SDA
NJ SCHOOLS DEVELOPMENT AUTHORITY

Bovis
Lend Lease

Addendum No. 1

DATE: August 6, 2009

PROJECT #: Marshall Street Elementary School
Paterson, NJ
SDA Contract #PA-0006-C03

The following revisions to the Bid Documents by Addendum #1 are:

A. Changes to General Conditions:

Section 2.6 (Plans and Specifications) shall be amended to ADD Section 2.6.3 as follows:

Notwithstanding anything to the contrary in the documents forming the bid package for this Project, any references, whether they be in the Technical Specifications or the General Conditions or any other aspect of the front end specifications, that in any way, directly or indirectly, refer to the environmental remediation work that is the subject of separate specifications issued by Maser Consulting (Addendum No. 1), which is a separate professional directly retained by NJSDA, is hereby deleted from the contract documents to the extent, if any, it pertains to said environmental remediation work that will be the subject of the Maser Consulting Specifications contained in this Addendum No. 1.

Section 13.2 (Schedule of Values) shall be amended to ADD Section 13.2.3 as follows:

13.2.3 When submitting a Schedule of Values for approval, the Contractor must delineate as a completely separate line item any and all Work which pertains to the environmental remediation work designed by Maser Consulting, P.A. as per Addendum No. 1.

B. Changes to Specifications

1. **ADD: Petroleum Impacted Soil Remediation Specifications by Maser Consulting dated July 2009 consisting of the following:**

Section 01000	Project Description Summary
Section 02250	Excavation, Removal & Handling of Petroleum Impacted Materials
Section 02260	Waste Disposal Requirements
Attachment #1	NJDEP RAWP Approval Letter (Feb. 5, 2009)

2. **ADD: Passive Remedial System Specifications by Maser Consulting dated July 2009**

3. **DELETE: Section 07260 Under Slab Vapor Barrier**

4. **DELETE: Radon Piping System shown on the Plumbing Drawings.**

C. **Changes to the Bid Advertisement:**

1. **Project Rating Proposal submission date changed from 5:00 pm, August 6th, 2009 to 5:00 pm, August 13, 2009.**

2. **Latest date for Request for Information (RFI) from bidders changed from 11:00 am, August 17, 2009 to 11:00 am, August 25, 2009.**

3. **The Bid Due date changed from 2:00 pm, September 3, 2009 to 2:00 pm, September 10, 2009.**

This addendum shall be considered part of the Bid Documents issued in connection with the referenced project. Should information conflict with the Bid Documents, this Addendum shall supersede the relevant information in the Bid Documents.

End of Addendum No. 1

Jack Coco 8/6/09

NJ Schools Development Authority 8/6/09
Jack Coco, Project Manager

MASER CONSULTING P.A.
Consulting, Municipal & Environmental Engineers
Planners ▪ Surveyors ▪ Landscape Architects

331 Newman Springs Road
Suite 203
Red Bank, NJ 07701
Tel: 732.383.1950 ▪ Fax: 732.383.1984

PETROLEUM IMPACTED SOIL REMEDIATION SPECIFICATIONS

FOR

MARSHALL STREET ELEMENTARY SCHOOL

FOR THE

NEW JERSEY SCHOOLS DEVELOPMENT AUTHORITY

AND

DESIGN IDEAS GROUP architecture + planning, llc

PREPARED BY:

MASER CONSULTING P.A.
331 Newman Springs Road
Suite 203
Red Bank, NJ 07701

July 24, 2009

MC PROJECT NO. 05001084A

TABLE OF CONTENTS

PETROLEUM IMPACTED SOIL REMEDIATION

SECTION 01000 - PROJECT DESCRIPTION SUMMARY

1.0 SCOPE

The specifications referred to herein are for the remediation of petroleum impacted soil at the proposed new Marshall Street Elementary School on Marshall Street in the City of Paterson, Passaic County, New Jersey. These specifications are technical descriptions and requirements for the soil remediation related work. They shall be used in conjunction with the site plan drawings prepared by Maser Consulting P.A. (Maser) and with the plans and specifications prepared by the Project Architect, Design Ideas Group architecture + planning, llc. All contractual and payment information is contained in the Design Ideas Group architecture + planning, llc. Specifications, and the conditions and requirements of the Design Ideas Group architecture + planning, llc. Specifications shall apply to the soil remediation work.

2.0 DRAWINGS

R-2 PROPOSED AREAS OF SOIL REMEDIATION - Prepared by Maser Consulting dated May 15, 2009.

3.0 PROJECT DESCRIPTION

The contractor shall furnish all labor, materials, tools, equipment and other appurtenances necessary to properly perform all work listed in the specifications contained herein and shown on the contract drawings described above.

The portion of the site were the petroleum impacted site is located was formerly utilized by Superior Automotive. Several gasoline and heating oil underground storage tanks (USTs) were previously removed in 1989. Groundwater in this area of the site is impacted by gasoline related compounds (benzene, toluene, ethylbenzene, and xylene), which can be attributed to residual petroleum impacts remaining in soil near the former USTs. Remedial activities for this project comprise the excavation and off-site disposal of petroleum impacted soil and site restoration activities. The selected contractor is expected to mobilize equipment to the Site, excavate the petroleum impacted soil, load and transport soil to a disposal facility licensed to handle such waste and backfill the excavation once confirmatory post-excavation sample analyses have been received and approved by the Engineer (Maser). Soil excavation will be continue into decomposed bedrock until competent bedrock is encountered or until confirmation soil samples indicate no further need for excavation. The Engineer will be responsible for observing excavation activities, collecting and laboratory analysis of the post-excavation soil samples, with the aid of the Contractor, from the base and sidewalls of the excavation. The Contractor shall expect a lag time of approximately two (2) weeks between the time of post-excavation sample collection and the receipt of laboratory results, and is encouraged to plan accordingly while generating the bid costs.

An area of surface soils impacted by benzo(a)pyrene, benzo(b)flourenthene, and chlordane above the New Jersey Department of Environmental Protection's (NJDEP) residential soil cleanup criteria is present at the site and will be capped with a minimum of 2 feet of certified clean fill material. The proposed area to be deed noticed is shown on Drawing R-2. Fill material used to bring the area up to proposed grade will be used as the cap. Fill material used in this area must be certified clean fill from an approved source. No imported fill or topsoil shall be delivered to the site until all required certifications have been approved by the Engineer (Maser).

The proposed remedial actions are detailed in a Remedial Action Workplan (RAW), dated April 30, 2007, which was prepared by Maser. The RAW was approved in a NJDEP in a correspondence dated February 5, 2009 (See Attachment #1). The RAW and is available for review upon request at the New Jersey Schools Development Authorities Newark Regional Office.

SECTION 02250 – EXCAVATION, REMOVAL & HANDLING OF PETROLEUM IMPACTED MATERIALS

1.0 GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Site Construction Specification Sections, apply to this Section.

1.2 Summary

A. This Section includes the following:

1. The excavation and removal of petroleum impacted soils in conjunction with soil remediation.

B. Related Sections include the following:

1. Section 02260 "Waste Disposal Requirements" for disposal of petroleum impacted soils in connection with remedial activities.

2. Section 01010 "Summary of Work".

1.3 Measurement and Payment

A. The base bid includes the excavation, disposal and backfilling of 1,200 tons of material. The unit prices established in the Price Proposal will be used to calculate a credit or addition based on the actual amount of material excavated and backfilled.

1.4 Submittals

A. Bills of lading shall be provided to the Engineer (Maser) to document the source(s) of all imported fill and topsoil.

B. Submit name of imported materials suppliers. Provide materials from same source throughout the work. Change of source requires approval.

2.0 EXECUTION

2.1 General

A. The contractor is responsible for preparing a Health and Safety Plan (HASP) for the soil remediation work. The Contractor shall supply proof that all of the contractor's personnel on the job relating to soil remediation are properly trained as required by OSHA regulations, 29 CFR 1910 and 29 CFR 1926.

B. The Contractor shall comply with New Jersey Department of Environmental Protection (NJDEP) Guidance Document for the Remediation of Contaminated Soil (1998). Excavation of petroleum impacted soils will be under the observation of the Engineer.

C. The Contractor shall be solely responsible for means, methods, techniques, sequences and safety precautions associated with the actual excavating operations. This includes, but is not limited to, maintaining the appropriate slopes on the sides of the excavation and safety protection around the open excavation in accordance with OSHA requirements. Provide all necessary protection to insure that daily vehicle operation and/or pedestrian traffic will be protected from open trenches and work being performed.

D. It is anticipated that excavation of overburden soil and decomposed bedrock will be required.

E. Stockpile petroleum impacted soil in locations as directed by Engineer (Maser). Excavated soils shall be placed on and covered with plastic sheeting until removed from the site.

F. The Contractor shall provide for waste classification laboratory analyses for the known contaminated material and any suspected contaminated material generated from the excavation. These analyses shall be conducted by an NJDEP-certified laboratory. All analyses shall be in accordance with NJDEP regulations. Following receipt of waste classification analytical results and approval of disposal facility, Contractor shall provide for the loading, transportation and disposal of all contaminated materials.

G. Post-excavation soil sample collection and laboratory analysis (to be performed by the Engineer (Maser)) shall proceed immediately upon removal of petroleum impacted soil. The contractor will assist the Engineer (Maser) with post-excavation soil sampling.

H. The Contractor will need to continuously coordinate its actions with those of the Engineer (Maser) to facilitate a smooth and orderly progression of the remediation activities.

I. Remove and dispose of all vapor, products, sludge, liquids, and soil in accordance with all Federal, State, and Local Statues.

J. Upon direction form the Engineer (Maser), the Contractor shall backfill the remedial excavation with NJSDA Certified Clean Fill.

K. NJSDA Certified Clean Fill: Certified clean fill for the purposes of remediation shall represent, uncontaminated, non-water soluble, non-decomposable, inert solids, such as quarry process rock, soil, sand or gravel from a certified virgin source. Based on visual inspection, imported certified clean fill shall not contain free liquids, extraneous debris, or solid waste. Documentation of certified clean fill shall be in the form of a written certification provided by the supplier of the fill material that to the best of the affiant's knowledge and belief the fill material being imported does not contain constituents of concern in excess of a New Jersey Soil Cleanup Criteria, and that the recycled material originates from a natural environment without degradation caused by human influences. Upon approval by Design Consultant, certified clean fill originating from an NJDEP-regulated Class B Recycler may be considered acceptable for use upon receipt of appropriate analytical testing that demonstrates the imported fill does not contain constituents of concern in excess of the current NJDEP Residential Direct Contact Soil Cleanup Criteria.

L. The certification for clean fill originating from an NJDEP-regulated Class B Recycler must be free of any constituents of concern in excess of New Jersey Residential Direct Contact Soil Cleanup Criteria. In addition to the required written certification, recycled materials proposed for use as certified clean fill shall also be analyzed for Total Petroleum Hydrocarbons ("TPH"), TAL Metals, TCL VOCs, TCL SVOCs, Pesticides/Herbicides, and PCBs. at a minimum frequency of one composite sample per 1,000 CY of material per each different source for the first 5,000 CY and one composite sample for each additional 5,000 CY. All environmental analyses shall be conducted by an NJDEP-certified laboratory. All costs are to be borne by the Contractor.

M. If virgin material is used, the Contractor shall provide written certification from the generator, documenting that the imported clean fill represents a virgin material from a commercial or non-commercial source, and that the fill originates from a natural environment without degradation caused by human influences.

N. No imported fill or topsoil shall be delivered to the site until all required certifications have been provided and the material has been approved by the Engineer (Maser).

2.2 Examination

A. Examine areas and conditions for compliance with requirements for, removal of petroleum impacted material and conditions affecting performance of work.

2.3 Field Quality Control and Scheduling

A. The contractor shall notify the Construction Manager a minimum of one week prior to initiating removal activities.

B. Contractor shall call the New Jersey One-Call (1-800-272-1000) to obtain utility mark-outs prior to excavation.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of *replaced* or additional work with specified requirements.

SECTION 02260 - WASTE DISPOSAL REQUIREMENTS

1.01 GENERAL

1.01 Description

A. This section specifies the requirements for disposal of uncontaminated wastes and hazardous and non-hazardous contaminated wastes generated during the soil remediation. This includes disposal of petroleum impacted soil, historic fill and construction wastes, etc.

1.02 Applicable Codes and Standards

A. USEPA, 40 CFR, Part 261, Identification and Listing of Hazardous Waste, latest edition.

B. N.J.A.C. 7:26-1, 2,3,4,7-13A, 16, 16A, 17 Hazardous Waste Regulations, latest edition.

2.0 PRODUCTS

2.01 Materials/Equipment

A. The Contractor shall use watertight waste containers, dump and tank trucks conforming to applicable New Jersey Department of Transportation (DOT) Regulations.

B. The Contractor shall be responsible for labeling hazardous and non-hazardous materials containers with labels conforming to Federal, State and local regulations.

3.0 EXECUTION

3.01 General Requirements

A. The Contractor shall be responsible for locating appropriate disposal facilities for all wastes generated during the entire course of the Contract. Such wastes may include, but are not limited to, uncontaminated debris and site demolition materials, non-hazardous solid wastes, and hazardous solid wastes.

1. The Contractor shall provide the Owner with the names and locations of all proposed disposal facilities prior to transportation of any waste materials from the site. All proposed disposal facilities must be approved by the Owner.

B. The Contractor shall be responsible for coordinating the safe legal transportation and off-site disposal of all waste material and any encountered groundwater generated during the entire course of the Contract. Transportation and disposal of waste materials shall be in accordance with all applicable Federal, State and local codes and regulations.

1. The Contractor shall provide the Owner with the names and DEP license of all proposed transporters prior to the removal of any waste materials from the site. All proposed transporters must be approved by the Owner.

C. The Contractor shall ensure that off-site tracking of mud and soil is minimized in accordance with the requirements of the soil erosion plan.

If, in the Owner's opinion, the paved surfaces of the site and/or adjacent streets are affected by the transportation of materials from the loading area, the Contractor shall supply mechanized road cleaning equipment to clean the paved surfaces at no additional cost. Any wash water generated will be disposed of in accordance with the Owner's instructions at no additional cost.

3.02 Waste Characterization

A. The Contractor shall coordinate and pay for all necessary sampling and analyses of stockpiled soils to be disposed of off-site in order to properly characterize them as either non-hazardous or hazardous, thereby ensuring the application of appropriate handling, transportation and disposal methods.

1. The Contractor shall provide the Owner with copies of the waste characterization analytical results a minimum of 5 working days prior to transportation of any waste materials from the site.

B. The Contractor shall coordinate and pay for all necessary sampling and analyses of wastewater generated during the entire Contract to properly characterize it and ensure appropriate handling, transportation and disposal methods. Such wastewater includes, but is not limited to water generated during decontamination operations.

3.03 Disposal of Non-Hazardous Site Demolition Materials

A. All debris, rubbish and other materials resulting from remediation and/or construction operations shall be safely and legally removed from the site and disposed of in accordance with applicable Federal, State and local codes and regulations. Burning of any debris or rubbish on-site shall not be permitted.

B. All tractors and all trailers proposed to haul must be properly licensed by the NJDEP and display the appropriate sticker. No vehicle lacking registration will be loaded.

C. The Contractor shall provide, to the CM and Engineer (Maser), daily disposal receipts showing the location and amount disposed, name and signature of truck driver and authorized recipient at disposal site.

D. No vehicle transporting waste materials will be permitted to leave the site until it is logged out by the Owner's Representative.

3.04 Disposal of Contaminated Wastes

A. The Contractor shall be responsible for the proper handling and transportation of all non-hazardous and hazardous contaminated wastes. Transport of contaminated solid and/or liquid wastes shall be in accordance with all applicable Federal, State (including NJDEP and NJDOT) and local codes and regulations.

1. The Contractor shall prepare all necessary manifests for transportation and disposal of the waste materials.

2. All vehicles and containers used to transport contaminated waste materials must be appropriately labeled.

B. No vehicle transporting contaminated waste materials will be permitted to leave the site until it is logged out by the Owner's Representative.

C. All trucks used to transport contaminated waste materials must be of watertight body construction and be lined with plastic. The trucks must be securely covered with plastic and tarps prior to exiting the site.

D. In the event of an accident or spill during transportation, the Contractor shall immediately notify the Owner. All spilled material shall be removed by the Contractor and property damage restored, all at the Contractor's expense.

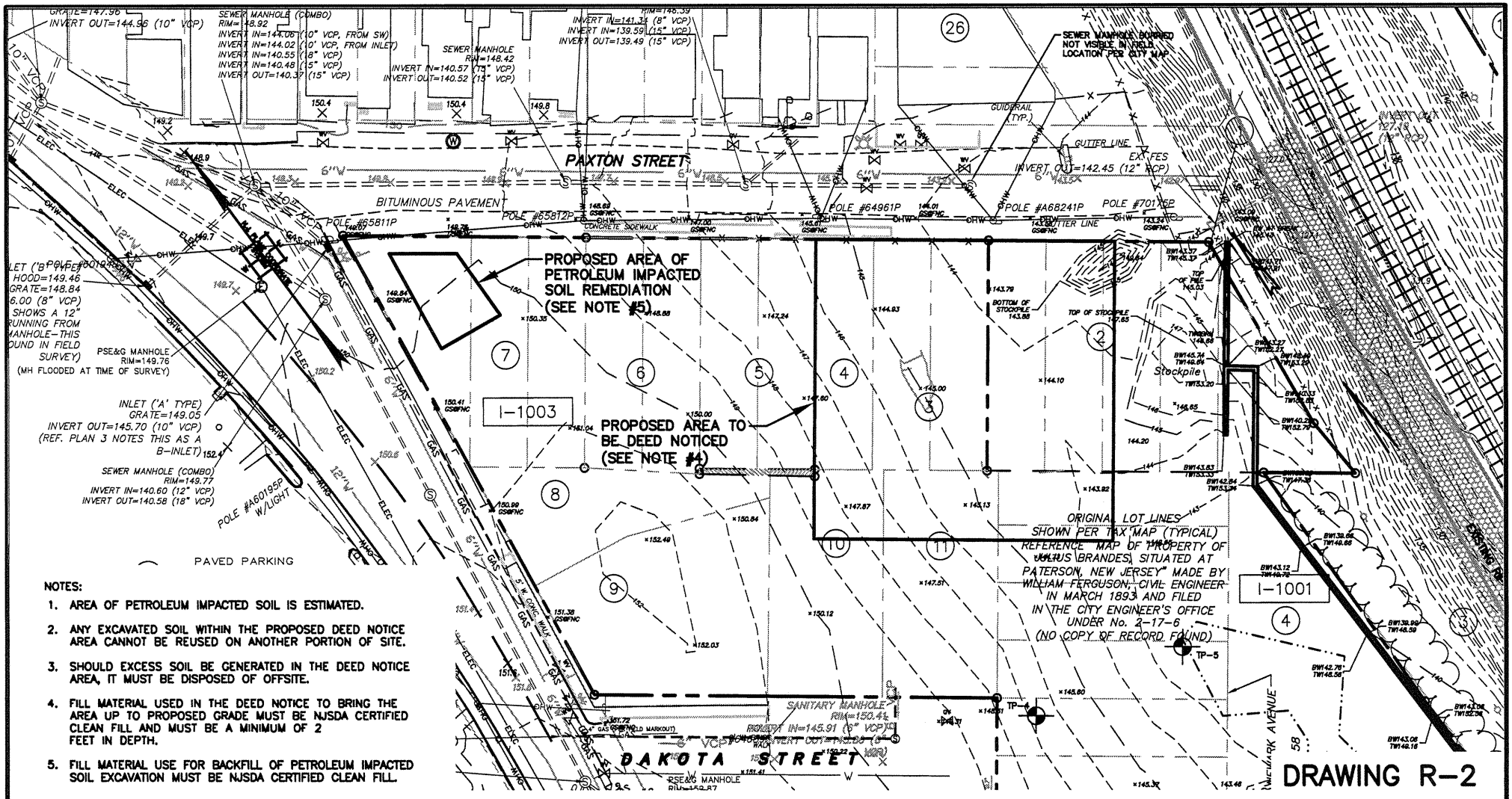
E. Bills of Lading and Waste Manifests.

