Response Action Plan

MLS Stadium Complex
Multiple Parcels
NE of St. Anthony Avenue and Snelling Avenue North
St. Paul, Minnesota

Prepared for:

City of St. Paul

MUSC Holdings, LLC

Metropolitan Council

RD Management, LLC

Project B1600941
March 18, 2016

Braun Intertec Corporation

BRAUN INTERTEC
The Science You Build On.

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March 18, 2016

Project B1600941

Ms. Shanna Schmitt
Mr. Mark Koplitz
Minnesota Pollution Control Agency
Voluntary Brownfield Program
520 Lafayette Road North
St. Paul, MN 55155

Re: Response Action Plan
MLS Stadium Complex
Multiple Parcels
NE of St. Anthony Avenue and Snelling Avenue North
St. Paul, Minnesota

Dear Ms. Schmitt and Mr. Koplitz:

Braun Intertec Corporation, on behalf of the City of St. Paul and MUSC Holdings, LLC, is submitting the enclosed Response Action Plan/Contingency Plan (RAP) for the MLS Stadium Complex project in St. Paul. The RAP summarizes environmental response actions and includes procedures for managing contaminated media, subsurface vapors and other environmental mitigation measures during proposed soccer stadium construction. The CCP portion of the document includes measures for handling unknown contaminated materials that may be encountered during project construction.

Per our previous discussions, review and approval of the enclosed RAP is requested from both the Minnesota Pollution Control Agency (MPCA) Voluntary Investigation and Cleanup (VIC) and Petroleum Brownfields (PB) Programs by no later than April 29, 2016 to facilitate submittal of cleanup grant applications.

If you have any questions regarding the attached report, please contact Ken Larsen at 952.995.2455.

Sincerely,

BRAUN INTERTEC CORPORATION

Jaclyn E. Dylla, CHMM
Principal/Senior Scientist

Kenneth A. Larsen, PE, PG
Principal Engineer

Attachment:
Response Action Plan

cc: Mr. Todd Hurley, City of St. Paul
Dr. Bill McGuire, MUSC Holdings, LLC
Ms. Amy Geisler, Metro Transit
Mr. Rick Birdoff, RD Management Corp.

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A. Introduction

Braun Intertec Corporation (Braun Intertec) was retained by the City of St. Paul and MUSC Holdings, LLC to prepare this Response Action Plan/Contingency Plan (RAP) for the proposed Major League Soccer (MLS) Stadium Complex project in St. Paul. Multiple additional parties are also involved with the project including the Metropolitan Council (owner of a portion of the project) and the Saint Paul Port Authority (technical assistance with development planning and coordination). The MLS Stadium Complex site includes construction of the proposed Minnesota United Soccer Club stadium and construction of new buildings adjacent to the east and west of the stadium. The RAP addresses construction of the proposed MLS Stadium (including associated infrastructure) and also addresses construction associated with the adjacent redevelopments to the east and west of the stadium. For purposes of the RAP, construction of the MLS stadium and adjacent planned redevelopments to the east and west are considered “the project.”

The RAP summarizes environmental response actions and includes procedures for managing contaminated media, subsurface vapors and other environmental mitigation measures during proposed soccer stadium construction. The CCP portion of the document includes measures for handling unknown contaminated materials that may be encountered during project construction. This RAP will be submitted to the Minnesota Pollution Control Agency (MPCA) Voluntary Investigation and Cleanup (VIC) and Petroleum Brownfields (PB) Programs for review and approval. If any modifications or changes are required regarding the RAP, an addendum outlining such modifications or changes will be submitted to the MPCA.

B. Background

B.1. Site Location and Description

The site addressed by RAP is bounded by St. Anthony Avenue to the south, Snelling Avenue North to the west, Pascal Street North to the east, and a portion of the existing Midway Shopping Center property to the north, and depicted on Figure 1 (“the Site”). The Site is approximately 21 acres in total and all or parts of four separate parcels as summarized below:

Parcel Name (per this RAP)	Parcel ID Number(s)	Current Parcel Owner	Approx. Size (in acres)
Metropolitan Council Parcel	PIN# 342923320003	Metropolitan Council	9.9
Midway East Parcel	PIN# 342923320008	Midway Lot 5 LLC	4.8

Midway Shopping Center Parcel	Part of PIN# 342923320012	RK Midway Shopping Center LLC	5.0
University Midway Parcel	Part of PIN# 342923320011	RK University Midway LLC	1.3

A site diagram showing the project area and parcel boundaries is presented as Figure 2.
At the time of this RAP, the Metropolitan Council Parcel is a primarily vacant gravel lot used as a construction staging area for the adjacent Snelling Bus Rapid Transit (BRT)/A-Line project. Bus parking, soil piles, and construction debris are present on the eastern half of the parcel; trailer parking, heavy equipment, and construction debris are present on the western half of the parcel. Construction materials such as concrete barriers and bus shelter parts are present along the southern boundary of the Metropolitan Council parcel.

The Midway East parcel consists of a bituminous parking lot for the existing Midway Shopping Center to the north. The Midway East parcel is bordered to the west by the Metropolitan Council Parcel.

The Midway Shopping Center Parcel contains portions of the Midway Shopping Center building, which is occupied primarily by retail and restaurant tenants. Major tenants include Rainbow Foods, Walgreens, Office Depot, Midway Pro Bowl, and MidPointe Event Center.

The University Midway Parcel includes a portion of a structure occupied by Big Top Wines and Spirits. A bituminous parking lot is located between Big Top Wines and Spirits building and the Midway Shopping Center building. A bituminous paved alley runs along the southern boundary of the University Midway Parcel and Midway Shopping Center Parcel (and just north of the Metropolitan Council Parcel and Midway East Parcel).

B.2. Site History

The properties comprising the Site were historically used as agricultural land before being sold to Twin City Lines (a predecessor to Metro Transit) in the late 1800s. The properties were then developed as a streetcar construction and maintenance facility in the early 1900s, and the Metropolitan Council Parcel portion of the Site was converted to a bus garage and maintenance facility in the 1940s to 1950s. In the early 1950s, a construction project was completed on the Metropolitan Council Parcel that incorporated several of the Site buildings into one larger structure. This structure was 240,000 square feet in size and was used by Metro Transit for office space and maintenance and storage of buses. The service area within the Site structure contained inspection pits, hydraulic hoists, parts storage, and bus washing. Buses were also parked outside the building. Fifteen registered underground storage tanks (USTs) with a cumulative capacity of over 170,000 gallons were historically located on the Metropolitan Council Parcel.

In the late 1950s or early 1960s, the structures on the Midway East Parcel and Midway North Parcel were removed/demolished and Midway Shopping Center and associated parking areas were constructed. Tenants of Midway Shopping Center have primarily included retailers and restaurants; however, Econ-O-Clean dry cleaners was listed as a tenant from 1964 to 1999.

In 2002, above grade structures, parking surfaces, floor slabs, hoists, inspection pits, waste traps, foundations, and USTs were removed from the Metropolitan Council Parcel. Following removal of these Site features, this portion of the Site was used for Metro Transit bus parking, as a park n' ride for the Minnesota State Fair, and as a construction staging area for the METRO Green Line/Central Corridor Light Rail Transit project.

B.3. Previous Investigations

A large number of geotechnical and environmental investigations have been conducted at the Site between 1989 and 2016. The following documents contain relevant historical, environmental and/or geotechnical data for the Site (from newest to oldest):

1. *Additional Phase II Environmental Site Asssessment, MLS Stadium Complex, Northeast of St. Anthony Avenue and Snelling Avenue North, St. Paul, Minnesota*, prepared by Braun Intertec, Project No. B1600941, dated March 18, 2016 (2016 Additional Phase II ESA).
2. *Phase I Environmental Site Assessment, MLS Stadium Complex, Northeast of St. Anthony Avenue and Snelling Avenue North, St. Paul, Minnesota*, prepared by Braun Intertec, Project No. B1600941, dated March 18, 2016 (2016 Phase I ESA).
3. *Pre-Demolition Hazardous Materials Survey, Various Buildings Associated with Midway Mall Property, St. Paul, Minnesota*, prepared by Braun Intertec, Project No. B1600941, dated March 18, 2016.
4. *Phase II Environmental Site Assessment, 400 Snelling Avenue North, St. Paul, Minnesota*, prepared by Braun Intertec, dated January 28, 2016 (2016 Phase II ESA).
5. *Phase I Environmental Site Assessment, 400 Snelling Avenue North, St. Paul, Minnesota*, prepared by Braun Intertec, dated January 28, 2016.
6. *Petroleum Tank Release Site File Closure, Snelling Garage (MTC), Leak 2995*, MPCA correspondence, dated May 4, 2007.
7. *Annual Monitoring Report, Metro Transit Snelling Bus Garage, 400 North Snelling Avenue*, prepared by Braun Intertec, dated February 8, 2007.

8. *Corrective Action Excavation Report Worksheet, Metro Transit Snelling Bus Garage, 400 North Snelling Avenue*, prepared by Braun Intertec, dated February 8, 2007.
9. *Supplemental Report of Subsurface Exploration and Geotechnical Review, Lowe's of Midway,* prepared by American Engineering & Testing (AET), dated on November 2, 2005.
10. *Report of Additional Subsurface Exploration and Geotechnical Review, Lowe's of Midway,* prepared by AET, dated August 26, 2005.
11. *Report of Geotechnical Exploration and Review, Lowe's of Midway,* prepared by AET, dated May 18, 2005.
12. *Final Abandonment Report, MPCA VIC Site #1700, Pascal Street Project, St. Paul, Minnesota*, prepared by Leggette, Brashears, & Graham, Inc. (LBG), dated August 2004.
13. *Corrective Action Design Approval Letter, 400 North Snelling Avenue, St. Paul, Minnesota*, MPCA correspondence, dated May 26, 2004.
14. *Revised Corrective Action Design (CAD), Snelling Garage Site, 400 North Snelling Avenue, St. Paul, Minnesota*, prepared by Braun Intertec, dated May 11, 2004.
15. *Response Action Implementation, Snelling Avenue Bus Garage*, prepared by Earth Tech, dated June 24, 2003.
16. *Site Status and Remediation Shut Down Report, February 1999 through December 2002, Pascal Street Project, Midway Shopping Center, St. Paul, Minnesota, VIC Site #1700*, prepared by LBG, dated May 2003.
17. *Request to Maintain Shut-Down of Remediation System, Midway Shopping Center (AKA Pascal Street Project), St. Paul, MPCA Project Number VP 1700*, MPCA correspondence, dated July 31, 2002.
18. *Response Action Plan (RAP), Snelling Avenue Bus Garage*, prepared by Earth Tech, Inc., (Earth Tech), dated March 2002.
19. *Request to Terminate Remediation System, Midway Shopping Center, St. Paul, Minnesota, MPCA Project Number VP1700*, MPCA correspondence, dated December 11, 2001.
20. *Request for Remediation System Shutdown, Midway Shopping Center, St. Paul*, prepared by LBG, dated October 22, 2001.
21. *Petroleum Tank Release Site File Closure, MCTO Tank Farm, Leak 5912,* MPCA correspondence, dated August 16, 2000.
22. *Quarterly Groundwater Sampling, Midway Pascal Street Remediation Project, St. Paul, Minnesot*a, prepared by LBG, dated December 1999.

23. *Remedial Implementation Report, Pascal Street Project, St. Paul, Minnesota*, prepared by LBG, dated July 1999.

24. MPCA Correspondence/Letters - *Certificate of Completion, Midway Shopping Center Site, MPCA Project Number 1700,* dated May 11, 1999, and *Certificate of Installation and Operation, Midway Shopping Center, St. Paul, Minnesota*, dated May 4, 1999.

25. *Remedial Investigation/Corrective Action Design Report, MTC Snelling Avenue Garage, MPCA Leak No. 2995*, prepared by Ceres Environmental Services, Inc. (Ceres), dated January 12, 1999.

26. *Soil and Groundwater Investigation Report, Snelling Garage Site*, prepared by PEER, dated November 11, 1998.

27. *Investigation Work Plan, Metro Transit Snelling Garage Site, 400 North Snelling Avenue, St. Paul, Minnesota*, prepared by Peer Environmental and Engineering Resources, Inc. (PEER), dated July 9, 1998.

28. *Risk Assessment and Feasibility Study, Pascal Street Project, St. Paul, Minnesota*, prepared by LBG, dated March 1998.

29. *Fact Sheet, Proposed Response Action, Pascal Street Project Site, St. Paul, Ramsey County, Minnesota*, prepared by MPCA, dated February 1, 1998.

30. *Phase I Environmental Site Assessment, Metro Transit Snelling Garage*, prepared by Wenck Associates, Inc., dated November 1997.

31. *Phase II Investigation, Pascal Street Project, St. Paul, Minnesota*, prepared by LBG, dated May 1996.

32. *Ground Water Monitoring Report, MCTO Snelling Avenue Garage, MPCA Leak No. 5912*, prepared by Nova Environmental Services (Nova), dated May 13, 1996.

33. *Revised Remedial Design and Response Action Plan, Pascal Street Project, St. Paul, Minnesota*, prepared by LBG, dated October 1995.

34. *Revised Remedial Design and Response Action Plan, Pascal Street Project, St. Paul, Minnesota*, MPCA correspondence, dated October 24, 1995.

35. Phase II Investigation Work Plan, Pascal Street Project, St. Paul, Minnesota, prepared by LBG, dated October 1994.

36. *Additional Investigation/Corrective Action Design, MCTO Facility, 400 Snelling Avenue North, MPCA Leak No 5912*, prepared by Nova, dated August 31, 1994.

37. *Remedial Design and Response Action Plan, Pascal Street Project, St. Paul, Minnesota*, prepared by LBG, dated November 1993.

38. *Petroleum Tank Release Investigation, MTC Facility, 400 Snelling Avenue North, MPCA Leak No 5912*, prepared by Nova, dated November 1, 1993.
39. *Project Summary, Midway Plaza, University Avenue and Pascal Avenue, St. Paul, Minnesota*, prepared by MPCA, dated February 1, 1993.
40. *Soil and Groundwater Investigation Report*, Midway Shopping Center, St. Paul, Minnesota, prepared by LBG, dated January 5, 1993.
41. *Subsurface PCE Investigation, Midway Center, St. Paul, Minnesota*, prepared by Warzyn, Inc., dated January 27, 1992.
42. *Untitled Correspondence, Midway Center Plaza, St. Paul, Minnesota*, MPCA correspondence dated April 1, 1991.
43. *Response to Limited Site Investigation, Midway Center Plaza, St. Paul, Minnesota*, MPCA correspondence, dated October 10, 1989.
44. *Limited Site Investigation, Soil Boring Project, Midway Center Plaza, St. Paul, Minnesota*, prepared by Hygienetics Inc., dated August 15, 1989.
45. *Scope of Work for Subsurface Investigations at Midway Center, St. Paul, Minnesota*, prepared by Hygienetics Inc., dated June 7, 1989.
46. *Phase I Environmental Site Assessment, Midway Center, St. Paul, Minnesota*, prepared by Hygienetics Inc., dated April 20, 1989.

Copies of the above referenced documents (or available excerpted portions of the documents) are provided on CD in Appendix A for reference purposes.

The 2016 Phase II ESA and 2016 Additional Phase II ESA completed by Braun Intertec for the project contain the majority of recent environmental data used for preparation of this RAP. The 2016 Phase II ESA was completed on behalf of the Metropolitan Council for only the Metropolitan Council owned property in order to facilitate a lease agreement between the Metropolitan Council and the City of St. Paul. The 2016 Additional Phase II ESA was completed to evaluate subsurface conditions on the remaining parcels comprising the Site, and also included collection of additional investigation data on the Metropolitan Council Parcel to supplement the data from the 2016 Phase II ESA. Both investigations included collection of multiple soil, groundwater and soil vapor samples for laboratory analysis. Relevant figures and tables from the all of the 2016 Phase II activities are included in Appendix B for reference purposes. The respective reports should be referenced for details regarding the investigation activities performed associated results.

C. Proposed Development

The MLS Stadium Complex project includes construction of the proposed Minnesota United Soccer Club stadium and also includes construction of new buildings on adjacent properties to the east and west of the stadium (see Figure 3). The proposed stadium is located near the center of the project area and with an approximate footprint of 190,000 square feet. The field or "pitch" level for the proposed stadium will be approximately 15 feet lower than the current ground surface at approximate elevation 925 feet. A portion of the stadium structure includes enclosed below grade areas used for locker rooms, offices and general stadium operations. Other enclosed spaces in the stadium are located at (or above) the current site grades. Final exterior grades for the stadium vary across the project area and generally range from approximately 3 to 4 feet above current site grades (elevations 928 to 929 feet). Stadium construction will also require improvements to roads and utility infrastructure on and near the project, including construction of a new public road.

Long-term storm water management for the project will include installation of large below ground storage structures to the east of the stadium with additional features for sediment filtration prior to discharge to the storm sewer. No designated areas of significant on-site storm water infiltration are currently planned; however, final storm water plans for the project may include innovative management practices recommended by the watershed that will include limited infiltration (e.g., tree trenches, rain gardens etc.).

The adjacent areas to the east and west of the stadium structure will be developed with separate commercial use buildings as follows:

- The development to the east of the stadium structure will include one to two hotel structures with up to two levels of underground parking.

- The development to the west of the stadium structure will include an office structure with one level of underground parking.

The proposed locations of the stadium and adjacent buildings to the east and west are shown on Figure 3. Available preliminary project design diagrams and schematics for project are included in Appendix C.

D. Site Conceptual Model

D.1. Geology and Hydrogeology

The geologic and hydrologic conditions were determined based the results of recent geotechnical and environmental investigations completed by Braun Intertec for the project and based on review of previous investigations for the various properties comprising the project. The available information indicates that soil conditions consisted of approximately 2 to 20 feet of previously placed fill materials overlying native alluvial and glacial soils. Fill materials consisted of sand with gravel, silty sand, clayey sand, and lean clay and in places locally contained or concealed topsoil/organic materials. Below the fill materials, the soils consisted of native alluvial and glacial soils. The alluvial soils consisted of silts and lean clays that are generally loose (silts) and medium to rather stiff (lean clay). The glacial soils consisted of clayey sand, sandy lean clay, silty sand, poorly graded sand, and poorly graded sand with silt.

Groundwater depths are variable on the properties comprising the project and ranged from approximately 8 feet to greater than 25 feet below existing grades. Given the variable levels at which groundwater has been observed, it appear that there are two distinct zones of groundwater in the area of the project; a discontinuous perched zone within saturated sand lenses within the shallow clay deposits primarily on the western portion of the project (approximately 10 to 12 feet below ground surface), and a permanent water table within sand (approximately 25 to 28 feet below ground surface).

D.2. Nature and Extent of Contamination

D.2.a. Overview

Results of Phase II ESA activities completed for the project identified impacts to soil, groundwater and soil vapor that warrant consideration for redevelopment.

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D.2.b. Soil

The Phase II ESAs identified sandy clay fill materials with intermixed debris at many locations across the project. Fill thicknesses across the Site varied by location and the debris was primarily identified within the upper 4 feet. Debris types observed in the fill materials also varied by location and included small pieces of intermixed debris. At most locations with debris, the only debris type observed was concrete. Other debris types were observed less frequently as sporadic occurrences and included various man-made materials such as brick, ceramic, glass, wood, and slag. The debris was generally less prevalent in the soil with increasing depth. When debris was encountered at depths greater than 4 feet, it generally appeared to consist primarily of pieces of older clay tile or steel utility lines/infrastructure that serviced the area of the project in the past.

The majority of fill materials with intermixed debris observed during the Phase II ESAs had contaminant concentrations that meet the MPCA Industrial Soil Reference Values (SRVs) and applicable petroleum guidelines and is considered suitable for re-use and re-compaction on the project as described in this RAP. However, the soil analytical results from the Phase II ESAs identified several locations where one or more soil samples exceeded an established MPCA Soil Reference Values (SRVs), unregulated fill criterion, and other regulatory comparison criteria (i.e., petroleum reuse criteria based on soil headspace readings). In general, the majority of soils with SRV exceedances also contained intermixed debris and were located in the upper 4 feet of the shallow fills soils at specific locations across the project parcels.

More specifically, excavated soil from the following project locations exceed the MPCA Industrial SRVs or the petroleum use criteria specified in this RAP and will require segregation and off-site disposal at a permitted landfill:

- Soils represented by soil samples PP-14 (2-4’) and AB-6 (0-2’) where total lead concentrations exceed the Industrial SRV and TCLP lead concentrations exceed the hazardous waste criteria.
- Soils represented by soil sample ST-4 (3-4’) where total lead concentrations exceed the Industrial SRV.
- Soils represented by soil sample PP-10 (0-2’) and ST-103 (4’) and where benzo(a)pyrene (BaP) equivalent concentrations exceed the Industrial SRV.
- Shallow and deeper petroleum-impacted soil located near the known closed petroleum releases in the southwest corner of the proposed stadium structure (i.e., soil response actions required to remove source material impacting potential petroleum vapor intrusion into future site structures and other environmental issues associated with shallow perched contaminated groundwater present at that location).

In addition, soil impacted by tetrachloroethene (PCE) is also known to exist in the area of a former drycleaner release associated with a previous use at the Midway Shopping Mall in the northeastern portion of the Site. The PCE release was previously investigated with oversight by the MPCA VIC Program (VIC #1700, see Certificate of Completion, Item 24, in Section 2.3 above) and limited soil remediation was also conducted. Post remediation verification testing conducted for the drycleaner release detected PCE in soil at concentrations ranging from 560 ug/kg to 6,800 ug/kg; these PCE concentrations exceed the current MPCA Soil Leaching Value (SLV) of 42 ug/kg. Based on this information, it is reasonable to assume that PCE impacted soil exceeding MPCA SLVs remains in place beneath the building in the area of the former drycleaner release.

D.2.c. Groundwater

The Phase II ESAs encountered two distinct zones of groundwater associated with the Site; a discontinuous perched zone at approximately 10 to 12 feet bgs, and a deeper water table aquifer at approximately 25 to 28 feet bgs. The perched groundwater was primarily identified on the west side of the Metropolitan Council Parcel, although additional locations of perched groundwater were also observed. Based on previous investigation data, the direction of perched groundwater flow in this area of the Site is to the south/southeast.

Petroleum-contaminated groundwater with constituent concentrations exceeding both Minnesota Department of Health (MDH) Health Risk Limits (HRLs) and Health Based Values (HBVs) was detected at sample locations PP-6W (collected from the perched groundwater zone during the 2016 Phase II ESA) and PP-8W (collected from the deeper groundwater zone during the 2016 Phase II ESA). An estimated one-inch of free product was observed in monitoring well MW-4B (installed in the deeper groundwater zone during the 2016 Additional Phase II ESA). All three of these locations were collected near the southwest corner of the Metropolitan Council Parcel near the previous closed petroleum releases. It is noted that free product was identified in the same general area during the previous petroleum release investigations, and the MPCA closed the leak site files with that information. Based on available information, the direction of groundwater flow for the deeper hydrostatic water table in the area of the Site is to the north/northeast.

In addition to petroleum, chlorinated solvent compounds 1,2 dichloroethane and trichloroethene were detected in groundwater sample AB-16W from the 2016 Phase II ESA. Both compounds were detected at concentrations that exceed established MDH HRLs for drinking water. This sample was collected from a depth of approximately 27.5 feet on the University Midway Parcel, just south of the current Big Top Liquor building. These compounds were not detected in the other groundwater samples collected during the Phase II ESAs.

PCE impacted groundwater exists in the area of a former drycleaner release associated with the Midway Shopping Mall. The PCE release was previously investigated and partially remediated with oversight by the MPCA VIC Program (VIC #1700, see Certificate of Completion, Item 24, in Section 2.3 above). PCE was detected at a concentration of 12.3 micrograms per liter (ug/L) in groundwater sample AB-11W, which exceeds the MDH HRL of 4 ug/L. This sample was collected from a depth of approximately 28.9 feet on the Midway Shopping Center Parcel. This result was generally consistent with the previous drycleaner release investigation data.

No other areas of significant shallow or deep groundwater contamination were identified during the Phase II ESAs that warrant further consideration as part of this RAP. It is noted that low concentrations of DRO and other compounds were detected at some locations, but in general does not appear to indicate evidence of groundwater contamination warranting further consideration as part of this RAP.

D.2.d. Soil Vapor

According to current MPCA vapor intrusion guidance, soil vapor concentrations less than 10 times an established Intrusion Screening Value (ISV) are generally not considered a significant risk and proactive mitigation measures related to the vapor intrusion pathway are usually not required. Conversely, consideration of proactive vapor mitigation is usually required when soil vapor concentrations at a site are greater than 10 times an established ISV.

The stadium structure and adjacent hotel and office buildings are considered commercial uses, and thus cleanup standards applied to the project warrant comparison to commercial/industrial standards. Based on the Phase II ESA results, the soil vapor sample analytical results identified compounds exceeding the 10 times Industrial ISV criterion at the following locations:

- Benzene was detected at a concentration of 204 ug/m^3 in vapor sample VP-6. This sample was collected at a depth of approximately 10 to 18 feet just outside the southwest corner of the proposed stadium structure and near the previous closed petroleum releases on the Metropolitan Council Parcel.
- PCE was detected at a concentration of 48,600 ug/m^3 in vapor sample VP-105. This sample was collected at a depth of approximately 10 to 12 feet in the general area of the previous drycleaner release at the Midway Shopping Center.

No VOCs were detected at concentrations exceeding 10 times the Industrial ISVs in the other soil vapor samples collected during the Phase II ESAs.

D.3. Exposure Pathways and Receptors

Based on the results of the Phase II ESAs and the proposed development plans, the following potential contaminant exposure pathways/issues have been considered and addressed in this RAP:

Contaminated Soil Contact

- Receptor Concern: Direct contact with contaminated soil by future users of development.
- RAP Approach: Removing contaminated soils exceeding MPCA Industrial SRVs and additional project-specific soil cleanup criteria.

Contaminated Soil Vapor

- Receptor Concern: Vapor intrusion into new building structures and inhalation of those vapors by users of future development.
- RAP Approach: Impacted soil source removal, diverting contaminated groundwater, and installation of sub-slab vapor barriers and venting systems for the new building structures.

Contaminated Groundwater (multiple considerations)

- Receptor Concerns: Contaminated groundwater as a source of vapor intrusion. Contaminated groundwater affecting structures/drainage systems. Contaminated groundwater entering construction excavations.
- RAP Approach: Protect completed redevelopment structures and related systems from contaminated groundwater. Obtain appropriate permits to manage, treat (if necessary) and discharge contaminated water from construction excavations to the sanitary sewer.

The specific proposed response actions to address the identified exposure pathways are provided in Section E below.

