9 November 2017
Project 750635603

Mr. Keith Nowell, PG
Alameda County Health Care Services Agency
Environmental Health Department
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502

Subject: **Revised Basis of Design for Vapor Mitigation System**
Cleanup Case No. RO03236
3000 Broadway SPE LLC
3000 and 3020 Broadway, 3007 and 3009 Brook Street,
250, 260 and 288 30th Street
Oakland, California
Langan Project: 731635603

Dear Mr. Nowell:

I have read and acknowledge the content, recommendations and/or conclusions contained in the attached document submitted on my behalf to ACDEH's FTP server and the SWRCB's GeoTracker website.

Sincerely yours,

Alan Chamorro
3000 Broadway SPE LLC

9 November 2017

Ms. Dilan Roe and Mr. Keith Nowell
Alameda County Department of Environmental Health
1131 Harbor Bay Parkway
Alameda, California 94502

Re: Revised Basis of Design for Vapor Mitigation System
3000 Broadway Redevelopment
3000 and 3020 Broadway, 3007 and 3009 Brook Street,
250, 260 and 288 30th Street
Oakland, California
Langan Project: 750635603
Cleanup Program Site – Case No. RO03236

Dear Ms. Roe and Mr. Nowell:

Langan Engineering and Environmental Services, Inc. (Langan), on behalf of 3000 Broadway SPE LLC (Client), previously submitted for your review the Basis of Design for Vapor Mitigation System (VMS), dated 22 May 2017, for the proposed redevelopment planned at 3000 and 3020 Broadway; 3007 and 3009 Brook Street; and 250, 260, and 288 30th Street (3000 Broadway Redevelopment) in Oakland, California (Figure 1). The previous Basis of Design was based on soil gas and groundwater data that was available at the time. However, based on recent discussions with both Alameda County Department of Environmental Health (ACDEH) and our Client, additional environmental sampling was completed to further evaluate and delineate contaminated soil and groundwater and to reevaluate the appropriate extent of the proposed VMS associated with the development. The purpose of this letter is to provide the updated basis of design for the VMS, including a set of revised preliminary draft design drawings depicting the major system components. The basis of design reflects Langan's years of design experience along with field data gathered during multiple field investigations. This letter is intended to streamline the process for approval of the final VMS engineering design drawings that Langan will be submitting for the development project.

BACKGROUND

Current development plans include the construction of a lot-line-to-lot-line, five-story, wood-frame apartment building, over a one- to two-story concrete podium with only parking proposed on the lowest level. The proposed development will have a single-level basement garage along

Broadway leveling out to the current grade at Brook Street, as the ground surface elevation drops. The entrance to the partially below-grade parking will be along Brook Street. The below-grade parking level will be naturally ventilated along the southern and eastern faces of the proposed building. In addition to natural ventilation, mechanical ventilation will be provided for the interior parking area. All residential and commercial units will be situated above the parking podium.

Several environmental investigations have been performed at the site and the larger redevelopment area by Langan since April 2016. Figure 2 shows soil and groundwater sampling locations completed in 2016 and 2017. Phase I (Langan, 2016a) and Phase II (Langan, 2016b) Environmental Site Assessments (ESAs) were performed in April 2016. The Phase I ESA for the larger redevelopment area reported a history of contamination associated with a leaking underground storage tank (LUST), which was abandoned in place, located near 250 30th Street. The April 2016 Phase II ESA focused on groundwater impacts associated with the 250 30th Street LUST and classifying soil for off-haul during future construction. The findings of the Phase II ESA indicated that low levels of contaminants are present in the subsurface beneath the redevelopment area with lead detected in soil samples exceeding the hazardous waste criteria in some areas and residual concentrations of total petroleum hydrocarbons (TPH) as gasoline (TPHg), as diesel (TPHd), and as motor oil (TPHmo) in groundwater near a previously closed-in-place underground storage tank (UST).

During a November 2016 geotechnical investigation, a petroleum odor was noted and responses on a photoionization detector (PID) were detected in soil collected from boring B-16 (Figure 2), which was advanced in the 260 30th Street portion of the redevelopment area. Soil samples were analyzed for TPH, VOCs, and metals. The results of the soil analyses indicated the subsurface of the 260 30th Street property had been impacted by TPH and VOCs. Subsequent environmental investigations focused on the 250 and 260 30th Street properties have found elevated concentrations of TPH and VOCs, particularly tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE), in groundwater beneath the 260 30th Street portion of the redevelopment likely originating from a floor drain located on the same property. Boring B-17 was advanced in the 250 30th Street property, upgradient of the 260 30th Street property, to determine if this parcel was a contributing source. Based on the lack of significant detections in B-17, the 250 30th Street property was ruled out as a potential source.

TPH and VOC concentrations in soil at the 260 30th Street property were found to exceed the Regional Water Quality Control Board (RWQCB) Tier 1 Environmental Screening Levels (ESLs) within the upper 10 feet. One boring, B-33, also had Tier 1 ESL exceedances in soil at a depth of 17.5 feet bgs. In addition, groundwater levels at the site were found to have risen as much as 15 feet between November 2016 and February 2017 during a period of above average rainfall (Langan, 2017a). Groundwater elevations measured in February 2017 were just below the proposed bottom of slab elevation for the planned development (see Attachment 1). Due to the potential hydrostatic conditions created by elevated groundwater levels at the Site, the entire underside of the proposed building slab will be waterproofed.

Two 18-foot groundwater monitoring wells (GW-1 and GW-2) were installed within the 260 30th Street property in late March 2017, which were screened from 8 to 18 feet bgs. On 19 May 2017, groundwater monitoring wells GW-3, GW-4, and GW-5 were installed outside and

downgradient of the site building, along the Brook Street right-of-way, to an approximate depth of 15 feet bgs, with screened intervals between 5 and 15 feet bgs. The approximate locations of the groundwater monitoring wells are shown on Figure 2.

Langan sampled the newly installed groundwater monitoring wells GW-1 and GW-2 on 5 April 2017 and GW-3, GW-4, and GW-5 on 25 May 2017. Cis- 1,2-DCE and TCE, were detected in the groundwater samples analyzed collected in April 2017 from monitoring wells in GW-1 and GW-2 at concentrations which exceed the established Tier 1 ESLs of 6.0 µg/L and 5.0 µg/L, respectively. Groundwater concentrations of VOCs in wells GW-3, GW-4, and GW-5 were significantly lower than in wells GW-1 and GW-2. In May 2017, well GW-4 had the highest TCE concentration of 320 µg/L. Well GW-3 did not have any Tier 1 ESL exceedances and well GW-4 only had slight exceedances of TCE and cis-1,2-DCE.

On 29 September 2017, Langan sampled groundwater monitoring wells GW-1 through GW-5 for a second time and also collected grab-groundwater samples from borings B-46, located on the northern edge of the proposed development, and B-47 and B-48, located west of the previously-proposed VMS extent. Borings B-46, B-47, and B-48 were advanced to delineate the groundwater plume and finalize the appropriate extent of the VMS. All soil borings were advanced to a depth of 24 feet below ground surface (bgs). This sampling event is described in the *Additional Environmental Information Technical Memorandum* for the 3000 Broadway Development (Langan, 2017c). Summaries of all groundwater sample analytical results collected by Langan for the site are presented in Attachment 2.

The results of the most recent groundwater and soil sampling indicate concentrations of VOCs in soil and groundwater at B-46 and B-48 do not exceed the RWQCB vapor intrusion ESLs, while soil and groundwater beneath portions of the 250 and 260 30th Street properties exceeding applicable ESLs (Figure 2). Based on these results, the extent of the VMS has been extended to the northern edge of the proposed development (near boring B-46) as well as approximately 15 feet to the west of B-48, as shown on Figure 3 and the attached draft Design Drawings (Attachment 3). The VMS will tie into the sub-slab waterproofing so that the entire building slab is waterproofed.

Due to the presence of PCE, TCE, and petroleum hydrocarbons at elevated concentrations in soil, Langan anticipates that extensive soil removal, to depths of 18 feet below ground surface (bgs), will occur during the initial phase of site redevelopment. Additionally, in order to achieve the proposed excavation depths, construction dewatering and treatment is proposed, which will further remove a significant portion of the VOCs currently present in the subsurface prior to construction. Consequently, the proposed VMS may not be necessary to mitigate health risks, as all soil currently exceeding Tier 1 ESLs is proposed for removal; however, the VMS will be constructed, to allow the redevelopment to proceed within a reasonable timeframe.

CONCEPTUAL DESIGN

The VMS will consist of a continuous, spray-applied vapor barrier membrane located immediately beneath a portion of the structural building slab, combined with a horizontal collection and venting system installed below the vapor barrier membrane to allow any soil vapors that would otherwise collect beneath the slab to migrate and vent to the atmosphere

outside the building. The VMS will also include a low-permeability lateral barrier on the western edge to serve as a vapor break. These features are described in greater detail in the following paragraphs.

Vapor Barrier Membrane

A typical section showing the vapor barrier membrane beneath the structural slab is shown in Detail 1 of Sheet VMS2.01 (see Attachment 3). The foundation for the building will consist of a spread-footing supported structural slab system. Typically, the footing and grade beams will be poured before the structural slab. After these foundation members are constructed, a carrier fabric will be placed on the soil subgrade and overlap onto the foundation units. The spray-applied membrane will be applied onto the carrier fabric. The membrane will then be covered by an HDPE-reinforced bentonite sheet protection course layer, so that the membrane is not damaged during the laying of the reinforcing steel for the concrete slab and to act as an underslab water barrier for the building. As it cures, the concrete of the structural slab will form a bond with the protection course fabric, causing the membrane system to adhere to the underside of the slab. In the event that voids are created beneath the slab due to settlement of the subgrade, the integrity of the membrane will not be compromised.

The vapor barrier membrane will be applied to approximately half of the development, covering the entire 260 30th Street portion of the redevelopment area with elevated VOC concentrations localized around the previously-identified floor drain, and extending north and west to areas that have been characterized as having soil and groundwater VOC concentrations below applicable vapor intrusion ESLs. The western extent of the vapor barrier membrane was chosen based on groundwater concentrations at B-48, which were below vapor intrusion ESLs (see Attachment 2). The northern extent of the vapor barrier membrane was chosen based on groundwater concentrations at B-46, which were below vapor intrusion ESLs.

The balance of the foundation slab will be underlain by a waterproofing membrane that is made by the same manufacturer (and applied by the same applicator) as the vapor barrier membrane.[1] This will allow for the simplest transition between the vapor barrier and waterproofing membranes. Where the transition occurs between the vapor barrier membrane and the waterproofing products, the gravel layer will be interrupted by a lateral barrier constructed of controlled density fill (CDF), concrete, or similar low-permeability material; the purpose of this barrier is to mitigate against the potential lateral migration of VOCs along the gravel layer into areas that are not covered by the vapor barrier membrane.

In addition, as shown in the architectural plans for the project, the entire site will be underlain by a partially below-grade parking garage, which will be naturally ventilated along the southern and eastern faces of the site. It is our opinion that the naturally ventilated, partially below-grade garage provides a break in potential exposure pathways that may exist between the sub-slab

[1] It is anticipated that the "vapor barrier membrane" product will be E-Protect-Plus and the "waterproofing" product will be E-Proformance (or E-Protect), all manufactured by EPRO Services Inc. of Wichita, KS. In the event of unacceptable delays in EPRO product delivery due to a shortage of materials or other reasons, the proposed alternative for both the "vapor barrier membrane" and the "waterproofing" product is Coreflex, manufactured by CETCO Minerals Technologies of Hoffman Estates, IL.

vapors and first floor occupants, providing a second, independent barrier against vapor intrusion into the occupied spaces.

In order to limit potential vapor migration via utility trenches beneath the proposed building, trench dams consisting of controlled density fill will be incorporated into the final design and will be installed in utility trenches, as appropriate, at the perimeter of the building during construction.

