depressurization system. The technologies presented in **Table 5** were evaluated against each other for effectiveness, implementability, and cost. Based on these criteria, the technologies that were deemed most viable were retained for final comparison and are presented in the following section.

6.3 Detailed Analysis of Remedial Action Alternatives

In this section, the technologies that were retained for soil vapor remediation have been compiled into remedial action alternatives for a detailed analysis. Based on the guidance established by CERCLA, consideration of technologies to remediate site impacts should be evaluated against nine standardized evaluation criteria. The alternatives retained for detailed analysis by the CERCLA-standardized evaluation criteria include:

Alternative 1: No-Action; and

Alternative 2: Vapor Mitigation System (VMS) – Building 127B.

6.3.1 Alternative 1 – No Action

This alternative intended as a baseline against which other potential remedial actions may be compared.

The no action alternative scenario assumes that no additional remedial activities occurs on Site. Under this alternative, no new active control, remediation, or management would be performed, and no monitoring would occur.

Overall Protection of Human Health and the Environment: The no action alternative does not provide protection of human health or the environment.

Compliance with ARARs: The no action alternative does not meet Site ARARs, specifically with respect to Site COCs.

Long-Term Effectiveness and Permanence: The no action alternative does not provide long-term effectiveness or performance.

Reduction of Toxicity, Mobility, or Volume: The no action alternative does not provide a reduction of toxicity, mobility, or volume of Site contaminants.

Short-Term Effectiveness: The no action alternative does not provide short-term effectiveness.

Implementability: The no action alternative is implementable.

Cost: The no action alternative is not cost prohibitive.

Agency Acceptance: The no action alternative would not address soil vapor impacts and as a result would likely be not be acceptable by the lead regulatory agency.

Community Acceptance: The no action alternative would not address soil vapor impacts and as a result would likely not gain community acceptance.

6.3.2 Alternative 2 – Vapor Mitigation System (VMS) – Building 127B and Existing Concrete Slab Mitigation – Buildings 127A and 128A

A VMS is a common mitigation approach used to eliminate the risk associated with harmful soil vapors entering an overlying building via a process called vapor intrusion (VI). VMS technologies typically include a membrane to seal the vapors below the indoor air zones and use various methods to collect and expel (and treat if needed) soil vapors into the atmosphere. Existing concrete slabs also provide effective mitigation by preventing migration into the living spaces and/or attenuating impacted soil vapors as they pass through the slab. Although a potential soil vapor intrusion risk is present in beneath Buildings 127A and 128A due to residual sub-slab soil and soil vapor impacts, current conditions have not resulted in an unacceptable risk to human health due to soil vapor intrusion.

This alternative consists of installation of a VMS beneath the basement of Building 127B (to address soil vapor intrusion) and preservation of current conditions (existing concrete basement floors) to mitigate soil vapor intrusion risk in Buildings 127A and 128A; Protocols for maintenance of the VMS system, inspection of basement conditions, and indoor air monitoring would be outlined in an Operation, Monitoring and Maintenance Plan prepared under a separate cover.

Overall Protection of Human Health and the Environment: A VMS beneath Building 127B would eliminate the ongoing source pathway into the overlying building, which would provide adequate protection of human health and the environment. Existing concrete basements in Buildings 127A and 128A currently provide mitigation of soil vapor intrusion risks with no unacceptable human health risk from vapor intrusion currently present.

Compliance with ARARs: A VMS and existing conditions mitigation (e.g., concrete slabs) would comply with chemical-specific ARARs.

Long-Term Effectiveness and Permanence: The installation of a VMS and inspection and maintenance of existing concrete slabs would be a long-term effective mitigation for soil vapors. VMS, including existing concrete slabs, are long-term solutions because they are permanent systems that continue to operate for the life of the building. Additionally, with periodic monitoring, ongoing performance can be ensured and verified.

Reduction of Toxicity, Mobility, or Volume: The application of a VMS technology would physically block, collect, and expel contaminant soil vapors, which would result in the reduction of toxicity, mobility, and volume. Preservation of the concrete slabs would physically block and reduce mobility of impacted soil vapors and potentially allow for natural processes to naturally attenuate impacted soil vapor reducing toxicity.

Short-Term Effectiveness: With this alternative, risk to human health and the environment would be effectively managed in the short term (i.e., during implementation). Implementation of this alternative would not result in significant environmental impacts.

Implementability: Installation of a VMS in Building 127B and preservation of current basement conditions in Building 127A and 128A are technically feasible based on Site-specific physical, chemical, and environmental conditions.

Cost Effectiveness: The use of a VMS in Building 127B and preservation of current conditions in Buildings 127A and 128A is a cost effective approach for eliminating the risk pathways for harmful soil vapors.

Agency Acceptance: Mitigating soil vapor intrusion by installing a VMS is a commonly used remedial approach; therefore, this alternative is anticipated to gain agency acceptance. Current site conditions at Buildings 127A and 128A have not resulted in unacceptable risk to human health from vapor intrusion and preservation of current condition is anticipated to also gain agency acceptance.

Community Acceptance: Although potential soil vapor intrusion is present beneath Buildings 127A, 127B, and 128A, community acceptance of this alternative is anticipated based on the level of risk reduction by the VMS and current conditions and confirmed no unacceptable vapor intrusion risks present in the units.

7.0 COMPARATIVE ANALYSIS

In this section, the final retained remedial technologies for each of the impacted media types are combined into CAP Alternatives and a comparative analysis is presented.

7.1 Summary of Corrective Action Plan Alternatives

The final retained alternatives have been combined into three CAP Alternatives and a comparative analysis is presented below; each CAP Alternative is intended to be a combined remedial approach to address the impacted media identified on Site.

CAP Alternative 1 – No Action: This alternative assumes that no additional remedial activities occur on Site. Under this alternative, no new active control, remediation, mitigation or management would be performed, and no monitoring would be conducted. This alternative is intended to be used as a baseline against which other potential remedial actions may be compared.

CAP Alternative 2 – Vapor Mitigation System, Capping, and Institutional Controls: This alternative will consist of implementing a long-term strategy for soil vapor mitigation, which includes the installation and on-going annual performance monitoring of a VMS beneath the basement of Building 127B and preservation of concrete basements in Buildings 127A and 128A. Capping would be provided in the form of new or existing concrete slab in the basements of 127A, 127B, and 128A, the existing 2-foot (minimum) clean fill in landscaped areas, and the existing hardscape (sidewalks, patios, stairs, etc.) around buildings 127A and 127B to mitigate residual soil contamination exposure risks. The 2-foot thick clean soil cap is currently in-place. Boring logs document the presence of the soli cap across the site (e.g., SB004, SB005, SB007, BR11-1SB010, BR11-1SB011, BR11-1SB012, BR11-1SB013, BR11-1GW01, etc.) (TRC, 2019b). Long-term ICs will be in the form of LUC and associated restrictions for the in-place management of the residual contamination and operation and monitoring of the installed remedy. Protocols for mitigation monitoring and maintenance are presented in the O&M plan of the Construction Completion Report (TRC, 2019c). A detailed layout of the VMS system is presented in **Figure 6A** and **6B**; a map of the proposed soil cap areas is presented on **Figure 7;** and a map showing the areal extent of the LUC areas is shown on **Figure 8**. Groundwater monitoring is included in this alternative on an annual basis at the three existing wells for five years testing for identified COCs, as described in Section 8.4.

CAP Alternative 3 – Vapor Mitigation System, Capping, Institutional Controls, and Limited "Hot Spot" Excavations: This alternative consists of the proposed corrective actions in Alternative 2 plus the removal and off-site disposal of impacted soil immediately to the southeast of Building 127B. Impacted soil in the "hot spot" area will be excavated and transported for offsite disposal at a licensed treatment facility. Under this alternative, the VMS system and ICs would still be required to address the soil vapor intrusion risk and residual soil contamination beneath Buildings 127A, 127B, and 128A. A detailed layout of the 127B VMS system is presented in **Figures 6A** and **6B**, a map of the existing concrete basements and proposed soil cap areas is presented on **Figure 7**, a map showing the areal extent of the LUC areas is shown on **Figure 8**, and a map showing the proposed areas for limited excavation are shown on **Figure 9**. Similar to Alternative 2, groundwater monitoring is included on an annual basis at the three existing wells for five years as described in Section 8.4.

7.2 Comparative Analysis of Corrective Action Plan Alternatives

The comparative analysis (**Table 6**) applies the CERCLA-standardized nine key criteria points and is presented below.

Overall Protection of Human Health and the Environment: CAP Alternatives 2 and 3 would provide protection of human health and the environment because risk paths for impacted media would be mitigated effectively with the installation of a VMS, capping, groundwater monitoring and ICs (which are performed in both CAP Alternatives).

Compliance with ARARs: CAP Alternative 2 and 3 would comply with ARARs because they comply with applicable state and federal laws for environmental remediation.

Long-Term Effectiveness and Permanence: CAP Alternatives 2 and 3 would provide long-term effectiveness and performance because the mitigation of risk paths for impacted media would be permanent under the foreseeable land use for the Site.

Reduction of Toxicity, Mobility, or Volume: CAP Alternative 2 and 3 would provide a reduction of the toxicity, mobility, or volume because both options would contain and expel soil vapors by implementing a VMS. CAP Alternative 3, however, would provide the higher level of reduction of volume due to the physical removal of impacted soil southeast of Building 127B via excavation.

Short-Term Effectiveness: Risks to human health and the environment could be effectively managed in the short-term (i.e., during implementation) equally for CAP Alternatives 2 and 3. However, Alternative 3 has the potential to increase exposure of COCs to residents and workers during implementation of the "hot spot" excavation, and with increased environmental risk associated with transportation of the waste material to a disposal facility.

Implementability: CAP Alternative 2 and 3 are both equally implementable.

Cost Effectiveness: CAP Alternative 2 is the most cost effective for the amount of protection it provides. This is because the 2-foot soil cap and hardscape areas currently provide adequate exposure prevention to impacted soil for risk receptors. Although, CAP Alternative 3 would remove additional COC mass (via "hot spot" excavation), there would be a significant cost associated with implementing this remedial measure (cost estimates presented on **Table 6**) for a limited return on reduction of risk and would not eliminate implementation of long term ICs. The estimate cost for Alternative 2 and Alternative 3 are $1,106,000 and $1,664,300, respectively. Alternative 1 was assigned a negligible value to implement. Cost estimates are presented in Appendix A.

Agency Acceptance: CAP Alternatives 2 and 3 are commonly used approaches that have an established track record for successfully mitigating soil and soil vapor risk; therefore, these alternatives are anticipated to gain agency acceptance.

Community Acceptance: CAP Alternative 2 and 3 would likely gain community support as both options provide adequate risk mitigation for identified impacted media.

8.0 RECOMMENDED CORRECTIVE ACTION PLAN

Soil: Based on the evaluation of viable remedial approaches presented in this Revised FS/CAP, the recommended corrective action plan to mitigate impacted soil includes the use of existing hardscape features and clean soil as a soil cap (shown on **Figure 7**), implementing ICs (including LUCs shown on **Figure 8**), and post-remediation monitoring.

Groundwater: Based on the evaluation of viable remedial approaches presented in this Revised FS/CAP, the recommended corrective action plan to mitigate impacted groundwater includes monitoring for five years on an annual basis with a Five-Year Review to recharacterize the plume trends and evaluated if further action is warranted.

Soil Vapor: Based on the evaluation of viable remedial approaches presented in this Revised FS/CAP, the recommended corrective action plan to mitigate impacted soil vapor at the Site includes mitigation measures below Building 127B, which includes the installation of a vapor barrier beneath the basement, a passive (wind-driven) sub-slab venting system, and a new concrete slab; see **Figures 6A** and **6B** for layout plans of the VMS in Building 127B and preservation and maintenance of existing concrete slabs in Buildings 127A and 128A.

These corrective actions are described in more detail below.

8.1 Recommended Corrective Action – Soil Impacts

Based on the feasibility study presented in this report, the recommended alternative for mitigation of impacted soil is utilizing the existing hardscape and 2-ft (minimum) of clean soil as a cap and implementing IC's via LUCs through the Presidio Trust LUCMRR; see **Figure 7** for an areal extent of soil cap areas and **Figure 8** for an areal extent of the proposed LUC areas.

Hardscape and Clean Soil Capping in Place: The proposed cap at the Site consists of the use and maintenance of existing hardscape and clean soil caps. The Site capping elements will prevent contact with residual soil contamination, render the contact exposure pathway to current and future residents incomplete, and continue to attenuate the potential vapor intrusion risk to residents. Exposure to the occasional maintenance and/or construction worker would be managed by the implementation of LUCs or LUN and associated ICs.

The proposed cap for residual soil contamination beneath the basements in Buildings 127A, 127B and 128A and residual sub-slab vapor beneath 127A will be a new or existing concrete basement floor. Current concrete floors in 127A and 128A will remain as well as the new, four-inch thick concrete floor recently installed in the basement of 127B.

The proposed cap for residual soil contamination present in the front yards of 127A and 127B consists of a minimum two-feet thick cap of clean soil and the existing concrete hardscape (i.e., walkways, stairs, landing areas), as shown in **Figure 7**. The 2-foot thick clean soil cap is currently in-place as documented by boring logs collected for sample locations across the site (e.g., SB004, SB005, SB007, BR11-1SB010, BR11-1SB011, BR11-1SB012, BR11-1SB013, BR11-1GW01, etc.) (TRC, 2019b). Currently, residual soil contamination above screening levels at the exterior landscaped areas begins at a depth of approximately 5 feet bgs and is overlain with clean soil and landscaping vegetation. As such, the existing landscaped areas currently meet the minimum proposed thickness for the soil cap and therefore, no further capping work is needed. The current hardscape is intact and does not require repairs. Long-term maintenance of the cap will be conducted during routine, scheduled maintenance undertaken by the Trust's Facilities Maintenance department, or as necessary based on deficiencies noted during annual site inspections performed as part of long-term operation and monitoring plan for the installed remedy.

Land Use Control: LUCs are ICs that provide a legal framework governing future land use, preserve the integrity of the remedy, provide soil management requirements, restrict use of cap areas for the growing of crops, and health and safety protocols for operations and maintenance work that may disrupt the remedy (including both hardscape or soil cover areas); see **Figure 8** for the proposed Site LUC areas.

The Presidio Trust Land Use Controls Master Reference Report (LUCMRR; EKI, 2009) serves as the implementation and enforcement plan to ensure that the LUCs in place in Area B of the Presidio are maintained to protect public health and the environment. LUCs limit or prohibit certain kinds of site uses, notify potential owners or tenants of the presence of hazardous substances remaining on-site at concentrations that are not protective of users, or establish procedures for subsurface soils disturbances. Established LUCs are described in site-specific addenda to the LUCMRR.

In addition, the LUCMRR also allows the use of Land Use Notifications (LUNs) as an IC. LUNs do not restrict land use but serve to notify present or future users, tenants, maintenance workers, landscaping/planting crews, or other entities of the presence and location of residual COC, debris fill, abandon utilities, building foundations, or other items left in place at the site. LUNs also do not require special site monitoring or inspections to be performed. Similar to LUCs, LUNs are described in site-specific addenda to the LUCMRR.

Projects in Area B of the Presidio are screened for compliance with the National Environmental Protection Act (NEPA) and the National Historic Preservation Act (NHPA), collectively referred to as N^2... The N^2 review is an interdisciplinary review process ensuring that rehabilitation efforts comply with NEPA and NHPA and considers potential impacts to environmental, historic, and archeological resources during project planning. The N^2 process is a first step of making project proponents aware of known contamination and associated LUCs at a project site. Another mechanism for notifying and ensuring compliance with LUCs and LUNs is the Presidio Trust building and dig permit process. Any project involving construction, excavation, or subsurface work in Area B of the Presidio requires a permit. Dig Permits are tracked and reported annually via the Annual O&M Reports (Trust, 2016 and 2017).

