July 17, 2023

Ronnie E. Lee, P.E.
NYSDEC
Department of Environmental Remediation
625 Broadway
Albany, NY 12233-7016

RE: Remedial Design Workplan – Engineering Controls
737 4th Avenue, Brooklyn, NY
BCP #C224332

Dear Mr. Lee:

P.W. Grosser Consulting Engineer & Hydrogeologist, P.C. (PWGC) has prepared this Remedial Design Workplan for the above referenced Site to further detail the remedial elements identified in the Remedial Action Work Plan (RAWP) prepared by PWGC in February 2023 and approved by the New York State Department of Environmental Conservation (NYSDEC) in March 2023. This document is a supplement to the May 18, 2023 Remedial Design Work Plan that was limited to detailing the proposed excavation and endpoint sampling portion of the remedial strategy. This document will detail the engineering controls of the remedial strategy, specifically the installation of a sub-slab depressurization system (SSDS), the installation of a vapor barrier system, the application of petroleum targeting remediation chemicals to address the residual petroleum impact from closed NYSDEC Spill #93-05122 and active NSYDEC Spill #16-10374, and the potential installation of a soil vapor extraction (SVE) system.

A Site Location Map is included as **Figure 1** and a Site Plan is included as **Figure 2**.

Chemical Injections:

The remedial effort will include the application of RegenOx, manufactured by Regenesis, to enhance degradation of petroleum compounds. Injection activities are intended to be performed at the site prior to most excavation activities.

Prior to conducting these chemical injections, PWGC has submitted to the United States Environmental Protection Agency (USEPA) an Underground Injection Control (UIC) Inventory form indicating that the injections will be occurring in July 2023.

PWGC has consulted with Regenesis to develop an appropriate chemical injection plan to address the petroleum impact to soil and groundwater at the site. A direct-push drill rig will be utilized to inject petroleum remediation chemicals into the subsurface.

Product Specifications and Safety Data Sheets for RegenOx and Petrofix are included as **Appendix A** and injection locations are included as **Figure 3**.

Southwest Section

In the southwest section of the site, a total of 800 pounds of RegenOx Part A, 200 pounds of RegenOx Part B,and 1,821 gallons of water will be mixed together. Each of the fifteen injection points will receive approximately 125 gallons of mixture (21 gallons per foot). Each of these injection points will range from 16 to 22 feet below grade.

Southeast Section

In the southeast section of the site, a total of 4,440 pounds of RegenOx Part A, 1,480 pounds of RegenOx Part B, and 10,109 gallons of water will be mixed together. Each of the 25 injection points will receive approximately 419 gallons of mixture (17 gallons per foot). Each of these injection points will range from 7 to 25 feet below grade.

Soil Sampling

Following the chemical injections and just prior to pouring of the concrete slabs and if feasible, soil samples will be collected at the two areas and depths previously sampled that contained exceedances of Protection of Groundwater SCOs for petroleum related compounds. These areas are the SB007/SB019 location at 7 to 9 feet below grade and 17 to 19 feet below grade and SB021 locations in the southeast and the SB011 location at 18 to 20 feet below grade in the southwest. In the event that groundwater is encountered at the deeper locations, the sample depth will be modified to be the 2 foot interval above the water table/smear zone. The locations of the soil borings are shown on **Figure 4**.

The three soil samples will be analyzed for VOCs by USEPA method 8260 in accordance with the Quality Assurance Plan included in the RAWP.

Soil Vapor Extraction System:

A SVE system will be installed as a contingency if the soil samples collected as part of the chemical injections do not pass Protection of Groundwater Soil Cleanup Objectives. Two SVE wells will be installed, one in the southeast area and one in the southwest area. The SVE wells will be constructed of 4-inch diameter schedule 40 PVC pipe. The well screen will be 20-slot screen installed 2 feet above the water table; the top of the screen at SVE-01 will be elevation 18.75 feet and the top of the screen at SVE-02 will be elevation 25.25. The SVE wells will be completed to grade with solid PVC riser. SVE-01 will be installed beneath the cellar space in the southwest corner of the site and SVE-02 will be installed beneath the first floor in the southeast corner of the site. A lateral pipe will connect SVE-02 to SVE-01 below grade into the cellar along the ceiling where it will be connected to a SVE blower package temporarily housed in the cellar. The package will consist of two 2-horsepower Amtek Windjammer Pro fans, a carbon filtration canister to remove contaminants prior to discharge, and a moisture separator. The temporary effluent discharge will be located outside and above the cellar level. Sampling ports will be installed on each SVE leg prior to being manifolded together. Influent samples will be collected to evaluate the efficacy of the SVE system and will be analyzed for VOCs by USEPA method TO-15.

It is intended that operation of the SVE will begin as soon as practicable while construction is

still ongoing if it is needed to further remediate the soil in the two areas of concern. If the system operation is needed to continue after the building is completed, the blower package and effluent will be relocated to the building's roof. The final discharge point of the SVE will be located above the eave of the roof, a minimum of 10 feet from any opening that is less than 2 feet below the exhaust point, and a minimum of 10 feet from any adjoining or adjacent buildings or HVAC intakes or supply registers.

The design of the SVE is included in **Appendix B**. If operation of the SVE is needed post-Certificate of Completion, an Operations, Monitoring, and Maintenance (OM&M) Plan will be prepared and included in the Site Management Plan (SMP).

Sub-Slab Depressurization System:

A SSDS will be installed beneath the new building footprint to mitigate potential soil vapor intrusion into the new building. The SSDS will be installed in a trench format beneath the cellar and the portion of the first floor that is in contact with the soil and the riser will be routed through the building to above the roofline to vent the vapor space beneath the building.

The SSDS piping will consist of geovent material placed within a 4-inch thick layer of ½-inch to 1-inch crushed stone beneath the basement slab and first floor slabs that are in contact with the soil. A non-woven geotextile fabric will be placed beneath the stone layer to reduce fines from entering the system. The geovent will be connected to closed duct riser piping that will be routed through the building. The geovent will be connected to 4-inch diameter closed duct piping. Above the first floor slab, the 4-inch closed duct piping from the SSDS legs will be combined and the riser pipe will be completed with a 6-inch closed duct pipe to above the roofline and finished with a 6-inch turbine ventilator. The exhaust point of the SSDS will be located above the eave of the roof, a minimum of 10 feet from any opening that is less than 2 feet below the exhaust point, and a minimum of 10 feet from any adjoining or adjacent buildings or HVAC intakes or supply registers.

Effluent sampling ports will be located on each riser section of the SSDS legs prior to their union and a combined effluent sampling point will be located on the riser pipe above the roof. A total of five vacuum monitoring points will be installed, two beneath the cellar and three beneath the first floor. The vacuum monitoring points will be constructed of 1.5-inch diameter schedule 40 PVC with 20 slot screen that will be screened from the bottom of the slab to approximately 3 inches inches below the slab. The annulus of the vacuum monitoring points below the slab will be filled with gravel pack.

Following the completion of the building construction and the HVAC system installation, a soil vapor intrusion (SVI) evaluation will be performed during the first available heating season to determine if the SSDS needs to be activated. The SVI evaluation will be conducted in accordance with the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006 and its subsequent addenda.

The SVI evaluation will consist of the collection of a sub-slab vapor sample from each of the five vacuum monitoring points, a co-located indoor air sample near each vacuum monitoring point, and one upwind outdoor air sample. The indoor and outdoor air samples will be collected from the breathing zone (approximately 3 to 5 feet above the ground). The samples will be collected over a period of 24 hours. During sample collection, an indoor air quality questionnaire and building inventory will be completed.

Following the SVI evaluation, the system will either remain passive or will be upgraded to an active system by the installation of a Cincinnati 2 horsepower fan, model number HP-41-15 or engineer approved equivalent. The SSDS design plans are included as **Appendix B**.

Vapor Barrier:

A vapor barrier will be incorporated into the construction of the proposed building. The vapor barrier, Preprufe 300R/160R, is a Class A vapor barrier, as per ASTM E1745-17. The vapor barrier will extend throughout the area occupied by the footprint of the new building and up the foundation sidewalls and will be installed in accordance with manufacturer specifications. At locations where a liquid mastic will be used, specifically between columns or foundation walls and their footings, Grace Liquid Bituthene will be utilized in accordance with ASTM E1993-98.

The vapor barrier design plans are provided in **Appendix B** and include typical design details. The vapor barrier specifications are included as **Appendix C**.

I, Paul K. Boyce, PE, PG, certify that I am currently a New York State registered professional engineer (PE) and that this Remedial Design Work Plan (RDWP) was prepared in accordance with applicable statutes and regulations and in substantial conformance with the New York State Department of Environmental Conservation's (NYSDEC's) Division of Environmental Remediation's (DER's) Technical Guidance for Site Investigation and Remediation (DER-10).

I certify that the information and statements in this certification are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

074604	07.17.2023	
New York State PE #	Date	Signature

It is a violation of Article 145 of the New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law.

Figures

PWGC
CLIENT DRIVEN SOLUTIONS
P.W. Grosser Consulting Engineer & Hydrogeologist, PC
630 Johnson Ave., Suite 7
Bohemia, NY 11716
Ph: 631-589-6353 • Fax: 631-589-8705
pwgc.info@pwgrosser.com

VICINITY MAP

731-747 4TH AVE
BROOKLYN, NY

0 ¼ ½ ¾ 1 Miles

Project:	TOT2101
Date:	4/14/2022
Designed by:	LS
Drawn by:	JCG
Approved by:	LS
Figure No:	1

Document Path: W:\Projects\S-Z\TOT\2101\ProjectFiles\TOT2101_RIWP_Figures\TOT2101_RIWP_Figures.aprx

Document Path: W:\Projects\S-Z\TOT\2101\Map Files\FIG02_SitePlan.mxd

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DRAWING PREPARED FOR:

REVISION	DATE	INITIAL	COMMENTS

DRAWING INFORMATION:

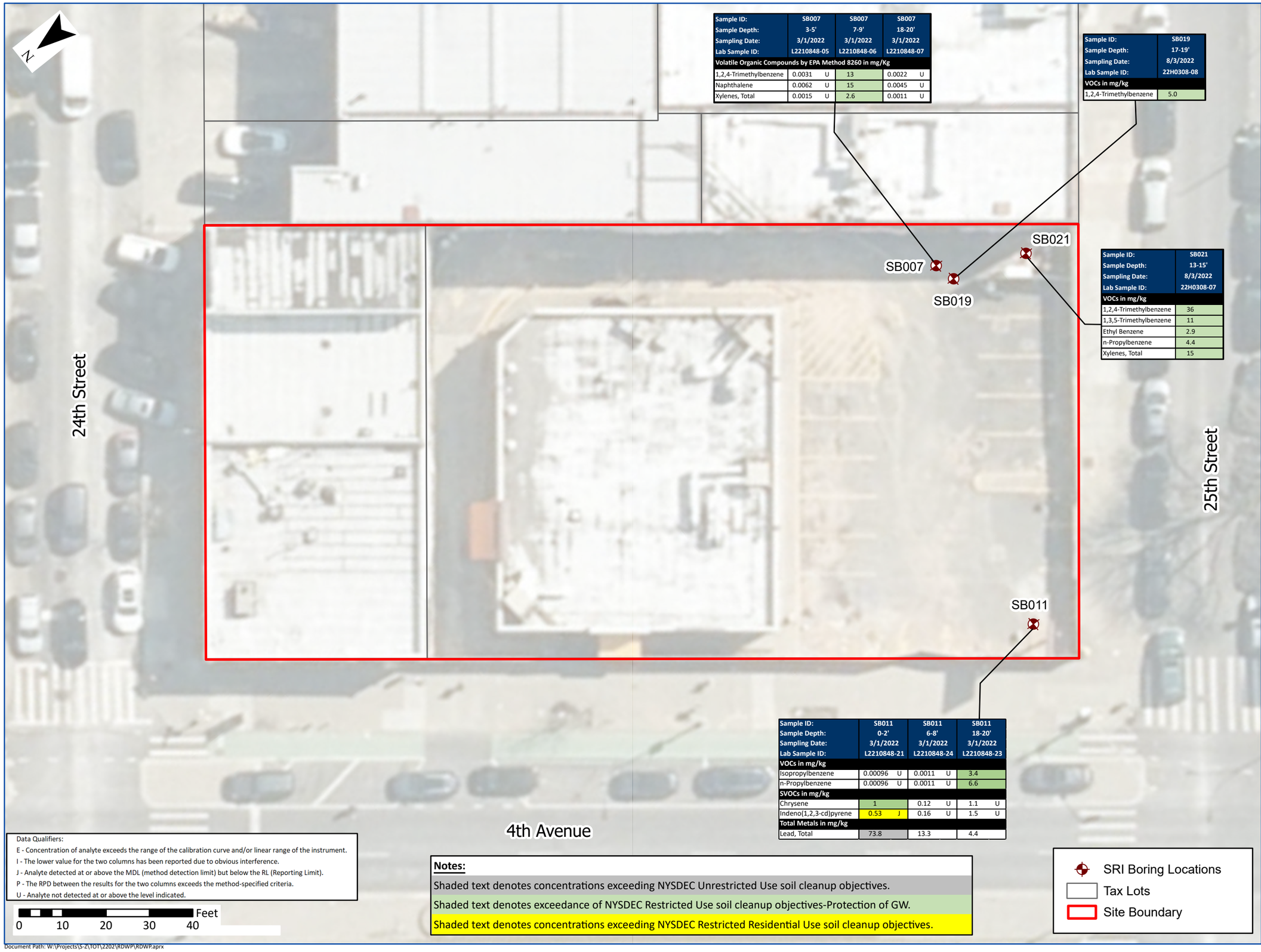
Project:	TOT2101	Designed by:	JL
Date:	3/29/2021	Drawn by:	UC
Scale:	AS SHOWN	Approved by:	JL

SITE PLAN

731-747 4th Ave
Brooklyn, NY

FIGURE NO:

2



Sample ID:	SB007		SB007		SB007	
Sample Depth:	3-5'		7-9'		18-20'	
Sampling Date:	3/1/2022		3/1/2022		3/1/2022	
Lab Sample ID:	L2210848-05		L2210848-06		L2210848-07	
Volatile Organic Compounds by EPA Method 8260 in mg/Kg						
1,2,4-Trimethylbenzene	0.0031	U	13		0.0022	U
Naphthalene	0.0062	U	15		0.0045	U
Xylenes, Total	0.0015	U	2.6		0.0011	U

Sample ID:	SB019
Sample Depth:	17-19'
Sampling Date:	8/3/2022
Lab Sample ID:	22H0308-08
VOCs in mg/kg	
1,2,4-Trimethylbenzene	5.0

Sample ID:	SB021
Sample Depth:	13-15'
Sampling Date:	8/3/2022
Lab Sample ID:	22H0308-07
VOCs in mg/kg	
1,2,4-Trimethylbenzene	36
1,3,5-Trimethylbenzene	11
Ethyl Benzene	2.9
n-Propylbenzene	4.4
Xylenes, Total	15

Sample ID:	SB011		SB011		SB011	
Sample Depth:	0-2'		6-8'		18-20'	
Sampling Date:	3/1/2022		3/1/2022		3/1/2022	
Lab Sample ID:	L2210848-21		L2210848-24		L2210848-23	
VOCs in mg/kg						
Isopropylbenzene	0.00096	U	0.0011	U	3.4	
n-Propylbenzene	0.00096	U	0.0011	U	6.6	
SVOCs in mg/kg						
Chrysene	1		0.12	U	1.1	U
Indeno(1,2,3-cd)pyrene	0.53	J	0.16	U	1.5	U
Total Metals in mg/kg						
Lead, Total	73.8		13.3		4.4	

Data Qualifiers:
E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.
I - The lower value for the two columns has been reported due to obvious interference.
J - Analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit).
P - The RPD between the results for the two columns exceeds the method-specified criteria.
U - Analyte not detected at or above the level indicated.

0 10 20 30 40 Feet

Notes:

Shaded text denotes concentrations exceeding NYSDEC Unrestricted Use soil cleanup objectives.

Shaded text denotes exceedance of NYSDEC Restricted Use soil cleanup objectives-Protection of GW.

Shaded text denotes concentrations exceeding NYSDEC Restricted Residential Use soil cleanup objectives.

SRI Boring Locations
Tax Lots
Site Boundary

PWGC
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DRAWING PREPARED FOR:

REVISION	DATE	INITIAL	COMMENTS

DRAWING INFORMATION:

Project:	TOT2202	Designed by:	JL
Date:	6/20/2023	Drawn by:	PH
Scale:	AS SHOWN	Approved by:	JL

PROPOSED RDWP SOIL SAMPLING LOCATIONS

731-747 4th Ave
Brooklyn, NY

FIGURE NO:

4

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DRAWING PREPARED FOR:

REVISION	DATE	INITIAL	COMMENTS

DRAWING INFORMATION:

Project:	TOT2202	Designed by:	JL
Date:	6/20/2023	Drawn by:	PH
Scale:	AS SHOWN	Approved by:	JL

Proposed Injection Points

731-747 4th Ave
Brooklyn, NY

FIGURE NO:

3

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Appendix A

REGENESIS

Technology-Based Solutions for the Environment

PROJECT NAME

731-747 4th Avenue

Revision 3

PREPARED FOR

P.W. Grosser Consulting
Joe Pressler
jpressler@pwgrosser.com

PREPARED BY

Regenesis
Tyler Harris
tharris@regenesis.com

Elliot Maker

emaker@regenesis.com

May 24, 2023

Project Summary

REGENESIS appreciates the opportunity to provide P.W. Grosser Consulting this remedial design and cost estimate for this project. Included within is a brief summary of our proposed solution, our understanding of your project goals, the technologies proposed, and a table summarizing the design.

Proposed Solution

We are proposing the use of RegenOx® and PetroFix Remedial Fluid to remediate dissolved phase hydrocarbons at your project site.

Project Goals

- The goal of this proposal is to treat the smear zone hydrocarbons located in the southeastern area and the northwestern area of the site. There are no specific treatment goals in the dissolved phase.
- This proposal is not intended to remediate PFOS and PFOA nor metals located within this treatment area.

Design Assumptions

- This design assumes that all buildings and infrastructure shown in the below map will be standing at the time of the application.
- This design assumes that NAPL on site will be removed prior to the application of PetroFix.
- This design assumes a limited application period that prevents multiple applications of RegenOx.

Technologies Proposed

- RegenOx®
- PetroFix®

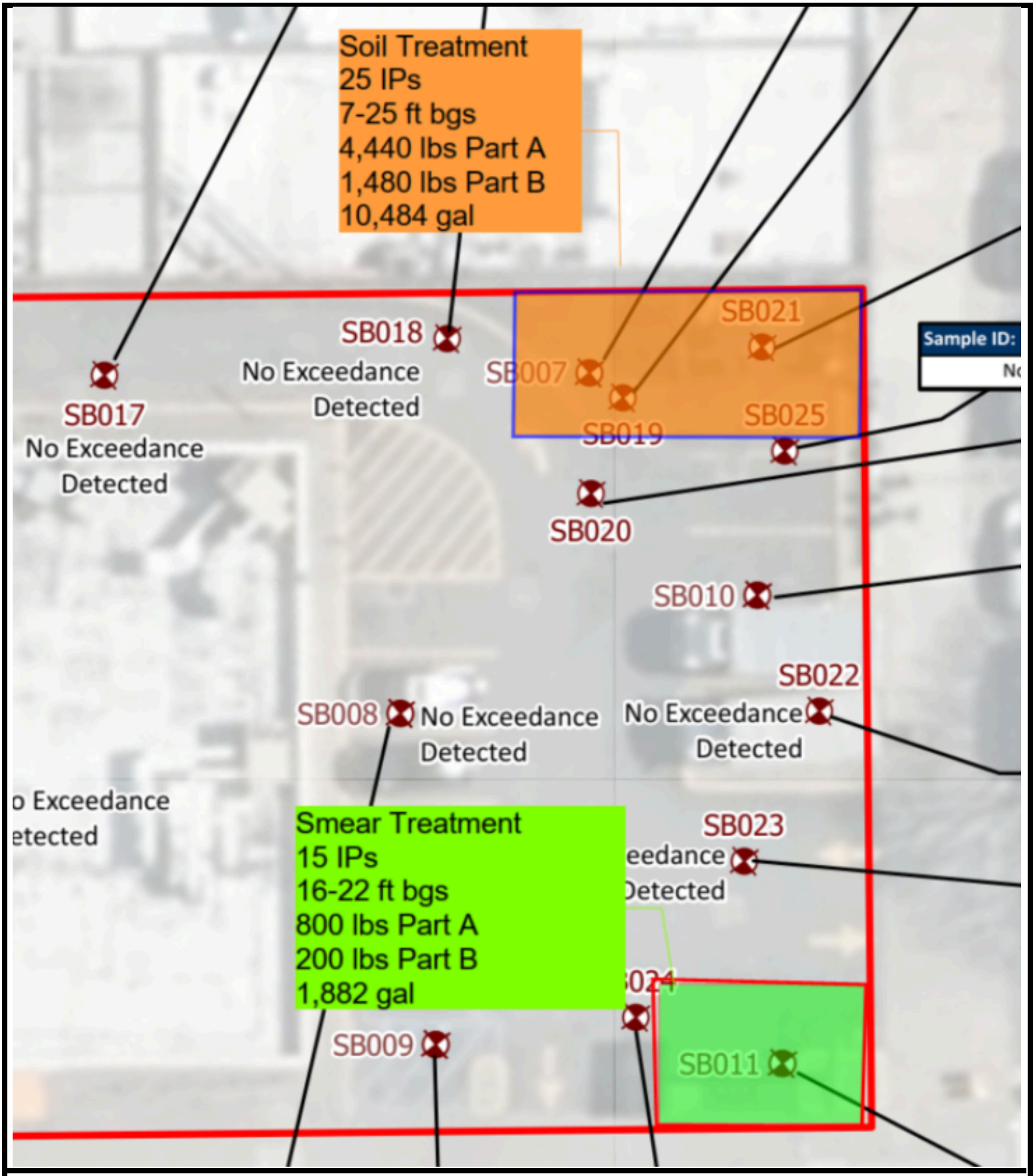
Click above to access product specification sheets

Representative Case Studies

- Former Gas Station Closure and +99% Reductions - CO
- PetroFix Case Study - All

Design Summary

Area Name	Applications Per Area	Area Square Footage	Injection Points Per Area Per App	Vertical Injection Interval (ft bgs)	RegenOx (A + B) (Per App) (lb)	Injection Volume Per Area Per App (gallons)
West Smear	**1**	430	15	16 to 22	1,000	1,882
East Vadose	**1**	700	25	7 to 25	5,920	10,484



731-747 4th Avenue

P.W. Grosser Consulting

May 24, 2023

Figure 1-Injection Location Map

REGENESIS

Technology-Based Solutions for the Environment

Technical Approach

Our review of the site data indicates there is a significant amount of hydrocarbon contaminant mass present in the target treatment zone. RegenOx is an advanced chemical oxidation technology that destroys contaminants through powerful, yet controlled chemical reactions. This product maximizes *in-situ* performance while using a solid alkaline oxidant that employs a sodium percarbonate complex with a multi-part catalytic formula. RegenOx directly oxidizes contaminants while its unique catalytic component generates a range of highly oxidizing free radicals that rapidly and effectively destroy a range of target contaminants including both petroleum hydrocarbons and chlorinated compounds.