Passive Vapor Collection and Venting System

A passive horizontal collection and venting system will be installed beneath the vapor barrier, described above, to collect soil vapors potentially containing VOCs from beneath the building slab and vent them to atmosphere outside the building. The system will include an interconnected network of 3-inch perforated PVC piping embedded in a 4-inch gravel layer directly beneath the building slab. The piping network will be connected to vertical risers, constructed of cast iron pipe, which will trend vertically (typically through utility pipe chases) to the roof level, where they will be capped with wind turbines that will generate a slight vacuum on the piping network to enhance collection and venting of the vapors. The vertical risers will also include a test port above the roof.

Groundwater level data collected in February 2017 indicates that groundwater flows in a southeasterly direction. Additionally, during exceptionally wet winters, the piping system may, at times, be under water; nevertheless, the vapor barrier/waterproofing membrane will remain protective. The VMS piping system is designed to drain and return to functionality as the water table drops and returns to more normal levels.

The area covered by the VMS has been increased, relative to the design proposed previously, to approximately 14,800 square feet (sf). Based on the Los Angeles Department of Building and Safety (LADBS) *Standard Plan: Methane Hazard Mitigation*, revised 8 March 2010, the recommended riser frequency is one per 10,000 sf of plan area. By that standard, which Langan also uses as a guideline for VMS design, two risers will be included for this building's VMS.

Perimeter Inlet Vents

The purpose of the perimeter inlet vents is to facilitate convective airflow up the vertical riser pipe of the collection and venting system by allowing fresh air to enter the space beneath the building slab. Each vent is constructed of solid PVC or cast iron pipe, and is placed through the formwork prior to pouring the concrete (see Attachment 3).

VMS Completion Report and Operations and Maintenance Manual

The installation of the VMS will be documented by periodic site visits to observe the installation of the gravel layer, piping, vapor barrier membrane, and risers; site visits will also include quality assurance/quality control (QA/QC) functions such as coupon sampling and smoke testing of the vapor barrier membrane. After the installation has been completed, a VMS Completion Report will be prepared and submitted to ACDEH. The report will include field daily observation reports for all site visits, photographs taken during VMS installation, and a set of Record Drawings.

An Operation and Maintenance (O&M) Manual will also be prepared for use by the building owner; maintenance requirements will be comparatively minimal, as this will be a passive VMS. The O&M Plan will describe routine, periodic maintenance activities, with a checklist for use by the building engineer or other owner's representative, as well as emergency response procedures in the event of a fire, earthquake, or other event that may damage the VMS. The O&M Plan will also state the conditions under which long-term O&M may be discontinued.

POST-CONSTRUCTION VMS PERFORMANCE MONITORING PLAN

Given that all soil exceeding Tier 1 ESLs is proposed for removal and impacted groundwater will be removed to facilitate over-excavation of impacted soils during construction, coupled with the ventilated first floor construction, the potential for vapor intrusion into the proposed building will be significantly reduced. Nonetheless, the performance of the VMS will be evaluated by collecting whole air samples from the VMS risers and measuring airflow within the riser. Because these samples are collected from risers that are connected to sub-slab piping within the gravel bed directly beneath the building slab, they are, in our opinion, analogous to sub-slab vapor samples. Grab samples will be collected in 1-liter SUMMA canisters; a primary and a duplicate sample will be collected and sent to a state-certified laboratory for analysis by EPA Method SIM TO-15 for VOCs. Flow rate and vented soil vapor concentrations will be used to calculate the emissions from each vent riser, if necessary. Because the first space above the foundation slab is a partially-open, naturally-ventilated garage, no indoor air sampling is proposed at this time.

The initial round of monitoring will be conducted when the VMS is substantially complete, i.e., completed at the roof level with wind turbines and sampling ports. Monitoring will continue on a quarterly basis until two consecutive sampling events indicate that all primary COCs, as identified in the Corrective Action Plan (Langan, 2017b) are present at concentrations at or below 75% of their respective RWQCB ESLs for soil gas. It is anticipated that this milestone will be achieved within one year or less, based on the proposed removal of all soil exceeding Tier 1 ESLs. The monitoring frequency may be revised in order to comply with any monitoring requirements of ACDEH or BAAQMD. If COC concentrations are not below 75% of their respective ESLs within the above timeframe, or if the monitoring data or other observations indicate any cause for concern, additional monitoring (potentially including indoor air sampling) or mitigative measures will be discussed with ACDEH.

SUMMARY

In summary, it is Langan's opinion that the proposed VMS described herein is an appropriate design that is consistent with designs for other sites with similar site conditions. Having a vapor barrier membrane and collection and ventilation system below a naturally ventilated parking garage provides for additional engineering redundancy in the mitigation system for this Site.

We look forward to receiving the ACDEH's approval of this basis of design. If you have any questions regarding this letter, please feel free to contact us at (510) 874-7000.

Sincerely,
Langan Engineering & Environmental Services, Inc.

Sigrida Reinis, Ph.D., P.E.
Associate

Joshua Graber. CHMM
Associate

cc: Alan Chamorro, 3000 Broadway SPE LLC

REFERENCES

Langan Engineering and Environmental Services (Langan), 2016a. *Phase I Environmental Site Assessment, 3000 and 3020 Broadway; 3007 and 3009 Brook Street; and 250, 260, and 288 30th Street, Oakland, California*. April.

Langan, 2016b. *Phase II Environmental Site Assessment, 3000 and 3020 Broadway; 3007 and 3009 Brook Street; and 250, 260, and 288 30th Street, Oakland, California*. April.

Langan, 2017a. *Additional Environmental Site Characterization 250 and 260 30th Street, Oakland, California*. March.

Langan, 2017b. *Feasibility Study and Corrective Action Plan, 3000 Broadway Redevelopment, Oakland, California 94611,* 2 May.

Langan, 2017c. *Additional Environmental Information 3000 Broadway Redevelopment, Oakland, California.* November.

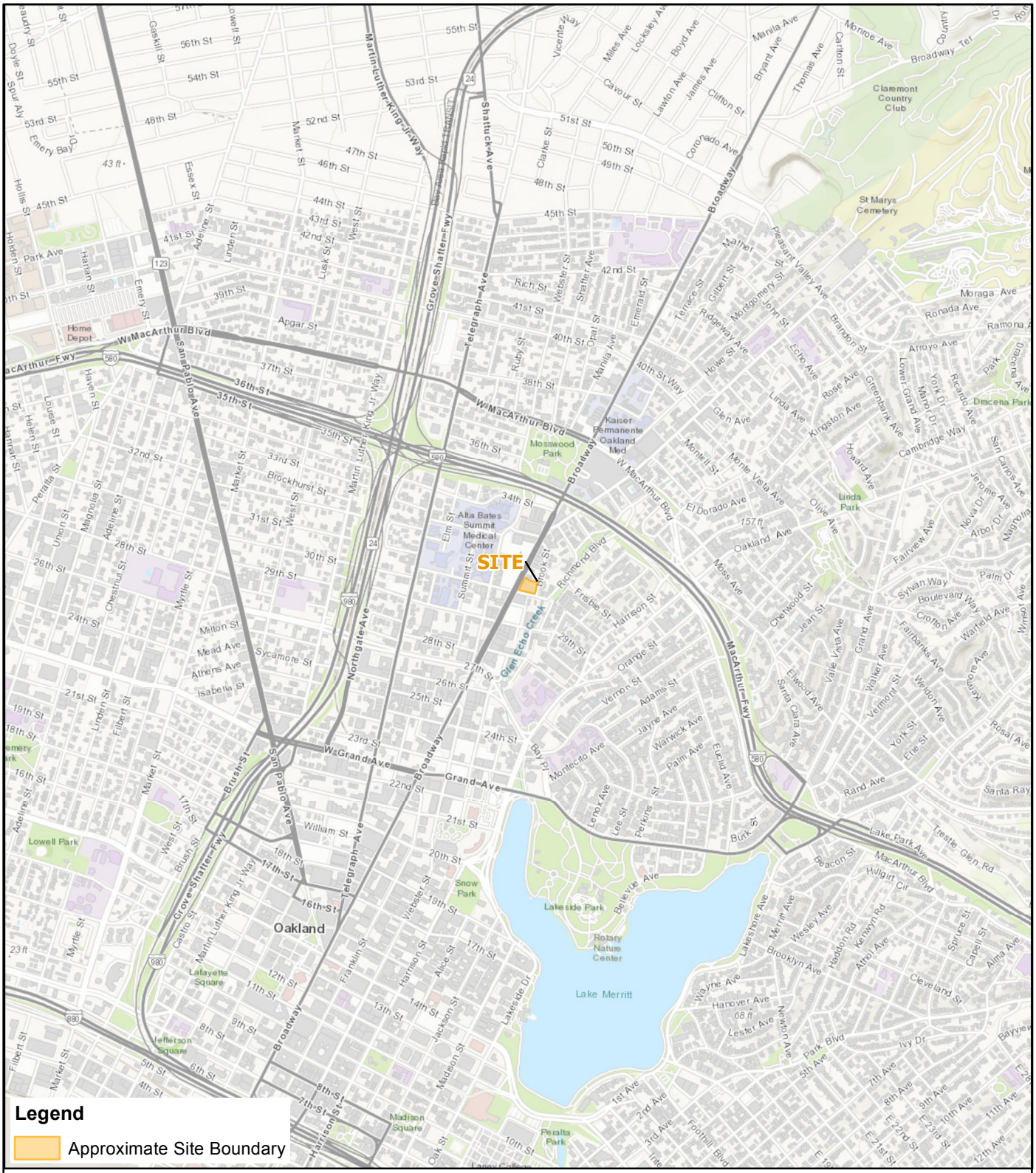
Enclosures:

Figure 1	Site Location Map
Figure 2	Site Plan and TCE Concentrations in Groundwater
Figure 3	Site Plan with Sampling Locations and VMS Extent

Attachments:

Attachment 1	Idealized Subsurface Profile A-A' *Feasibility Study and Corrective Action Plan*, dated 2 May 2017
Attachment 2	Groundwater Data Tables from *Additional Environmental Information Technical Memorandum*, dated 27 October 2017
Attachment 3	Preliminary VMS Design Drawings, Revised 9 November 2017

FIGURES



NOTES:
1. Topographic basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online © 2011 National Geographic Society, i-cubed.
2. All features shown are approximate.

3000 BROADWAY REDEVELOPMENT
260 30th STREETt
Oakland, California

LANGAN

SITE LOCATION MAP

Date 11/7/2017	Project No. 750635603	Figure 1

Path: \\langan.com\data\OAK\data6\750635603\ArcGIS\ArcMap_Documents\Site Location Map 20171107.mxd User: bsaylor

Reference: Nearmap aerial imagery 2017.