Whenever the Trust transfers real property that is subject to LUCs/LUNs and resource use restrictions to another federal agency, the transfer documents shall require that the federal transferee include the LUCs/LUNs, and applicable resource use restrictions in its resource use plan or equivalent resource use mechanism. The Trust shall advise the recipient federal agency of obligations contained in the decision documents, including the obligation that a State Land Use Covenant will be executed and recorded pursuant to 22 CCR Section 67391.1 in the event the federal agency transfers the property to a non-federal agency.

If at any point, the Trust is given authority to transfer real property subject to resource use restrictions and LUCs/LUNs to a non-federal entity, it will provide information to that entity in the draft deed and transfer documents regarding necessary resource use restrictions and LUCs/LUNs, including the obligation that a State Land Use Covenant will be executed and recorded pursuant to 22 CCR Section 67391.1. The signed deed will include LUCs and resource use restrictions equivalent to those contained in the State Land Use Covenant and applicable decision documents.

The Trust will provide notice to the appropriate regulatory agency (i.e., DTSC and/or the RWQCB) at least six (6) months prior to any transfer or sale of any site within the Presidio so that DTSC and the RWQCB can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs/LUNs. If it is not possible for the facility to notify DTSC and the RWQCB at least six months prior to any transfer or sale, then the facility will notify DTSC and RWQCB as soon as possible but no later than 60 days prior to the transfer or sale of any property subject to LUCs/LUNs. In addition to the land transfer notice and discussion provisions above, the Trust further agrees to provide DTSC and the RWQCB with similar notice, within the same time frames, as to federal-to-federal transfer of property. The Trust shall provide a copy of the executed deed or transfer documents to DTSC and the RWQCB.

The Trust proposes establishing a LUC area to manage for the residual soil contamination beneath Buildings 127A, 127B and 128A and surrounding area. No LUNs are proposed for the Site in this Revised FS/CAP. The proposed extents for the 127A,127B, and 128A LUC areas are presented in **Figure 8**.

8.2 Recommended Corrective Action – Groundwater Impacts

Based on the evaluation of viable remedial approaches presented in this Revised FS/CAP, the recommended corrective action plan to mitigate impacted groundwater at the Site is monitoring. Monitoring is proposed for five additional years on an annual basis, with a Five-Year Review report to recharacterize and evaluate the plume trends, and determine if continued groundwater monitoring is necessary. Proposed groundwater wells to monitor include, BR11-GW01, BR11-GW02, and BR11-GW03, with analytical testing to include selected site-specific COCs present in groundwater.

This approach is recommended although the groundwater impacts are limited in areal extent and magnitude, the data set for the plume is not extensive, and currently there are insufficient data to determine if the plume remains stable or decreasing in areal extent and magnitude. If after five years, the plume is found by the RWQCB to pose a low threat to human health and the environment a request for No Further Action will be submitted.

8.3 Recommended Corrective Action – Soil Vapor Impacts

Based on the FS presented in this report, the recommended alternative for mitigation of soil vapors is the installation of a VMS below Building 127B and preservation of existing basement conditions in Buildings 127A and 128 with future monitoring to confirm effectiveness. The effectiveness mitigation of soil vapor intrusion risk in Buildings 127A and 128A has been confirmed through conducted indoor air sampling demonstrating that no current unacceptable risk is present (TRC, 2018d and 2018e). The VMS beneath 127B was constructed (with RWQCB approval) during 2019 per the VMS design workplan (TRC, 2019a), and is recommended as the final corrective action to mitigate soil vapors, with documentation of effectiveness through inspection and monitoring, as described further below.

The VMS design consists of the following primary elements:

- Approximately 750 square feet of a 15 mil-thick, Stego® vapor barrier over the entire permeable base layer containing the sub slab ventilation system (SSVS).

- Permeable base layer consisting of a minimum of four inches of gravel or crushed rock placed continuously beneath the vapor barrier. The permeable base provides a continuous, highly permeable zone that allows advective flow of soil vapor to the collection piping.

- SSVS venting (fresh air) and collection piping within a permeable base layer beneath the membrane, which is passively vented through a 4-inch, wind turbine-equipped stack/vent located above the roofline of the building. The venting and collection system consists of pre-fabricated, low-profile (flat), three-dimensional vent cores wrapped in non-woven, needle-punched filter fabric. The collection vents are fabricated of high density polyethylene. The vapor collection system was installed directly on the subgrade and beneath the vapor barrier. The horizontal vapor collection piping was connected to vertical vent risers. The oblong piping is designed to connect to round, 4-inch, schedule 80 polyvinyl chloride pipes using manufacturer-provided transition fittings. The vertical vent riser penetrates the vapor membrane and foundation concrete slab; penetration through the membrane is sealed in accordance with the manufacturer's recommendations. A wind-driven turbine fan is installed at the top of the riser vent to provide wind siphoning flow from the vent.

- A four-inch thick, reinforced concrete slab is installed on top of the vapor barrier (although not considered part of the VMS system, the concrete slab serves as an additional barrier and provides further soil vapor attenuation).

The extents and layout of the VMS system and construction details are shown in **Figure 6A** and **Figure 6B**, and materials and equipment specifications are provided in the Construction Completion Report (TRC, 2019c).

Post-construction confirmation sampling at 127B consists of two (2) indoor and ambient air sampling events to establish that the installed remedy is effectively attenuating potential vapor intrusion. The indoor air samples are collected from the basement, kitchen, sunroom and upstairs bedroom (nearest to the bathroom), and three (3) ambient air locations. Indoor and ambient air sampling was conducted using the protocols described in the *VI Work Plan* and utilized for the completed SVI investigations conducted for Buildings 127A, 128A, and 129B. Collected indoor and ambient air samples are analyzed for benzene, toluene, ethylbenzene, xylenes (BTEX) and naphthalene by Environmental Protection Agency (EPA) Test Method TO-15 Selective Ion Mode, TPH-d by TO-17, TPH-g by EPA Test Method TO-03M Low Level and TO-17, and fixed gases (carbon dioxide, carbon monoxide, methane, nitrogen, and oxygen) by ASTM D-1946.

In addition to the indoor and ambient air samples, a sample is collected from the vent riser of the SSVS system for laboratory analysis to assess the sub-VMS vapor conditions. The sampling of the vent is conducted via sampling port installed in the above-ground pipe section. Sampling is conducted using sub-slab vapor sampling protocols described in the *VI Work Plan*. The collected sample will be analyzed for BTEX, naphthalene, TPH-d, TPH-g, and fixed gases. The first post-construction confirmation sampling took place once the concrete slab is fully cured (minimum of 28-days curing time) with the second sampling event six months later.

The results of the post-construction confirmation samplings in 127B were submitted to the RWQCB in the Construction Completion Report (TRC, 2019c) and Building 127B Second Post-Construction Sampling Report (TRC, 2019d).

8.4 Recommended Monitoring Program

Long-term monitoring and maintenance of the mitigation system would be performed in accordance with Operations, Monitoring and Maintenance Plan (OMMP) to ensure ongoing compliance with CAOs. Annual inspections will be conducted to verify that remedial measures implemented at the Site, including hardscape and clean soil caps, continue to meet the CAOs.

Groundwater monitoring is proposed for five additional years on an annual basis, with a Five-Year Review report to recharacterize and evaluate the plume trends and determine if continued groundwater monitoring is necessary. Proposed groundwater wells to monitor include, BR11-GW01, BR11-GW02, and BR11-GW03, with analytical testing to include site-specific COCs present in groundwater (TPH-d, TPH-g, TPH-mo, and TPH-bc) and Total Dissolved Solids. As discussed with the RWQCB, monitoring of PAHs will no longer be necessary because PAHs were not detected above laboratory reporting limits during quarterly groundwater monitoring during 2018 and 2019 (TRC, 2019b).

Ongoing monitoring of the performance of the VMS installed in Building 127B will be performed on an annual basis, as well as inter-occupancy testing when a new resident moves into the property. The VMS performance monitoring will include inspection of the visible portions of the venting system and functionality of the wind-driven vent pipe fan. Inspection the basement slab conditions will be conducted along with the VMS inspection.

Monitoring of the continued effectiveness of the existing concrete slabs in Buildings 127A and 128A will include annual inspections of the basement slab condition, maintenance and repairs of the concrete slab as necessary, and inter-occupancy indoor air sampling to evaluate concentration trends and potential responses to mitigate vapor intrusion risks if determined to be present prior to re-occupancy. Detailed descriptions of monitoring activities will be presented in the OMMP.

The long-term monitoring program will be in effect while the LUCs are in place which is anticipated for the foreseeable future.

9.0 PROJECT DOCUMENTATION, REPORTING, AND SCHEDULE

The following sections identify the means and methods for documenting, reporting, and scheduling the proposed remedial action.

9.1 Project Documentation and Reporting

The construction of the VMS system took place as an interim measure earlier in 2019 as documented in the Construction Completion Report (CCR) for the VMS system (TRC, 2019c). The CCR summarizes construction activities, documents deviations from the remedial design, presents as-built drawings, provides photographic documentation of the field work, and presents the results of the first post-construction confirmation sampling.

Upon approval of this Revised FS/CAP, site-specific LUCMRR Addendums will be prepared to establish Buildings 127A and 127B LUCs and 128A LUN. The addendums will document the areas included in the LUC/LUN, descriptions of the Site and COCs, land use restrictions, as applicable, soil management, monitoring, and inspection requirements.

Additional project documentation will include interim updates documenting confirmation sampling results and requests for concurrence, groundwater monitoring reports, and long-term yearly LUC inspection reports. Activities conducted at LUC sites are presented in annual operation and maintenance reports submitted to the DTSC and RWQCB by March 31 for the previous year.

In addition, the performance of the remedial system and effectiveness of the long-term monitoring program will be reviewed every five years and reported in the Five-Year Review report. The Five-Year Review report will address remedial performance of the VMS and Cap. The major elements to be evaluated and technically assessed during the Five-Year Review include: (1) cap integrity (hardscape and landscape); (2) VMS system operation; and (3) long-term monitoring program.

9.2 Schedule

A preliminary schedule for the implementation of the remedial action and post-construction confirmation sampling is as follows:

Table 9.2 – Preliminary Schedule for Implementation of Remedial Action

Activity/Milestone	Date
Revised FS/CAP RWQCB Approval	January 2020
LUCMRR addenda (LUC) Preparation and RWQCB Review	February/March 2020
LUCMRR addenda RWQCB Approval	March 2020
First annual groundwater monitoring	April 2020 and annual thereafter for five years

Table 9.2 – Preliminary Schedule for Implementation of Remedial Action

Activity/Milestone	Date
Implementation of annual inspections	Fourth Quarter 2020 and yearly thereafter

The presented schedule is dependent on regulatory approval of submitted documents and is subject to change due to circumstances outside the control of the Trust such as force majeure, subcontractor, equipment, and materials availability. The Trust will provide updates to the RWQCB as necessary to communicate project progress and expected delays or changes to the proposed schedule.

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Tables

Table 1
Soil Cleanup & Screening Levels
Section BR11-1 Fuel Distribution System
Presidio of San Francisco, San Francisco, California

Chemicals of Concern	Soil Cleanup Level: Human Health Residential[a]	RWQCB ESLs (Tier 1, 2019)[b]	RWQCB ESLs (Residential, 2019)[b]
	Soil (mg/kg)		
Total Petroleum Hydrocarbons			
Gasoline	1,030	100	430
Diesel	1,380	260	260
Motor Oil	1,900	1,600	12,000
Volatile Organic Compounds			
Benzene	0.6	0.025	0.33
Ethylbenzene	840	0.43	5.9
Toluene	530	3.2	1100
o-Xylene	1,080	2.1	580
Polycyclic Aromatic Hydrocarbons			
Acenaphthene	2,700	12	3,600
Acenaphthylene	--	6.4	--
Anthracene	5,900	1.9	18,000
Benz(a)anthracene	0.43	0.63	1.10
Benzo(a)pyrene	0.04	0.11	0.110
Benzo(b)fluoranthene	0.43	1.1	1.1
Benzo(g,h,i)perylene	620	2.5	--
Benzo(k)fluoranthene	0.43	2.8	11.0
Chrysene	4.3	2.2	110
Dibenz(a,h)anthracene	0.078	0.11	0.110
Fluoranthene	820	0.69	2,400
Fluorene	770	6.0	2,400
Indeno(1,2,3-cd) pyrene	0.27	0.48	1.1
Naphthalene	480	0.042	3.8
Phenanthrene	600	7.8	--
Pyrene	620	45	1,800

Abbreviations:
-- = not available
mg/kg = milligrams per kilogram
ESL = Environmental Screening Level
RWQCB = Regional Water Quality Control Board

Footnotes:
[a] Soil cleanup levels from Tables 7-2 and 7-5 and groundwater cleanup levels from Table 7-6 from EKI's 2002 (with updates through 2013) Development of Presidio-Wide Cleanup Levels for Soil, *Sediment, Groundwater, and Surface Water. Presidio of San Francisco.*
[b] RWQCB ESLs are from RWQCB's 2019 (Rev. 2) Summary Table of Soil ESLs (http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/esl.shtml).

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Table 2
Groundwater Cleanup & Screening Levels
Section BR11-1 Fuel Distribution System
Presidio of San Francisco, San Francisco, California

Chemicals of Concern	Groundwater Cleanup Level: Drinking Water[a]	RWQCB ESLs (Tier 1, 2019)[b]	RWQCB ESLs (MCL Priority, 2019)[b]
	Groundwater (µg/L)		
Total Petroleum Hydrocarbons			
Gasoline	770	100	760
Diesel	880	100	200
Motor Oil	1,200	--	--
Volatile Organic Compounds			
Benzene	1.0	0.42	1.0
Ethylbenzene	300	3.5	30
Toluene	150	40	40
o-Xylene	1,750	20	20
Polycyclic Aromatic Hydrocarbons			
Acenaphthene	--	15	530
Acenaphthylene	--	15	--
Anthracene	770	0.73	1,800
Benz(a)anthracene	0.1	0.017	0.017
Benzo(a)pyrene	0.2	0.014	0.20
Benzo(b)fluoranthene	0.2	0.049	0.25
Benzo(g,h,i)perylene	150	0.1	--
Benzo(k)fluoranthene	2.0	0.049	2.5
Chrysene	20	0.049	25
Dibenz(a,h)anthracene	--	0.025	0.025
Fluoranthene	300	8.0	800
Fluorene	300	3.9	290
Indeno(1,2,3-cd)pyrene	--	0.049	0.25
Naphthalene	300	0.17	0.17
Phenanthrene	230	4.6	--
Pyrene	230	2.0	120

Abbreviations:
-- = not available
µg/L = micrograms per liter
Com/Ind = Commercial/Industrial
ESL = Environmental Screening Level
GW = groundwater
MCL = Maximum Contaminant Level
RWQCB = Regional Water Quality Control Board

Footnotes:
[a] Soil cleanup levels from Tables 7-2 and 7-5 and groundwater cleanup levels from Table 7-6 from EKI's 2002 (with updates through 2013) Development of Presidio-Wide Cleanup Levels for Soil, *Sediment, Groundwater, and Surface Water. Presidio of San Francisco.*
[b] RWQCB ESLs are from RWQCB's 2019 (Rev.02) Summary Table of Groundwater ESLs (http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/esl.shtml).