1. Upon the removal of non-hazardous and hazardous wastes from the work site, the Contractor shall submit bills of lading to the Owner's Representative on a daily basis, a copy of which is to be included as part of the "Close Out" documentation. Such bills of lading shall contain:

Contractor's Name

Contractor's Address
Permit Number
Quantity of Waste Removed
Location, Name, and EPA ID Number of Waste Generator Facility
Name of Disposal Facility and its EPA ID Number
Disposal Facility Address
Date Removed from Work Site
Signature of Driver
Signature Receipt by Disposal Facility

2. The Contractor shall be responsible for the completion of all required hazardous waste manifest forms for hazardous materials regardless of material classification. Once completed and verified, the forms will be signed by the Owner. A copy of the forms shall be submitted to the Owner after they are signed by the disposal site. All truck weights must be indicated on the forms. Upon disposal at the approved facility, a certificate of disposal shall be issued to the Owner. The certificate of disposal shall include: A reference to the manifest number for each shipment; the name address and EPA ID Number of each facility at which the hazardous wastes were ultimately treated or destroyed; and the address and EPA ID Number of the generator facility.



NOTES:

1. AREA OF PETROLEUM IMPACTED SOIL IS ESTIMATED.
2. ANY EXCAVATED SOIL WITHIN THE PROPOSED DEED NOTICE AREA CANNOT BE REUSED ON ANOTHER PORTION OF SITE.
3. SHOULD EXCESS SOIL BE GENERATED IN THE DEED NOTICE AREA, IT MUST BE DISPOSED OF OFFSITE.
4. FILL MATERIAL USED IN THE DEED NOTICE TO BRING THE AREA UP TO PROPOSED GRADE MUST BE NJSDA CERTIFIED CLEAN FILL AND MUST BE A MINIMUM OF 2 FEET IN DEPTH.
5. FILL MATERIAL USE FOR BACKFILL OF PETROLEUM IMPACTED SOIL EXCAVATION MUST BE NJSDA CERTIFIED CLEAN FILL.

MASER CONSULTING P.A.
Consulting, Municipal & Environmental Engineers
Planners ▪ Surveyors ▪ Landscape Architects
State of N.J. Certificate of Authorization: 24GA27986500

CLINTON OFFICE
Perryville III Corporate Park
53 Frontage Road, Suite 120
P.O. Box 4017, Clinton, NJ 08809
Phone (908) 238-0900
Fax (908) 238-0901
E-mail - solutions@maserconsulting.com

Regional Offices
Red Bank, N.J.
Hamilton, N.J.
Logan, N.J.
Marmora, N.J.
Mt. Arlington, N.J.
Newburgh, N.Y.
West Nyack, N.Y.
Bethlehem, PA.

PROPOSED MARSHALL ELEMENTARY SCHOOL

PROPOSED AREAS OF SOIL REMEDIATION

FOR

NEW JERSEY SCHOOLS DEVELOPMENT AUTHORITY
BLOCK 11000 LOT 5, BLOCK 11001 LOT 4 AND BLOCK 11003 LOTS 1 THRU 11

CITY OF PATERSON PASSAIC COUNTY NEW JERSEY

JOB NUMBER: 05001084B	DATE: 05/15/09
SCALE: 1" = 40'	LATEST REVISION:
INDEX NUMBER: CL006522	DESIGN BY: K.M.
SHEET NUMBER: 1 of 1	

ATTACHMENT #1

State of New Jersey

Jon S. Corzine
Governor

Department of Environmental Protection

Mark N. Mauriello
Acting Commissioner

Bureau of Case Management
401 East State Street
P.O. Box 028
Trenton, NJ 08625-0028
Phone #: 609-633-1455
Fax #: 609-633-1439

New Jersey Schools Development Authority
1 West State Street
P.O. Box 991
Trenton, New Jersey 08625

February 5, 2009

Approval

Re: Paterson City Board of Education
Proposed Marshall Street Elementary School
2731 Hazel St
Paterson City, Passaic County
Block: I1003, Lots: 1-11
Block I1001, Lot 4
Block I1000, Lot 5
SRP PI# 240948
Activity Number Reference: RPC040001
Case Name/Number: Paterson BOE Marshall School

Dear Mr. Ronald Carper:

The New Jersey Department of Environmental Protection (Department) has completed review of the Remedial Action Work Plan received on April 30, 2007. The Department has determined that the Remedial Action Work Plan is in compliance with the Technical Requirements for Site Remediation, N.J.A.C. 7:26E and other applicable requirements. The Department hereby approves the Remedial Action Work Plan, effective the date of this letter.

The NJDEP recommends that the NJSCC retain the services of an environmental consultant during construction. This would be very beneficial during the ground intrusive activities/site development phase of the project. By retaining an environmental consultant during this phase of the project if unforeseen issues are discovered (i.e. UST, stained soil, etc.) they may be addressed in an expeditious manner. This requirement

should be incorporated into the technical specifications for demolition and site preparation work.

In accordance with the recently adopted amendments to the Technical Requirements for Site Remediation (N.J.A.C. 7:26E) the person responsible for conducting the remediation of a contaminated site shall perform public notification and outreach beginning at the onset of the remedial investigation phase. Amendments to N.J.A.C. 7:26E - 1.4 and 1.11 are published in the September 2, 2008 New Jersey Register.

Pursuant to the schedule applicable to the site you shall submit a Remedial Action Report within six (6) months from the date of this letter. Please submit the document by that date, or submit a written request for an extension at least 2 weeks prior to the due date. Failure to submit the Remedial Action Report in accordance with the schedule may result in the initiation of enforcement action. For your convenience, the regulations concerning the Department's remediation requirements can be found at http://www.state.nj.us/dep/srp/regs/.

If you require copies of Department Guidance Documents or applications, many of these are available on the Internet http://www.state.nj.us/dep/srp. If you have any questions regarding this matter contact me at (609) 633-2466 prior to the date indicated.

Sincerely,

Bob Simpson
Bureau of Case Management

cc: Brenda Zema, Paterson City School District
Clerk, Paterson City
Paterson Health Officer
Kurt Martin, Maser Consulting, PA

MASER CONSULTING P.A.
Consulting, Municipal & Environmental Engineers
Planners ▪ Surveyors ▪ Landscape Architects

331 Newman Springs Road
Suite 203
Red Bank, NJ 07701
Tel: 732.383.1950 ▪ Fax: 732.383.1984

PASSIVE REMEDIAL SYSTEM SPECIFICATIONS

FOR

MARSHALL STREET ELEMENTARY SCHOOL

FOR THE

NEW JERSEY SCHOOLS DEVELOPMENT AUTHORITY

AND

DESIGN IDEAS GROUP architecture + planning, llc

PREPARED BY:

WHITMAN
116 Tices Lane
Unit B-1
East Brunswick, NJ 08816

FOR

MASER CONSULTING P.A.
331 Newman Springs Road
Suite 203
Red Bank, NJ 07701

July 24, 2009

MC PROJECT NO. 05001084A

PASSIVE REMEDIAL SYSTEM SPECIFICATIONS
FOR
MASHALL STREET SCHOOL
CITY OF PATERSON
PASSAIC COUNTY, NEW JERSEY

Table of Contents

Figures

1. R-1: Sub-Slab Gas Collection System

Attachments

1. Liquid Boot®-Brownfield Membrane/Liner Section 2, Version 4.0 & Standard Details:

   Cut Sheet – Gas Vapor Barrier Zero Lot Line with Lagging (G1.1)
   Cut Sheet – Gas Vapor Barrier Membrane Lap Joints on Solid Substrate (G1.2)
   Cut Sheet – Gas Vapor Barrier Membrane Lap Joints on Geotextile (G1.3)
   Cut Sheet – Gas Vapor Barrier Under Slab & Walls (G2.1)
   Cut Sheet – Gas Vapor Barrier Under Slab & Walls (G2.2)
   Cut Sheet – Gas Vapor Barrier Footings & Grade Beams (G2.3)
   Cut Sheet – Gas Vapor Barrier on Mudslabs (G2.4)
   Cut Sheet – Gas Vapor Barrier Membrane Lap Joints on Solid Substrate (G2.5)
   Cut Sheet – Gas Vapor Barrier Membrane Lap Joints on Geotextile (G2.6)
   Cut Sheet – Gas Vapor Barrier Membrane Pile Cap (G2.7)
   Cut Sheet – Gas Vapor Barrier Over Footings and Grade Beams (G2.8)
   Cut Sheet – Gas Vapor Barrier Between Slab & Concrete Cold Joints (G3.1)
   Cut Sheet – Gas Vapor Barrier Between Slab & Lap Joints on Solid Substrate (G3.2)
   Cut Sheet – Gas Vapor Barrier Between Slab & Lap Joints on Geotextile (G3.3)
   Cut Sheet – Gas Vapor Barrier Penetrations with Solid Substrate (G4.1)
   Cut Sheet – Gas Vapor Barrier Penetrations with Solid Substrate - Option 2 (G4.2)
   Cut Sheet – Gas Vapor Barrier Penetrations on Earth or Gravel Subgrade - Option 1 (G4.3)
   Cut Sheet – Gas Vapor Barrier Penetrations on Earth or Gravel Subgrade - Option 2 (G4.4)
   Cut Sheet – Gas Vapor Barrier Solid Nail (G4.5)
   Cut Sheet – Gas Vapor Barrier Membrane Lap Joints on Solid Substrate (G4.6)
   Cut Sheet – Gas Vapor Barrier Membrane Lap Joints on Geotextile (G4.7)

PASSIVE REMEDIAL SYSTEM SPECIFICATIONS
FOR
MARSHALL STREET SCHOOL
CITY OF PATERSON
PASSAIC COUNTY, NEW JERSEY

1.0 REMEDIAL ACTIVITIES TO BE CONDUCTED PRIOR TO PASSIVE REMEDIAL SYSTEM INSTALLATION

The proposed vapor mitigation system to be installed at the Marshall Street School property located in the City of Paterson in Passaic, New Jersey will consist of a passive system to allow for the flow/dissipation of residual volatile organic compounds (VOCs) that may volatilize off the soil from beneath the proposed School structure. The system will be installed subsequent to the New Jersey Department of Environmental Protection's (NJDEP) approval of the remedial activities to be conducted by the NJSDA which will consist of the removal of the soil impacted with VOCs as identified during investigative activities. The excavated volume that will be removed under the direction of others will be based upon the vertical and horizontal delineation sampling and post-excavation sampling that will be conducted under the auspices and with the approval of the NJDEP.

Subsequent to the implementation of the NJDEP approved remedial actions (i.e., excavation of petroleum impacted soil for proper off-site disposal) by NJSDA, fill will be imported and installed into the excavated area, where appropriate, with proper attention to installation of the clean fill to attain permeability similar to the soils removed.

2.0 OVERVIEW OF THE PASSIVE REMEDIAL SYSTEM

Once the site has been brought back to grade with the fill, the vapor remedial system will be installed by the NJSDA contractor. The site will be prepared with the installation of a proof-rolled soil layer to a minimum of 95 percent relative compaction. Subsequent to proof-rolling the soil, a layer of 2-inch thick layer of gravel will be installed, which will also be rolled to prevent any sharp edges from protruding. Within the gravel layer, just above the soil, a series of four (4) inch diameter polyvinyl chloride (PVC) pipes will be installed. Above that, a 2-inch thick layer of gravel cover will be required over the PVC piping. At intervals, the PVC will be perforated to allow the off-gassing of VOCs into the piping and out from under the building. Above the gravel layer, a spray on liner, Liquid Boot®, will be installed to prevent penetration of the VOCs into the building. As part of the Liquid Boot® installation, a "T-60" base fabric will be placed on top of the prepared gravel. The Liquid Boot® will be sprayed/applied in sections ranging from 7,000 to 10,000 square feet (sq ft) with the edges fastening to the walls of the

structure (to portions of the clean/freshly troweled surface). Following installation, smoke testing of the material laid down the previous day will be performed at increments of 2,000 to 5,000 square feet as a quality control measure to ensure that there are no leaks. As this is occurring the site is being prepared for the next 7,000 to 10,000 sq ft section of Liquid Boot® application. This sequence would continue until the foot print of the approximately 68,120 sq ft building is covered, which is estimated at a period of two to three weeks.

Drawing R-1 provides a planar view of the PVC piping system that will be installed within the gravel layer to provide a preferential pathway for any potential VOCs present to be removed from beneath the building. The Liquid Boot® liner will inhibit potential VOCs from permeating into any utility pathways and/or through the concrete building slab foundation. Cut Sheets G 1.1 through G 4.7 present details of the system installation.

3.0 SYSTEM SPECIFICATIONS

3.1 Piping

A series of under-slab piping runs, running north to south, east and west, composed of 4-inch diameter schedule 40 perforated PVC pipe will be installed within the gravel layer, just above the soil interface with staggered slotted screen laterals. The various runs will consist of 6-inch diameter schedule 40 PVC riser stacks which will interconnect the 4-inch diameter solid schedule 40 PVC header pipes to the 4-inch diameter schedule 40 perforated PVC laterals. The designed under-slab perforated piping headers and laterals shall be laid in the sub-grade with the top of the pipe approximately 2-inches below the concrete slab within a layer of DOT No. 4 sized gravel or approved equal. The laterals shall be 4-inches in diameter and have perforations fully around the circumference of the pipe with free air space equal to 1.83 square inches per square foot of the exterior pipe surface area. All components of the venting pipe system shall be installed to avoid water or moisture to enter the piping and provide positive drainage of any moisture to the ground beneath the slab or membrane.

The various runs will be equally distributed beneath the proposed building structure with their exact locations field determined. If the air sample concentrations exceed the NJDEP Air Quality Criteria, the installation of roof fans to enhance the passive remedial system to an active remedial system will be performed. The conversion of the passive system to an active system is not included in this specification. All of the PVC piping will surface along the remote walls and central roof portions of the new School since visibility will be at a minimum on this location of the building. The piping will be manifolded into a 6-inch diameter PVC stack that will run vertically through the interior walls, to a height of approximately 3 feet minimum above the

height of the roof line of the School for venting. Stack piping should not be less than 3 feet above any roof top air intakes and not less than 10 feet from any window or other opening in an adjoining or adjacent building; or 2 feet above any window; 20 feet away from any mechanically powered vent that supplies air to the interior of the building.

System Piping and Fittings will consist of:

- 4-inch Schedule 40 PVC (approximately 1200 feet)
- 4-inch Screened Schedule 40 PVC (approximately 1300 feet)
- 6-inch Schedule 40 PVC Risers (approximately 260 feet)
- 6-inch Schedule 40 PVC, 90 degree elbows (approximately 6)
- 6-inch x 4-inch Schedule 40 PVC reducer couplings (approximately 6)
- 6-inch Schedule 40 PVC "T" joints (approximately 6)
- 4-inch Schedule 40 PVC, Long Sweep 90 degree elbows (approximately 6)
- 4-inch x 4-inch Schedule 40 PVC Crosses (approximately 7)
- 4-inch x 6-inch Schedule 40 PVC couplings (as required, where necessary)
- 4-inch Schedule 40 PVC "T" joints (approximately 27)
- 4-inch x 6-inch Schedule 40 PVC "T" joints (approximately 4)
- 4-inch x 6-inch schedule 40 PVC, 90 degree elbows (approximately 2)
- 4-inch Schedule 40 PVC caps (approximately 40)
- 4-inch Schedule 40 PVC, 90 degree elbows (approximately 3)
- 4 -inch Schedule 40 PVC 22.5 degree elbows (approximately 3)
- 4-inch Schedule 40 PVC Wye (approximately 1)
- Schedule 40 Solvent for welded pipe fittings to meet or exceed ASTM D-2564

Sample ports will also be installed by the Engineer (Maser) to allow for the collection of air samples to assess system performance. Equipment required for the sample ports and monitoring include:

- ¼-inch Close Nipple (approximately 6)
- ¼-inch Ball Valve (approximately 6)
- ¼-inch Hose Barb (approximately 6)
- Liquid tube manometer or analogue magnahelix (approximately 6)

3.1.1 Future Ventilation Fans

Permanent provisions shall be made to allow for the ability to add continuous operating of in-line ventilation fans at all vent riser locations and outside the conditioned envelope of the building (i.e. attic space or crawl space). Future fan locations shall be permantly accessible for servicing and maintenance. All fan circuits shall have a means of positive disconnection and be terminated in an approved electrical outlet in accordance with the National Electric Code (NEC).

Notes:

1.) If based upon air sampling, and field diagnostic testing of the piping system, the concentrations of the contaminants are too high or not enough draw of the off-gassing is being attained, the installation of a blower or other air removal means will be evaluated by NJSDA and/or the Project Engineer (Maser).

2.) Refer to the R-1, Underground Piping Remediation Plan as well as the referenced plumbing, electrical, mechanical, structural and architectural drawings and specifications for additional related information required for the remediation piping system specifications.

3.2 Liner

LIQUID BOOT® (LB) Brownfield Membrane/Liner is a gas vapor asphalt membrane system has been used to mitigate the threat of gas intrusion into buildings. The following specifications are provided to describe the LB membrane and its general installation requirements.

3.2.1 General

Description

General and Supplementary Conditions and Division 1 - General Requirements applies to this section. Provide gas vapor barrier as indicated, specified and required. Install a fluid applied soil gas vapor barrier under concrete slab and for wall applications as indicated, specified and required in the Contract Documents and Drawings.

Note: This section specifically references products manufactured by LBI Technologies Inc. (LBI). Another NJSDA approved product may be substituted provided it meets the material properties, test and application procedures defined in Part 3.2.3 and Part 3.2.4 of this Section.

Work in this section - principal items include:

Gas vapor barrier providing protection from the following gases: Methane, other Hydrocarbon vapors in concentrations up to 20,000 ppm, Hydrogen Sulfide, Radon.