RegenOx should be applied via direct push injections; REGENESIS recommends using a bottom-up injection method and applying injectate through a 2-3 ft long retractable screen is preferred. These are starting recommendations and maybe be changed in the field as data is gathered throughout the application.

Pricing

Below is the cost estimate to provide the remediation technologies and execute the application design provided in this proposal. Please also see the assumptions and qualifications section.

Description	Price	Qty	Subtotal
RegenOx® Part B Pails (40 lb)	$4.19	5240	$21,955.60
RegenOx® Part A Bags (40 lb)	$4.19	1680	$7,039.20
Subtotal			$28,994.80
Shipping and Tax (18%)			+$5,219.06
Total			**$34,213.86**

Electron Acceptor Blend (a mix of ammonium sulfate and sodium nitrate) is included in the price of PetroFix.

COST ESTIMATE DISCLAIMER: The cost listed assumes conditions set forth within the proposed scope of work and assumptions and qualifications. Changes to either could impact the final cost of the project. This may include final shipping arrangements, sales tax or application-related tasks such as product storage and handling, access to water, etc. If items listed need to be modified, please contact Regenesis for further evaluation.

REGENESIS developed this Scope of Work in reliance upon the data and professional judgments provided by those who completed the earlier environmental site assessment(s), and in reliance upon REGENESIS' prior experience on similar project sites. The fees and charges associated with the Scope of Work were generated through REGENESIS' proprietary formulas and thus may not conform to billing guidelines, constraints or other limits on fees. REGENESIS does not seek reimbursement directly from any government agency or any governmental reimbursement fund (the "Government"). In any circumstance where REGENESIS may serve as a supplier or subcontractor to an entity that seeks reimbursement from the Government for all or part of the services performed or products provided by REGENESIS, it is the sole responsibility of the entity seeking reimbursement to ensure the Scope of Work and associated charges are in compliance with and acceptable to the Government prior to submission. When serving as a supplier or subcontractor to an entity that seeks reimbursement from Government, REGENESIS does not knowingly present or cause to be presented any claim for payment to the government.

PROFESSIONAL JUDGEMENT: In generating this estimate, REGENESIS relied upon professional judgment and site-specific information provided by others. Using this information as input, we performed calculations based upon the known chemical and geologic relationships to generate an estimate of the mass of product and subsurface placement required to effect remediation of the site.

Acknowledgement

This scope and associated costs are budgetary and should not be considered final. Listed below are the next steps to secure a final design and cost estimate from REGENESIS.

Steps to Final Design and Scope of Work

1. Signature notifying REGENESIS to proceed with final design.
2. REGENESIS technical team contacts P.W. Grosser Consulting to review final scope of work and provide a detailed design and cost estimate
3. Provide Detailed Remediation Services Scope of Work, if applicable.
4. Confirm Implementation Schedule
5. Submit Detailed Design and Cost Estimate to P.W. Grosser Consulting for review and final approval

Signature below confirms signee accepts this preliminary scope of work and would like REGENESIS to proceed with a detailed design and cost estimate.

SIGNATURE
Joe Pressler

Not yet accepted

P.W. Grosser Consulting | Joe Pressler, Project Manager

Terms & Conditions

1. **PAYMENT TERMS.** Net 30 Days. Accounts outstanding after 30 days will be assessed 1.5% monthly interest. Volume discount pricing will be rescinded on all accounts outstanding over 90 days. An early payment discount of 1.5% Net 10 is available for cash or check payments only. We accept Master Card, Visa and American Express.
2. **RETURN POLICY.** A 15% re-stocking fee will be charged for all returned goods. All requests to return product must be pre-approved by seller. Returned product must be in original condition and no product will be accepted for return after a period of 90 days.
3. **FORCE MAJEURE.** Seller shall not be liable for delays in delivery or services or failure to manufacture or deliver due to causes beyond its reasonable control, including but not limited to acts of God, acts of buyer, acts of military or civil authorities, fires, strikes, flood, epidemic, war, riot, delays in transportation or car shortages, or inability to obtain necessary labor, materials, components or services through seller's usual and regular sources at usual and regular prices. In any such event Seller may, without notice to buyer, at any time and from time to time, postpone the delivery or service dates under this contract or make partial delivery or performance or cancel all or any portion of this and any other contract with buyer without further liability to buyer. Cancellation of any part of this order shall not affect Seller's right to payment for any product delivered or service performed hereunder.
4. **LIMITED WARRANTY.** Seller warrants the product(s) sold and services provided as specified on face of invoice, solely to buyer. Seller makes no other warranty of any kind respecting the product and services, and expressly DISCLAIMS ALL OTHER WARRANTIES OF WHATEVER KIND RESPECTING THE PRODUCT AND SERVICES, INCLUDING ALL WARRANTIES OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE AND NON-INFRINGEMENT.
5. **DISCLAIMER.** Where warranties to a person other than buyer may not be disclaimed under law, seller extends to such a person the same warranty seller makes to buyer as set forth herein, subject to all disclaimers, exclusions and limitations of warranties, all limitations of liability and all other provisions set forth in the Terms and Conditions herein. Buyer agrees to transmit a copy of the Terms and Conditions set forth herein to any and all persons to whom buyer sells, or otherwise furnishes the products and/or services provided buyer by seller and buyer agrees to indemnify seller for any liability, loss, costs and attorneys' fees which seller may incur by reason, in whole or in part, of failure by buyer to transmit the Terms and Conditions as provided herein.
6. **LIMITATION OF SELLER'S LIABILITY AND LIMITATION OF BUYER'S REMEDY.** Seller's liability on any claim of any kind, including negligence, for any loss or damage arising out of, connected with, or resulting from the manufacture, sale, delivery, resale, repair or use of any goods or performance of any services covered by or furnished hereunder, shall in no case exceed the lesser of (1) the cost of repairing or replacing goods and repeating the services failing to conform to the foregoing warranty or the price of the goods and/or services or part thereof which gives rise to the claim. IN NO EVENT SHALL SELLER BE LIABLE FOR SPECIAL INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFITS, OR FOR DAMAGES IN THE NATURE OF PENALTIES.
7. **INDEMNIFICATION.** Buyer agrees to defend and indemnify seller of and from any and all claims or liabilities asserted against seller in connection with the manufacture, sale, delivery, resale or repair or use of any goods, and performance of any services, covered by or furnished hereunder arising in whole or in part out of or by reason of the failure of buyer, its agents, servants, employees or customers to follow instructions, warnings or recommendations furnished by seller in connection with such goods and services, by reason of the failure of buyer, its agents, servants, employees or customers to comply with all federal, state and local laws applicable to such goods and services, or the use thereof, including the Occupational Safety and Health Act of 1970, or by reason of the negligence or misconduct of buyer, its agents, servants, employees or customers.

8. **EXPENSES OF ENFORCEMENT.** In the event seller undertakes any action to collect amounts due from buyer, or otherwise enforce its rights hereunder, Buyer agrees to pay and reimburse Seller for all such expenses, including, without limitation, all attorneys and collection fees.
9. **TAXES.** Liability for all taxes and import or export duties, imposed by any city, state, federal or other governmental authority, shall be assumed and paid by buyer. Buyer further agrees to defend and indemnify seller against any and all liabilities for such taxes or duties and legal fees or costs incurred by seller in connection therewith.
10. **ASSISTANCE AND ADVICE.** Upon request, seller in its discretion will furnish as an accommodation to buyer such technical advice or assistance as is available in reference to the goods and services. Seller assumes no obligation or liability for the advice or assistance given or results obtained, all such advice or assistance being given and accepted at buyer's risk.
11. **SITE SAFETY.** Buyer shall provide a safe working environment at the site of services and shall comply with all applicable provisions of federal, state, provincial and municipal safety laws, building codes, and safety regulations to prevent accidents or injuries to persons on, about or adjacent to the site.
12. **INDEPENDENT CONTRACTOR.** Seller and Buyer are independent contractors and nothing shall be construed to place them in the relationship of partners, principal and agent, employer/employee or joint ventures. Neither party will have the power or right to bind or obligate the other party except as may be expressly agreed and delegated by other party, nor will it hold itself out as having such authority.
13. **REIMBURSEMENT.** Seller shall provide the products and services in reliance upon the data and professional judgments provided by or on behalf of buyer. The fees and charges associated with the products and services thus may not conform to billing guidelines, constraints or other limits on fees. Seller does not seek reimbursement directly from any government agency or any governmental reimbursement fund (the "Government"). In any circumstance where seller may serve as a supplier or subcontractor to an entity that seeks reimbursement from the Government for all or part of the services performed or products provided by seller, it is the sole responsibility of the buyer or other entity seeking reimbursement to ensure the products and services and associated charges are in compliance with and acceptable to the Government prior to submission. When serving as a supplier or subcontractor to an entity that seeks reimbursement from the Government, seller does not knowingly present or cause to be presented any claim for payment to the Government.
14. **APPLICABLE LAW/JURISDICTION AND VENUE.** The rights and duties of the parties shall be governed by, construed, and enforced in accordance with the laws of the State of California (excluding its conflict of laws rules which would refer to and apply the substantive laws of another jurisdiction). Any suit or proceeding hereunder shall be brought exclusively in state or federal courts located in Orange County, California. Each party consents to the personal jurisdiction of said state and federal courts and waives any objection that such courts are an inconvenient forum.
15. **ENTIRE AGREEMENT.** This agreement constitutes the entire contract between buyer and seller relating to the goods or services identified herein. No modifications hereof shall be binding upon the seller unless in writing and signed by seller's duly authorized representative, and no modification shall be effected by seller's acknowledgment or acceptance of buyer's purchase order forms containing different provisions. Trade usage shall neither be applicable nor relevant to this agreement, nor be used in any manner whatsoever to explain, qualify or supplement any of the provisions hereof. No waiver by either party of default shall be deemed a waiver of any subsequent default.

Detailed Design Tables

RegenOx® Application Design Summary

West Smear		Field App. Instructions
Application Method	**Direct Push**	
Spacing Within Rows (ft)	5	**Add RegenOx Part A to water, mix until dissolved, then add Part B and mix until dissolved.**
Spacing Between Rows (ft)	5	
Injection Points (per app.)	**15**	
Number of Applications	**1**	
Areal Extent (square ft)	430	**Field Mixing Ratios**
Top Application Depth (ft bgs)	16	Water per Pt per App (gals)
Bottom Application Depth (ft bgs)	22	121
Total RegenOx to be Applied (lbs)	**1,000**	RegenOx Part A per Pt per App (lbs)
RegenOx Part A (lbs)	800	53
RegenOx Part B (lbs)	200	RegenOx Part B per Pt per App (lbs)
RegenOx Part A Solution %	5%	13
Volume Water (gals)	**1,821**	Total Volume per Pt per App (gals)
Total Solution Volume (gals)	**1,882**	125
Per Application Totals		
Total RegenOx per App (lbs)	*1,000*	*Volume per vertical ft (gals)*
RegenOx Part A Per App (lbs)	*800*	*21*
RegenOx Part B Per App (lbs)	*200*	
Water per App (gals)	*1821*	
Injection Volume per App (gals)	*1882*	

Technical Notes/Discussion

Break up the application as needed for a few days by applying in the PetroFix area.

Prepared By: ***Tyler Harris***

Date: ***5/22/2023***

RegenOx® Application Design Summary

Soil Treatment		Field App. Instructions
Application Method	**Direct Push**	
Spacing Within Rows (ft)	5	**Add RegenOx Part A to water, mix until dissolved, then add Part B and mix until dissolved.**
Spacing Between Rows (ft)	5	
Injection Points (per app.)	**25**	
Number of Applications	**1**	
Areal Extent (square ft)	700	**Field Mixing Ratios**
Top Application Depth (ft bgs)	7	Water per Pt per App (gals)
Bottom Application Depth (ft bgs)	25	404
Total RegenOx to be Applied (lbs)	**5,920**	RegenOx Part A per Pt per App (lbs)
RegenOx Part A (lbs)	4,440	178
RegenOx Part B (lbs)	1,480	RegenOx Part B per Pt per App (lbs)
RegenOx Part A Solution %	5%	59
Volume Water (gals)	**10,109**	Total Volume per Pt per App (gals)
Total Solution Volume (gals)	**10,484**	419
Per Application Totals		
Total RegenOx per App (lbs)	*5,920*	*Volume per vertical ft (gals)*
RegenOx Part A Per App (lbs)	*4,440*	*23*
RegenOx Part B Per App (lbs)	*1480*	
Water per App (gals)	*10109*	
Injection Volume per App (gals)	*10484*	

Technical Notes/Discussion

Break up the application as needed for a few days by applying in the PetroFix area.

Prepared By: ***Tyler Harris***

Date: ***4/12/2023***

SAFETY DATA SHEET

1. Identification

Product identifier	**RegenOx® Part A**
Other means of identification	None.
Recommended use	Soil and Groundwater Remediation.
Recommended restrictions	None known.

Manufacturer/Importer/Supplier/Distributor information

Company Name	REGENESIS
Address	1011 Calle Sombra San Clemente, CA 92673 USA
General information	949-366-8000
E-mail	CustomerService@regenesis.com

Emergency phone number	For Dangerous Goods Incidents ONLY (spill, leak, fire, exposure or accident), call CHEMTREC 24/7 at:
USA, Canada	1-800-424-9300
International	+1 703-741-5970

2. Hazard(s) identification

Physical hazards	Oxidizing solids	Category 2
Health hazards	Acute toxicity, oral	Category 4
	Serious eye damage/eye irritation	Category 1
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 2

OSHA defined hazards Not classified.

Label elements

Signal word	Danger
Hazard statement	May intensify fire; oxidizer. Harmful if swallowed. Causes serious eye damage. Toxic to aquatic life.

Precautionary statement

Prevention	Keep away from heat. Keep/Store away from clothing and other combustible materials. Take any precaution to avoid mixing with combustibles. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Wear protective gloves/eye protection/face protection. Avoid release to the environment.
Response	If swallowed: Call a poison center/doctor if you feel unwell. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor. Rinse mouth. In case of fire: Use appropriate media to extinguish.
Storage	Store away from incompatible materials.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	None.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Sodium carbonate peroxyhydrate	15630-89-4	≥95
Silicic acid, sodium salt, sodium silicate	1344-09-8	<1

Composition comments All concentrations are in percent by weight unless otherwise indicated.

4. First-aid measures

Inhalation Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact If on clothing: Rinse immediately contaminated clothing and skin with plenty of water before removing clothes. Wash off with soap and water. Get medical attention if irritation develops and persists.

Eye contact Do not rub eyes. Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention immediately.

Ingestion Rinse mouth. Never give anything by mouth to a victim who is unconscious or is having convulsions. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Get medical advice/attention if you feel unwell.

Most important symptoms/effects, acute and delayed Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Dusts may irritate the respiratory tract, skin and eyes.

Indication of immediate medical attention and special treatment needed Provide general supportive measures and treat symptomatically. Keep victim warm. Keep victim under observation. Symptoms may be delayed.

General information Take off all contaminated clothing immediately. Contact with combustible material may cause fire. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance. Wash contaminated clothing before reuse.

5. Fire-fighting measures

Suitable extinguishing media Water spray, fog (flooding amounts).

Unsuitable extinguishing media Dry chemical, CO2, halon. Foam.

Specific hazards arising from the chemical Greatly increases the burning rate of combustible materials. Containers may explode when heated. During fire, gases hazardous to health may be formed. Combustion products may include: carbon oxides, metal oxides.

Special protective equipment and precautions for firefighters Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Fire fighting equipment/instructions In case of fire and/or explosion do not breathe fumes. Move containers from fire area if you can do so without risk. Use water spray to cool unopened containers.

Specific methods Cool containers exposed to flames with water until well after the fire is out.

General fire hazards May intensify fire; oxidizer. Contact with combustible material may cause fire.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Keep away from clothing and other combustible materials. Wear appropriate protective equipment and clothing during clean-up. Use a NIOSH/MSHA approved respirator if there is a risk of exposure to dust/fume at levels exceeding the exposure limits. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Collect dust using a vacuum cleaner equipped with HEPA filter. Keep combustibles (wood, paper, oil, etc.) away from spilled material. Ventilate the contaminated area. This product is miscible in water. Stop the flow of material, if this is without risk. Absorb in vermiculite, dry sand or earth and place into containers. Large Spills: Sweep up or vacuum up spillage and collect in suitable container for disposal. Shovel the material into waste container. Minimize dust generation and accumulation. Avoid the generation of dusts during clean-up. Prevent product from entering drains. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Minimize dust generation and accumulation. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Keep away from heat. Provide appropriate exhaust ventilation at places where dust is formed. Keep away from clothing and other combustible materials. Take any precaution to avoid mixing with combustibles. Do not get this material in contact with eyes. Do not taste or swallow. When using, do not eat, drink or smoke. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Avoid release to the environment. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Keep away from heat. Store in a cool, dry place out of direct sunlight. Store at temperatures not exceeding 40°C/104°F. Store in original tightly closed container. Store in a well-ventilated place. Do not store near combustible materials. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. If material is ground, cut, or used in any operation which may generate dusts, use appropriate local exhaust ventilation to keep exposures below the recommended exposure limits. Provide eyewash station.
Individual protection measures, such as personal protective equipment	
Eye/face protection	Unvented, tight fitting goggles should be worn in dusty areas.
Skin protection	
Hand protection	Wear appropriate chemical resistant gloves. Suitable gloves can be recommended by the glove supplier. Frequent change is advisable. Rubber, neoprene or PVC gloves are recommended.
Skin protection	
Other	Wear appropriate chemical resistant clothing.
Respiratory protection	If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn. Recommended use: Wear respirator with dust filter.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Keep from contact with clothing and other combustible materials. Remove and wash contaminated clothing promptly. Keep away from food and drink. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	
Physical state	Solid.
Form	Powder.
Color	White.
Odor	Odorless.

Odor threshold	Not available.
pH	10.5 (3% solution/water)
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	May intensify fire; oxidizer.
Upper/lower flammability or explosive limits	
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	14.5 g/100g water @ 20 ºC (minimum)
Partition coefficient (n-octanol/water)	No data available.
Auto-ignition temperature	Not available.
Decomposition temperature	122 °F (50 °C)
Viscosity	Not available.
Other information	
Bulk density	0.9 - 1.2 g/ml
Explosive properties	Not explosive.
Oxidizing properties	May intensify fire; oxidizer.

10. Stability and reactivity

Reactivity	Greatly increases the burning rate of combustible materials.
Chemical stability	Product may be unstable at temperatures above: 50°C/122°F. Decomposes on heating.
Possibility of hazardous reactions	Reacts slowly with water.
Conditions to avoid	Moisture. Heat. Avoid temperatures exceeding the decomposition temperature. Contact with incompatible materials.
Incompatible materials	Acids. Bases. Salts of heavy metals. Reducing agents. Combustible material. Water.
Hazardous decomposition products	Oxygen. Steam. Heat.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Dust may irritate respiratory system.
Skin contact	Dust or powder may irritate the skin.
Eye contact	Causes serious eye damage.
Ingestion	Harmful if swallowed.
Symptoms related to the physical, chemical and toxicological characteristics	Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Dusts may irritate the respiratory tract, skin and eyes.

Information on toxicological effects

Acute toxicity	Harmful if swallowed.

Components	Species	Test Results
Silicic acid, sodium salt, sodium silicate (CAS 1344-09-8)		
Acute		
Oral		
LD50	Mouse	1100 mg/kg
	Rat	1.1 g/kg

Skin corrosion/irritation Prolonged skin contact may cause temporary irritation.

Serious eye damage/eye irritation Causes serious eye damage.

Respiratory or skin sensitization

Respiratory sensitization Not a respiratory sensitizer.

Skin sensitization This product is not expected to cause skin sensitization.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity Not classifiable as to carcinogenicity to humans.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

NTP Report on Carcinogens

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not listed.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure Not classified.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard Not an aspiration hazard.

12. Ecological information

Ecotoxicity Toxic to aquatic life.

Components		Species	Test Results
Silicic acid, sodium salt, sodium silicate (CAS 1344-09-8)			
Aquatic			
Acute			
Crustacea	EC50	Water flea (Ceriodaphnia dubia)	>= 0.28 - <= 0.57 mg/l, 48 hours
Fish	LC50	Western mosquitofish (Gambusia affinis)	1800 mg/l, 96 hours

Persistence and degradability Decomposes in the presence of water. The product contains inorganic compounds which are not biodegradable.

Bioaccumulative potential The product does not contain any substances expected to be bioaccumulating.

Mobility in soil This product is water soluble and may disperse in soil.

Other adverse effects None known.

13. Disposal considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents/container in accordance with local/regional/national/international regulations.

Local disposal regulations Dispose in accordance with all applicable regulations.

Hazardous waste code The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products Dispose in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner.

Contaminated packaging Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number	UN3378
UN proper shipping name	Sodium carbonate peroxyhydrate
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Label(s)	5.1
Packing group	III
Environmental hazards	
Marine pollutant	No.
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	B120, IB8, IP3, T1, TP33
Packaging exceptions	152
Packaging non bulk	213
Packaging bulk	240

IATA

UN number	UN3378
UN proper shipping name	Sodium carbonate peroxyhydrate
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Packing group	III
Environmental hazards	No.
ERG Code	5L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IMDG

UN number	UN3378
UN proper shipping name	SODIUM CARBONATE PEROXYHYDRATE
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Packing group	III
Environmental hazards	
Marine pollutant	No.
EmS	F-A, S-Q
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not listed.

Toxic Substances Control Act (TSCA) All components of the mixture on the TSCA 8(b) inventory are designated “active”.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical Yes

Classified hazard categories	Oxidizer (liquid, solid, or gas) Acute toxicity (any route of exposure) Serious eye damage or eye irritation

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA)	Not regulated.

US state regulations

US. Massachusetts RTK - Substance List

Not regulated.

US. New Jersey Worker and Community Right-to-Know Act

Not listed.

US. Pennsylvania Worker and Community Right-to-Know Law

Not listed.

US. Rhode Island RTK

Not regulated.

California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins. For more information go to www.P65Warnings.ca.gov.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Industrial Chemicals (AICIS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Chemical Substance Inventory (TCSI)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	26-March-2015
Revision date	15-July-2022
Version #	03
HMIS® ratings	Health: 3 Flammability: 0 Physical hazard: 2 Personal protection: E

NFPA ratings

Disclaimer

Regenesis cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available.

SAFETY DATA SHEET

1. Identification

Product identifier **RegenOx® Part B**

Other means of identification None.

Recommended use Soil and Groundwater Remediation.

Recommended restrictions None known.

Manufacturer/Importer/Supplier/Distributor information

Company Name REGENESIS

Address 1011 Calle Sombra
San Clemente, CA 92673 USA

General information 949-366-8000

E-mail CustomerService@regenesis.com

Emergency phone number For Dangerous Goods Incidents ONLY (spill, leak, fire, exposure or accident), call CHEMTREC 24/7 at:

USA, Canada 1-800-424-9300

International +1 703-741-5970

2. Hazard(s) identification

Physical hazards Not classified.