E. Response Actions

E.1. Response Action Objectives

E.1.a. Overview

The following categories of environmental response actions will be completed for the project:

1. Pre-demolition removal of asbestos-containing materials and hazardous materials associated with the existing buildings to be demolished within the project area.
2. Completion of the additional pre-construction investigations to verify subsurface conditions and soil and groundwater contaminant concentrations at selected locations to optimize RAP implementation.
3. Environmental monitoring during all project excavation activities (including excavations for utilities) that have the potential to disturb contaminated fill soils and/or deeper petroleum contamination.
4. Stabilization and off-site disposal of two areas of lead-impacted soil.
5. Excavation and off-site disposal of soil from identified locations exceeding the MPCA Industrial SRVs.
6. Excavation and off-site disposal of the petroleum soil located near the southwest corner of the Site exceeding Site-specific petroleum cleanup standards established in the RAP.
7. Segregation and off-site disposal of the PCE-impacted soil source area associated with the drycleaner release exceeding SLVs.
8. Building demolition to access the PCE-impacted soil source area described above.
9. On-site management and reuse of excavated materials with low level impacts considered “regulated fill” to the extent practicable and acceptable to the developing party.
10. On-site reuse of excavated materials considered to be “unregulated fill” (i.e., clean excavated soil with no debris).
11. Export of excess material that meets the MPCA’s definition of “unregulated fill” for unrestricted use at another site (i.e., clean excavated soil with no debris), provided a location with a land owner willing to accept the material can be found.

12. Export of excess material considered to be "regulated fill" for use at another industrial site subject to applicable guidance documents and MPCA approval, provided a location with a land owner willing to accept the material can be found.
13. Disposal at a permitted landfill of excess regulated fill and/or unregulated fill which cannot be reused on the Site and for which an off-site export location with a willing landowner cannot be found.
14. Installation of sub-slab vapor mitigation systems protecting occupied portions of the MLS stadium structure and adjacent buildings to the east and west of the stadium to address the potential vapor intrusion pathway.
15. Implementation of a Construction Contingency Plan during construction to address potential unexpected contamination and hazardous materials.

The following sections provide additional information pertaining to the proposed response actions. Proposed field methods and procedures will be consistent with those described in Appendix D.

E.1.b. Response Action Goals

Implementation of this RAP will achieve the following goals established for the project:

- Document that soils excavated for construction are handled, managed and disposed of in a manner consistent with current MPCA guidelines and this RAP.
- Provide safeguards addressing the soil vapor intrusion pathway for all future occupied structures including the proposed stadium and adjacent buildings to the east and west of the stadium.
- Provide data and documentation to support issuance of regulatory assurance letters to be requested from the MPCA VIC and PB Programs.
- Provide organized framework to address unexpected contamination encountered during construction.

E.1.c. Cleanup Standards

The proposed MLS stadium and the adjacent developments to the east (hotel buildings) and west (office building) are all considered commercial/industrial uses. Consequently, the MPCA Industrial SRVs for soil will be used as the primary comparison criteria in this RAP for determining proper management and disposition of excavated soils for the project. The following additional project specific soil standards for petroleum and PCE soil source areas will apply to the project as described below.

<u>Petroleum Soil Source Area – Southwest Corner of Proposed Stadium</u>

The petroleum soil located near the southwest corner of the proposed stadium is considered a source area and is targeted for proactive removal and off-site disposal as part of this RAP within the approximate area shown on Figure 4. The following project specific soil cleanup standards will apply to this area:

- Excavated soil with DRO or GRO concentrations exceeding 100 mg/kg based on laboratory analysis.
- Petroleum stained soil with strong petroleum odors.
- Excavated soil with photoionization detector (PID) readings above 10 parts per million (ppm) based on field screening.

The above petroleum soil standards were selected to protect the southwest corner of the stadium structure from petroleum vapor intrusion and other environmental issues associated with shallow perched contaminated groundwater. The estimated maximum depth of petroleum source removal excavation for this area is 22 feet. This maximum excavation depth may be increased or decreased based on the final stadium design and what is needed to protect the stadium structure. The lateral limits of the excavation will be limited to the area shown on Figure 4.

<u>PCE Soil Source Area – Former Drycleaner Release Area</u>

The dry cleaner release area was previously the subject of a multi-year, VIC Program (VIC# 1700) cleanup which resulted in the issuance of a Certificate of Completion (included in Item 24, in Section 2.3 above). The PCE-impacted soil located in the area of the former drycleaner release is targeted for proactive removal and off-site disposal as part of this RAP.

The following soil cleanup standards will apply specifically to this area:

- Soil with PCE concentrations exceeding the MPCA SLV of 0.042 mg/kg based on laboratory analysis.
- Soil with evidence of staining, solvent odors, and/or PID readings above 5 ppm based on field screening.

Removal of the PCE impacted soil will reduce the potential for vapor intrusion related to the future hotel buildings proposed for construction in the northeast portion of the Site, and will have the added benefit of reducing additional impacts to groundwater related to the soil leaching pathway. The maximum depth of PCE impacted soil excavation for this area is 12 feet.

Buffer Zones

All soils targeted for reuse on the project will meet standards appropriate for commercial/industrial use. Consequently, establishing requirements for clean buffer zones will not apply to the project, except the petroleum-impacted soil reuse standards allowed by MPCA guidelines.

E.2. Demolitions and Related Activities

E.2.a. Pre-Demolition Asbestos and Hazardous Materials Abatement

Portions of the following Site buildings will be demolished in preparation for redevelopment:

1. Big Top Wines and Spirits building located on University Midway Parcel.
2. Southern portion of the Midway Shopping Center Building.

The locations of the buildings (or portions of buildings) located within the project area are shown on Figure 2.

Building demolition will be completed in two separate phases. The first phase of building demolition will occur early during the project and will include the Big Top Wines and Spirits building and west portion of the Midway Shopping Center Building (from Rainbow Foods to approximate 675 feet to the east). The remaining east portion of the Midway Shopping Center Building will be demolished as a second phase later in the project (during construction of the hotel buildings to the east of stadium). This second phase of demolition is considered an environmental response action under this RAP since it is required to mitigate the known PCE-impacted soils related to the former drycleaner release.

Hazardous materials surveys were previously completed for these buildings are summarized in the report titled: *Pre-Demolition Hazardous Materials Survey, Various Buildings Associated with Midway Mall Property, St. Paul, Minnesota*, prepared by Braun Intertec, Project No. B1600941, dated March 18, 2016. Prior to demolition, the buildings will be abated of any asbestos-containing materials (ACM) and other hazardous materials identified by the survey. The abatement work will be conducted by licensed contractors and will include:

- Securing necessary state, federal and local permits and submitting required demolition notifications and plans.
- Abatement of identified friable and non-friable ACM, as required for demolition of the respective buildings.
- Removal and disposal of all hazardous equipment, hazardous substances and remaining regulated materials in the buildings as required for demolition.

An environmental professional will be on-site periodically during the abatement and demolition activities to observe and document the completed work and assess for unknowns as required for RAP implementation.

E.2.b. Utility Removals and Installs

Selected existing utilities within and adjacent to the project area will be removed to access impacted soils and/or rerouting for project construction. The locations of utilities requiring removal and rerouting are shown on the preliminary development diagrams in Appendix C. The environmental monitoring and soil management components of this RAP will apply to all utility removal and rerouting work associated with the project, including locations adjacent to the Site, that are impacted by the contamination addressed by this RAP.

E.3. Additional Pre-Construction Investigation

Additional pre-construction investigation will be conducted prior to commencement of construction to verify subsurface conditions and soil and groundwater contaminant concentrations and selected locations key to RAP implementation. The purpose of the additional pre-construction investigation is to verify media management assumptions and optimize construction sequencing efficiencies.

The following areas will be targeted for additional pre-construction investigation:

1. Subject to execution of a customary entry right and indemnification agreement, or the affected land's becoming Team-Acquired Property under the Stadium Development Agreement, additional soil investigation for lead identified at sample AB-6 (2-4'). The additional investigation will be completed to further define the extent of lead-impacted soil exceed TCLP criteria, which requires stabilization prior to off-site disposal. The additional investigation includes completion of soil borings or test trenches with depth stratified soil samples collected for laboratory analysis of total lead and TCLP lead. The investigation locations will include all four directions surrounding the original sample location, with additional locations added to define the extent of lead impacted soil as necessary.
2. Additional investigation near the southwest corner of the proposed stadium structure to verify subsurface conditions relevant to final design details and implementing the shallow perched contaminated groundwater cut off wall approach (see Section E.5.a) included as a response action in this RAP. The additional investigation will include additional soil borings, monitoring wells, and related sampling and testing of soil and groundwater.
3. Additional investigation after building demolition in the area of the previous drycleaner release. The additional investigation will be completed after building demolition (and prior to construction of the hotel) to further define the extent of PCE impacted soil requiring removal as described in this RAP.
4. Additional investigation in areas of planned utility removals and rerouting near areas of known or suspected contamination. The additional investigation will include soil borings and related sampling and testing of soil and groundwater.

The results of the additional pre-construction investigations will be submitted to the MPCA VIC and PB Programs upon completion.

E.4. Soil Response Actions

E.4.a. Overview

The following sections of this RAP provide a summary of the response actions to be completed for the project, proposed implementation procedures, and documentation requirements. A Contingency Plan for addressing potential unknowns and/or unexpected conditions is provided in Section G.

E.4.b. Contaminated Soil Requiring Off-Site Disposal

Overview

Excavated soil with contaminant exceeding Industrial SRVs or other project specific criteria will be segregated and disposed of at a permitted landfill. The general locations of soil contamination requiring off-site disposal are shown on Figure 4 and are summarized below:

- Soils represented by soil samples PP-14 (2-4') and AB-6 (0-2') where total lead concentrations exceed the Industrial SRV and TCLP lead concentrations exceed the hazardous waste criteria.
- Soils represented by soil sample ST-4 (3-4') where total lead concentrations exceed the Industrial SRV.
- Soils represented by soil sample PP-10 (0-2') and ST-103 (4') and where BaP equivalent concentrations exceed the Industrial SRV.
- Shallow and deeper petroleum-impacted soil located near the closed petroleum releases at the southwest corner of the proposed stadium structure based on a combination of laboratory analytical results, staining, strong petroleum odors and elevated organic vapor field readings.
- The PCE-impacted soils located in the area of the former drycleaner release associated with the Midway Shopping Center parcel.

Subgrade structures and/or large pieces of debris that are encountered during the above soil excavations will be removed as necessary to complete the planned soil remediation work.

Contaminated Soils Exceeding Industrial SRVs

The lead impacted soils represented by soil samples PP-14 (0-2') and AB-6 (2-4') require treatment by stabilization prior to excavation and off-site disposal in the area discussed in Section E.4.c of this RAP. The following procedure will be used to address the other areas of soil exceeding MPCA Industrial SRVs:

1. The perimeter of the areas to be excavated will be surveyed and marked.
2. Soil within each marked area will be excavated to a targeted depth below existing ground surface. The estimated lateral extent and depth of impacted soil excavation will based on the Phase II ESA results.
3. The soil excavated from within the marked areas will be segregated and disposed of at a permitted landfill. If practical, the excavated soil will be loaded directly on a truck, manifested, and transported to the selected disposal facility. If the excavated contaminated soil requires temporary on-site staging prior to disposal, the soil will be placed on and covered by 10-mil reinforced plastic sheeting secured with clean soil or other suitable materials.
4. Post-excavation documentation sampling and testing will be conducted from the completed excavations. The soil samples will be collected from the base and sidewalls of each excavation. The samples will be analyzed for the specific compounds of concern for the respective area (i.e., total lead or PAHs as appropriate). Four sidewall samples and one excavation base samples will be collected for each area.
5. Additional soil excavation to remove contaminated soil will be completed for an area if the post-excavation analytical results indicate additional soil contamination still present at concentrations exceeding Industrial SRVs. If additional excavation is completed, additional post-excavation documentation sampling will be completed as described in Step #4 above.

Petroleum Impacted Soil Source Removal - Southwest Corner of MLS Stadium

Soil excavated for construction from the area of significant petroleum contamination at the southwest corner of the MLS stadium structure will be targeted for off-site disposal at a permitted landfill (see Figure 4). The contamination in this area is related to the former closed petroleum releases on the Metropolitan Council Parcel, and the contaminated soils from this area are targeted for removal to protect the future stadium structure from petroleum vapor intrusion and related issues associated with shallow perched contaminated groundwater. The proposed project specific cleanup criteria for the petroleum soil source area is provided in Section E.1.c.

PCE Impacted Soil Source Removal – Former Drycleaner Release Area

The PCE-impacted soil located in the area of the former drycleaner release associated with the Midway Shopping Center parcel is targeted for proactive removal and off-site disposal as part of this RAP (area shown Figure 5). The contaminated soils from this area are targeted for removal to mitigate the PCE contamination source, protect the future hotel structure from vapor intrusion, and minimize ongoing potential impacts to groundwater. The proposed project specific cleanup criteria for the PCE impacted soil source removal is provided in Section E.1.c.

E.4.c. Lead Impacted Soil Stabilization and Removal

Overview

The Phase II ESAs identified two areas where lead concentrations in soil exceed both the Industrial SRVs and TCLP hazardous waste criterion of 5 milligrams per liter (mg/L). Specifically, the soil represented by previous soil samples PP-14 (0-2') and AB-6 (2-4') will require treatment by stabilization prior to excavation and off-site disposal at a permitted landfill.

Proposed Response Actions

The proposed response actions for the lead impacted soil include the stabilization, removal, and disposal of soil within the areas shown on Figure 4. The soil will be stabilized to depths of approximately 3 feet below ground surface (bgs) in the area of sample PP-14 (0-2') and approximately 5 feet bgs in the area of sample AB-6 (2-4').

The soil with lead concentrations exceeding the TCLP hazardous waste criteria (5 mg/L) will be stabilized in-situ using EnviroBlend® stabilization treatment chemical (or equivalent). The treatment chemical will be thoroughly mixed into the soil in one-foot lifts using a backhoe. Mixing will continue until the treatment product and soil appear to be well mixed based on visual criteria. If necessary, water will be used to suppress the dust. After thorough mixing, the treated soil will be temporarily stockpiled on-site pending confirmation testing. The temporary stockpile will be placed on and covered with poly sheeting.

Confirmation Sampling and Testing

Soil samples will be collected from the base and sidewalls of the completed excavations to document that the remaining soil has total lead concentrations below the Industrial SRV of 700 mg/kg and TCLP lead concentrations below the 5.0 mg/L hazardous waste criterion. It is anticipated that four sidewall samples and one base sample will be collected from each area for confirmation purposes. The samples will be submitted to a laboratory for analysis of total lead by EPA Method 6010 and TCLP lead using standard methods. The laboratory results for each area will be reviewed to confirm that the lead concentrations in all sidewall and base samples are less than both the Industrial SRV (total lead less than 700 mg/kg) and TCLP hazardous waste criteria (TCLP lead less than 5 mg/L). After confirmation, project excavations in the respective areas will proceed as needed for construction.

Soil samples will be collected for analytical testing from the temporary soil stockpiles generated after stabilization. A minimum of one soil sample will be collected for every 250 cubic yards of material stabilized/stockpiled, with additional stockpile samples collected if required for landfill acceptance. The samples will be used to confirm the stabilized material is acceptable for disposal as non-hazardous waste at a permitted landfill. The samples will be submitted to a laboratory for analysis of TCLP lead. The soil analytical results will be provided to the disposal facility to obtain final waste acceptance prior to transport of the soil to the landfill.

Additional Soil Excavation or Stabilization

Additional soil excavation and/or stabilization will be completed if the confirmation testing results exceed an applicable TCLP criteria or Industrial SRVs. If additional excavation or stabilization is completed, additional post-excavation and stockpile confirmation testing will be completed as appropriate.

E.4.d. On-Site Soil Reuse

Soil with Low Level Impact

“Soil with Low Level Impact” is defined in this RAP as soil excavated for construction with contaminant levels above the Residential SRVs, but below the Industrial SRVs, and petroleum-impacted soils with PID readings of 10 ppm or less and DRO/GRO concentrations less than 100 mg/kg. For purposes of this RAP, “Soil with Low Level Impact” will be used without restriction on the project. Blending of “Soil with Low Level Impact” with other soils from the project will not be completed for purposes of creating clean soil meeting unregulated fill criteria. However, blending of soils may be completed to meet geotechnical requirements for the on-site placement and compaction soil during construction.

Restricted Use Soil

"Restricted Use Soil" is defined in this RAP as excavated soil within the project construction limits with contaminant levels above the Residential SRVs, but below the Industrial SRVs and/or petroleum-impacted soil that exhibits PID readings between 10 and 200 ppm. For purposes of this RAP, Restricted Use Soil may be reused on the beneath paved surfaces provided that 2 feet of clean soil or "Soil with Low Level Impact" is placed above it.

E.4.e. Off-Site Disposal at Permitted Landfills

Contaminated materials removed from the project during RAP implementation will be disposed of at an appropriate permitted landfill as industrial waste and/or alternative daily cover depending on its composition and specific disposal facility requirements. All contaminated material truckloads will be accompanied by a disposal manifest. If large pieces of concrete are encountered during excavation, the concrete will be segregated and targeted for disposal at a demolition waste landfill or for recycling, as appropriate. The MPCA will be notified of the specific disposal facilities to be used for the project once they have been determined.

E.4.f. Clean Soil Import

If warranted, imported fill material needed for the redevelopment project will be sampled and tested to ensure the materials are clean and suitable for use at the Site. Available information regarding fill sources will be evaluated to determine appropriate sampling requirements and analytical testing parameters, including DRO, VOCs, PAHs, and Resource Conservation and Recovery (RCRA) metals. Any fill material imported to the Site will have documentation that the soil meets the MPCA unregulated fill criteria or be sourced from a native material pit.

E.4.g. Unregulated Fill

A large quantity of native soil will be excavated for project construction that is anticipated to meet the definition of "Unregulated Fill" as presented in the MPCA's guidance document titled: *Best Management Practices for the Off-Site Reuse of Unregulated Fill* (dated February 2012). The MPCA guidance document defines Unregulated Fill as excess soil from construction projects that meets all of the following field screening and contaminant concentration criteria:

- Free from solid waste, debris, asbestos-containing material, visual staining, and chemical odor.
- Organic vapors field measurements less than 10 ppm using a PID.

- For petroleum-impacted soil, DRO/GRO at concentrations less than 100 mg/kg.
- Contaminants detected in soil at concentrations less than the Residential SRVs and Screening SLVs (Note: naturally-occurring concentrations of some metals, such as arsenic, selenium, or copper, sometimes exceed the SRV or SLV. Such soils are not considered impacted in the absence of a contaminant source or other field or laboratory indications of contamination).

Unregulated Fill excavated for this project will be targeted for the following uses to the degree practical: 1) reuse as general construction fill on the project (if material meets project geotechnical requirements), or 2) haul off-site for unrestricted use at another property. Excess material that cannot be re-used on the project and for which an off-site export location with an owner willing to accept the material cannot be found may need to be disposed in a permitted landfill.

E.5. Groundwater Response Actions

E.5.a. Contaminated Perched Groundwater

A cut off barrier wall approach will be implemented as a response action to protect the stadium structure from the identified area of contaminated perched groundwater. The cut off wall approach will be designed and constructed in a manner that prevents contaminated shallow perched groundwater from impacting the stadium structure, including eliminating a potential source of vapor intrusion. By managing the contaminated groundwater in place, the cut off wall approach will also eliminate the need for long-term collection, treatment and discharge of contaminated groundwater. Two alternatives are currently being evaluated for the cut off barrier wall:

1. Utilizing the southwest exterior wall of the stadium structure as the cut off wall barrier for the contaminated perched groundwater. This alternative would include installation of a contaminant resistant and water resistant membrane on the exterior wall, and construction of wing wall extensions at specified locations to the north and south to ensure contaminated perched water does not affect the structure outside the wall.
2. Installing a standalone cut off barrier wall located west of the stadium structure. This alternative would include construction of a slurry trench or sheet pile based wall oriented in a manner to separate the known area of petroleum-impacted perched groundwater from the future stadium structure. The base of the cut off wall would be tied into the top of the glacial till unit (a natural low permeability layer) that is present at depths ranging from approximately 9.5 feet to 21.5 feet.

Both alternatives are being evaluated by the project team to determine which alternative will be implemented. The final design details for the selected alternative will be forwarded to the MPCA at a later date prior to construction.

E.5.b. Construction Water Management

Contaminated groundwater and/or storm water will be managed by permit under the following approaches (as appropriate):

- A MCES temporary discharge permit may be obtained in order to facilitate the discharge of any contaminated groundwater or storm water accumulated in Site excavations to appropriate nearby sanitary sewer connections. Monitoring, testing, and reporting will be required by MCES. Pre-discharge treatment will be completed for storm water or groundwater collected during construction with contaminant concentrations or characteristics exceeding permit requirements. Anticipated pretreatment approaches (if required) could include product separation and/or carbon treatment.
- A NPDES discharge permit may also be obtained in order to facilitate the discharge of construction-related water to appropriate nearby storm sewer connections. Monthly monitoring, testing and/or treatment and quarterly reporting would be required by the permit.

E.6. Environmental Monitoring, Sampling and Testing

Full-time environmental monitoring by an environmental professional will be conducted during project excavation activities (including excavations for utilities) that have the potential to disturb contaminated fill soils and/or deeper petroleum contaminated soil. The purpose of the environmental monitoring is to identify contaminated and potentially contaminated soil that requires segregation and off-site disposal at a permitted landfill.

Excavated soil with contaminant exceeding MPCA Industrial SRVs and/or other project specific criteria will be segregated and disposed of at a permitted landfill as discussed in Sections E.4.b. and E.4.c. For all other locations on the project, contaminated soil will be segregated from clean materials as described in this RAP and using a combination of visual and/or olfactory observations, organic vapor screening results, and/or existing analytical testing results. During monitoring, the excavated soils will be observed at regular intervals (every 20 cubic yards) by the environmental professional for visual and olfactory evidence of significant contamination (e.g., debris, staining or discoloration, or chemical odors), and screened for organic vapors using a PID equipped with a 10.6 eV lamp. The PID will be calibrated to an isobutylene standard to read in ppm benzene. Existing soil analytical data will also be utilized to guide excavation activities.

Sampling and analytical testing will be performed as necessary during RAP implementation. The primary types of sampling and analytical testing include:

- Post excavation verification sampling of the base and sidewalls for the areas proactively targeted for off-site disposal at a permitted landfill as described in Section E.4.b and E.4.c.
- Verification sampling for the stockpiled lead impacted soil s treated by stabilization as outlined in Section E.4.c.
- Additional characterization sampling and testing of soil targeted for disposal at a permitted landfill (if required by the facility).
- Documentation sampling and testing of potentially contaminated soil left in place.

Soil analytical data from the Phase II ESAs will be used to obtain disposal facility approvals for the project. If required by the selected disposal facility, additional soil sampling and analytical testing will be completed. Pre-approval from the permitted landfill will be obtained for the soil treated by stabilization from the lead impacted soil areas addressed by Section E.4.c.

E.7. Vapor Controls for New Structures

E.7.a. Overview

Based on the review of the soil gas and soil and groundwater analytical testing results from samples collected during the Phase II ESAs, installation of vapor intrusion mitigation systems (VIMS) are recommended for the various permanent structures as part of this redevelopment project including the enclosed portions of the MLS stadium, the planned structures east of the stadium, and the proposed structures west of the stadium. Descriptions of the vapor control approaches for the various structures are provided in the following sections.

E.7.b. Recommended Vapor Controls

The following presents a general description of the vapor control component details that will apply to the respective buildings constructed for the project.

MLS Stadium – Only Applies to Enclosed Indoor Spaces

1. Sub-slab aggregate ventilation layer.
2. Composite vapor collection strips placed in aggregate layer.
3. Vapor barrier placed between aggregate layer and floor slab.
4. Vapor barrier on exterior subgrade walls as appropriate.
5. Sub-slab vapor sample collection/pressure check points.
6. Rigid plastic or cast-iron pipe from vapor collection strips to exhaust locations.
7. Open pipe to atmosphere for exhaust (passive venting).

Proposed Development East of Stadium (Proposed Hotel)

1. All components as provided above for the MLS Stadium Enclosed Indoor Spaces.
2. Electric powered blowers for each exhaust (active venting).

Proposed Development West of Stadium (Proposed Office Building)

1. Same components as provided for enclosed spaces of the MLS Stadium (passive venting).

Additional vapor control system installation details for the respective structures are provided in Appendix E. Recommendations for post installation verification testing for the vapor control systems is also provided in Appendix E.

E.7.c. Vapor Controls for Utilities

A vapor barrier will be installed in utility trenches within the project where petroleum-contaminated soil remains in the base of a utility trench at field screening concentrations above 10 ppm (as measured with a PID). Where identified, the contaminated soil at the base of a utility trench will be “over-excavated” by approximately one foot to achieve separation between the contaminated soil and the new utility line. Clean soil will be then be placed and compacted in the trench as bedding material for the utility. A vapor barrier consisting of 10-mil polyethylene sheeting (or two layers of 6-mil polyethylene sheeting) will then be placed in the trench in a manner that covers the clean soil at the base and contaminated portions of the sidewalls. After utility installation and trench backfilling, the excess poly sheeting will be wrapped over the top of the trench so that the utility lines are completely enclosed by the poly sheeting.

F. RAP Implementation Report

Following completion of response actions for the redevelopment, a RAP Implementation Report will be prepared and submitted to the MPCA for review and approval. The RAP Implementation Report will include the following at a minimum:

- Overview of the environmental response actions performed.
- Documentation of pre-demolition hazardous materials removal for demolished buildings.
- Summary of environmental monitoring results during construction.
- Documentation of lead impacted soil stabilization activities.
- Documentation of all contaminated soil excavations for materials targeted for off-site disposal.
- Disposal documentation including manifests and disposal facility approvals.
- Summary of off-site disposal material types and volumes.
- Documentation of imported fill sources and associated analytical testing results.
- All soil and groundwater analytical testing results completed for RAP implementation.
- As-built diagrams and related installation documentation for the vapor control systems installed in the stadium and adjacent development buildings.
- Documentation of the contaminated perched groundwater cut off wall alternative installed for the project.
- Descriptions and documentation related to contingency actions (if any) completed during construction.
- Photographic documentation of response actions completed.

G. Construction Contingency Plan

The Construction Contingency Plan (CCP) outlined in this section will be implemented during redevelopment to address unexpected environmental conditions. As outlined in the RAP, Braun Intertec will conduct on-site monitoring during all significant excavations activities. When the environmental professional is not present on-site, it will be the responsibility of the owner and site contractors to ensure that appropriate response actions are carried out in accordance with this section. Specifically, if any unexpected condition is encountered, excavation activities will cease until the situation has been properly assessed and a plan of action is developed. Potential contingency events could include encountering previously unknown soil contamination; underground storage tanks (USTs), drums, debris, wells, oily substances, and/or suspect ACM. The following steps will be taken if a contingency event occurs:

1. The situation will be assessed by the environmental professional to determine the nature of the issue and the potential risks involved. The MPCA staff assigned to the project will be notified of the potential issue, as appropriate.
2. Samples of the suspect contaminated materials will be collected for laboratory analysis as appropriate. The analytical parameters will be selected based on the nature of the suspected contamination and input by the MPCA. Further actions will depend on the test results and discussions with MPCA staff.
3. If suspect ACM are identified, samples of the suspect materials will be collected by a licensed asbestos inspector and tested for asbestos. The need for further actions (e.g., Emissions Control Plan) related to asbestos will be dependent upon the test results.
4. All findings will be incorporated into the RAP Implementation Report prepared for the Site.