GW-1	cis- 1,2 DCE	TCE
04/05/17	**170**	**1,200**
09/29/17	**1,000**	**8,400**

GW-3	cis- 1,2 DCE	TCE
05/25/17	< 0.50	< 0.50
09/29/17	< 0.50	2.1

GW-2	cis- 1,2 DCE	TCE
04/05/17	**300**	**2,400**
09/29/17	**470**	**3,600**

GW-4	cis- 1,2 DCE	TCE
05/25/17	**51**	**320**
09/29/17	**47**	**300**

GW-5	cis- 1,2 DCE	TCE
05/25/17	**12**	**6.9**
09/29/17	**9.6**	**14**

EXPLANATION

- **B-46** — Approximate location of environmental boring by Langan, September 2017
- **GGW-1** — Approximate location of deep grab groundwater sample by Langan, March 2017
- **GW-1** — Approximate location of groundwater monitoring well
- **SV-1** — Approximate location of soil vapor sample by Langan, April 2017
- **MIP-1** — Approximate location of MIP by Langan, March 2017
- **B-31** — Approximate location of soil and/or groundwater boring by Langan, March and April 2017
- **B-37** — Approximate location of soil sampling boring for composite characterization, 20 feet bgs max. by Langan, April 2017
- **B-42** — Approximate location of boring for composite characterization, 8 feet bgs max. by Langan, April 2017
- **B-17** — Approximate location of environmental boring by Langan, February 2017
- **B-3** — Approximate location of 20-foot boring by Langan Treadwell Rollo, April 2016
- **B-5** — Approximate location of 15-foot boring by Langan Treadwell Rollo, April 2016
- **B-7** — Approximate location of 10-foot boring by Langan Treadwell Rollo, April 2016
- Approximate location of abandoned in-place 1,000-gallon waste oil UST, March 1997
- Approximate location of former USTs (350-gallon gasoline and 1,000-gallon diesel), removed in July 1992
- Approximate location of floor drain
- Approximate footprint of proposed 3000 Broadway Redevelopment
- Approximate location of drain line piping
- **[230]** — TCE concentrations in groundwater (µg/L), concentration in bold exceed cleanup criteria

3000 BROADWAY REDEVELOPMENT
Oakland, California

SITE PLAN WITH TCE CONCENTRATIONS IN GROUNDWATER

Date 11/09/17	Project No. 750635603	Figure 2

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\\langan.com\data\OAK\data6\750635603\Cadd Data - 750635603\2D-DesignFiles\Environmental\750635603-N-SP01012_11.7.17.dwg 11/10/17

Reference: Nearmap aerial imagery 2017.

EXPLANATION

- **B-46** — Approximate location of environmental boring by Langan, September 2017
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- Approximate location of former USTs (350-gallon gasoline and 1,000-gallon diesel), removed in July 1992
- Approximate location of floor drain
- Approximate extent of VMS membrane and piping
- Approximate footprint of proposed 3000 Broadway Redevelopment
- Approximate location of drain line piping

3000 BROADWAY REDEVELOPMENT
Oakland, California

SITE PLAN WITH SAMPLING LOCATIONS AND VMS EXTENT

Date 11/09/17	Project No. 750635603	Figure 3

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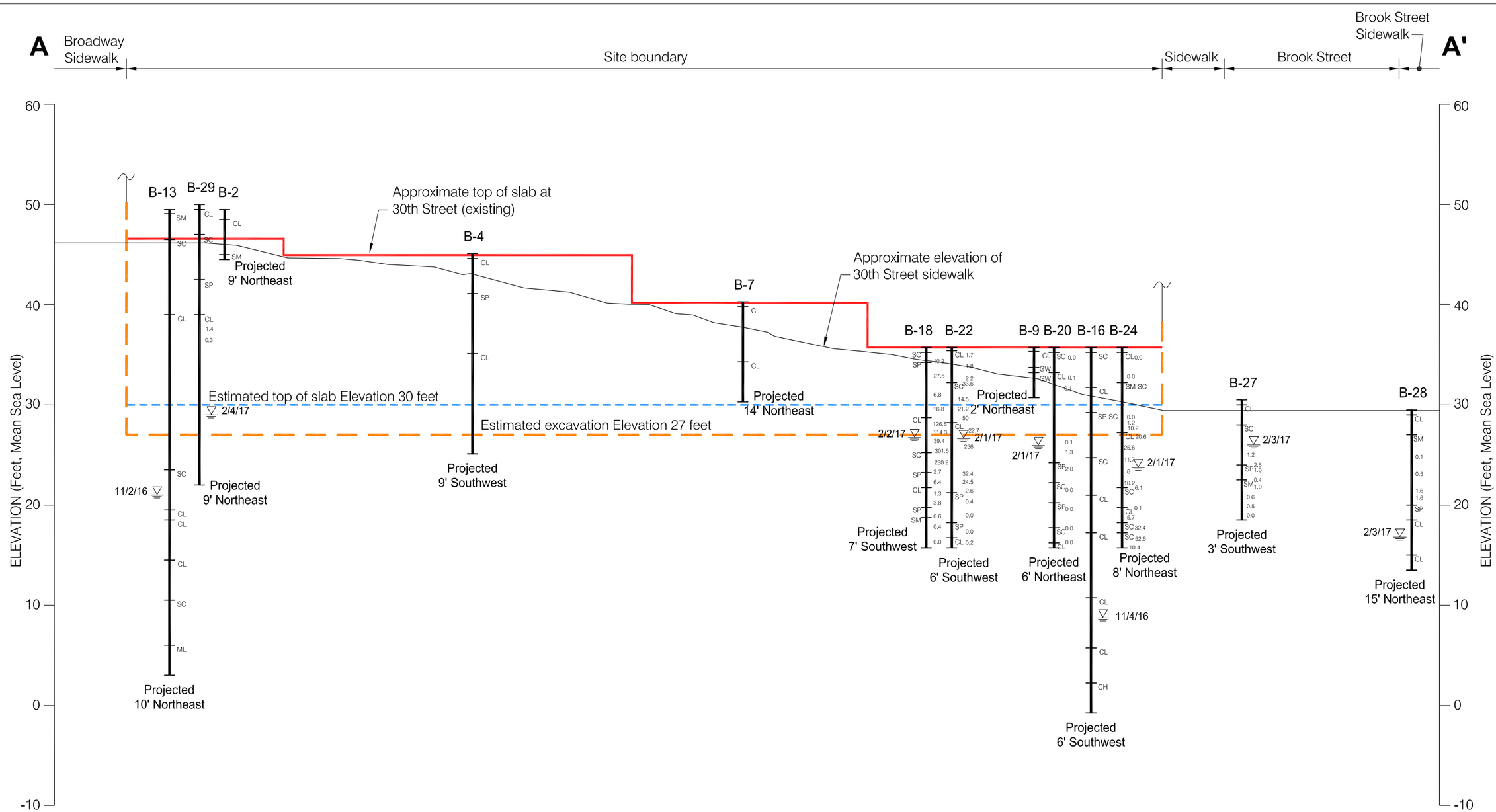
ATTACHMENT 1

IDEALIZED SUBSURFACE PROFILE A-A' *FEASIBILITY STUDY AND CORRECTIVE ACTION PLAN*, DATED 2 MAY 2017



Notes:
1. The above profile represents a generalized soil cross section interpreted from widely spaced borings. Soil deposits may vary in type, strength, and other important properties between points of exploration. All elevations are approximate.

10
0
0 20
SCALE IN FEET

3000 BROADWAY REDEVELOPMENT
Oakland, California

IDEALIZED SUBSURFACE PROFILE
A-A'

Date 04/24/17	Project No. 750635603	Figure 3

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ATTACHMENT 2

GROUNDWATER DATA TABLES FROM *ADDITIONAL ENVIRONMENTAL INFORMATION TECHNICAL MEMORANDUM*, DATED 27 OCTOBER 2017

Table 3
Groundwater Monitoring Well Analytical Results for Non-Metals
3000 Broadway Redevelopment
Oakland, Californa

Sample ID	Date Sampled	HEM; Oil & Grease	TPHg	TPHd	TPHmo	VOCs								PAHs			Phenolics	Total Cyanide
						cis- 1,2 DCE	trans- 1,2 DCE	1,2,4-TCB	TCE	PCE	Vinyl Chloride	Xylenes	All Other VOCs	2- Methyl-naphthalene	Naphthalene	All Other PAHs		
		(mg/L)	(µg/L)															
GW-1	04/05/17	–	67	< 50	< 250	**170**	< 25	< 25	**1,200**	< 25	< 25	< 25	ND (< 10 - < 500)	< 0.0500	< 0.0590	ND	–	–
	09/29/17	–	97	< 50	< 250	**1,000**	< 250	< 250	**8,400**	< 250	< 250	< 250	ND (< 250 - < 5,000)	–	–	–	–	–
GW-2	04/05/17	–	**130**	56	< 250	**300**	< 50	< 50	**2,400**	< 50	< 50	< 50	ND (< 20 - < 1,000)	< 0.0500	< 0.0500	ND	–	–
	06/02/17	< 5.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.1	< 1.0
	09/29/17	–	61	< 50	< 250	**470**	< 100	< 100	**3,600**	< 100	< 100	< 100	ND (< 40 - < 2,000)	–	–	–	–	–
GW-3	05/25/17	–	< 50	< 50	< 250	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND (< 0.20 - < 10)	< 0.0500	< 0.0500	ND	–	–
	09/29/17	–	< 50	< 50	< 250	< 0.50	< 0.50	< 0.50	2.1	< 0.50	< 0.50	< 0.50	ND (< 0.20 - < 10)	–	–	–	–	–
GW-4	05/25/17	–	< 50	< 50	< 250	**51**	< 5.0	**5.5**	**320**	< 5.0	< 5.0	< 5.0	ND (< 5.0 - < 100)	< 0.0500	< 0.0500	ND	–	–
	09/29/17	–	< 50	< 50	< 250	**47**	< 17	< 17	**300**	< 17	< 17	< 17	ND (< 6.7 - < 330)	–	–	–	–	–
GW-5	05/25/17	–	< 50	< 50	< 250	**12**	**2.8**	< 0.50	**6.9**	< 0.50	3.3	< 0.50	ND (< 0.20 - < 10)	< 0.0500	0.0565	ND	–	–
	09/29/17	–	< 50	< 50	< 250	**9.6**	**0.84**	< 0.50	**14**	< 0.50	< 0.50	< 0.50	ND (< 0.20 - < 10)	–	–	–	–	–
Tier 1 ESL		–	100	100	50,000	6.0	10.0	5.0	5.0	3.0	0.061	20	Various	2.1	0.17	Various	5.0	–
Residential Vapor Intrusion ESL		–	–	–	–	110	1,000	240	5.6	3.0	0.061	1,300	Various	–	20	Various	–	–
Direct Exposure ESL		–	220	150	50,000	6.0	10.0	5.0	5.0	5.0	0.5	20	Various	36	0.17	Various	4,200	150

Notes:
mg/L - Milligrams per liter
µg/L - Micrograms per liter
HEM - Hexane extractable material
TPHg - Total Petroleum Hydrocarbons as Gasoline, EPA Method 8015B
TPHd - Total Petroleum Hydrocarbons as Diesel Range, EPA Method 8015B
TPHmo - Total Petroleum Hydrocarbons as Motor Oil, EPA Method 8015B
VOCs - Volatile Organics Compounds, EPA Method 8260B
PAHs - Polycyclic aromatic hydrocarbons, EPA Method 8310
cis-1,2-DCE - cis-1,2-dichloroethene
trans-1,2-DCE - trans-1,2-dichloroethene
1,2,4-TCB - 1,2,4-trichlorobenzene
TCE - Trichloroethene
PCE - Tetrachloroethene
< 50 - Analyte was not detected above the laboratory reporting limit (50 µg/L)
< 5.0 - Analyte was not detected above the laboratory reporting limit (5.0 mg/L)
ND - Not detected at or above the laboratory reporting limit(s)
– - Sample not analyzed or not established
ESL - Environmental screening level(s)
Various - ESLs, where established, vary for each of the multiple compounds analyzed
Bold - Detection exceeds established ESL
Tier 1 ESL - San Francisco Bay Regional Water Quality Control Board's Environmental Screening Levels - *Tier 1 Groundwater.* February 2016 [Rev. 3]
Residential Vapor Intrusion ESL - San Francisco Bay Regional Water Quality Control Board's Environmental Screening Levels - Residential Groundwater Vapor Intrusion Human Health Risk Levels (Table GW-3) for Shallow Groundwater. February 2016 [Rev. 3]
Direct Exposure ESL - San Francisco Bay Regional Water Quality Control Board's Environmental Screening Levels - Groundwater Direct Exposure Human Health Risk Levels (Table GW-1) MCL Priority. February 2016 [Rev. 3]