Health hazards

Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 2A

OSHA defined hazards Not classified.

Label elements

Signal word Warning

Hazard statement Causes skin irritation. Causes serious eye irritation.

Precautionary statement

Prevention Wash thoroughly after handling. Wear protective gloves/eye protection/face protection.

Response If on skin: Wash with plenty of water. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If skin irritation occurs: Get medical advice/attention. If eye irritation persists: Get medical advice/attention. Take off contaminated clothing and wash it before reuse.

Storage Store away from incompatible materials.

Disposal Dispose of waste and residues in accordance with local authority requirements.

Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information None.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Silicic acid, sodium salt, sodium silicate	1344-09-8	25-40
Silicon dioxide (amorphous silica gel)	63231-67-4	<10

Chemical name	CAS number	%
Ferrous sulfate	7720-78-7	2-5

Composition comments All concentrations are in percent by weight unless otherwise indicated.

4. First-aid measures

Inhalation Move to fresh air. Keep victim at rest in a position comfortable for breathing. Call a physician if symptoms develop or persist.

Skin contact Remove contaminated clothing. Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.

Eye contact Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation develops and persists.

Ingestion Rinse mouth. Never give anything by mouth to a victim who is unconscious or is having convulsions. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Skin irritation. May cause redness and pain. Spray mist may irritate the respiratory system. Symptoms may include coughing, difficulty breathing and shortness of breath.

Indication of immediate medical attention and special treatment needed Provide general supportive measures and treat symptomatically.

General information Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance.

5. Fire-fighting measures

Suitable extinguishing media Use fire-extinguishing media appropriate for surrounding materials.

Unsuitable extinguishing media None known.

Specific hazards arising from the chemical During fire, gases hazardous to health may be formed. Combustion products may include: silicon oxides, metal oxides, sulfur oxides.

Special protective equipment and precautions for firefighters Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Fire fighting equipment/instructions Move containers from fire area if you can do so without risk.

Specific methods Use standard firefighting procedures and consider the hazards of other involved materials.

General fire hazards No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water.

Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.

Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.

Environmental precautions Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling Avoid contact with eyes, skin, and clothing. Avoid prolonged exposure. Provide adequate ventilation. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities Store in original tightly closed container. Store in a cool, dry, well-ventilated place. Maintain storage temperatures between 50°F to 140°F (10°C to 60°C). Store away from incompatible materials (see Section 10 of the SDS). Recommended storage containers: steel or plastic. Do not use containers made of aluminum, fiberglass, copper, brass, zinc or galvanized containers.

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-3 (29 CFR 1910.1000)

Components	Type	Value	Form
Silicon dioxide (amorphous silica gel) (CAS 63231-67-4)	TWA	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.
		0.8 mg/m3	
		20 mppcf	

US. ACGIH Threshold Limit Values

Components	Type	Value
Ferrous sulfate (CAS 7720-78-7)	TWA	1 mg/m3

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
Ferrous sulfate (CAS 7720-78-7)	TWA	1 mg/m3
Silicon dioxide (amorphous silica gel) (CAS 63231-67-4)	TWA	6 mg/m3

Biological limit values No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection Chemical goggles are recommended. Wear a face shield if there is a risk of splashing.

Skin protection

Hand protection Wear appropriate chemical resistant gloves.

Skin protection

Other Wear appropriate chemical resistant clothing.

Respiratory protection If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn. Recommended use: Wear NIOSH approved respirator appropriate for airborne exposure at the point of use.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state Liquid.

Form Liquid.

Color Green to dark blue.

Odor Odorless.

Odor threshold Not available.

pH 11 (10% solution/water)

Melting point/freezing point Not available.

Initial boiling point and boiling range Not available.

Flash point Not available.

Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable.
Upper/lower flammability or explosive limits	
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	1.2 - 1.4
Solubility(ies)	
Solubility (water)	Miscible.
Partition coefficient (n-octanol/water)	No data available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	< 10,000cP
Other information	
Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Hydrogen fluoride. Fluorine. Oxygen difluoride. Chlorine trifluoride. Strong acids. Strong bases. Oxidizers. Aluminum metal. Copper. Brass. Zinc. Galvanized metals.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Prolonged inhalation may be harmful. Spray mists may cause respiratory tract irritation.
Skin contact	Causes skin irritation.
Eye contact	Causes serious eye irritation.
Ingestion	Ingestion may cause irritation and malaise.
Symptoms related to the physical, chemical and toxicological characteristics	Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Skin irritation. May cause redness and pain. Spray mist may irritate the respiratory system. Symptoms may include coughing, difficulty breathing and shortness of breath.

Information on toxicological effects

Acute toxicity Not expected to be acutely toxic.

Components	Species	Test Results
Silicic acid, sodium salt, sodium silicate (CAS 1344-09-8)		
Acute		
Dermal		
LD50	Rat	> 5000 mg/kg, 24 Hours
Inhalation		
Vapor		
LC50	Rat	> 2.06 mg/l, 4 Hours
Oral		
LD50	Rat	2000 - 2500 mg/kg
		3400 mg/kg

Components	Species	Test Results
		3200 mg/kg

Skin corrosion/irritation Causes skin irritation.

Serious eye damage/eye irritation Causes serious eye irritation.

Respiratory or skin sensitization

Respiratory sensitization Not a respiratory sensitizer.

Skin sensitization This product is not expected to cause skin sensitization.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity Not classifiable as to carcinogenicity to humans.

IARC Monographs. Overall Evaluation of Carcinogenicity

Silicon dioxide (amorphous silica gel) (CAS 63231-67-4) 3 Not classifiable as to carcinogenicity to humans.

NTP Report on Carcinogens

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not listed.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure Not classified.

Specific target organ toxicity - repeated exposure Not classified.

Silicic acid, sodium salt, sodium silicate (CAS 1344-09-8)	> 159 mg/kg Result: NOAEL Species: Rat

Aspiration hazard Not an aspiration hazard.

Chronic effects Prolonged inhalation may be harmful.

12. Ecological information

Ecotoxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Components		Species	Test Results
Silicic acid, sodium salt, sodium silicate (CAS 1344-09-8)			
Aquatic			
Acute			
Crustacea	EC50	Daphnia magna	1700 mg/l, 48 hours
Fish	LC50	Danio rerio	1108 mg/l, 96 hours

Persistence and degradability No data is available on the degradability of this product.

Bioaccumulative potential No data available.

Mobility in soil This product is water soluble and may spread in the water system.

Other adverse effects None known.

13. Disposal considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents/container in accordance with local/regional/national/international regulations.

Local disposal regulations Dispose in accordance with all applicable regulations.

Hazardous waste code The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products Dispose in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

Contaminated packaging Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not established.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Ferrous sulfate (CAS 7720-78-7) Listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not listed.

Toxic Substances Control Act (TSCA) All components of the mixture on the TSCA 8(b) inventory are designated “active”.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical Yes

Classified hazard categories Skin corrosion or irritation
Serious eye damage or eye irritation

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

US state regulations

US. Massachusetts RTK - Substance List

Ferrous sulfate (CAS 7720-78-7)

US. New Jersey Worker and Community Right-to-Know Act

Ferrous sulfate (CAS 7720-78-7)

US. Pennsylvania Worker and Community Right-to-Know Law

Ferrous sulfate (CAS 7720-78-7)

US. Rhode Island RTK

Ferrous sulfate (CAS 7720-78-7)
Silicon dioxide (amorphous silica gel) (CAS 63231-67-4)

California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins. For more information go to www.P65Warnings.ca.gov.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Industrial Chemicals (AICIS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Chemical Substance Inventory (TCSI)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 02-April-2015

Revision date 15-July-2022

Version # 04

HMIS® ratings

Health: 2
Flammability: 0
Physical hazard: 0
Personal protection: D

NFPA ratings

Disclaimer

Regenesis cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available.

RegenOx® Technical Description

RegenOx is an advanced chemical oxidation technology that destroys contaminants through powerful, yet controlled chemical reactions. This product maximizes *in situ* chemical oxidation (ISCO) performance through use of a two-part product system; a sodium percarbonate oxidizer complex activated by a patented surface catalyst system. The technology degrades pollutants through direct oxidation, as well as through the generation of a suite of free radical compounds which in turn oxidize recalcitrant contaminants. RegenOX rapidly and effectively destroys a range of target contaminants including petroleum hydrocarbons and chlorinated compounds.

Close up of RegenOx

RegenOx is especially effective in destroying target contaminants present in high concentration source areas within the saturated and vadose zones. For petroleum hydrocarbon treatment, RegenOx produces oxygen as a result of its reactions, providing seamless transition from ISCO to enhanced aerobic bioremediation. RegenOx produces minimal heat when applied, and continues to destroy contaminants for up to 30 days on a single application. RegenOx is safe for use in direct contact with underground utilities, since it is non-corrosive to concrete and most metals.

$$C_2Cl_4 + 4/3\ Na_2CO_3 \bullet 2H_2O_2 + 4NaOH \rightarrow 2CO_2 + 4NaCl + 4H_2O + 4/3\ Na_2CO_3$$

- Free Radical Oxidation via production of:
  - Perhydroxyl Radical ($HO_2\bullet$)
  - Hydroxyl Radical ($OH\bullet$)
  - Superoxide Radical ($O_2^{-}\bullet$)

For a list of treatable contaminants with the use of RegenOx, view the Range of Treatable Contaminants Guide

Chemical Composition – Part A Oxidant

- Sodium Percarbonate – CAS #15630-89-4
- Sodium Carbonate Monohydrate - CAS #5968-11-6
- Silicic Acid – CAS #7699-11-6
- Silica Gel – CAS #63231

Chemical Composition – Part B Activator Complex

- Silicic Acid, Sodium Salt, Sodium Silicate - CAS#1344-09-08
- Silica Gel – CAS #63231
- Ferrous Sulfate – CAS #7720-78-7
- Water – CAS#7732-18-5

Properties

- Bulk Density – Part A 0.9-1.2 g/cm3; Part B – 1.39 g/cm3
- pH - 10-11 per recommended mixing ratios (3-5% oxidant in solution)
- Solubility – Oxidant - 14.5 g/100 g water; Activator – miscible in water
- Appearance – Brown to orange-brown when mixed with water
- Odor – Not detectable
- Vapor Pressure – None
- Non-hazardous

RegenOx® Technical Description

Storage and Handling Guidelines

Storage
Store in a cool, dry place out of heat/direct sunlight
Store at temperatures not to exceed 40°C/104°F
Store in original tightly closed container
Store in a well-ventilated place
Do not store near combustible materials
Store away from incompatible materials
Protect from contamination
Provide appropriate exhaust ventilation in places where dust is formed

Handling
Minimize dust generation and accumulation
Observe good industrial hygiene practices
Keep away from clothing and combustible materials
Take any precaution to avoid mixing with combustibles
Avoid contact with eyes
Do not taste or swallow
Do not eat, drink or smoke nearby
Wear appropriate personal protective equipment
Wash hands thoroughly after handling
Avoid release to the environment

Applications

RegenOx is applied using direct-injection techniques or wells. The application process enables the two- part product to be combined, then pressure-injected into the zone of contamination and moved out into the aquifer media. Application instructions for this product are contained in the RegenOx Application Instructions Guide.

Health and Safety

Material is relatively safe to handle; however, we recommend avoiding contact with eyes, skin and clothing. OSHA Level D personal protection equipment including vinyl or rubber gloves, eye protection and dust mask are recommended when handling this product. Please review the Material Safety Data Sheet for additional storage, packaging, usage, and handling requirements here: RegenOx Part A SDS and RegenOx Part B SDS.

REGENESIS

www.regenesis.com
1011 Calle Sombra, San Clemente CA 92673
949.366.8000

RegenOx® Installation Instructions: Direct-Push Injection

General Guidelines

One of the best methods to deliver RegenOx® into the subsurface is to inject the material through direct push rods using hydraulic equipment. This approach increases the spreading and mixing of RegenOx into the aquifer. This set of instructions is specific to direct push equipment. For advice on other injections methods such as soil mixing, hydraulic and pneumatic fracturing, and vertical injection, please contact Technical Services directly.

The installation of RegenOx should span the entire vertical contaminated saturated thickness, or in the case of vadose zone treatment the entire affected vadose zone targeted for treatment.

Typical Installation Equipment

- Direct push rig
- Drive Rods (typically 1 ½-inch O.D.) & Injection Tooling with fluid deliver sub-assembly
- Injection Pump rated for 5 gpm @ 200 psi for sandy formations and 800 psi for silt and clay formations (Geoprobe DP-800, Yamada, Moyno, Rupe Models 9-1500 and 9-1600, Wilden, etc.)
- Injection hosing and a pressure relief valve with a bypass
- Clear hosing between mixing tank/drum and pump
- Pressure gauges
- Power drill paint stirrer (3-inch diameter or smaller propeller tip)
- Plastic bucket lid puller tool/opener tool
- 5-amp sump pump (such as Little Giant) and hose
- Three to four 55-gallon drums or similarly sized mixing tanks for RegenOx mixing
- Sand, bentonite chips, granular bentonite, cement, hydraulic cement, and quick-set concrete for closing and sealing temporary injection holes
- Wood plugs or similar for temporarily sealing injection holes prior to grout sealing
- Access to water
- Access to electricity

Personal Protective Equipment (PPE)

Personnel working with or in areas of potential contact with RegenOx should be required at a minimum to be fitted with modified Level D personal protective equipment:

- Eye protection – Wear well sealed goggles or a face shield (recommended for full face protection)
- Head – Hard hat when required
- Respiratory – Use dust respirator approved by NIOSH/MSA
- Hands – Wear neoprene gloves
- Feet – Wear steel toe shoes with chemical resistant soles or neoprene boots
- Clothing – Wear long sleeve shirts and long pant legs. Consider using a Tyvek® body suit, Carhartt® coverall or splash gear

Material Overview, Handling, and Safety

RegenOx is packaged in two parts. RegenOx Part A Oxidizer complex and RegenOx Part B Activator complex. Part A is shipped in a 40 pound bag and Part B is shipped in separate 5-gallon buckets and has a gross weight of approximately 42 pounds (net weight of RegenOx material in each bucket is 40 pounds). The RegenOx Oxidizer complex is shipped as a fine white powder and the RegenOx Activator complex is shipped as a liquid gel. The Activator has a viscosity roughly equivalent to honey. It is common for stored RegenOx Activator to settle somewhat in a container, so it is imperative to adequately pre-mix the RegenOx Activator prior to mixing it with the RegenOx Oxidizer. Mixing the RegenOx Part B Activator with water at a ratio of roughly 1 gallon water per bucket of Activator makes the activator pourable and easier to work with. A Material Safety Data Sheet for Part A (RegenOx Oxidizer) and for Part B (RegenOx Activator) is provided with each shipment. Personnel who operate field equipment during the installation process should have appropriate training, supervision, and experience.

Installation Procedures

1. Prior to the installation of RegenOx, any surface or overhead impediments should be identified as well as the location of all underground structures. Underground structures include but are not limited to: utility lines; tanks; distribution piping; sewers; drains; and landscape irrigation systems.
2. The planned installation locations should be adjusted to account for all impediments and obstacles.
3. Pre-mark the installation locations, noting any points that may have different vertical application requirements or total depth.
4. Set up the direct push unit over each specific point and follow the manufacturer standard operating procedures (SOP) for the direct push equipment. Care should be taken to assure that probe holes remain in the vertical.
5. For most applications, REGENESIS suggests using 1.5-inch O.D./0.625-inch I.D drive rods. However, some applications may require the use of 2.125-inch O.D./1.5-inch I.D. or larger drive rods.
6. Advance drive rods through the surface pavement, as necessary, following SOP.
7. Push the drive rod assembly with an expendable tip to the desired maximum depth. REGENESIS suggests pre-counting the number of drive rods needed to reach depth prior to starting injection activities.
8. After the drive rods have been pushed to the desired depth, the rod assembly should be withdrawn three to six inches. Then the expendable tip can be dropped from the drive rods,
9. following SOP. If an injection tool was used instead of an expendable tip, the application of material can take place without any preliminary withdrawal of the rods.
10. In some cases, introduction of a large column of air prior to RegenOx application may be problematic. This is particularly the case in deep injections (>50 ft) with large diameter rods (>1.5-inch O.D.). To prevent the injection of air into the aquifer during RegenOx application, as well as to prevent problems associated with heaving sands, fill the drive rods with water, or the RegenOx mixture prior dropping the expendable tip or exposing the injection tool.
11. Open one of the buckets of RegenOx Part B Activator and pour/spoon the entire bucket of Activator into a small mixing bucket or tank, making sure that any Activator that settled in the bottom of the bucket was scraped out of the Activator bucket and into the mixing tank. Stir the Activator with the power drill mixer for roughly 2 to 3 minutes. Add roughly one gallon of water to the activator, and stir again for at least 2 to 3 minutes. The net weight of Activator in a bucket is 40

pounds. The pounds of Activator required for one vertical foot of injection can be divided by 40. Pour the stirred/mixed Activator into empty buckets based on that fraction. (For example, if 5 pounds of activator are required per foot, pour 5/40 or 1/8 of the contents into each of six empty buckets.)

12. Measure the appropriate quantity of RegenOx Oxidizer for each vertical foot of injection.
13. RegenOx % oxidizer in solution should typically range between 4% to 8%. Solutions up to 10% can be used, but flocculation of the solution prior to injection may result. Solutions with greater than 10% oxidizer in solution will result in excess reaction and flocculation prior to injection and are not normally recommended. Into a 55-gallon drum or mixing tank, pour the required amount of water for one to four vertical feet of injection. The volume of water per injection location can be calculated from the following equation:

Volume of water (gallons/vertical foot of injection):

$$\frac{\text{RegenOx Oxidizer lbs/foot}}{(8.34\ \text{lbs/gal water})(\%\ \text{RegenOx\_Oxidizer solids})} \left[{}_{1} - (\%\ \text{RegenOx\_ Oxidizer solids}) \right]$$

Tighter formations (clays and silts), and even some fine sand formations will likely require higher oxidant percentages since less volume can be injected per location. The following are guides to various RegenOx mixing ratios based on the above equation.

- to make a roughly 5% oxidant solution for every 10 lbs of oxidant and 10 lbs of activator (20 lbs total RegenOx), use 22 gallons of water.
- to make a roughly 8% oxidant solution for every 10 lbs of oxidant and 10 lbs of activator (20 lbs total RegenOx), use 13.5 gallons of water.
- to make a roughly 10% oxidant solution for every 10 lbs of oxidant and 10 lbs of activator (20 lbs total RegenOx), use 11 gallons of water.

14. Pour the pre-measured quantity of RegenOx Oxidizer to make the desired target % oxidant in solution mixture into the mixing drum or tank. Mix the water and oxidant with a power drill paint stirrer to ensure that the Oxidizer has dissolved in the water.
15. Pour the applicable amount of the pre-mixed RegenOx Activator into the oxidant mixing tank or pump hopper. Mix the Oxidant and Activator using a power drill paint stirrer or hand paddle mixer for at least 5 minutes until a homogenous mixture is formed. After mixing the RegenOx mixture should be injected into the subsurface as soon as possible.
16. Do not mix more RegenOx material then will be used over roughly 1 to 4 feet of injection so as to minimize potential above ground reaction/flocculation prior to injection.
17. Transfer the contents of the mixing tank to the pump hopper using a gravity drain or a sump pump.
18. For some types of pumps, it may be desirable to perform a volume check prior to injecting RegenOx. Determining volume displaced per pump stroke can be accomplished in 2 easy steps:
    a) Determine the number of pump strokes needed to deliver 3 gallons of RegenOx (use a graduated bucket for this).
    b) Divide 3 gallons by the results from the first step to determine the number of gallons of RegenOx delivered by each pump stroke.
19. Connect the delivery hose to the pump outlet and the delivery sub-assembly. Circulate RegenOx though the hose and the delivery sub-assembly to displace air in the hose.
20. Connect the sub-assembly to the drive rod. After confirming that all of the connections are secure, pump the RegenOx through the delivery system to displace the water/fluid in the rods.

21. Slowly withdraw the drive rods. Commonly, RegenOx injections progress at 1-foot intervals. However, continuous injection while slowly withdrawing single lengths of drive rod (3 or 4 feet) is an acceptable option. The pre-determined volume of RegenOx should be pumped into the aquifer across the desired treatment interval.
22. Remove one section of the drive rod. The drive rod may contain some residual RegenOx. Place the RegenOx-filled rod in a clean, empty bucket and allow the RegenOx to drain. Eventually, the RegenOx should be returned to the RegenOx pump hopper for reuse.
23. Observe any indications of aquifer refusal. This is typically indicated by a high-pitched squeal in the pump's hydraulic system or (in the case of shallow applications) RegenOx "surfacing" around the injection rods or previously installed injection points. At times backpressure caused by gassing will impede pump movement. This can be corrected by bleeding the pressure off using a pressure relief/bypass valve (placed inline between the pump discharge and the delivery sub-assembly) and then resume pumping. If aquifer acceptance appears to be low, allow enough time for the aquifer to equilibrate prior to removing the drive rod.
24. Repeat steps 13-23 until treatment of the entire contaminated vertical zone has been achieved. It is recommended that the procedure extend to the top of the capillary fringe/smear zone, or to the top of the targeted treatment interval.
25. Install an appropriate seal, such as bentonite, above the RegenOx material through the entire vadose zone. Prior to emplacing the borehole seal, we recommend placing clean sand in the hole to the top of the RegenOx treatment zone (especially important in holes that stay open). Bentonite chips or granular bentonite should be placed immediately above the treatment zone, followed by a cement/bentonite grout to roughly 0.5 feet below ground surface. Quick-set concrete should then be used as a surface seal.
26. Remove and clean the drive rods as necessary.
27. Finish the borehole at the surface as appropriate (concrete or asphalt cap, if necessary). We recommend a quick set concrete to provide a good surface seal with minimal set up time.
28. A proper borehole and surface seal assures that RegenOx remains properly placed and prevents contaminant migration from the surface. Each borehole should be sealed immediately following RegenOx application to minimize RegenOx surfacing during the injection process. If RegenOx continues to "surface" up the direct push borehole, an appropriately sized (oversized) disposable drive tip or wood plug/stake can be used to plug the hole until the aquifer equilibrates and the RegenOx stops surfacing. If wells are used for RegenOx injection, the RegenOx injection wells and all nearby groundwater monitoring wells should be tightly capped to reduce potential for surfacing through nearby wells.
29. Periodically compare the pre-and post-injection volumes of RegenOx in the pump hopper using pre-marked volume levels. Volume level indicators are not on all pump hoppers. In this case, volume level markings can be temporarily added using known amounts of water and a carpenter's grease pencil (Kiel crayon). We suggest marking the water levels in 3-gallon increments.
30. Move to the next probe point, repeating steps 8 through 29. We recommend that the next RegenOx injection point be as far a distance as possible within the treatment zone from the previous RegenOx injection point. This will further minimize RegenOx surfacing and short circuiting up an adjacent borehole. When possible, due to the high volumes of liquid being injected, working from the outside of the injection area towards the center will limit expansion of the plume.