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Table 3
Soil Vapor & Sub-Slab Vapor Screening Levels
Section BR11-1 Fuel Distribution System
Presidio of San Francisco, San Francisco, California

Chemicals of Concern	Screening Levels[a]
	Soil Vapor ($\mu g/m^3$)
Total Petroleum Hydrocarbons	
Gasoline	3,333 / 20,000
Diesel	8,900
Volatile Organic Compounds	
Benzene	3.2
Ethylbenzene	37
Toluene	10,000
o-Xylene	3,500
p/m-Xylene	3,500
Polycyclic Aromatic Hydrocarbons	
Naphthalene	2.8
Fixed Gases	
Methane	1.25% by volume

Abbreviations:

-- = not available

$\mu g/m^3$ = micrograms per cubic meter

AF = Attenuation Factor

Com/Ind = Commercial/Industrial

ESL = Environmental Screening Level

LEL = Lower Explosive Limit

RWQCB = Regional Water Quality Control Board

Footnotes:

[a] RWQCB ESLs are from RWQCB's 2019 (Rev. 02) Summary Table of Vapor ESLs (http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/esl.shtml).

Table 4
Indoor Air Screening Levels
Section BR11-1 Fuel Distribution System
Presidio of San Francisco, San Francisco, California

Chemicals of Concern	RWQCB ESLs (Tier 1, Indoor Air, 2019)[a]	RWQCB ESLs (Residential, Indoor Air, 2019)[a]
	Indoor Air (µg/m^3)	
Total Petroleum Hydrocarbons		
Gasoline	100	600
Diesel	270	270
Volatile Organic Compounds		
Benzene	0.097	0.097
Ethylbenzene	1.1	1.1
Toluene	310	310
o-Xylene	100	100
p/m-Xylene	100	100
Polycyclic Aromatic Hydrocarbons		
Naphthalene	0.083	0.083

Fixed Gases	Screening Level	Action Level
Methane	0.75%	1.25%

Abbreviations:
-- = not available
µg/m^3 = micrograms per cubic meter
ESL = Environmental Screening Level
RWQCB = Regional Water Quality Control Board

Footnotes:
[a] RWQCB ESLs are from RWQCB's 2019 (Rev. 02) Summary Table of Vapor ESLs (http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/esl.shtml).

TABLE 5
SCREENING OF CORRECTIVE ACTION TECHNOLOGIES
SECTION BR11-1 FUEL DISTRIBUTION SYSTEM
Riley Avenue, Presidio of San Francisco, California

Technology	Description	Effectiveness	Implementability	Relative Cost	Retain for Detailed Evaluation?
Monitored Natural Attenuation (MNA) – Soil	MNA relies on natural processes to achieve corrective action objectives. These processes may include biodegradation, sorption, dispersion and dilution, chemical reactions, and/or volatilization. In order to consider MNA, it must first be verified that subsurface conditions are suitable for the attenuation processes, especially bioremediation; it also requires monitoring to verify progress.	*Potentially effective in the long-term if combined with other remedial technologies* The slow rate of natural attenuation on TPH indicates that MNA will not be effective in the short term at the site. With respect to the long-term effectiveness, slow, natural attenuation may occur, but TPH concentrations in impacted soil are expected to remain constant for a substantial time period.	*Easy to Implement* MNA requires only monitoring to verify progress; therefore, implementation is not complex. The materials and services needed to implement MNA are readily available.	Low	No
Capping - Soil	Capping involves the presence of a physical barrier between impacted soils and potential receptors.	*Can be effective if combined with other remedial technologies.* Capping could be effective in the short and long-term in providing a physical barrier to impacted soils at the site.	*Easy to Implement* Capping already in place Personnel and equipment are generally available for implementation if additional capping is necessary.	Low	Yes
Groundwater Extraction – Groundwater	Groundwater extraction involves the physical removal of groundwater via pumping mechanisms.	*Can be effective if combined with other remedial technologies or disposed off-site.* Groundwater extraction would provide a long-term mitigation approach by reducing the contaminant mass. Groundwater extraction is a well-proven technology for groundwater mitigation, when combined with a treatment method or off-site disposal. Groundwater extraction is also proven technology for hydraulic containment.	*Moderate to Difficult to Implement* Personnel and equipment are generally available for implementation.	High	No

TRC

Technology	Description	Effectiveness	Implementability	Relative Cost	Retain for Detailed Evaluation?
In Situ Bioremediation (Aerobic) – Groundwater and Soil	Aerobic *in-situ* bioremediation is accomplished by introducing oxygen and/or other substrates to the subsurface. Oxygen could be introduced at the site by installing diffusive oxygen emitters in the subsurface. Diffusive oxygen emitters consist of coiled silicone tubing that can be lowered into a well. The tubing is pressurized with oxygen, resulting in a slow, continuous release of oxygen to the subsurface.	*Possibly effective* The site groundwater chemistry appears to be favorable for in-situ bioremediation. The COCs at the site are amenable to aerobic biodegradation and *in-situ* bioremediation. Effective implementation of the technology would be difficult to assess without a pilot treatability study to determine full site-wide implementation. Consistent delivery of oxygen would require closely spaced injection points and possible permanent infrastructure for additional delivery post site development.	*Moderate to Difficult to Implement* Personnel and equipment are generally available for implementation; however, specialized design work is required.	High	No
Enhanced In-Situ Bioremediation (Anaerobic) – Groundwater and Soil	Anaerobic *in-situ* bioremediation involves introducing an electron donor and/or bacterial amendment to the treatment area to create strongly reducing conditions and foster contaminant biodegradation. PCE and TCE have been shown to be degraded by appropriate bacteria (e.g. Dhc) under highly reducing conditions. Electron donor addition would likely occur by injecting substrate (e.g., lactate) into the target treatment zone. Recirculation would potentially be used to more effectively distribute the injected substrate throughout the treatment area.	*Not effective* The COCs at the site are not amenable to anaerobic biodegradation.	*Moderate to Difficult Implement* Personnel and equipment are generally available for implementation; however, specialized design work is required.	High	No

TRC

Technology	Description	Effectiveness	Implementability	Relative Cost	Retain for Detailed Evaluation?
In Situ Chemical Treatment – Groundwater and Soil	In-situ Chemical Treatment involves injecting chemical oxidants (e.g., persulfate or hydrogen peroxide) into the subsurface where they oxidize contaminants *in situ*. Oxidants are typically injected using temporary direct-push points or permanent injection wells.	*Possibly effective* May be effective for reducing some site COCs. However, there can be challenges in the delivery of the oxidant, unfavorable side reactions, and effectiveness can be limited by complexities in site geochemistry requiring multiple rounds of treatment.	*Moderate to Difficult to Implement* Potentially feasible for treating select COCs in hotspot areas. Potential delivery challenges due to high degree of heterogeneity. Personnel and equipment are generally available for implementation; however, specialized design work is required.	High	No
Thermal Desorption – Soil	Thermal desorption involves heating soils (in-situ or ex-situ) to temperatures sufficient to cause constituents to desorb from the soil. The desorbed hydrocarbons are then usually treated in a secondary treatment unit (e.g., an afterburner, catalytic oxidation changer, condenser, or carbon adsorption unit) prior to discharge to the atmosphere.	*Effective for impacted soil* Thermal desorption has proven effective in reducing concentrations of petroleum products including gasoline and diesel fuel. There is a very rapid treatment time and can be used to mitigate hot spot source areas with high concentrations of petroleum hydrocarbons. Excavation of soils is required and generally limited to 25 feet below land surface. Soils excavated from below the groundwater table require dewatering prior to treatment because of high moisture content.	*Difficult* Personnel and equipment are generally available for implementation; however, specialized design work is required. Secondary treatment would also be needed before discharge to the atmosphere. The thermal desorption and secondary treatment equipment installation may require extensive permitting.	High	No

TABLE 5
SCREENING OF CORRECTIVE ACTION TECHNOLOGIES
SECTION BR11-1 FUEL DISTRIBUTION SYSTEM
Riley Avenue, Presidio of San Francisco, California

Technology	Description	Effectiveness	Implementability	Relative Cost	Retain for Detailed Evaluation?
Excavation/Disposal (Area Southwest of Building 127B) - Soil	Excavation represents the physical removal and off-site disposal of the impacted soil. This remedial action eliminates the source of any groundwater contamination from the constituents currently present in the soil.	*Effective for removing impacted soil* Excavation has been proven effective to address TPH impacts to soil. This technology is effective in both the short- and long-terms.	*Moderate to Implement* Excavation of remaining impacted soil at the Site can be accomplished, while personnel and equipment are generally available.	High (based on identified site constrains and location of remaining soil impacts)	Yes
Soil Vapor Extraction (SVE) – Soil and Soil Vapor	SVE involves applying a vacuum (negative pressure) that induces subsurface vapor flow through soil in the vadose zone to reduce the mass of contaminants in soil. The induced negative pressure volatilizes COCs adsorbed to soil particles. The COCs are then carried with the induced subsurface flow and treated above ground using a treatment system (e.g., granulated activated carbon, thermal oxidation).	*Not effective for removing denser hydrocarbons such a diesel and motor oil range compounds in tight soil conditions present at the Site* SVE would not be effective for the treatment of the heavier hydrocarbon–impacted soil at the Site.	*Easy to Moderate to Implement* Personnel and equipment are generally available for implementation; however, specialized design work is required. Implementation of SVE for the small areas identified with remaining soil impacts would not result in a favorable cost/benefit ratio when compared to the excavation approach.	Moderate	No
Vapor Barrier – Soil Vapor	A vapor barrier involves the use of high density polyethylene (HDPE) sheets or sprayed-applied asphaltic emulsions placed beneath new building foundations. The applied vapor barrier prevents vapors from entering the building by sealing typical soil vapor pathways such as expansion joints, slab cracks, and utility penetrations.	*Effective in controlling vapor intrusion into buildings* Although effective on its own over both the short-and long-term for the control of minor soil vapor impacts, the vapor barrier would be used in combination with a sub-slab depressurization system for additional protection.	*Easy to Implement* Personnel and equipment are generally available for implementation; however, specialized design work is required.	Low to Moderate (retrofit)	Yes

TABLE 5
SCREENING OF CORRECTIVE ACTION TECHNOLOGIES
SECTION BR11-1 FUEL DISTRIBUTION SYSTEM
Riley Avenue, Presidio of San Francisco, California

Technology	Description	Effectiveness	Implementability	Relative Cost	Retain for Detailed Evaluation?
Sub-Slab Depressurization (SSD) – Soil Vapor	SSD involves the installation of vapor collection piping underneath a building to create negative pressure and extract accumulated soil vapors beneath the building foundations. Extracted soil vapors are vented to the atmosphere. Depending on extracted concentrations, extracted soil vapors might require pre-treatment prior to discharge to atmosphere.	*Effective in controlling vapor intrusion into buildings* Although effective on its own for the control of minor soil vapor impacts, the use of a SSD system is typically used in combination with a vapor barrier for additional protection. A SSD is an effective mitigation measure in the long term, as the negative pressures induced by the system create a convective flow of air upward through the system to draw air from beneath the slab and vent it to the outdoors.	*Easy to Implement* Personnel and equipment are generally available for implementation; however, specialized design work is required.	Moderate to High (retrofit)	Yes
Institutional Controls (ICs) and Long-Term Site Management – Groundwater, Soil, and Soil Vapor	ICs and long-term site management are administrative and legal restrictions implemented and/or imposed on the property to minimize the human exposure to contamination and protect the integrity and stability of the remedy. ICs might include deed restrictions on the use of the soil and groundwater, scheduled inspections of the remedy, site management plans, Codes, Covenants and Restrictions (CCRs) as a legal document that remains in place with the property, and review of compliance with any covenant restricting the use of the property, among others.	*Effective* ICs are a supplement to engineering controls to facilitate short- and long-term management of risk by preventing and limiting exposure to COCs. Enforcement of ICs is effective at the site until such time the site is deemed as requiring no further action.	*Easy to Implement* Personnel and equipment are generally available for implementation. ICs are currently being implemented at the Site in the form of lease agreements prohibiting tenants from undertaking ground disturbing activities and the Dig Permit project review process.	Low to Moderate	Yes

<u>Abbreviations</u>
CCRs = codes, covenants, and restrictions
COC = contaminant of concern
Dhc = Dehalococcoides
F.E. Pit = front end alignment pit
GWET = groundwater extraction and treatment
HDPE = high density polyethylene
ICs = institutional controls
ISCO = in-situ chemical oxidation
MNA = monitored natural attenuation
NPDES = National Pollutant Discharge Elimination System
PCE = tetrachloroethene
POTW = publicly owned treatment works
SSD = sub-slab depressurization
SVE = soil vapor extraction
TBA = tertiary butyl alcohol
TCE = trichloroethylene
TPH = total petroleum hydrocarbons
VOC = volatile organic compounds
ZVI = zero valent iron

TABLE 6
EVALUATION OF REMEDIAL ALTERNATIVES
SECTION BR11-1 FUEL DISTRIBUTION SYSTEM
Riley Avenue, Presidio of San Francisco, California

	Feasibility Evaluation Criteria								
	Overall Protection of Human Health and Environment (Corrective Action Objectives)		**Effectiveness**			**Implementability**	**Costs**	**Sustainability**
			Short-Term Effectiveness	**Long-Term Effectiveness and Permanence**	**Reduction in Toxicity, Mobility, and Volume**			
Corrective Action Alternative	**Mitigate Vapor Intrusion Risk to Future Site Occupants and Maintenance Workers**	**Mitigate Potential Exposure to Impacted Soil to Future Construction and Maintenance Workers**	**Risk Associated with Alternative Implementation and Risk Reduction in Short Term due to Alternative Implementation**	**Reduction of COCs or Mitigation of Health Risks to Reduce Long-Term Reliance on O&M**	**COC Distribution and Concentration**	**Technical Feasibility, Engineering Services, Materials, Approvals, and Permits**	**Estimated Capital Costs**	**Water Conservation, Energy Saving, Waste and GHG Minimization, Local Economy Boost, and Stakeholder Satisfaction**
Alternative 1 No Action	**No** No action is taken to remediate or mitigate vapor concentrations from impacted soil at the site.	**No** No action is taken to reduce potential risk of exposure to impacted soil at the site.	Alternative 1 implementation poses a high risk associated with maintaining soil as soil vapor conditions as is. Alternative 1 does not actively reduce soil or soil vapor impacts at the Site.	Alternative 1 does not reduce the extent and concentrations of COCs at the site, and does not provide mitigation against possible vapor intrusion concerns.	Alternative 1 does not effectively reduce or eliminate the presence of soil or soil vapor impacts at the site.	The No Action Alternative is not anticipated to be an acceptable remedy by the lead regulatory agency.	Negligible	***Not Sustainable****:* No Action alternative minimizes waste and GHG generation.Loss of revenue will be incurred from vacant properties (no action alternative will not allow leasing of the building due to environmental concerns).
Alternative 2 Vapor barrier and sub-slab depressurization, plus capping, long-term site management, groundwater monitoring, and institutional controls	**Yes** A vapor barrier and SSD will effectively mitigate intrusion of impacted vapor to basement of 127B. The SSD creates a negative pressure, venting impacted vapors to the atmosphere. Monitoring will be used to determine the effectiveness of the corrective action. Long-term vapor and groundwater monitoring will occur to assure effective implementation of the alternative.	**Yes** Capping in the form of a new concrete slab in the basement of 127B, existing concrete slab in 127A and 128B, and exterior existing 2-foot clean soil and hardscape will mitigate the exposure to impacted soil. A SMP and ICs will be implemented to provide health and safety guidance during subsurface intrusive activities.	Alternative 2 implementation poses relatively low risks associated with subsurface work at the site. Alternative 2 does actively mitigate vapor intrusion but does not remove COCs from impacted soil.	Alternative 2 provides long term protection against vapor intrusion, and protects against the direct exposure to impacted soil through capping and ICs. A minimum of five years of groundwater monitoring will provide assurance that localized impacts to groundwater are not an environmental concern.	Alternative 2 does not reduce or eliminate the presence of impacted soil at the site, but does mitigate exposure risk through soil vapor intrusion or groundwater migration.	Materials and engineering services are readily available. Regulatory approvals and building permits for implementation of the proposed remedial alternative are expected to be readily obtainable. Services to implement institutional controls are expected to be readily obtainable. Similar LUC/LUN controls are established throughout the Presidio in areas with residual soil impacts.	$1,106,000	***Sustainable****:* Requires long-term monitoring involving travel to the site, which produces greenhouse gas emissions as well as waste from sampling activities. Installation of the vapor barrier is material- and equipment- intensive and will produce GHG emissions in the short term.