Table 4
Grab-Groundwater Analytical Results for Non-Metals
3000 Broadway Redevelopment
Oakland, California

Sample ID	Date Sampled	TPHg	TPHd	TPHmo	VOCs					PAHs		
					cis- 1,2 DCE	TCE	PCE	Xylenes	All Other VOCs	2- Methyl-naphthalene	Naphthalene	All Other PAHs
		(µg/L)										
B-11-GW	04/02/16	**250**	**460**	6,900	< 0.50	< 0.50	< 0.50	0.88	acetone = 15 benzene = 0.65 bromodichloromethane = 0.61 t-butyl alcohol = 12 sec-butyl benzene = 0.67 tert-butyl benzene = 0.96 chlorobenzene = 0.65 isopropylbenzene = 1.3 n-propyl benzene = 0.93	--	< 0.50	--
B-12-GW	04/09/16	< 50	< 50	< 250	< 0.50	< 0.50	< 0.50	< 0.50	toluene = 0.50	--	< 0.50	--
B-13-GW	11/03/16	< 50	< 50	< 250	< 0.50	1.8	< 0.50	< 0.50	chloroform = 0.62	--	< 0.50	--
B-17-GW	02/03/17	< 50	< 50	< 250	2.7	3.5	0.58	< 0.50	**chloroform = 3.3**	< 0.50	< 0.50	< 0.50
B-18-GW	02/02/17	55	**200**	1,200	**350**	**2,000**	< 100	< 100	ND	0.54	**0.62**	< 0.50
B-19-GW	02/02/17	< 50	< 100	630	4.5	**41**	< 1.2	< 1.2	ND	< 0.50	< 0.50	< 0.50
B-20-GW	02/02/17	75	**2,400**	8,600	**460**	**4,700**	< 120	< 120	ND	< 0.50	< 0.50	< 0.50
B-21-GW	02/02/17	< 50	< 100	510	**19**	**170**	< 5.0	< 5.0	ND	< 0.50	< 0.50	< 0.50
B-22-GW	02/02/17	**120**	< 100	680	**2,200**	**6,100**	< 120	< 120	ND	< 0.50	< 0.50	< 0.50
B-23-GW	02/03/17	**250**	**40,000**	**110,000**	**210**	**470**	< 12	< 12	chlorobenzene = 19	**4.6**	**3.5**	**benzo (a) anthracene = 0.64** fluorene = 0.83 1-methylnaphthalene = 3.0 phenanthrene = 1.2
B-24-GW	02/02/17	**1,400**	**250,000**	**500,000**	**1,600**	**590**	< 50	< 50	ND	**3.4**	**3.5**	fluorene = 3.3 1-methylnaphthalene = 2.8 pyrene = 1.4
B-25-GW	02/03/17	66	**5,100**	18,000	**29**	**210**	< 5.0	< 5.0	ND	--	< 5.0	--
B-26-GW	02/03/17	**110**	**770**	1,300	**20**	**63**	< 2.5	< 2.5	1,2,3-trichlorobenzene = 3.7 1,2,4-trimethylbenzene = 3.1	< 0.50	**0.64**	ND
B-27-GW	02/03/17	59	< 100	540	4.8	**48**	< 1.7	9.4	ND	--	< 1.7	--
B-28-GW	02/03/17	< 50	< 100	960	**37**	**230**	< 10	< 10	ND	--	< 10	--
B-30-GW	02/04/17	< 50	< 50	< 250	< 0.5	1.4	< 0.5	< 0.5	ND	< 0.50	< 0.50	ND
B-31-GW	03/29/17	< 50	**110**	870	**72**	**68**	< 1.7	< 1.7	chloroform = 1.8	< 0.0500	0.0632	ND
B-34-GW	03/29/17	< 50	**140**	700	**26**	**160**	< 2.5	< 2.5	**chloroform = 2.9**	< 0.0500	0.0735	ND
B-35-GW	03/29/17	< 50	**140**	1,100	1.0	4.3	< 0.50	< 0.50	**vinyl chloride = 0.79**	< 0.0500	< 0.0500	ND
B-36-GW	04/11/17	< 50	**120**	580	4.7	**28**	< 0.50	< 0.50	methyl t-butyl ether = 1.6	< 0.500	< 0.500	ND
GGW-2	03/30/17	< 50	**150**	420	< 0.5	**5.2**	< 0.50	< 0.50	ND	< 0.50	< 0.50	< 0.50
B-46-GW	09/29/17	< 50	**120**	390	< 0.50	< 0.50	< 0.50	< 0.50	ND	--	--	--
B-47-GW	09/29/17	< 50	**78,000**	**330,000**	**83**	**130**	< 5.0	< 5.0	ND	--	--	--
	9/29/2017 [1]	--	**92,000**	**280,000**	--	--	--	--	--	--	--	--
B-48-GW	09/29/17	< 50	78	< 250	< 0.50	0.72	1.7	< 0.50	chloroform = 2.1 **1,2-DCA = 0.53**	--	--	--
Tier 1 ESL		100	100	50,000	6.0	5.0	3.0	20	Various	2.1	0.17	Various
Residential Vapor Intrusion ESL		--	--	--	110	5.6	3.0	1,300	Various	--	20	Various
Direct Exposure ESL		220	150	50,000	6.0	5.0	5.0	20	Various	36	0.17	Various

Notes:
1 - Sample run using silica gel cleanup method 3630A

ESLs for Other VOCs	Tier 1 ESL	Residential VI ESL	Direct Exposure ESL
Benzo(a)anthracene	0.027	--	0.034
Chloroform	2.3	2.3	80
1,2-DCA	0.5	6.1	0.5
vinyl chloride	0.061	0.061	0.5

µg/L - micrograms per liter
TPHg - Total Petroleum Hydrocarbons as Gasoline, EPA Method 8015B
TPHd - Total Petroleum Hydrocarbons as Diesel Range, EPA Method 8015B
TPHmo - Total Petroleum Hydrocarbons as Motor Oil, EPA Method 8015B
VOCs - Volatile Organics Compounds, EPA Method 8260B
PAHs - Polycyclic aromatic hydrocarbons, EPA Method 8310
cis-1,2-DCE - cis-1,2-dichloroethene
TCE - Trichloroethene
PCE - Tetrachloroethene
1,2-DCA - 1,2-dichloroethane
< 0.50 - Analyte was not detected above the laboratory reporting limit (0.50 µg/L)
ND - Not detected at or above the laboratory reporting limit(s)
-- - Sample not analyzed or not established
ESL - Environmental screening level(s)
Various - ESLs, where established, vary for each of the multiple compounds analyzed
Bold - Detection exceeds established ESL
Tier 1 ESL - San Francisco Bay Regional Water Quality Control Board's Environmental Screening Levels - Tier 1 Groundwater. February 2016 [Rev. 3]
Residential Vapor Intrusion ESL - San Francisco Bay Regional Water Quality Control Board's Environmental Screening Levels - Residential Groundwater Vapor Intrusion Human Health Risk Levels (Table GW-3) for Shallow Groundwater. February 2016 [Rev. 3]
Direct Exposure ESL - San Francisco Bay Regional Water Quality Control Board's Environmental Screening Levels - Groundwater Direct Exposure Human Health Risk Levels (Table GW-1) MCL Priority. February 2016 [Rev. 3]

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ATTACHMENT 3

PRELIMINARY VMS DESIGN DRAWINGS, REVISED 9 NOVEMBER 2017

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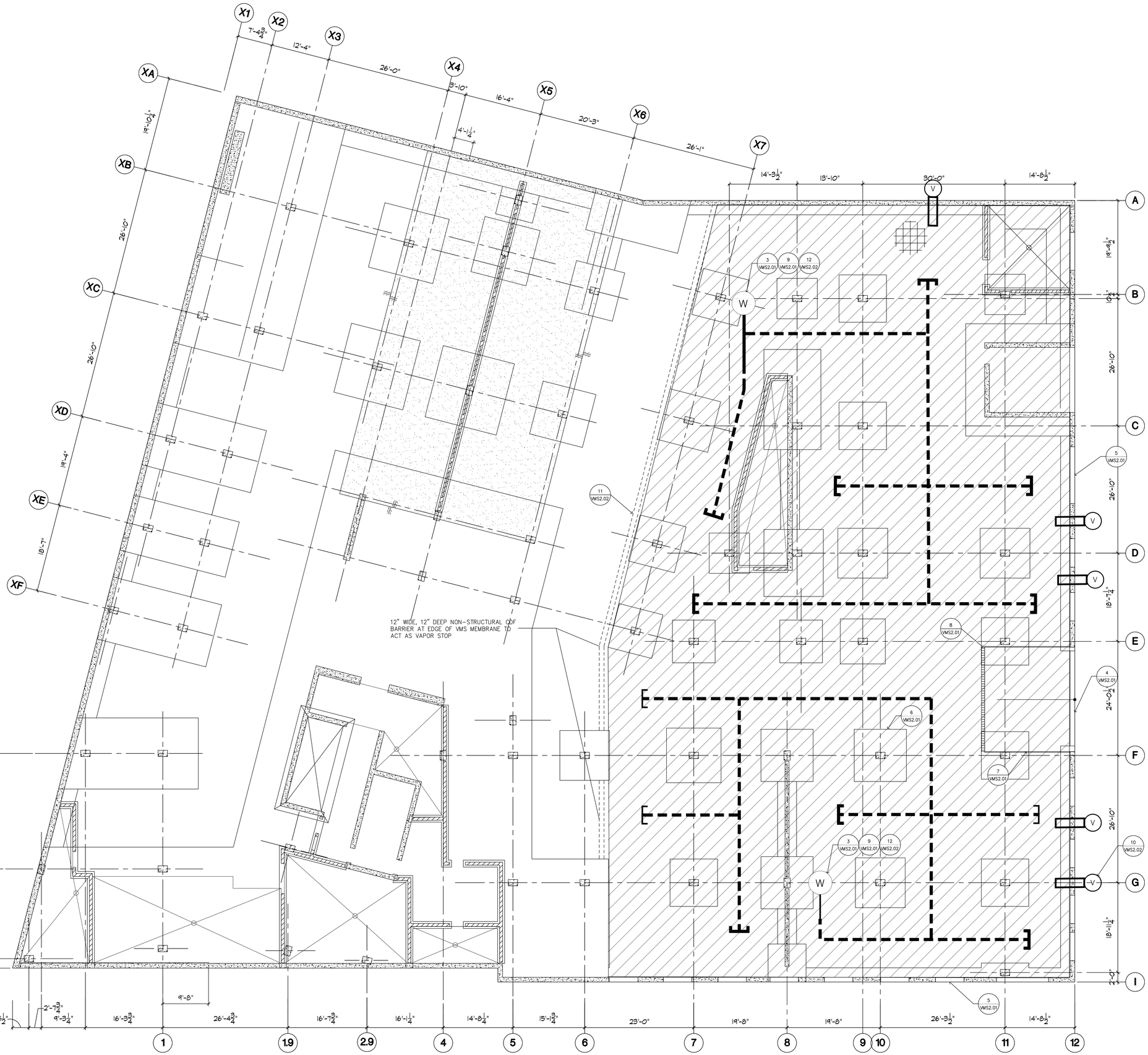

PRELIMINARY – NOT FOR CONSTRUCTION

LEGEND

- SOLID PVC PIPING
- PERFORATED PVC PIPING
- W — VMS RISER TO ROOF
- V — PERIMETER INLET VENT
- PVC END CAP
- EXTENT OF SPRAY APPLIED VAPOR BARRIER MEMBRANE
- 1 / VMS2.01 — SEE DETAIL 1, SHEET VMS 2.01
- CDF BARRIER

Background drawing is taken from the Structural Concrete Set, page SC–2.1, Level B1 Foundation Plan issued for GMP on 16 March 2017, drawn by FBA Inc. Structural Engineers