Related work not in this section:

1. Excavation and backfilling.
2. Parge coat on masonry to receive gas vapor barrier membrane.
3. Mortar beds or concrete toppings over gas vapor barrier membranes.
4. Latex waterproofing.
5. Damp-proofing.
6. Flashing and sheet metal.
7. Joint sealers.
8. Soil sterilant.
9. Gas collection systems.
10. Gas monitoring.
11. Drainage.

3.2.2 Quality Assurance

Gas vapor barrier contractor/applicator shall be trained and approved by gas vapor barrier manufacturer, LBI Technologies, Inc.

A pre-installation conference shall be held prior to application of gas vapor barrier to assure proper substrate and installation conditions, to include contractor, applicator, architect/engineer, and special inspector. Review installation, protection and coordination with other work.

General performance requirement: It is required that this gas vapor barrier be vapor tight for at least twenty (20) years. Failure to comply with this requirement will be considered to be a failure of materials and workmanship. The gas vapor barrier shall pass all acceptance tests outlined in Section 3.2.6 of this document.

Installer: Gas vapor barrier installer shall be trained and approved by gas vapor barrier manufacturer, LBI Technologies, Inc. (LBI) or NJSDA approved equal.

The following is a list of some approved installers:

Edgeboro International

Debrino Caulking

Terrafix Environmental

EAI

Inspection: The Engineer (Maser) will conduct the inspection of the gas vapor barrier installation. Approval of the work by the Engineer (Maser) does not relieve the manufacturer and/or the installer of their responsibility to produce and install the vapor protection system to meet the performance requirements as stated above.

The installer shall perform a smoke test in accordance with Section 3.2.6.3 of this document and shall document the successful completion of this test.

Submittals

All submittals shall be received by the Engineer (Maser) for review at least 14 days prior to the commencement of work.

Project Data - Submit manufacturer's product data and installation instructions for specific application.

Samples - Submit representative samples of the following for approval:

1 Gas vapor barrier membrane material.
2 Protection Board and/or Protection Mat.
3 Prefabricated Drainage Mat.
4 Geotextiles.

Documentation of successful smoke test completion as required in Section 3.2.6.3 of this Section.

Material Test Reports: Indicate and interpret test results for compliance of vapor barrier with requirements indicated, as applicable.

Certification: Submit manufacturer's Certification of Compliance indicating that materials delivered and used in the work are in strict compliance with specified requirements, see Section 3.2.3 in this document.

3.2.2.1 Delivery, Storage and Handling

Deliver materials to site in original unbroken packages bearing manufacturer's label showing brand, weight, volume, and batch number. Stored materials at the site should be in strict compliance with manufacturer's instructions. Do not allow materials to freeze in containers.

Site Conditions

Protect all adjacent areas not to receive gas vapor barrier. Where necessary, apply masking to prevent staining of surfaces to remain exposed wherever membrane abuts to other finish surfaces.

Perform work only when existing and forecasted weather conditions are within manufacturer's recommendations for the material and product used.

Minimum clearance required for application of product:

- 90° spray wand - 2 feet
- Conventional spray wand - 4 feet.

Ambient temperature shall be within manufacturer's specifications. If winter conditions apply, we recommend the use space of heaters and necessary cover (i.e. visqueen) to **bring the ambient temperature to at least +45°F** until the protection course and structural slab rebar or a mudslab protection course has been placed.

The Contractor shall coordinate with all trades involved, the scheduling of excavation and backfill to ensure that all necessary components of work, due to be buried, are installed thus avoiding duplication of excavation work unless otherwise shown on the Contract Drawings or noted in other sections of the Contract Documents. No other work should be performed in areas above an installed vapor barrier section until the vapor barrier protection geotextile has been installed and the vapor barrier installer approves it. The Contractor shall verify there are no interferences with other existing or proposed subsurface systems. Aggregate backfill shall be rolled flat and non-angular.

All plumbing, electrical, mechanical, and structural items to be under or passing through the gas vapor barrier shall be positively secured in their proper positions and appropriately protected prior to membrane application.

Gas vapor barrier shall be installed before the placement of reinforcing steel. When not possible, all exposed reinforcing steel shall be masked by General Contractor prior to membrane application.

Expansion joints must be filled with a conventional waterproof expansion joint material. Surface preparation shall be per manufacturer's specification.

3.2.2.2 Product Warranty

LBI Technologies, Inc. (LBI) warrants its products to be free of defects. This warranty only applies when the LIQUID BOOT® is applied by LBI Approved Applicators and that the required respective LBI products (such as LIQUID BOOT® UltraDrain. LIQUID BOOT® UltraShield, LIQUID BOOT® BaseFabric and LIQUID BOOT® GeoVent) are used. Hence, only LBI approved materials and authorized applicators should be utilized. As factors which affect the result obtained from this product including weather, equipment utilized, construction, workmanship and other variables, are all beyond the manufacturer's control, LBI warrants only that the material conforms to its product specifications. Under this warranty, LBI will replace, at no charge, any product not meeting these specifications within 20 years of manufacture, provided it has been applied in accordance with LBI written directions for use recommended as suitable for this product. Warranties are available for a longer period upon request and mutual written consent.

3.2.3 Products

Materials

Fluid applied gas vapor barrier system, LIQUID BOOT® is composed of a single course, high build, polymer modified asphaltic emulsion. LIQUID BOOT® Spray is applied at ambient temperatures. A thickness of 60 dry mils is used for vapor barriers. The material is non-toxic and odorless. The material is manufactured by LBI Technologies, Inc.

Gas vapor barrier physical properties.

Gas Vapor Membrane	Test Method	Value
Hydrogen Sulfide Gas Permeability	ASTM D1343	None Detected
Benzene, Toulene, Ethylene, Xylene, Gasoline, Hexane, Perchloroethylene	ASTM D543, D412, D1434 (tested at 20,000 ppm)	Passed in gas permeability and weight change

Gas Vapor Membrane	Test Method	Value
Acid Exposure (10% H_2SO_4 for 90 days)	ASTM D543	Less than 1% weight change
Radon Permeability	Tested by US Dept. of Energy	Zero permeability to Radon (222Rn)
Bonded Seam Strength Tests	ASTM D6392	Passed
Micro-Organism Resistance (Soil Burial) average weight change, average tensile strength change, average tensile stress change, average elongation change, bonded seams, methane permeability	ASTM D4068-88	Passed
Methane Permeability	ASTM 1434-82	Passed
Oil Resistance Test average weight change, average tensile strength change, average tensile stress change, average elongation change, bonded seams, methane permeability	ASTM D543-87	Passed
Heat Aging average tensile strength change, average tensile stress change, average elongation change, bonded seams	ASTM D4068-88	Passed
Dead Load Seam Strength	City of Los Angeles	Passed
Environmental Stress-Cracking	ASTM D1693-78	Passed
PCE Diffusion Coefficient	Tested at 6,000 mg/m^3	2.74 x 10-14 m^2/sec
TCE Diffusion Coefficient	Tested at 20,000 mg/m^3	8.04 x 10-14 m^2/sec
Waterproofing	**Test Method**	**Value**
Soil Burial	ASTM E154-88	Passed
Water Penetration Rate	ASTM D2434	$<7.75 \times 10^{-9}$ cm/sec
Water Vapor Permeability	ASTM E96	0.24 perms
Water Vapor Transmission	ASTM E96	0.10 grains/h-ft^2

Potable Water	Test Method	Value
Toxicity Test	22 CCR 66696	Passed. CCR Bioassay—Flathead Minnow
Potable Water Containment	ANSI/NSF 61	NSF Certified for tanks >300,000 gal

General Information	Test Method	Value
Coefficient of Friction- geotextile both sides	ASTM D5321	0.72
Cold Bend Test	ASTM D146	Passed. No cracking at –25°F
Freeze-Thaw Resistance (100 Cycles)	ASTM A742	Meets criteria. No spalling or disbondment
Accelerated Weathering & Ultraviolet Exposure	ASTM D822	No adverse effect after 500 hours
Hydrostatic Head Resistance	ASTM D751	Tested to 138 feet or 60 p.s.i
Elongation	ASTM D412	1,332% - Ø reinforcement, 90% recovery
Elongation- 8oz. non-woven geotextile both sides	ASTM D751	100% (same as geotextile tested separately)
Tensile Strength	ASTM D412	58 p.s.i. without reinforcement
Tensile Strength-8oz. non-woven geotextile both sides	ASTM D751	196 p.s.i. (same as geotextile tested separately)

General Information	Test Method	Value
Tensile Bond Strength to Concrete	ASTM D413	2,556 lbs/ft^2 uplift force
Puncture Resistance-8oz. non-woven geotextile both sides	ASTM D4833	286 lbs. (travel of probe = 0.756 inches) (same as geotextile tested separately)
Flame Spread	ASTM E108	Class A with top coat (comparable to UL790)
Electric Volume Resistivity	ASTM D257	1.91 x 10^{10} ohms-cm

Protection - On vertical surfaces, use: LIQUID BOOT® UltraShield P-100 or other protections as approved by the manufacturer, project architect or engineer.

- On horizontal surfaces, use: LIQUID BOOT® UltraShield G-1000 above the 60 mil LIQUID BOOT® vapor barrier or other protections as approved by the manufacturer, project architect or engineer.

Due to the diverse jobsite conditions, all protection materials must be approved by the **membrane manufacturer, including the use of the LIQUID BOOT® UltraShield products.**

Prefabricated Drain Mat - Vertical surfaces, use LIQUID BOOT® UltraDrain 6200

- Horizontal surfaces, use LIQUID BOOT® UltraDrain 9000

Adhesive system for LIQUID BOOT® UltraShield and LIQUID BOOT® UltraDrain: Use LIQUID BOOT® UltraGrip.

Base Geotextile- LIQUID BOOT® BaseFabric T-60 non-woven geotextile, unless otherwise specified and approved by membrane manufacturer. The heat-rolled side shall be used as the application surface.

Cold Joints, Cracks, Form Tie Holes: Covered with Hardcast CRT 1602 Tape 3" wide.

General - Provide additional installation accessories as necessary. Ensure accessories are from same manufacturer as vapor barrier.

3.2.4 Execution

3.2.4.1 Examination

All surfaces to receive gas vapor barrier shall be inspected and approved by the NJSDA, the Engineer (Maser) and the applicator at least one day prior to commencing work.

3.2.4.2 Surface Preparation

Provide 24-inch minimum clearance out from surfaces to receive the gas vapor barrier. The application surface shall be prepared and provided to the applicator in accordance with manufacturer's specifications listed below:

Concrete/Shotcrete/Masonry

Concrete surfaces shall be light broom finish or smoother, free of any dirt, debris, loose material, release agents or curing compounds. Fill all voids more than ¼- inch deep and ¼-inch wide. Masonry joints, cold joints, and form joints shall be struck smooth.

All penetrations shall be prepared in accordance with manufacturer's specifications (see attached Cut sheets G 1.1 through G 4.7). Provide a 3/4-inch minimum cant of LIQUID BOOT®, or other suitable material as approved by manufacturer, at all horizontal to vertical transitions and other inside corners of 120° or less and allow to cure overnight before the application of LIQUID BOOT®.

All cracks or cold joints greater than 1/16- inch must be completely grouted with non-shrink grout as approved by engineer.

Install Hardcast reinforcing tape over all cold joints, cracks and form tie holes (after holes and cracks are grouted).

Dirt & Gravel

The sub-grade shall be moisture conditioned and compacted to a minimum relative compaction of 90 percent or as specified by civil/geotechnical engineer. The finished surface shall be smooth, uniform, free of debris and standing water. Remove all stones or dirt clods greater than 1/4 inch. (NOTE: Aggregate sub-bases shall be rolled flat, free from any protruding sharp edges). Penetrations shall be prepared in accordance with manufacturer's specifications. All form stakes that penetrate the membrane shall be of rebar, which shall be bent over and left in the slab. The Engineer (Maser) shall approve the subgrade on which the liner is to be installed prior to commencing work.

Trenches shall be cut oversize to accommodate gas vapor barrier membrane and protection course with perpendicular to sloped sides and maximum obtainable compaction. Adjoining grade shall be finish graded and compacted. Excavated walls shall be vertical or sloped back, free of roots and protruding rocks. Specific sub-grade preparation shall be designed by a qualified civil or geotechnical engineer. If organic materials with potential for growth (ie: seeds

or grasses) exist within the sub-base, spray apply soil sterilant at the sterilant manufacturer's recommended rate.

3.2.5 Installation

Installation on Concrete/Shotcrete/Masonry (Follow the procedures below carefully).

Refer to section3.3.5.3, "Sealing Around Penetrations", for procedures to seal around penetrations.

Provide a ¾-inch minimum cant of LIQUID BOOT®, or other suitable material as approved by manufacturer, at all horizontal to vertical transitions and other inside corners of 120° or less. Allow to cure overnight before the application of LIQUID BOOT®.

Delineate a test area on site with a minimum dimension of 10 feet by 10 feet. Apply LIQUID BOOT® to a thickness of 60 mils and let it cure for 24 hours. Observe for blisters. If minor or no blistering occurs, proceed to the next step (See note regarding blisters). If significant blistering does occur, apply a thin (10 mil) tack coat of LIQUID BOOT® "A" side without catalyst to the entire concrete surface and allow to cure before proceeding. (See also information regarding blister repair).

Spray apply LIQUID BOOT® to a 60 mil minimum dry thickness. Increase thickness to 100 dry mils if shotcrete is to be applied directly to membrane. If a second coat is required, remove any standing water from the membrane before proceeding with the second application. Do not penetrate membrane. Keep membrane free of dirt and debris and traffic until a protective cover is in place. It is the responsibility of the Contractor to insure that the membrane and the protection system are not penetrated.

After membrane has cured and checked for proper thickness and flaws, install protection material pursuant to manufacturer's instructions.

Note: All testing or inspection to be performed prior to placing protection course.

NON-HORIZONTAL SURFACES: Spray on non-horizontal surfaces should begin at the bottom and work towards the top. This method allows the product to adhere to the surface before hitting catalyst runoff.

Note: Due to the nature of concrete as a substrate, it is normal for some blistering to occur. This is caused by either concrete's tendency to off-gas or water that is temporarily trapped between the concrete and the membrane. With time and the applied pressure of

backfill or over-slab, blisters will absorb into the concrete without detriment to the membrane. A small number of blister heads should be sampled and checked for proper membrane thickness. If the samples have the minimum required membrane thickness, then the remaining blisters should not be punctured or cut. If the samples have less than the minimum required membrane thickness, then the area can either be re-sprayed to obtain the proper thickness, or the blisters can be cut out and the area re-sprayed or patched with LIQUID BOOT® Trowel Grade.

3.2.5.1 Installation on Dirt Surfaces and Mudslabs

Roll out LIQUID BOOT® Base Fabric geotextile on sub-grade with the heat-rolled side facing up. Overlap seams a minimum of six inches (6"). Lay geotextile tight at all inside corners. Apply a thin (10 mil) tack coat of LIQUID BOOT® "A" side without catalyst within the seam overlap.

Line trenches with geotextile extending at least six inches (6") onto adjoining sub-grade if slab and footings are to be sprayed separately. Overlap seams a minimum of six inches (6"). Lay geotextile tight at all inside corners. Apply a thin (10 mil) tack coat of LIQUID BOOT® "A" side without catalyst within the seam overlap (See Cut sheet G2.8).

Minimize the use of nails to secure the geotextile to the dirt subgrade. Remove all nails before spraying membrane, if possible. Nails that cannot be removed from the dirt subgrade are to be patched with geotextile or Hardcast reinforcing tape overlapping the nail head by a minimum of two inches (2"). Apply a thin tack coat of LIQUID BOOT® under the geotextile patch, when patching with geotextile.

Refer to section 3.2.5.3, "Sealing Around Penetrations", for procedures to seal around penetrations (See Cut sheets G2.7, G4.3 and G4.4).

Spray apply LIQUID BOOT® onto geotextile to an 60 mil minimum dry thickness. Increase thickness to 100 dry mils if shotcrete is to be applied directly to membrane. If a second coat is required, remove any standing water from the membrane before proceeding with the second application.

Do not penetrate membrane. Keep membrane free of dirt, debris and traffic until a protective cover is in place. **It is the responsibility of the Contractor to insure that the membrane and the protection system are not penetrated.**

After membrane has cured and checked for proper thickness and flaws, install protection material pursuant to manufacturer's instructions.

Note: All testing or inspection to be performed prior to placing protection course.

3.2.5.2 Blind Side Installation (If Necessary)

Attach subsurface drain mat or, securely nail 8 oz. non-woven geotextile over lagging and soldier piles keeping geotextile tight to lagging wall. Overlap seams a minimum of six inches (6").

Roll out specified geotextile vertically with the heat-rolled side facing out and staple to lagging using 3/8 long staples 12" on center. Overlap seams a minimum of six inches (6"). Spray LIQUID BOOT® within the seam overlap to a thickness of 60 mils minimum. Do not staple top layer of geotextile at overlap.

Refer to section 3.2.5.3, "Sealing Around Penetrations", for procedures to seal around penetrations.

Provide a 3/4 inch minimum cant of LIQUID BOOT®, or other suitable material as approved by manufacturer, at all horizontal to vertical transitions and other inside corners of 120° or less. **Allow to cure overnight before the application of LIQUID BOOT® membrane.**

Spray apply LIQUID BOOT® to a minimum thickness of 60 mils (100 mils if installing shotcrete walls). Remove any standing water.

Do not penetrate membrane. Keep membrane free of dirt and debris until concrete is in place. **It is the responsibility of the General Contractor to insure that the membrane and the protection system are not penetrated.**

3.2.5.3 Sealing Around Penetrations

For Gas Vapor Membrane Only

Clean all penetrations. All metal penetrations shall be sanded clean with emery cloth. For applications requiring LIQUID BOOT® BaseFabric geotextile, roll out geotextile on sub-grade with the heat-rolled side facing up, overlapping seams a minimum of six inches (6"). Cut the geotextile around penetrations so that it lays flat on the sub-grade. Lay geotextile tight at all

inside corners. Apply a thin (10 mil) tack coat of LIQUID BOOT® "A" side without catalyst within the seam overlap.

Spray-apply LIQUID BOOT® to surrounding areas as specified for the particular application to a 60 mil minimum dry thickness. At the base of penetration, install a minimum ¾-inch thick membrane cant of LIQUID BOOT®, or other suitable material as approved by manufacturer. Extend the membrane at 60 mil thickness up the penetration a minimum of three inches (3"). Allow to cure overnight before proceeding to D. **(See manufacturer's standard detail, LIQUID BOOT detailed drawings.)**

Spray apply LIQUID BOOT® the membrane at an 60 mil thickness three inches (3") around the base of penetration and up the penetration, completely encapsulating the collar assembly, to a height of one and one half inches (1 1/2") minimum above the membrane as described in 3.03.32 C above. **(See attached manufacturer's standard detail.)**

Allow LIQUID BOOT® to cure completely before proceeding to step "F".
Wrap penetration with polypropylene cable tie at a point two inches (2") above the base of the penetration. Tighten the cable tie firmly so as to squeeze, but not cut, the cured membrane collar.