Contact information related to RAP implementation/construction contingencies is provided in Section H.

H. Site Responsibilities and Coordination

City of St. Paul

The City of St. Paul have entered into a joint powers agreement with the Metropolitan Council to redevelop the Site into a soccer stadium. The City of St. Paul will own and operate the stadium after construction and will enter into a long term lease agreement with MUSC Holdings LLC.

The City of St. Paul contact for the project is:

Contact: Todd Hurley
Director of Financial Services
15 Kellogg Boulevard West
700 City Hall
St. Paul, MN 55102
651.266.8800

Developer – MLS Stadium Construction

MUSC Holdings, LLC is the entity that will responsible for construction of the MLS Stadium portion of the project and will enter into a long term lease agreement for the stadium (on behalf of the Minnesota United Soccer Club) with the City of St. Paul. The contact person for MUSC Holdings, LLC is:

Contact: Bill McGuire
MUSC Holdings, LLC
4050 Olson Memorial Highway, Suite 295
Golden Valley, MN 55422
612-720-3943

Owner/Developer – Construction of Developments East and West of Stadium

RD Management, Corp., through various 'RK Midway' subsidiaries and/or their assigns, is the party currently planned as the developer of the properties adjacent to the east and west of the Stadium (proposed hotel and office building, respectively). The contact person for RD Management Corp. is:

Contact: Rick Birdoff
RD Management Corp.
810 Seventh Avenue, 10th Floor
New York, New York 10019
Phone: 212-265-6600

General Contractor

M.A. Mortenson Construction, Inc. (Mortenson) is the general contractor for constructing the MLS stadium project and including preliminary earthwork for the adjacent properties to the east (proposed hotel) and west (proposed office building) of the proposed stadium. Mortenson will coordinate and subcontract a variety of specialty contractors to construct the project. The Mortenson contact person for the project is:

Contact: Greg Huber
M.A. Mortenson Company
700 Meadow Lane North
Minneapolis, MN 55422-4899
Phone: 763-287-5909

Braun Intertec Corporation

Braun Intertec is the environmental consultant for the project and will be responsible for environmental monitoring and sampling, contaminated media characterization, documentation and reporting of all environmental activities in connection with the project. Braun Intertec's project contacts are:

Contacts: Kenneth Larsen
Braun Intertec Corporation
11001 Hampshire Avenue S.
Minneapolis, MN 55438
Phone: 952.995.2455

Mark Ciampone
Braun Intertec Corporation
1826 Buerkle Road.
St. Paul, MN 55110
Phone: 651.487.7015

Minnesota Pollution Control Agency

The project will be conducted through the MPCA Voluntary Brownfield Program. The MPCA has authority over all environmental response actions, and are responsible for all review and approval of environmental activities performed at the Site. The MPCA project contacts are:

Contacts: Shanna Schmitt
MPCA Voluntary Investigation and Cleanup Program
520 Lafayette Road N
St. Paul, MN 55155
Phone: 651.757.2697

Mark Koplitz
MPCA Petroleum Brownfields Program
520 Lafayette Road N
St. Paul, MN 55155
Phone: 651.757.2502

Additional Parties

The Metropolitan Council currently owns the parcel at 400 Snelling Avenue North (Metropolitan Council Parcel) and will continue to own the parcel after construction of the MLS stadium under a long term lease agreement with the City of St. Paul. The Metropolitan Council contact for the project is:

Contact: Amy Geisler
Metropolitan Council
390 Robert Street North
St. Paul, MN 55101
Phone: 612.349.7692

Coordination between Parties

Braun Intertec will coordinate with Mortenson regarding the construction schedule and activities addressed by this RAP. It is anticipated that Braun Intertec will conduct environmental monitoring and sampling on behalf of Owners/Developers to help document that contaminated materials encountered as part of redevelopment activities are properly identified and managed. Braun Intertec will communicate with the MPCA, and other interested parties as necessary regarding environmental monitoring results and any necessary environmental actions.

I. Training and Site Safety

Environmental professionals involved in monitoring and sampling activities will be required to meet the training requirements of 29 CFR 1920.120. Specifically each person will have completed an OSHA certified 40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) safety course. In addition, they will have experience in directing contaminated material excavation and be competent in proper screening and sampling procedures. Braun Intertec will prepare a site-specific Health and Safety Plan (HASP) that addresses monitoring and sampling activities completed by its personnel. Personnel involved with general construction activities will not be required to have special training or certificates. However, all contractor personnel and individuals who are involved with the handling and moving of potentially contaminated or known contaminated soil should have appropriate training that meets OSHA requirements.

J. Project Schedule

Construction earthwork for the project is expected to start in August 2016, with completion of the stadium structure needed by March 2018 in time for the start of the MLS season. Where practical, preliminary earthwork and related response actions for the adjacent developments to the east (hotel building) and west (office building) will be conducted concurrent with stadium construction. The proposed developments (hotel and office) to the east and west of the Stadium will not be able to begin until Stadium construction is substantially complete (staging needs, etc.). It is anticipated that the proposed construction east and west of the stadium will occur in years 1-4 after the Stadium is opened to the public

Additional information regarding the overall project schedule and sequencing will be provided to the MPCA when it becomes available.

Figures

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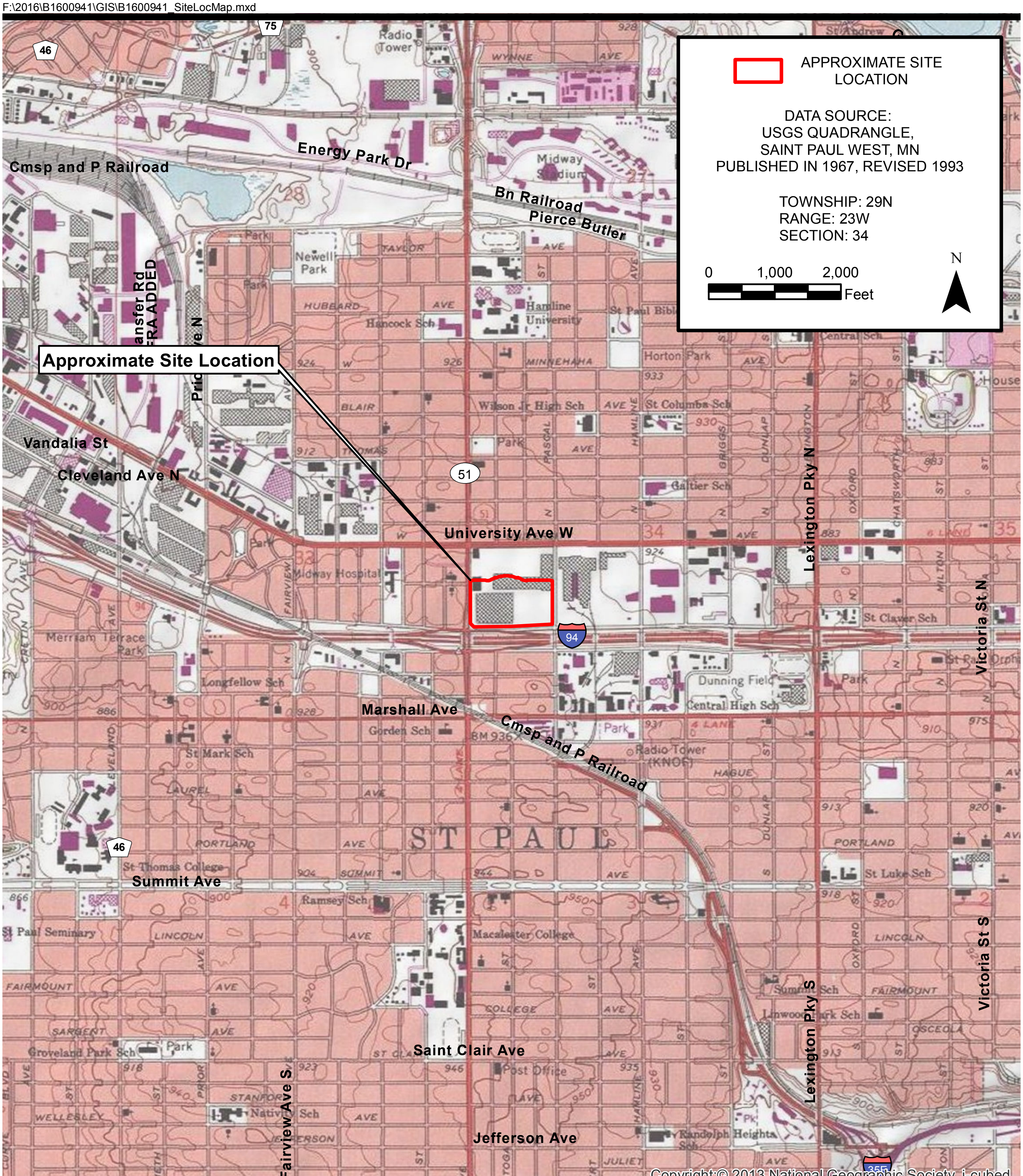


Sheet: 1 of 1

Fig. 1

Project No: B1600941

Drawing No. B1600941_SiteLocMap

Scale: 1 in = 2,000 ft

Drawn By: CMF

Date Drawn: 03/08/2016

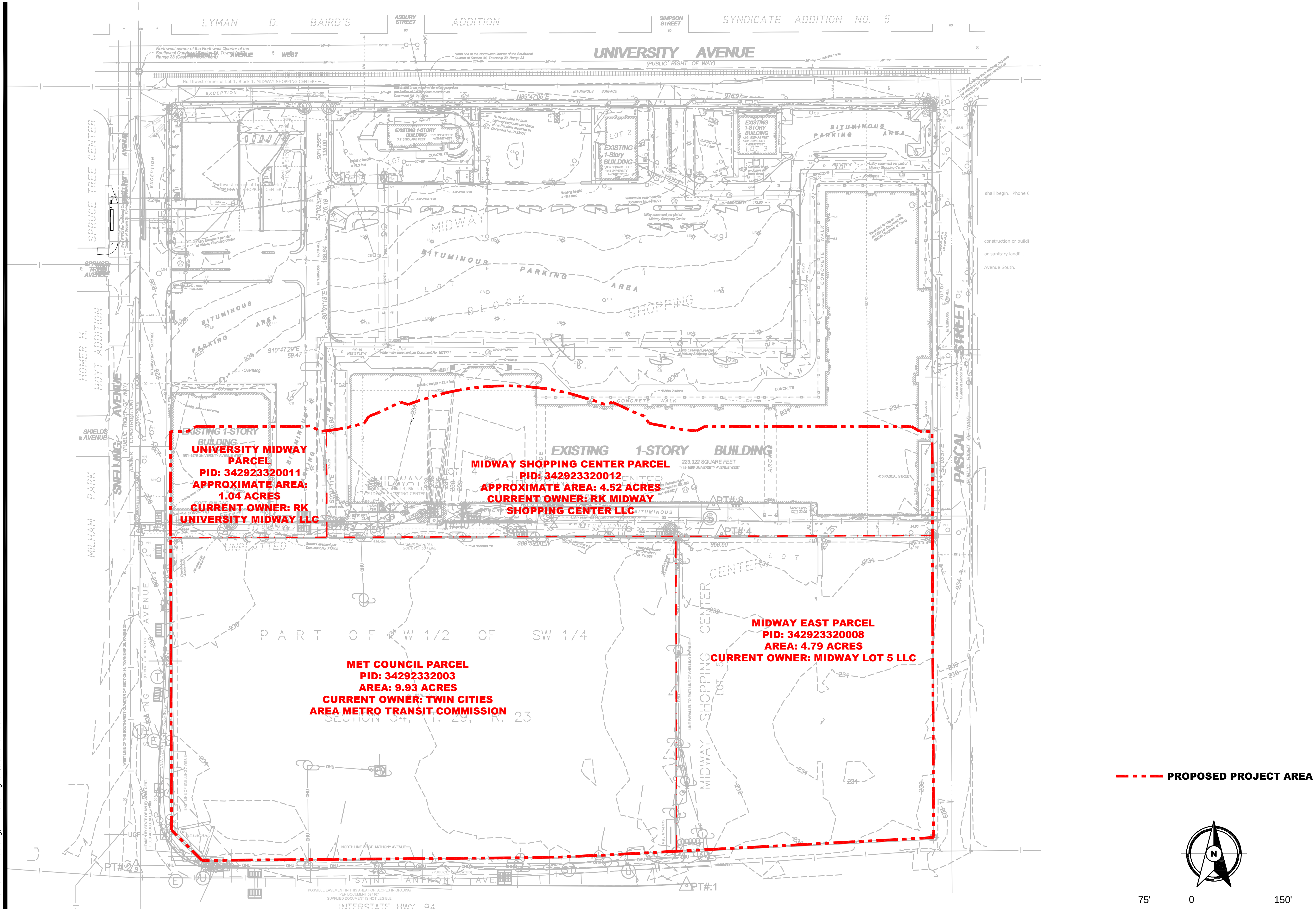
Checked By: MJ

Last Modified: 3/8/16

SITE LOCATION MAP

RESPONSE ACTION PLAN
PROPOSED SOCCER STADIUM PROJECT
400 SNELLING AVENUE NORTH
ST. PAUL, MINNESOTA

BRAUN INTERTEC
11001 Hampshire Avenue So.
Minneapolis, MN 55438
PH. (952) 995-2000
FAX (952) 995-2020



BRAUN INTERTEC
The Science You Build On.
11001 Hampshire Avenue S
Minneapolis, MN 55438
PH. (952) 995-2000
FAX (952) 995-2020

SITE DIAGRAM
RESPONSE ACTION PLAN
PROPOSED SOCCER STADIUM PROJECT
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

Project No:	B1600941
Drawing No:	B1511122-00
Scale:	1" = 150'
Drawn By:	BJB
Date Drawn:	12/15/15
Checked By:	KAL
Last Modified:	3/9/16
Sheet: of	Fig: 2

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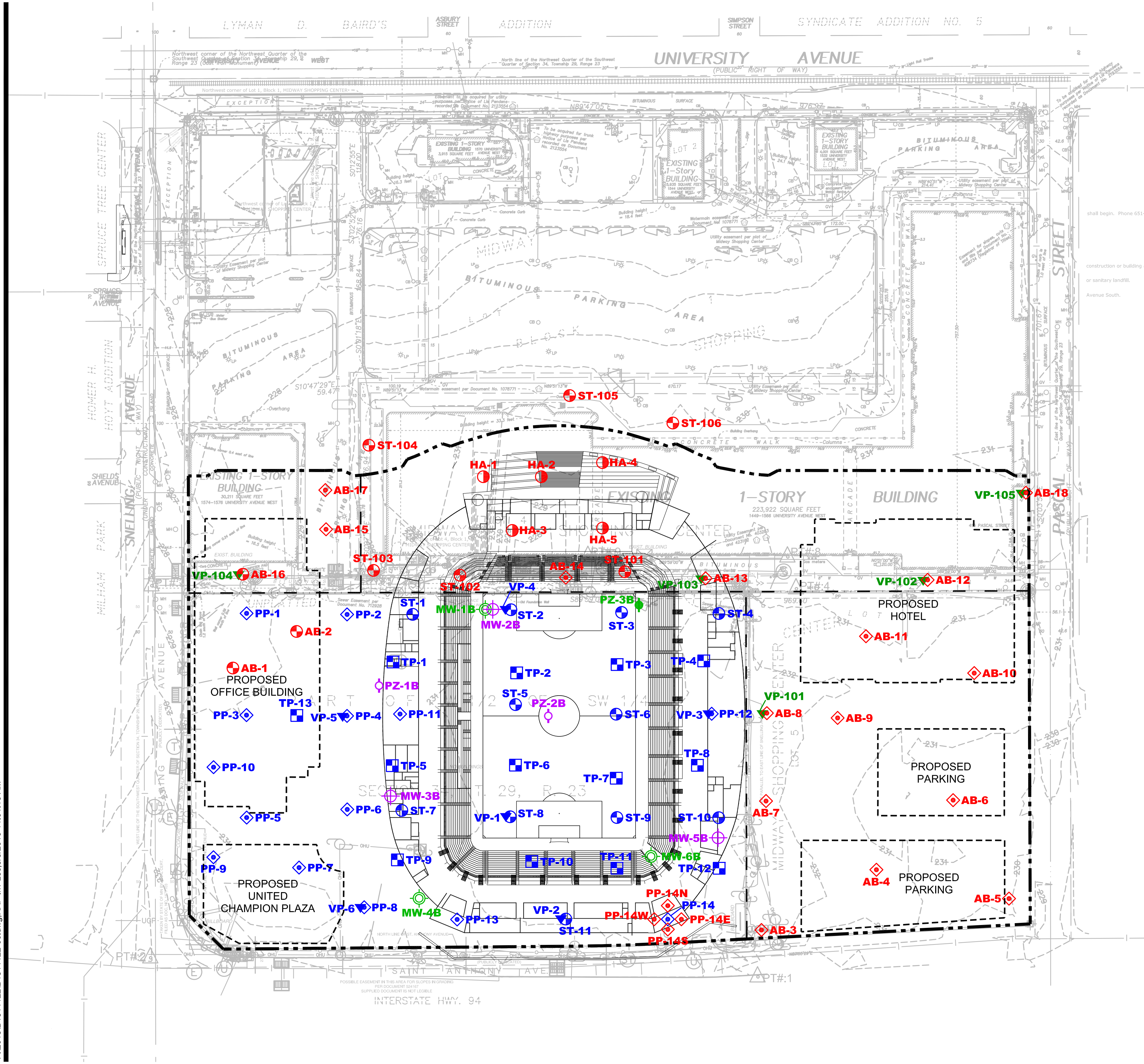

- - - PROPOSED PROJECT AREA

APPROXIMATE LOCATION OF HOLLOW STEM BORING (BRAUN, 2016)

APPROXIMATE LOCATION OF PUSH PROBE (BRAUN, 2016)

APPROXIMATE LOCATION OF HAND AUGER BORING (BRAUN, 2016)

APPROXIMATE LOCATION OF DEEP PIEZOMETER (BRAUN, 2016)

APPROXIMATE LOCATION OF SHALLOW PIEZOMETER (BRAUN, 2016)

APPROXIMATE LOCATION OF DEEP MONITORING WELL (BRAUN, 2016)

APPROXIMATE LOCATION OF SHALLOW MONITORING WELL (BRAUN, 2016)

APPROXIMATE LOCATION OF VAPOR POINT (BRAUN, 2016)

APPROXIMATE LOCATION OF HOLLOW STEM BORING (PREVIOUSLY COMPLETED - BRAUN, 2015)

APPROXIMATE LOCATION OF PUSH PROBE (PREVIOUSLY COMPLETED - BRAUN, 2015)

APPROXIMATE LOCATION OF TEST TRENCH (PREVIOUSLY COMPLETED - BRAUN, 2015)

APPROXIMATE LOCATION OF VAPOR POINT (PREVIOUSLY COMPLETED - BRAUN, 2015)

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INVESTIGATION LOCATIONS AND PROPOSED DEVELOPMENT
RESPONSE ACTION PLAN
PROPOSED SOCCER STADIUM PROJECT
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

Project No:	B1600941
Drawing No:	B1511122-00
Scale:	1" = 150'
Drawn By:	BJB
Date Drawn:	12/15/15
Checked By:	KAL
Last Modified:	3/8/16
Sheet: of	Fig: 3

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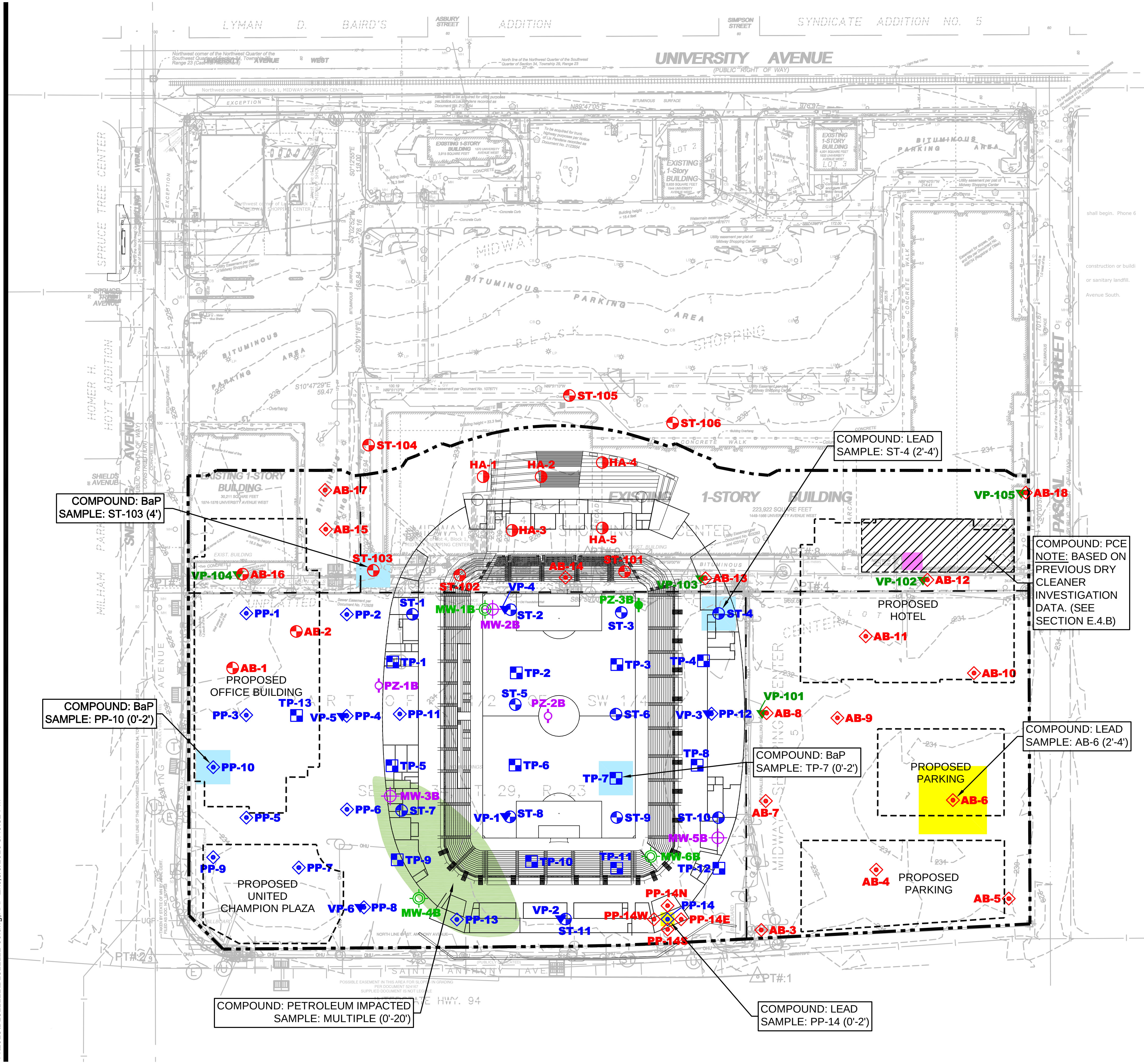

▬ · ▬ · PROPOSED PROJECT AREA

PCE IMPACTED SOIL REQUIRING OFF-SITE DISPOSAL

FORMER ECONO CLEAN DRY CLEANER

PETROLEUM IMPACTED SOIL REQUIRING OFF-SITE DISPOSAL WHEN ENCOUNTERED DURING CONSTRUCTION

LEAD IMPACTED SOIL REQUIRING STABILIZATION AND OFF-SITE DISPOSAL

SOIL EXCEEDING INDUSTRIAL SRV's REQUIRING OFF-SITE DISPOSAL

APPROXIMATE LOCATION OF HOLLOW STEM BORING (BRAUN, 2016)

APPROXIMATE LOCATION OF PUSH PROBE (BRAUN, 2016)

APPROXIMATE LOCATION OF HAND AUGER BORING (BRAUN, 2016)

APPROXIMATE LOCATION OF DEEP PIEZOMETER (BRAUN, 2016)

APPROXIMATE LOCATION OF SHALLOW PIEZOMETER (BRAUN, 2016)

APPROXIMATE LOCATION OF DEEP MONITORING WELL (BRAUN, 2016)

APPROXIMATE LOCATION OF SHALLOW MONITORING WELL (BRAUN, 2016)

APPROXIMATE LOCATION OF VAPOR POINT (BRAUN, 2016)

APPROXIMATE LOCATION OF HOLLOW STEM BORING (PREVIOUSLY COMPLETED - BRAUN, 2015)

APPROXIMATE LOCATION OF PUSH PROBE (PREVIOUSLY COMPLETED - BRAUN, 2015)

APPROXIMATE LOCATION OF TEST TRENCH (PREVIOUSLY COMPLETED - BRAUN, 2015)

APPROXIMATE LOCATION OF VAPOR POINT (PREVIOUSLY COMPLETED - BRAUN, 2015)

75' 0 150'

SCALE: 1" = 150'

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CONTAMINATED SOIL EXCAVATION AREAS
RESPONSE ACTION PLAN
PROPOSED SOCCER STADIUM PROJECT
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

Project No:	B1600941
Drawing No:	B1511122-00
Scale:	1" = 150'
Drawn By:	BJB
Date Drawn:	12/15/15
Checked By:	KAL
Last Modified:	3/9/16
Sheet: of	Fig: 4

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Appendix A
Previous Site Reports (on CD)