1) RegenOx Pump Information

REGENESIS® has evaluated a number of pumps that are capable of delivering RegenOx to the subsurface at a sufficient pressure and volumetric rate. Although a number of pumps may be capable of delivering the RegenOx to the subsurface at adequate pressures and volume, each pump has a set of practical issues that make it difficult to manage in a field setting. In general, REGENESIS strongly recommends using a pump with a minimum pressure rating of 200 pounds per square inch (psi) in sandy formations or 800 psi in silt, clay or weathered bedrock formations, and a minimum delivery rate of 5 gallons per minute (gpm). A lower gpm rated pump can be used; however, they are not recommended due to the amount of time required to inject the volume of liquids typically associated with a RegenOx injection (i.e. 1,000 lbs of RegenOx [500 lbs Oxidant/500 lbs Activator] require roughly 1,100 gallons of water to make a 5% Oxidant solution).

2) Pump Cleaning

For best results, use a hot water pressure washer (150-170 °F or 66-77 °C) to clean equipment and rods periodically throughout the day. Internal pump mechanisms and hoses can be easily cleaned by circulating hot water and a biodegradable cleaner such as Simple Green® through the pump and delivery hose. Further cleaning and decontamination (if necessary due to subsurface conditions) should be performed according to the equipment supplier's standard procedures and local regulatory requirements.

For more information contact REGENESIS at 949.366.8000

Appendix B

Scope of Work

INSTALLATION OF PASSIVE SUB-SLAB DEPRESSURIZATION SYSTEM (SSDS) AND SOIL VAPOR EXTRACTION (SVE) SYSTEM AT PROJECT SITE AS SHOWN ON THESE PLANS AND SPECIFICATIONS INCLUDING:

1. INSTALLATION OF SUB-SLAB PIPING AND MATERIAL
2. INSTALLATION OF TWO SVE WELLS
3. FURNISH AND INSTALL BLOWER PACKAGE
4. INSTALLATION OF RISER PIPING AND EQUIPMENT
5. INSTALLATION OF VAPOR BARRIER BELOW ENTIRE BUILDING SLAB TO GRADE
6. INSTALLATION OF CRUSHED STONE LAYER BELOW SLAB
7. INSTALLATION OF ELECTRICAL WORK
8. FACILITATION OF WORK AS SPECIFIED

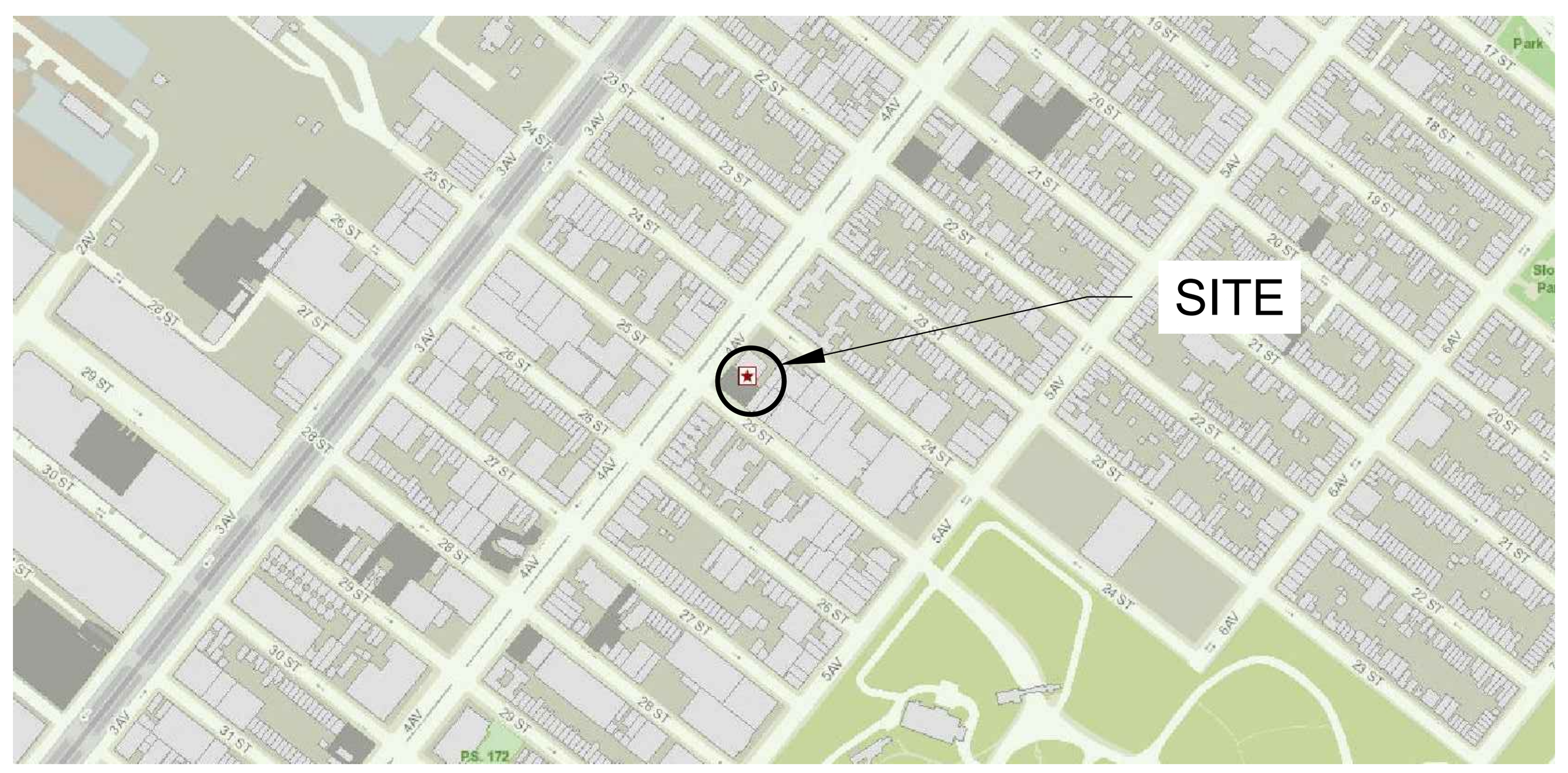
Legend

Notes

- ABOVE-SLAB SOLID PIPING/DUCTING
- EXTENTS OF VAPOR BARRIERS AND GRAVEL LAYER INSTALLATION
- SUB-SLAB GEOVENT
- SUB-SLAB SVE SOLID PIPING

General Notes

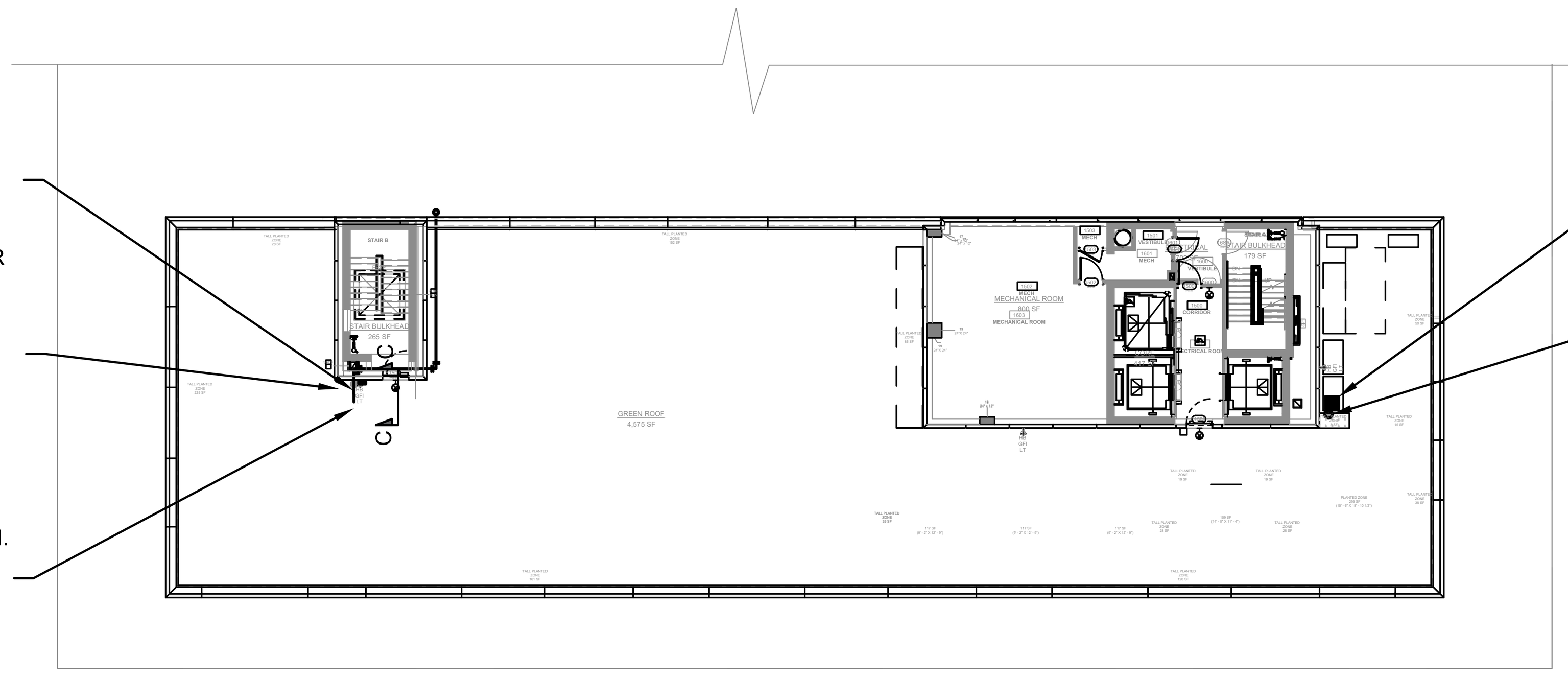
1. DRAWING NOT TO BE USED FOR STRUCTURAL, ARCHITECTURAL OR OTHER REFERENCE EXCEPT FOR SUB-SLAB DEPRESSURIZATION SYSTEM AND VAPOR BARRIER.
2. COORDINATE ALL WORK FOR SUB-SLAB DEPRESSURIZATION SYSTEM, VAPOR BARRIER AND ROOF PENETRATION WITH OTHER TRADES PRIOR TO INSTALLATION.
3. COORDINATE LOCATION OF RISER WITH ARCHITECT.
4. FIELD CONDITIONS TO BE VERIFIED BY CONTRACTOR PRIOR TO ANY WORK.
5. SLOPE ALL SOLID PIPING DOWNWARD TOWARDS SSDS GEOVENT AT MIN. 1/8" PER FT OF PIPING.
6. ALL DUCTING AND FITTINGS TO BE GALVANIZED CLOSED DUCTING NORDFAB WITH AIR TIGHT QUICK FIT COUPLINGS OR APPROVED EQUIVALENT.
7. COUPLING FLANGES TO BE SEALED WITH VAPOR TIGHT TAPE AND COUPLED WITH QUICK FIT COUPLINGS.
8. SOIL VAPOR EXHAUST VENT SHALL BE
   - 8.1. ABOVE THE EAVE OF THE ROOF (PREFERABLY, ABOVE THE HIGHEST EAVE OF THE BUILDING AT LEAST 12 INCHES ABOVE THE SURFACE OF THE ROOF)
   - 8.2. AT LEAST 10 FEET ABOVE GROUND LEVEL,
   - 8.3. AT LEAST 10 FEET AWAY FROM ANY OPENING THAT IS LESS THAN 2 FEET BELOW THE EXHAUST POINT, AND 10 FEET FROM ANY ADJOINING OR ADJACENT BUILDINGS, OR HVAC INTAKES OR SUPPLY REGISTERS.
9. ALL ELECTRICAL TO BE INSTALLED BY LICENSED ELECTRICIAN.
10. PROVIDE DESIGNATED CIRCUIT FOR POTENTIAL FUTURE BLOWER AS SPECIFIED.
11. ALL EXTERIOR PENETRATIONS FOR ELECTRICAL & PIPING TO BE BOOTED AND WATER TIGHT.
12. ALL CONCRETE PENETRATIONS SHALL BE SEALED WITH LIQUID BITUTHENE OR ENGINEER APPROVED EQUAL.
13. GRAVEL LAYER TO BE 3/4"-1" CRUSHED STONE WITH LESS THAN 10% PASSING #100 SIEVE.
15. VAPOR BARRIER TO BE INSTALLED BELOW ENTIRE BUILDING FOOTPRINT AND TERMINATE AT OR ABOVE GRADE ON EXTERIOR FOUNDATION WALL.
16. GEOTEXTILE FABRIC TO BE 8 OZ NON-WOVEN OR APPROVED EQUIVALENT.
17. CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR ENGINEERS APPROVAL, INCLUDING BUT NOT LIMITED TO;
   - 17.1. PIPING MATERIALS AND FITTINGS
   - 17.2. FAN MAKE AND MANUFACTURER
   - 17.3. VACUUM MONITORING POINT & FITTINGS
   - 17.4. DUCT SUPPORTS
   - 17.5. CRUSHED STONE SELECTION AND SIEVE ANALYSIS
   - 17.6. BLOWER PACKAGE WITH APPURTENANCES



BASEMAP REFERENCE: NYC GIS

SITE LOCATION MAP

SCALE: 1" = 500'

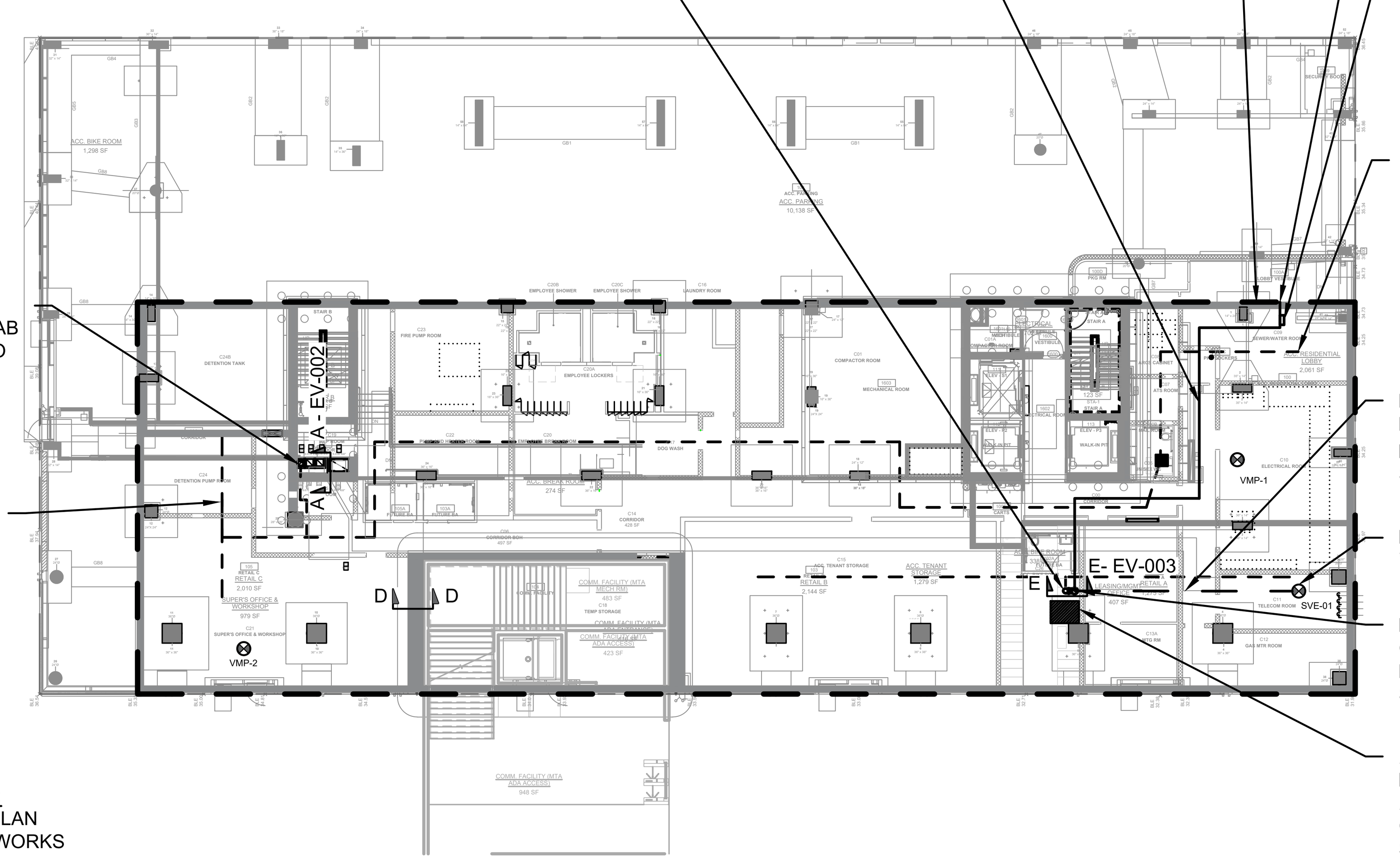


BASEMAP REFERENCES:
A-215 - 15TH FLOOR MAIN ROOF FLOOR PLAN
PREPARED BY DENCITYWORKS
DATED 02-03-2023

ROOF SSDS & SVE PLAN

SCALE: 1" = 200'

0 20 40
SCALE: 1" = 20'

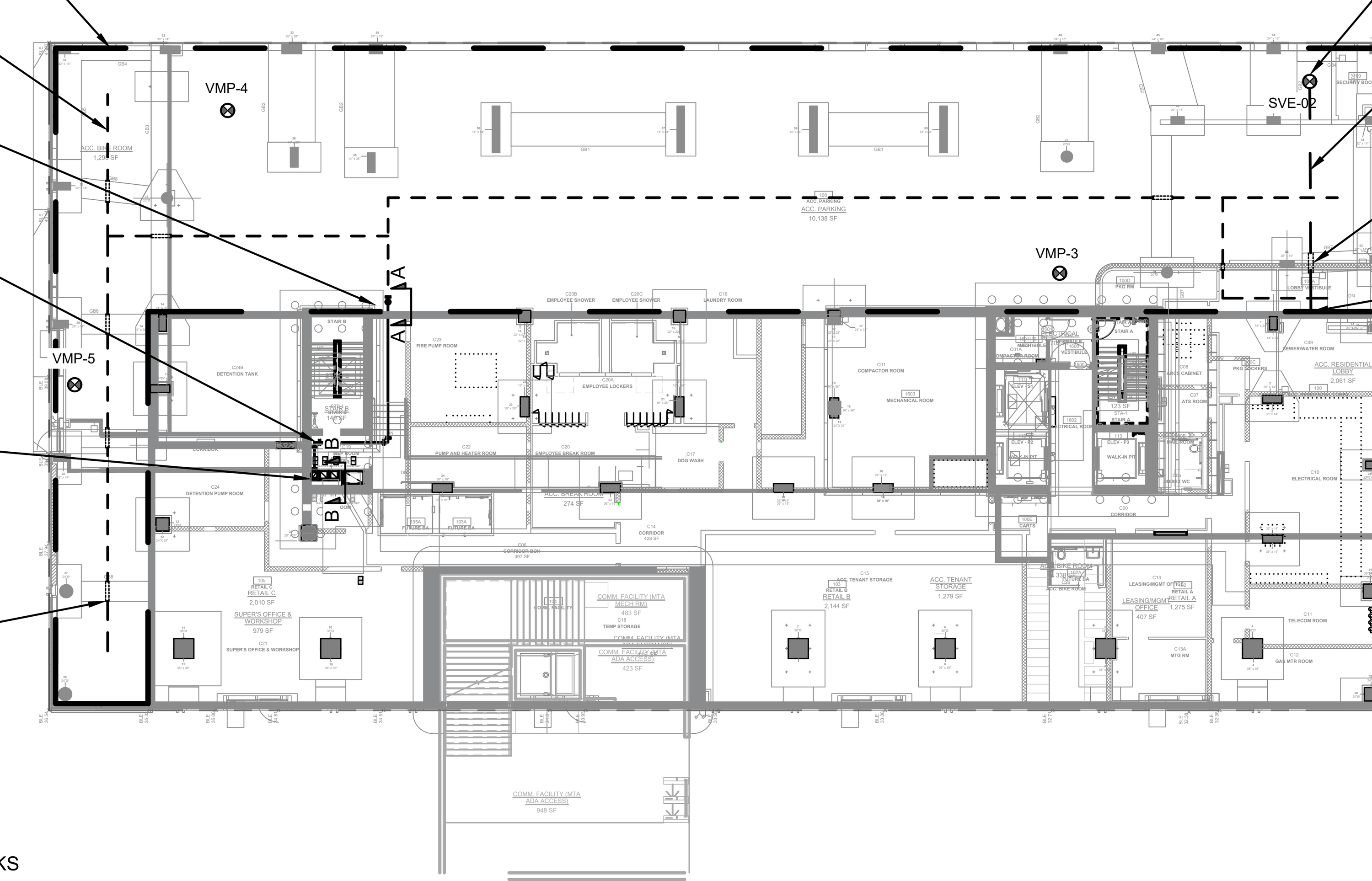


BASEMAP REFERENCES:
A-200 - CELLAR FLOOR PLAN
PREPARED BY DENCITYWORKS
DATED 02-03-2023
FO-011.01 - FOUNDATION FRAMING PLAN (CELLAR)
PREPARRED BY ROSENWASSER/GROSSMAN CONSULTING ENGINEERS, P.C.

CELLAR SSDS & SVE PLAN

SCALE: 1" = 20'

0 20 40
SCALE: 1" = 20'



BASEMAP REFERENCES:
A-201 - FIRST FLOOR PLAN
PREPARED BY DENCITYWORKS
DATED 02-03-2023
FO-011.01 - FOUNDATION FRAMING PLAN (CELLAR)
PREPARRED BY ROSENWASSER/GROSSMAN CONSULTING ENGINEERS, P.C.