3.2.6 Field Quality Control

Field Quality Control is a very important part of all LIQUID BOOT® applications. Applicators should check their own work for coverage, thickness, and all around good workmanship before calling for inspections.

The membrane must be cured at least overnight before inspecting for dry-thickness, holes, shadow shrinkage, and any other membrane damage. If water testing is to be performed, allow the membrane to cure at least 72 hours prior to the water test.

When thickness or integrity is in question the membrane should be tested in the proper manner as described below. However, over-sampling defeats the intent of inspections. Inspectors should always use visual and tactile measurement to guide them. Areas suspected of being too thin to the touch should be measured with the gauges, or other LBI recommended equipment, to determine the exact thickness.

A minimum of one (1) sample per thousand square feet of applied material shall be observed by the Engineer (Maser).

3.2.6.1 On Concrete/Shotcrete/Masonry & Other Hard Substrates

Membrane may be checked for proper thickness with a blunt-nose depth gauge, taking one reading every 500 square feet. Record the readings. Mark the test area for repair, if necessary.

If necessary, test areas are to be patched over with LIQUID BOOT® to a 60 mils minimum dry thickness, extending a minimum of one inch (1") beyond the test perimeter.

3.2.6.2 On Dirt and Other Soft Substrates

Samples may be cut from the membrane and geotextile sandwich to a maximum area of 2 square inches. Measure the thickness with a mil-reading caliper, per 500 square feet. Deduct the plain geotextile thickness to determine the thickness of LIQUID BOOT® membrane. Mark the test area for repair. Readings shall be recorded on the coupon sampling and smoke testing log by the Engineer (Maser).

Voids left by sampling are to be patched with geotextile overlapping the void by a minimum of two inches (2"). Apply a thin tack coat of LIQUID BOOT® under the geotextile patch. Then spray or trowel apply the LIQUID BOOT® to an 60 mils minimum dry thickness, extending at least three inches (3") beyond geotextile patch.

3.2.6.3 Smoke Testing for Holes

Holes or other breaches in the membrane can be detected by conducting a smoke test. This involves pumping smoke under the membrane for a specified period of time, under a specified pressure, which varies from project to project. This test should be performed in accordance with the following procedures specified by LBI Technologies:

1. The gas membrane shall be visually inspected. Any apparent deficiencies and/or installation problems shall be corrected prior to smoke test.
2. Smoke Testing of Liquid Boot® membrane to be conducted by Approved Liquid Boot® Applicator and observed by a qualified inspector as designated.
3. The date, time, testing reference area, temperature, wind speed/direction, and cloud cover shall be recorded on the Smoke Testing Record. The ambient air temperature at the time of testing should be in excess of 45^0 F and the wind speed at ground level should be 15 mph or less.
4. Delineate a smoke testing area in increments of 2,000-5,000 ft^2 (maximum). Assemble and situate smoke testing system to inject smoke beneath membrane. Only inert, non-toxic smoke is to be utilized for membrane smoke test.

5. Designate testing control areas by cutting openings in a "X" pattern (min. 4" x 4") in the membrane at selected locations. Mark testing control areas for identification prior to conducting the smoke test.
6. Activate smoke generator/blower system (nominal 150-950 cfm). Apply sufficient pressure as to ensure that smoke will permeate the designated testing area. For verification, ensure that smoke is leaking through testing control areas.
7. Pump smoke beneath the membrane (Min. 1-2 minutes). Observe for leaks in the membrane. Reduce pressure/flow rate if excessive lifting of the membrane occurs.
8. Thoroughly inspect entire membrane surface within area delineated for testing. Use marking device as approved by LBI Technologies Inc. to mark/label any leak locations. Mark/label leak locations on floor plan and corresponding testing reference area.
9. Repair leak locations marked in Step 7 by spraying Liquid Boot® or by using Liquid Boot® trowel grade.
10. Repeat Steps 7-8, as necessary to confirm integrity of membrane.
11. Readings shall be recorded on the Coupon sampling and smoke testing log by qualified inspector. Once the membrane has passed the smoke test inspection, the successful completion should be documented and signed off by a qualified inspector as delineated by the Engineer (Maser), General Contractor, or the NJSDA.

3.2.7 Protection

The 60 mil gas vapor barrier shall be protected per manufacturer's recommendations to prevent disturbance, damage or deterioration by work of other trades or environmental conditions. Protect gas vapor barrier from damage during installation of reinforcing steel and utilities and during placement of concrete slab or granular materials. Sharp angular backfill materials shall not be placed immediately against the LIQUID BOOT® barrier.

The Engineer (Maser) will visually inspect the condition of the 60 mil gas vapor barrier immediately prior to placing the overlying geotextile protective layer or below-grade wall backfill. All damage to the installed gas vapor barrier shall be repaired at the Contractor's expense prior to placement of concrete or backfill.

Ensure there is no moisture entrapment by vapor barrier due to rainfall or ground water intrusion.

Protect reinforced vapor barrier from damage until covered by finish wall.

Immediately repair damaged vapor barrier in accordance with manufacturer's instructions.

Warranty

The manufacturer/installer shall provide a written warranty to the NJSDA as specified in Section 3.2.3 and 3.2.4 of this document.

4.0 POST VAPOR MITIGATION SYSTEM INSTALLATION ACTIVITIES

Subsequent to the NJDEP and/or NJSDA approval of the system and/or obtaining the required permits and the awarding of the specifications, the Engineer (Maser) will be on site to review and/or inspect the installation of the system to ensure that the system is being installed in accordance with the specifications and to provide direction if unforeseen events are encountered. Once the system has been installed and the building is enclosed, air gas samples will be collected, from the interior building structure and one will be collected as an exterior background sample. The sampling and analysis will be conduction in accordance with the NJDEP Vapor Intrusion Guidance Document March 2007 revision. The samples will be analyzed for Total Volatile Organic (TO-15) which will include the contaminants of concern. At a minimum, six (6) air samples will be collected for laboratory testing. Collection and testing of the indoor air samples will be completed by the Engineer (Maser). If sample concentrations exceed the NJDEP Residential Indoor Air Screening Levels (RIASL) Air Quality Criteria for TO-15 (see Table Below), fans will be installed converting the passive system to an active system. Indoor air samples will be collected upon system completion to ensure the improved vapor mitigation system reduces the Total Volatile Organics to below the NJDEP RIASLs.

NJDEP Indoor Air Screening Levels		
Compound	**Residential**	**Non Residential**
(units)	**(ug/m³)**	**(ug/m³)**
Acetone (2-propanone)	3,300	4,600
Benzene	2	2
Bromodichloromethane	3	3
Bromoethene	2	2
Bromoform	5	5
Bromomethane (Methyl bromide)	5	7
1,3-Butadiene	1	1
2-Butanone (Methyl ethyl ketone)	5,100	7,200
Compound	**Residential**	**Non Residential**
Carbon disulfide	730	1,000
Carbon tetrachloride	3	3
Chlorobenzene	51	72
Chloroethane	2	5
Chloroform	2	2
Chloromethane (Methyl chloride)	95	130
3-Chloropropene (allyl chloride)	2	2
2-Chlorotoluene (o-Chlorotoluene)	73	100
Cyclohexane	6,200	8,700

Dibromochloromethane	4	4
1,2-Dibromoethane	4	4
1,2-Dichlorobenzene	150	200
1,3-Dichlorobenzene	11	15
1,4-Dichlorobenzene	3	3
Dichlorodifluoromethane	180	260
1,1-Dichloroethane	510	720
1,2-Dichloroethane	2	2
1,1-Dichloroethene	220	310
1,2-Dichloroethene (cis)	36*	51*
1,2-Dichloroethene (trans)	73*	100*
1,2-Dichloropropane	2	2
1,3-Dichloropropene (cis)	*	*
1,3-Dichloropropene (trans)	*	*
1,2-Dichlorotetrafluoroethane (Freon 114)	NS	NS
Ethylbenzene	1,100	1,500
4-Ethyltoluene (p-Ethyltoluene)	NS	NS
n-Heptane	NS	NS
Hexachlorobutadiene	5	5
n-Hexane	730	1,000
Methylene Chloride	4	9
4-Methyl-2-pentanone (MIBK)	3,100	4,400
MTBE (Methyl tert-butyl ether)	2	4
Styrene	1,000	1,500
Tertiary butyl alcohol (TBA)	66	92
1,1,2,2-Tetrachloroethane	3	3
Tetrachloroethene (PCE)	3	3
Toluene	5,100	7,200
1,2,4-Trichlorobenzene	36	51
1,1,1-Trichloroethane	1,000	1,400
1,1,2-Trichloroethane	3	3
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	31,000	44,000
Trichloroethene (TCE)	3	3
Trichlorofluoromethane (Freon 11)	730	1,000
1,2,4-Trimethylbenzene	NS	NS
1,3,5-Trimethylbenzene	NS	NS
2,2,4-Trimethylpentane	NS	NS
Vinyl Chloride	1	1
Xylene (Total)	5,500	7,700
1,2-Dichloroethene (total)	33	46
1,3-Dichloropropene (total)	2	2

Notes:

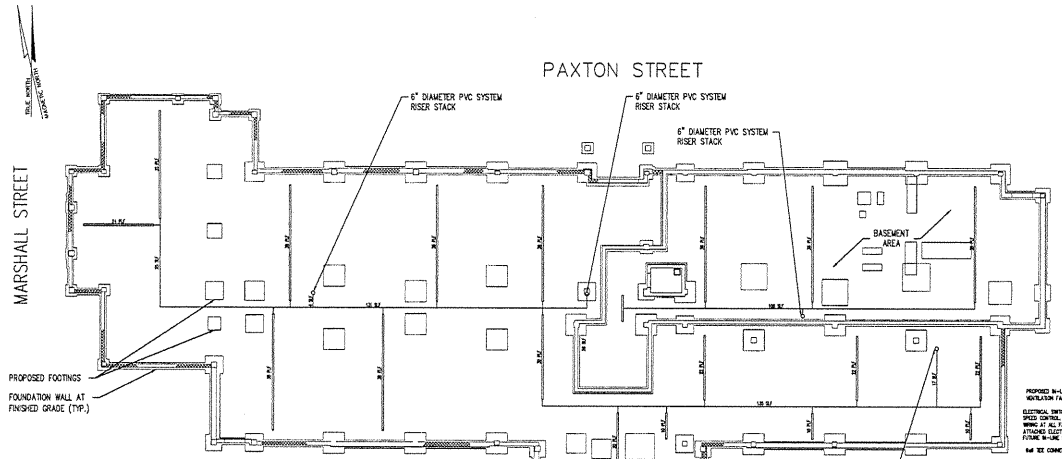
* - Add isomers and compare to "total" for compound

LIST OF SUBMITTALS

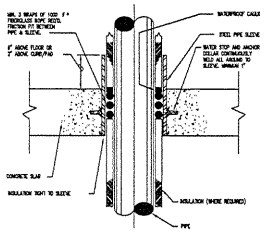
SUBMITTAL	DATE SUBMITTED	DATE APPROVED
Product Data:	_____	_____
1. Gas Vapor Barrier Material 2. Protection Board/Mat 3. Geotextiles		
Shop Drawings:	_____	_____
Samples:	_____	_____
Design Data: 1. Barrier Composition	_____	_____
Test Reports:	_____	_____
Daily Logs:	_____	_____
Certification:	_____	_____
Warranty:	_____	_____

* * *

FIGURES

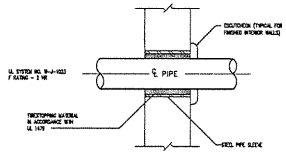


NOTES:
1. UTILIZE ONLY MANUFACTURER SPECIFIED PRODUCTS AND PARTS INDICATED OR BETTER THAN APPROVED EQUAL.
2. ULTIMATE OPERATION AND MAINTENANCE IS THE OWNER'S RESPONSIBILITY UNDER THE DIRECTION AND GUIDELINES OF THE ENGINEER.
3. ALL PIPING-SUBGRADE SOILS SHALL BE A STRUCTURAL FILL WITH 95 PERCENT RELATIVE COMPACTION AND FREE OF STANDING WATER.
4. ALL LATERAL PIPING IS TO BE INSTALLED LEVEL AND WITH NO SAGGING.
5. REFER TO THE PROJECT SPECIFICATIONS FOR ALL SYSTEM SPECIFICATIONS AND REQUIREMENTS DURING CONSTRUCTION.
6. REFER TO PROJECT SPECIFICATIONS FOR ALL STORAGE HANDLING, COLOR, SIZE, TYPE, JOINING AND CONSTRUCTION REQUIREMENTS OF ALL INDICATED PIPING
7. THE CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION OF ALL PROPOSED/EXISTING CABLES, CONDUITS, PIPING AND THE LIKE UNDERGROUND UTILITIES OR STRUCTURES WHICH MAY BE ENCOUNTERED EITHER ABOVE OR UNDERGROUND. ALL NECESSARY PRECAUTIONS MUST BE TAKEN BY THE CONTRACTOR TO PREVENT DAMAGE TO THEIR EXISTING/PROPOSED IMPROVEMENTS. IN THE EVENT THAT SUCH DAMAGE SHOULD OCCUR FROM THE CONTRACTOR'S OPERATIONS, THE CONTRACTOR SHALL REPAIR, REPLACE OR BRING THE ORIGINAL CONDITION TO THE DAMAGED UTILITIES OR IMPROVEMENTS AT THE CONTRACTOR'S EXPENSE.
8. ALL PIPE LENGTHS INDICATED ON THIS PLAN ARE APPROXIMATE AND WILL VARY DURING CONSTRUCTION. HENCE, THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING AND VERIFYING ACTUAL LENGTHS AND SHALL NOT BID BASED ON THE VALUES PROVIDED ON THIS PLAN.
9. ALL MATERIALS SHALL BE NEW AND WITHOUT FLAWS OR DEFECTS OF ANY TYPE AND SHALL HAVE A MINIMUM GUARANTEE OF ONE YEAR AGAINST MATERIAL DEFECTS OR DEFECTIVE WORKMANSHIP.
10. ALL PVC PIPE SHALL BE CONTINUOUSLY AND PERMANENTLY MARKED WITH THE MANUFACTURER'S NAME OR TRADE MARK, SIZE, SCHEDULE, TYPE, WORKING PRESSURE AT 73 DEGREES F., SDR NUMBER, PRODUCTS STANDARD NUMBER AND NATIONAL SANITATION FOUNDATION (NSF) APPROVAL.
11. ALL LATERAL LINE PIPES SHALL BE SOLVENT WELDED.
12. SOLVENT WELDED PIPE FITTINGS SHALL BE MOLDED FITTINGS, SCHEDULE 40, MANUFACTURED OF THE SAME MATERIAL AS THE PIPE, AND SHALL BE SUITABLE FOR SOLVENT WELD SLIP JOINT RING, TIGHT SEAL OR THREADED CONNECTION.
13. CEMENT SHALL BE CLEAR PLASTIC, NON-CRACKING PIPE CEMENT FOR USE ON ALL SIZES AND SCHEDULES OF PVC PIPE AND FITTINGS. CEMENT MUST BE NSF APPROVED AND MEET ASTM D2564 SPECIFICATIONS. NO BLUE GLUE IS TO BE USED FOR ANY REASON.
14. CLEANER/PRIMER MUST BE ANY COLOR OTHER THAN CLEAR.
15. REFER TO ORIGINAL PROJECT SPECIFICATIONS AS WELL AS SPECIFICATIONS AND DETAILS PROVIDED BY LIQUID BOOT® AS REFERENCE.
16. THE CONTRACTOR IS TO INSTALL THE INDICATED LATERALS AS SHOWN, ANY RELOCATION OF PROPOSED LATERALS, HEADERS OR RISERS IS TO BE BROUGHT TO THE ENGINEER'S ATTENTION IMMEDIATELY.
17. ALL VERTICLE RISERS WILL BE LABELED PASSIVE GAS COLLECTION SYSTEM DO NOT ALTER.
18. LIQUID BOOT WILL BE INSTALLED UNDER THE COMPLETE BUILDING FOOT PRINT.



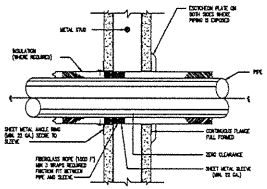
2 (R-1) PIPE SLEEVE DETAIL
SCALE: NONE

NOTE:
-REFER TO PLUMBING & ARCHITECTURAL DRAWINGS FOR ADDITIONAL DETAILS, INFORMATION AND SPECIFICATIONS



3 (R-1) TYPICAL FIRE WALL PENETRATION DETAIL
SCALE: NONE

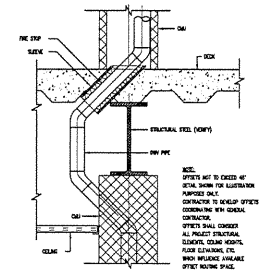
NOTE:
-REFER TO ARCHITECTURAL DRAWINGS FOR ADDITIONAL DETAILS INFORMATION AND SPECIFICATIONS



4 (R-1) PIPE SLEEVE DETAIL
SCALE: NONE

NOTE:
-REFER TO ARCHITECTURAL DRAWINGS FOR ADDITIONAL DETAILS, INFORMATION AND SPECIFICATIONS

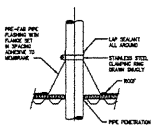
TYPICAL REMEDIATION PIPING
5 (R-1) SECTION FOR SLOPED ROOF
NOT TO SCALE



6 (R-1) PIPE RISER OFFSET DETAIL
SCALE: NONE

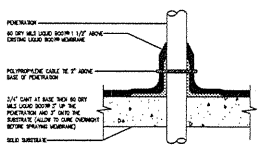
NOTE:
-REFER TO ARCHITECTURAL DRAWINGS FOR ADDITIONAL DETAILS, INFORMATION AND SPECIFICATIONS

NOTE:
OFFSETS NOT TO EXCEED 45° DETAIL SHOWN FOR ILLUSTRATION PURPOSES ONLY.
CONTRACTOR TO DEVELOP OFFSETS COORDINATING WITH GENERAL CONTRACTOR.
OFFSETS SHALL CONSIDER ALL PROJECT STRUCTURAL ELEMENTS, CEILING HEIGHTS, FLOOR ELEVATIONS, ETC. WHICH INFLUENCE AVAILABLE OFFSET ROUTING SPACE.