Appendix B
Relevant Phase II ESA Data

Metropolitan Council Phase II ESA Data

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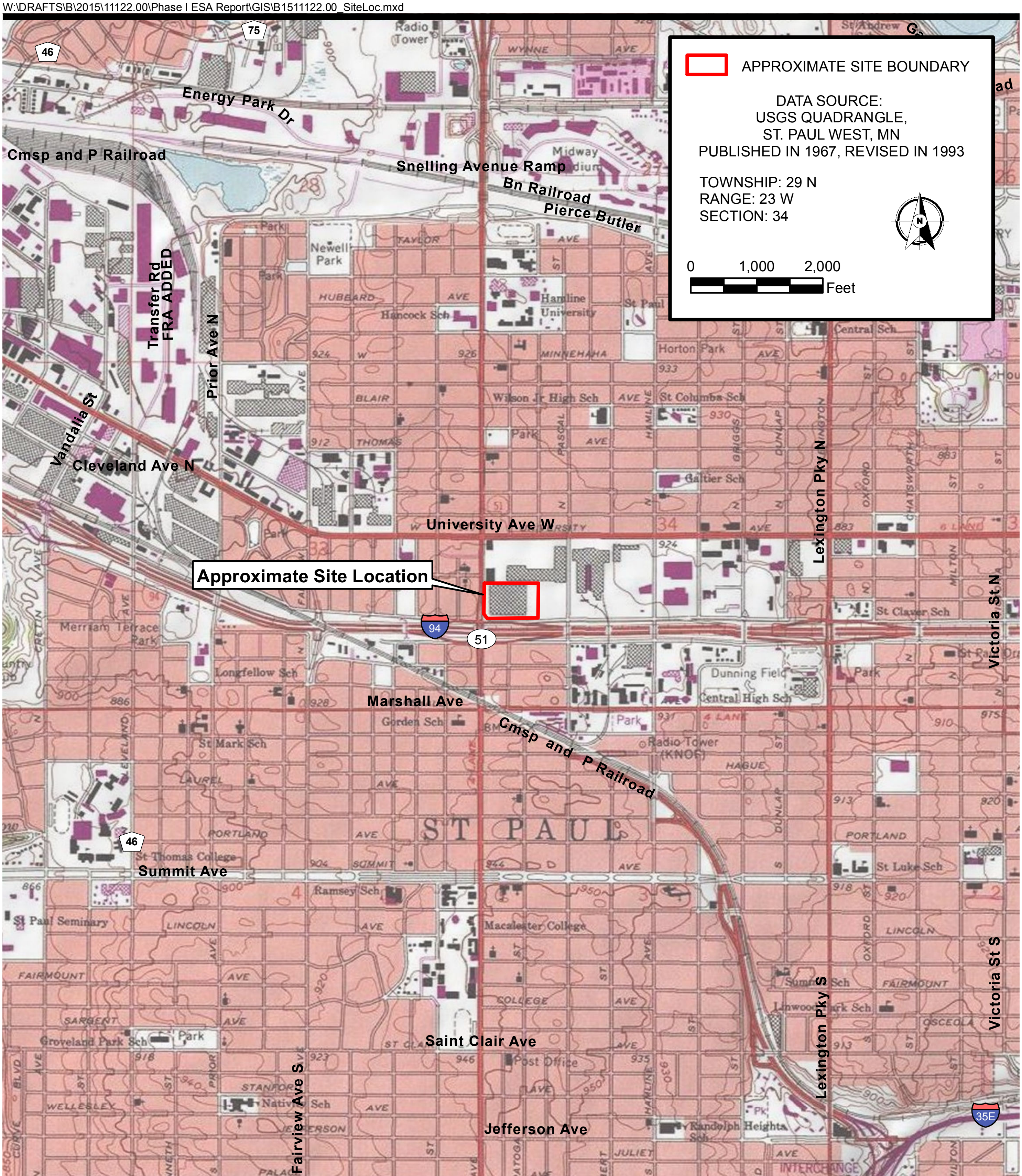

Sheet: 1 of 1

Fig. 1

Project No:	B1511122.00
Drawing No.	B1511122.00_SiteLoc
Scale:	1 in = 2,000 ft
Drawn By:	FER
Date Drawn:	1/5/16
Checked By:	MJ
Last Modified:	1/29/16

SITE LOCATION MAP
400 SNELLING AVENUE NORTH
ST. PAUL, MINNESOTA

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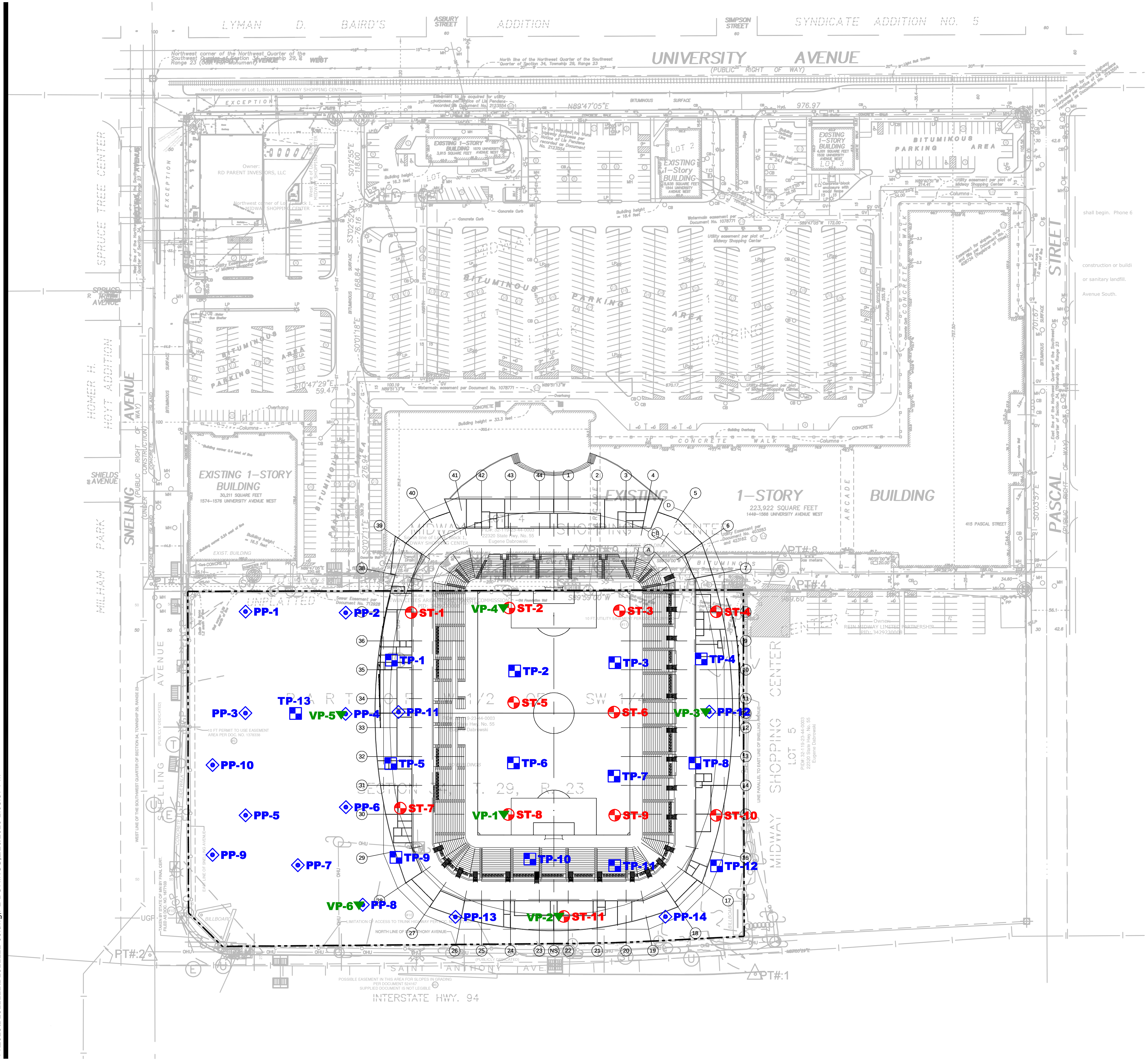

APPROXIMATE LOCATION OF PUSH PROBE ENVIRONMENTAL ONLY

APPROXIMATE LOCATION OF HOLLOW STEM BORING ENVIRONMENTAL AND GEOTECHNICAL

APPROXIMATE LOCATION OF TEST TRENCH ENVIRONMENTAL ONLY

APPROXIMATE LOCATION OF VAPOR POINT

75' 0 150'

SCALE: 1" = 150'

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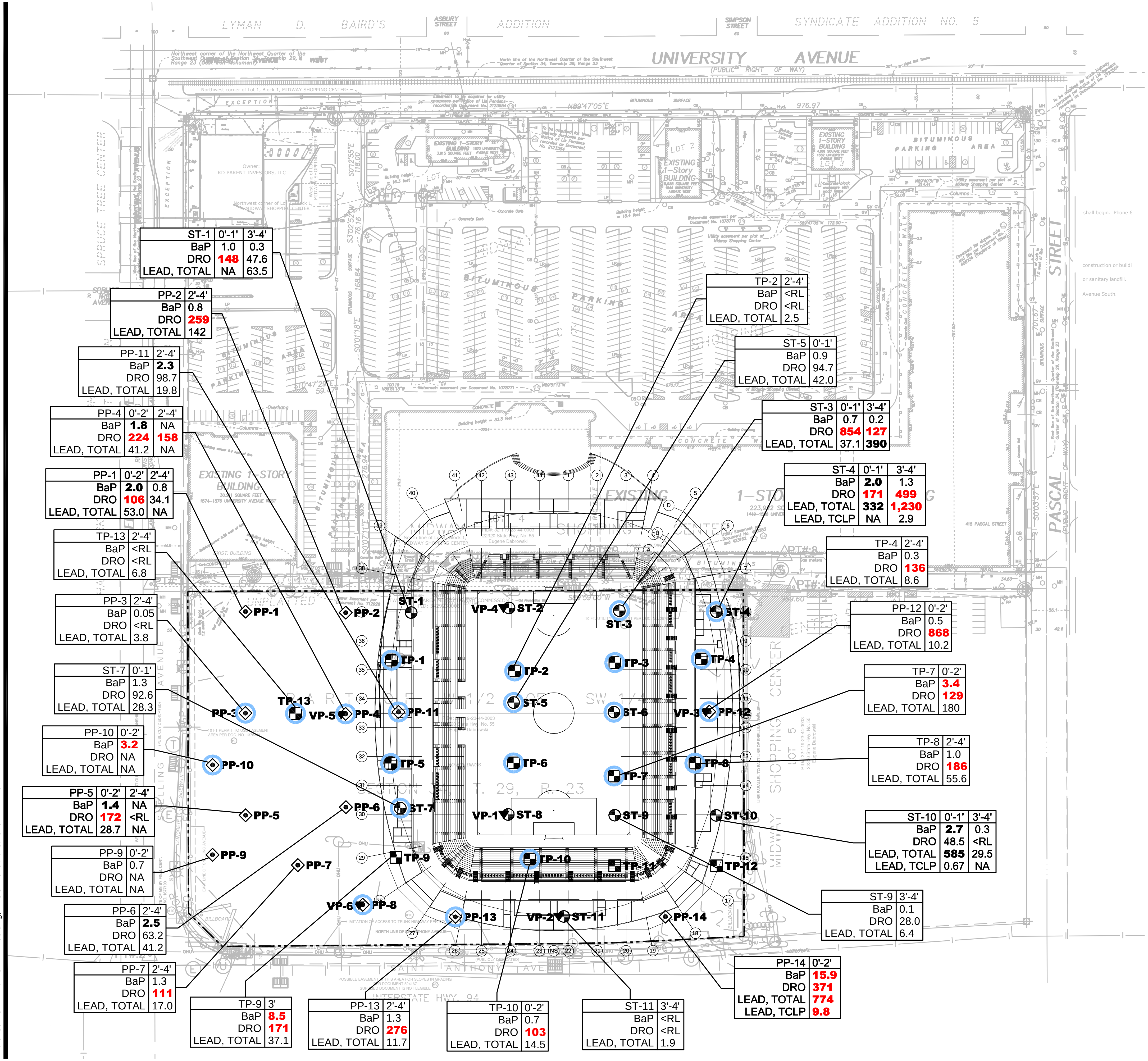
SOIL BORINGS AND TEST PIT LOCATIONS
PHASE II ENVIRONMENTAL SITE ASSESSMENT
SNELLING NORTH
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

Project No:	B1511122.00
Drawing No:	B1511122-00
Scale:	1" = 150'
Drawn By:	BJB
Date Drawn:	12/15/15
Checked By:	KAL
Last Modified:	1/26/16
Sheet: of	Fig: 2



ST-1	0'-1'	3'-4'
BaP	1.0	0.3
DRO	**148**	47.6
LEAD, TOTAL	NA	63.5

PP-2	2'-4'
BaP	0.8
DRO	**259**
LEAD, TOTAL	142

PP-11	2'-4'
BaP	**2.3**
DRO	98.7
LEAD, TOTAL	19.8

PP-4	0'-2'	2'-4'
BaP	**1.8**	NA
DRO	**224**	**158**
LEAD, TOTAL	41.2	NA

PP-1	0'-2'	2'-4'
BaP	**2.0**	0.8
DRO	**106**	34.1
LEAD, TOTAL	53.0	NA

TP-13	2'-4'
BaP	<RL
DRO	<RL
LEAD, TOTAL	6.8

PP-3	2'-4'
BaP	0.05
DRO	<RL
LEAD, TOTAL	3.8

ST-7	0'-1'
BaP	1.3
DRO	92.6
LEAD, TOTAL	28.3

PP-10	0'-2'
BaP	**3.2**
DRO	NA
LEAD, TOTAL	NA

PP-5	0'-2'	2'-4'
BaP	**1.4**	NA
DRO	**172**	<RL
LEAD, TOTAL	28.7	NA

PP-9	0'-2'
BaP	0.7
DRO	NA
LEAD, TOTAL	NA

PP-6	2'-4'
BaP	**2.5**
DRO	63.2
LEAD, TOTAL	41.2

PP-7	2'-4'
BaP	1.3
DRO	**111**
LEAD, TOTAL	17.0

TP-9	3'
BaP	**8.5**
DRO	**171**
LEAD, TOTAL	37.1

PP-13	2'-4'
BaP	1.3
DRO	**276**
LEAD, TOTAL	11.7

TP-10	0'-2'
BaP	0.7
DRO	**103**
LEAD, TOTAL	14.5

ST-11	3'-4'
BaP	<RL
DRO	<RL
LEAD, TOTAL	1.9

PP-14	0'-2'
BaP	**15.9**
DRO	**371**
LEAD, TOTAL	**774**
LEAD, TCLP	**9.8**

TP-2	2'-4'
BaP	<RL
DRO	<RL
LEAD, TOTAL	2.5

ST-5	0'-1'
BaP	0.9
DRO	94.7
LEAD, TOTAL	42.0

ST-3	0'-1'	3'-4'
BaP	0.7	0.2
DRO	**854**	**127**
LEAD, TOTAL	37.1	**390**

ST-4	0'-1'	3'-4'
BaP	**2.0**	1.3
DRO	**171**	**499**
LEAD, TOTAL	**332**	**1,230**
LEAD, TCLP	NA	2.9

TP-4	2'-4'
BaP	0.3
DRO	**136**
LEAD, TOTAL	8.6

PP-12	0'-2'
BaP	0.5
DRO	**868**
LEAD, TOTAL	10.2

TP-7	0'-2'
BaP	**3.4**
DRO	**129**
LEAD, TOTAL	180

TP-8	2'-4'
BaP	1.0
DRO	**186**
LEAD, TOTAL	55.6

ST-10	0'-1'	3'-4'
BaP	**2.7**	0.3
DRO	48.5	<RL
LEAD, TOTAL	**585**	29.5
LEAD, TCLP	0.67	NA

ST-9	3'-4'
BaP	0.1
DRO	28.0
LEAD, TOTAL	6.4

DEBRIS ENCOUNTERED (SEE BORING AND TRENCH LOGS FOR DETAILS)

APPROXIMATE LOCATION OF PUSH PROBE ENVIRONMENTAL ONLY

APPROXIMATE LOCATION OF HOLLOW STEM BORING ENVIRONMENTAL AND GEOTECHNICAL

APPROXIMATE LOCATION OF TEST TRENCH ENVIRONMENTAL ONLY

APPROXIMATE LOCATION OF VAPOR POINT

BaP	Benzo(a)pyrene
DRO	Diesel Range Organics
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
<RL	Not Detected at or Above the Reporting Limit Indicated in Laboratory Report
NE	Not Established
NA	Not Analyzed
SLV	Soil Leaching Value
SRV	Soil Reference Value
TCLP	Toxicity Characteristic Leaching Procedure
*	Minnesota Pollution Control Agency Petroleum Remediation Program has set Guidance Levels for DRO at less than 100 mg/kg

NOTES: TCLP Concentrations in mg/L
All other Concentrations in mg/kg

Compound	Residential SRV	Industrial SRV	SLV	Regulatory Level
BaP Equivalent	2	3	1.4	NE
DRO*	NE	NE	NE	100*
LEAD, TOTAL	300	700	2,700	NE
TCLP, LEAD	NE	NE	NE	5.0

75' 0 150'

SCALE: 1" = 150'

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SOIL ANALYTICAL RESULTS (0'-5')
PHASE II ENVIRONMENTAL SITE ASSESSMENT
SNELLING NORTH
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

Project No:	B1511122.00
Drawing No:	B1511122-00
Scale:	1" = 150'
Drawn By:	BJB
Date Drawn:	12/15/15
Checked By:	KAL
Last Modified:	1/29/16
Sheet: of	Fig: 3

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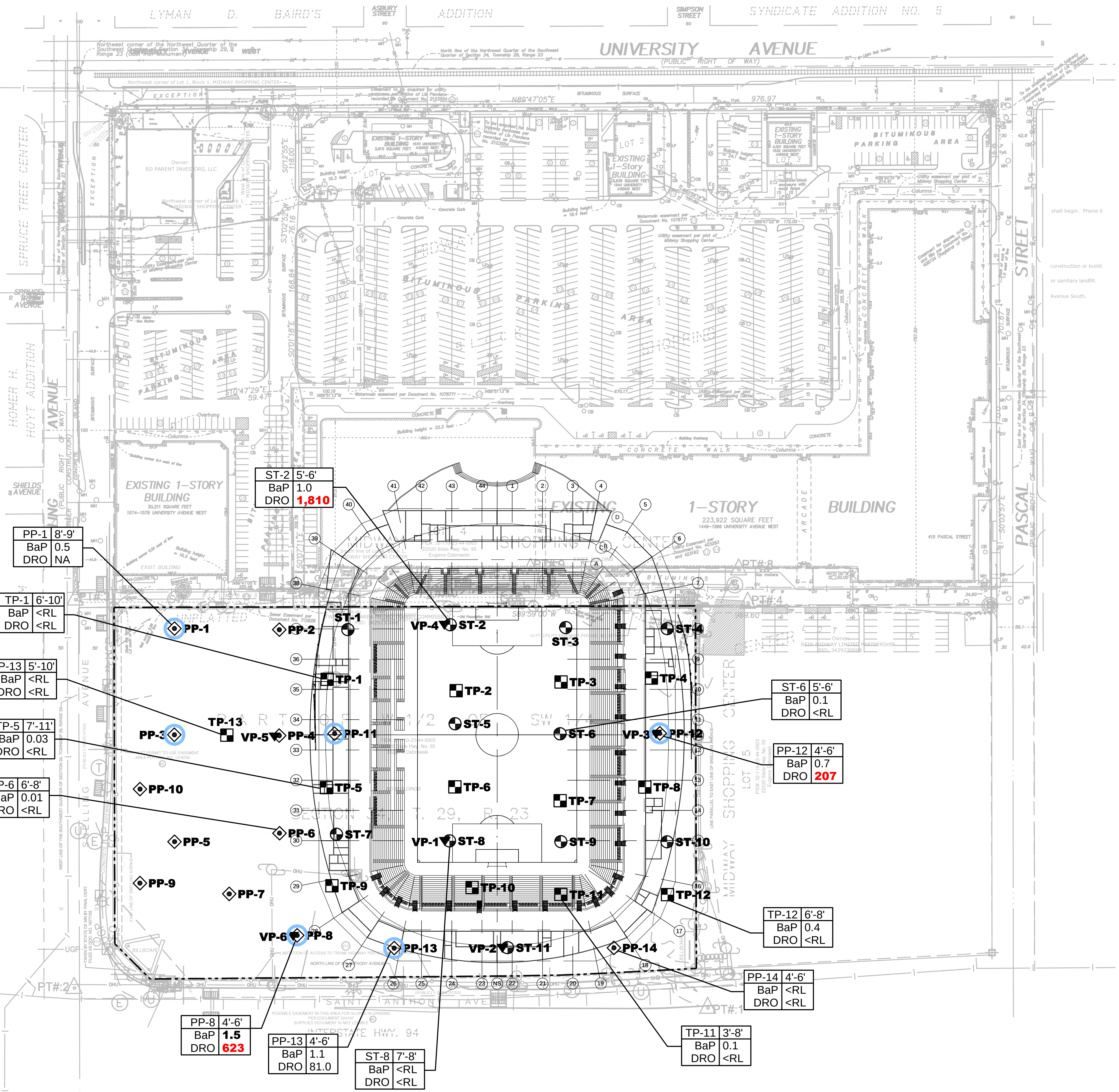

DEBRIS ENCOUNTERED (SEE BORING AND TRENCH LOGS FOR DETAILS)

APPROXIMATE LOCATION OF PUSH PROBE ENVIRONMENTAL ONLY

APPROXIMATE LOCATION OF HOLLOW STEM BORING ENVIRONMENTAL AND GEOTECHNICAL

APPROXIMATE LOCATION OF TEST TRENCH ENVIRONMENTAL ONLY

APPROXIMATE LOCATION OF VAPOR POINT

BaP Benzo(a)pyrene
DRO Diesel Range Organics
mg/kg Milligrams per Kilogram
<RL Not Detected at or Above the Reporting Limit Indicated in Laboratory Report
NE Not Established
NA Not Analyzed
SLV Soil Leaching Value
SRV Soil Reference Value

* Minnesota Pollution Control Agency Petroleum Remediation Program has set Guidance Levels for DRO at less than 100 mg/kg

NOTES: All Concentrations in mg/kg

Compound	Residential SRV	Industrial SRV	SLV	Regulatory Level
BaP Equivalent	2	3	1.4	NE
DRO*	NE	NE	NE	100*

N

75' 0 150'

SCALE: 1" = 150'

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SOIL ANALYTICAL RESULTS (5'-10')
PHASE II ENVIRONMENTAL SITE ASSESSMENT
SNELLING NORTH
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

Project No: B1511122.00
Drawing No: B1511122-00

Scale:	1" = 150'
Drawn By:	BJB
Date Drawn:	12/15/15
Checked By:	KAL
Last Modified:	1/29/16

Sheet: of
Fig: 4

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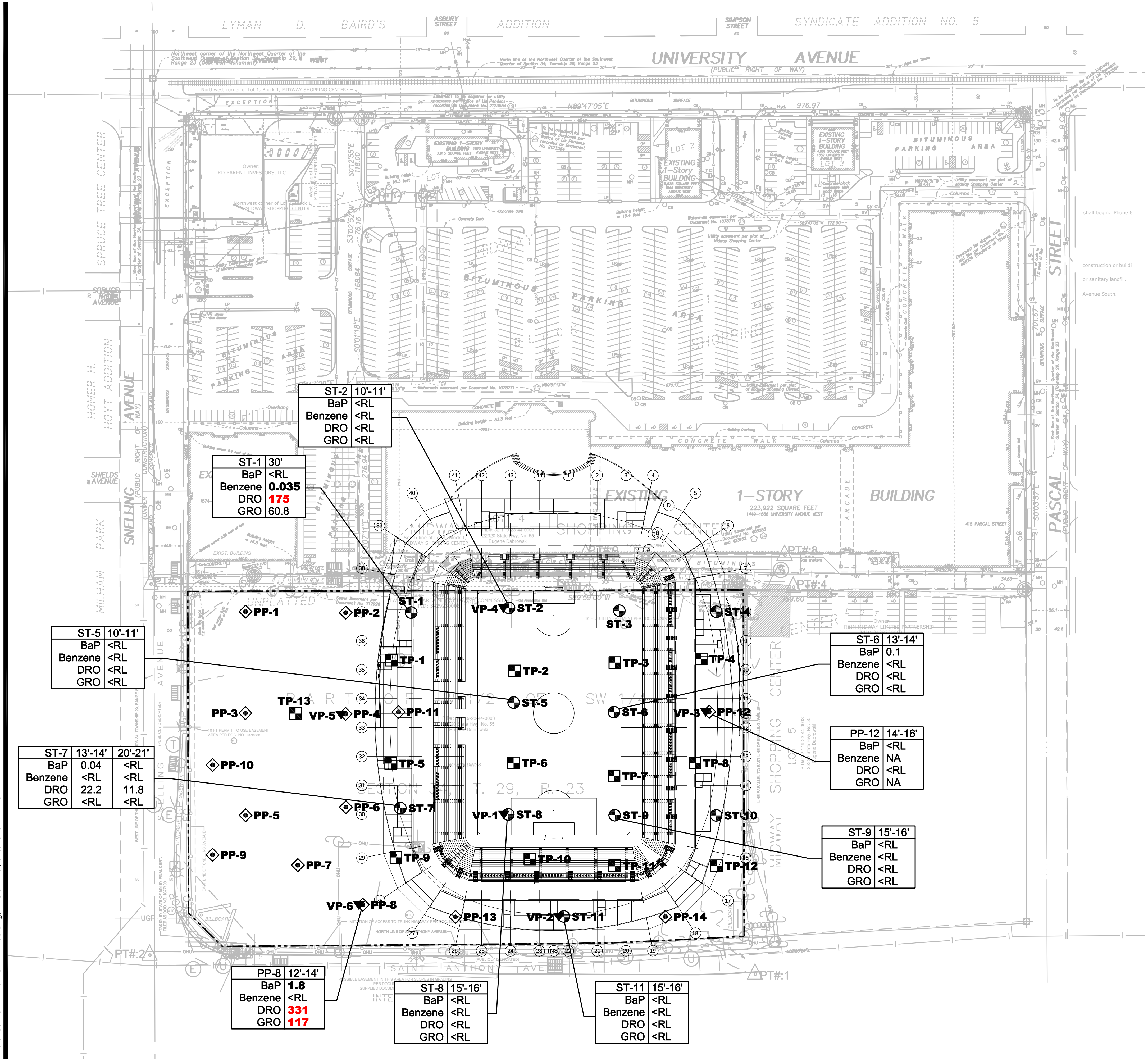

ST-2	10'-11'
BaP	<RL
Benzene	<RL
DRO	<RL
GRO	<RL

ST-1	30'
BaP	<RL
Benzene	**0.035**
DRO	**175**
GRO	60.8

ST-5	10'-11'
BaP	<RL
Benzene	<RL
DRO	<RL
GRO	<RL

ST-7	13'-14'	20'-21'
BaP	0.04	<RL
Benzene	<RL	<RL
DRO	22.2	11.8
GRO	<RL	<RL

PP-8	12'-14'
BaP	**1.8**
Benzene	<RL
DRO	**331**
GRO	**117**

ST-8	15'-16'
BaP	<RL
Benzene	<RL
DRO	<RL
GRO	<RL

ST-11	15'-16'
BaP	<RL
Benzene	<RL
DRO	<RL
GRO	<RL

ST-6	13'-14'
BaP	0.1
Benzene	<RL
DRO	<RL
GRO	<RL

PP-12	14'-16'
BaP	<RL
Benzene	NA
DRO	<RL
GRO	NA

ST-9	15'-16'
BaP	<RL
Benzene	<RL
DRO	<RL
GRO	<RL

APPROXIMATE LOCATION OF PUSH PROBE ENVIRONMENTAL ONLY

APPROXIMATE LOCATION OF HOLLOW STEM BORING ENVIRONMENTAL AND GEOTECHNICAL

APPROXIMATE LOCATION OF TEST TRENCH ENVIRONMENTAL ONLY

APPROXIMATE LOCATION OF VAPOR POINT

BaP Benzo(a)pyrene
DRO Diesel Range Organics
GRO Gasoline Range Organics
mg/kg Milligrams per Kilogram
<RL Not Detected at or Above the Reporting Limit Indicated in Laboratory Report
NE Not Established
NA Not Analyzed
SLV Soil Leaching Value
SRV Soil Reference Value