TABLE 6
EVALUATION OF REMEDIAL ALTERNATIVES
SECTION BR11-1 FUEL DISTRIBUTION SYSTEM
Riley Avenue, Presidio of San Francisco, California

	Feasibility Evaluation Criteria							
	Overall Protection of Human Health and Environment (Corrective Action Objectives)		Effectiveness			Implementability	Costs	Sustainability
			Short-Term Effectiveness	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume			
Corrective Action Alternative	**Mitigate Vapor Intrusion Risk to Future Site Occupants and Maintenance Workers**	**Mitigate Potential Exposure to Impacted Soil to Future Construction and Maintenance Workers**	**Risk Associated with Alternative Implementation and Risk Reduction in Short Term due to Alternative Implementation**	**Reduction of COCs or Mitigation of Health Risks to Reduce Long-Term Reliance on O&M**	**COC Distribution and Concentration**	**Technical Feasibility,Engineering Services,Materials, Approvals,and Permits**	**Estimated Capital Costs**	**Water Conservation, Energy Saving, Waste and GHG Minimization, Local Economy Boost, and Stakeholder Satisfaction**
Alternative 3 Vapor barrier and sub-slab depressurization, plus soil excavation/disposal, capping, long-term site management, groundwater monitoring, and institutional controls	**Yes** A vapor barrier and SSD will effectively mitigate intrusion of impacted vapor to basement of 127B. The SSD creates a negative pressure, venting impacted vapors to the atmosphere. Monitoring will be used to determine the effectiveness of the corrective action. Long-term vapor and groundwater monitoring will occur to assure effective implementation of the alternative.	**Yes** Excavation of impacted soil to the southeast of 127B, new concrete slab in the basement of 127B, existing concrete slab in 127A and 128B will reduce the risk of exposure to impacted soil. A SMP and ICs will be implemented to provide health and safety guidance during subsurface intrusive activities.	Alternative 3 implementation poses increased short-term risks associated with the excavation, loading and transportation offsite of impacted soils. Alternative 3 actively reduces the volume of soil impacts, partially mitigates vapor intrusion, and reduces potential future impacts to groundwater.	Alternative 3 provides long term protection against vapor intrusion and long term protection against impacted soil. Groundwater monitoring will be performed to document that risks associated with groundwater are nominal.	Alternative 3 effectively reduces the volume of soil impacts and mitigates soil vapor intrusion. Groundwater monitoring documents that the small plume is stable or declining in size.	Materials and engineering services are readily available. Regulatory approvals, building, and excavation permits for implementation of the proposed remedial alternative are expected to be readily obtainable. Services to implement institutional controls are expected to be readily obtainable. LUC/LUN controls are established throughout the Presidio in areas with residual soil impacts.	$1,664,300	***Sustainable**:* Relatively limited excavation will generate soil that will require disposal off site. Requires long-term monitoring involving travel to the site, which produces greenhouse gas emissions as well as waste from sampling activities. Installation of the vapor barrier is material- and equipment- intensive and will produce GHG emissions in the short term.

Abbreviations

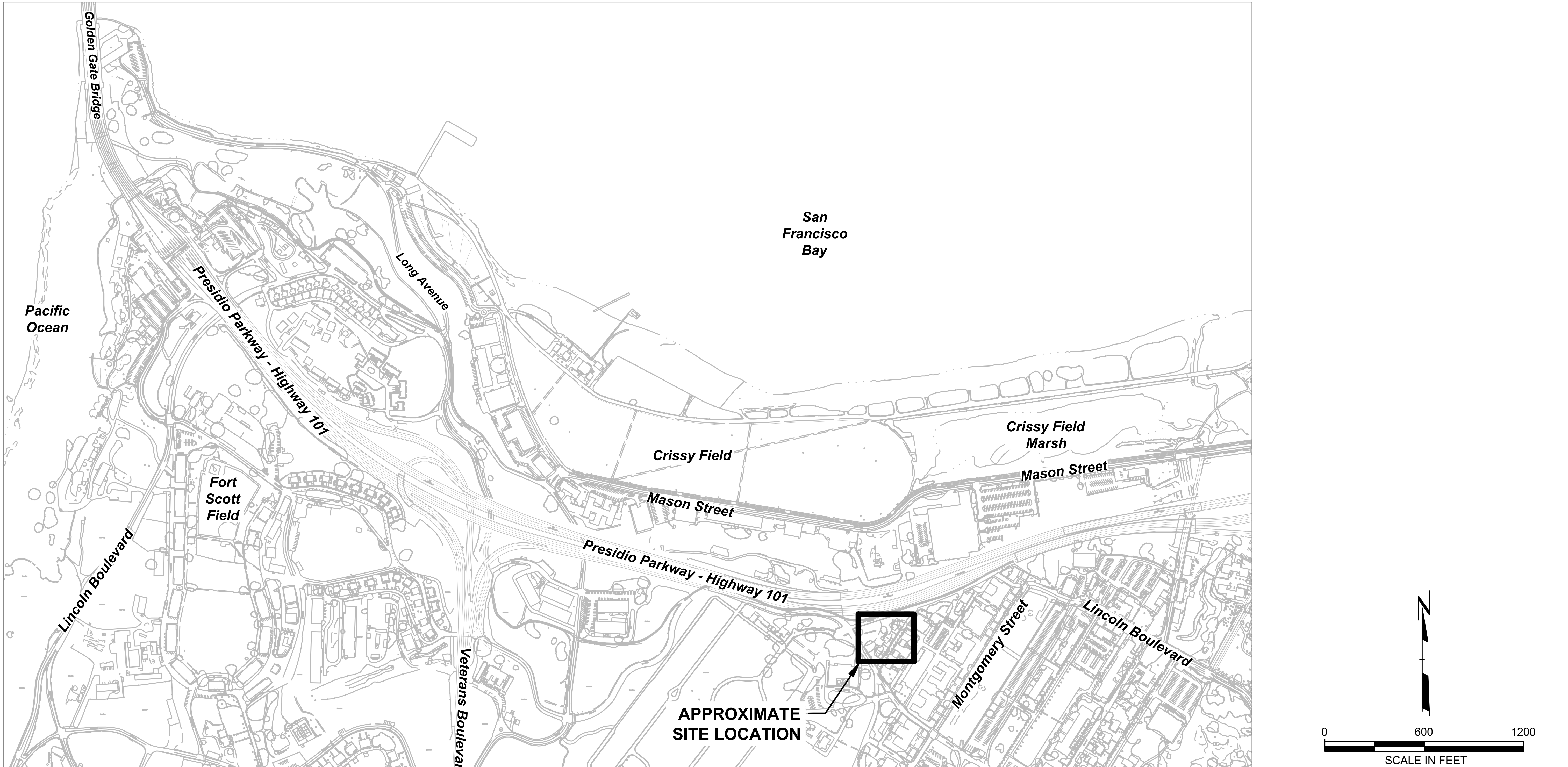
COC = constituent of concern

IC = institutional control

SMP = site management plan

SSD = sub-slab depressurization

Figures

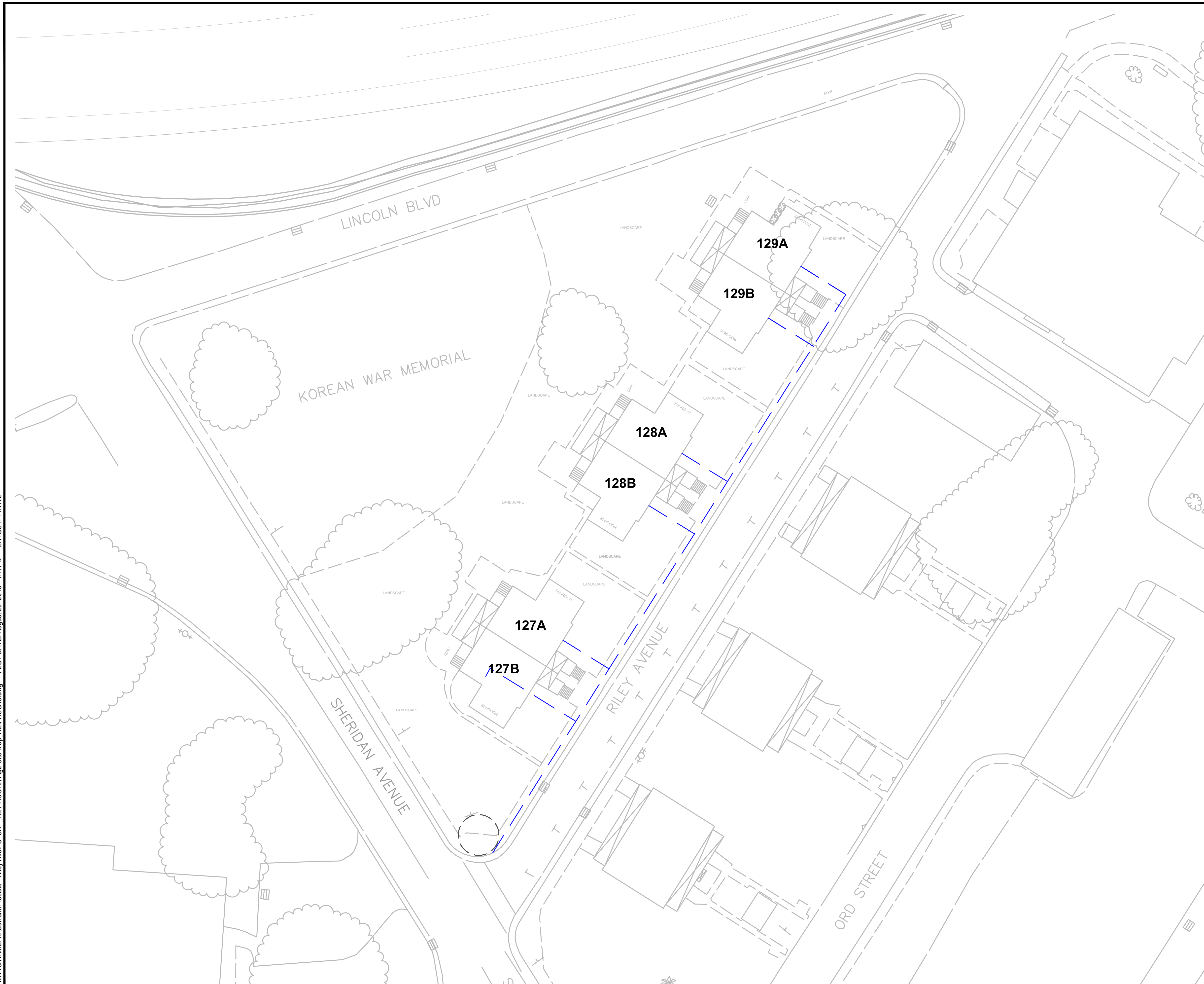


SOURCE: Base map by Towill, Oct.- Nov. 2015, Apr. 2016, May 2017, and Jan. 2018

PROJECT: THE PRESIDIO TRUST BR11-1 FUEL DISTRIBUTION SYSTEM RILEY AVENUE, SAN FRANCISCO, CALIFORNIA			
TITLE: VICINITY MAP			
DRAWN BY:	K. LI	PROJ NO.:	285830.00001A.TASK07
CHECKED BY:	A. ANG	FIGURE 1	
APPROVED BY:	A. ANG		
DATE:	AUGUST 2019		
TRC		505 Sansome Street Suite 1600 San Francisco, CA 94111 Phone: 415.434.2600	
FILE NO.:		Fig1 Vicinity Map_REV AUG19.dwg	

11x17 --- USER: KLi --- ATTACHED XREF'S: MASTER Presidio_Planimetrics_New Doyle Alignment --- ATTACHED IMAGES:
DRAWING NAME: X:\Current\Presidio - Riley Ave\FS_CAP_REV AUG19\ Fig1 Vicinity Map_REV AUG19.dwg --- PLOT DATE: August 29, 2019 - 6:46PM --- LAYOUT: 11X17L

Version: 2017-10-21



LEGEND

FORMER BR11-1 FDS LINE

RESIDENTIAL UNITS

LOCATION OF HISTORIC UNDERGROUND FUEL TANK PSF-127 (REMOVED 1978 - WES, 1990; MW, 1992)

NOTES

1. REFERENCES
   - 1.1. US ARMY ENGINEERS WATERWAYS EXPERIMENT STATION (WES), 1990. PHASE II PRELIMINARY ASSESSMENT UST DATA SHEETS, UST LOCATIONS AND STATUS ASSESSMENT UST/FDS 162. MARCH 1990.
   - 1.2. MONTGOMERY WATSON (MW), 1992. UST MANAGEMENT PLAN.