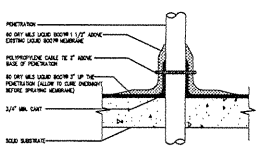
7 (R-1) VENT THROUGH ROOF DETAIL
SCALE: NONE

NOTE:
-REFER TO PLUMBING & ARCHITECTURAL DRAWINGS FOR ADDITIONAL DETAILS, INFORMATION AND SPECIFICATIONS



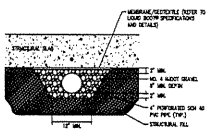
NOTE:
-ALL PENETRATIONS SHALL BE CLEANED PER SPECIFICATIONS BEFORE LIQUID BOOT® IS APPLIED
-REFER TO LIQUID BOOT® FOR ADDITIONAL DETAILS, INFORMATION AND SPECIFICATIONS
-REFER TO MANUFACTURERS REQUIREMENTS

LIQUID BOOT® GAS VAPOR PENETRATIONS WITH SOLID SUBSTRATE (OPTION 1)
8 (R-1) NOT TO SCALE

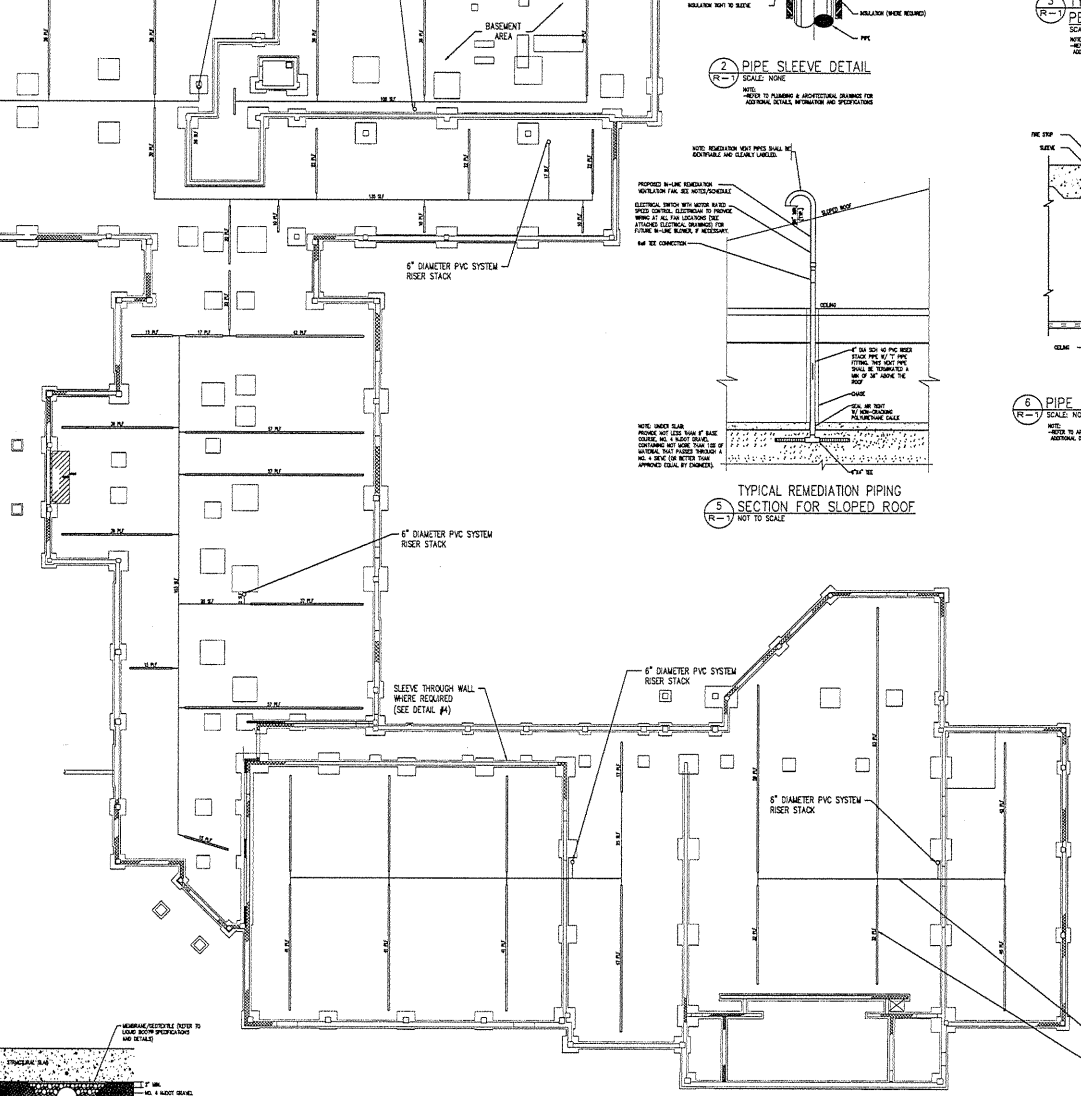


NOTE:
-ALL PENETRATIONS SHALL BE CLEANED PER SPECIFICATIONS BEFORE LIQUID BOOT® IS APPLIED
-REFER TO LIQUID BOOT® FOR ADDITIONAL DETAILS, INFORMATION AND SPECIFICATIONS
-REFER TO MANUFACTURERS REQUIREMENTS

LIQUID BOOT® GAS VAPOR PENETRATIONS WITH SOLID SUBSTRATE (OPTION 2)
9 (R-1) NOT TO SCALE



10 (R-1) VENTILATION SYSTEM DETAIL
SCALE: NONE



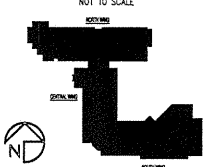
1 (R-1) SUB-SLAB GAS COLLECTION SYSTEM
SCALE: 1/16"=1'-0"

NOTE:
THIS MAP HAS BEEN REFERENCED AND CONSISTS OF INFORMATION TAKEN FROM A CONSTRUCTION PLAN SET ENTITLED "SCHOOL CONSTRUCTION PROGRAM FOR MARSHALL STREET ELEMENTARY SCHOOL, LOT 5, BLOCK 1000, LOTS 2-11, BLOCK 1002, PATERSON, NJ 07522, PREPARED FOR THE NJSCC, 1 WEST STATE STREET, TRENTON, NJ 08625, NJDEA CONTRACT #PA-0006-A03, NJDOE PROJECT #4010-N01-02-0169, NJDCA PROJECT #OLCEHPC-05--013 ERU #6095-05", DATED 12/1/06.

LEGEND/SYMBOLS:

20 PLF	TYPE AND LINEAR FEET OF 4" DIAMETER SCHEDULE 40 PVC PERFORATED/ PIPING LATERAL SECTIONS
220 SLF	TYPE AND LINEAR FEET OF 4" DIAMETER SCHEDULE 40 PVC SOLID PIPING HEADERS
○	6" DIAMETER SCHEDULE 40 SOLID PVC PIPING RISERS TO ROOF

KEY PLAN
NOT TO SCALE



SUB-SLAB COLLECTION SYSTEM

NJSDA
WEST STATE STREET
TRENTON, NEW JERSEY

MARSHALL STREET ELEMENTARY SCHOOL PROJECT
CITY OF PATERSON
PASSAIC COUNTY, NEW JERSEY

PROJECT MANAGER	B.U.	PROJECT NO.	07-01-39

THE WHITMAN companies, inc.
118 TICES LANE, UNIT B-1
EAST BRUNSWICK, NJ 08816
732-390-1888

SIZE	DRAWN BY	DATE INITIATED	DRAWING NUMBER
E	J.W.W.	4/4/07	R-1

ATTACHMENTS

LIQUID BOOT® Brownfield Membrane/Liner

Section 2 | Version 4.0

These Specifications may have changed. Please contact CETCO Liquid Boot Company (CLB) at 714.384.0111 for the most recent version.

NOTE: If the membrane is to also perform as a waterproofing membrane, do not use this specification. Use the standard LIQUID BOOT® fluid-applied waterproofing specification.

PART 1 - GENERAL

1.01 DESCRIPTION- General and Supplementary Conditions and Division 1- General Requirements applies to this section. Provide gas vapor barrier as indicated, specified and required.

A. Work in this section - principal items include:
   1. Gas vapor barrier providing protection from the following gases: Methane, other Hydrocarbon vapors in concentrations up to 20,000ppm, Hydrogen Sulfide, Radon
   2. Gas vapor barrier under single family homes.

B. Related work NOT in this section: excavation and backfilling, parge coat on masonry to receive gas vapor barrier membrane, mortar beds or concrete toppings over gas vapor barrier membranes, latex waterproofing, damp-proofing, flashing and sheet metal, joint sealers, soil sterilant, gas collection systems, gas monitoring, and drainage.

1.02 QUALITY ASSURANCE- Gas vapor barrier contractor/applicator shall be trained and approved by gas vapor barrier manufacturer, CETCO Liquid Boot Company (CLB). A pre-installation conference shall be held prior to application of gas vapor barrier to assure proper substrate and installation conditions, to include contractor, applicator, architect/engineer and special inspector.

1.03 SUBMITTALS

A. Project Data - Submit manufacturer's product data and installation instructions for specific application.

B. Samples - Submit representative samples of the following for approval:
   1. Gas vapor barrier membrane material.
   2. Protection Board and/or Protection Mat.
   3. Prefabricated Drainage Mat.
   4. Geotextiles.

1.04 DELIVERY, STORAGE AND HANDLING- Deliver materials to site in original unbroken packages bearing manufacturer's label showing brand, weight, volume, and batch number. Store materials at site in strict compliance with manufacturer's instructions. Do not allow materials to freeze in containers.

1.05 JOB CONDITIONS

A. Protect all adjacent areas not to receive gas vapor barrier. Where necessary, apply masking to prevent staining of surfaces to remain exposed wherever membrane abuts to other finish surfaces.

B. Perform work only when existing and forecasted weather conditions are within manufacturer's recommendations for the material and product used.

C. Minimum clearance of required for application of product: 90° spray wand- 2 feet / Conventional spray wand- 4 feet.

D. Ambient temperature shall be within manufacturer's specifications. If winter conditions apply, we recommend the use space of heaters and necessary cover (i.e. visqueen) to bring the ambient temperature to at least +45°F until the protection course and structural slab rebar or a mudslab protection course has been placed.

E. All plumbing, electrical, mechanical and structural items to be under or passing through the gas vapor barrier shall be positively secured in their proper positions and appropriately protected prior to membrane application.

F. Gas vapor barrier shall be installed before placement of reinforcing steel. When not possible, all exposed reinforcing steel shall be masked by General Contractor prior to membrane application.

G. Expansion joints must be filled with a conventional waterproof expansion joint material.

H. Surface preparation shall be per manufacturer's specification.

1.06 PRODUCT WARRANTY- CETCO Liquid Boot Company (CLB) warrants its products to be free of defects. This warranty only applies when the LIQUID BOOT® is applied by CETCO Liquid Boot Company Approved Applicators and that the required respective CLB products (such as LIQUID BOOT® UltraDrain. LIQUID BOOT® UltraShield, LIQUID BOOT® BaseFabric and LIQUID BOOT® GeoVent) are used. As factors, which affect the

result obtained from this product, including weather, equipment utilized, construction, workmanship and other variables- are all beyond the manufacturer's control, CLB warrants only that the material conforms to its product specifications. Under this warranty CLB will replace at no charge any product not meeting these specifications within 12 months of manufacture, provided it has been applied in accordance with CLB's written directions for use recommended as suitable for this product. Warranties are available for a longer period upon request and mutual written consent. This warranty is in lieu of any and all other warranties expressed or implied (including any implied warranty of merchantability or fitness for a particular use), and CLB shall have no further liability of any kind including liability for consequential or incidental damages resulting from any defects or delays caused by replacement or otherwise.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fluid applied gas vapor barrier system - LIQUID BOOT®; a single course, high build, polymer modified asphaltic emulsion. Water borne and spray applied at ambient temperatures. A minimum thickness of 60 dry mils, unless specified otherwise as some cities and engineers may require a thicker membrane. Non-toxic and odorless. LIQUID BOOT® Trowel Grade has similar properties with greater viscosity and is trowel applied. Manufactured by CETCO Liquid Boot Company, Santa Ana, CA (714) 384-0111.

C. Gas vapor barrier physical properties:

GAS VAPOR MEMBRANE	TEST METHOD	VALUE
Hydrogen Sulfide Gas Permeability	ASTM D1434	None Detected
Benzene, Toluene, Ethylene, Xylene, Gasoline, Hexane, Perchloroethylene	ASTM D543, D412, D1434 (tested at 20,000 ppm)	Passed in gas permeability and weight change
Acid Exposure (10% H_2SO_4 for 90 days)	ASTM D543	Less than 1% weight change
Radon Permeability	Tested by US Dept. of Energy	Zero permeability to Radon (222Rn)
Bonded Seam Strength Tests	ASTM D6392	Passed
Micro Organism Resistance (Soil Burial)- average weight change, average tensile strength change, average tensile stress change, average elongation change, bonded seams, methane permeability	ASTM D4068-88	Passed
Methane Permeability	ASTM 1434-82	Passed
Oil Resistance Test- average weight change, average tensile strength change, average tensile stress change, average elongation change, bonded seams, methane permeability	ASTM D543-87	Passed
Heat Aging- average tensile strength change, average tensile stress change, average elongation change, bonded seams	ASTM D4068-88	Passed
Dead Load Seam Strength	City of Los Angeles	Passed
Environmental Stress-Cracking	ASTM D1693-78	Passed
PCE Diffusion Coefficient	Tested at 6,000 mg/m³	2.74 x 10-14 m²/sec
TCE Diffusion Coefficient	Tested at 20,000 mg/m³	8.04 x 10-14 m²/sec
WATERPROOFING	**TEST METHOD**	**VALUE**
Soil Burial	ASTM E154-88	Passed
Water Penetration Rate	ASTM D2434	<7.75 x 10^{-9} cm/sec
Water Vapor Permeability	ASTM E96	0.24 perms
Water Vapor Transmission	ASTM E96	0.10 grains/h-ft²
POTABLE WATER	**TEST METHOD**	**VALUE**
Toxicity Test	22 CCR 66696	Passed. CCR Bioassay—Flathead Minnow
Potable Water Containment	ANSI/NSF 61	NSF Certified for tanks >300,000 gal
GENERAL INFORMATION	**TEST METHOD**	**VALUE**
Coefficient of Friction- geotextile both sides	ASTM D5321	0.72
Cold Bend Test	ASTM D146	Passed. No cracking at –25°F
Freeze-Thaw Resistance (100 Cycles)	ASTM A742	Meets criteria. No spalling or disbondment
Accelerated Weathering & Ultraviolet Exposure	ASTM D822	No adverse effect after 500 hours
Hydrostatic Head Resistance	ASTM D751	Tested to 138 feet or 60 p.s.i
Elongation	ASTM D412	1,332% - Ø reinforcement, 90% recovery
Elongation- 8oz. non-woven geotextile both sides	ASTM D751	100% (same as geotextile tested separately)
Tensile Strength	ASTM D412	58 p.s.i. without reinforcement
Tensile Strength-8oz. non-woven geotextile both sides	ASTM D751	196 p.s.i. (same as geotextile tested separately)
Tensile Bond Strength to Concrete	ASTM D413	2,556 lbs/ft² uplift force
Puncture Resistance-8oz. non-woven geotextile both sides	ASTM D4833	286 lbs. (Probe Travel= .756 in., same as geotextile tested separately)
Flame Spread	ASTM E108	Class A with top coat (comparable to UL790)
Electric Volume Resistivity	ASTM D257	1.91 x 10^{10} ohms-cm

C. Agency Approvals:
- City of Los Angeles Research Report # 24860-Approved for "LIQUID BOOT® Membrane for Below-Grade Waterproofing and Gas Barrier"
- United States Navy-Approved for "LIQUID BOOT® for Use World Wide to Waterproof Earth-Covered Steel Ammunition Storage"
- NSF International-NSF/61 approved for "Potable Water Tank Liner"
- Canadian Construction Materials Board-Approved for "Waterproofing and Damp proofing"
- County of Los Angeles Department of public works-Approved for "LIQUID BOOT® Application as a Methane Gas Barrier"

D. **LIQUID BOOT® 500- Contact CETCO Liquid Boot Company before specifying or bidding LIQUID BOOT® 500 to insure LIQUID BOOT® 500 is appropriate for the project.** LIQUID BOOT® 500 may be used in lieu of LIQUID BOOT® (described in section 2.01 B. above) where the membrane is not exposed to hydrostatic head pressure. The Agency Approvals in section 2.01 C above do not apply to LIQUID BOOT® 500. The physical properties for LIQUID BOOT® 500 are as follows:

Note: LIQUID BOOT® 500 may tend to sag on vertical surfaces at higher ambient temperatures. When this condition occurs, use LIQUID BOOT® at these locations.

WATERPROOFING	TEST METHOD	VALUE
Elongation	ASTM D412	800%
Bond Seam Strength Tests	ASTM D6392	Passed
Methane Permeability	ASTM D1434	None detected
Water Vapor Permeability	ASTM E96	0.18 perms

- Agency Approval- City of Los Angeles Research Report-RR 25549-Approved for "LIQUID BOOT® 500 Spray Applied Membrane for Below-Grade Waterproofing and Gas Barrier"

E. Protection- On vertical surfaces, use LIQUID BOOT® UltraShield P-100 or other protections as approved by the manufacturer, project architect or engineer. On horizontal surfaces, use LIQUID BOOT® UltraShield G-1000 or other protections as approved by the manufacturer, project architect or engineer.

Due to the diverse jobsite conditions, all protection materials must be approved by the membrane manufacturer, including the use of the LIQUID BOOT® UltraShield products.

F. Prefabricated Drain Mat- On vertical surfaces, use LIQUID BOOT® UltraDrain 6200. On horizontal surfaces, use LIQUID BOOT® UltraDrain 9000

G. Adhesive system for LIQUID BOOT® UltraShield and LIQUID BOOT® UltraDrain: Use LIQUID BOOT® UltraGrip.

H. Gas vapor vent piping- LIQUID BOOT® GeoVent system

I. Base Geotextile- LIQUID BOOT® BaseFabric T-40 non-woven geotextile, unless otherwise specified and approved by membrane manufacturer. The heat-rolled side shall be used as the application surface. Some projects may require a heavier geotextile (LIQUID BOOT® BaseFarbic T-60.)

J. Cold Joints, Cracks, Form Tie Holes: Covered with Hardcast CRT 1602 Tape 3" wide.

PART 3 - EXECUTION

3.01 **EXAMINATION-** All surfaces to receive gas vapor barrier shall be inspected and approved by the applicator at least one day prior to commencing work.

3.02 **SURFACE PREPARATION-** Provide 24 inch minimum clearance out from surfaces to receive the gas vapor barrier. The application surface shall be prepared and provided to the applicator in accordance with manufacturer's specifications listed below:

A. **Concrete/Shotcrete/Masonry-** Concrete surfaces shall be light broom finish or smoother, free of any dirt, debris, loose material, release agents or curing compounds. Fill all voids more than 1/4 inch deep and 1/4 inch wide. Masonry joints, cold joints, and form joints shall be struck smooth. All penetrations shall be prepared in accordance with manufacturer's specifications. Provide a 3/4 inch minimum cant of LIQUID BOOT®, or other suitable material as approved by manufacturer, at all horizontal to vertical transitions and other inside corners of 120° or less. Allow to cure overnight before the application of LIQUID BOOT®. All cracks or cold joints greater than 1/16 inch must be completely grouted with non-shrink grout as approved by engineer. Install Hardcast reinforcing tape over all cold joints, cracks and form tie holes (after holes and cracks are grouted).