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Issued for Bid	08.04.2017
ACDEH Submittal	10.19.2017
ACDEH Revised	11.09.2017
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PIPING LAYOUT

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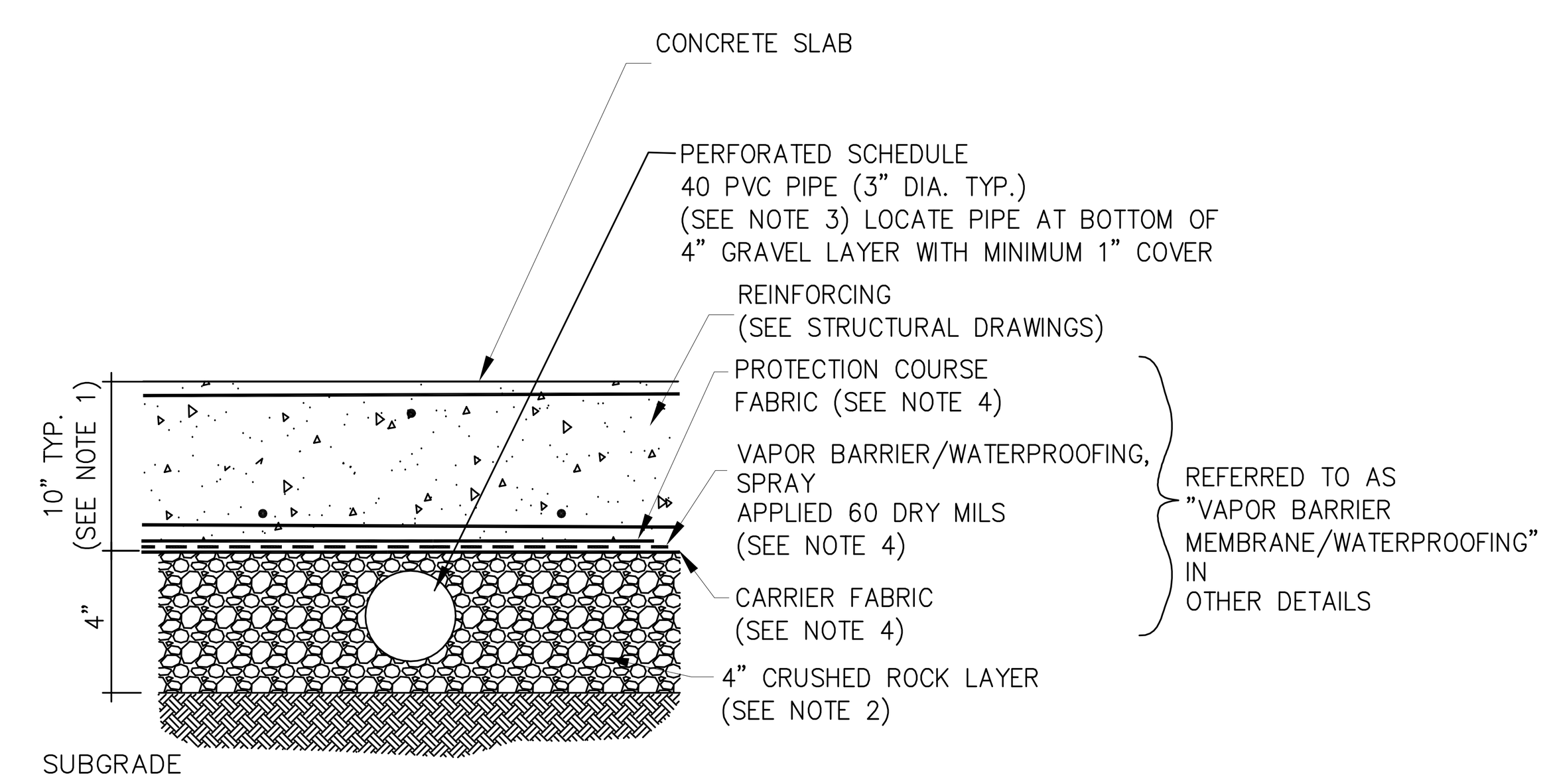
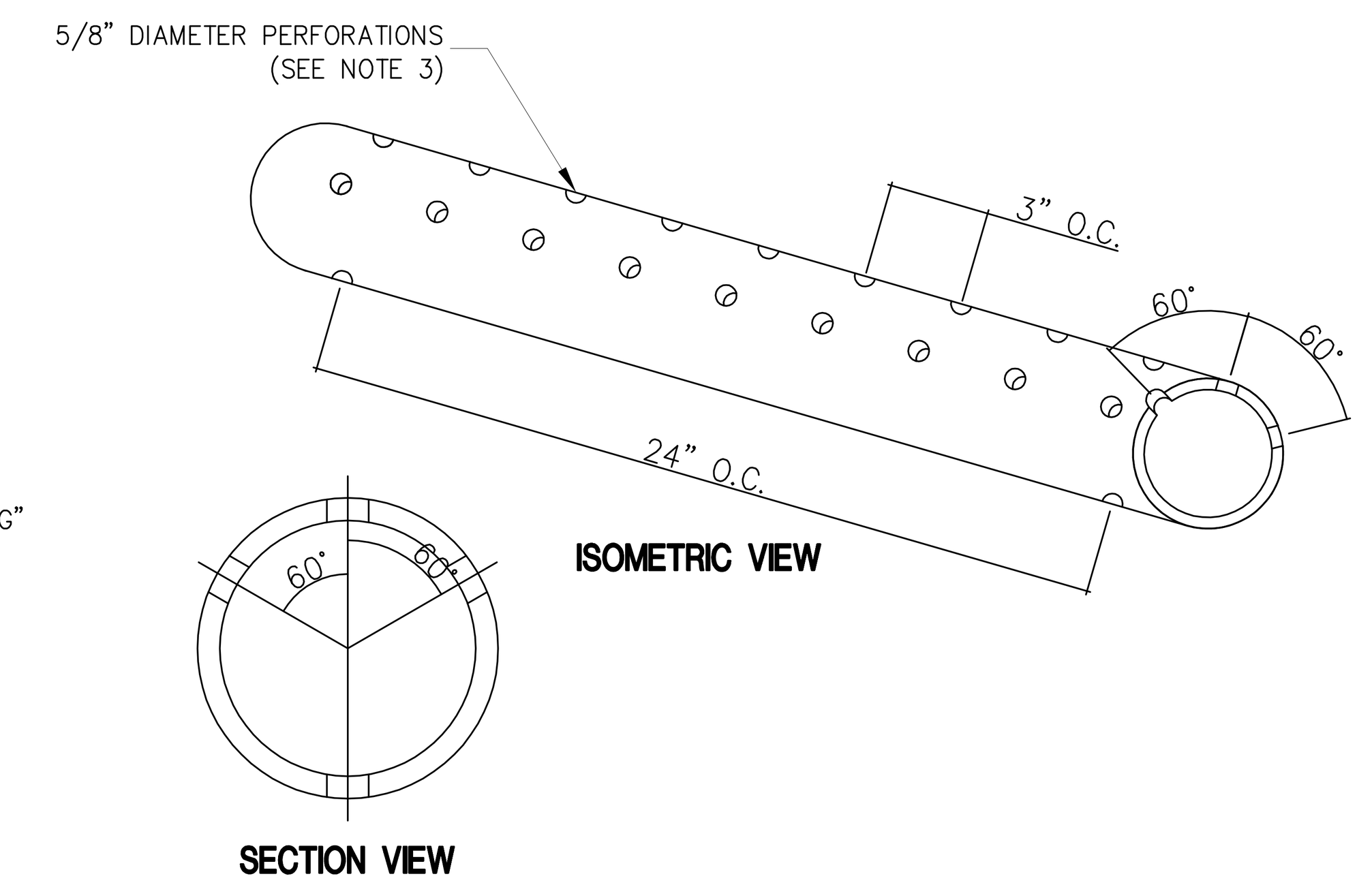