0 40 80

SCALE IN FEET

SOURCE: Base map by Towill, Oct.- Nov. 2015, Apr. 2016, May 2017, and Jan. 2018

PROJECT:	**THE PRESIDIO TRUST** **BR11-1 FUEL DISTRIBUTION SYSTEM** **RILEY AVENUE, SAN FRANCISCO, CALIFORNIA**
TITLE:	**SITE MAP**
DRAWN BY: K. LI	PROJ NO.: 285830.00001A.TASK07
CHECKED BY: A. ANG	**FIGURE 2**
APPROVED BY: A. ANG	
DATE: AUGUST 2019	
FILE NO.:	Fig2 Site Map_REV AUG19.dwg

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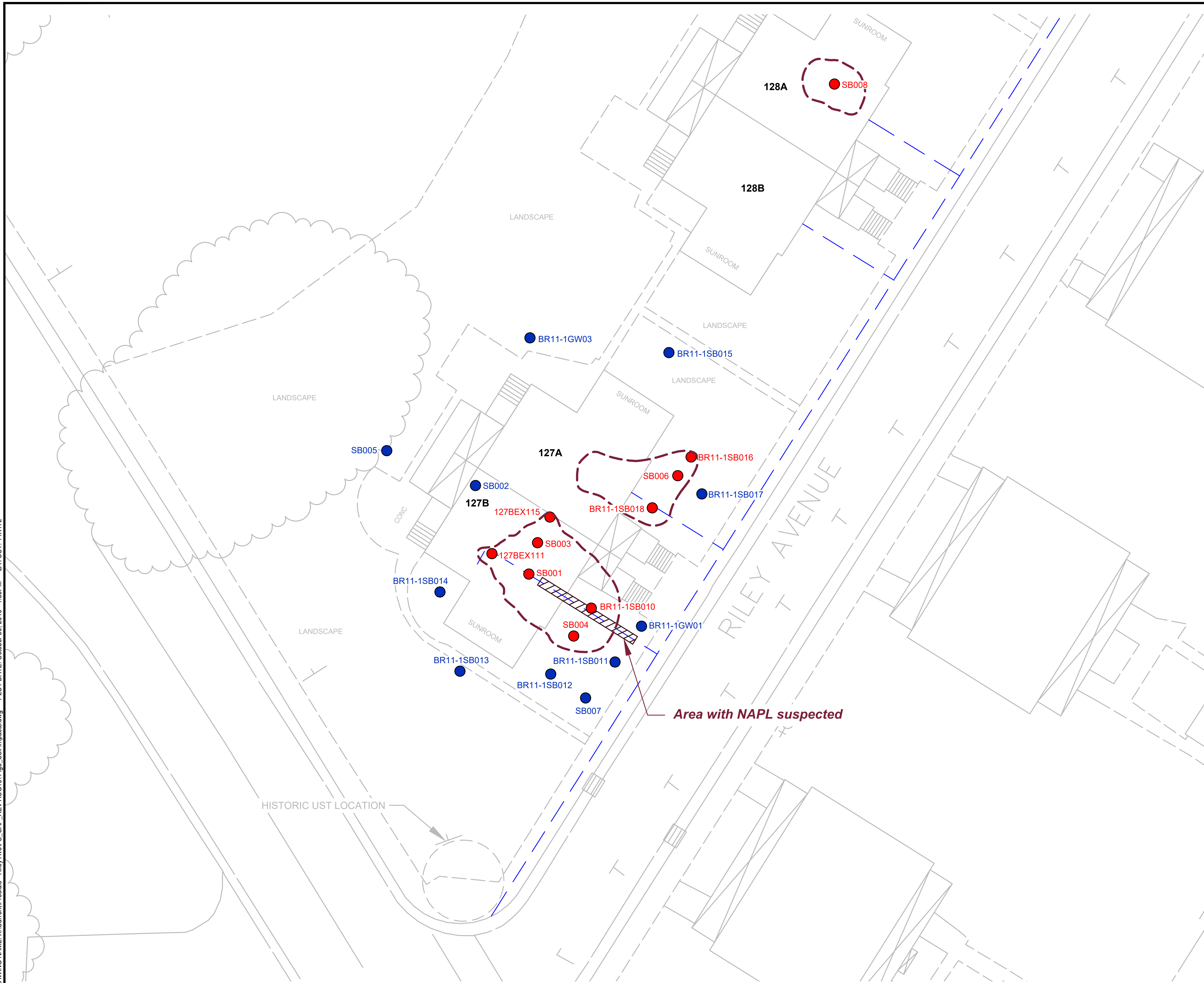
11x17 --- USER: KLI --- ATTACHED XREFS: MASTER Presidio, Planimetrics, New Doyle Alignment --- ATTACHED IMAGES:
DRAWING NAME: X:\Current\Presidio - Riley Ave\FS_CAP_REV AUG19\Fig2 Site Map_REV AUG19.dwg --- PLOT DATE: August 29, 2019 - 4:17PM --- LAYOUT: 11X17L
Version: 2017-10-21



LEGEND

FORMER BR11-1 FDS LINE

NON-IMPACTED SOIL SAMPLE

IMPACTED SOIL SAMPLE (ABOVE ESLs)

APPROXIMATE EXTENT OF TPH-d SOIL IMPACTS ABOVE SCREENING LEVEL (260 mg/kg)

NOTES

COC	CONTAMINANT OF CONCERN
ESL	ENVIRONMENTAL SCREENING LEVEL
FDS	FUEL DISTRIBUTION SYSTEM
mg/kg	MILLIGRAMS PER KILOGRAM
NAPL	NON-AQUEOUS PHASE LIQUIDS
TPH-D	TOTAL PETROLEUM HYDROCARBONS AS DIESEL
TPH-G	TOTAL PETROLEUM HYDROCARBONS AS GASOLINE

SOIL SCREENING VALUES*

SITE COC	ESL (mg/kg)
TPH-g	100
TPH-d	260
NAPTHALENE	0.042

* SCREENING VALUES BASED ON TIER 1 ESLs FROM THE REGIONAL WATER QUALITY CONTROL BOARD'S 2019 (REV. 2) SUMMARY TABLE OF ESLs.

IMPACTED MEDIA BASED ON INVESTIGATIVE ANALYTICAL RESULTS PRESENTED IN THE 2019 REVISED SUPPLEMENTAL SITE INVESTIGATION REPORT.

N

0 20 40

SCALE IN FEET

PROJECT:

THE PRESIDIO TRUST
BR11-1 FUEL DISTRIBUTION SYSTEM
RILEY AVENUE, SAN FRANCISCO, CALIFORNIA

TITLE:

SOIL IMPACTS

DRAWN BY:	KQ	PROJ NO.:	285830.00001A.TASK07
CHECKED BY:	L. SHANNON		**FIGURE 3**
APPROVED BY:	L. SHANNON		
DATE:	AUGUST 2019		

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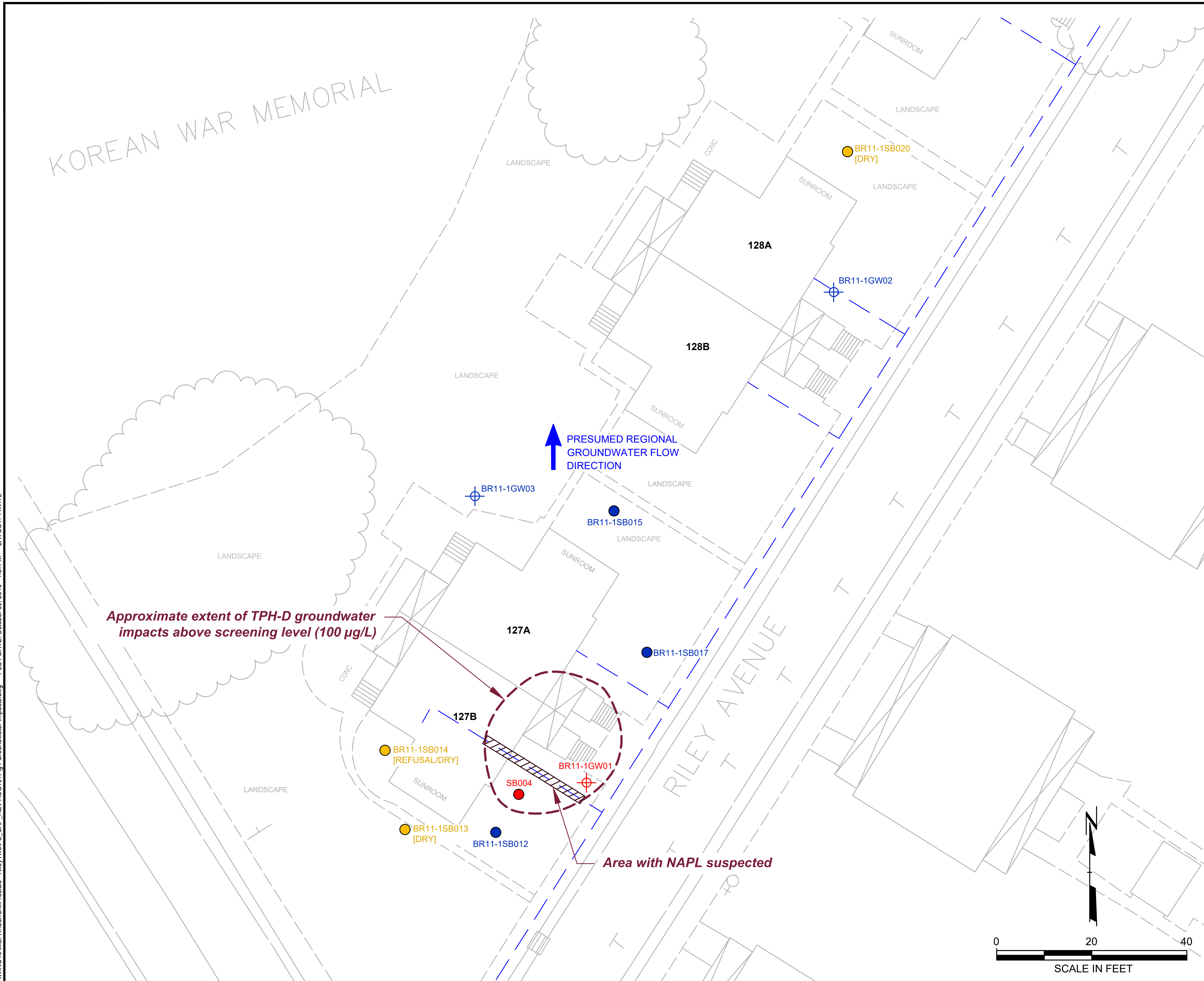
Phone: 415.434.2600

FILE NO.: Fig3_Soil Impacts.dwg

11x17 --- USER: KLi --- ATTACHED XREF'S: MASTER Presidio_Planimetrics_New Doyle Alignment; MASTER PRESIDIO BASEMAP --- ATTACHED IMAGES:
DRAWING NAME: X:\Current\Presidio - Riley Ave\FS_CAP_REV AUG19\ Fig3_Soil Impacts.dwg --- PLOT DATE: October 30, 2019 - 1:55PM --- LAYOUT: 11X17L

Version: 2017-10-21



LEGEND

FORMER BR11-1 FDS LINE

RESIDENTIAL UNITS

IMPACTED (ABOVE ESLs) GROUNDWATER SAMPLE - MONITORING WELL

IMPACTED (ABOVE ESLs) GROUNDWATER SAMPLE - BORING LOCATION

NON-IMPACTED GROUNDWATER SAMPLE - MONITORING WELL

NON-IMPACTED GROUNDWATER SAMPLE - BORING LOCATION

DRY BORING

NOTES

COC CONTAMINANT OF CONCERN
ESL ENVIRONMENTAL SCREENING LEVEL
FDS FUEL DISTRIBUTION SYSTEM
µg/L MICROGRAMS PER LITER
NAPL NON-AQUEOUS PHASE LIQUIDS
TPH-D TOTAL PETROLEUM HYDROCARBONS AS DIESEL
TPH-G TOTAL PETROLEUM HYDROCARBONS AS GASOLINE

GROUNDWATER SCREENING VALUES*

SITE COC	ESL (µg/L)
TPH-g	100
TPH-d	100
NAPTHALENE	0.17

* SCREENING VALUES BASED ON TIER 1 ESLs FROM THE REGIONAL WATER QUALITY CONTROL BOARD'S 2019 (REV. 2) SUMMARY TABLE OF ESLs.

IMPACTED MEDIA BASED ON INVESTIGATIVE ANALYTICAL RESULTS PRESENTED IN THE 2019 REVISED SUPPLEMENTAL SITE INVESTIGATION REPORT.

PROJECT:
THE PRESIDIO TRUST
BR11-1 FUEL DISTRIBUTION SYSTEM
RILEY AVENUE, SAN FRANCISCO, CALIFORNIA

TITLE:
GROUNDWATER IMPACTS

DRAWN BY:	KQ	PROJ NO.:	285830.00001A.TASK07
CHECKED BY:	L. SHANNON		**FIGURE 4**
APPROVED BY:	L. SHANNON		
DATE:	AUGUST 2019		

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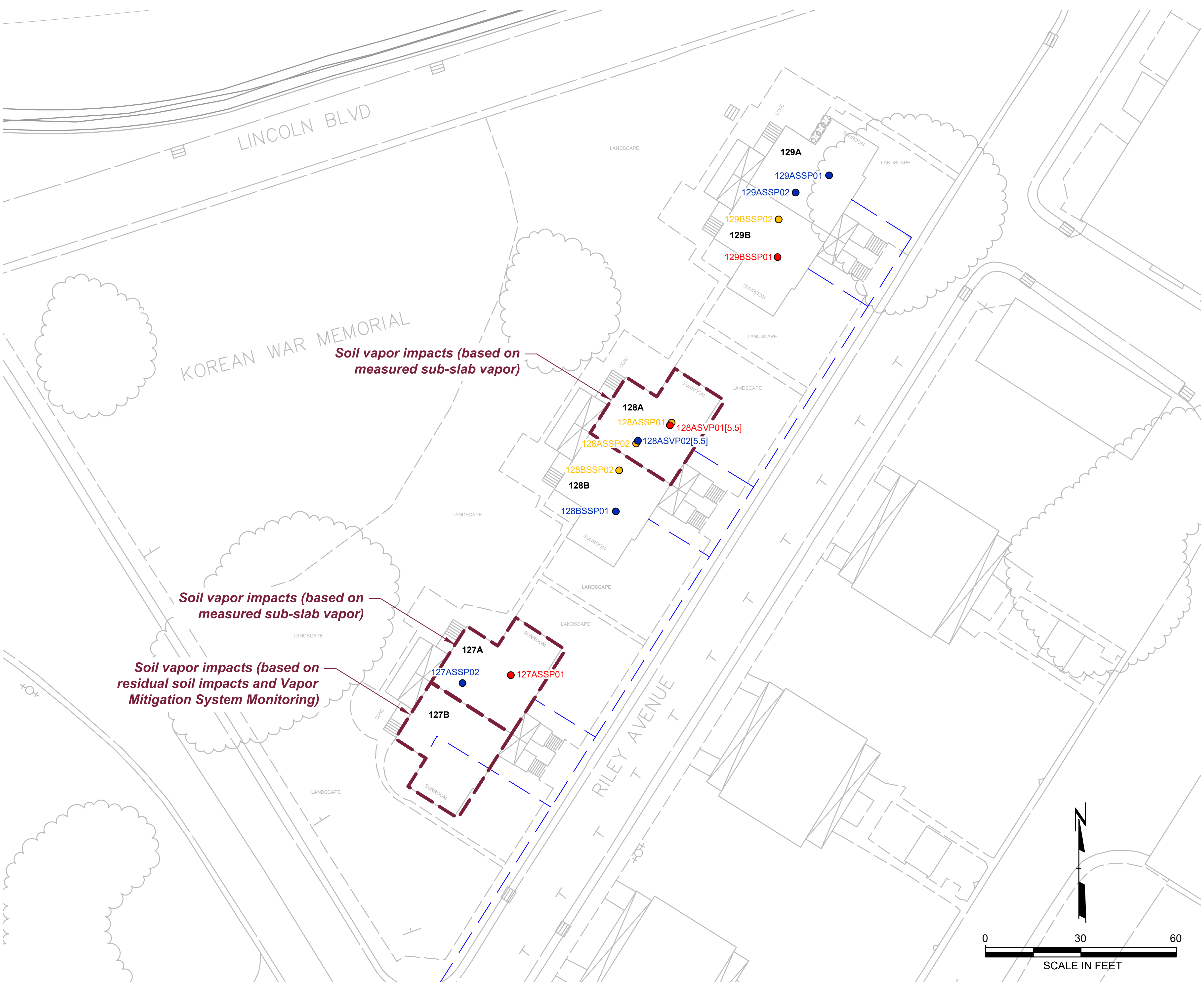
FILE NO.: Fig4 Groundwater Impacts.dwg

DRAWING NAME: X:\Current\Presidio - Riley Ave\FS_CAP_REV AUG19\ Fig4 Groundwater Impacts.dwg --- PLOT DATE: October 30, 2019 - 1:57PM --- LAYOUT: 11X17L

Version: 2017-10-21



LEGEND

- FORMER BR11-1 FDS LINE
- RESIDENTIAL UNITS
- IMPACTED (ABOVE ESLs) SOIL VAPOR LOCATION
- NON-IMPACTED SOIL VAPOR LOCATION
- NO SAMPLE DUE TO HIGH APPLIED VACUUM
- NO SAMPLE DUE TO SATURATION

NOTES

COC CONTAMINANT OF CONCERN
ESL ENVIRONMENTAL SCREENING LEVEL
FDS FUEL DISTRIBUTION SYSTEM
μg/m³ MICROGRAMS PER CUBIC METER
TPH-D TOTAL PETROLEUM HYDROCARBONS AS DIESEL
TPH-G TOTAL PETROLEUM HYDROCARBONS AS GASOLINE

SOIL VAPOR SCREENING VALUES*

SITE COC	ESL (μg/m³)
TPH-g	3,333
TPH-d	8,900
BENZENE	3.2

* SCREENING VALUES BASED ON TIER 1 ESLs FROM THE REGIONAL WATER QUALITY CONTROL BOARD'S 2019 (REV. 2) SUMMARY TABLE OF ESLs.