B. **Dirt & Gravel-** The sub-grade shall be moisture conditioned and compacted to a minimum relative compaction of 90 percent or as specified by civil/geotechnical engineer. The finished surface shall be smooth, uniform, free of debris and standing water. Remove all stones or dirt clods greater than 1/4 inch. (NOTE: Aggregate sub-bases shall be rolled flat, free from any protruding sharp edges). Penetrations shall be prepared in accordance with manufacturer's specifications. All form stakes that penetrate the membrane shall be of rebar which shall be bent over and left in the slab. Trenches shall be cut oversize to accommodate gas vapor barrier membrane and protection course with perpendicular to sloped sides and maximum obtainable compaction. Adjoining grade shall be finish graded and compacted. Excavated walls shall be vertical or sloped back, free of roots and protruding rocks. Specific sub-grade preparation shall be designed by a qualified civil or geotechnical engineer. If organic materials with potential for growth (ie: seeds or grasses) exist within the sub-base, spray apply soil sterilant at the sterilant manufacturer's recommended rate.

3.03 INSTALLATION

3.03.10 INSTALLATION ON CONCRETE/SHOTCRETE/MASONRY (Follow the procedures below carefully)

A. Refer to section 3.03.30, "Sealing Around Penetrations", for procedures to seal around penetrations.

B. Provide a ¾" minimum cant of LIQUID BOOT®, or other suitable material as approved by manufacturer, at all horizontal to vertical transitions and other inside corners of 120° or less. **Allow to cure overnight before the application of LIQUID BOOT®.**

C Delineate a test area on site with a minimum dimension of 10 feet by 10 feet (3m by 3m). Apply LIQUID BOOT® to a thickness of 60 mils and let it cure for **24 hours.** Observe for blisters. If minor or no blistering occurs, proceed to the next step. (See note regarding blisters). If significant blistering does occur, apply a thin (10 mil) tack coat of LIQUID BOOT® "A" side without catalyst to the entire concrete surface and allow to cure before proceeding. (See also information regarding blister repair).

D. Spray apply LIQUID BOOT® to a 60 mil minimum dry thickness. Increase thickness to 100 dry mils if shotcrete is to be applied directly to membrane. If a second coat is required, remove any standing water from the membrane before proceeding with the second application.

E. Do not penetrate membrane. Keep membrane free of dirt and debris and traffic until a protective cover is in place. It is the responsibility of the General Contractor to insure that the membrane and the protection system are not penetrated.

F. After membrane has cured and checked for proper thickness and flaws, install protection material pursuant to manufacturer's instructions.
NOTE: All testing or inspection to be performed prior to placing protection course.

NON-HORIZONTAL SURFACES: Spray on non-horizontal surfaces should begin at the bottom and work towards the top. This method allows the product to adhere to the surface before hitting catalyst runoff.

NOTE: Due to the nature of concrete as a substrate, it is normal for some blistering to occur. This is caused by either concrete's tendency to off-gas or water that is temporarily trapped between the concrete and the membrane. With time and the applied pressure of backfill or over-slab, blisters will absorb into the concrete without detriment to the membrane. A small number of blister heads should be sampled and checked for proper membrane thickness. If the samples have the minimum required membrane thickness, then the remaining blisters should not be punctured or cut. If the samples have less than the minimum required membrane thickness, then the area can either be re-sprayed to obtain the proper thickness, or the blisters can be cut out and the area re-sprayed or patched with LIQUID BOOT® Trowel Grade.

3.03.20 INSTALLATION ON DIRT SURFACES AND MUDSLABS

A. Roll out LIQUID BOOT® BaseFabric geotextile on sub-grade with the heat-rolled side facing up. Overlap seams a minimum of 6 inches. Lay geotextile tight at all inside corners. Apply a thin 10 mil tack coat of LIQUID BOOT® "A" side without catalyst within the seam overlap. Line trenches with geotextile extending at least six inches (6") onto adjoining sub-grade if slab and footings are to be sprayed separately. Overlap seams a minimum of 6 inches. Lay geotextile tight at all inside corners. Apply a thin 10 mil tack coat of LIQUID BOOT® "A" side without catalyst within the seam overlap.

B. Minimize the use of nails to secure the geotextile to the dirt subgrade. Remove all nails before spraying membrane, if possible. Nails that cannot be removed from the dirt subgrade are to be patched with geotextile or Hardcast reinforcing tape overlapping the nail head by a minimum of two inches (2"). Apply a thin tack coat of LIQUID BOOT® under the geotextile patch, when patching with geotextile.

C. Refer to section 3.03.30, "Sealing Around Penetrations", for procedures to seal around penetrations.

D. Spray apply LIQUID BOOT® onto geotextile to a 60 mil minimum dry thickness. Increase thickness to 100 dry mils if shotcrete is to be applied directly to membrane. If a second coat is required, remove any standing water from the membrane before proceeding with the second application.

E. Do not penetrate membrane. Keep membrane free of dirt, debris and traffic until a protective cover is in place. **It is the responsibility of the General Contractor to insure that the membrane and the protection system are not penetrated.**

F. After membrane has cured and checked for proper thickness and flaws, install protection material pursuant to manufacturer's instructions.
NOTE: All testing or inspection to be performed prior to placing protection course.

3.03.30 SEALING AROUND PENETRATIONS

3.03.31 OPTION 1

A. Clean all penetrations. All metal penetrations shall be sanded clean with emery cloth.

B. For applications requiring LIQUID BOOT® BaseFabric geotextile, roll out geotextile on sub-grade with the heat-rolled side facing up, overlapping seams a minimum of six inches (6"). Cut the geotextile around penetrations so that it lays flat on the sub-grade. Lay geotextile tight at all inside corners. Apply a thin (10 mil) tack coat of LIQUID BOOT® "A" side without catalyst within the seam overlap.

C. At the base of penetration Install a minimum ¾ inch thick membrane cant of LIQUID BOOT®, or other suitable material as approved by manufacturer. Extend the membrane at a 60 mil thickness three inches (3") around the base of penetration and up the penetration a minimum of three inches (3"). **Allow to cure overnight before the application of LIQUID BOOT® membrane. (See attached manufacturer's standard detail.)**

D. Spray apply LIQUID BOOT® to an 60 mils minimum dry thickness around the penetration, completely encapsulating the collar assembly and to a height of one and one half inches (1 1/2") minimum above the membrane as described in 3.03.31 C above. Spray apply LIQUID BOOT® to surrounding areas as specified for the particular application. **(SEE MANUFACTURER'S STANDARD DETAIL)**

E. Allow LIQUID BOOT® to cure completely before proceeding to step "F".

F. Wrap penetration with polypropylene cable tie at a point two inches (2") above the base of the penetration. Tighten the cable tie firmly so as to squeeze, but not cut, the cured membrane collar.

3.03.32 OPTION 2 (For Gas Vapor Membrane Only)

A. Clean all penetrations. All metal penetrations shall be sanded clean with emery cloth.

B. For applications requiring LIQUID BOOT® BaseFabric geotextile, roll out geotextile on sub-grade with the heat-rolled side facing up, overlapping seams a minimum of six inches (6"). Cut the geotextile around penetrations so that it lays flat on the sub-grade. Lay geotextile tight at all inside corners. Apply a thin (10 mil) tack coat of LIQUID BOOT® "A" side without catalyst within the seam overlap.

C. Spray-apply LIQUID BOOT® to surrounding areas as specified for the particular application to a 60 mil minimum dry thickness. At the base of penetration Install a minimum 3/4 inch thick membrane cant of LIQUID BOOT®, or other suitable material as approved by manufacturer. Extend the membrane at 60 mil thickness up the penetration a minimum of three inches (3"). Allow to cure overnight before proceeding to D **(SEE MANUFACTURER'S STANDARD DETAIL)**

D. Spray apply LIQUID BOOT® the membrane at an 60 mil thickness three inches (3") around the base of penetration and up the penetration, completely encapsulating the collar assembly, to a height of one and one half inches (1 1/2") minimum above the membrane as described in 3.03.32 C above. **(SEE ATTACHED MANUFACTURER'S STANDARD DETAIL)**

E. Allow LIQUID BOOT® to cure completely before proceeding to step "F".

F. Wrap penetration with polypropylene cable tie at a point two inches (2") above the base of the penetration. Tighten the cable tie firmly so as to squeeze, but not cut, the cured membrane collar.

3.04 FIELD QUALITY CONTROL- Field Quality Control is a very important part of all LIQUID BOOT® applications. Applicators should check their own work for coverage, thickness, and all around good workmanship before calling for inspections.

The membrane must be cured at least overnight before inspecting for dry-thickness, holes, shadow shrinkage, and any other membrane damage. If water testing is to be performed, allow the membrane to cure at least 72 hours prior to the water test. When thickness or integrity is in question the membrane should be tested in the proper manner as described below. However, over-sampling defeats the intent of inspections. Inspectors should always use visual and tactile measurement to guide them. Areas suspected of being too thin to the touch should be measured with the gauges to determine the exact thickness. With practice and by comparing tactile measurements with those of the gauges, fingers become very accurate tools.

3.04.10 ON CONCRETE/SHOTCRETE/MASONRY & OTHER HARD SURFACES

A. Membrane may be checked for proper thickness with a blunt-nose depth gauge, taking one reading every 500 square feet. Record the readings. Mark the test area for repair, if necessary.

B. If necessary, test areas are to be patched over with LIQUID BOOT® to a 60 mils minimum dry thickness, extending a minimum of one inch (1") beyond the test perimeter.

3.04.20 ON DIRT AND OTHER SOFT SUBSTRATES

A. Samples may be cut from the membrane and geotextile sandwich to a maximum area of 2 square inches. Measure the thickness with a mil-reading caliper, per 500 sq. feet. Deduct the plain geotextile thickness to determine the thickness of LIQUID BOOT® membrane. Mark the test area for repair.

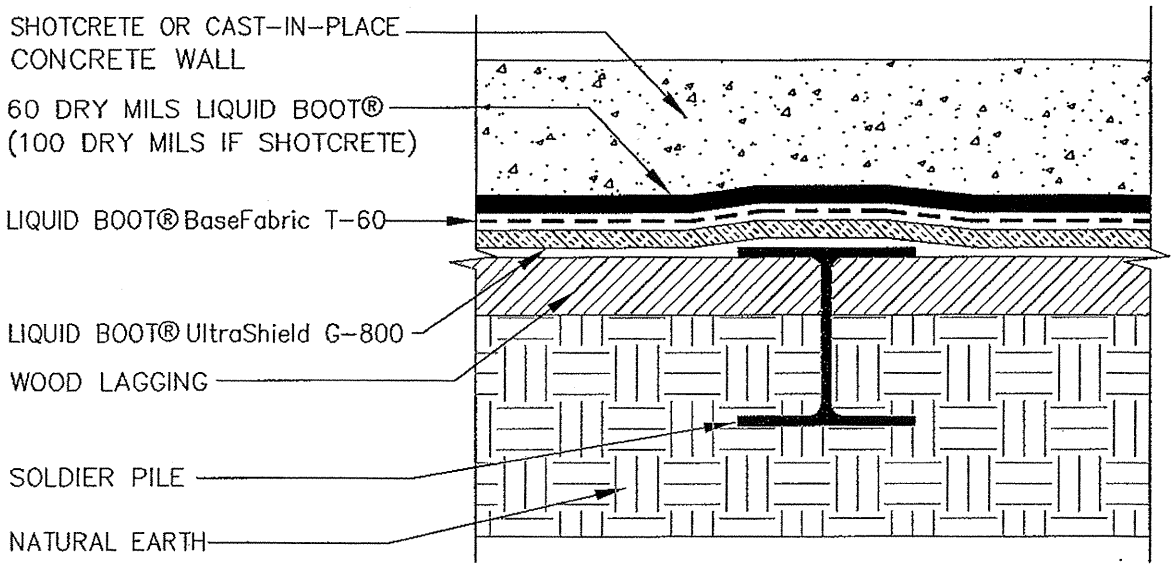
B. Voids left by sampling are to be patched with geotextile overlapping the void by a minimum of two inches (2"). Apply a thin tack coat of LIQUID BOOT® under the geotextile patch. Then spray or trowel apply LIQUID BOOT® to a 60 mils minimum dry thickness, extending at least three inches (3") beyond geotextile patch.

3.04.30 SMOKE TESTING FOR HOLES (Optional) - Holes or other breaches in the membrane can be detected by conducting a smoke test. This involves pumping smoke under the membrane for a specified period of time, under a specified pressure, which varies from project to project. Contact CLB for information about this test at 714-384-0111.

LIQUID BOOT® Brownfield Membrane/Liner

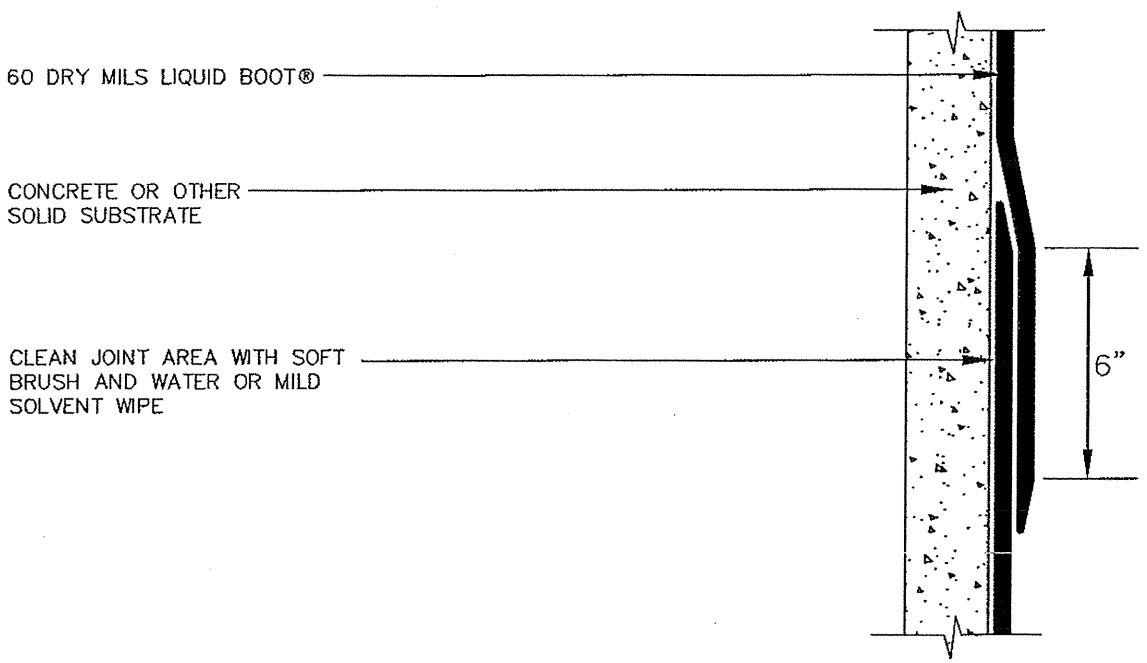
Standard Details

CETCO Liquid Boot Company • 1001 S. Linwood Ave. • Santa Ana, CA 92705 • Ph: 714-384-0111 • Fax: 714-384-0112 • www.liquidboot.com