1 TYPICAL VAPOR MITIGATION SYSTEM CROSS-SECTION
NOT TO SCALE



2 DETAIL OF PERFORATED PIPE PATTERN
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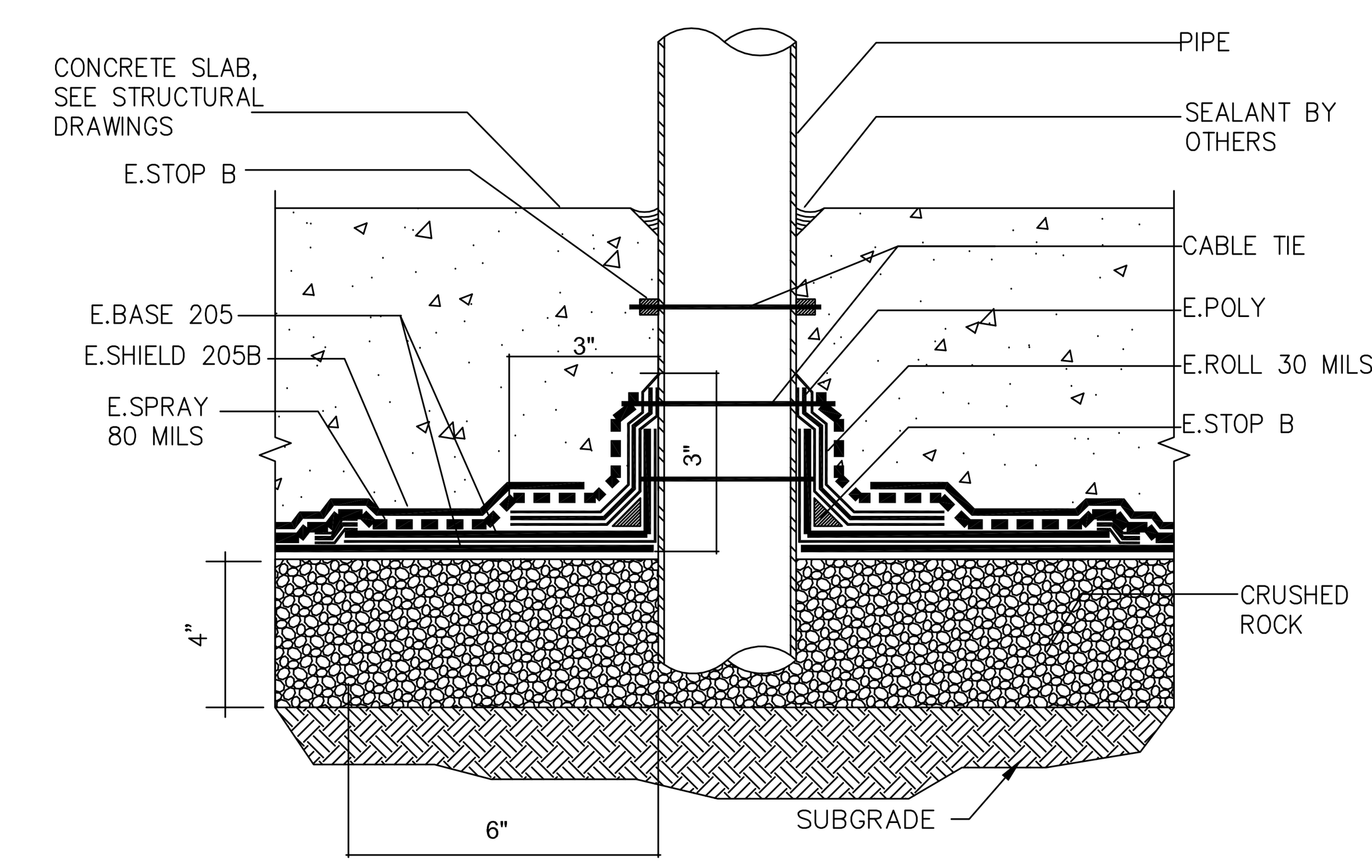
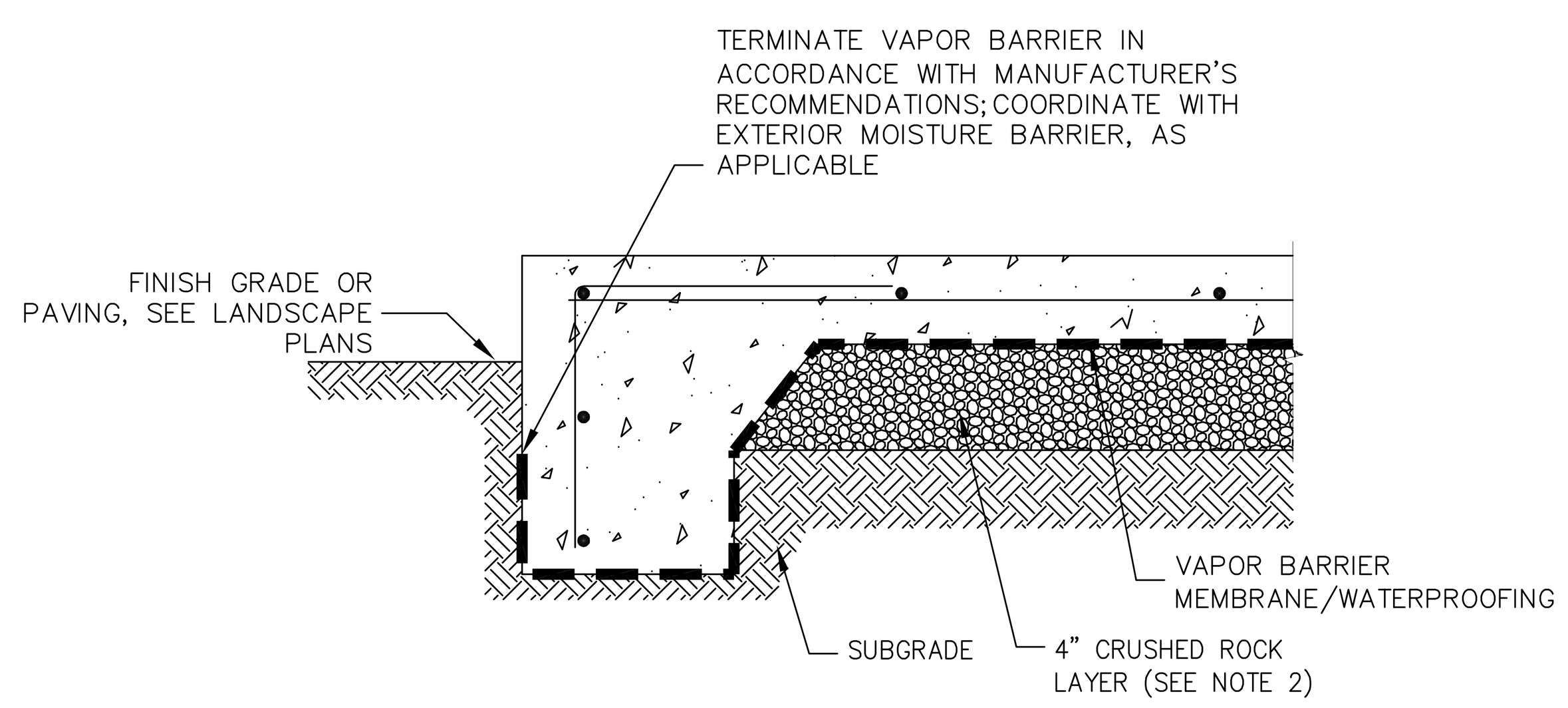
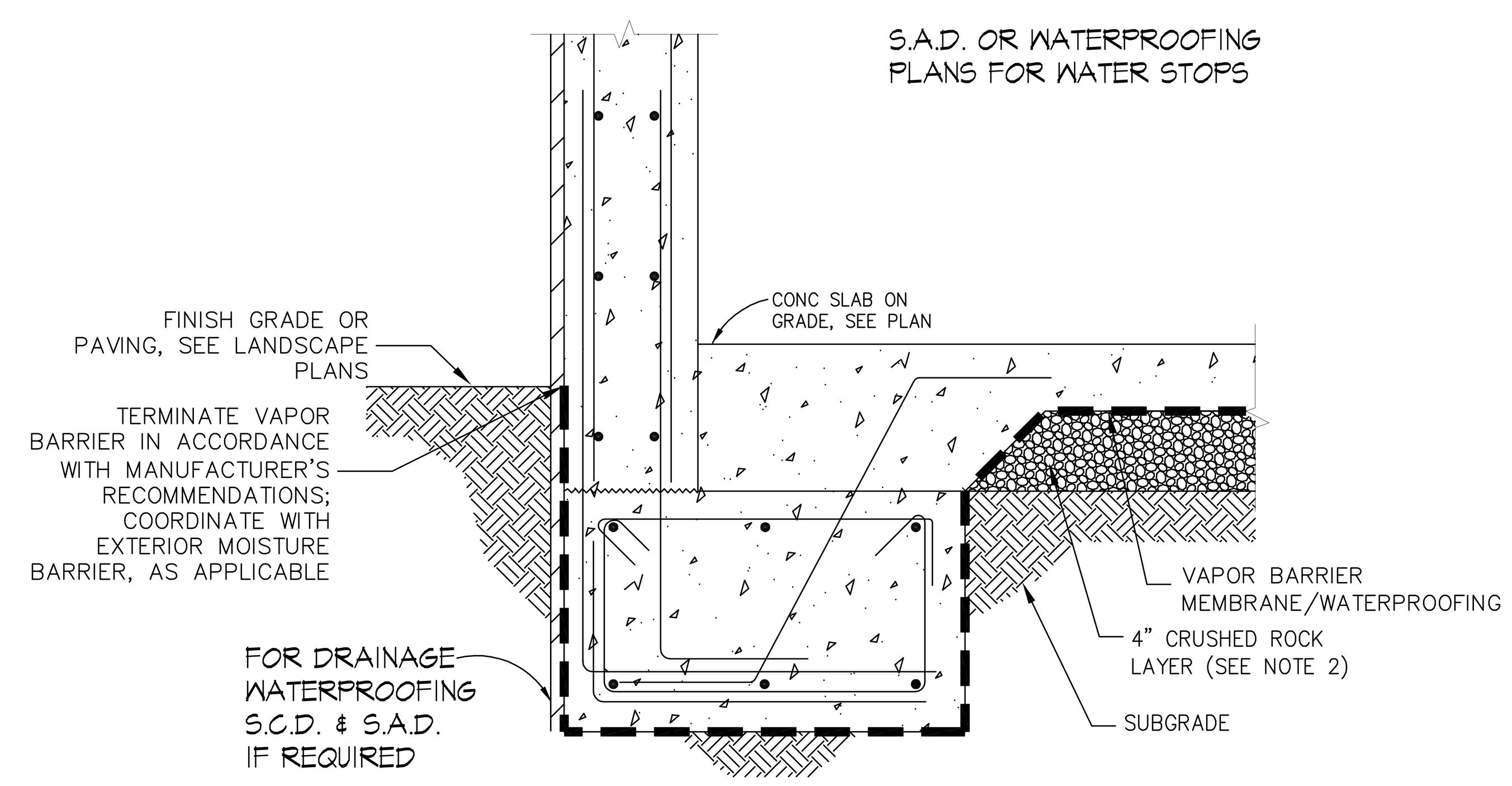