IMPACTED MEDIA BASED ON INVESTIGATIVE ANALYTICAL RESULTS PRESENTED IN THE 2019 REVISED SUPPLEMENTAL SITE INVESTIGATION REPORT.

PROJECT:
THE PRESIDIO TRUST
BR11-1 FUEL DISTRIBUTION SYSTEM
RILEY AVENUE, SAN FRANCISCO, CALIFORNIA

TITLE:
SOIL VAPOR IMPACTS

DRAWN BY:	KQ	PROJ NO.:	285830.00001A.TASK07
CHECKED BY:	L. SHANNON		**FIGURE 5**
APPROVED BY:	L. SHANNON		
DATE:	DECEMBER 2019		

TRC
505 Sansome Street
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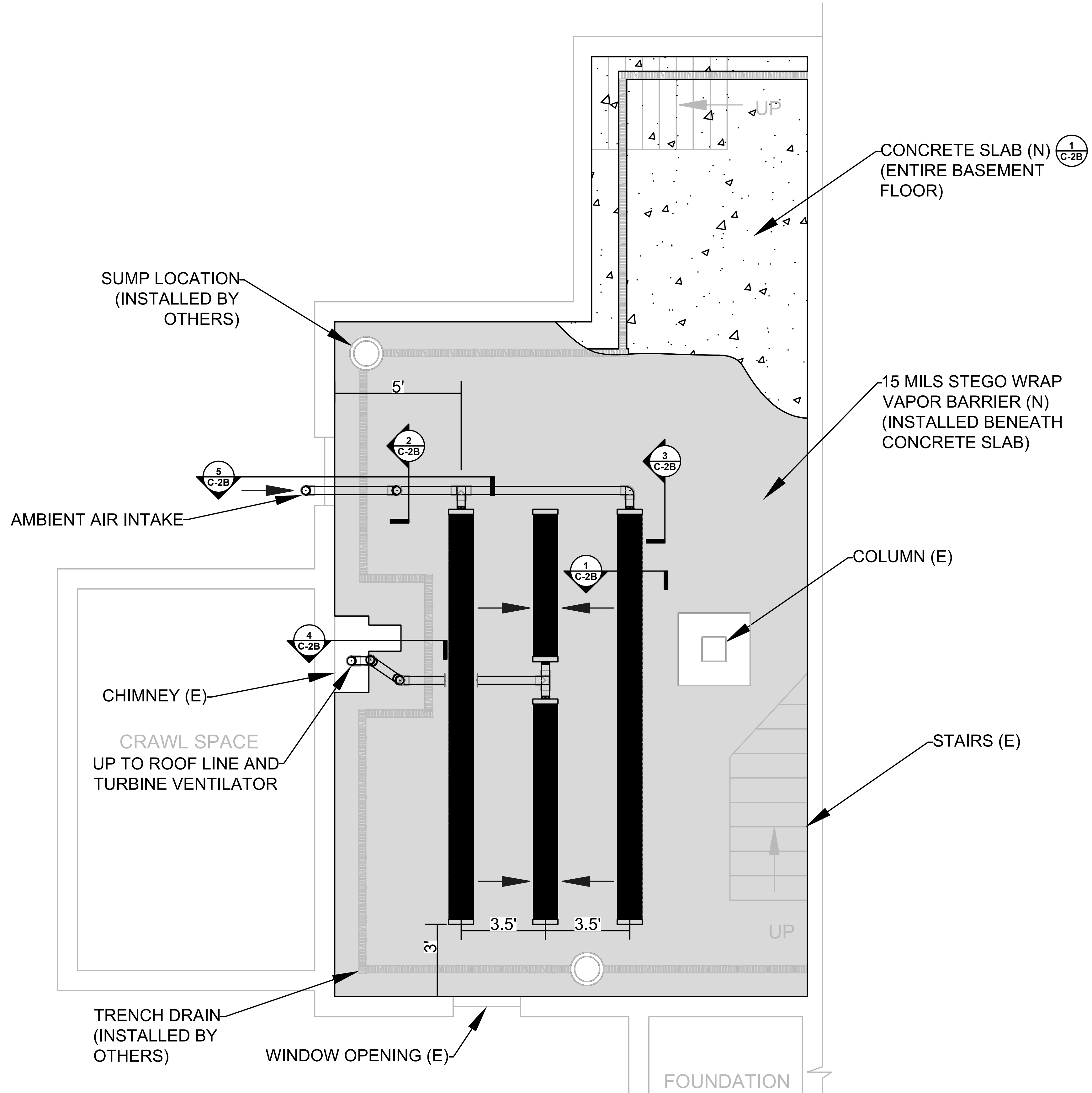
San Francisco, CA 94111
Phone: 415.434.2600

FILE NO.: Fig5_Soil Vapor Impacts_REV DEC19.dwg

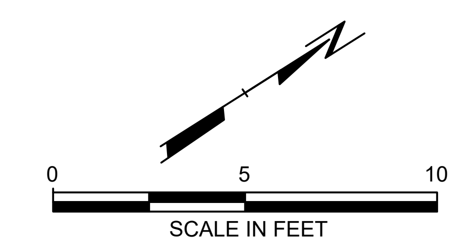
DRAWING NAME: X:\Current\Presidio - Riley Ave\FS_CAP_REV AUG19\Fig5_Soil Vapor Impacts_REV DEC19.dwg --- PLOT DATE: December 26, 2019 - 2:36PM --- LAYOUT: 11X17L
Version: 2017-10-21



BUILDING 127B - BASEMENT

LEGEND

- SUB-SLAB VAPOR VENT PIPING
- STEGO SOIL VAPOR BARRIER
- AIR FLOW



PROJECT: THE PRESIDIO TRUST BR11-1 FUEL DISTRIBUTION SYSTEM RILEY AVENUE, SAN FRANCISCO, CALIFORNIA	
TITLE: 127B SUB-SLAB VENTING SYSTEM PLAN	
DRAWN BY: K. LI	PROJ NO.: 285830.00001A.TASK07
CHECKED BY: A. ANG	FIGURE 6A
APPROVED BY: A. ANG	
DATE: MAY 2019	

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Suite 1600
San Francisco, CA 94111
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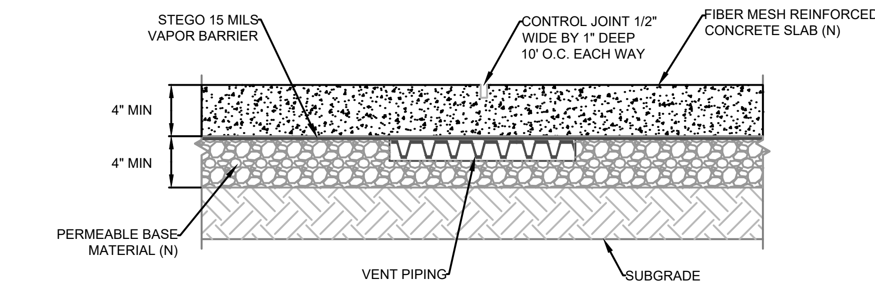
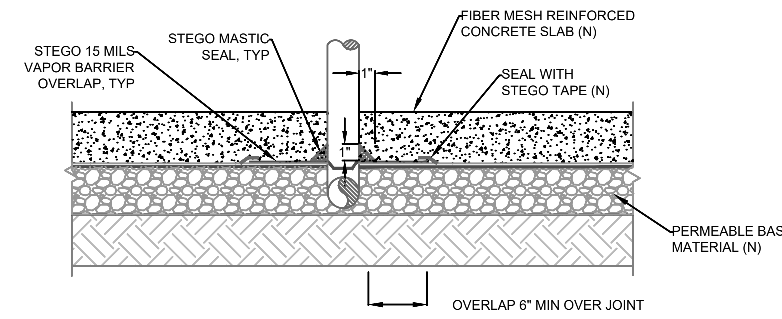
FILE NO.: Fig6A 127B Sub-Slab Venting System Plan_REV AUG19.dwg



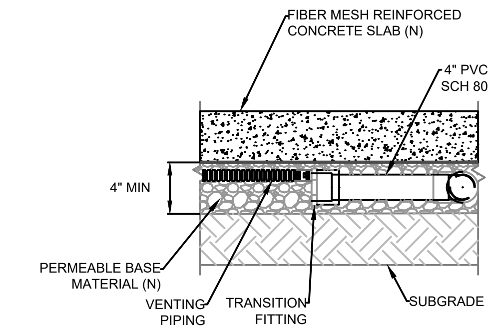
1 C-2A **TYPICAL VENT PIPE AND CONCRETE SLAB**

(NOT TO SCALE)



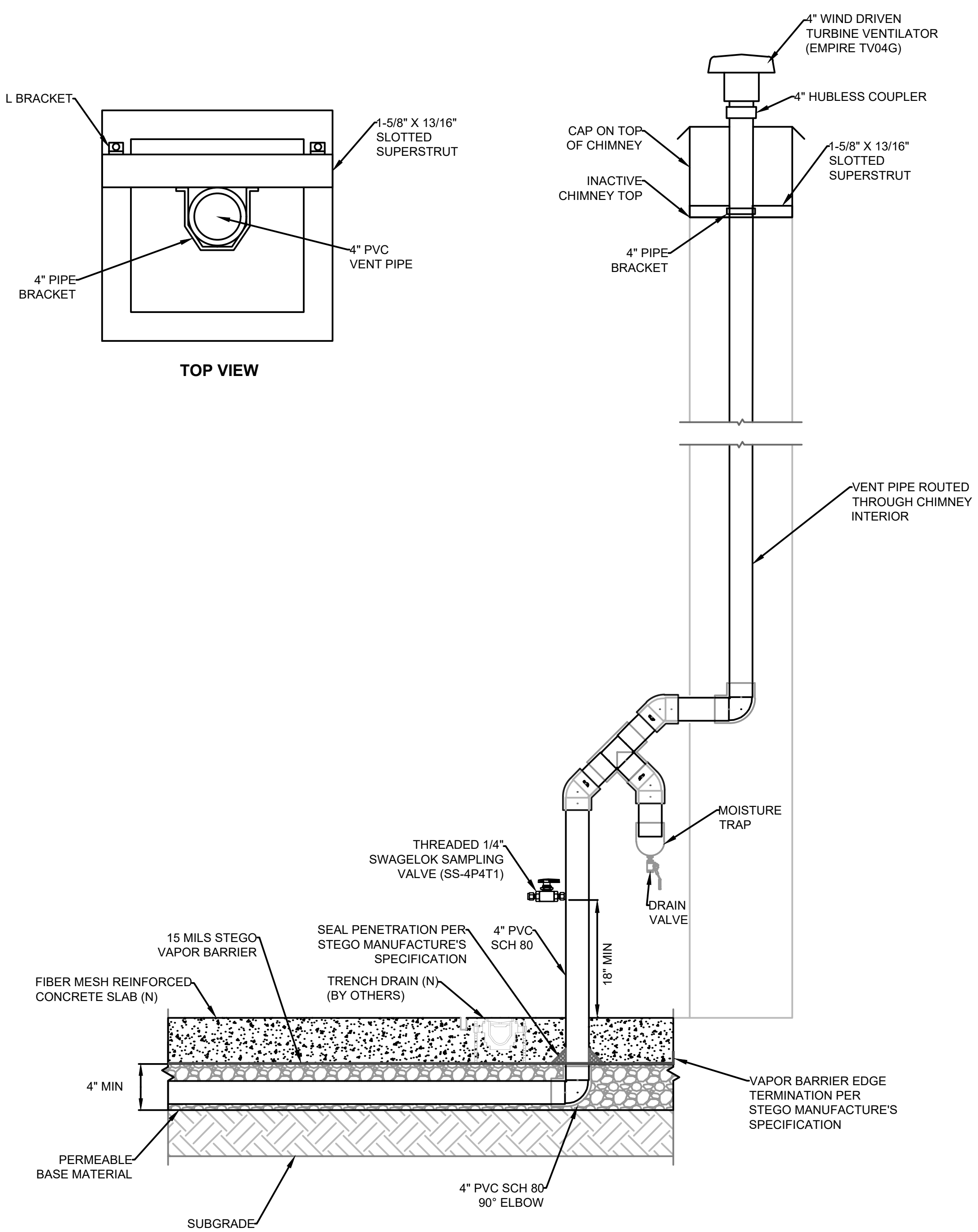
2 C-2A **TYPICAL VENT PIPE SLAB PENETRATION**

(NOT TO SCALE)



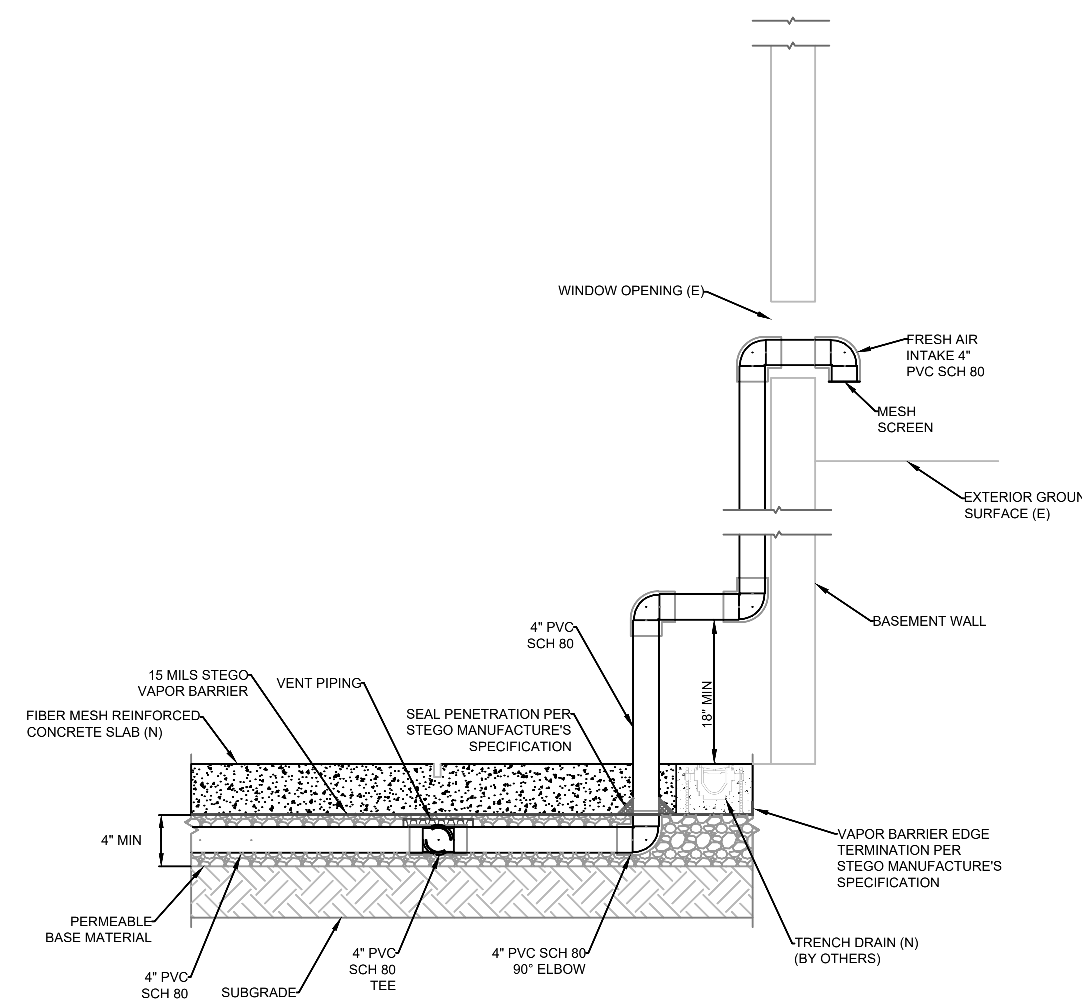
3 C-2A **SUB-SLAB PIPING TRANSITION**

(NOT TO SCALE)