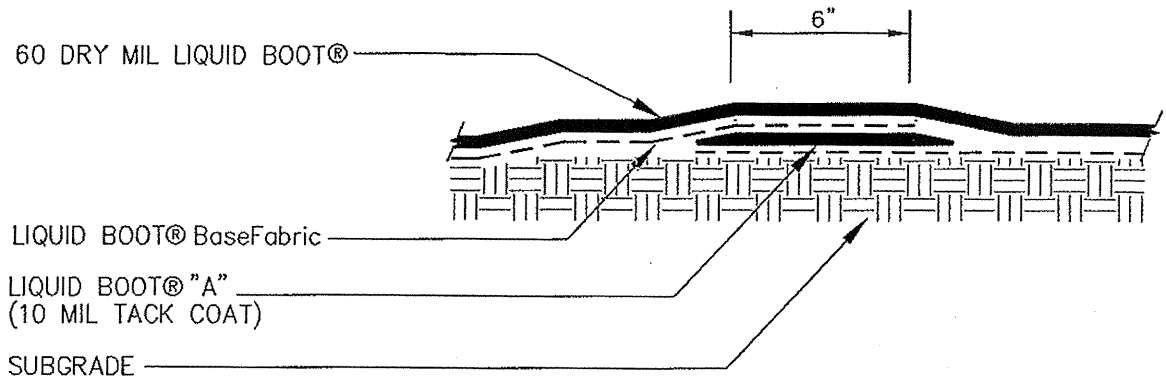
GAS VAPOR BARRIER
ZERO LOT LINE WITH LAGGING
NOT TO SCALE

G1.1



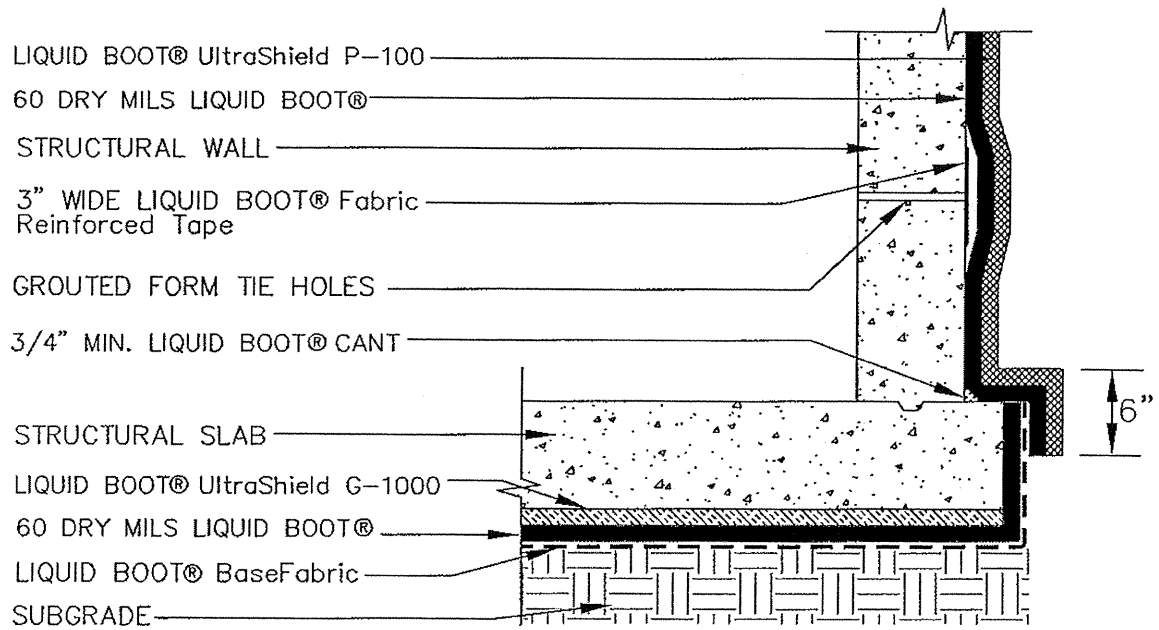
GAS VAPOR BARRIER
MEMBRANE LAP JOINTS
ON SOLID SUBSTRATE
NOT TO SCALE

G1.2



GAS VAPOR BARRIER
MEMBRANE LAP JOINTS
ON GEOTEXTILE
NOT TO SCALE

G1.3

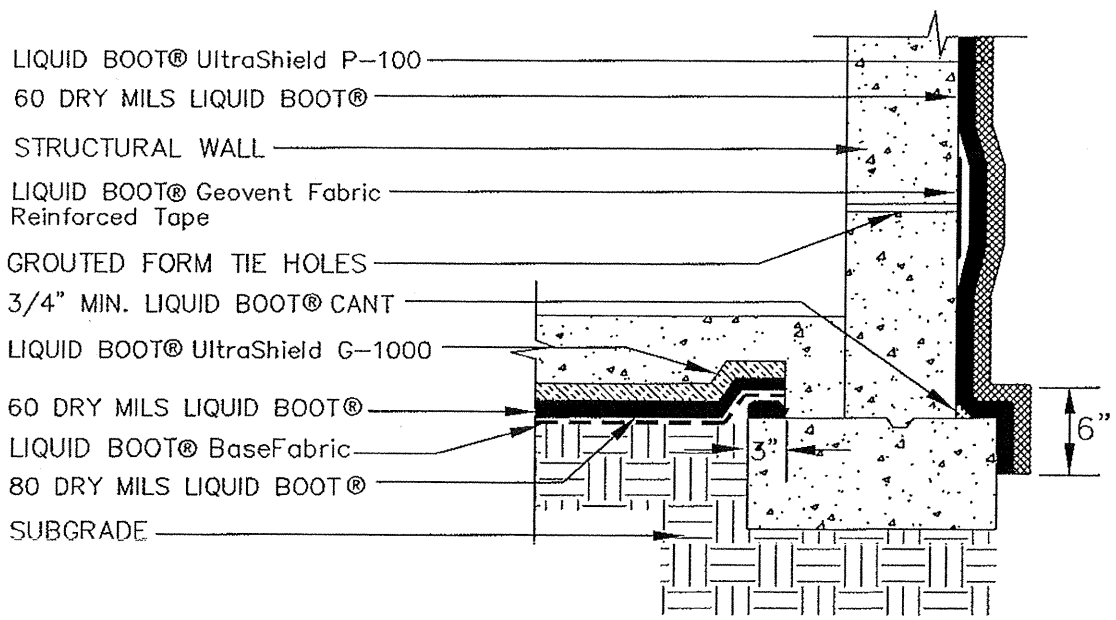


GAS VAPOR BARRIER
UNDER SLAB AND WALLS

NOT TO SCALE

G2.1

NOTE:
Terminate membrane
1" above finish grade.

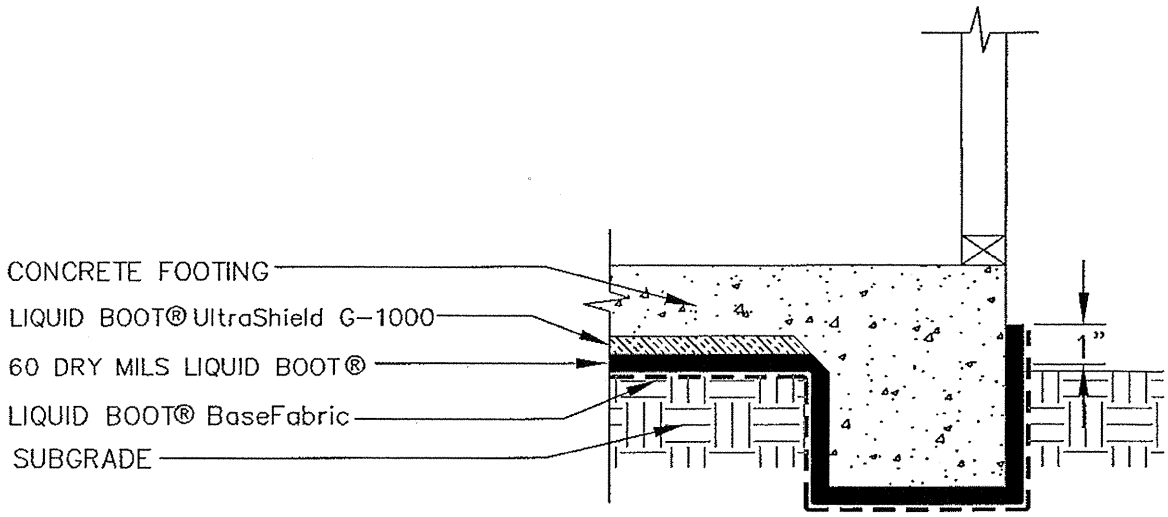


GAS VAPOR BARRIER
UNDERSLAB AND WALLS

NOT TO SCALE

G2.2

NOTE:
Terminate membrane
1" above finish grade.

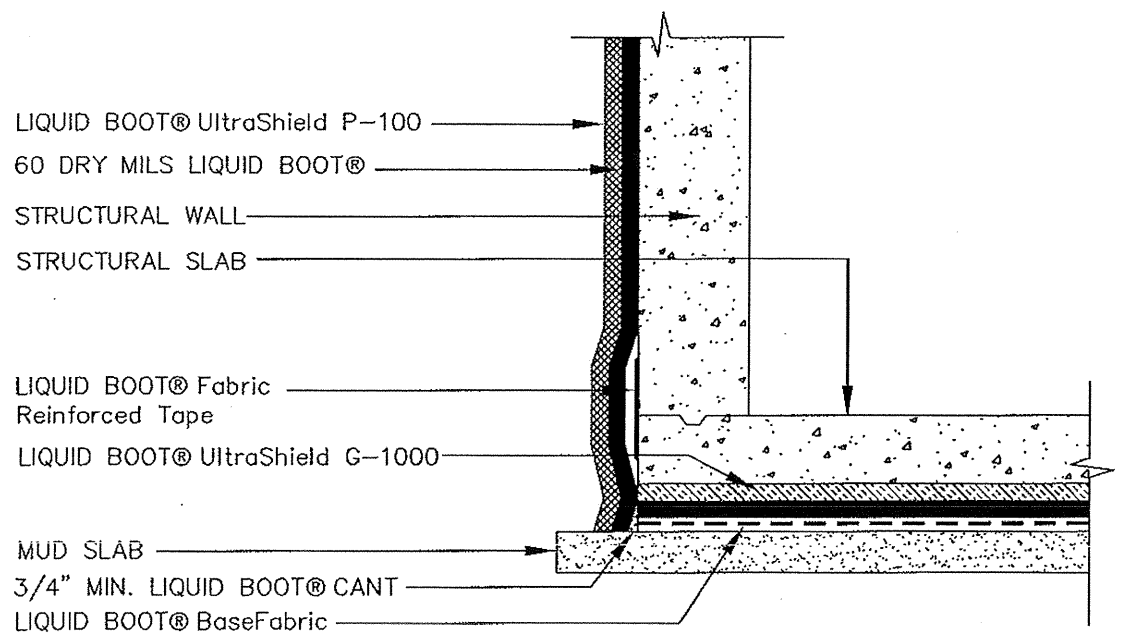


GAS VAPOR BARRIER
FOOTING AND GRADE BEAMS

NOT TO SCALE

G2.3

NOTE:
Terminate membrane
1" above finish grade.

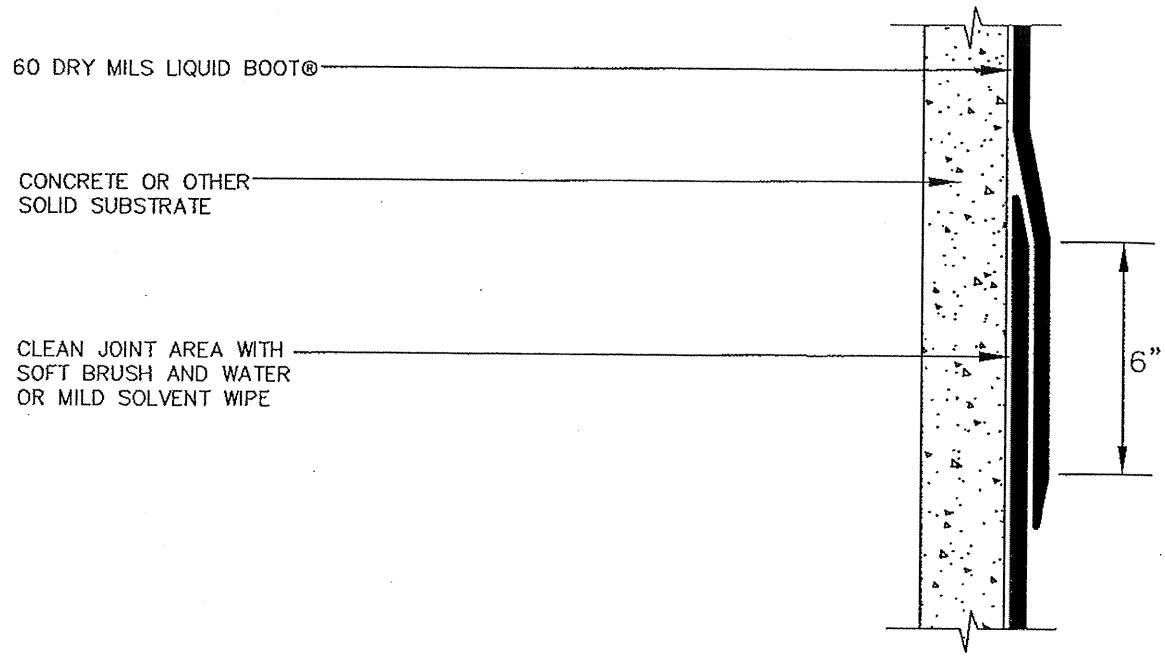


GAS VAPOR BARRIER
ON MUDSLABS

NOT TO SCALE

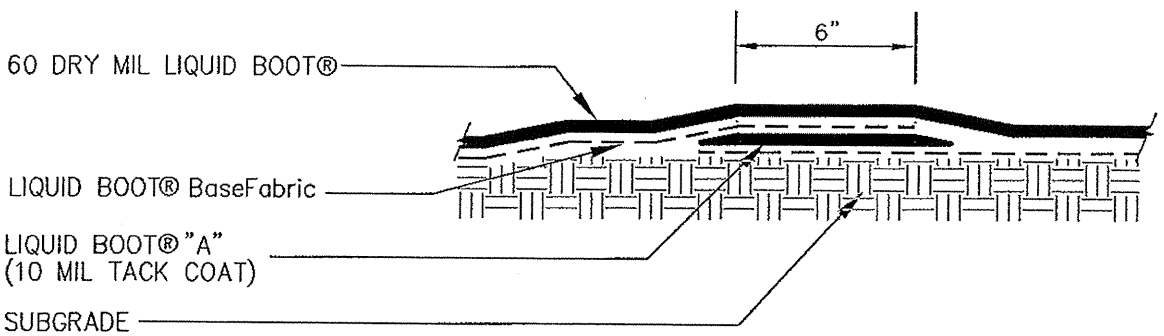
G2.4

NOTE:
Terminate membrane
1" above finish grade.



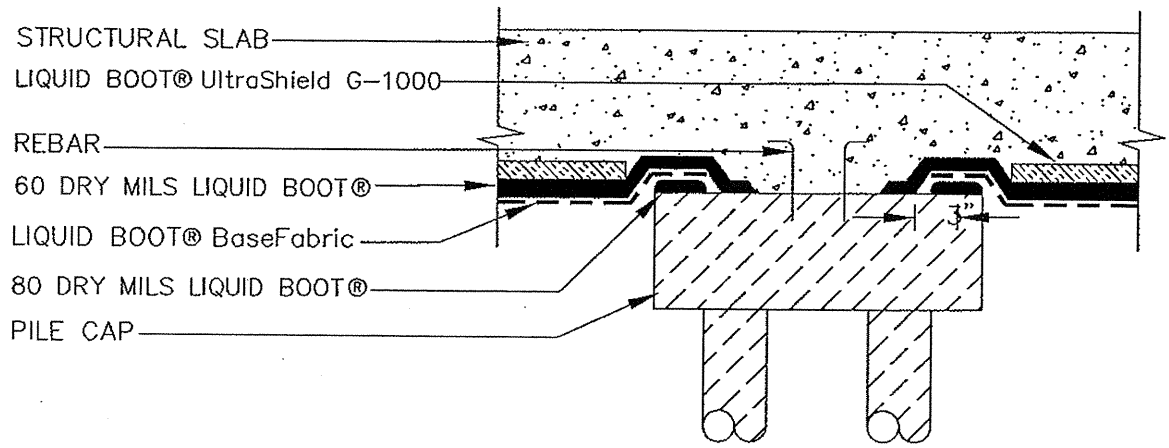
GAS VAPOR BARRIER MEMBRANE LAP JOINTS ON SOLID SUBSTRATE
NOT TO SCALE

G2.5



GAS VAPOR BARRIER MEMBRANE LAP JOINTS ON GEOTEXTILE
NOT TO SCALE

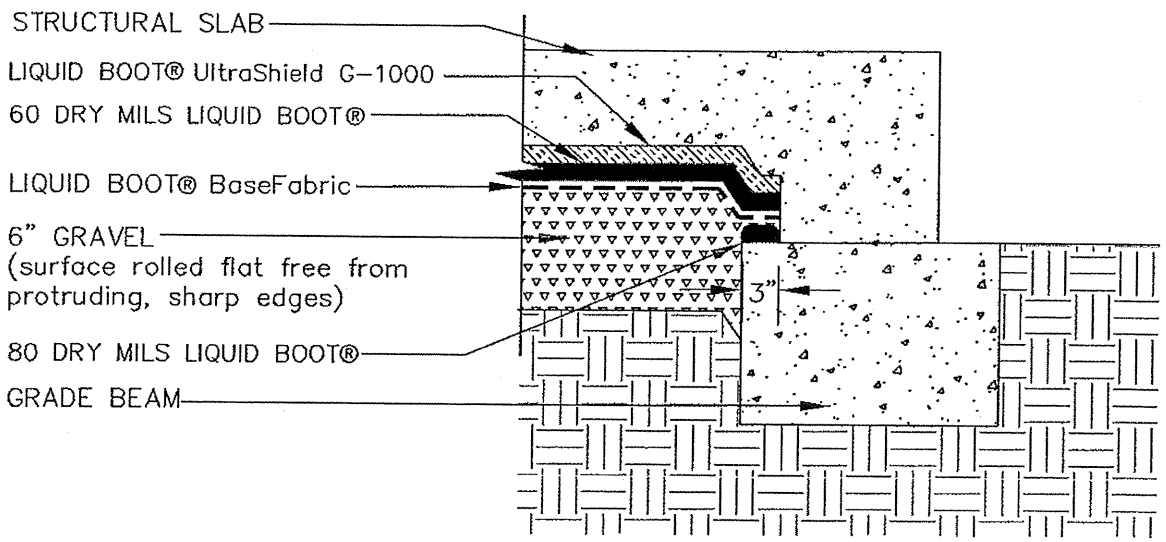
G2.6



NOTE:
Bring the membrane 3" onto the pile cap. The geotextile is then encapsulated in the membrane.

GAS VAPOR BARRIER
PILE CAP
NOT TO SCALE

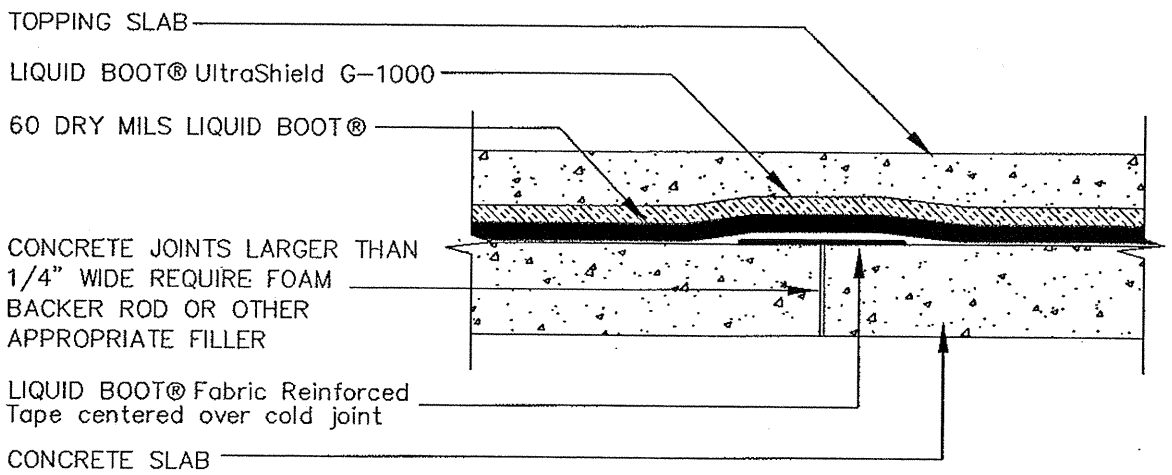
G2.7



NOTE:
Bring the membrane 3" onto the footings. The geotextile is then encapsulated in the membrane.