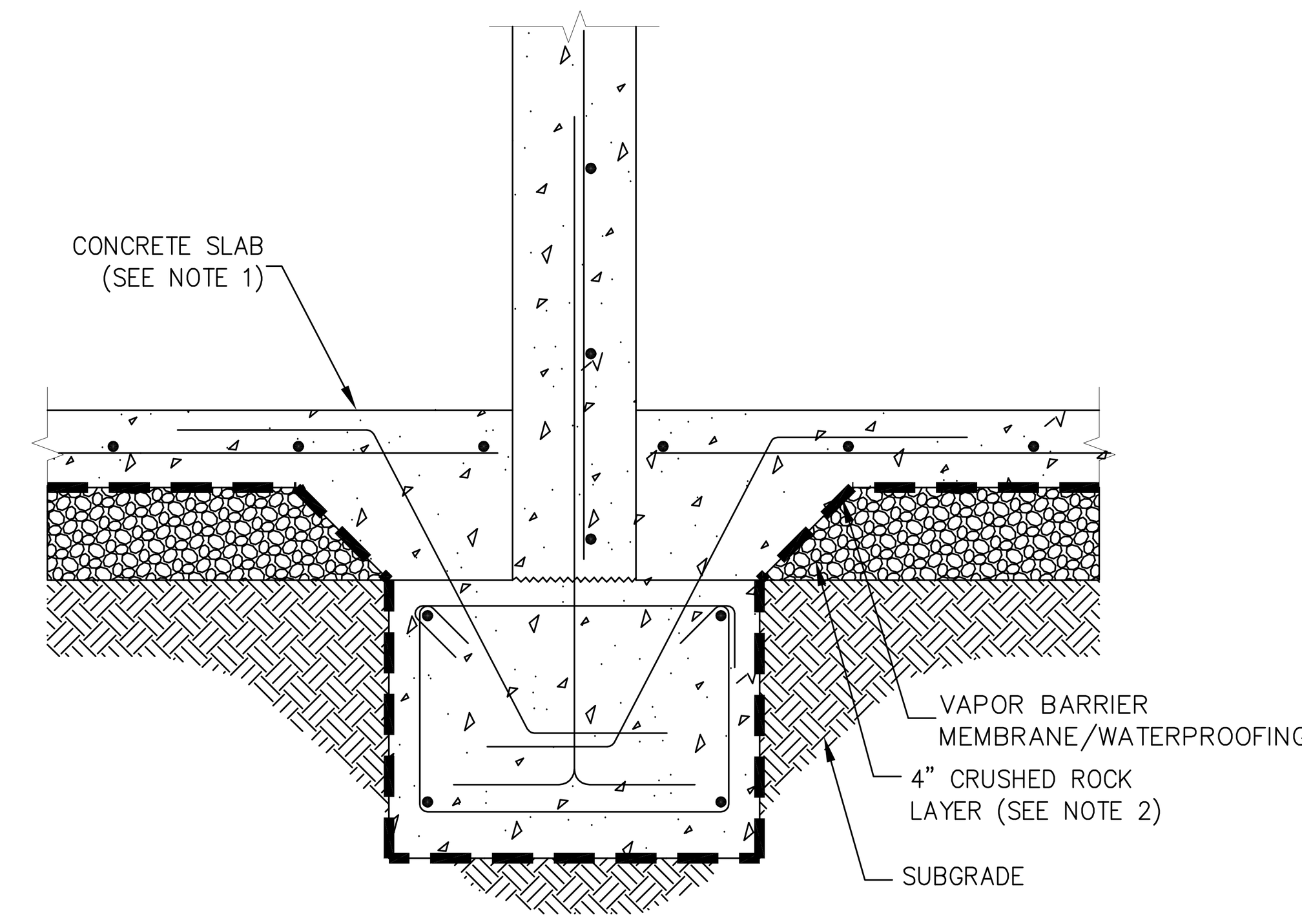
3 TYPICAL SEALING OF ALL PENETRATIONS THROUGH CONCRETE SLAB
NOT TO SCALE



4 TYPICAL VAPOR BARRIER TIE-IN AT EDGE OF SLAB
NOT TO SCALE



5 TYPICAL VAPOR BARRIER TIE-IN AT EXTERIOR ECCENTRIC FOOTING SECTION
NOT TO SCALE



6 TYPICAL VAPOR BARRIER AT INTERIOR CONCENTRIC FOOTING SECTION
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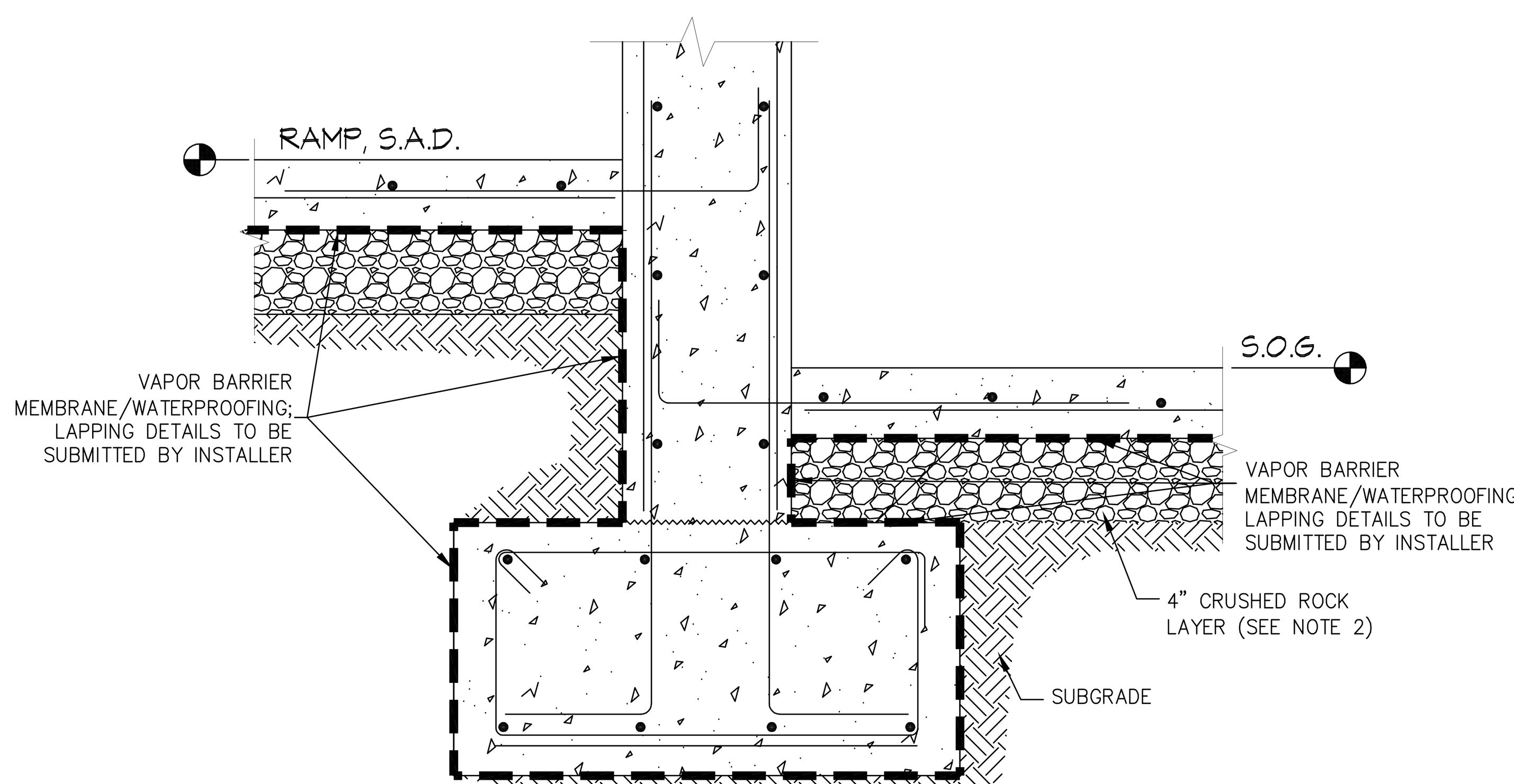
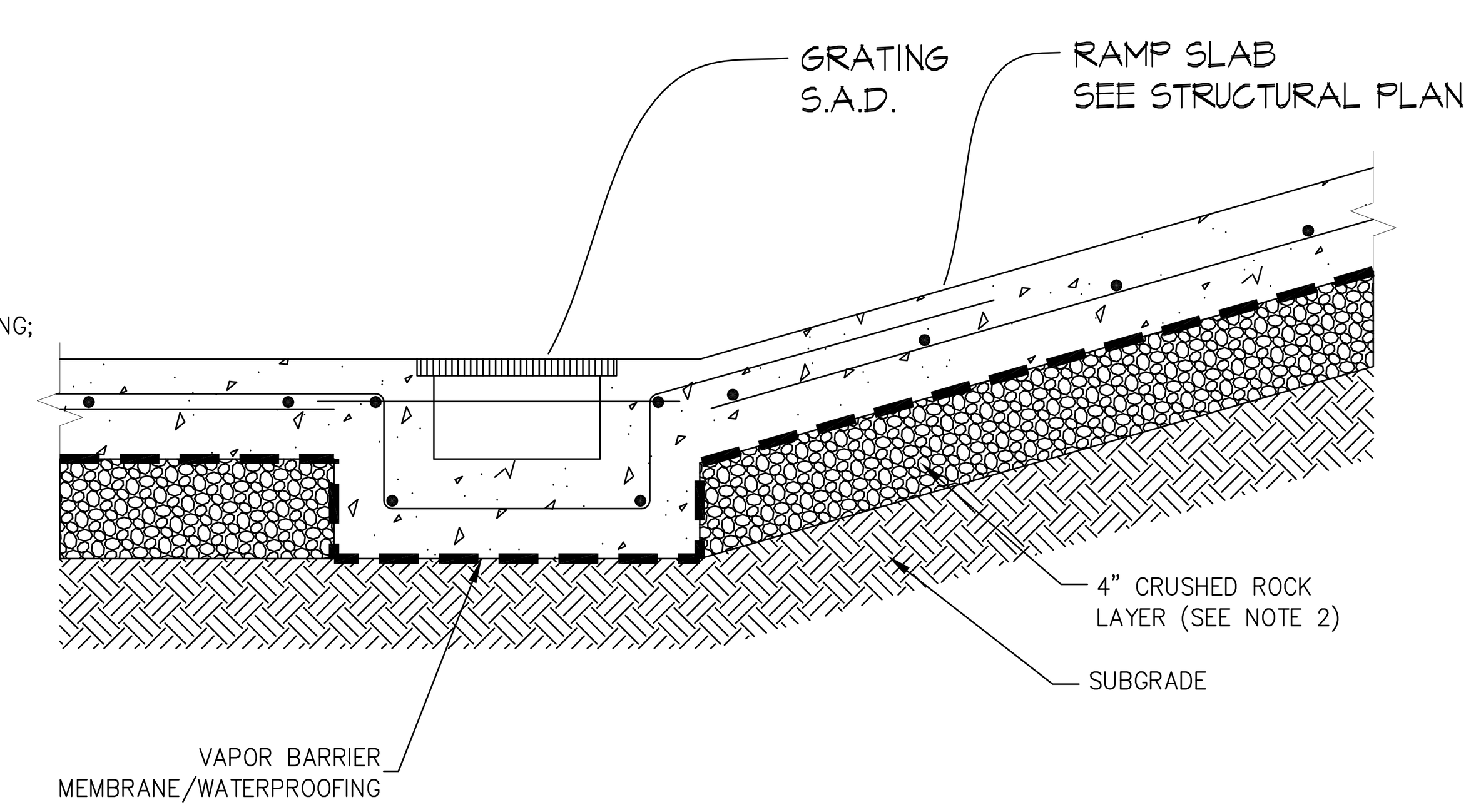
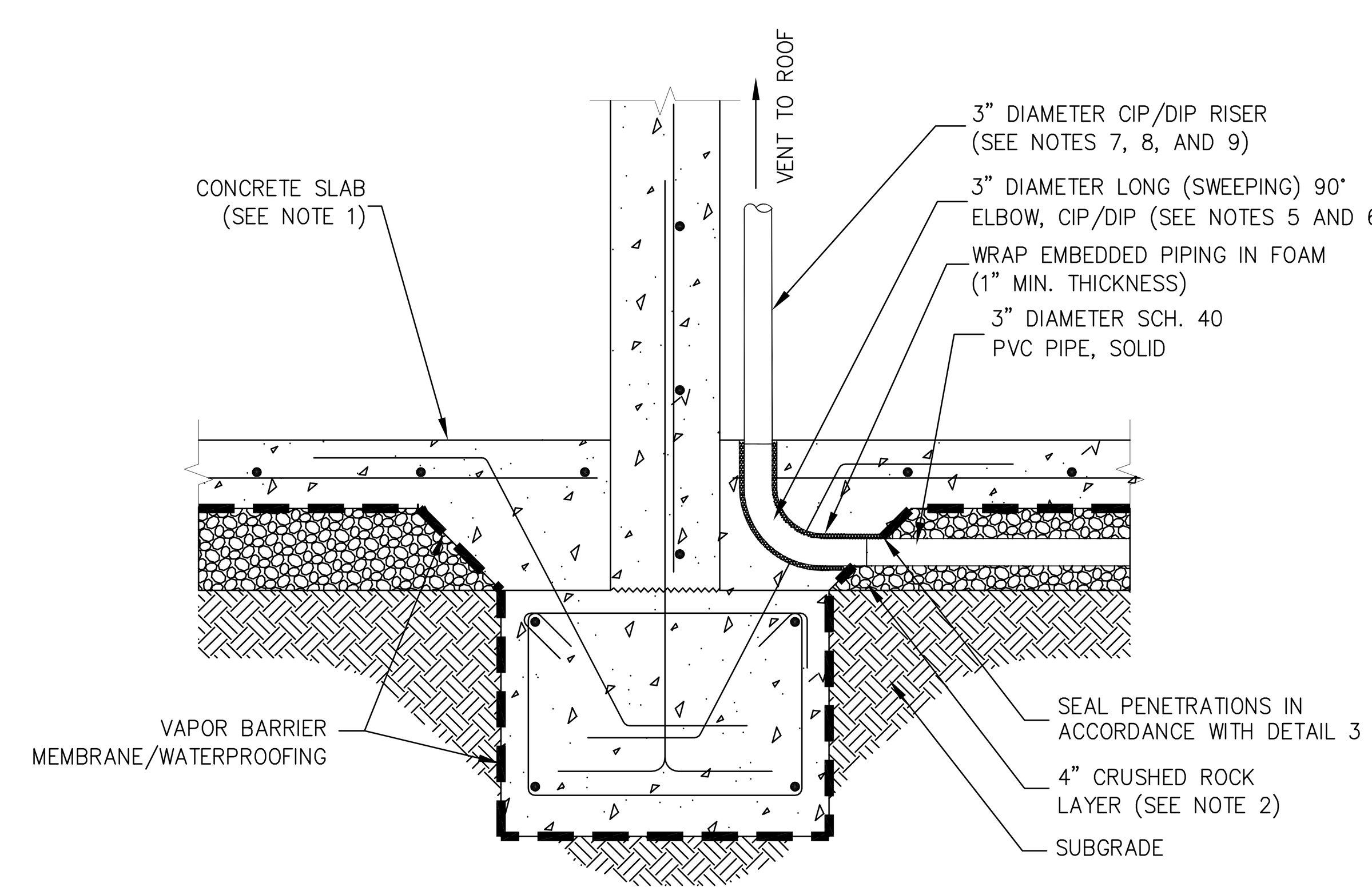