4 C-2A **VENT PIPING**

(NOT TO SCALE)



5 C-2A **AIR INTAKE PIPING**

(NOT TO SCALE)

PROJECT:

THE PRESIDIO TRUST
BR11-1 FUEL DISTRIBUTION SYSTEM
RILEY AVENUE, SAN FRANCISCO, CALIFORNIA

TITLE:

127B SUB-SLAB VENTING SYSTEM DETAILS

DRAWN BY:	K. LI	PROJ NO.:	285830.00001A.TASK07
CHECKED BY:	A. ANG	**FIGURE 6B**	
APPROVED BY:	A. ANG		
DATE:	MAY 2019		

TRC

505 Sansome Street
Suite 1600
San Francisco, CA 94111
Phone: 415.434.2600

FILE NO.: Fig6B 127B Sub-Slab Venting System Details_REV AUG19.dwg

LEGEND

- FORMER BR11-1 FDS LINE
- RESIDENTIAL UNITS BOUNDARY
- HARDSCAPE AREA
- NON-IMPACTED SOIL COVER AREA (2 FT. MINIMUM DEPTH)
- LAND USE CONTROL BOUNDARY

NOTES

1. THE 2-FT. MINIMUM DEPTH FOR NON-IMPACTED SOIL COVER CONFIRMED VIA SOIL BORING LOGS FROM LOCATIONS ACROSS THE SITE AND WAS DOCUMENTED IN THE 2019 SUPPLEMENTAL SITE INVESTIGATION REPORT.

PROJECT:

THE PRESIDIO TRUST
BR11-1 FUEL DISTRIBUTION SYSTEM
RILEY AVENUE, SAN FRANCISCO, CALIFORNIA

TITLE:

EXISTING CAPPING

DRAWN BY:	KQ	PROJ NO.:	285830.00001A.TASK07
CHECKED BY:	L. SHANNON		**FIGURE 7**
APPROVED BY:	L. SHANNON		
DATE:	DECEMBER 2019		

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FILE NO.: Fig7_Existing Capping_REV DEC19.dwg

DRAWING NAME: X:\Current\Presidio - Riley Ave\FS_CAP_REV AUG19\Fig7_Existing Capping_REV DEC19.dwg --- PLOT DATE: December 26, 2019 - 5:00PM --- LAYOUT: 11X17L

Version: 2017-10-21

LEGEND

FORMER BR11-1 FDS LINE

IMPACTED SOIL SAMPLE

NON-IMPACTED SOIL SAMPLE

NOTES

EXTENT OF TPH-d SOIL IMPACTS BASED ON INVESTIGATIVE ANALYTICAL RESULTS FOR SOIL SAMPLES (PRESENTED IN THE 2019 REVISED SUPPLEMENTAL SITE INVESTIGATION REPORT).

0 20 40

SCALE IN FEET

PROJECT:

THE PRESIDIO TRUST
BR11-1 FUEL DISTRIBUTION SYSTEM
RILEY AVENUE, SAN FRANCISCO, CALIFORNIA

TITLE:

PROPOSED LUC AND LUN AREAS

DRAWN BY:	KQ	PROJ NO.:	285830.00001A.TASK07
CHECKED BY:	L. SHANNON		FIGURE 8
APPROVED BY:	L. SHANNON		
DATE:	DECEMBER 2019		

TRC

505 Sansome Street
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San Francisco, CA 94111
Phone: 415.434.2600

FILE NO.: Fig8_Proposed LUC LUN Areas_REV DEC19.dwg

DRAWING NAME: X:\Current\Presidio - Riley Ave\FS_CAP_REV AUG19\Fig8_Proposed LUC LUN Areas_REV DEC19.dwg --- PLOT DATE: December 26, 2019 - 2:50PM --- LAYOUT: 11X17L

Version: 2017-10-21

LEGEND

- FORMER BR11-1 FDS LINE
- HARDSCAPE AREA
- NON-IMPACTED SOIL COVER AREA (2 FT. MINIMUM DEPTH)

NOTES

1. THE 2-FT. MINIMUM DEPTH FOR NON-IMPACTED SOIL COVER CONFIRMED VIA SOIL BORING LOGS FROM LOCATIONS ACROSS THE SITE AND WAS DOCUMENTED IN THE 2019 SUPPLEMENTAL SITE INVESTIGATION REPORT.
2. EXTENT OF TPH-d SOIL IMPACTS BASED ON INVESTIGATIVE ANALYTICAL RESULTS FOR SOIL SAMPLES (PRESENTED IN THE 2019 REVISED SUPPLEMENTAL SITE INVESTIGATION REPORT).

0 10 20
SCALE IN FEET

PROJECT:
THE PRESIDIO TRUST
BR11-1 FUEL DISTRIBUTION SYSTEM
RILEY AVENUE, SAN FRANCISCO, CALIFORNIA

TITLE:
PROPOSED "HOT SPOT" SOIL EXCAVATION AREA

DRAWN BY:	KQ	PROJ NO.:	285830.00001A.TASK07
CHECKED BY:	L. SHANNON	FIGURE 9	
APPROVED BY:	L. SHANNON		
DATE:	AUGUST 2019		

TRC
505 Sansome Street
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Phone: 415.434.2600

FILE NO.: Fig9_Proposed Hot Spot Soil Excavation Area.dwg

Version: 2017-10-21

Attachment A
Alternative Corrective Action Cost Summary Tables

Table A-1
Corrective Action Alternatives Cost Comparision
Riley Avenue, Presidio of San Francisco, San Francisco, CA

REMEDIAL COST COMPONENT	***Estimated Cost***
Capital Costs	
1. Vapor Mitigation System - 127B	$ 258,430.00
2. Capping (Existing)	$ -
3. Excavation - 127B Front Yard	$ 558,300.00
O&M Costs	
4. Institutional Controls (70 years)	$ 405,750.00
5. Operation and Maintenance (70 years with 5-years of Groundwater Monitoring)	$ 441,820.00

REMEDIAL ALTERNATIVES	**Total Estimated Costs**		
	Capital	**O&M**	**Total**
Alternative 1 - No Action	**$ -**	**$ -**	**$ -**
Alternative 2 - VMS, Capping, Institutional Controls, and Groundwater Monitoring (5 years)	**$ 258,430.00**	**$ 847,570.00**	**$ 1,106,000.00**
Alternative 3 - VMS, Capping, Institutional Controls, Groundwater Monitoring (5 years), and "Hot Spot" Excavation	**$ 816,730.00**	**$ 847,570.00**	**$ 1,664,300.00**

Abbreviations:

O&M = operation and maintenance
VMS = Vapor Mitigation System
GW = Groundwater

Notes:

1. Costs are for the purpose of feasibility study analysis only and based on engineer cost experience for similar work.
2. All costs are presented in 2019 dollars.

Table A-2
Vapor Mitigation System Cost Summary (Alternative 2 and 3)
Riley Avenue, Presidio of San Francisco, San Francisco, CA

Location	Vapor Mitigation System Components	Unit	Unit Cost	Quantity	Cost	Comments
Building 127B	Bond	LS	$ 2,130.00	1	$ 2,130.00	Assumes 2% of Construction Costs
	Mobilization/Demobilization	LS	$ 2,500.00	1	$ 2,500.00	Estimate
	Gravel Base	LS	$ 13,000.00	1	$ 13,000.00	Contractor Price
	Sub-Slab Venting Piping and Vapor Barrier	LS	$ 25,000.00	1	$ 25,000.00	Contractor Price
	Concrete Slab	LS	$ 36,000.00	1	$ 36,000.00	Contractor Price
	Post-Remediation Confirmation Sampling (indoor and ambient air)	Ea	$ 15,000.00	2	$ 30,000.00	Estimate - indoor and ambient air
	Remedial Action Completion Report	LS	$ 15,000.00	1	$ 15,000.00	
	Business Losses - Rental 127B	Month	$ 5,500.00	6	$ 33,000.00	Estimate - assumes unit 127B remains vacant for a minimum of 6 months months until post confirmation sampling is complete and RWQCB has concurred mitigation is working and no risk to human health is present. Assumes monthly rental of $5,500
				Sub-Total	$ 156,630.00	
				Remedial Design	$ 31,300.00	Assumes 20% of Construction Costs, concept plans prepared
				CM	$ 23,500.00	Assumes 15% of Contruction Costs
				PM	$ 15,700.00	Assumes 10% of Contruction Costs
				Permitting	$ 7,800.00	Assumes 5% of Construction Costs
				Contingency (15%)	$ 23,500.00	15% of Construction Costs
				Total	***$ 258,430.00***	

Abbreviations:

O&M = operation and maintenance
RWQCB = Regional Water Quality Control Board
VMS = Vapor Mitigation System

Notes:

1. Costs are for the purpose of feasibility study analysis only and based on engineer cost experience for similar work.
2. All costs are presented in 2019 dollars.

Table A-3
Soil Capping Cost Summary (Alternative 2 and 3)
Riley Avenue, Presidio of San Francisco, San Francisco, CA

Location	Capping Components	Unit	Unit Cost	Quantity	Cost	Comments
BR11-1	Bond	LS	$ -	1	$ -	Assumes 2% of Construction Costs
	Mob/Demobilization	LS	$ 5,000.00	0	$ -	Estimate
	Hardscape (Concrete)	SF	$ 50.00	0	$ -	ERRG unit price for slab
	Softscape (Landscape)	SF	$ 25.00	0	$ -	Estimate
	Surveying (Final)	LS	$ 4,500.00	0	$ -	Towill Day Rate
				Sub-Total	$ -	
				Remedial Design	$ -	Assumes 15% of Construction Costs, concept plans prepared
				CM	$ -	Assumes 10% of Contruction Costs
				PM	$ -	Assumes 8% of Contruction Costs
				Permitting	$ -	Assumes 5% of Construction Costs
				Contingency (15%)	$ -	15% of Construction Costs
				Total	***$ -***	

Abbreviations:

O&M = operation and maintenance
RWQCB = Regional Water Quality Control Board
VMS = Vapor Mitigation System

Notes:

1. Costs are for the purpose of feasibility study analysis only and based on engineer cost experience for similar work.
2. All costs are presented in 2019 dollars.

Table A-4
"Hot Spot" Excavation Cost Summary (Alternative 3)
Riley Avenue, Presidio of San Francisco, San Francisco, CA

Location	"Hot Spot" Excavation Components	Unit	Unit Cost	Quantity	Cost	Comments
Building 127B - Front Yard	Remedial Design Implementation Plan and Soil Management Plan	LS	$ 25,000.00	1	$ 25,000.00	Estimate
	Soil Management Plan	LS	$ 15,000.00	1	$ 15,000.00	Estimate
	Bond	LS	$ 6,200.00	1	$ 6,200.00	Assumes 2% of Construction Costs
	Mob/Demobilization	LS	$ 10,000.00	1	$ 10,000.00	Estimate - half the cost quoted by ERRG for ADL
	Temporary Fencing	LF	$ 3.00	100	$ 300.00	ERRG unit price from ADL
	Stormwater BMPs	LS	$ 2,500.00	1	$ 2,500.00	Estimate, protection of storm drain inlets
	Clear and Grub	SF	$ 5.00	600	$ 3,000.00	ERRG unit price from ADL
	Soil Removal and CDF backfill (Large diameter augers, 12' x 17' x 30' bgs)	BCY	$ 250.00	230	$ 57,500.00	Estimate - half the cost for hand digging basement of $570/CY performed by ERRG
	1/5" Drain Rock Backfill (bottom 5 feet) - 38 CY, 1.35 ton/cy	Ton	$ 60.00	51	$ 3,100.00	ERRG estimate for placement of drain rock inside 127B
	Controlled Density Fill Backfill - one sack (Backfill from 25 to 5 ft bgs - 152 CY)	CY	$ 150.00	152	$ 22,800.00	Price from quotes ranging from $115 to $195/CY
	Import, Place, and Compact Soil (Trust Approved soil) - top 5 feet (38 CY or 57 tons [1.5 tons/CY])	Ton	$ 65.00	57	$ 3,700.00	Price from quotes ranging from $45 to $65/Ton
	Soil Transportation and Disposal (Class II)	Ton	$ 55.00	345	$ 19,000.00	ERRG unit price for disposal of soil in ADL excavation
	Dust and Odor Control	Weeks	$ 3,500.00	2	$ 7,000.00	Estimate based on $2900/week from ERRG for ADL
	Site Revegetation	LS	$ 6,500.00	1	$ 6,500.00	One third of Sheterbelt estimate of $19,000 for ADL area.
	Sprinker system reinstallation	LS	$ 8,000.00	1	$ 8,000.00	Estimate
	Water Line Restoration	LS	$ 5,000.00	1	$ 5,000.00	Estimate
	Surveying (Final)	LS	$ 1,500.00	1	$ 1,500.00	Survey of completed excavation area
	Remedial Action Completion Report	LS	$ 25,000.00	1	$ 25,000.00	
	Regulatory Oversigh	LS	$ 4,800.00	1	$ 4,800.00	Estimate - 24 hours oversight at $200/hr
	Business Losses - Rental 127A and 127B	Month	$ 11,000.00	12	$ 132,000.00	Estimate - assumes buildings 127A and 127B remain vacant for a minimum of 12 months until remedial excvation is completed and RWQCB has approved Remedial Action Completion Report. Assumes monthly rental of $5,500/unit
				Sub-Total	$357,900	
				Remedial Design	$53,700	Assumes 15% of Construction Costs, Drawings and Specs
				CM	$35,800	Assumes 10% of Contruction Costs
				PM	$28,600	Assumes 8% of Contruction Costs
				Permitting	$28,600	Assumes 8% of Construction Costs (N2 Review, Dig Permit)
				Contingency (15%)	$53,700	15% of Construction Costs
				Total	***$558,300***	

Abbreviations:

O&M = operation and maintenance
RWQCB = Regional Water Quality Control Board
VMS = Vapor Mitigation System

Notes:

1. Costs are for the purpose of feasibility study analysis only and based on engineer cost experience for similar work.
2. All costs are presented in 2019 dollars.