* Minnesota Pollution Control Agency Petroleum Remediation Program has set Guidance Levels for DRO / GRO at less than 100 mg/kg

NOTES: All Concentrations in mg/kg

Compound	Residential SRV	Industrial SRV	SLV	Regulatory Level
BaP Equivalent	**2**	**3**	**1.4**	NE
Benzene	**6**	**10**	**0.017**	NE
DRO*	NE	NE	NE	**100***
GRO*	NE	NE	NE	**100***

75' 0 150'
SCALE: 1" = 150'

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SOIL ANALYTICAL RESULTS (>10')
PHASE II ENVIRONMENTAL SITE ASSESSMENT
SNELLING NORTH
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

Project No: B1511122.00
Drawing No: B1511122-00
Scale: 1" = 150'
Drawn By: BJB
Date Drawn: 12/15/15
Checked By: KAL
Last Modified: 1/29/16
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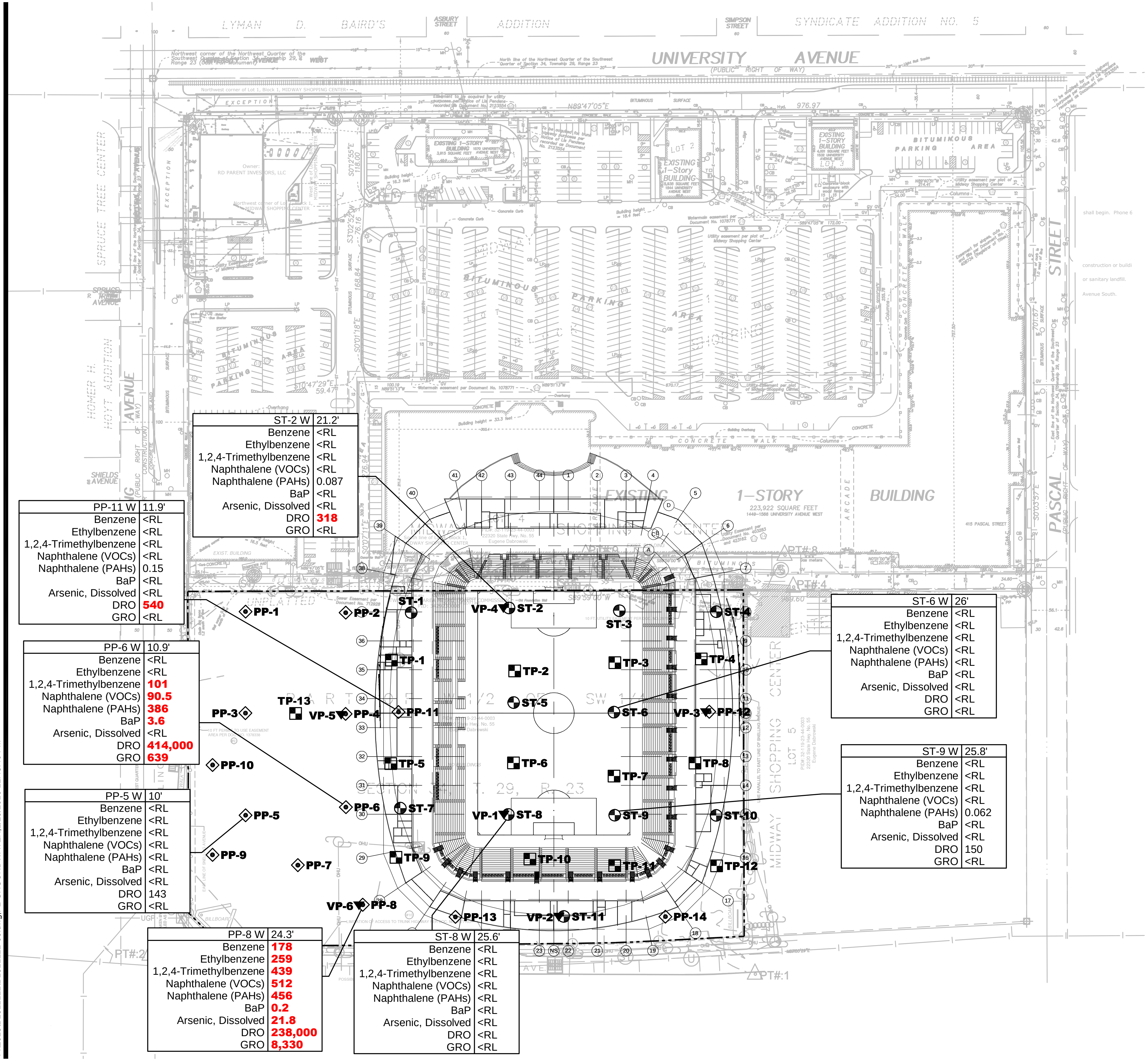

ST-2 W	21.2'
Benzene	<RL
Ethylbenzene	<RL
1,2,4-Trimethylbenzene	<RL
Naphthalene (VOCs)	<RL
Naphthalene (PAHs)	0.087
BaP	<RL
Arsenic, Dissolved	<RL
DRO	**318**
GRO	<RL

PP-11 W	11.9'
Benzene	<RL
Ethylbenzene	<RL
1,2,4-Trimethylbenzene	<RL
Naphthalene (VOCs)	<RL
Naphthalene (PAHs)	0.15
BaP	<RL
Arsenic, Dissolved	<RL
DRO	**540**
GRO	<RL

PP-6 W	10.9'
Benzene	<RL
Ethylbenzene	<RL
1,2,4-Trimethylbenzene	**101**
Naphthalene (VOCs)	**90.5**
Naphthalene (PAHs)	**386**
BaP	**3.6**
Arsenic, Dissolved	<RL
DRO	**414,000**
GRO	**639**

PP-5 W	10'
Benzene	<RL
Ethylbenzene	<RL
1,2,4-Trimethylbenzene	<RL
Naphthalene (VOCs)	<RL
Naphthalene (PAHs)	<RL
BaP	<RL
Arsenic, Dissolved	<RL
DRO	143
GRO	<RL

PP-8 W	24.3'
Benzene	**178**
Ethylbenzene	**259**
1,2,4-Trimethylbenzene	**439**
Naphthalene (VOCs)	**512**
Naphthalene (PAHs)	**456**
BaP	**0.2**
Arsenic, Dissolved	**21.8**
DRO	**238,000**
GRO	**8,330**

ST-8 W	25.6'
Benzene	<RL
Ethylbenzene	<RL
1,2,4-Trimethylbenzene	<RL
Naphthalene (VOCs)	<RL
Naphthalene (PAHs)	<RL
BaP	<RL
Arsenic, Dissolved	<RL
DRO	<RL
GRO	<RL

ST-6 W	26'
Benzene	<RL
Ethylbenzene	<RL
1,2,4-Trimethylbenzene	<RL
Naphthalene (VOCs)	<RL
Naphthalene (PAHs)	<RL
BaP	<RL
Arsenic, Dissolved	<RL
DRO	<RL
GRO	<RL

ST-9 W	25.8'
Benzene	<RL
Ethylbenzene	<RL
1,2,4-Trimethylbenzene	<RL
Naphthalene (VOCs)	<RL
Naphthalene (PAHs)	0.062
BaP	<RL
Arsenic, Dissolved	<RL
DRO	150
GRO	<RL

APPROXIMATE LOCATION OF PUSH PROBE ENVIRONMENTAL ONLY

APPROXIMATE LOCATION OF HOLLOW STEM BORING ENVIRONMENTAL AND GEOTECHNICAL

APPROXIMATE LOCATION OF TEST TRENCH ENVIRONMENTAL ONLY

APPROXIMATE LOCATION OF VAPOR POINT

BaP	Benzo(a)pyrene
DRO	Diesel Range Organics
GRO	Gasoline Range Organics
<RL	Not Detected at or Above the Reporting Limit Indicated in Laboratory Report
PAHs	Polycyclic-Aromatic Hydrocarbons
VOCs	Volatile Organic Compounds
µg/L	Micrograms per Liter
*	Provisional MDH Health Based Value for Total Petroleum Hydrocarbons (Sum of DRO and GRO)

NOTES: All Concentrations in µg/L

Compound	**MDH Recommended Value for Drinking Water**
Benzene	**2**
Ethylbenzene	**50**
1,2,4-Trimethylbenzene	**100**
Naphthalene (VOCs)	**70**
Naphthalene (PAHs)	**70**
BaP	**0.06**
Arsenic, Dissolved	**10**
DRO*	**200***
GRO*	**200***

75' 0 150'

SCALE: 1" = 150'

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GROUNDWATER ANALYTICAL RESULTS
PHASE II ENVIRONMENTAL SITE ASSESSMENT
SNELLING NORTH
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

Project No:	B1511122.00
Drawing No:	B1511122-00
Scale:	1" = 150'
Drawn By:	BJB
Date Drawn:	12/15/15
Checked By:	KAL
Last Modified:	1/29/16
Sheet: of	Fig: 6

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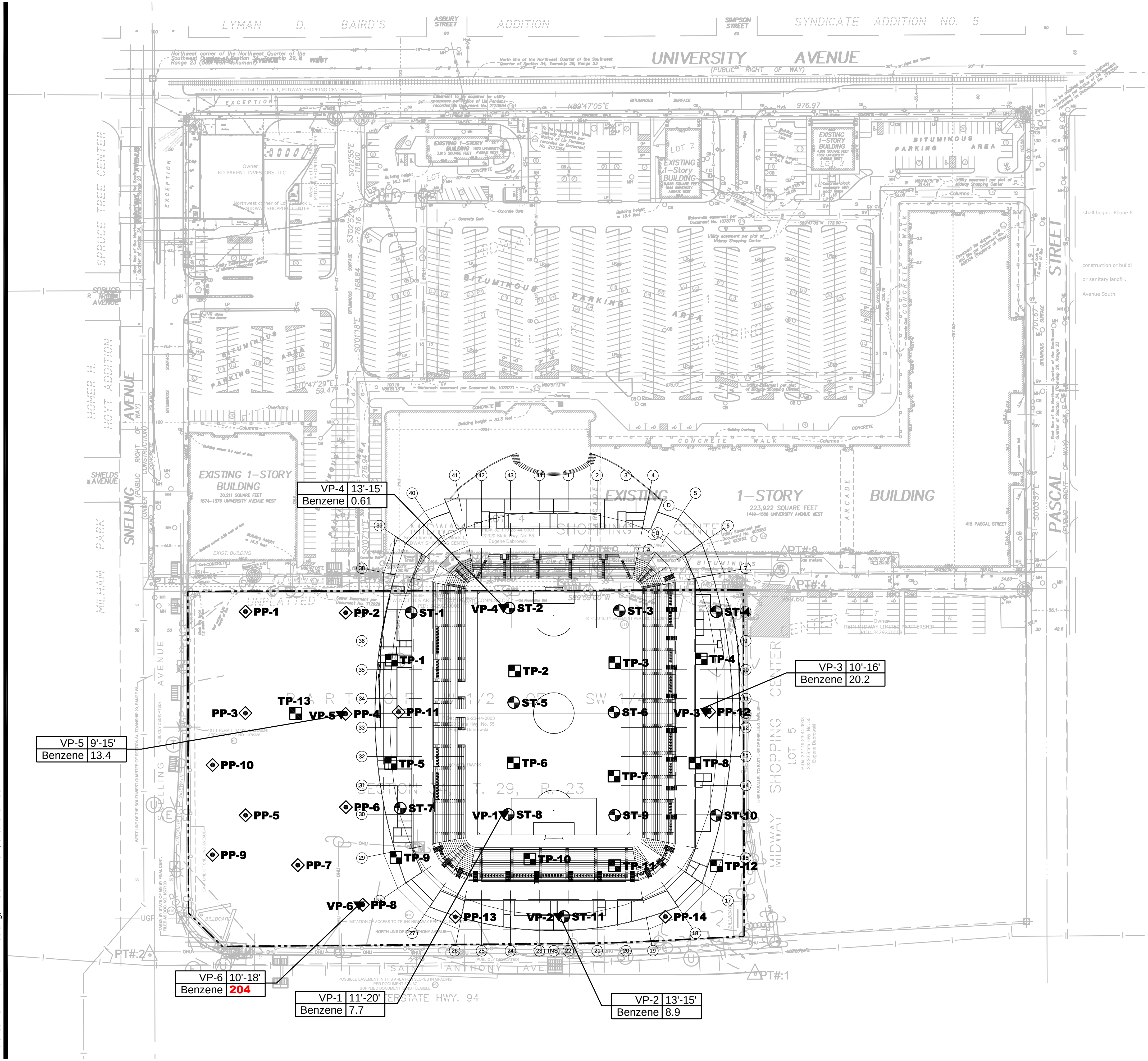

APPROXIMATE LOCATION OF PUSH PROBE ENVIRONMENTAL ONLY

APPROXIMATE LOCATION OF HOLLOW STEM BORING ENVIRONMENTAL AND GEOTECHNICAL

APPROXIMATE LOCATION OF TEST TRENCH ENVIRONMENTAL ONLY

APPROXIMATE LOCATION OF VAPOR POINT

ISV Intrusion Screening Value

µg/m³ Micrograms per Cubic Meter

NOTES: All Concentrations in µg/m³

Compound	10x ISV
Benzene	130

75' 0 150'

SCALE: 1" = 150'

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SOIL VAPOR ANALYTICAL RESULTS
PHASE II ENVIRONMENTAL SITE ASSESSMENT
SNELLING NORTH
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

Project No:	B1511122.00
Drawing No:	B1511122-00
Scale:	1" = 150'
Drawn By:	BJB
Date Drawn:	12/15/15
Checked By:	KAL
Last Modified:	1/26/16
Sheet: of	Fig: 7

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Table 1
Summary of Sampling Intervals and Analytical Parameters
Snelling North
Saint Paul, Minnesota
Project: B1511122.00

Soil Boring Number and Sampling Depth	Sample Type	Area of Environmental Concern and Location Relative to Proposed Stadium Development	Chemical Analysis Parameters
ST-1 (3-4’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-1 (30’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-2 (2-4’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-2 (10-11’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-3 (3-4’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-4 (0-1’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-5 (0-1’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-5 (10-11’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-6 (5-6’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-6 (13-14’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-7 (0-1’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-7 (13-14’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals

Notes:
VOCs = Volatile Organic Compounds
DRO = Diesel-Range Organics
GRO = Gasoline-Range Organics
PAH = Polynuclear Aromatic Hydrocarbons
RCRA = Eight Resource Conservation and Recovery Act metals

Table 1
Summary of Sampling Intervals and Analytical Parameters
Snelling North
Saint Paul, Minnesota
Project: B1511122.00

Soil Boring Number and Sampling Depth	Sample Type	Area of Environmental Concern and Location Relative to Proposed Stadium Development	Chemical Analysis Parameters
ST-7 (20-21’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-8 (7-8’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-8 (15-16’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-9 (3-4’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-9 (15-16’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-10 (0-1’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-10 (3-4’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-11 (3-4’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
ST-11 (15-16’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-1 (0-2’)	Soil	Shallow fill soil/debris. Outside of stadium structure footprint. Possible parking and utilities.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-1 (8-9’)	Soil	Fill soil/debris. Outside of stadium structure footprint. Possible parking and utilities.	PAHs and RCRA metals
PP-2 (2-4’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures. At edge of anticipated stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-3 (2-4’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures. Outside of stadium structure footprint. Possible parking and utilities.	VOCs, DRO, GRO, PAHs, and RCRA metals

Notes:
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Table 1
Summary of Sampling Intervals and Analytical Parameters
Snelling North
Saint Paul, Minnesota
Project: B1511122.00

Soil Boring Number and Sampling Depth	Sample Type	Area of Environmental Concern and Location Relative to Proposed Stadium Development	Chemical Analysis Parameters
PP-4 (0-2')	Soil	Shallow fill soil/debris. Possible buried debris from former structures. At edge of anticipated stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-5 (0-2')	Soil	Shallow fill soil/debris. Near previous petroleum release area. Outside of stadium structure footprint. Possible parking and utilities.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-6 (2-4')	Soil	Shallow fill soil/debris. Possible buried debris from former structures. At edge of anticipated stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-6 (6-8')	Soil	Shallow fill soil/debris. Possible buried debris from former structures. At edge of anticipated stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-7 (2-4')	Soil	Shallow fill soil/debris. Near previous petroleum release area. Outside of stadium structure footprint. Possible parking and utilities.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-8 (4-6')	Soil	Shallow fill soil/debris. Possible buried debris from former structures, near former petroleum release area, and within likely area backfilled during previous petroleum-related corrective actions. At edge of anticipated stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-8 (12-14')	Soil	Shallow fill soil/debris. Possible buried debris from former structures, near former petroleum release area, and within likely area backfilled during previous petroleum-related corrective actions. At edge of anticipated stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-9 (0-2')	Soil	PAH soil left in-place during previous demolition. Outside of stadium structure footprint. Possible parking and utilities.	PAHs
PP-10 (0-2')	Soil	PAH soil left in-place during previous demolition. Outside of stadium structure footprint. Possible parking and utilities.	PAHs
PP-11 (2-4')	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-12 (0-2')	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals

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DRO = Diesel-Range Organics
GRO = Gasoline-Range Organics
PAH = Polynuclear Aromatic Hydrocarbons
RCRA = Eight Resource Conservation and Recovery Act metals

Table 1
Summary of Sampling Intervals and Analytical Parameters
Snelling North
Saint Paul, Minnesota
Project: B1511122.00

Soil Boring Number and Sampling Depth	Sample Type	Area of Environmental Concern and Location Relative to Proposed Stadium Development	Chemical Analysis Parameters
PP-12 (4-6’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-13 (2-4’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination, and within likely area backfilled during previous petroleum-related corrective actions. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-13 (4-6’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination, and within likely area backfilled during previous petroleum-related corrective actions. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-14 (0-2’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
PP-14 (4-6’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
TP-1 (6-10’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures. Within stadium structure footprint.	DRO, GRO, PAHs, and RCRA metals
TP-2 (2-4’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures. Within stadium structure footprint.	DRO, GRO, PAHs, and RCRA metals
TP-4 (2-4’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures. Within stadium structure footprint.	DRO, GRO, PAHs, and RCRA metals
TP-5 (7-11’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures. Within stadium structure footprint.	DRO, GRO, PAHs, and RCRA metals
TP-7 (0-2’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures. Within stadium structure footprint.	DRO, GRO, PAHs, and RCRA metals
TP-8 (2-4’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures and deeper contamination. Within stadium structure footprint.	DRO, GRO, PAHs, and RCRA metals

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RCRA = Eight Resource Conservation and Recovery Act metals
DRO = Diesel-Range Organics
PAH = Polynuclear Aromatic Hydrocarbons

Table 1
Summary of Sampling Intervals and Analytical Parameters
Snelling North
Saint Paul, Minnesota
Project: B1511122.00

Soil Boring Number and Sampling Depth	Sample Type	Area of Environmental Concern and Location Relative to Proposed Stadium Development	Chemical Analysis Parameters
TP-9 (3’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures. Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and RCRA metals
TP-10 (0-2’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures. Within stadium structure footprint.	DRO, GRO, PAHs, and RCRA metals
TP-11 (3-8’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures. Within stadium structure footprint.	DRO, GRO, PAHs, and RCRA metals
TP-12 (6-8’)	Soil	Shallow fill soil/debris. Possible buried debris from former structures. Within stadium structure footprint.	DRO, GRO, PAHs, and RCRA metals
TP-13 (2-4’)	Soil	Shallow fill soil/debris. Possible buried debris from former structure. Outside of stadium structure footprint. Possible parking and utilities.	DRO, GRO, PAHs, and RCRA metals
TP-13 (5-10’)	Soil	Shallow fill soil/debris. Possible buried debris from former structure. Outside of stadium structure footprint. Possible parking and utilities.	DRO, GRO, PAHs, and RCRA metals
ST-2W (21.2’)	Water	Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and Dissolved RCRA metals
ST-6W (26’)	Water	Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and Dissolved RCRA metals
ST-8W (25.6’)	Water	Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and Dissolved RCRA metals
ST-9W (25.8’)	Water	Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and Dissolved RCRA metals
PP-5W (10.0’)	Water	Outside of stadium structure footprint. Possible parking and utilities.	VOCs, DRO, GRO, PAHs, and Dissolved RCRA metals
PP-6W (10.9’)	Water	At edge of anticipated stadium structure footprint.	VOCs, DRO, GRO, PAHs, and Dissolved RCRA metals
PP-8W (24.3’)	Water	At edge of anticipated stadium structure footprint.	VOCs, DRO, GRO, PAHs, and Dissolved RCRA metals
PP-11W (11.9’)	Water	Within stadium structure footprint.	VOCs, DRO, GRO, PAHs, and Dissolved RCRA metals

Notes:
VOCs = Volatile Organic Compounds
GRO = Gasoline-Range Organics
RCRA = Eight Resource Conservation and Recovery Act metals
DRO = Diesel-Range Organics
PAH = Polynuclear Aromatic Hydrocarbons

Table 1
Summary of Sampling Intervals and Analytical Parameters
Snelling North
Saint Paul, Minnesota
Project: B1511122.00

Soil Boring Number and Sampling Depth	Sample Type	Area of Environmental Concern and Location Relative to Proposed Stadium Development	Chemical Analysis Parameters
VP-1 (11-20’)	Vapor	Within stadium structure footprint.	VOCs
VP-2 (13-15’)	Vapor	At edge of anticipated stadium structure footprint.	VOCs
VP-3 (10-16’)	Vapor	At edge of anticipated stadium structure footprint.	VOCs
VP-4 (13-15’)	Vapor	Within stadium structure footprint. Near possible contamination concern from adjoining property.	VOCs
VP-5 (9-15’)	Vapor	At edge of anticipated stadium structure footprint.	VOCs
VP-6 (10-18’)	Vapor	At edge of anticipated stadium structure footprint. Near former petroleum release area.	VOCs

Notes:
VOCs = Volatile Organic Compounds
GRO = Gasoline-Range Organics
RCRA = Eight Resource Conservation and Recovery Act metals
DRO = Diesel-Range Organics
PAH = Polynuclear Aromatic Hydrocarbons

Table 2
Summary of Soil Screening Intervals
Snelling North
Saint Paul, Minnesota
Project: B1511122.00

Depth (ft)	ST-1	ST-2	ST-3	ST-4	ST-5	ST-6	ST-7	ST-8	ST-9	ST-10	ST-11
0-1.5’	0.1	0.1	3.1	0.0	0.0	0.0	0.4	0.0	0.1	0.4	0.0
2.5-4’	0.2	0.4	1.9	0.1	0.0	0.0	0.4	0.0	0.0	1.2	0.0
5-6.5’	0.4	**55.0**	0.0	0.1	0.0	0.0	0.3	0.3	0.0	0.5	0.0
7.5-9’	0.2	-	-	-	-	0.0	0.2	0.0	0.0	2.4	0.0
10-11.5’	0.3	0.0	0.5	0.1	0.0	0.0	0.6	0.0	0.0	-	0.0
12.5-14’	0.2	0.0	0.2	0.0	-	0.0	0.5	0.0	0.0	1.4	0.0
15-16.5’	0.1	0.0	0.5	-	0.1	0.1	**31.6**	0.1	0.0	0.3	0.0
20-21.5’	0.1	0.0	-	0.1	0.0	-	**45.8**	0.0	0.0	0.1	0.0
25-26.5’	0.0	0.0	-	0.2	0.0	-	**6.8**	0.0	0.0	0.2	0.0
30-31.5’	**395.1**	0.1	-	0.1	0.1	0.0	2.7	-	0.1	0.3	0.0
35-36.5’	**219.31**	0.0	0.0	-	0.0	0.0	0.1	-	0.0	0.1	0.0
40-41.5’	-	-	0.1	-	-	-	0.5	-	-	-	-

Note:
Concentrations in parts per million (ppm)
- = No sample recovery

Table 2
Summary of Soil Screening Intervals
Snelling North
Saint Paul, Minnesota
Project: B1511122.00

Depth (ft)	PP-1	PP-2	PP-3	PP-4	PP-5	PP-6	PP-7	PP-8	PP-9	PP-10	PP-11	PP-12	PP-13	PP-14
0-2.5’	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.5-5’	0.0	1.8	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	**23.2**	0.0
5-7.5’	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**77.5**	-	-	0.0	0.0	1.5	0.0
7.5-10’	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	-	-	0.0	0.0	0.0	0.0
10-12.5’	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**10.2**	-	-	0.0	0.0	0.0	0.0
12.5-15’	-	-	-	-	0.0	1.7	**235.9**	**10.6**	-	-	0.0	0.0	0.3	0.0
15-17.5’	-	-	-	-	0.0	**122.5**	**501.8**	1.5	-	-	0.0	-	**51.5**	0.0
17.5-20’	-	-	-	-	0.0	**24.0**	**562.7**	**611.2**	-	-	0.0	-	-	-
20-22.5’	-	-	-	-	-	-		**270.6**	-	-	-	-	-	-
22.5-25’	-	-	-	-	-	-	-	**285.1**	-	-	-	-	-	-
25-27.5’	-	-	-	-	-	-	-	**256.8**	-	-	-	-	-	-
27.5-30’	-	-	-	-	-	-	-	**18.9**	-	-	-	-	-	-

Note:
Concentrations in parts per million (ppm)
- = No sample recovery

Table 2
Summary of Soil Screening Intervals
Snelling North
Saint Paul, Minnesota
Project: B1511122.00

Depth (ft)	TP-1	TP-2	TP -3	TP -4	TP -5	TP -6	TP -7	TP -8	TP -9	TP -10	TP -11	TP -12	TP-13
0-2.5’	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
2.5-5’	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**6.8**	0.0	0.0	0.0	0.0
5-7.5’	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0
7.5-10’	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0