7 VAPOR BARRIER AT PARKING RAMP
NOT TO SCALE



8 VAPOR BARRIER AT PARKING RAMP AND GRATING
NOT TO SCALE



9 TYPICAL HORIZONTAL TO VERTICAL TRANSITION AT RISER
NOT TO SCALE

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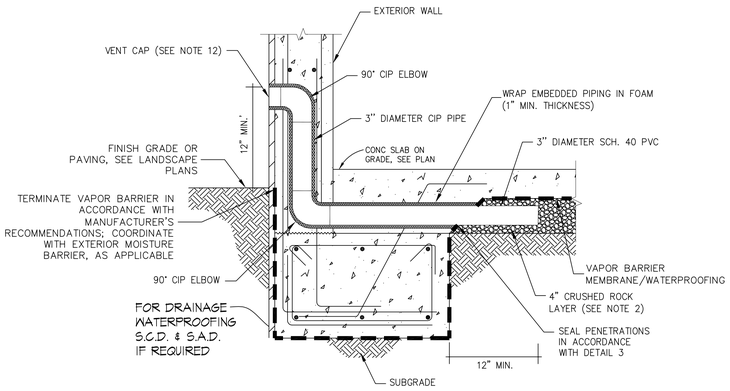
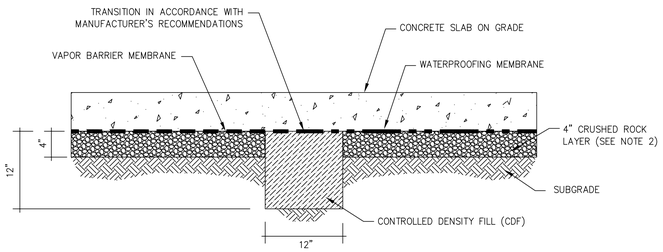
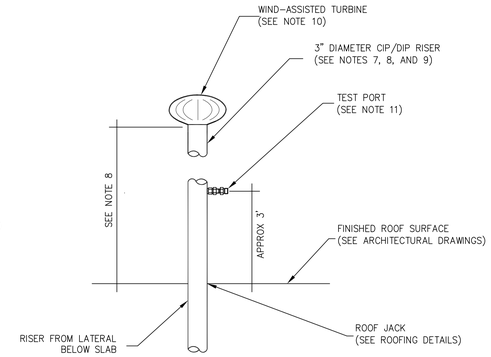
S.A.D. OR WATERPROOFING
PLANS FOR WATER STOPS



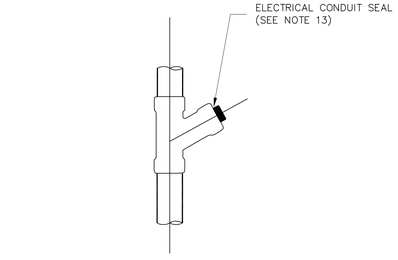
10 TYPICAL PERIMETER INLET VENT
NOT TO SCALE



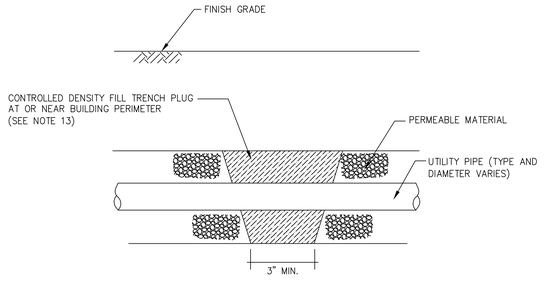
11 CDF BARRIER AT EDGE OF VMS
NOT TO SCALE



12 RISER AND TURBINE AT ROOF
NOT TO SCALE



13 TYPICAL INTERIOR AND EXTERIOR CONDUIT SEAL
NOT TO SCALE



14 SOIL VAPOR CUT-OFF BARRIER IN UTILITY TRENCH AT BUILDING PERIMETER
NOT TO SCALE

SHEET NOTES

1. ALL LOCATIONS AND DIMENSIONS OF BUILDING SLABS, FOOTINGS, GRADE BEAMS, PILE CAPS, AND OTHER FOUNDATION ELEMENTS TO BE CONFIRMED WITH STRUCTURAL DETAILS.
2. CRUSHED ROCK (GRAVEL) LAYER SHALL BE 1/4-INCH BY 3/4-INCH (100% PASSING 1-INCH; BETWEEN 90% AND 100% PASSING 3/4-INCH; 5% MAXIMUM PASSING #4). SURFACE OF CRUSHED ROCK LAYER SHALL BE SMOOTH-ROLLED PRIOR TO APPLICATION OF THE CARRIER FABRIC.
3. THE HORIZONTAL PERFORATED PIPE SHALL BE SCHEDULE 40 POLY VINYL CHLORIDE (PVC). INDICATED SECTIONS OF HORIZONTAL PIPE SHALL BE PERFORATED WITH 5/8 INCH DIAMETER HOLES, THREE HOLES ACROSS THE UPPER ONE-THIRD OF THE PIPE, EVERY 3 INCHES ALONG THE PERFORATED SECTION; AN ADDITIONAL 5/8 INCH DIAMETER HOLE SHALL BE DRILLED ON THE UNDERSIDE OF THE PIPE AT LEAST EVERY 2 LINEAR FEET ALONG THE PERFORATED SECTION TO ALLOW WATER, IF ANY, TO DRAIN FROM THE PIPE.
4. THE SPRAY-APPLIED VAPOR BARRIER FOR VMS (AS INDICATED IN SHEET VMS1.01) AND THE WATERPROOFING MEMBRANE (ALL OTHER PORTIONS OF THE SLAB) SHALL BE EPRO E-PROTECT THROUGHOUT UNDERSIDE OF SLAB AND EXTERIOR BELOW-GRADE WALLS. VMS PORTION OF MEMBRANE SHALL BE SMOKE TESTED. THE SPRAY APPLIED MEMBRANE SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S SPECIFICATIONS AND QA/QC REQUIREMENTS BY A MANUFACTURER APPROVED APPLICATOR. CARRIER FABRIC AND PROTECTION COURSE FABRIC SHALL BE PER MEMBRANE MANUFACTURER'S SPECIFICATIONS. APPLICATION SEQUENCE AND TRANSITIONS FROM VERTICAL TO HORIZONTAL SURFACES SHALL BE COORDINATED BETWEEN APPLICATOR(S) AND GENERAL CONTRACTOR. SEE WATERPROOFING DRAWINGS FOR ADDITIONAL REQUIREMENTS.
5. SLAB PENETRATIONS WILL BE PREPARED AND STUBBED PRIOR TO MEMBRANE INSTALLATION. ALL PENETRATIONS SHALL BE CLEANED PER SPECIFICATIONS BEFORE MEMBRANE IS APPLIED.
6. PENETRATIONS THROUGH SLAB SHALL BE LOCATED CLEAR OF AND BETWEEN REINFORCING STEEL OR TIES. SLAB PENETRATION SHALL NOT BE IN CONTACT WITH ADJACENT PENETRATIONS OR STEEL COLUMNS TO ALLOW FOR PROPER SEALING OF THE ENTIRE PENETRATION CIRCUMFERENCE.
7. THE VERTICAL RISER PIPES (W) TO THE WIND TURBINES SHALL BE 3 INCH DIAMETER DUCTILE IRON PIPE (DIP) OR CAST IRON PIPE (CIP). THE RISER SHALL BE FULLY SUPPORTED THROUGH THE ENTIRE HEIGHT OF THE BUILDING, SUCH THAT NO DOWNWARD FORCE (DUE TO WEIGHT OF RISER) IS EXERTED ON THE PVC ASSEMBLY LOCATED BENEATH THE SLAB.
8. THE RISER PIPES (W) SHALL BE AFFIXED TO THE STRUCTURE PER DETAILS PROVIDED BY THE PLUMBING CONTRACTOR AS A DESIGN-BUILD ITEM. ATTACHMENT METHODS MAY INCLUDE STRAPS, BRACES, OR OTHER MECHANISMS TO FULLY SUPPORT THE WEIGHT OF THE PIPE. THE TOP OF THE RISER PIPE SHALL EXTEND TO AN ELEVATION OF 1 FOOT ABOVE THE TOP OF WIND SCREEN, ROOF PARAPET, EDGE OF ROOF LEVEL OR ANY OTHER OBSTRUCTIONS TO WIND ACTIVATION OF THE TURBINE, BE LOCATED A MINIMUM OF 15 FEET AWAY FROM FRESH AIR INTAKES FOR BUILDING'S HVAC SYSTEM OR OTHER OPENINGS (WINDOWS, DOORS, ETC.), AND SHALL BE SUPPORTED BY UNISTRUTS ATTACHED TO AN ADJACENT COLUMN OR STABILIZED WITH GUY WIRES THAT ARE ATTACHED TO THE ROOF.
9. THE VERTICAL RISER PIPES (W) TO THE WIND TURBINE SHALL BE PROMINENTLY LABELED AS "CONTAINS VAPORS; DO NOT BREAK OR CUT," AT A MINIMUM OF ONCE PER FLOOR LEVEL. RISER PIPE MATERIAL WITHIN THE BUILDING ENVELOPE SHALL BE DIP OR CIP; TRANSITIONS FROM/TO PVC, AS APPLICABLE, SHALL OCCUR WITHIN OR BELOW THE FLOOR SLAB OR ABOVE FINISHED ROOF. RISER SHALL BE FIRE CAULKED AT THE PENETRATION THROUGH THE FOUNDATION FLOOR SLAB.
10. THE WIND-ASSISTED TURBINE VENTS ON TOP OF THE VERTICAL RISER PIPES SHALL BE 12-INCH DIAMETER, 680 CFM, TYPE 304 STAINLESS STEEL (McMASTER-CARR CATALOG NO. 1992K48) AND SHALL BE SECURELY ATTACHED TO TOP OF RISER. TURBINE SHALL BE ADAPTED TO FIT A 3 INCH PIPE. TURBINE SHALL BE INSTALLED TO RESIST WIND, SEISMIC, AND OTHER LOADS, AS NEEDED.
11. A TEST PORT SHALL BE INSTALLED AT THE RISER PIPE (W) TO SAMPLE AIR FROM THE COLLECTION PIPE AT AN ACCESSIBLE LOCATION AT THE ROOF LEVEL. TEST PORT SHALL BE BRASS TUBE FITTING, BORED-THROUGH, MALE CONNECTOR, WITH ½ INCH TUBE OD AND 3/8 INCH MALE NPT (SWAGELOK B-810-1-6BT OR EQUIVALENT). TEST PORT CAP SHALL BE BRASS CAP FOR ½ INCH OD TUBING (SWAGELOK B-810-C OR EQUIVALENT). IF THE VERTICAL RISER IS AT LEAST 40 INCHES ABOVE THE TOP OF ROOF LEVEL, THE TEST PORT SHALL BE 36 INCHES ABOVE THE ROOF. IF THE VERTICAL RISER IS LESS THAN 40 INCHES ABOVE THE TOP OF ROOF LEVEL, THE TEST PORT SHALL BE 6 INCHES BELOW THE TOP OF RISER.
12. PERIMETER INLET VENT MATERIAL WITHIN THE BUILDING ENVELOPE SHALL BE DIP OR CIP; TRANSITIONS FROM/TO PVC, AS APPLICABLE, SHALL OCCUR WITHIN OR BELOW THE FLOOR SLAB. PERIMETER INLET VENTS SHALL BE FIRE CAULKED AT THE PENETRATION THROUGH THE FOUNDATION FLOOR SLAB. THE VENT PIPE CAP SHALL KEEP OUT DEBRIS BUT ALLOW AIR TO ENTER THE PIPE. VENTS SHALL BE LOCATED A MINIMUM OF 36 INCHES AWAY FROM OPERABLE WINDOWS AND DOOR JAMS. VENT CAP TO BE COORDINATED WITH ARCHITECT. VENT CAP SHALL BE FABRICATED OF METAL AND INCLUDE A MESH DEBRIS SCREEN.
13. SEE MECHANICAL, ELECTRICAL, AND PLUMBING DRAWINGS FOR CONDUIT SEAL LOCATIONS AND SEALING PRODUCT.

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