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Table A-5
Institutional Controls Cost Summary (Alternative 2 and 3)
Riley Avenue, Presidio of San Francisco, San Francisco, CA

Location	Institutional Control Components	Unit	Unit Cost	Quantity	Cost	Comments
Buildings 127A, 127B and 128A	LUCMRR Addendum	LS	$ 15,000.00	1	$ 15,000.00	Estimate
	Operations and Maintenance Plan	LS	$ 15,000.00	1	$ 15,000.00	Estimate
	Surveying (LUC/LUN Boundaries)	LS	$ 4,500.00	1	$ 4,500.00	Towill Day Rate
	Annual Inspections (Yearly, 70 years)	LS	$ 67,000.00	1	$ 67,000.00	Estimate
	Y1 to Y5	EA	$ 850.00	5	$ 4,250.00	Estimate
	Y6 to Y10 (3% Escalation)	EA	$ 880.00	5	$ 4,400.00	
	Y11 to Y15 (3% Escalation)	EA	$ 910.00	5	$ 4,550.00	
	Y16 to Y20 (3% Escalation)	EA	$ 940.00	5	$ 4,700.00	
	Y21 to Y25 (3% Escalation)	EA	$ 970.00	5	$ 4,850.00	
	Y26 to Y30 (3% Escalation)	EA	$ 1,000.00	5	$ 5,000.00	
	Y31 to Y35 (3% Escalation)	EA	$ 1,030.00	5	$ 5,150.00	
	Y36 to Y40 (3% Escalation)	EA	$ 1,060.00	5	$ 5,300.00	
	Y41 to Y45 (3% Escalation)	EA	$ 1,090.00	5	$ 5,450.00	
	Y46 to Y50 (3% Escalation)	EA	$ 1,120.00	5	$ 5,600.00	
	Y51 to Y60 (3% Escalation)	EA	$ 1,150.00	5	$ 5,750.00	
	Y61 to Y65 (3% Escalation)	EA	$ 1,180.00	5	$ 5,900.00	
	Y66 to Y70 (3% Escalation)	EA	$ 1,220.00	5	$ 6,100.00	
	Reporting (Yearly, 70 Years)	LS	$ 117,750.00	1	$ 117,750.00	Estimate
	Y1 to Y5	EA	$ 1,500.00	5	$ 7,500.00	Estimate
	Y6 to Y10 (3% Escalation)	EA	$ 1,550.00	5	$ 7,750.00	
	Y11 to Y15 (3% Escalation)	EA	$ 1,600.00	5	$ 8,000.00	
	Y16 to Y20 (3% Escalation)	EA	$ 1,650.00	5	$ 8,250.00	
	Y21 to Y25 (3% Escalation)	EA	$ 1,700.00	5	$ 8,500.00	
	Y26 to Y30 (3% Escalation)	EA	$ 1,750.00	5	$ 8,750.00	
	Y31 to Y35 (3% Escalation)	EA	$ 1,800.00	5	$ 9,000.00	
	Y36 to Y40 (3% Escalation)	EA	$ 1,850.00	5	$ 9,250.00	
	Y41 to Y45 (3% Escalation)	EA	$ 1,910.00	5	$ 9,550.00	
	Y46 to Y50 (3% Escalation)	EA	$ 1,970.00	5	$ 9,850.00	
	Y51 to Y60 (3% Escalation)	EA	$ 2,030.00	5	$ 10,150.00	
	Y61 to Y65 (3% Escalation)	EA	$ 2,090.00	5	$ 10,450.00	
	Y66 to Y70 (3% Escalation)	EA	$ 2,150.00	5	$ 10,750.00	

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Table A-5
Institutional Controls Cost Summary (Alternative 2 and 3)
Riley Avenue, Presidio of San Francisco, San Francisco, CA

Location	Institutional Control Components	Unit	Unit Cost	Quantity	Cost	Comments
	Five Year Reports (Every 5 Years, 70 Years)	LS	$ 42,800.00	1	$ 42,800.00	Estimate
	Y5	EA	$ 2,500.00	1	$ 2,500.00	Estimate
	Y10 (3% Escalation)	EA	$ 2,580.00	1	$ 2,580.00	
	Y15 (3% Escalation)	EA	$ 2,660.00	1	$ 2,660.00	
	Y20 (3% Escalation)	EA	$ 2,740.00	1	$ 2,740.00	
	Y25 (3% Escalation)	EA	$ 2,820.00	1	$ 2,820.00	
	Y30 (3% Escalation)	EA	$ 2,900.00	1	$ 2,900.00	
	Y35 (3% Escalation)	EA	$ 2,990.00	1	$ 2,990.00	
	Y40 (3% Escalation)	EA	$ 3,080.00	1	$ 3,080.00	
	Y45 (3% Escalation)	EA	$ 3,170.00	1	$ 3,170.00	
	Y50 (3% Escalation)	EA	$ 3,270.00	1	$ 3,270.00	
	Y55 (3% Escalation)	EA	$ 3,370.00	1	$ 3,370.00	
	Y60 (3% Escalation)	EA	$ 3,470.00	1	$ 3,470.00	
	Y65 (3% Escalation)	EA	$ 3,570.00	1	$ 3,570.00	
	Y70 (3% Escalation)	EA	$ 3,680.00	1	$ 3,680.00	
	Agency Oversight (Yearly, 70 Years)	LS	$ 62,550.00	1	$ 62,550.00	Estimate
	Y1 to Y5	EA	$ 800.00	5	$ 4,000.00	Estimate - 4 hours oversight per year at $200/hr
	Y6 to Y10 (3% Escalation)	EA	$ 820.00	5	$ 4,100.00	
	Y11 to Y15 (3% Escalation)	EA	$ 840.00	5	$ 4,200.00	
	Y16 to Y20 (3% Escalation)	EA	$ 870.00	5	$ 4,350.00	
	Y21 to Y25 (3% Escalation)	EA	$ 900.00	5	$ 4,500.00	
	Y26 to Y30 (3% Escalation)	EA	$ 930.00	5	$ 4,650.00	
	Y31 to Y35 (3% Escalation)	EA	$ 960.00	5	$ 4,800.00	
	Y36 to Y40 (3% Escalation)	EA	$ 990.00	5	$ 4,950.00	
	Y41 to Y45 (3% Escalation)	EA	$ 1,020.00	5	$ 5,100.00	
	Y46 to Y50 (3% Escalation)	EA	$ 1,050.00	5	$ 5,250.00	
	Y51 to Y60 (3% Escalation)	EA	$ 1,080.00	5	$ 5,400.00	
	Y61 to Y65 (3% Escalation)	EA	$ 1,110.00	5	$ 5,550.00	
	Y66 to Y70 (3% Escalation)	EA	$ 1,140.00	5	$ 5,700.00	
				Sub-Total	$324,600	
				Remedial Design	$0	
				CM	$0	
				PM	$32,460	Assumes 10% of Sub-Total Costs
				Contingency (15%)	$48,690	15% of Sub-Total Costs
				Total	***$405,750***	

Abbreviations:
O&M = operation and maintenance
RWQCB = Regional Water Quality Control Board
VMS = Vapor Mitigation System

Notes:
1. Costs are for the purpose of feasibility study analysis only and based on engineer cost experience for similar work.
2. All costs are presented in 2019 dollars.

Table A-6
Operation and Maintenance Cost Summary (Alternative 2 and 3)
127 Riley Avenue, Presidio of San Francisco, San Francisco, CA

Location	Operation and Maintenance Components	Unit	Unit Cost	Quantity	Cost	Comments
Buildings 127A, 127B and 128A	Maintenance VMS (every 5 years, 70 years)	Ea	$ 1,500.00	14	$ 29,400.00	Minor Repairs every five years (fourteen events with 5% escalation rate)
	Maintenance CAP (every 5 years, 70 years)	Ea	$ 5,000.00	14	$ 98,000.00	Estimate for minor crack repairs, painting, etc. (fourteen events with 5% escalation rate)
	Indoor Air Sampling (in-between occupancy, estimate once every five years for units 127A and 127B) and Reporting (30 years)	LS	$ 204,000.00	1	$ 204,000.00	Assumes individual event for each unit and includes four indoor locations and three ambient air locations, assumes turns every 5 years with a 5% escalation rate between sampling events
	Unit 127A	Ea	$ 15,000.00	6	$102,000.00	
	Unit 127B	Ea	$ 15,000.00	6	$102,000.00	
	Annual Groundwater Monitoring (5 years)	LS	$ 36,800.00	1	$ 36,800.00	Assumes five annual events and RWQCB approval of monitoring suspension after the fifth year
	Groundwater Sampling	Ea	$4,000.00	5	$20,800.00	Three groundwater monitoring wells (5 events with 2% escalation rate per year)
	Reporting	Ea	$2,500.00	5	$13,000.00	
	Well Rehabilitation	Ea	$ 3,000.00	1	$ 3,000.00	Once during the 5 year period (no escalation rate)
				Sub-Total	$ 368,200.00	
				Remedial Design	$ -	
				CM	$ -	
				PM	$ 36,800.00	Assumes 10% of Sub-Total Costs
				Contingency (10%)	$ 36,820.00	10% of Sub-Total Costs
				Total	***$ 441,820.00***	

Abbreviations:
O&M = operation and maintenance
RWQCB = Regional Water Quality Control Board
VMS = Vapor Mitigation System

Notes:
1. Costs are for the purpose of feasibility study analysis only and based on engineer cost experience for similar work.
2. All costs are presented in 2019 dollars.

TRC

Attachment B
RWQCB Comments on October 31, 2019 FS/CAP

December 13, 2019
File No. SL0607548721 (jdw)

Presidio Trust
Attn. Ms. Nina Larssen
Remediation Program Manager
103 Montgomery Street
P.O. Box 29052
San Francisco, CA 94129-0052
Via email: nlarssen@presidiotrust.gov

Subject: **Water Board Review of the October 31, 2019 *Feasibility Study and Corrective Action Plan Report***
Riley Avenue Site, Building Units 127A, 127B, and 128A
Fuel Distribution System Section BR11-1
Presidio of San Francisco, San Francisco, California

Dear Ms. Larssen:

I reviewed the Presidio Trust's October 31, 2019 *Feasibility Study and Corrective Action Plan* report (FS/CAP) for the subject Site. The FS/CAP presents the results of a feasibility study of corrective action alternatives to address Site contamination, and it identifies the preferred corrective action alternative. Based on my review, the FS/CAP is unacceptable and must be revised to address the comments below.

BACKGROUND

Former Presidio Fuel Distribution System (FDS), Section BR11-1 is located on the west side of Riley Avenue in the Main Post Area of the Presidio of San Francisco. In May 2017, during maintenance work, the Trust discovered soil contaminated with petroleum in the basement of unoccupied residential unit 127B, immediately beneath and in contact with the foundation slab. Subsequent site investigations found petroleum contamination in soil, soil gas, and groundwater along the pipeline from the basement to the front yard of Unit 127B; in soil and soil gas along the pipeline from the basement to the front yard of Unit 127A; and in soil and soil gas along the pipeline beneath the basement slab of Unit 128A. The source of contamination was the leaking, abandoned-in-place, subsurface portion of the FDS BR11-1 pipeline that delivered fuel oil to the boilers of the three residences.

Criteria provided in the *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA 1988) were used to screen various cleanup technologies and, based the screening results, three finalist CAP alternatives were retained for detailed analyses.

1. Alternative 1 – No Action.
2. Alternative 2 – Vapor Mitigation System (VMS) at 127B, Soil Capping, Groundwater Monitoring, and Institutional Controls (ICs).

a. **Riley Avenue Unit 127B**. The installed VMS consists of the subslab venting system, vapor barrier, and new basement slab. The VMS mitigates soil vapor intrusion (VI) into Unit 127B. An integrated cap of the basement slab, existing exterior hardscape, and at least two feet of clean surface soil prevents exposure of residents and workers to contaminated subsurface soil. Groundwater will be monitored at existing monitoring well GW01 in the front yard.

b. **Riley Avenue Unit 127A**. The existing basement slab mitigates soil VI into Unit 127A. An integrated cap of the basement slab, existing exterior hardscape, and at least two feet of clean surface soil prevents direct exposure to contaminated subsurface soil. Groundwater will be monitored at existing monitoring well GW03 in the back yard.

c. **Riley Avenue Unit 128A**. The existing basement slab mitigates soil VI into Unit 128A, and it prevents direct exposure to the contaminated soil beneath it. Because subsurface contamination does not extend beyond the building footprint, no exterior cap is proposed. Groundwater will be monitored at existing monitoring well GW02 in the front yard.

3. Alternative 3 – Alternative 3 is equivalent to Alternative 2, except it includes “hot spot” removal of contaminated subsurface soil, including some free product, from the front yards of Units 127A and 127B.

Based on the results of the detailed analysis of the three finalist corrective action alternatives, Alternative 2 was selected as the preferred alternative. Alternative 2 was judged to be the most cost-effective. Although Alternative 3 would remove secondary source soil, it was found to provide limited risk reduction, because it would not eliminate the necessity of the VMS at 127B, caps, or long-term ICs at Units 127A, 127B, and Unit 128A (e.g., inspection and maintenance of the caps and inter-occupancy indoor air sampling).

COMMENTS

1. **Section 2.5, Updated Conceptual Site Model, page 6, Soil Vapor Migration, second bullet** – The FS/CAP states that “based on the investigative results (TRC, 2018e), sub-slab concentrations below Building 127A do not indicate a significant risk for soil VI to human health.”

   Comment 1: The FS/CAP must be acceptably revised to reflect the potential soil VI hazard, including revision of Figure 5 to show the presence of soil vapor impacts at Unit 127A.

   February and July 2018 indoor air sample analytical results indicate that there is currently no unacceptable risk to residents of Unit 127A from soil VI. However, the subslab soil vapor concentrations of diesel-range organics (TPHd) and gasoline-range organics (TPHg) range up to 30,000 μg/m^3 and 190,000 μg/m^3, respectively, indicating significant potential risk (i.e., a non-cancer hazard index of approximately 61 for TPHd and TPHg).

2. **Section 6.3.2, Alternative 2 – Vapor Mitigation System (VMS) – Building 127B, page 20, Community Acceptance** - The FS/CAP states that “community acceptance of this alternative is anticipated based on the risk reduction and confirmed no unacceptable vapor intrusion risks present in units 127A and 128A.”

Comment 2: The FS/CAP must be acceptably revised to reflect the potential soil VI risks at Units 127A and 128A, including revision of Figure 5 to show the presence of soil vapor impacts at Unit 127A and 128A.

The risks of soil VI to the indoor air of Units 127A and 128A are unrelated to the VMS at Unit 127B. This is because the VMS at Unit 127B does not mitigate soil VI risk at Units 127A or 128A. As stated above, the subslab soil vapor concentrations of TPHd and TPHg at Unit 127A range up to 30,000 $\mu g/m^3$ and 190,000 $\mu g/m^3$, indicating significant potential non-cancer hazard due soil VI. Further, a TPHd concentration of 210,000 $\mu g/m^3$ in soil vapor beneath the basement slab of Unit 128A was reported in October 2017. Notwithstanding the high vacuum experienced while collecting the sample, significant potential non-cancer hazard due to soil VI also exists at Unit 128A.

3. **Section 8.1, Recommended Corrective Action – Soil Impacts, page 24, Land Use Control and Land Use Notification** – The footprint of Unit 128A is proposed as a Land Use Notification (LUN) area. Importantly, a LUN area designation would *not* require annual inspections of the basement slab or inter-occupancy indoor air sampling and laboratory analysis to verify acceptable indoor air quality.

   Comment 3: For the reason stated in the comment above on Section 6.3.2, significant potential non-cancer hazard due to soil VI exists at Unit 128A. Consequently, the FS/CAP must be acceptably revised to describe in the text and delineate on Figure 8 a land use control (LUC) area for the subslab contamination at Unit 128A. The FS/CAP must acceptably describe the LUCs that will be implemented to address the subslab contamination at Unit 128A, including annual inspection, inter-occupancy indoor air sampling, trend analysis of indoor air data, and timely responses to mitigate any potential exposure prior to re-occupancy.

Please resubmit the revised FS/CAP for our review.

If you have any questions, contact me at (510) 622-2375 or at jeff.white@waterboards.ca.gov.

Sincerely,

Jeffrey White

Jeffrey D. White
Water Resource Control Engineer