1ST FLOOR SSDS & SVE PLAN

SCALE: 1" = 20'

0 20 40
SCALE: 1" = 20'

PWGC
CLIENT DRIVEN SOLUTIONS
P.W. GROSSER CONSULTING ENGINEER AND HYDROGEOLOGIST, P.C.
630 Johnson Avenue. • Suite 7
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E-mail: INFO@PWGROSSER.COM

CONSULTANTS

Number	Revision Description	Revision Date
7		
6		
5	DEC RESUBMISSION	06/19/2023
4	ISSUED FOR 80% CD	04/25/2023
3	DEC SUBMISSION	03/31/2023
2	ISSUED FOR 70% CD	02/03/2023
1	ISSUED FOR 60% CD	12/02/2022

Designed By	MS	Date Submitted	-
Drawn By	KLM	Date Created	11/03/2022
Approved By	PKB	Scale	AS NOTED

Client:
TOT2101
-
-

Project:
731-747 4TH AVE. BROOKLYN, NY EXCAVATION PLAN

Project Address:
731-747 4TH AVE.
BROOKLYN, NY
KINGS COUNTY, NEW YORK

County Tax Map Number: BLOCK 652- LOT 1,7
Contract Number: TOT2101
Regulatory Reference Number: -

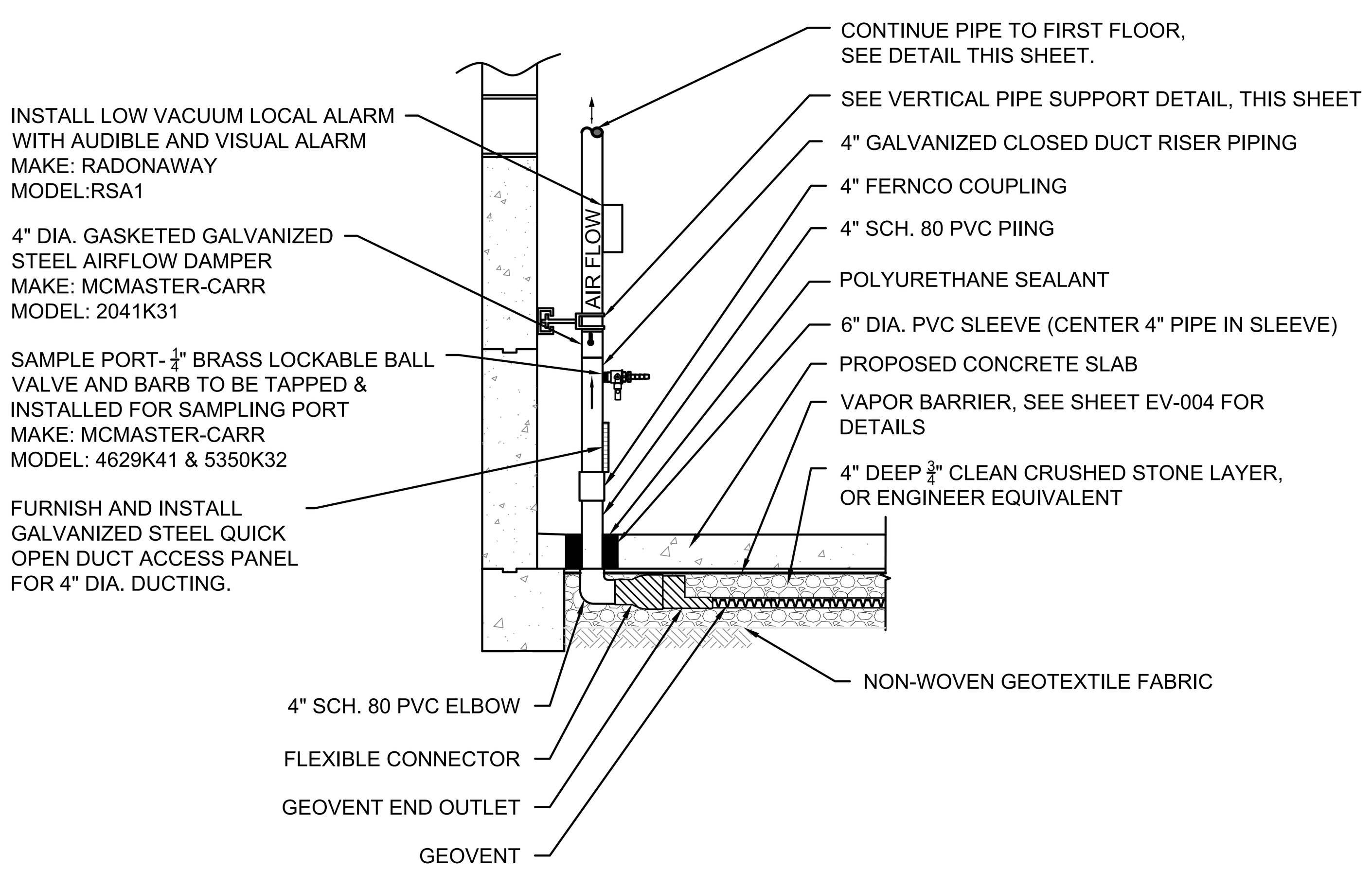
Title of Drawing:
SSDS & SVE FLOOR PLANS

Drawing Number: EV-001

Sheet 1 of 4

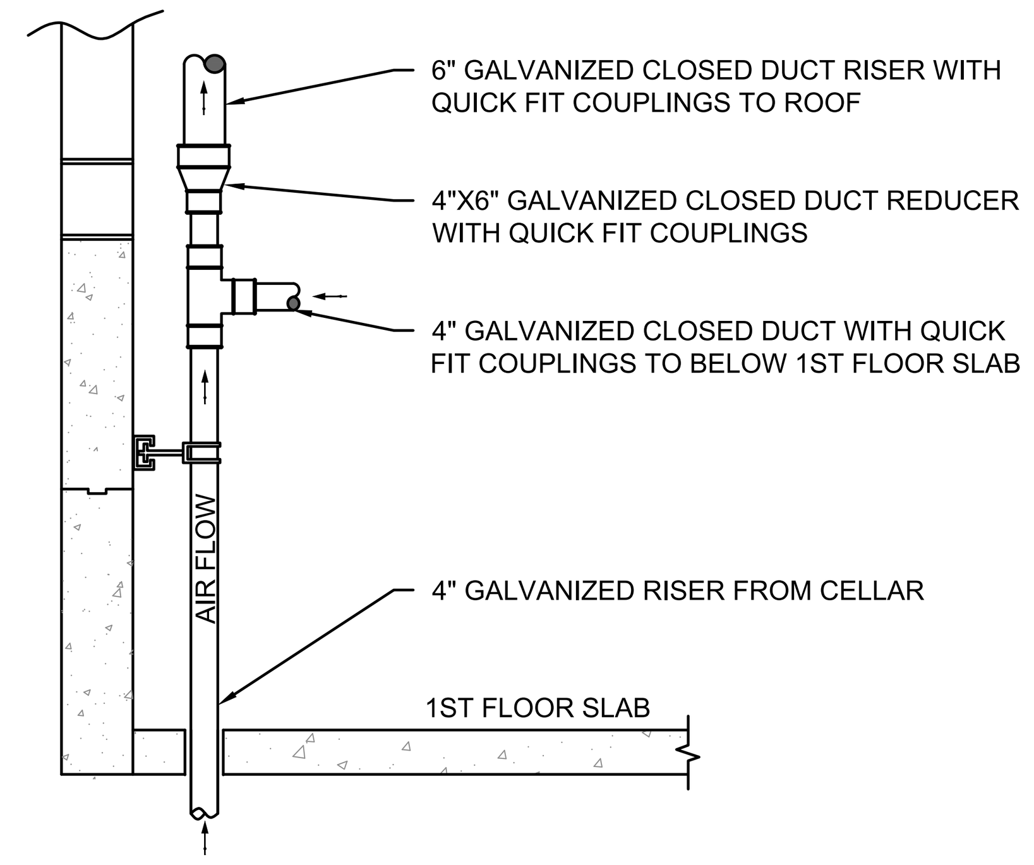
PWGC Project Number: TOT2101

PWGC FILE NAME: J:\Projects S-Z\TOT - Totem Brooklyn\2101 - 737 4th Ave - BCP\CAD\SSDS Plans\2023-05-30 - Final Design Rev. 3\2023-05-30 - 4th Ave - SSDS & SVE Final Design - 80% CD - PWGC & Architect Plans.dwg (EN-01_PWGC)
PLOT DATE/TIME: Jun 23, 2023-2:07pm By: scanlon



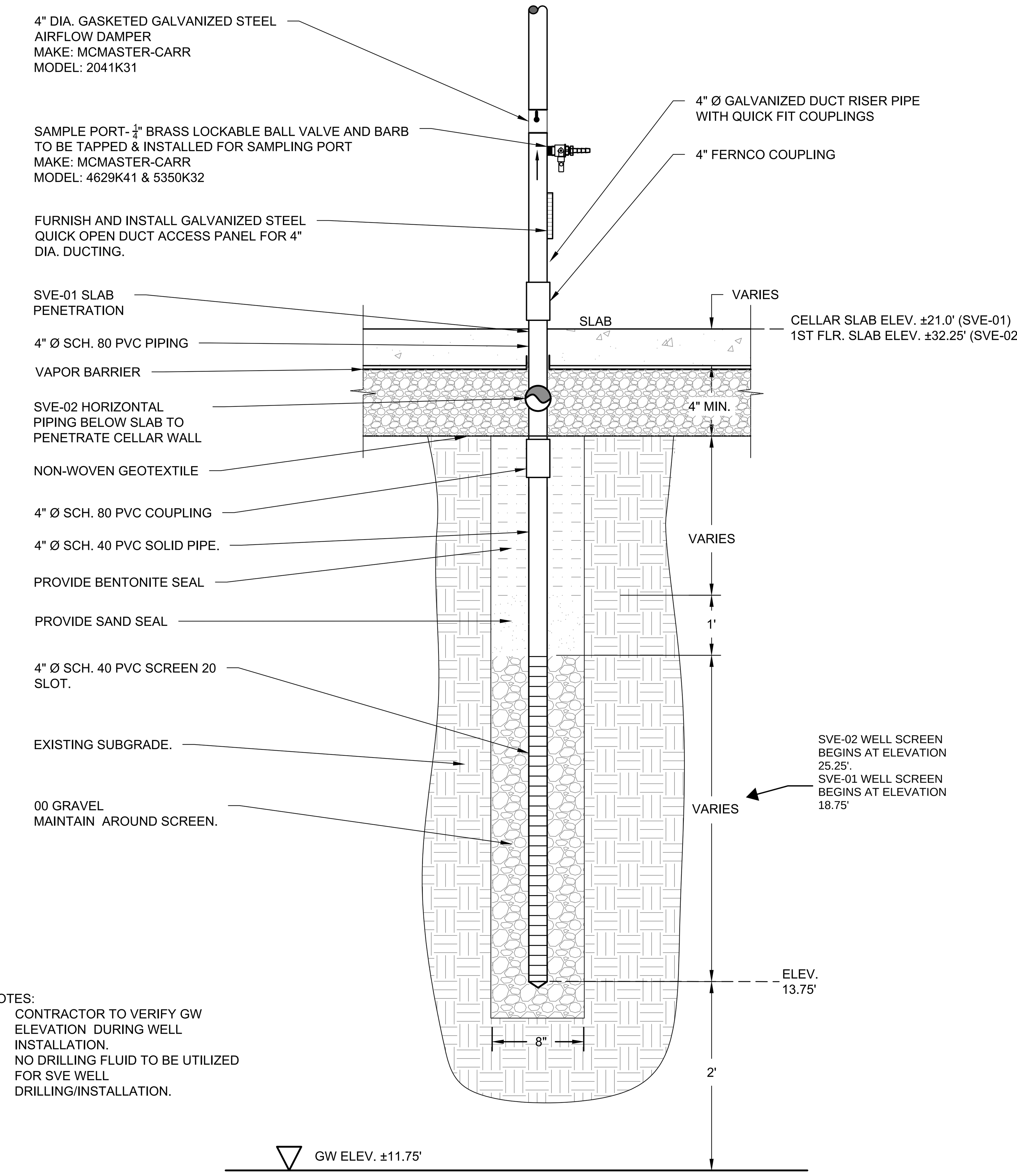
SECTION A-A SUB-SLAB PIPING PENETRATION

SCALE: NTS



SECTION B-B SUB-SLAB PIPING PENETRATION

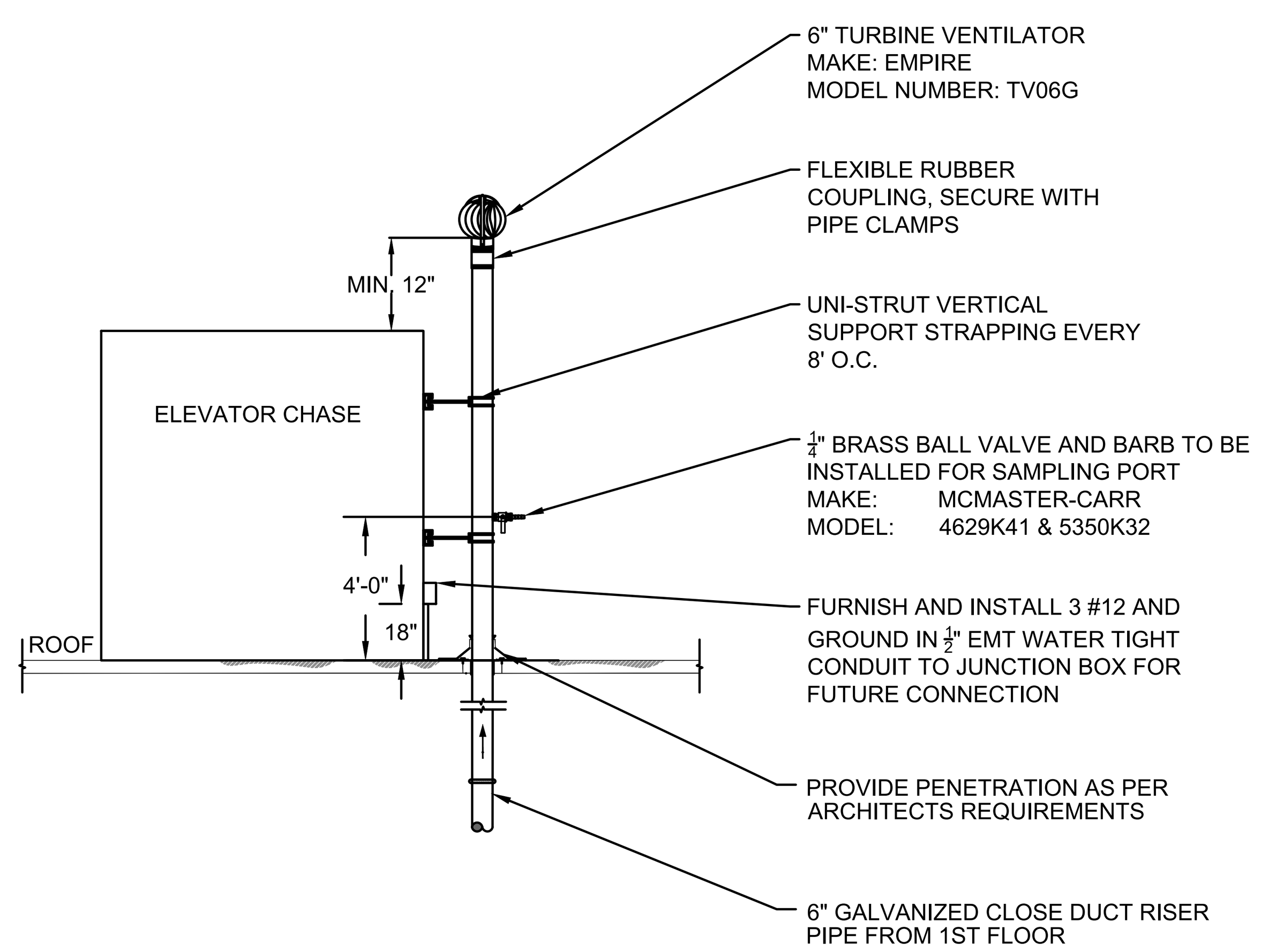
SCALE: NTS



NOTES:
1. CONTRACTOR TO VERIFY GW ELEVATION DURING WELL INSTALLATION.
2. NO DRILLING FLUID TO BE UTILIZED FOR SVE WELL DRILLING/INSTALLATION.

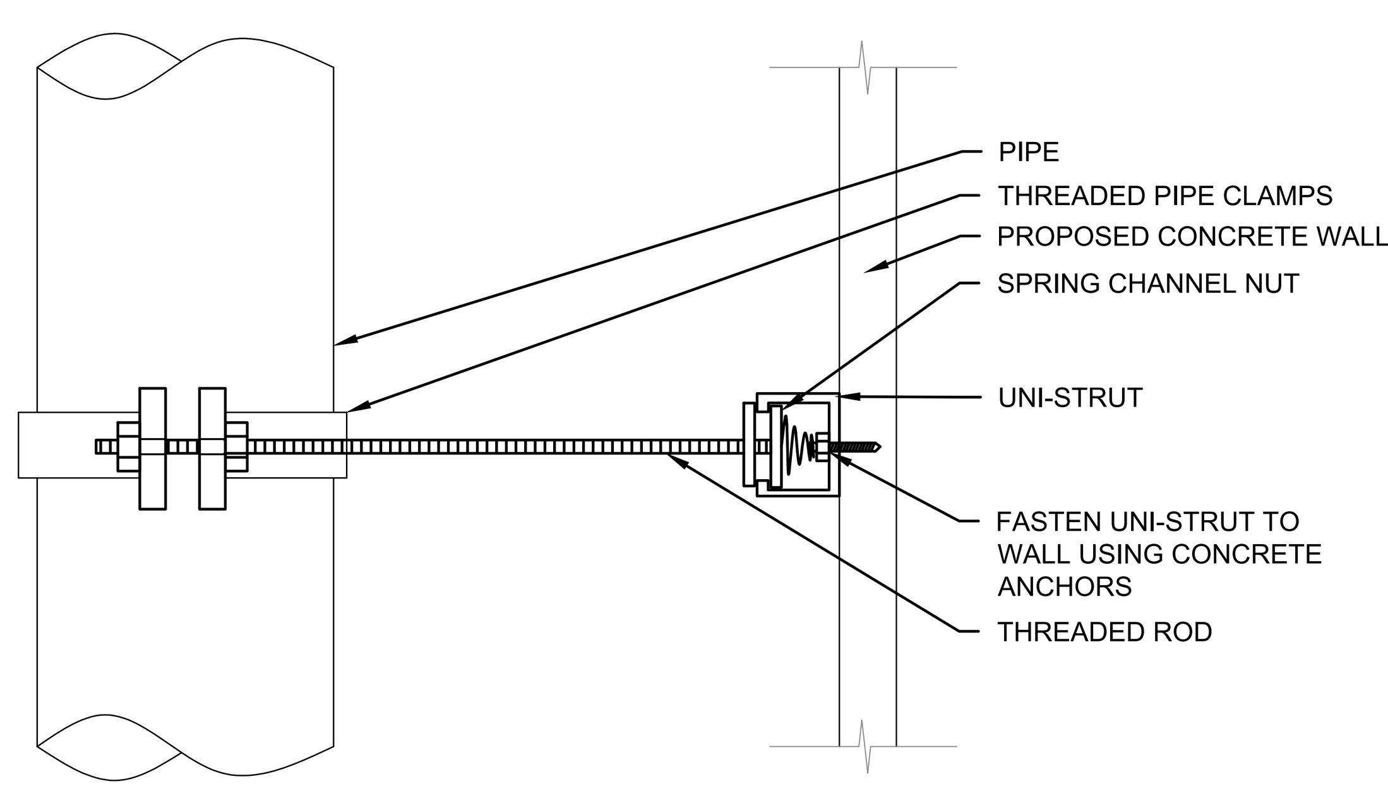
SVE WELL DETAIL

SCALE: NOT TO SCALE



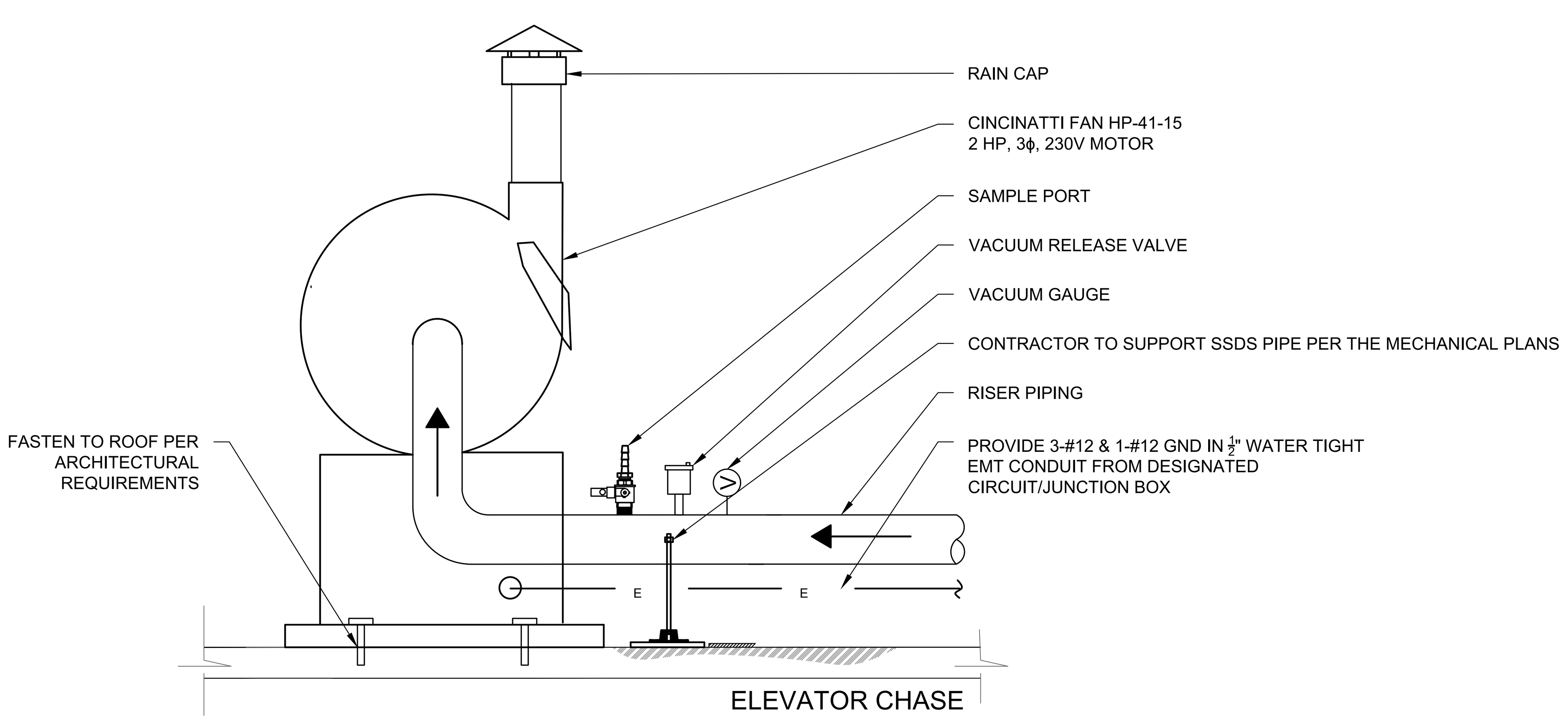
SECTION C-C ROOF PENETRATION/VENTILATOR DETAIL

SCALE: NTS



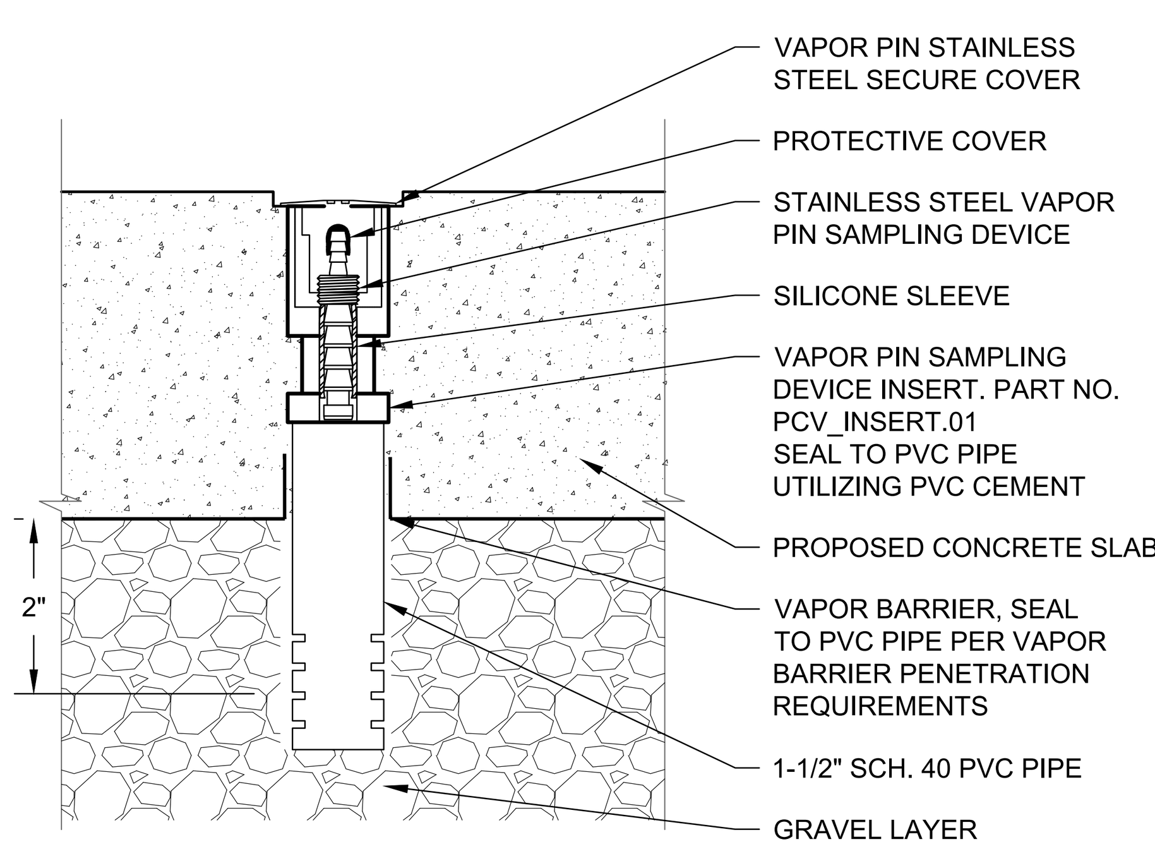
TYPICAL VERTICAL PIPE SUPPORT

SCALE: NTS



FUTURE ACTIVE SYSTEM CONVERSION (IF NECESSARY)