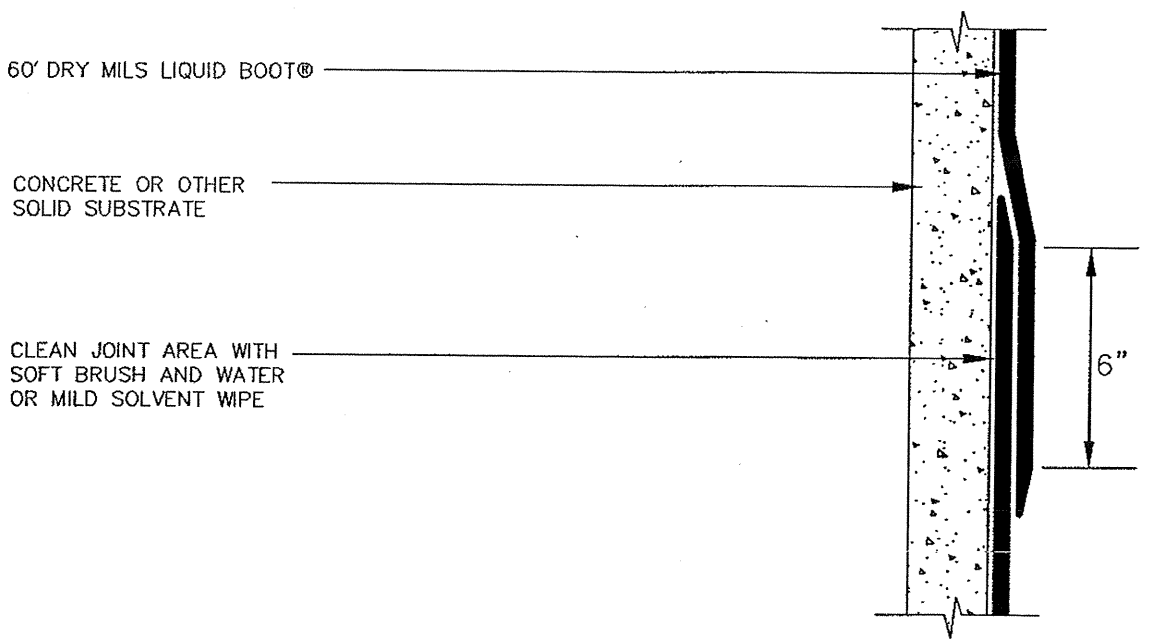
GAS VAPOR BARRIER
OVER FOOTINGS AND
GRADE BEAMS
NOT TO SCALE

G2.8



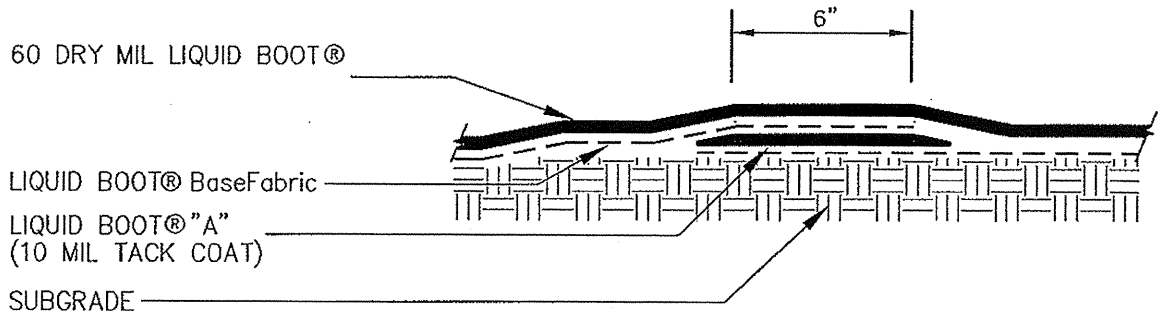
GAS VAPOR BARRIER
BETWEEN SLAB &
CONCRETE COLD JOINTS
NOT TO SCALE

G3.1



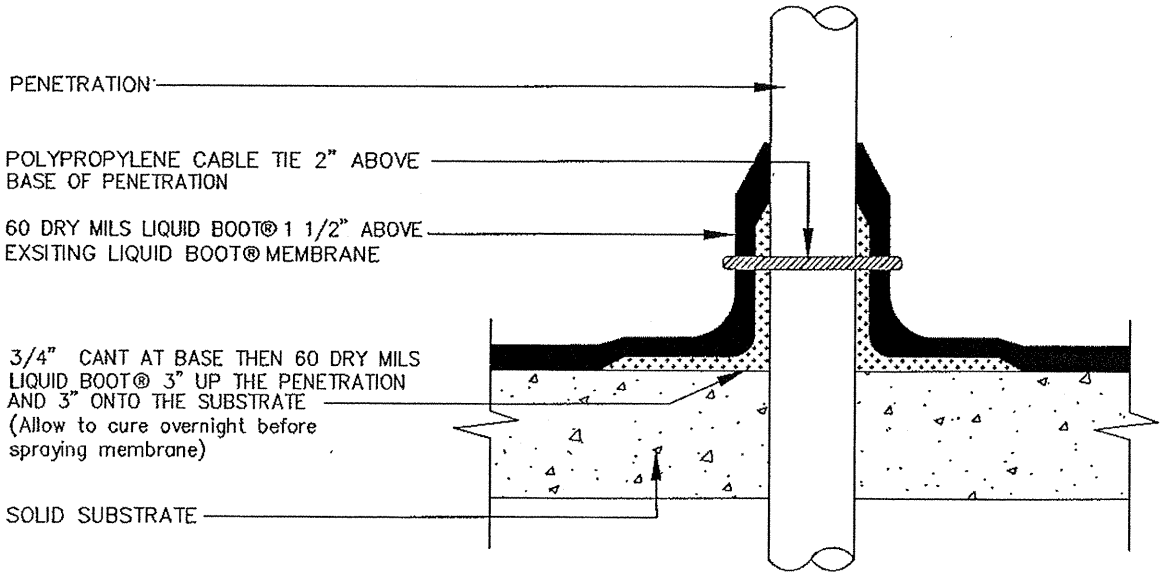
GAS VAPOR BARRIER
MEMBRANE LAP JOINTS
ON SOLID SUBSTRATE
NOT TO SCALE

G3.2



GAS VAPOR BARRIER
MEMBRANE LAP JOINTS
ON GEOTEXTILE
NOT TO SCALE

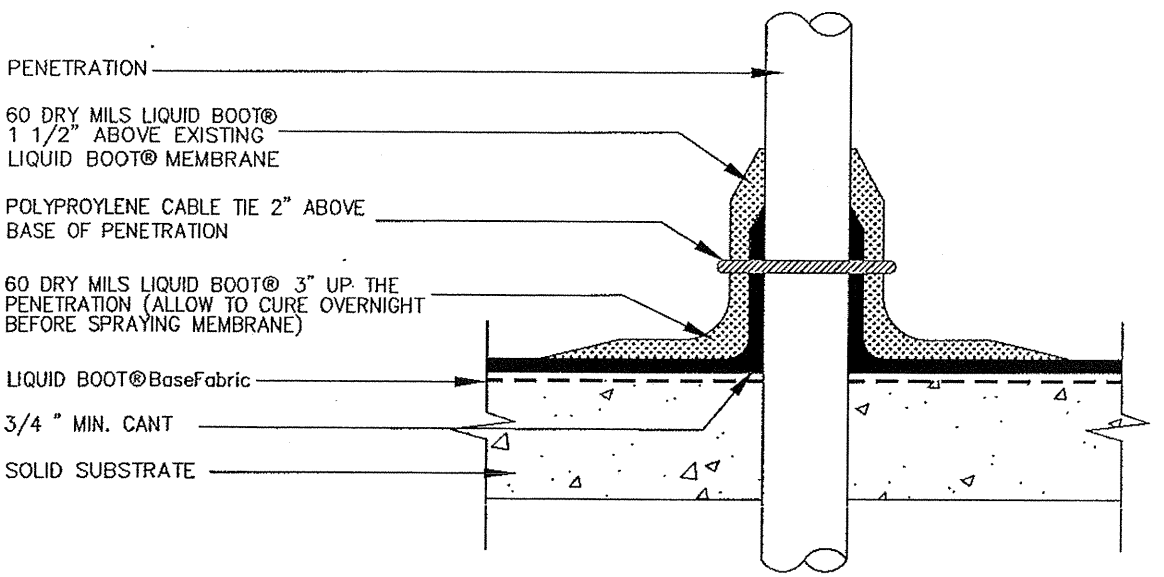
G3.3



NOTE:
All penetrations shall be cleaned per specification before LIQUID BOOT® is applied.

GAS VAPOR BARRIER
PENETRATIONS
WITH SOLID SUBSTRATE
NOT TO SCALE

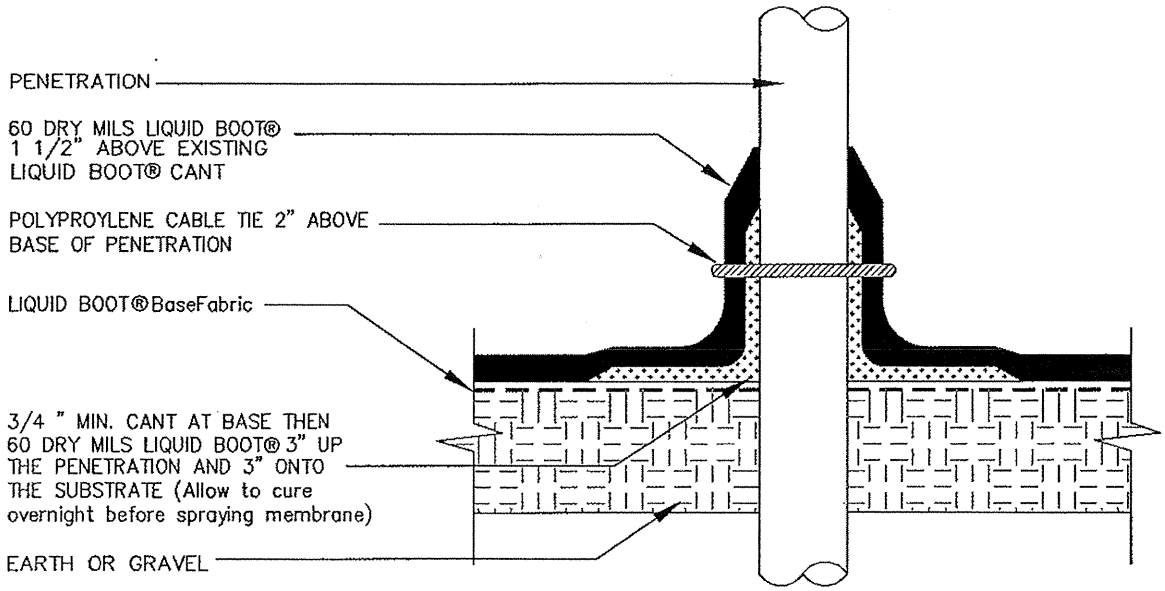
G4.1



NOTE:
All penetrations shall be cleaned per specification before LIQUID BOOT® is applied

GAS VAPOR BARRIER
PENETRATIONS WITH SOLID
SUBSTRATE (OPTION 2)
NOT TO SCALE

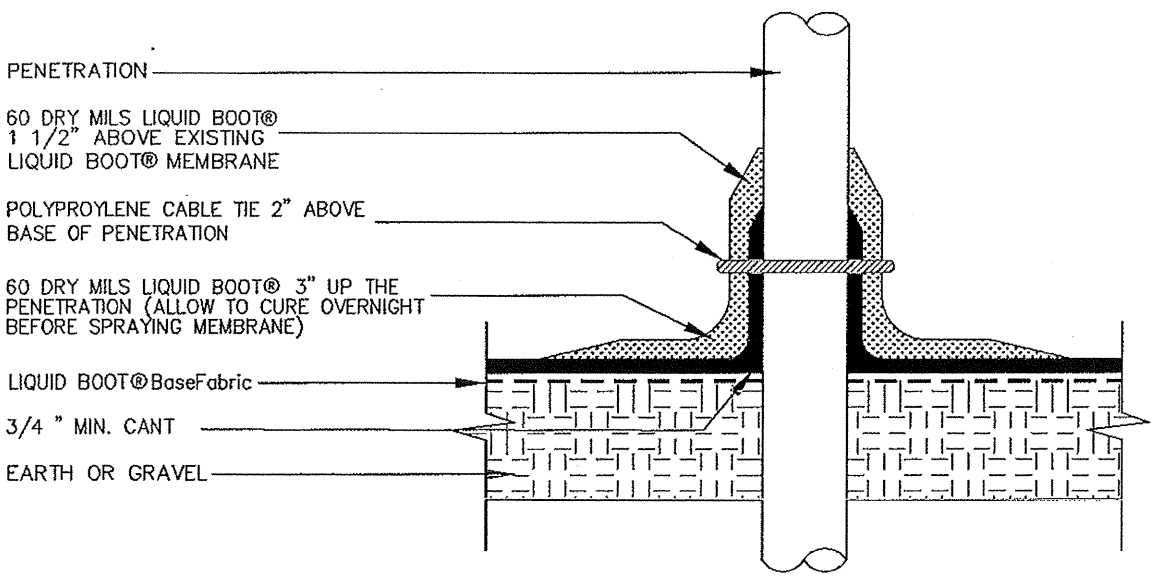
G4.2



NOTE:
All penetrations shall be cleaned per specifications before LIQUID BOOT® is applied.

GAS VAPOR BARRIER
PENETRATIONS ON EARTH OR
GRAVEL SUBSGRADE (OPTION 1)
NOT TO SCALE

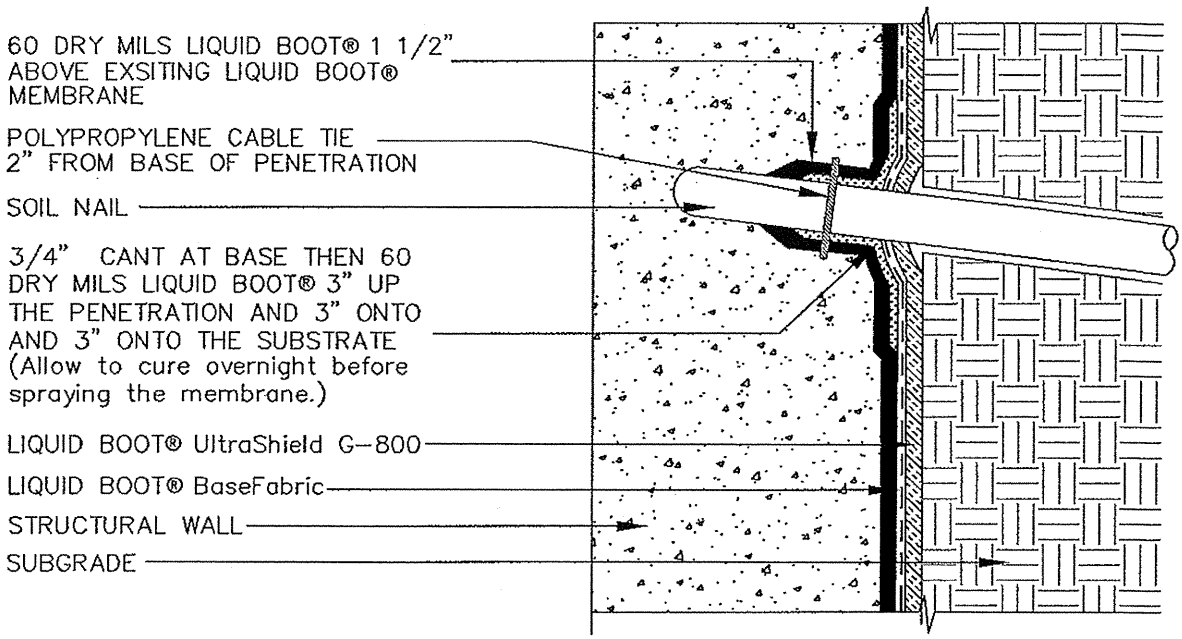
G4.3



NOTE:
All penetrations shall be cleaned per specification before LIQUID BOOT® is applied

GAS VAPOR BARRIER
PENETRATIONS ON EARTH OR
GRAVEL SUBSGRADE (OPTION 2)
NOT TO SCALE

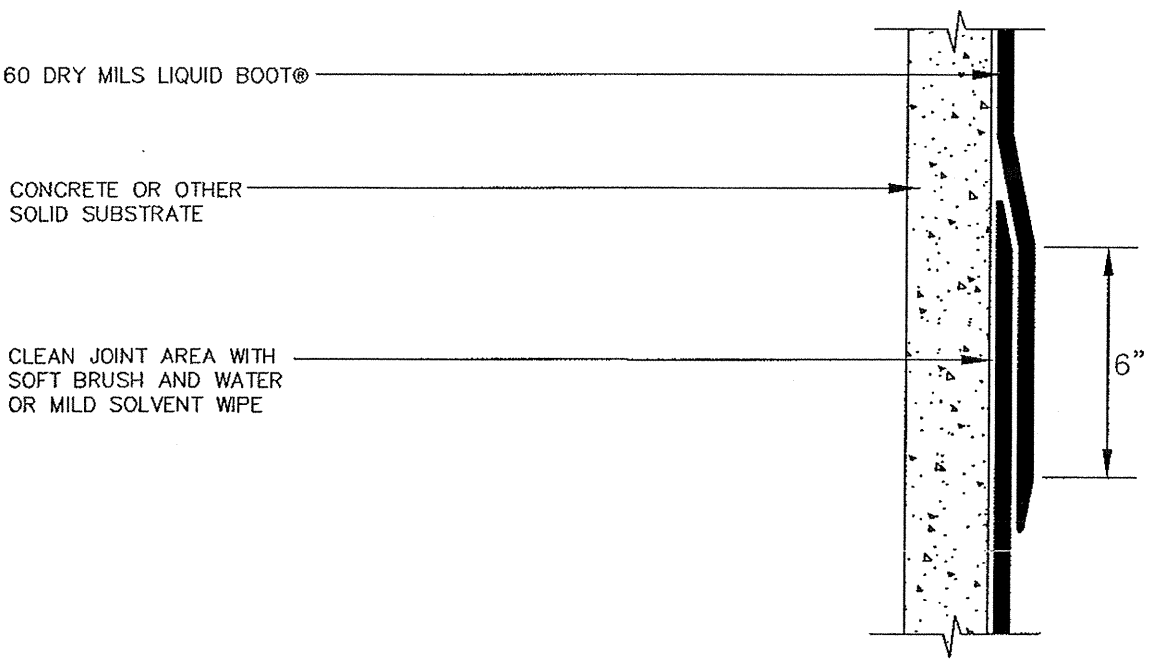
G4.4



NOTE:
All penetrations shall be cleaned per specifications before LIQUID BOOT® is applied.

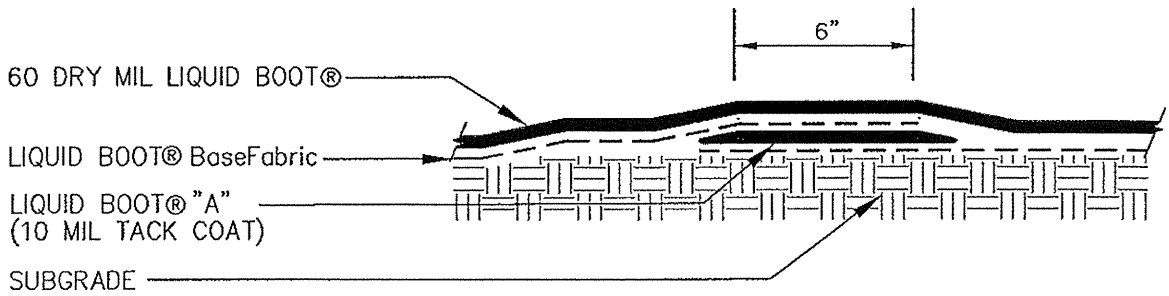
GAS VAPOR BARRIER
SOIL NAIL
NOT TO SCALE

G4.5



GAS VAPOR BARRIER
MEMBRANE LAP JOINTS
ON SOLID SUBSTRATE
NOT TO SCALE

G4.6



GAS VAPOR BARRIER
MEMBRANE LAP JOINTS
ON GEOTEXTILE
NOT TO SCALE

G4.7