Note:
Concentrations in parts per million (ppm)
- = No sample recovery

Additional Phase II ESA Data

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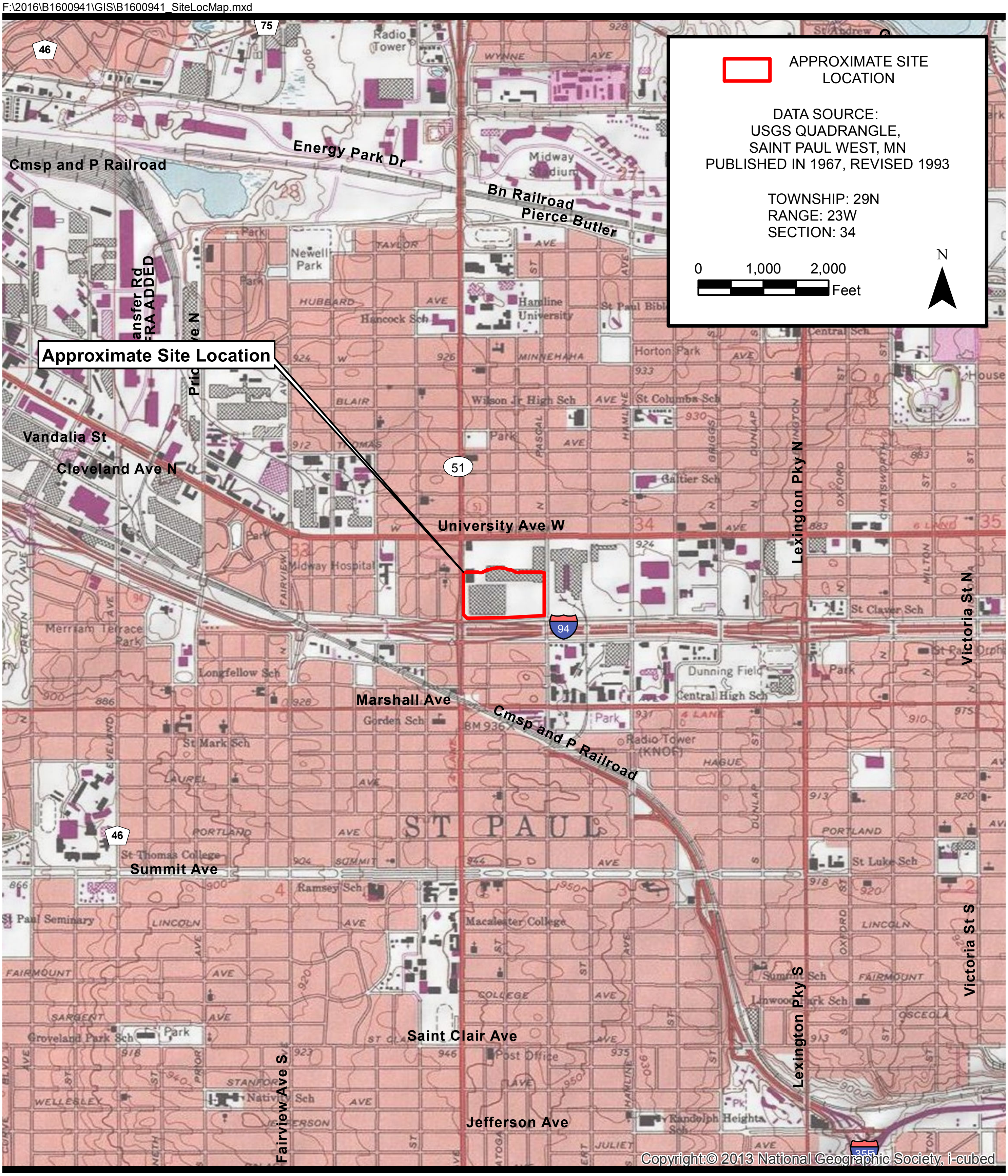

Sheet: 1 of 1

Fig. 1

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Scale:	1 in = 2,000 ft
Drawn By:	CMF
Date Drawn:	03/08/2016
Checked By:	MJ
Last Modified:	3/8/16

SITE LOCATION MAP

ADDITIONAL PHASE II ENVIRONMENTAL SITE ASSESSMENT
PROPOSED SOCCER STADIUM PROJECT
400 SNELLING AVENUE NORTH
ST. PAUL, MINNESOTA

BRAUN INTERTEC
11001 Hampshire Avenue So.
Minneapolis, MN 55438
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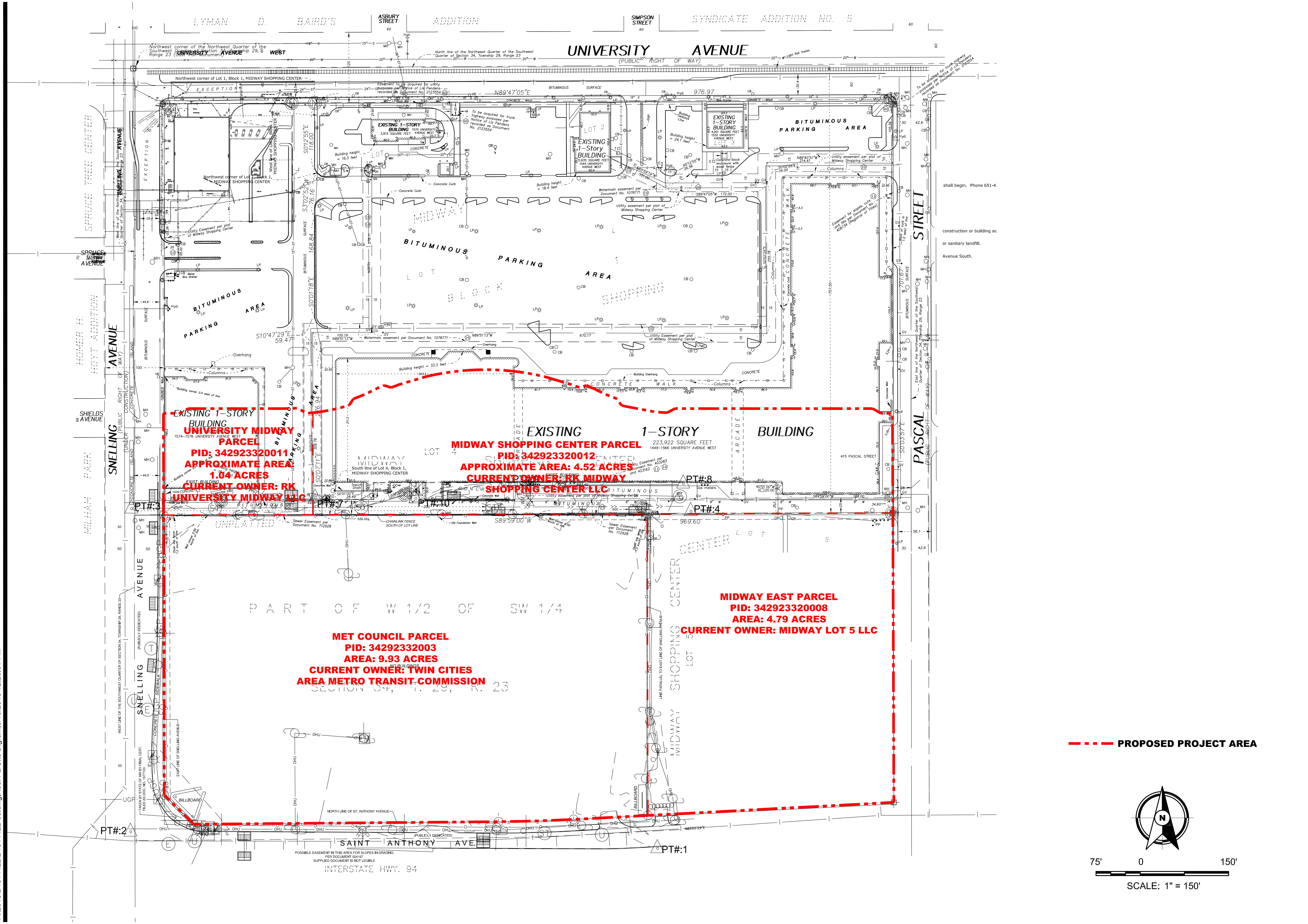

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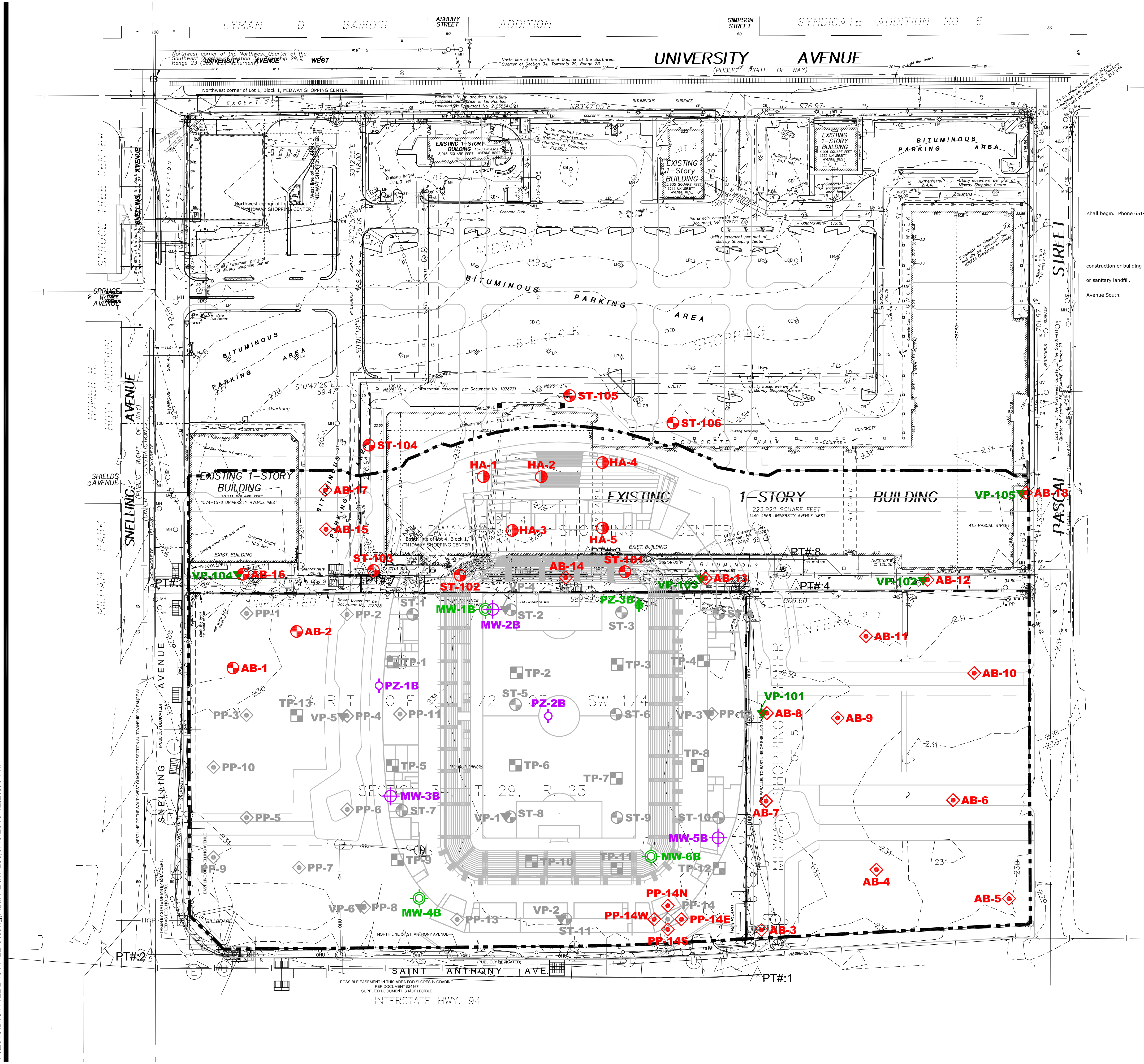
The Science You Build On.
11001 Hampshire Avenue S
Minneapolis, MN 55438
PH. (952) 995-2000
FAX (952) 995-2020

SITE DIAGRAM
ADDITIONAL PHASE II ENVIRONMENTAL SITE ASSESSMENT
PROPOSED SOCCER STADIUM PROJECT
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

Project No:	B1600941
Drawing No:	B1511122-00
Scale:	1" = 150'
Drawn By:	BJB
Date Drawn:	12/15/15
Checked By:	MAC
Last Modified:	3/13/16
Sheet: of	Fig: 2



- PROPOSED PROJECT AREA
- APPROXIMATE LOCATION OF HOLLOW STEM BORING (BRAUN, 2016)
- APPROXIMATE LOCATION OF PUSH PROBE (BRAUN, 2016)
- APPROXIMATE LOCATION OF HAND AUGER BORING (BRAUN, 2016)
- APPROXIMATE LOCATION OF DEEP PIEZOMETER (BRAUN, 2016)
- APPROXIMATE LOCATION OF SHALLOW PIEZOMETER (BRAUN, 2016)
- APPROXIMATE LOCATION OF DEEP MONITORING WELL (BRAUN, 2016)
- APPROXIMATE LOCATION OF SHALLOW MONITORING WELL (BRAUN, 2016)
- APPROXIMATE LOCATION OF VAPOR POINT (BRAUN, 2016)
- APPROXIMATE LOCATION OF HOLLOW STEM BORING (PREVIOUSLY COMPLETED - BRAUN, 2015)
- APPROXIMATE LOCATION OF PUSH PROBE (PREVIOUSLY COMPLETED - BRAUN, 2015)
- APPROXIMATE LOCATION OF TEST TRENCH (PREVIOUSLY COMPLETED - BRAUN, 2015)
- APPROXIMATE LOCATION OF VAPOR POINT (PREVIOUSLY COMPLETED - BRAUN, 2015)

75' 0 150'

SCALE: 1" = 150'

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ADDITIONAL INVESTIGATION LOCATIONS

ADDITIONAL PHASE II ENVIRONMENTAL SITE ASSESSMENT
PROPOSED SOCCER STADIUM PROJECT
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

Project No: B1600941

Drawing No: B1511122-00

Scale:	1" = 150'
Drawn By:	BJB
Date Drawn:	12/15/15
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Last Modified:	3/13/16

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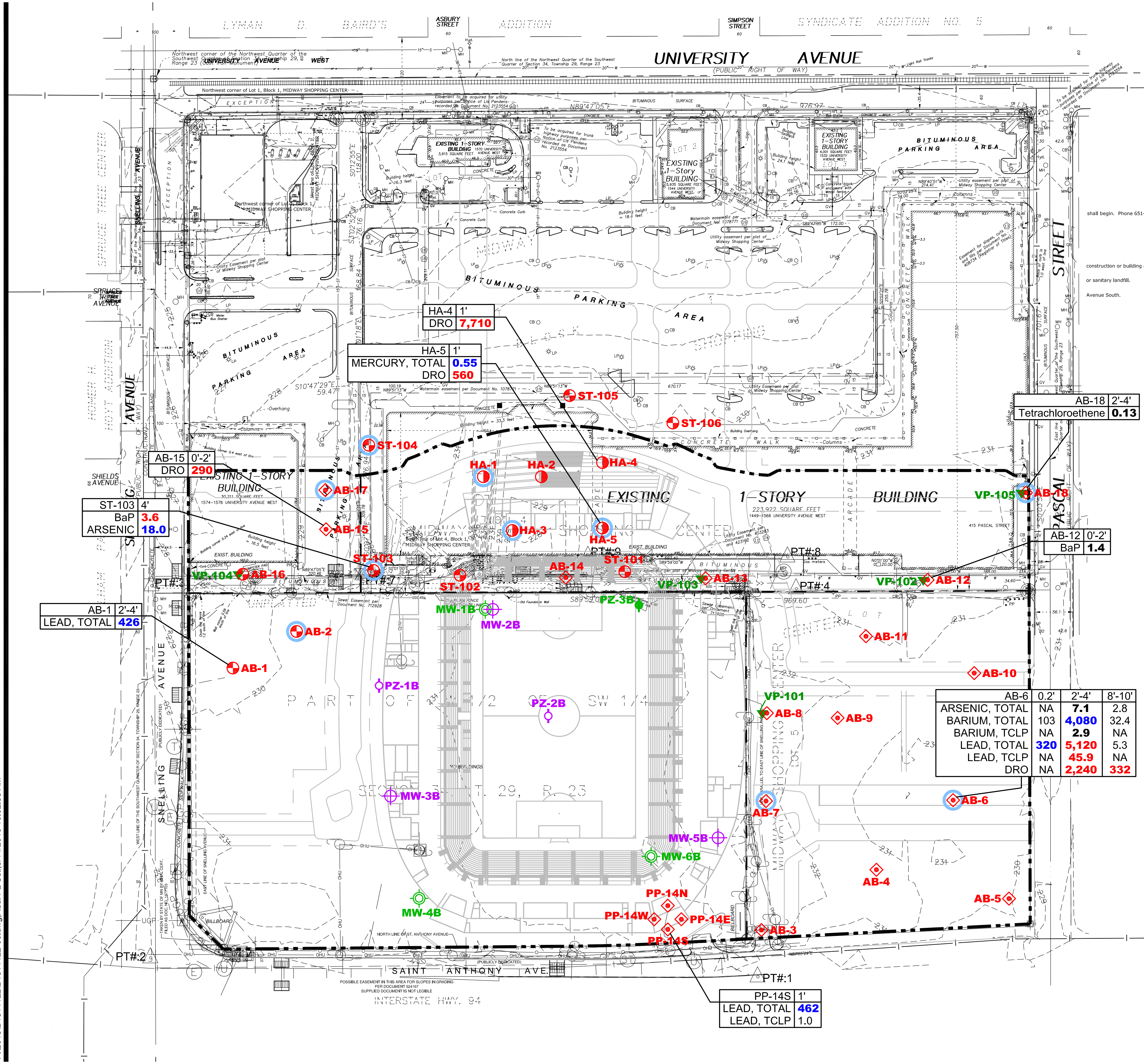

PROPOSED PROJECT AREA

DEBRIS ENCOUNTERED (SEE BORING AND TRENCH LOGS FOR DETAILS)

APPROXIMATE LOCATION OF HOLLOW STEM BORING (BRAUN, 2016)

APPROXIMATE LOCATION OF PUSH PROBE (BRAUN, 2016)

APPROXIMATE LOCATION OF HAND AUGER BORING (BRAUN, 2016)

APPROXIMATE LOCATION OF DEEP PIEZOMETER (BRAUN, 2016)

APPROXIMATE LOCATION OF SHALLOW PIEZOMETER (BRAUN, 2016)

APPROXIMATE LOCATION OF DEEP MONITORING WELL (BRAUN, 2016)

APPROXIMATE LOCATION OF SHALLOW MONITORING WELL (BRAUN, 2016)

APPROXIMATE LOCATION OF VAPOR POINT (BRAUN, 2016)

BaP Benzo(a)pyrene
DRO Diesel Range Organics
mg/kg Milligrams per Kilogram
mg/L Milligrams per Liter
NE Not Established
NA Not Analyzed
SLV Soil Leaching Value
SRV Soil Reference Value
TCLP Toxicity Characteristic Leaching Procedure

* Minnesota Pollution Control Agency Petroleum Remediation Program has set Guidance Levels for DRO at less than 100 mg/kg

NOTES: TCLP Concentrations in mg/L
All other Concentrations in mg/kg

Compound	Residential SRV	Industrial SRV	SLV	Regulatory Level
BaP Equivalent	2	3	1.4	NE
ARSENIC, TOTAL	9	20	5.8	NE
BARIUM, TOTAL	1,100	18,000	1,700	NE
BARIUM, TCLP	NE	NE	NE	100
LEAD, TOTAL	300	700	2,700	NE
TCLP, LEAD	NE	NE	NE	5.0
MERCURY, TOTAL	0.5	1.5	3.3	NE
DRO*	NE	NE	NE	100*
Tetrachloroethene	72	131	0.042	NE

75' 0 150'

SCALE: 1" = 150'

BRAUN INTERTEC
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SOIL ANALYTICAL RESULTS
ADDITIONAL PHASE II ENVIRONMENTAL SITE ASSESSMENT
PROPOSED SOCCER STADIUM PROJECT
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

Project No: B1600941
Drawing No: B1511122-00
Scale: 1" = 150'
Drawn By: BJB
Date Drawn: 12/15/15
Checked By: MAC
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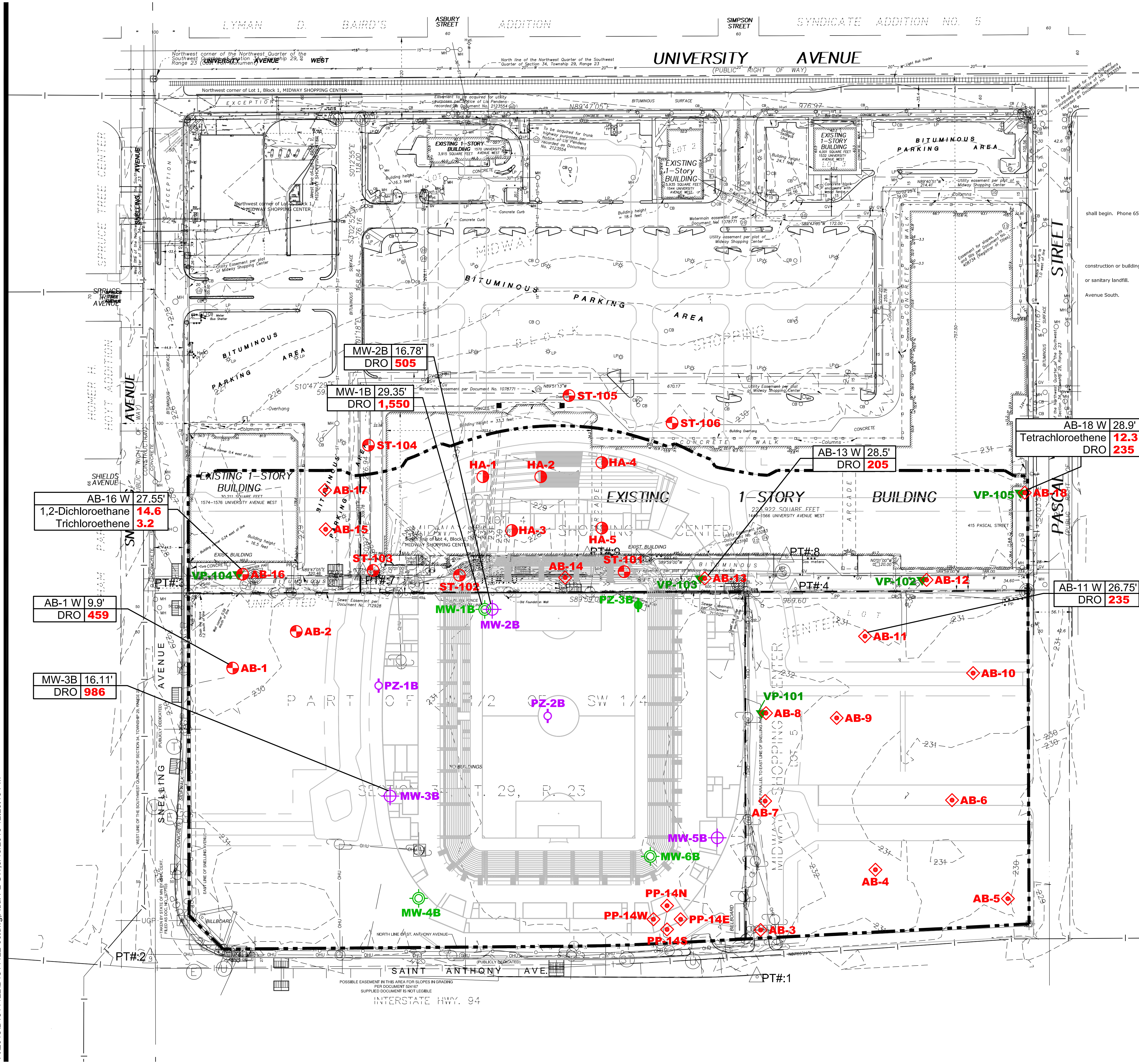

PROPOSED PROJECT AREA

APPROXIMATE LOCATION OF HOLLOW STEM BORING (BRAUN, 2016)

APPROXIMATE LOCATION OF PUSH PROBE (BRAUN, 2016)

APPROXIMATE LOCATION OF HAND AUGER BORING (BRAUN, 2016)

APPROXIMATE LOCATION OF DEEP PIEZOMETER (BRAUN, 2016)

APPROXIMATE LOCATION OF SHALLOW PIEZOMETER (BRAUN, 2016)

APPROXIMATE LOCATION OF DEEP MONITORING WELL (BRAUN, 2016)

APPROXIMATE LOCATION OF SHALLOW MONITORING WELL (BRAUN, 2016)

APPROXIMATE LOCATION OF VAPOR POINT (BRAUN, 2016)

DRO Diesel Range Organics
µg/L Micrograms per Liter

NOTE: All Concentrations in µg/L

Compound	MDH Recommended Value for Drinking Water
1,2-Dichloroethane	1
Tetrachloroethene	4
Trichloroethene	0.4
DRO	200

GROUNDWATER ANALYTICAL RESULTS
ADDITIONAL PHASE II ENVIRONMENTAL SITE ASSESSMENT
PROPOSED SOCCER STADIUM PROJECT
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

BRAUN INTERTEC
The Science You Build On.
11001 Hampshire Avenue S
Minneapolis, MN 55438
PH. (952) 995-2000
FAX (952) 995-2020

Project No:	B1600941
Drawing No:	B1511122-00
Scale:	1" = 150'
Drawn By:	BJB
Date Drawn:	12/15/15
Checked By:	MAC
Last Modified:	3/13/16
Sheet: of	Fig: 5

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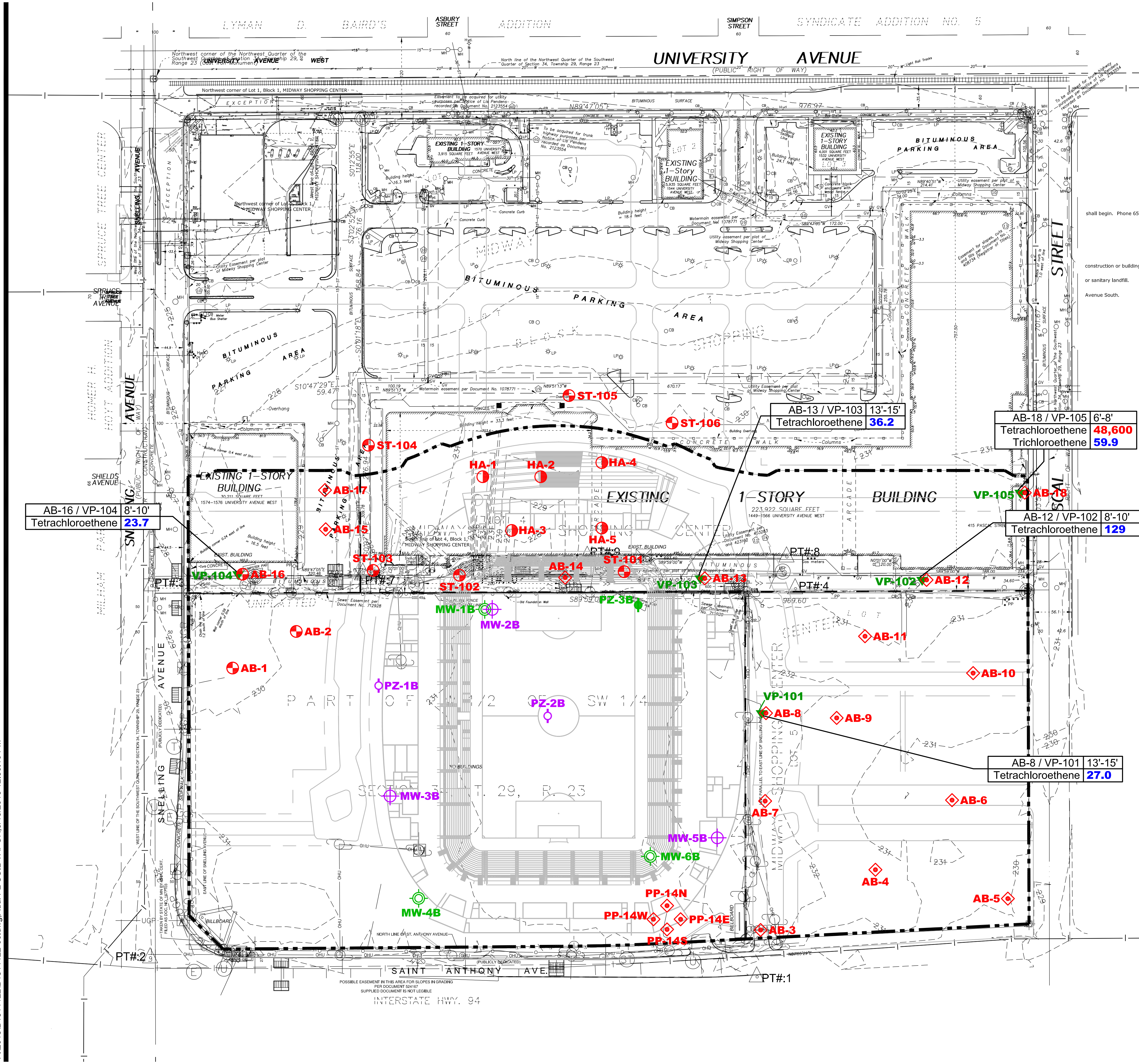