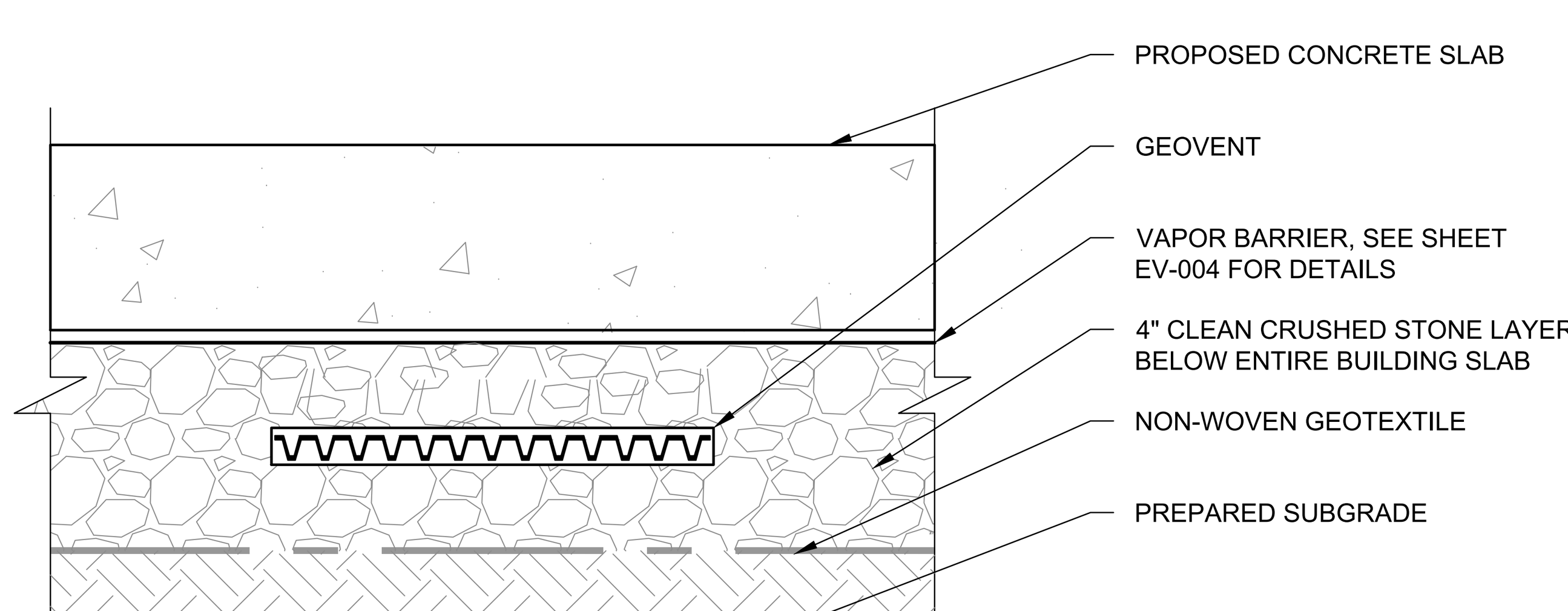
SCALE: NOT TO SCALE



NOTE(S):
1. REFER TO VAPOR PIN STANDARD OPERATING PROCEDURE INSTALLATION OF THE VAPOR PIN SAMPLING DEVICE INSERT FOR FULL INSTALLATION INSTRUCTIONS.
2. VAPOR PIN SAMPLING DEVICE INSERT CAP (PART NO. PVC_INSERT_CAP.01) AND ⅜"-13 THREADED ROD MAY BE REQUIRED DURING INSTALLATION IF INSTALLED PRIOR TO NEW CONCRETE SLABS.

TYPICAL SUB-SLAB MONITORING POINT

SCALE: NTS



GEOVENT INSTALLATION DETAIL

SCALE: NTS

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CONSULTANTS

Number	Revision Description	Revision Date
7		
6		
5	DEC RESUBMISSION	06/19/2023
4	ISSUED FOR 80% CD	04/25/2023
3	DEC SUBMISSION	03/31/2023
2	ISSUED FOR 70% CD	02/03/2023
1	ISSUED FOR 60% CD	12/02/2022

Designed By	MS	Date Submitted	-
Drawn By	KLM	Date Created	11/03/2022
Approved By	PKB	Scale	AS NOTED

Client:
TOT2101
-
-

Project:
731-747 4TH AVE. BROOKLYN, NY EXCAVATION PLAN

Project Address:
731-747 4TH AVE.
BROOKLYN, NY
KINGS COUNTY, NEW YORK

County Tax Map Number: BLOCK 652- LOT 1,7
Contract Number: TOT2101
Regulatory Reference Number: -

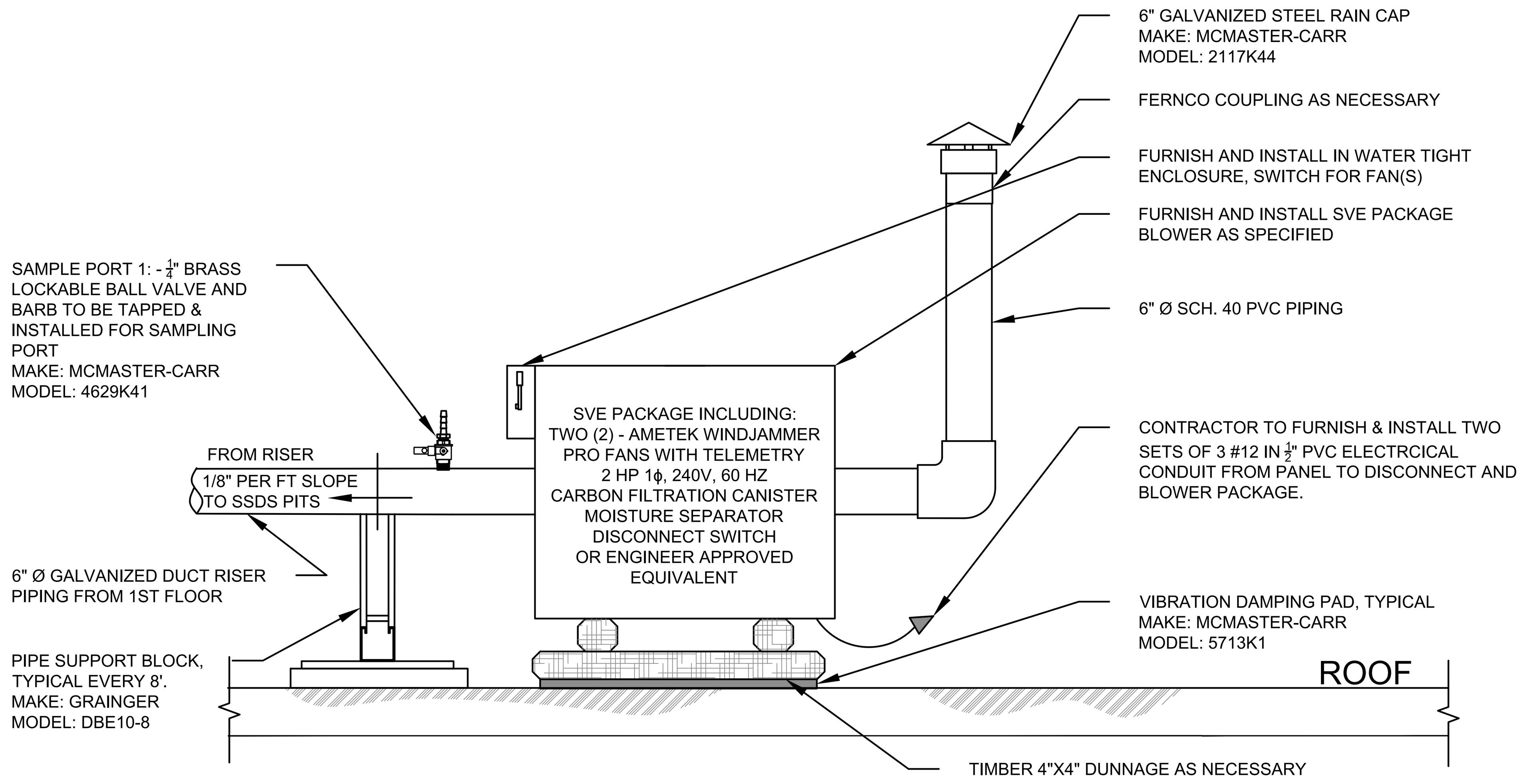
Title of Drawing:
SSDS DETAILS-1

Drawing Number: EV-002

Sheet 2 of 4

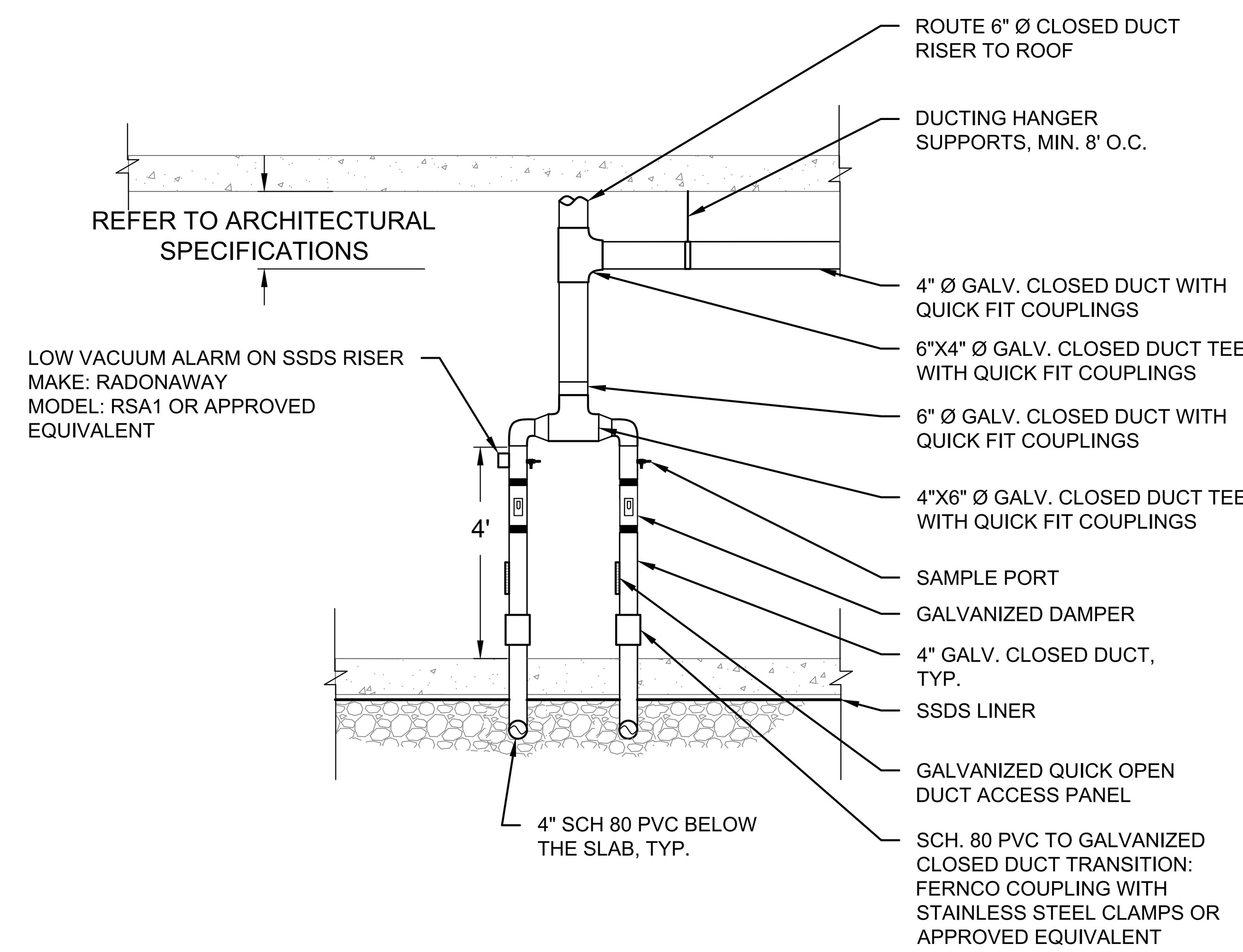
PWGC Project Number: TOT2101

PWGC FILE NAME: J:\Projects S-Z\TOT - Totem Brooklyn\2101 - 737 4th Ave - BCP\CAD\SSDS Plans\2023-05-30 - Final Design Rev. 3\2023-05-30 - 4th Ave - SSDS & SVE Final Design - 80% CD - PWGC & Architect Plans.dwg (EN-02 PWGC)
PLOT DATE/TIME: Jun 23, 2023-2:07pm By: scanlon



SVE BLOWER PACKAGE DETAIL

SCALE: NOT TO SCALE



SECTION E-E SSDS & SVE PIPING PENETRATION AND MANIFOLD

SCALE:NOT TO SCALE

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CONSULTANTS

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1	ISSUED FOR 60% CD	12/02/2022

Designed By	MS	Date Submitted	-
Drawn By	KLM	Date Created	11/03/2022
Approved By	PKB	Scale	AS NOTED

Client:
TOT2101
-
-

Project:
731-747 4TH AVE. BROOKLYN, NY EXCAVATION PLAN

Project Address:
731-747 4TH AVE.
BROOKLYN, NY
KINGS COUNTY, NEW YORK

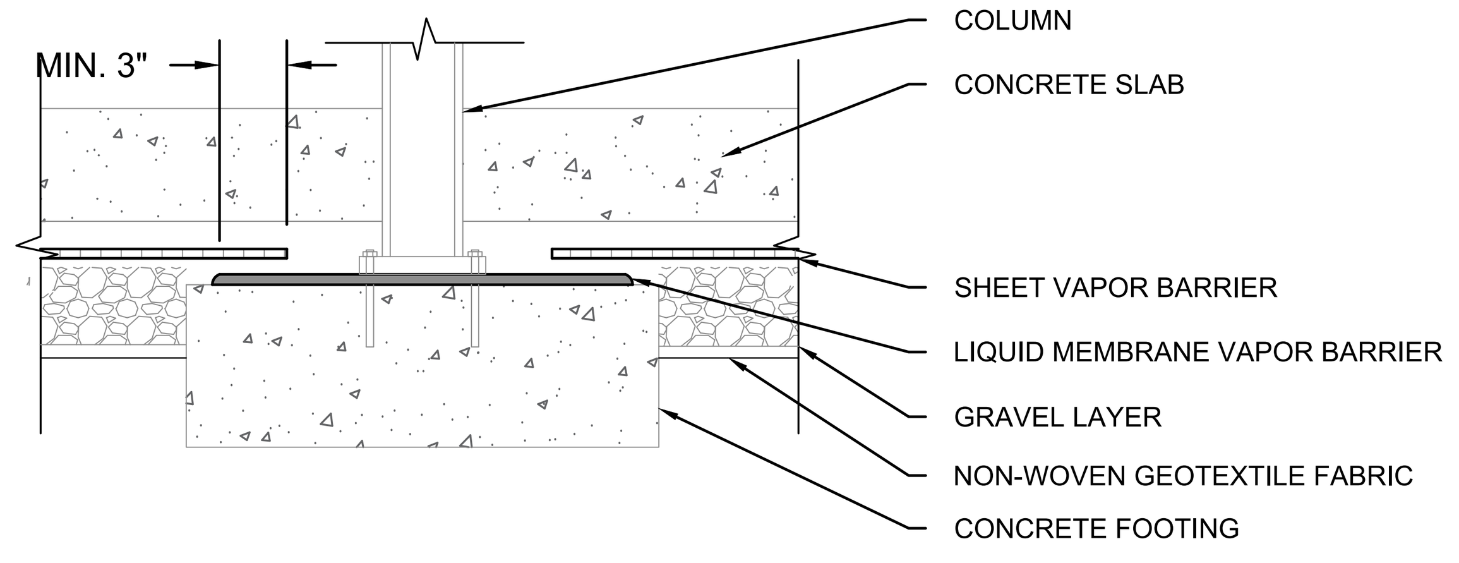
County Tax Map Number: BLOCK 652- LOT 1,7
Contract Number: TOT2101
Regulatory Reference Number: -

Title of Drawing:
SSDS DETAILS-2

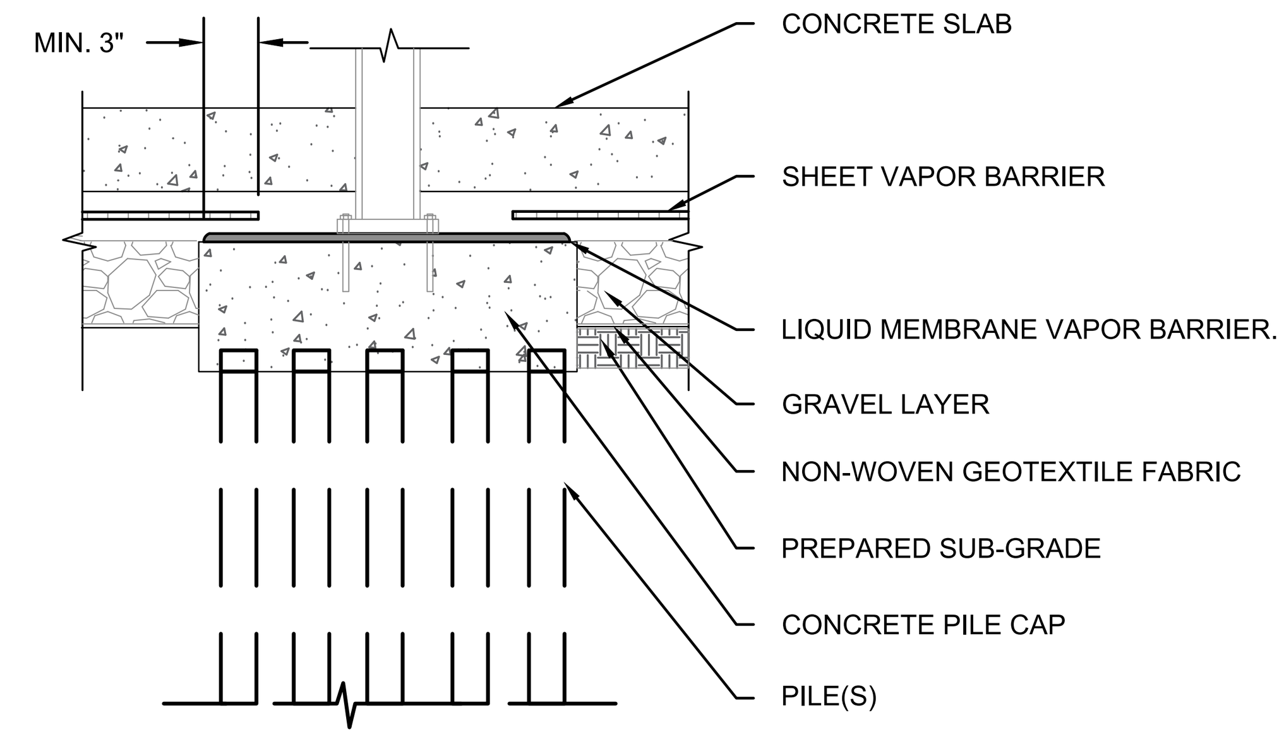
Drawing Number: EV-003

Sheet 3 of 4

PWGC Project Number: TOT2101



VAPOR BARRIER OVER FOOTING AT COLUMN DETAIL
SCALE: NOT TO SCALE



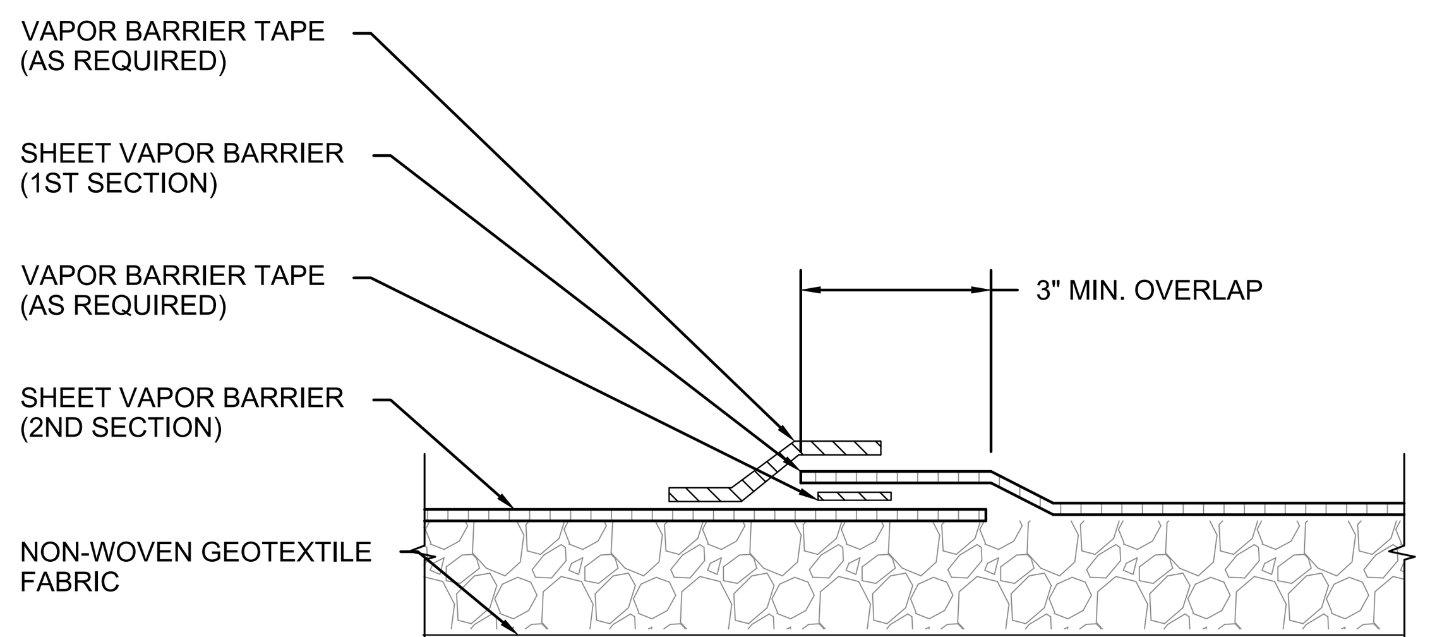
VAPOR BARRIER OVER PILE CAP DETAIL
SCALE: NOT TO SCALE

NOTES:

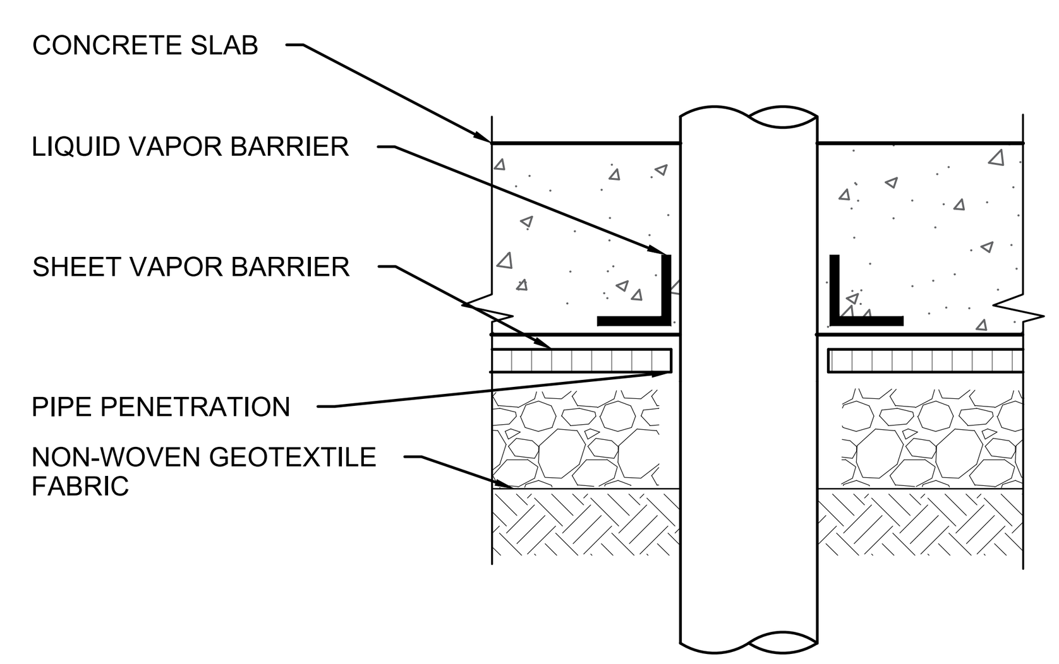
1. VAPOR BARRIER TO BE GCP PREPRUFE 300R (HORIZONTAL APPLICATIONS) OR 160R (VERTICAL APPLICATIONS) OR ENGINEER APPROVED EQUIVALENT.
2. LIQUID MEMBRANE VAPOR BARRIER TO BE BITUTHENE LIQUID MEMBRANE MANUFACTURED BY GCP APPLIED TECHNOLOGIES, OR ENGINEER APPROVED EQUIVALENT.
3. VAPOR BARRIER PRODUCTS SHALL BE INSTALLED PER ASTM E1993 - SPECIFICATION FOR BITUMINOUS WATER VAPOR RETARDERS USED IN CONTACT WITH SOIL OR GRANULAR FILL UNDER CONCRETE SLABS AND ASTM E1745-11 - STANDARD SPECIFICATION FOR PLASTIC WATER VAPOR RETARDERS USED IN CONTACT WITH SOIL OR GRANULAR FILL UNDER CONCRETE SLABS AND MEET THE SPECIFICATIONS OF A "CLASS A" VAPOR BARRIER, OR ENGINEER APPROVED EQUIVALENT.
4. WHERE THESE SPECIFICATIONS DIFFER WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS, THE MANUFACTURER'S INSTALLATION INSTRUCTIONS SHALL TAKE PRECEDENCE.
5. VAPOR BARRIER INSTALLATIONS SHALL BE INSPECTED BY ENVIRONMENTAL PROFESSIONAL OR ENGINEER PRIOR TO COVERING.
6. MINIMUM VAPOR BARRIER THICKNESS TO BE 20 MILS.
7. ALL DAMAGE, PUNCTURES, AND PENETRATIONS SHALL BE SEALED PER MANUFACTURER'S SPECIFICATIONS.
8. MIN. 3" OVERLAP AT VAPOR BARRIER SEAMS.
9. MIN. 3" OVERLAP AT PLASTIC VAPOR BARRIER AND LIQUID VAPOR BARRIER SEAMS.
10. UTILIZE PREPRUFE TAPE AS NECESSARY AT VAPOR BARRIER END JOINTS AND CUT EDGES.
11. STORE IN DRY CONDITIONS BETWEEN 40°-90°F.
12. PLANS FOR COMPLIANCE WITH ENVIRONMENTAL REGULATIONS ONLY. THEY ARE NOT FOR COMPLIANCE WITH MANUFACTURER'S REQUIREMENTS FOR WARRANTY.

LEGEND

Existing	Proposed	Notes
VAPOR BARRIER		
	(sheet symbol)	SHEET VAPOR BARRIER
	(liquid symbol)	LIQUID MEMBRANE VAPOR BARRIER
	(line symbol)	8 OZ NON-WOVEN GEOTEXTILE FABRIC
	(tape symbol)	VAPOR BARRIER TAPE

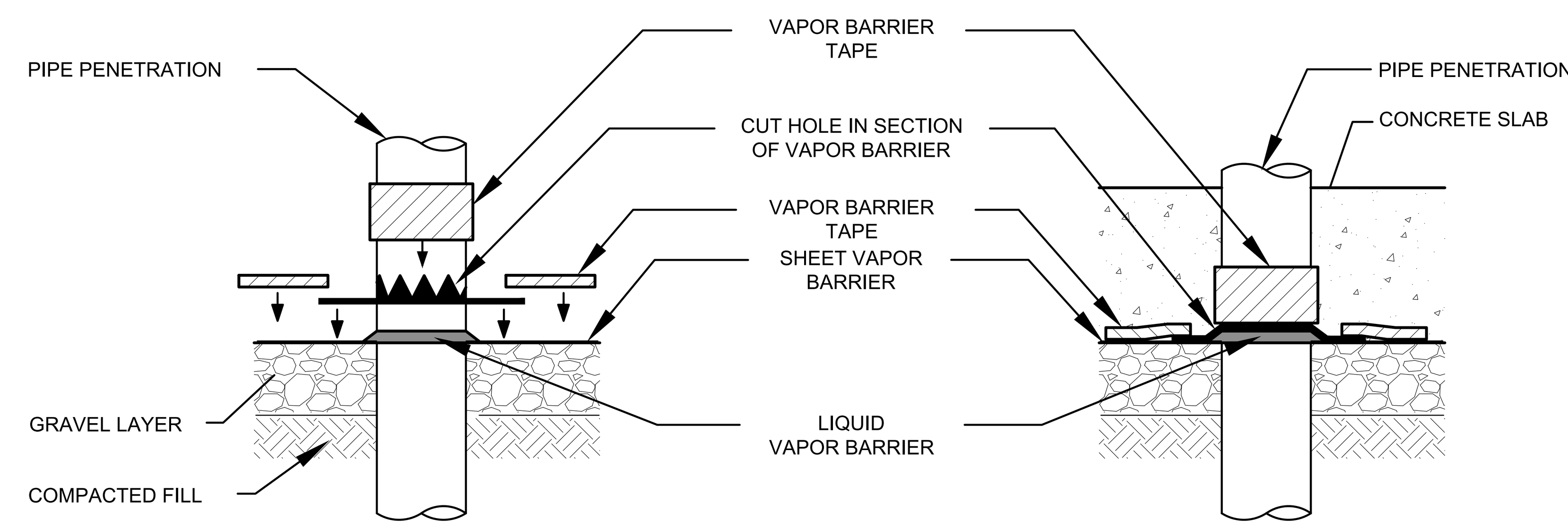


TYPICAL VAPOR BARRIER OVERLAP DETAIL
SCALE: NOT TO SCALE



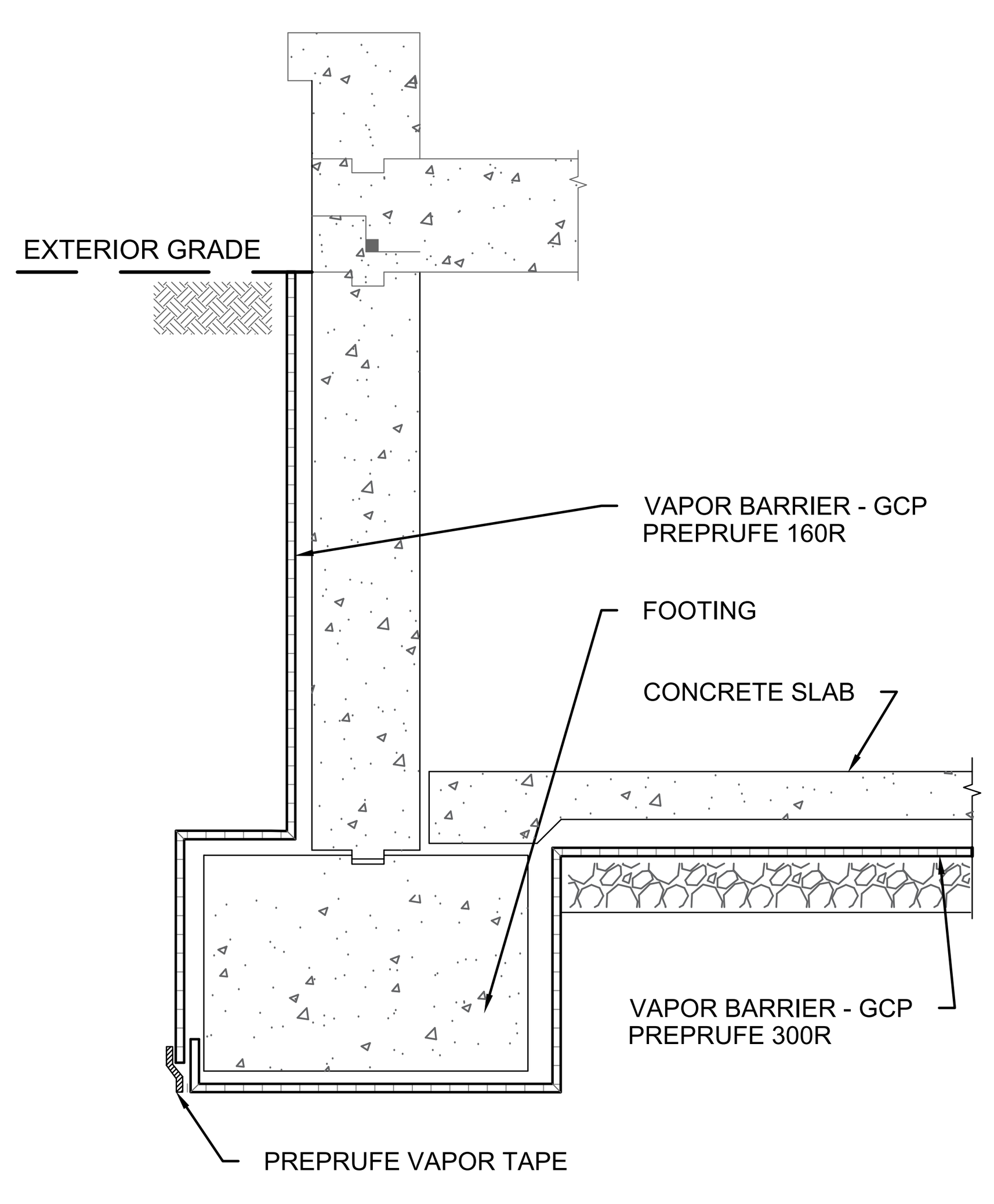
NOTE:
PATCH FOR VAPOR BARRIER SHALL OVERLAP IN PLACE VAPOR BARRIER BY MINIMUM SIX INCHES.

ALTERNATE 1



ALTERNATE 2

TYPICAL VAPOR BARRIER PENETRATION DETAIL
SCALE: NOT TO SCALE



ALTERNATE - 1
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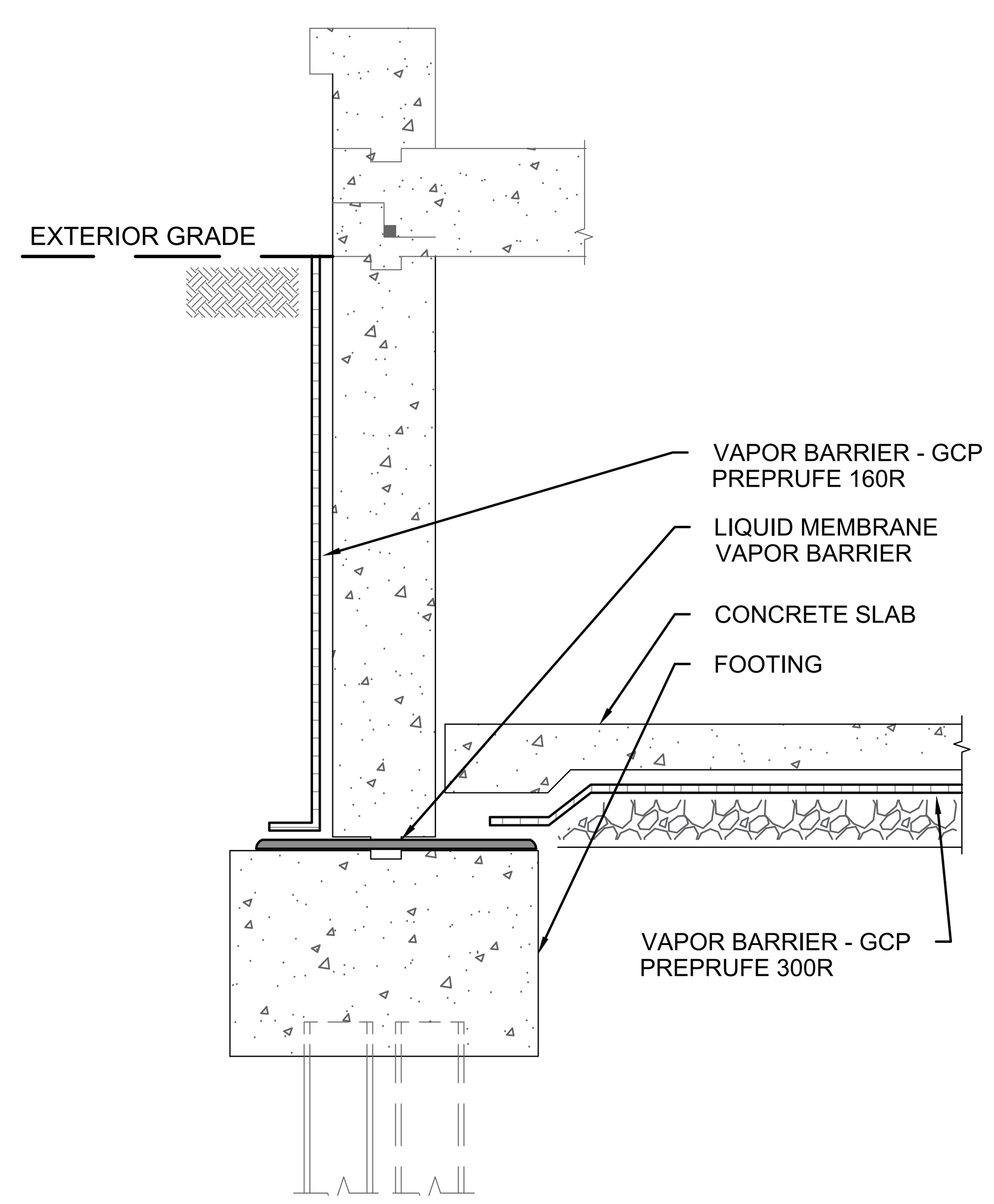
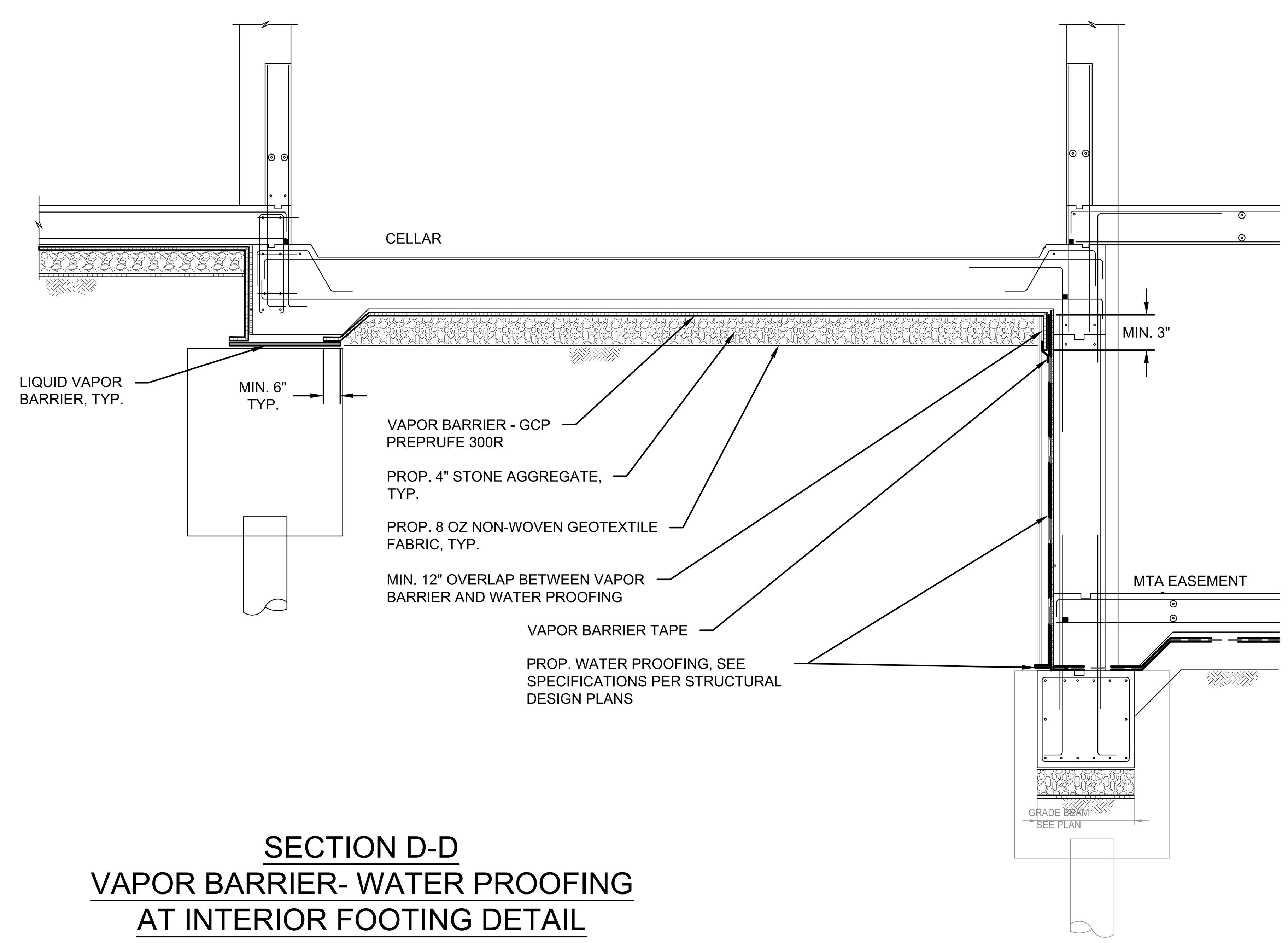


ALTERNATE - 2
SCALE: NOT TO SCALE

VAPOR BARRIER AT EXTERIOR FOOTING DETAIL
SCALE: NOT TO SCALE



SECTION D-D VAPOR BARRIER- WATER PROOFING AT INTERIOR FOOTING DETAIL
SCALE: NOT TO SCALE

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Designed By: MS | Date Submitted: -
Drawn By: KLM | Date Created: 11/03/2022
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731-747 4TH AVE. BROOKLYN, NY EXCAVATION PLAN

Project Address:
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KINGS COUNTY, NEW YORK

County Tax Map Number: BLOCK 652- LOT 1,7 | Contract Number: TOT2101
Regulatory Reference Number: -

Title of Drawing:
VAPOR BARRIER DETAILS

Drawing Number: **EV-004**
Sheet 4 of 4
PWGC Project Number: TOT2101

PWGC FILE NAME: J:\Projects S-Z\TOT - Totem Brooklyn\2101 - 737 4th Ave - BCP\CAD\SSDS Plans\2023-05-30 - Final Design Rev. 3\2023-05-30 - 4th Ave - SSDS & SVE Final Design - 80% CD - PWGC & Architect Plans.dwg (EN-04 PWGC)
PLOT DATE/TIME: Jun 23, 2023-2:07pm By: scanlon

Appendix C

PREPRUFE® 300R/160R Plus & PREPRUFE® 300R/160R Plus LT Data Sheet

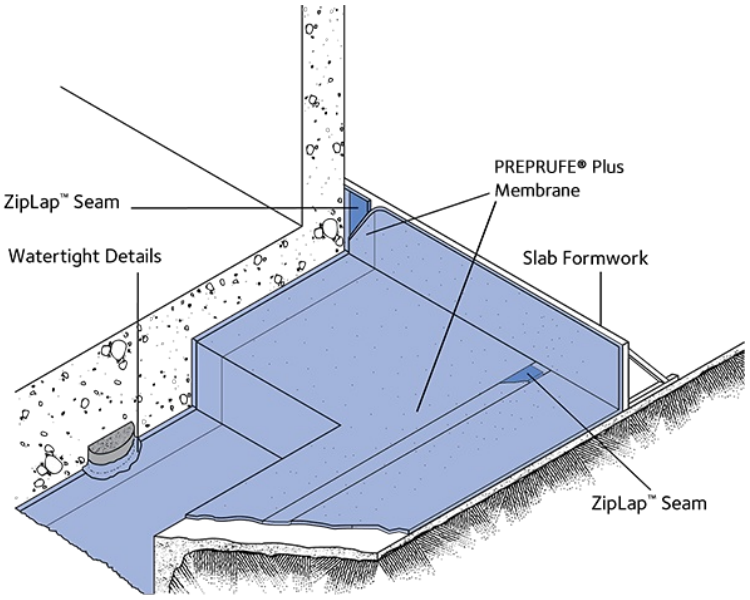
Pre-applied waterproofing membranes that bond integrally to poured concrete for use below slabs or behind basement walls on confined sites.