- PROPOSED PROJECT AREA
- APPROXIMATE LOCATION OF HOLLOW STEM BORING (BRAUN, 2016)
- APPROXIMATE LOCATION OF PUSH PROBE (BRAUN, 2016)
- APPROXIMATE LOCATION OF HAND AUGER BORING (BRAUN, 2016)
- APPROXIMATE LOCATION OF DEEP PIEZOMETER (BRAUN, 2016)
- APPROXIMATE LOCATION OF SHALLOW PIEZOMETER (BRAUN, 2016)
- APPROXIMATE LOCATION OF DEEP MONITORING WELL (BRAUN, 2016)
- APPROXIMATE LOCATION OF SHALLOW MONITORING WELL (BRAUN, 2016)
- APPROXIMATE LOCATION OF VAPOR POINT (BRAUN, 2016)

ISV Intrusion Screening Value
µg/m³ Micrograms per Cubic Meter

NOTE: All Concentrations in µg/m³

Compound	ISV 10x Residenital	ISV 100x Industrial
Tetrachloroethene	20	3,000
Trichloroethene	20	600

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SOIL VAPOR ANALYTICAL RESULTS
ADDITIONAL PHASE II ENVIRONMENTAL SITE ASSESSMENT
PROPOSED SOCCER STADIUM PROJECT
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

Project No:	B1600941
Drawing No:	B1511122-00
Scale:	1" = 150'
Drawn By:	BJB
Date Drawn:	12/15/15
Checked By:	MAC
Last Modified:	3/13/16
Sheet: of	Fig: 6

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Table 1
Summary of Sampling Intervals and Analytical Parameters
Snelling North
Saint Paul, Minnesota
Project: B1511122.00

Soil Boring Number and Sampling Depth	Sample Type	Area of Environmental Concern and Location	Chemical Analysis Parameters
AB-1 (2-4’)	Soil	Shallow fill soil/debris. Possible impacts on Metropolitan Council Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-1 W (9.9’)	Water	Possible impacts on Metropolitan Council Parcel.	GRO, DRO, and VOCs
AB-2 (2-4’)	Soil	Shallow fill soil/debris. Possible impacts on Metropolitan Council Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-2 (8-10’)	Soil	Shallow fill soil/debris. Possible impacts on Metropolitan Council Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-3 (0-2.5)	Soil	Possible impacts from historical site operations on Midway East Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-4 (0-2’)	Soil	Possible impacts from historical site operations on Midway East Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-5 (2-4’)	Soil	Possible impacts from historical site operations on Midway East Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-6 (0-2’)	Soil	Possible impacts from historical site operations on Midway East Parcel.	Total Lead and Total Barium
AB-6 (2-4’)	Soil	Possible impacts from historical site operations on Midway East Parcel.	DRO, GRO, VOCs, PAHs, RCRA metals, TCLP Lead, and TCLP Barium
AB-6 (8-10’)	Soil	Possible impacts from historical site operations on Midway East Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-6 W (26.90’)	Water	Possible impacts on Midway East Parcel.	GRO, DRO, VOCs, PAHs, and dissolved metals
AB-7 (0-2’)	Soil	Possible impacts from historical site operations on Midway East Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-7 W (28.75’)	Water	Possible impacts on Midway East Parcel.	GRO, DRO, VOCs, PAHs, and dissolved metals
AB-8 (0-2’)	Soil	Possible impacts from historical site operations on Midway East Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-8 (2-4’)	Soil	Possible impacts from historical site operations on Midway East Parcel.	DRO, PAHs, and RCRA metals

Table 1
Summary of Sampling Intervals and Analytical Parameters
Snelling North
Saint Paul, Minnesota
Project: B1511122.00

Soil Boring Number and Sampling Depth	Sample Type	Area of Environmental Concern and Location	Chemical Analysis Parameters
AB-8 VP-101 (13-15’)	Soil Vapor	Possible impacts on Midway East Parcel.	VOCs by TO-15
AB-9 (2-4’)	Soil	Possible impacts from historical site operations on Midway East Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-9 (10-12’)	Soil	Possible impacts from historical site operations on Midway East Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-10 (2-4’)	Soil	'Possible impacts from historical site operations on Midway East Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-10 (7-9’)	Soil	Possible impacts from historical site operations on Midway East Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-11 (2-4’)	Soil	Possible impacts from historical site operations on Midway East Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-11 (10-12’)	Soil	Possible impacts from historical site operations on Midway East Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-11 W (26.75’)	Water	Possible impacts on Midway East Parcel.	GRO, DRO, VOCs, PAHs, and dissolved metals
AB-12 (0-2’)	Soil	Possible impacts on Midway Shopping Center Parcel. Close to known drycleaner release.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-12 (8-10’)	Soil	Possible impacts on Midway Shopping Center Parcel. Close to known drycleaner release.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-12 VP-102 (8-10')	Soil Vapor	Possible impacts on Midway Shopping Center Parcel. Close to known drycleaner release.	VOCs by TO-15
AB-13 (2-4')	Soil	Possible impacts from historical site operations south end of Midway Shopping Center Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-13 (10-12')	Soil	Possible impacts from historical site operations south end of Midway Shopping Center Parcel.	DRO, PAHs, and RCRA metals
AB-13 W (28.5’)	Water	Possible impacts from historical site operations south end of Midway Shopping Center Parcel.	GRO, DRO, VOCs, PAHs, and dissolved metals
AB-13 VP-103 (13-15’)	Soil Vapor	Possible impacts from historical site operations south end of Midway Shopping Center Parcel.	VOCs by TO-15
AB-14 (0-2’)	Soil	Possible impacts from historical site operations on south end of Midway Shopping Center Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-14 (2-4’)	Soil	Possible impacts from historical site operations on south end of Midway Shopping Center Parcel.	DRO, PAHs, and RCRA metals

Table 1
Summary of Sampling Intervals and Analytical Parameters
Snelling North
Saint Paul, Minnesota
Project: B1511122.00

Soil Boring Number and Sampling Depth	Sample Type	Area of Environmental Concern and Location	Chemical Analysis Parameters
AB-14 (10-12’)	Soil	Possible impacts from historical site operations on south end of Midway Shopping Center Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-15 (0-2’)	Soil	Possible impacts from historical site operations on University Midway Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-15 (2-4’)	Soil	Possible impacts from historical site operations on University Midway Parcel.	DRO, PAHs, and RCRA metals
AB-16 (9-11’)	Soil	Possible impacts from historical site operations on University Midway Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-16 W (27.55’)	Water	Possible impacts from historical site operations on University Midway Parcel.	GRO, DRO, VOCs, PAHs, and dissolved metals
AB-16 VP-104 (8-10')	Soil Vapor	Possible impacts from historical site operations on University Midway Parcel.	VOCs by TO-15
AB-17 (2-4’)	Soil	Possible impacts from historical site operations on University Midway Parcel.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-18 (2-4’)	Soil	Possible impacts on Midway Shopping Center Parcel. Close to known drycleaner release.	DRO, GRO, VOCs, PAHs, and RCRA metals
AB-18 (8-9’)	Soil	Possible impacts on Midway Shopping Center Parcel. Close to known drycleaner release.	VOCs
AB-18 W (29.9’)	Water	Possible impacts on Midway Shopping Center Parcel. Close to known drycleaner release.	GRO, DRO, VOCs, PAHs, and dissolved metals
AB-18 VP-105 (6-8’)	Soil Vapor	Possible impacts on Midway Shopping Center Parcel. Close to known drycleaner release.	VOCs by TO-15
PP-14-N (1’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead, TCLP Lead
PP-14-N (2’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead, TCLP Lead
PP-14-N (3’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead, TCLP Lead
PP-14-N (4’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead
PP-14-E (1’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead, TCLP Lead
PP-14-E (2’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead, TCLP Lead

Table 1
Summary of Sampling Intervals and Analytical Parameters
Snelling North
Saint Paul, Minnesota
Project: B1511122.00

Soil Boring Number and Sampling Depth	Sample Type	Area of Environmental Concern and Location	Chemical Analysis Parameters
PP-14-E (3’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead
PP-14-E (4’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead
PP-14-S (1’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead, TCLP Lead
PP-14-S (2’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead, TCLP Lead
PP-14-S (3’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead
PP-14-S (4’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead
PP-14-W (1’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead, TCLP Lead
PP-14-W (2’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead, TCLP Lead
PP-14-W (3’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead
PP-14-W (4’)	Soil	Further define the extent of lead impacted soil to be addressed by stabilization as part of RAP.	Total Lead
HA-1 (2')	Soil	Possible impacts on Midway Shopping Center Parcel (beneath current building).	PAHs, Metals
HA-2 (2')	Soil	Possible impacts on Midway Shopping Center Parcel (beneath current building).	PAHs, Metals
HA-3 (3')	Soil	Possible impacts on Midway Shopping Center Parcel (beneath current building).	DRO, GRO, VOCs, PAHs, and RCRA metals
HA-4 (1')	Soil	Possible impacts on Midway Shopping Center Parcel. Accessible from dirt floor crawl space area of current building basement.	DRO, GRO, VOCs, PAHs, and RCRA metals
HA-5 (1')	Soil	Possible impacts on Midway Shopping Center Parcel. Accessible from dirt floor crawl space area of current building basement.	DRO, GRO, VOCs, PAHs, and RCRA metals
ST-103 (4')	Soil	Environmental monitoring of geotechnical boring.	DRO, GRO, VOCs, PAHs, and RCRA metals

Table 1
Summary of Sampling Intervals and Analytical Parameters
Snelling North
Saint Paul, Minnesota
Project: B1511122.00

Soil Boring Number and Sampling Depth	Sample Type	Area of Environmental Concern and Location	Chemical Analysis Parameters
ST-104 (4')	Soil	Environmental monitoring of geotechnical boring.	DRO, GRO, VOCs, PAHs, and RCRA metals
MW-1B (29.35’)	Water	Monitoring well installed for hydrogeologic evaluation of Metropolitan Council Parcel.	GRO, DRO and VOCs
MW-2B (16.78’)	Water	Monitoring well installed for hydrogeologic evaluation of Metropolitan Council Parcel.	GRO, DRO, VOCs, PAHs, and dissolved metals
MW-3B (16.11’)	Water	Monitoring well installed for hydrogeologic evaluation of Metropolitan Council Parcel.	GRO, DRO, VOCs, PAHs, and dissolved metals
MW-6B (30.33’)	Water	Monitoring well installed for hydrogeologic evaluation of Metropolitan Council Parcel.	GRO, DRO and VOCs

Table 2
Summary of Soil Screening Results
Proposed Soccer Stadium
Saint Paul, Minnesota
Project: B1600941

Depth (ft.)	ST-101	ST-102	ST-103	ST-104	ST-105	ST-106	AB-01	AB-02	AB-03	AB-04	AB-05	AB-06	AB-07	AB-08	AB-09	AB-10	AB-11	AB-12	AB-13	AB-14	AB-15	AB-16	AB-17	AB-18	HA-1	HA-2	HA-3	HA-4	HA-5	MW-1B	MW-2B	MW-3B	MW-4B	MW-5B	MW-6B	PZ-1B	PZ-2B	PZ-3B
0-2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.4	0.3	0.1	0.2	0.1	0.3	0.4	0.5	0.1	0.4	0.1	0.0	0.7	0.2	1.0 / 1.8 EOB 2'	4.2 / **6.4** EOB 2'	1.3 / 1.9	**10.2*** EOB 1'	0.0 EOB 1'	0.0	0.0	0.0	0.0	4.2 / 0.2	0.5	0.0	0.0	1.0
2.5-5	0.0 / 0.0	0.0 / 0.0	**7.0** / 0.0	**8.0** / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 1.0	0.0 / -	0.2	0.0	1.3	0.0	0.0	0.4	0.0	1.2	0.5	0.4	0.0	0.1	0.1	0.0 / -	0.5	0.1			2.2 / 1.4 EOB 3.5'			0.0 / 0.0	0.0 / 0.0	0.0 / -	4.0 / **54***		0.3 / 0.8	0.8 / 0.0	0.0 / 0.0	1.5 / 0.0
5-7.5	0.0	0.0	0.0	0.0	0.0	0.0	-	-	0.0	-	-	-	0.0	-	0.0	-	-	0.3	-	0.1	0.0	0.0	0.2	-						-	0.0	-	0*	0.4	-	0.0	0.0	0.0
7.5-10	0.0	0.0	0.0	0.0	0.0	0.0	**69***	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.1	- / 0.2	0.2	0.2	0.0	0.3	0.0						0.0	0.0	0.0	1*	0.3		-	0.0	0.0
10-12.5	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	-	-	-	0.0	0.0	-	0.2	0.0	0.1	0.0	0.0	0.1	0.1						0.0	0.0	-	**18***	0.5	0.4	0.8	0.0	0.0
12.5-15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 EOB 15'	0.0	0.0	0.1 EOB 15'	0.1	0.0 EOB 15'	0.2	0.2	0.0	0.2	0.0						0.0	2.1	-	0*	0.3	2.1	0.0	0.0	0.0
15-17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0		0.0	0.0		0.0		0.1	0.0	0.0	-	0.0						0.0	0.0	2.1	**60***	0.0	0.9	EOB 16'	0.0	0.0 / 0.0
17.5-20									0.1 EOB 20'	0.0 EOB 20'	0.0 EOB 20'	-	0.0		0.0 EOB 20'	0.0 EOB 20'		0.0 EOB 20'		0.0 EOB 20'	0.1		0.1 EOB 20'	0.2						-	0.0	1.8	**299***	0.3	1.5		0.0	-
20-22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				-	0.0								0.0	0.0		0.1						0.0	EOB 21'	EOB 21'	**120***	1.6			0.0	-
22.5-25												0.0									0.0			0.1						0.0			**209**	1.2 EOB 23.5'	1.9		0.0 / 0.0	0.0
25-27.5	0.0	**28.5**	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0								0.0	0.0		0.0						5			-*				0.0	0.0
27.5-30												0.0 EOB 30'	0.0 EOB 30'								0.0 EOB 30'			0.0 EOB 29'						15			**58***				0.0	0.0 / 0.0
30-32.5	0.0	**59**	0.0	0.0	0.0	0.0	0.0	0.0														0.0								-			**44**		1.3		0.0	0.0
32.5-35																														0.0			EOB 34'		EOB 35'		0.0	0.0
35-37.5	0.0	**22**	0.0 EOB 37.5'	0.0 EOB 38'	0.0	-	- EOB 38'	-														- EOB 37'								EOB 36'							0.0 EOB 36'	
37.5-40	EOB 40'	EOB 40'			EOB 40'	EOB 40'		EOB 39'																														EOB 38.5'

Note:
Concentrations in parts per million (ppm)
EOB = End of boring
* = odor noted
- = No Sample Recover

Table 3
Soil Analytical Results
Proposed Soccer Stadium Project
Saint Paul, Minnesota
Project B1600941

Compound/Parameter	CAS No.	Sample Identifier and Date Collected																Residential Soil Reference Value (SRV) (mg/kg)	Industrial Soil Reference Value (SRV) (mg/kg)	Screening Soil Leaching Value (SLV) (mg/kg)
		ST-103 (4')	**ST-104 (4')**	**AB-1 (2-4')**	**AB-2 (2-4')**	**AB-2 (8-10')**	**AB-3 (0-2.5')**	**AB-4 (0-2')**	**AB-5 (2-4')**	**AB-6 (0-2)**	**AB-6 (2-4')**	**AB-6 (8-10')**	**AB-7 (0-2')**	**AB-8 (0-2')**	**AB-8 (2-4')**	**AB-9 (2-4')**	**AB-9 (10-12')**			
		02/04/2016	02/04/2016	02/18/2016	02/18/2016	02/18/2016	02/16/2016	02/16/2016	02/16/2016	02/18/2016	02/18/2016	02/18/2016	02/18/2016	02/17/2016	02/17/2016	02/16/2016	02/16/2016			
Volatile Organic Compounds (VOCs) (mg/kg)																				
Ethylbenzene	100-41-4	<0.055	<0.066	<0.11	<0.055	<0.055	<0.057	<0.055	<0.054	---	**0.24**	<0.050	<0.056	<0.052	---	<0.056	<0.052	200	200	1
Tetrachloroethene	127-18-4	<0.055	<0.066	<0.11	<0.055	<0.055	<0.057	<0.055	<0.054	---	<0.062	<0.050	<0.056	<0.052	---	<0.056	<0.052	72	131	0.042
Toluene	108-88-3	<0.055	<0.066	<0.11	<0.055	<0.055	<0.057	<0.055	<0.054	---	**0.064**	<0.050	<0.056	<0.052	---	<0.056	<0.052	107	305	2.5
1,2,4-Trimethylbenzene	95-63-6	<0.055	<0.066	<0.11	<0.055	<0.055	<0.057	<0.055	<0.054	---	**0.49**	<0.050	<0.056	<0.052	---	<0.056	<0.052	8	25	2.7
1,3,5-Trimethylbenzene	108-67-8	<0.055	<0.066	<0.11	<0.055	<0.055	<0.057	<0.055	<0.054	---	**0.15**	<0.050	<0.056	<0.052	---	<0.056	<0.052	3	10	2.7
Xylene (Total)	1330-20-7	<0.17	<0.20	<0.32	<0.16	<0.16	<0.17	<0.17	<0.16	---	**3.6**	<0.15	<0.17	<0.16	---	<0.17	<0.16	45 [b]	130 [b]	5.4 [b]
All other reported VOCs	---	<RL	<RL	<RL	<RL	<RL	<RL	<RL	<RL	---	<RL	<RL	<RL	<RL	---	<RL	<RL	---	---	---
Polycyclic-Aromatic Hydrocarbons (PAHs) (mg/kg)																				
Acenaphthene	83-32-9	**0.2**	<0.011	**0.062**	<0.011	<0.011	<0.011 [2]	<0.011	<0.011	---	<0.11	<0.010	<0.011	<0.011	**0.57**	<0.012	<0.011	1,200	5,260	81
Acenaphthylene	208-96-8	**0.69**	<0.011	**0.05**	**0.027**	<0.011	**0.024 [2]**	**0.065**	<0.011	---	**0.22**	<0.010	**0.073**	**0.042**	**0.032**	<0.012	<0.011	NE	NE	NE
Anthracene	120-12-7	**1.8**	**0.016**	**0.13**	**0.024**	<0.011	**0.030 [2]**	**0.045**	<0.011	---	**0.21**	<0.010	**0.051**	**0.025**	**0.97**	<0.012	<0.011	7,880	45,400	1,300
Benzo(a)anthracene	56-55-3	**3.4**	**0.075**	**0.31**	**0.054**	<0.011	**0.13 [2]**	**0.23**	**0.049**	---	**0.43**	<0.010	**0.18**	**0.13**	**0.8**	**0.013**	<0.011	cPAH	cPAH	cPAH
Benzo(b)fluoranthene	205-99-2	**3.3**	**0.12**	**0.39**	**0.1**	<0.011	**0.20 [2]**	**0.36**	**0.065**	---	**0.73**	<0.010	**0.29**	**0.25**	**0.83**	**0.025**	<0.011	cPAH	cPAH	cPAH
Benzo(k)fluoranthene	207-08-9	**1.7**	**0.04**	**0.14**	**0.038**	<0.011	**0.094 [2]**	**0.17**	**0.032**	---	**0.26**	<0.010	**0.13**	**0.085**	**0.34**	<0.012	<0.011	cPAH	cPAH	cPAH
Benzo(a)pyrene	50-32-8	**2.6**	**0.088**	**0.25**	**0.067**	<0.011	**0.14 [2]**	**0.27**	**0.048**	---	**0.46**	**0.021**	**0.22**	**0.14**	**0.85**	**0.014**	<0.011	cPAH	cPAH	cPAH
Benzo(g,h,i)perylene	191-24-2	**1.1**	**0.022**	**0.2**	**0.078**	<0.011	**0.062 [2]**	**0.078**	**0.014**	---	**0.18**	<0.010	**0.11**	**0.049**	**0.33**	<0.012	<0.011	NE	NE	NE
Chrysene	218-01-9	**3.3**	**0.082**	**0.33**	**0.069**	<0.011	**0.14 [2]**	**0.24**	**0.053**	---	**0.42**	**0.024**	**0.16**	**0.13**	**0.78**	**0.016**	<0.011	cPAH	cPAH	cPAH
Dibenz(a,h)anthracene	53-70-3	<0.11	<0.011	**0.054**	**0.017**	<0.011	**0.020 [2]**	**0.026**	<0.011	---	<0.11	<0.010	**0.036**	**0.017**	**0.082**	<0.012	<0.011	cPAH	cPAH	cPAH
Fluoranthene	206-44-0	**9.8**	**0.13**	**0.69**	**0.1**	<0.011	**0.24 [2]**	**0.33**	**0.077**	---	**0.7**	<0.010	**0.23**	**0.19**	**2.5**	**0.023**	<0.011	1,080	6,800	670
Fluorene	86-73-7	**0.83**	<0.011	**0.085**	<0.011	<0.011	<0.011 [2]	<0.011	<0.011	---	<0.11	<0.010	<0.011	<0.011	**0.38**	<0.012	<0.011	850	4,120	110
Indeno(1,2,3-cd)pyrene	193-39-5	**1.1**	**0.022**	**0.15**	**0.055**	<0.011	**0.053 [2]**	**0.079**	**0.012**	---	**0.16**	<0.010	**0.11**	**0.043**	**0.26**	<0.012	<0.011	cPAH	cPAH	cPAH
Naphthalene	91-20-3	<0.11	<0.011	**0.039**	<0.011	<0.011	<0.011	<0.011	<0.011	---	<0.11	<0.010	<0.011	<0.011	**0.24**	<0.012	<0.011	10	28	4.5
Phenanthrene	85-01-8	**5.3**	**0.044**	**0.57**	**0.051**	<0.011	**0.10 [2]**	**0.11**	**0.04**	---	**0.35**	<0.010	**0.067**	**0.042**	**2.9**	<0.012	<0.011	NE	NE	NE
Pyrene	129-00-0	**6.9**	**0.11**	**0.55**	**0.086**	<0.011	**0.19 [2]**	**0.32**	**0.072**	---	**0.65**	<0.010	**0.19**	**0.16**	**2.5**	**0.025**	<0.011	890	5,800	440
BaP Equivalent [c]	---	**3.6**	**0.1**	**0.4**	**0.1**	---	**0.2**	**0.4**	**0.1**	---	**0.6**	**0.0**	**0.3**	**0.2**	**1.1**	**0.0**	---	2	3	1.4
Metals (mg/kg)																				
Arsenic, Total	7440-38-2	**18.0**	**2.2**	**4.3**	**3.8**	**2.3**	**2.4**	**2.4**	**3.7**	---	**7.1**	**2.8**	**2.3**	**2.2**	**2.5**	**2.4**	**1.6**	9	20	5.8
Barium, Total	7440-39-3	**198**	**43.8**	**115 [1]**	**40.9**	**25.1**	**30.7**	**38.4**	**45.7**	**103**	**4,080**	**32.4**	**29.4**	**28.2**	**76.3**	**86.9**	**20.5**	1,100	18,000	1,700
Cadmium, Total	7440-43-9	**0.52**	**0.25**	**0.29**	<0.14	<0.13	<0.13	<0.13	**0.15**	---	**2.4**	<0.13	<0.13	<0.12	<0.15	<0.14	<0.11	25	200	8.8
Chromium, Total [d]	7440-47-3	**16.3**	**10.5**	**15.9**	**11.1**	**12.3**	**9.9**	**9.4**	**8.6**	---	**57.4**	**14.3**	**10.4**	**10.4**	**11.3**	**10.5**	**11.9**	44,000/87 [d]	100,000/650 [d]	1,000,000,000/36 [d]
Lead, Total	7439-92-1	**574**	**57.1**	**426 [2]**	**7.1**	**2.4**	**34.9 [1]**	**39.8**	**18.4**	**320**	**5,120**	**5.3**	**17.3**	**27.4 [1]**	**5.8**	**7.5**	**2.1**	300	700	2,700
Mercury, Total	7439-97-6	**0.17**	<0.019	**0.029**	<0.019	<0.022	<0.019	<0.019	**0.044**	---	<0.020	<0.021	**0.019**	<0.018	<0.023	**0.045**	<0.019	0.5	1.5	3.3
Selenium, Total	7782-49-2	**1.2**	<0.89	<1.0	<0.92	<0.89	<0.89	<0.88	<0.87	---	**1.1**	<0.84	<0.85	<0.82	<0.98	<0.95	<0.75	160	1,300	2.6
Silver, Total	7440-22-4	<0.38	**2.4**	<0.50	<0.46	<0.44	<0.45	<0.44	<0.43	---	<0.49	<0.42	<0.43	<0.41	<0.49	<0.47	<0.37	160	1,300	7.9
Other Parameters (mg/kg)																				
Diesel Range Organics (DRO)	---	**136 [3]**	**70.6 [3]**	**64.7 [3]**	**44.2 [3]**	<9.6	**18.7 [3]**	**47.8 [3]**	**17.4 [3]**	---	**2,240 [3]**	**332 [3]**	**43.5 [3]**	**45.7 [3]**	**23.5 [3]**	**16.2 [3]**	<9.4	NE	NE	NE
Gasoline Range Organics (GRO)	---	**23.2**	<11.5	<24.9	<10.9	<10.5	<12.0	<10.4	<11.4	---	<11.9	<9.9	<10.4	<11.1	---	<11.6	<10.5	NE	NE	NE

Notes

[1] [M1] Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
[2] [M1] Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery. - [R1] RPD value was outside control limits.
[3] [T6] High boiling point hydrocarbons are present in the sample.
[4] [CL] The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased low.
SRVs and SLVs updated 12/19/14.
mg/kg = Milligrams per kilogram.
< = Not detected at or above the laboratory reporting limit indicated.
---- = Not analyzed or calculated for this parameter or not applicable.
RL = Reporting limits for other parameters that are not listed individually in this table because their concentrations were below reporting limits provided in the laboratory report.
NE = Regulatory limit not established for this parameter.
cPAH = Individual regulatory limit not established for this carcinogenic PAH; included in BaP equivalent calculation.
[b] = Regulatory limit for combination of m, p, and o-xylenes.
[c] = Benzo(a)pyrene (BaP) equivalent is calculated based on the concentration and weighted toxicity of cPAHs; Minnesota Pollution Control Agency; 2009. If no cPAHs were detected above reasonable laboratory reporting limits the BaP equivalent is reported as 0 mg/kg per MPCA Remediation Division Policy; June 2011.
[d] = Reported result is total chromium, regulatory limit for chromium III and chromium VI are provided.