View Sustainability Certifications: 300R Plus, 160R Plus, 300R Plus LT, 160R Plus LT

Product Description

GCP PREPRUFE® 300R/160R Plus pre applied waterproofing membranes are unique composite sheets comprised of a thick HDPE film, pressure sensitive adhesive, and weather resistant protective coating. Designed with Advanced Bond Technology™ and dual adhesive ZipLap™ seams, PREPRUFE® 300R/160R Plus form a unique, integral bond to poured concrete. This integral bond is specifically designed to provide a robust barrier to water, moisture and gas and prevents both the ingress and lateral migration of water.

PREPRUFE® 300R/160R Plus are release liner free and designed for efficient, reliable installation. PREPRUFE® Plus ZipLap™ seams allow for an adhesive to adhesive bond at membrane sheet overlaps and deliver superior performance in harsh conditions without the need for specialized equipment, heat or power.



Drawings are for illustration purposes only.
Please refer to gcpat.com for specific application details.

Advantages

- The unique continuous adhesive bond to concrete poured against it prevents water migration and makes it unaffected by ground settlement beneath slabs.
- Designed with fully adhered adhesive to adhesive watertight ZipLap™ seams and easy to execute detailing. Provides a barrier to water, moisture and gas physically isolating the structure from the surrounding substrate. Easy roll/kick out installation reduces installation time and cost.
- Release liner free, expedites installation and reduces construction site waste.
- Simple and quick to install requiring no priming or fillets.
- Can be applied to permanent formwork - allows maximum use of confined sites
- Self-protecting - can be trafficked immediately after application and ready for immediate placing of reinforcement Membrane is unaffected by wet jobsite conditions - cannot activate prematurely
- Inherently waterproof as supplied. Passive non-reactive waterproofing system does not require water activation Waterproofing is not reliant on confining pressures or hydration
- PREPRUFE® 300R/160R Plus unaffected by freeze/thaw, wet/dry cycling
- Chemical resistance – designed to help protect structure from salt or sulphate attack effective in most types of soils and waters,
- Gas resistance – PREPRUFE® 300R/160R Plus will restrict the ingress of Methane, Radon, Benzene, Toluene, Gasoline & other VOCs Trichloroethylene & Tetrachloroethylene (TCE/PCE) into buildings from landfill and naturally occurring sources and satisfy the performance criteria for a gas-resistant membrane.

System Components:

Membrane

- PREPRUFE® 300R Plus/300R Plus LT— heavy-duty 46mil grade membrane designed for horizontal and vertical use. Designed for use below slabs and on rafts (i.e. mud slabs) and for vertical blind side applications. Designed to accept the placing of heavy reinforcement using conventional concrete spacers.
- PREPRUFE® 160R Plus/160R Plus LT — 32mil grade membrane designed for vertical use in blindside, zero property line applications against soil retention systems.

Ancillary Components (refer to the most current Data Sheets for all system components available on gcpat.com)

- PREPRUFE® Tape – 4 in. wide tape for covering cut edges, roll ends, penetrations and detailing
- PREPRUFE® CJ Tape – 8 in. wide tape for detailing, and may be used at construction joints for optional additional protection
- BITUTHENE® Liquid Membrane - for sealing around penetrations, etc.
- ADCOR® - hydrophilic waterstop for joints in concrete walls and floors
- PREPRUFE® Tieback Covers - preformed cover for soil retention wall tieback heads
- DE NEEF® INJECTO® Tube groutable Waterstop for non-moving concrete construction joints and penetrations

Limitations of Use

- Approved uses only include those uses specifically detailed in this Product Data Sheet and other current Product Data Sheets that can be found at gcpat.com
- PREPRUFE® 300R/160R Plus Membranes are not intended for any other use. Contact GCP Technical Services where any other use is anticipated or intended.
- PREPRUFE® 300R/160R Plus Membranes are designed for in-service temperatures below 120°F(49°C).
- PREPRUFE® 160R Plus/160R Plus LT membrane should not be used in horizontal applications.
- PREPRUFE® 300R/160R Plus Membranes should not be used with conventional two-sided formwork. (See PREPRUFE® Technical Letter # 13 Forming Systems For Use with PREPRUFE® Membranes)

Special Note: When this information is printed from the gcpat.com global website, a footer appearing on this document will restrict its applicability to the United States. Note that the information and references in this document are hereby expanded and apply to North, Central and South America.

Safety and Handling

Users must read and understand the product label and Safety Data Sheets (SDS's) for each system component before use. All users should acquaint themselves with this information prior to working with the material. Carefully read detailed precaution statements on the product labels and SDS's before use. The most current SDS's can be obtained from the GCP web site at gcpat.com.

Storage

- Observe 1 year shelf life and use on a first in first out basis
- Store in dry conditions between 40°F (4.5°C)-90°F (32°C)
- Store off ground under tarps or otherwise protected from rain and ground moisture
- See PREPRUFE® Technical Letter #30 Shelf Life/Storage and Handling of GCP Waterproofing

Installation

Technical Support, Details and Technical Letters

The most up to date detail drawings and technical letters are available at gcpat.com. For complete application instructions, please refer to the current Literature on (www.gcpat.com). Documents in hardcopy as well as information found on websites other than www.gcpat.com may be out of date or in error. Before using this product it is important that information be confirmed by accessing www.gcpat.com and reviewing the most recent product information, including without limitation Product Data Sheets, Technical Bulletins, Detail Drawings and detailing recommendations. Please review all materials prior to installation of PREPRUFE® 300R/160R Plus.

Support is also available by full-time technically trained GCP field sales representatives and technical service personnel, backed by a central research and development technical services staff. For technical assistance with detailing and problem solving please contact your local representative. A GCP Representative locater is available at www.gcpat.com.

Temperature Requirements

- PREPRUFE® 160R Plus LT and PREPRUFE® 300R Plus LT membrane can be applied between temperature 25ºF to 95ºF. Use PREPRUFE® 300R Plus & PREPRUFE® 160R Plus membranes for application above 95ºF.
- PREPRUFE® Tape LT and PREPRUFE® CJ Tape LT can be applied between temperature 25ºF to 95ºF. Use PREPRUFE® Tape HC and PREPRUFE® CJ Tape HC for application above 95ºF.

Substrate Preparation

All surfaces –It is essential to create a sound and solid substrate to eliminate movement during the concrete pour. Substrates must be regular and smooth with no gaps or voids greater than 0.5 in. (12 mm). Grout around all penetrations such as utility conduits, etc. for stability.

Horizontal – The substrate must be free of loose aggregate and sharp protrusions. Avoid curved or rounded substrates. When installing over earth or crushed stone, ensure substrate is well compacted to avoid displacement of substrate due to traffic or concrete pour. The surface does not need to be dry, but standing water must be removed.

Vertical – Use concrete, plywood, insulation or other approved facing over sheet piling to provide support to the membrane. Board systems such as timber lagging must be close butted to provide support and not more than 0.5 in. (12 mm) out of alignment. HYDRODUCT® 220 drainage sheet can be used to bridge voids, gaps and out of alignment up to 2 in. (50mm) prior to PREPRUFE® 300R/160R Plus installation.

Membrane Application

PREPRUFE® 300R/160R Plus has a colored zip strips at the top and bottom of the seam area on the edge of the roll. Both zip strips cover an aggressive adhesive. Once the green zip strip on the top of the membrane and the blue zip strip on the bottom of the membrane are removed, a strong adhesive to adhesive bond is achieved in the overlap area. This PREPRUFE® ZipLap™ provides an enhanced sealing of the overlaps in harsh conditions combined with a fast and easy way of execution without specialized equipment, heat or power.

Horizontal substrates – (PREPRUFE® 300R Plus/ PREPRUFE® 300R Plus LT membrane only) – PREPRUFE® 300R Plus & PREPRUFE® 300R Plus LT membrane can be applied in horizontal applications to smooth prepared concrete, carton forms or well rolled and compacted earth or crushed stone substrate. Kick out or roll out the membrane HDPE film side to the substrate with the green zip strip facing towards the concrete pour. End laps should be staggered to avoid a build-up of layers. Leave green and blue zip strips on the membrane until overlap procedure is completed. When completed remove release liner. When installing over carton forms, contact your local GCP representative.

Accurately position succeeding sheets to overlap the previous sheet 3 in. (75 mm) along the marked selvedge with the blue zip strip on top of the green zip strip. Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap. Peel back and remove both the green and blue zip strips in the overlap area to achieve an adhesive to adhesive bond at the overlap.

Ensure a continuous bond is achieved without creases and roll firmly with a heavy roller.

- PREPRUFE® 300R Plus/300R Plus LT membrane can be returned up the inside face of slab formwork. To attain a fully bonded system and to allow a tie in with BITUTHENE® self-adhered membrane or PROCOR® fluid-applied membrane to all vertical structural surfaces after removal of formwork. Ensure to cut the length of the membrane (terminate) to height of formwork less 2 inches.
- Rebar Chairs: See PREPRUFE® Technical Letter #15 Rebar Chairs on PREPRUFE® Membranes.
- PREPRUFE® 160R Plus & 160R Plus LT membrane may not be used in horizontal applications.

Vertical substrates – PREPRUFE® 300R/160R Plus membranes can be applied vertically to permanent formwork or adjoining structures. Mechanically fasten the membrane vertically using fasteners appropriate for the substrate with the green zip strip facing towards the concrete pour. The membrane may be installed in any convenient length. Fastening can be made through the selvedge within 0.5 in. (50 mm) from the leading edge of the membrane using a small low profile head fastener so that the membrane lays flat and allows firmly rolled overlaps. Accurately position each succeeding sheet to overlap the previous sheet 3 in. (75 mm) along the marked selvedge with the blue zip strip on top of the green zip strip.

Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap. Peel back and remove both the green and blue zip strips in the overlap area to achieve an adhesive to adhesive bond at the overlap. Roll firmly to ensure a watertight seal.

Note that PREPRUFE® 300R/160R Plus membranes should not be used with conventional two-sided formwork. (See PREPRUFE® Technical Letter # 13 Forming Systems For Use with PREPRUFE® Membranes)

Roll ends and cut edges – Overlap all roll ends and cut edges by a minimum 3 in. (75 mm) and ensure the area is clean and free from contamination, wiping with a damp cloth if necessary. Allow surface to dry and apply PREPRUFE® Tape centered over the lap edges and roll firmly. Immediately remove tinted plastic release liner from the tape.

Membrane Repair

Inspect the membrane before installation of reinforcement steel, formwork and final placement of concrete. The membrane can be easily cleaned by power washing if required. Repair damage by wiping the area with a damp cloth to ensure the area is clean and free from dust, and other contaminants and allow the membrane to dry. Repair small punctures and slices 0.5 in. (12 mm) or less by applying PREPRUFE® Tape centered over the damaged area. Repair punctures and holes larger than 0.5 in. (12mm) by applying a patch of PREPRUFE® Membrane. Extend the patch 6 in. (150 mm) beyond the damaged area. Seal all edges of the patch with PREPRUFE® Tape. Where exposed selvedge has lost adhesion or laps have not been sealed, ensure the area is clean and dry and cover with fresh PREPRUFE® Tape. Any areas of damaged adhesive should be covered with PREPRUFE® Tape. All PREPRUFE® Tape must be rolled firmly and the tinted release liner removed.

Slices or relief cuts can be butted or overlapped and repaired by applying PREPRUFE® Tape centered over the edge of the overlap or center of the butt joint. Where it is not possible to create a butt joint or overlap, repair with fresh membrane and PREPRUFE® Tape as detailed above.

Pouring of Concrete

Ensure the plastic release liner is removed from all PREPRUFE® Tapes.

Under most climatic conditions concrete should be poured within 56 days of membrane installation. Where ambient temperatures will exceed 100ºF (38°C) for more than a total of 7 days, concrete should be placed within 42 days of installation of the membrane. Concrete must be placed and compacted carefully to avoid damage to the membrane. Never use a sharp object to consolidate the concrete.

Removal of Formwork

A minimum concrete compressive strength of 3000 psi (20 N/mm^2) is required prior to stripping formwork supporting PREPRUFE® 300R/160R Plus Membranes. Premature stripping may result in displacement of the membrane and/or spalling of the concrete. (see PREPRUFE® Technical Letter #17 Removal of Formwork Placed against PREPRUFE® 300R/160R Plus Membranes).

After removal of the formwork and prior to backfilling, all exposed PREPRUFE® 300R/160R Plus Membrane must be protected from damage with an approved protective course.

Supply

Dimensions (Nominal)	PREPRUFE® 300R Plus PREPRUFE® 300R Plus LT	PREPRUFE® 160R Plus PREPRUFE® 160R Plus LT
Roll size Note#1	3 ft. 10 in. X 102 ft. (392 ft^2) 1.17m x 31.15m (36.4 m^2)	3 ft. 10 in. X 120 ft. (460 ft^2) 1.17m x 36.6m (42.8 m^2)
Roll weight	108 lbs (49 kg)	92 lbs (42 kg)
Minimum side/end laps	3 in. (75 mm)	3 in. (75 mm)
Note: when calculating coverage account for the Minimum side/end laps Note#1 Individual roll length may vary +/-1%		

Physical Properties

Property	PREPRUFE® 300R Plus & PREPRUFE® 300R Plus LT	PREPRUFE® 160R Plus & PREPRUFE® 160R Plus LT	Test Method
Color	white	white	
Thickness	0.046 in. (1.2 mm)	0.032 in. (0.8 mm)	ASTM D3767
Lateral Water Migration Resistance	Pass at 231 ft (71 m) of hydrostatic head pressure	Pass at 231 ft (71 m) of hydrostatic head pressure	ASTM D5385[1]
Low temperature flexibility	Unaffected at -20°F (-29°C)	Unaffected at -20°F (-29°C)	ASTM D1970
Resistance to hydrostatic head	231 ft (71 m)	231 ft (71 m)	ASTM D5385[2]
Elongation	400%	400%	ASTM D412[3]
Tensile strength, film	4000 psi (27.6 Mpa)	4000 psi (27.6 Mpa)	ASTM D412
Crack cycling at -9.4°F (-23°C), 100 cycles	Unaffected, Pass	Unaffected, Pass	ASTM C836[4]

Puncture resistance	200 lbs (890 N)	100 lbs (445 N)	ASTM E154
Peel adhesion to concrete	5 lbs/in. (880 N/m)	5 lbs/in. (880 N/m)	ASTM D903[5]
Lap peel adhesion	8 lbs/in. (1408 N/m)	8 lbs/in. (1408 N/m)	ASTM D1876[6]
Permeance to water vapor transmission	<0.01 perms (0.6 ng/(Pa x s x m^2))	<0.01 perms (0.6 ng/(Pa x s x m^2))	ASTM E96, method B
VOC permeance	Not Detectable Membrane, Seam	Not Detectable Membrane, Seam	ASTM F 739 Open loop
Methane permeance	<40 ml/day.m^2.atm	-	ASTM D 1434
Radon diffusion coefficient , m^2/s	3.7 X 10-12 Membrane, Seam	5.3 X 10^{-12} Membrane, Seam	Method C of ISO/TS11665-1

Footnotes:

1. Lateral water migration resistance is tested by casting concrete against membrane with a hole and subjecting the membrane to hydrostatic head pressure with water. The test measures the resistance of lateral water migration between the concrete and the membrane.
2. Hydrostatic head tests of PREPRUFE® Membranes are performed by casting concrete against the membrane with a lap. Before the concrete cures, a 0.125 in. (3 mm) spacer is inserted perpendicular to the membrane to create a gap. The cured block is placed in a chamber where water is introduced to the membrane surface up to the head indicated.
3. Elongation of membrane is run at a rate of 2 in. (50 mm) per minute.
4. Concrete is cast against the PREPRUFE® Membrane and allowed to cure (7 days minimum).
5. Concrete is cast against the protective coating surface of the membrane and allowed to properly dry (7 days minimum). Peel adhesion of membrane to concrete is measured at a rate of 2 in. (50 mm) per minute at room temperature.
6. The test is conducted 15 minutes after the lap is formed and run at a rate of 2 in. (50 mm) per minute at 72°F (22°C).

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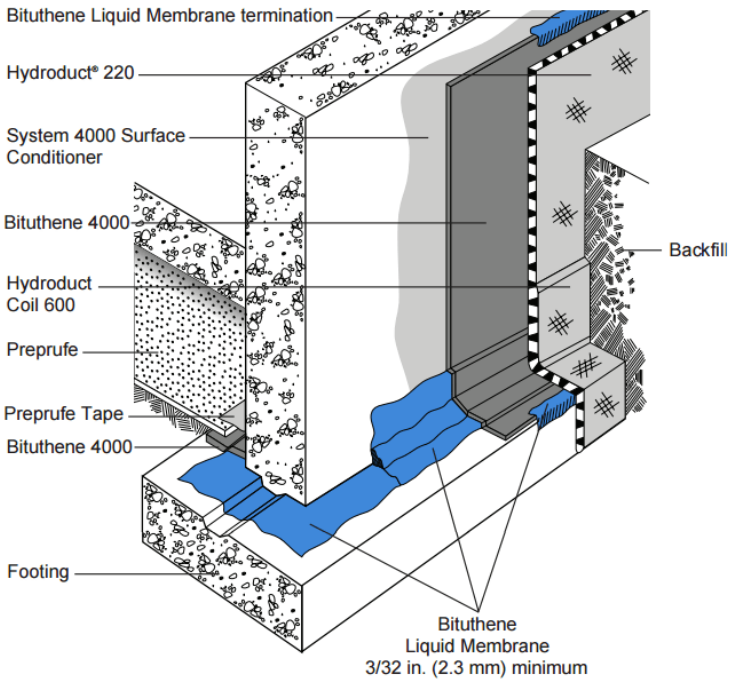
gcpat.com/solutions/products/preprufe-comprehensive-waterproofing-system/preprufe-300r160r-plus-preprufe

BITUTHENE® Liquid Membrane Data Sheet

Two component, elastomeric, liquid applied detailing compound for use with GCP waterproofing membranes

Product Description

BITUTHENE® Liquid Membrane is a two component, elastomeric, cold applied, trowel grade material designed for a variety of uses with the GCP waterproofing systems. The VOC (Volatile Organic Compound) content is 10 g/L. Architectural and industrial maintenance regulations limit the VOC content in products classified as architectural coatings. Refer to Technical Letters for the most current list of allowable limits.



Product Advantages

- Liquid applied
- Waterproof
- Tough, rubber-like
- Chemically cured
- Cold applied
- System compatible

Use

BITUTHENE® Liquid Membrane is ideally suited for the following uses:

- Fillet material at inside corners
- Reinforcement material at inside corners
- Flashing material around drains, protrusions, curbs and parapets
- Sealing material at terminations
- Repair material for defects on concrete surfaces
- Flashing material at corners

The two parts of BITUTHENE® Liquid Membrane are mixed on site and troweled on to provide a simple and quick waterproofing detailing aid in conjunction with BITUTHENE®, PREPRUFE® and PROCOR® systems.

Compatibility

BITUTHENE® Liquid Membrane is completely compatible with BITUTHENE®, PREPRUFE® and PROCOR®, and with existing asphalt or coal tar-based waterproofing materials. It is also compatible with cured silicone and polyurethane sealants. It is not compatible with creosote, pentachlorophenol, linseed oil or polysulfide-based sealants.

Supply

BITUTHENE® Liquid Membrane (Parts A & B)		
Unit size	1.5 gal (5.7 L)	4 gal (15.1 L)
Net weight per unit	16 lbs (8 kg)	44 lbs (20 kg)
Units per pallet	100	24

Physical Properties

PROPERTY	TYPICAL VALUE	TEST METHOD
Part A Color	Black	
Part B Color	Clear	
Mixture of Parts A and B Color	Black	
Solids content	100%	ASTM D1644
Elongation	250% minimum	ASTM D412
Peel strength	5 lbs/in. (880 N/m) minimum	ASTM D903
Flexibility, 180° bend over 1 in. (25 mm) mandrel at -25°F (-32°C)	Unaffected	ASTM D1970

Application Procedures

Safety, Storage and Handling Information

BITUTHENE® products must be handled properly. Vapors from solvent based primers and mastic are harmful and flammable. For these products, the best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered. Safety Data Sheets (SDS) are available on the web site and users should acquaint themselves with this information. Carefully read detailed precaution statements on product labels and the SDS before use.

Surface Preparation

All surfaces must be dry and free from dirt, grease, oil, dust or other contaminants. BITUTHENE® Liquid Membrane may be applied at temperatures of 25°F (-4°C) or above. Store in a dry place above 40°F.

Mixing

Add the entire contents of the Part B container to Part A and mix for 3 to 5 minutes until uniform. Part A is black and Part B is clear. Take care to scrape material from the side and bottom of the containers to ensure thorough mixing. A low speed (150 rpm) mechanical mixer with flat paddle blades is required. Do not apply any material if streaks can be seen due to insufficient mixing. Once mixed, BITUTHENE® Liquid Membrane must be applied by trowel within 1.5 hours. More time is available at lower temperatures.

At high temperatures, thickening and curing will be faster. Material that has thickened must be discarded. The material will cure to a very flexible rubber-like material.

BITUTHENE® Liquid Membrane must be applied at a minimum thickness of 3⁄16 in. (2.3 mm) unless otherwise noted on details. 32 In fillet applications, the face of the fillet should be a minimum of ¾ in. (20 mm). In corner flashing application details, it should extend 6 in. (150 mm) in each direction from the corner. BITUTHENE® Liquid Membrane will adhere to primed or unprimed concrete.

BITUTHENE® Liquid Membrane should be allowed to cure at least 24 hours before flood testing.

Coverage

As a fillet material, 1 gal (3.8 L) will cover approximately 100 linear feet (30 m). As a flashing material, 1 gal (3.8 L) will cover approximately 17 f^2 (1.6 m^2). As a fillet and reinforcement, 1 gal (3.8 L) will cover approximately 14 linear feet (4.3 m).

Cleaning

Clean tools and equipment with mineral spirits before BITUTHENE® Liquid Membrane has cured. Mineral spirits is a combustible liquid and should be used only in accordance with the manufacturer's safety recommendations. Do not use solvents to clean hands or skin.

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