Exceeds Residential SRV
Exceeds Industrial SRV
Exceeds Screening SLV

Table 3
Soil Analytical Results
Proposed Soccer Stadium Project
Saint Paul, Minnesota
Project B1600941

Compound/Parameter	CAS No.	Sample Identifier and Date Collected															Residential Soil Reference Value (SRV) (mg/kg)	Industrial Soil Reference Value (SRV) (mg/kg)	Screening Soil Leaching Value (SLV) (mg/kg)
		AB-10 (2-4')	**AB-10 (7-9')**	**AB-11 (2-4')**	**AB-11 (10-12')**	**AB-12 (0-2')**	**AB-12 (8-10')**	**AB-13 (2-4')**	**AB-13 (10-12')**	**AB-14 (0-2')**	**AB-14 (2-4')**	**AB-14 (10-12')**	**AB-15 (0-2')**	**AB-15 (2-4')**	**AB-16 (9-11')**	**AB-17 (2-4')**			
		02/16/2016	02/16/2016	02/18/2016	02/18/2016	02/17/2016	02/17/2016	02/19/2016	02/19/2016	02/17/2016	02/17/2016	02/17/2016	02/18/2016	02/18/2016	02/18/2016	02/17/2016			
Volatile Organic Compounds (VOCs) (mg/kg)																			
Ethylbenzene	100-41-4	<0.059	<0.053	<0.057	<0.055	<0.060	<0.053	<0.060	---	<0.054	---	<0.053	<0.054	---	<0.089	<0.052	200	200	1
Tetrachloroethene	127-18-4	<0.059	<0.053	<0.057	<0.055	<0.060	<0.053	<0.060	---	<0.054	---	<0.053	<0.054	---	<0.089	<0.052	72	131	0.042
Toluene	108-88-3	<0.059	<0.053	<0.057	<0.055	<0.060	<0.053	<0.060	---	<0.054	---	<0.053	<0.054	---	<0.089	<0.052	107	305	2.5
1,2,4-Trimethylbenzene	95-63-6	<0.059	<0.053	<0.057	<0.055	<0.060	<0.053	<0.060	---	<0.054	---	<0.053	<0.054	---	<0.089	<0.052	8	25	2.7
1,3,5-Trimethylbenzene	108-67-8	<0.059	<0.053	<0.057	<0.055	<0.060	<0.053	<0.060	---	<0.054	---	<0.053	<0.054	---	<0.089	<0.052	3	10	2.7
Xylene (Total)	1330-20-7	<0.18	<0.16	<0.17	<0.16	<0.18	<0.16	<0.18	---	<0.16	---	<0.16	<0.16	---	<0.27	<0.16	45 [b]	130 [b]	5.4 [b]
All other reported VOCs	---	<RL	<RL	<RL	<RL	<RL	<RL	<RL	---	<RL	---	<RL	<RL	---	<RL	<RL	---	---	---
Polycyclic-Aromatic Hydrocarbons (PAHs) (mg/kg)																			
Acenaphthene	83-32-9	<0.012	<0.011	<0.012	<0.011	**0.19**	<0.011	**0.022**	<0.011	**0.013**	<0.011	<0.011	**0.021**	<0.011	<0.012	<0.011	1,200	5,260	81
Acenaphthylene	208-96-8	<0.012	<0.011	<0.012	<0.011	**0.076**	<0.011	**0.41**	<0.011	**0.12**	<0.011	<0.011	<0.021	<0.011	<0.012	<0.011	NE	NE	NE
Anthracene	120-12-7	<0.012	<0.011	<0.012	<0.011	**0.41**	<0.011	**0.21**	<0.011	**0.084**	<0.011	<0.011	**0.063**	<0.011	<0.012	**0.027**	7,880	45,400	1,300
Benzo(a)anthracene	56-55-3	<0.012	<0.011	<0.012	<0.011	**1.1**	<0.011	**0.46**	<0.011	**0.25**	<0.011	<0.011	**0.17**	<0.011	<0.012	**0.1**	cPAH	cPAH	cPAH
Benzo(b)fluoranthene	205-99-2	<0.012	<0.011	<0.012	<0.011	**1.3**	<0.011	**0.98**	<0.011	**0.45**	<0.011	<0.011	**0.24** [1]	<0.011	<0.012	**0.16**	cPAH	cPAH	cPAH
Benzo(k)fluoranthene	207-08-9	<0.012	<0.011	<0.012	<0.011	**0.51**	<0.011	**0.27**	<0.011	**0.19**	<0.011	<0.011	**0.11** [1]	<0.011	<0.012	**0.078**	cPAH	cPAH	cPAH
Benzo(a)pyrene	50-32-8	<0.012	<0.011	<0.012	<0.011	**1.0**	<0.011	**0.68**	<0.011	**0.34**	<0.011	<0.011	**0.18** [1]	<0.011	<0.012	**0.1**	cPAH	cPAH	cPAH
Benzo(g,h,i)perylene	191-24-2	<0.012	<0.011	<0.012	<0.011	**0.24**	<0.011	**0.6**	<0.011	**0.084**	<0.011	<0.011	**0.094** [1]	<0.011	<0.012	**0.023**	NE	NE	NE
Chrysene	218-01-9	<0.012	<0.011	<0.012	<0.011	**0.98**	<0.011	**0.47**	<0.011	**0.25**	<0.011	<0.011	**0.20** [1]	<0.011	<0.012	**0.1**	cPAH	cPAH	cPAH
Dibenz(a,h)anthracene	53-70-3	<0.012	<0.011	<0.012	<0.011	**0.092**	<0.011	**0.16**	<0.011	**0.034**	<0.011	<0.011	**0.026** [1]	<0.011	<0.012	<0.011	cPAH	cPAH	cPAH
Fluoranthene	206-44-0	<0.012	<0.011	<0.012	<0.011	**2.5**	<0.011	**0.52**	<0.011	**0.48**	<0.011	<0.011	**0.38**	<0.011	<0.012	**0.2**	1,080	6,800	670
Fluorene	86-73-7	<0.012	<0.011	<0.012	<0.011	**0.15**	<0.011	**0.033**	<0.011	**0.02**	<0.011	<0.011	<0.021	<0.011	<0.012	<0.011	850	4,120	110
Indeno(1,2,3-cd)pyrene	193-39-5	<0.012	<0.011	<0.012	<0.011	**0.25**	<0.011	**0.44**	<0.011	**0.091**	<0.011	<0.011	**0.074** [1]	<0.011	<0.012	**0.024**	cPAH	cPAH	cPAH
Naphthalene	91-20-3	<0.012	<0.011	<0.012	<0.011	**0.017**	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.021	<0.011	<0.012	<0.011	10	28	4.5
Phenanthrene	85-01-8	<0.012	<0.011	<0.012	<0.011	**1.6**	<0.011	**0.15**	<0.011	**0.18**	<0.011	<0.011	**0.22** [1]	<0.011	<0.012	**0.11**	NE	NE	NE
Pyrene	129-00-0	<0.012	<0.011	<0.012	<0.011	**2.0**	<0.011	**0.53**	<0.011	**0.38**	<0.011	<0.011	**0.31** [1]	<0.011	<0.012	**0.18**	890	5,800	440
BaP Equivalent[c]	---	---	---	---	---	**1.4**	---	**1.0**	---	**0.5**		---	**0.3**	---	---	**0.1**	2	3	1.4
Metals (mg/kg)																			
Arsenic, Total	7440-38-2	**3.3**	**1.9**	**2.2**	**2.3**	**3.9**	**1.7**	**2.7**	**1.6**	**3.0**	**2.8**	**1.9**	**2.6**	**2.3**	**2.8**	**3.5**	9	20	5.8
Barium, Total	7440-39-3	**96.6**	**31.2**	**82.3**	**27.6**	**74.2**	**21.9**	**61.4** [1]	**23.2**	**32.3**	**41.6**	**20.1**	**41.8**	**32.0**	**52.4**	**52.1**	1,100	18,000	1,700
Cadmium, Total	7440-43-9	<0.15	<0.12	<0.13	<0.15	<0.14	<0.13	<0.16	<0.13	<0.15	<0.15	<0.12	<0.13	<0.13	<0.15	<0.12	25	200	8.8
Chromium, Total[d]	7440-47-3	**12.9**	**10.2**	**9.2**	**15.5**	**12.0**	**10.9**	**12.2**	**10.1**	**13.0**	**15.8**	**13.5**	**16.4**	**12.1**	**20.2**	**17.7**	44,000/87[d]	100,000/650[d]	1,000,000,000/36[d]
Lead, Total	7439-92-1	**9.6**	**2.1**	**4.9**	**2.6**	**32.5**	**2.5**	**24.5**	**2.0**	**38.9**	**3.0**	**1.9**	**85.0** [1]	**2.9**	**4.7**	**31.9**	300	700	2,700
Mercury, Total	7439-97-6	<0.020	<0.021	<0.020	<0.019	<0.021	<0.020	<0.021	<0.020	**0.02**	<0.021	<0.019	<0.020	<0.019	<0.022	<0.020	0.5	1.5	3.3
Selenium, Total	7782-49-2	<1.0	<0.80	<0.85	<0.99	<0.92	<0.90	<1.1	<0.86	<0.99	<0.98	<0.80	<0.89	<0.84	<0.99	<0.83	160	1,300	2.6
Silver, Total	7440-22-4	<0.50	<0.40	<0.42	<0.50	<0.46	<0.45	<0.54	<0.43	<0.50	<0.49	<0.40	<0.44	<0.42	<0.49	<0.41	160	1,300	7.9
Other Parameters (mg/kg)																			
Diesel Range Organics (DRO)	---	**46.7** [3]	<6.7	<9.8	<8.1	**23.4** [3]	<8.8	**42.1** [3]	<8.8	**10.6** [3]	<9.2	<8.4	**290** [3]	<8.4	<9.8	**38.0** [3]	NE	NE	NE
Gasoline Range Organics (GRO)	---	<12.5	<10.6	<12.1	<11.0	<10.8	---	<11.5	---	<10.9	---	<11.1	<10.7	---	<15.0	<10.4	NE	NE	NE

Notes

[1] [M1] Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
[2] [M1] Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery. - [R1] RPD value was outside control limits.
[3] [T6] High boiling point hydrocarbons are present in the sample.
[4] [CL] The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased low.
SRVs and SLVs updated 12/19/14.
mg/kg = Milligrams per kilogram.
< = Not detected at or above the laboratory reporting limit indicated.
---- = Not analyzed or calculated for this parameter or not applicable.
RL = Reporting limits for other parameters that are not listed individually in this table because their concentrations were below reporting limits provided in the laboratory report.
NE = Regulatory limit not established for this parameter.
cPAH = Individual regulatory limit not established for this carcinogenic PAH; included in BaP equivalent calculation.
[b] = Regulatory limit for combination of m, p, and o-xylenes.
[c] = Benzo(a)pyrene (BaP) equivalent is calculated based on the concentration and weighted toxicity of cPAHs; Minnesota Pollution Control Agency; 2009. If no cPAHs were detected above reasonable laboratory reporting limits the BaP equivalent is reported as 0 mg/kg per MPCA Remediation Division Policy; June 2011.
[d] = Reported result is total chromium, regulatory limit for chromium III and chromium VI are provided.

Exceeds Residential SRV
Exceeds Industrial SRV
Exceeds Screening SLV

Table 3
Soil Analytical Results
Proposed Soccer Stadium Project
Saint Paul, Minnesota
Project B1600941

Compound/Parameter	CAS No.	Sample Identifier and Date Collected															Residential Soil Reference Value (SRV) (mg/kg)	Industrial Soil Reference Value (SRV) (mg/kg)	Screening Soil Leaching Value (SLV) (mg/kg)
		AB-18 (2-4')	**AB-18 (8-9')**	**PP-14-E (1')**	**PP-14-E (2')**	**PP-14-E (3')**	**PP-14-E (4')**	**PP-14-N (1')**	**PP-14-N (2')**	**PP-14-N (3')**	**PP-14-N (4')**	**PP-14-S (1')**	**PP-14-S (2')**	**PP-14-S (3')**	**PP-14-S (4')**	**PP-14-W (1')**			
		02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016			
Volatile Organic Compounds (VOCs) (mg/kg)																			
Ethylbenzene	100-41-4	<0.059	<0.061	---	---	---	---	---	---	---	---	---	---	---	---	---	200	200	1
Tetrachloroethene	127-18-4	**0.13**	<0.061	---	---	---	---	---	---	---	---	---	---	---	---	---	72	131	0.042
Toluene	108-88-3	<0.059	<0.061	---	---	---	---	---	---	---	---	---	---	---	---	---	107	305	2.5
1,2,4-Trimethylbenzene	95-63-6	<0.059	<0.061	---	---	---	---	---	---	---	---	---	---	---	---	---	8	25	2.7
1,3,5-Trimethylbenzene	108-67-8	<0.059	<0.061	---	---	---	---	---	---	---	---	---	---	---	---	---	3	10	2.7
Xylene (Total)	1330-20-7	<0.18	<0.18	---	---	---	---	---	---	---	---	---	---	---	---	---	45 [b]	130 [b]	5.4 [b]
All other reported VOCs	---	<RL	<RL	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Polycyclic-Aromatic Hydrocarbons (PAHs) (mg/kg)																			
Acenaphthene	83-32-9	<0.011	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1,200	5,260	81
Acenaphthylene	208-96-8	**0.025**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NE	NE	NE
Anthracene	120-12-7	**0.029**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	7,880	45,400	1,300
Benzo(a)anthracene	56-55-3	**0.11**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	cPAH	cPAH	cPAH
Benzo(b)fluoranthene	205-99-2	**0.16**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	cPAH	cPAH	cPAH
Benzo(k)fluoranthene	207-08-9	**0.052**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	cPAH	cPAH	cPAH
Benzo(a)pyrene	50-32-8	**0.11**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	cPAH	cPAH	cPAH
Benzo(g,h,i)perylene	191-24-2	**0.077**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NE	NE	NE
Chrysene	218-01-9	**0.11**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	cPAH	cPAH	cPAH
Dibenz(a,h)anthracene	53-70-3	**0.022**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	cPAH	cPAH	cPAH
Fluoranthene	206-44-0	**0.15**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1,080	6,800	670
Fluorene	86-73-7	<0.011	---	---	---	---	---	---	---	---	---	---	---	---	---	---	850	4,120	110
Indeno(1,2,3-cd)pyrene	193-39-5	**0.064**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	cPAH	cPAH	cPAH
Naphthalene	91-20-3	<0.011	---	---	---	---	---	---	---	---	---	---	---	---	---	---	10	28	4.5
Phenanthrene	85-01-8	**0.071**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NE	NE	NE
Pyrene	129-00-0	**0.14**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	890	5,800	440
BaP Equivalent[c]	---	**0.2**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2	3	1.4
Metals (mg/kg)																			
Arsenic, Total	7440-38-2	**1.7**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	9	20	5.8
Barium, Total	7440-39-3	**26.1**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1,100	18,000	1,700
Cadmium, Total	7440-43-9	<0.14	---	---	---	---	---	---	---	---	---	---	---	---	---	---	25	200	8.8
Chromium, Total[d]	7440-47-3	**7.5**	---	---	---	---	---	---	---	---	---	---	---	---	---	---	44,000/87[d]	100,000/650[d]	1,000,000,000/36[d]
Lead, Total	7439-92-1	**13.7**	---	**2.0**	**1.9**	**1.7**	**1.8**	**4.7**	**2.3**	**1.8**	**1.8**	**462** [2]	**8.7**	**4.3**	**1.8**	**2.4**	300	700	2,700
Mercury, Total	7439-97-6	<0.019	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.5	1.5	3.3
Selenium, Total	7782-49-2	<0.93	---	---	---	---	---	---	---	---	---	---	---	---	---	---	160	1,300	2.6
Silver, Total	7440-22-4	<0.46	---	---	---	---	---	---	---	---	---	---	---	---	---	---	160	1,300	7.9
Other Parameters (mg/kg)																			
Diesel Range Organics (DRO)	---	**11.5** [3]	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NE	NE	NE
Gasoline Range Organics (GRO)	---	<10.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NE	NE	NE

Notes

[1] [M1] Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sam
[2] [M1] Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control
[3] [T6] High boiling point hydrocarbons are present in the sample.
[4] [CL] The continuing calibration for this compound is outside of Pace Analytical acceptance
SRVs and SLVs updated 12/19/14.
mg/kg = Milligrams per kilogram.
< = Not detected at or above the laboratory reporting limit indicated.
---- = Not analyzed or calculated for this parameter or not applicable.
RL = Reporting limits for other parameters that are not listed individually in this table because their concentrations we
NE = Regulatory limit not established for this parameter.
cPAH = Individual regulatory limit not established for this carcinogenic PAH; included in BaP equiva
[b] = Regulatory limit for combination of m, p, and o-xylenes.
[c] = Benzo(a)pyrene (BaP) equivalent is calculated based on the concentration and weighted toxicity of cPAHs; Minnesota Pollution Control Agency; 2009. If no cPAHs were detected above reasonable laboratory reporting limits the BaP equivalent is reported as 0 mg/kg per MPCA Remediation Division Policy; June 2011.
[d] = Reported result is total chromium, regulatory limit for chromium III and chromium VI are provic

Exceeds Residential SRV
Exceeds Industrial SRV
Exceeds Screening SLV

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Table 3
Soil Analytical Results
Proposed Soccer Stadium Project
Saint Paul, Minnesota
Project B1600941

Compound/Parameter	CAS No.	Sample Identifier and Date Collected								Residential Soil Reference Value (SRV) (mg/kg)	Industrial Soil Reference Value (SRV) (mg/kg)	Screening Soil Leaching Value (SLV) (mg/kg)
		PP-14-W (2')	**PP-14-W (3')**	**PP-14-W (4')**	**HA-1 (2')**	**HA-2 (2')**	**HA-3 (3')**	**HA-4 (1')**	**HA-5 (1')**			
		02/19/2016	02/19/2016	02/19/2016	02/22/2016	02/22/2016	02/22/2016	02/23/2016	02/23/2016			
Volatile Organic Compounds (VOCs) (mg/kg)												
Ethylbenzene	100-41-4	---	---	---	---	---	<0.053	<0.052	<0.053	200	200	1
Tetrachloroethene	127-18-4	---	---	---	---	---	<0.053	<0.052	<0.053	72	131	0.042
Toluene	108-88-3	---	---	---	---	---	<0.053	<0.052	<0.053	107	305	2.5
1,2,4-Trimethylbenzene	95-63-6	---	---	---	---	---	<0.053	<0.052	<0.053	8	25	2.7
1,3,5-Trimethylbenzene	108-67-8	---	---	---	---	---	<0.053	<0.052	<0.053	3	10	2.7
Xylene (Total)	1330-20-7	---	---	---	---	---	<0.16	<0.16	<0.16	45 [b]	130 [b]	5.4 [b]
All other reported VOCs	---	---	---	---	---	---	<RL	<RL	<RL	---	---	---
Polycyclic-Aromatic Hydrocarbons (PAHs) (mg/kg)												
Acenaphthene	83-32-9	---	---	---	<0.011	<0.011	<0.011	<0.051	<0.011	1,200	5,260	81
Acenaphthylene	208-96-8	---	---	---	<0.011	<0.011	<0.011	<0.051	<0.011	NE	NE	NE
Anthracene	120-12-7	---	---	---	<0.011	<0.011	<0.011	<0.051	<0.011	7,880	45,400	1,300
Benzo(a)anthracene	56-55-3	---	---	---	<0.011	**0.022**	<0.011	**0.26**	**0.038**	cPAH	cPAH	cPAH
Benzo(b)fluoranthene	205-99-2	---	---	---	<0.011	**0.032**	**0.021**	<0.051	**0.056**	cPAH	cPAH	cPAH
Benzo(k)fluoranthene	207-08-9	---	---	---	<0.011	**0.013**	<0.011	**0.12**	**0.022**	cPAH	cPAH	cPAH
Benzo(a)pyrene	50-32-8	---	---	---	<0.011	**0.024**	**0.016**	<0.051	**0.035**	cPAH	cPAH	cPAH
Benzo(g,h,i)perylene	191-24-2	---	---	---	<0.011	**0.017**	**0.013**	<0.051	**0.026**	NE	NE	NE
Chrysene	218-01-9	---	---	---	<0.011	**0.024**	**0.013**	**0.51**	**0.047**	cPAH	cPAH	cPAH
Dibenz(a,h)anthracene	53-70-3	---	---	---	<0.011	<0.011	<0.011	<0.051	<0.011	cPAH	cPAH	cPAH
Fluoranthene	206-44-0	---	---	---	<0.011	**0.041** [1]	**0.018**	**0.18**	**0.072**	1,080	6,800	670
Fluorene	86-73-7	---	---	---	<0.011	<0.011	<0.011	<0.051	<0.011	850	4,120	110
Indeno(1,2,3-cd)pyrene	193-39-5	---	---	---	<0.011	**0.015**	<0.011	<0.051	**0.023**	cPAH	cPAH	cPAH
Naphthalene	91-20-3	---	---	---	<0.011	<0.011	<0.011	<0.051	<0.011	10	28	4.5
Phenanthrene	85-01-8	---	---	---	<0.011	**0.017**	<0.011	**0.74**	**0.033**	NE	NE	NE
Pyrene	129-00-0	---	---	---	<0.011	**0.035** [1]	**0.017**	**0.089**	**0.056**	890	5,800	440
BaP Equivalent[c]	---	---	---	---	---	**0.0**	**0.0**	**0.0**	**0.0**	2	3	1.4
Metals (mg/kg)												
Arsenic, Total	7440-38-2	---	---	---	**1.9**	**2.1**	**2.7**	**2.0**	**2.2**	9	20	5.8
Barium, Total	7440-39-3	---	---	---	**38.2**	**25.3**	**38.5**	**28.3**	**35.7**	1,100	18,000	1,700
Cadmium, Total	7440-43-9	---	---	---	<0.16	<0.16	<0.14	<0.12	<0.13	25	200	8.8
Chromium, Total[d]	7440-47-3	---	---	---	**10.8**	**9.2**	**11.3**	**11.3**	**10.9**	44,000/87[d]	100,000/650[d]	1,000,000,000/36[d]
Lead, Total	7439-92-1	**2.0**	**1.6**	**1.5**	**3.4**	**5.7**	**11.6**	**4.2**	**4.1**	300	700	2,700
Mercury, Total	7439-97-6	---	---	---	<0.019	<0.020	<0.020	<0.018	**0.55**	0.5	1.5	3.3
Selenium, Total	7782-49-2	---	---	---	<1.1	<1.0	<0.91	<0.81	<0.90	160	1,300	2.6
Silver, Total	7440-22-4	---	---	---	<0.54	<0.52	<0.45	<0.41	<0.45	160	1,300	7.9
Other Parameters (mg/kg)												
Diesel Range Organics (DRO)	---	---	---	---	---	---	**16.4** [3]	**7,710** [3]	**560**	NE	NE	NE
Gasoline Range Organics (GRO)	---	---	---	---	---	---	<11.5	<9.9	<10.2	NE	NE	NE

Notes

[1] [M1] Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
[2] [M1] Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS)
[3] [T6] High boiling point hydrocarbons are present in the sample.
[4] [CL] The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may
SRVs and SLVs updated 12/19/14.
mg/kg = Milligrams per kilogram.
< = Not detected at or above the laboratory reporting limit indicated.
---- = Not analyzed or calculated for this parameter or not applicable.
RL = Reporting limits for other parameters that are not listed individually in this table because their concentrations were below reporting limits provided in the laboratory report.
NE = Regulatory limit not established for this parameter.
cPAH = Individual regulatory limit not established for this carcinogenic PAH; included in BaP equivalent calculation.
[b] = Regulatory limit for combination of m, p, and o-xylenes.
[c] = Benzo(a)pyrene (BaP) equivalent is calculated based on the concentration and weighted toxicity of cPAHs; Minnesota Pollution Control Agency; 2009. If no cPAHs were detected above reasonable laboratory reporting limits the BaP equivalent is reported as 0 mg/kg per MPCA Remediation Division Policy; June 2011.
[d] = Reported result is total chromium, regulatory limit for chromium III and chromium VI are provided.

Exceeds Residential SRV
Exceeds Industrial SRV
Exceeds Screening SLV

Table 4
TCLP Analytical Results
Proposed Soccer Stadium Project
Saint Paul, Minnesota
Project B1600941

Compound/Parameter	EPA Hazardous Waste Number	CAS No.	Sample Identifier and Date Collected									Regulatory Level (mg/L)
			AB-6 (2-4')	**PP-14-E (1')**	**PP-14-E (2')**	**PP-14-N (1')**	**PP-14-N (2')**	**PP-14-S (1')**	**PP-14-S (2')**	**PP-14-W (1')**	**PP-14-W (2')**	
			02/18/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	02/19/2016	
TCLP - Metals (mg/L)												
Barium	D005	7440-39-3	**2.9**	---	---	---	---	---	---	---	---	100.0
Lead	D008	7439-92-1	**45.9** [1]	<0.050	<0.050	<0.050	<0.050	**1.0**	**0.12**	<0.050	<0.050	5.0

Notes
[1] [M1] Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS)
Regulatory Level for Maximum Concentration of Contaminants for the Toxicity Characteristic (mg/L) from 40 CFR 261.24
TCLP = Toxicity Characteristic Leaching Procedure
mg/L = Milligrams per liter.
< = Less than the reporting limit indicated in parentheses.
NA = Not Applicable

Exceeds Regulatory Level

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Table 5
Groundwater Analytical Results
Proposed Soccer Stadium Project
Saint Paul, Minnesota
Project B1600941

Compound/Parameter	CAS No.	Sample Identifier, Screen Interval, Groundwater Level and Date Collected											Drinking Water Criteria (µg/L)	Source - Date
		AB-1 W	**AB-6 W**	**AB-7 W**	**AB-11 W**	**AB-13 W**	**AB-16 W**	**AB-18 W**	**MW-1B**	**MW-2B**	**MW-3B**	**MW-6B**		
		Screen @ (9'-14')	Screen @ (30'-35')	Screen @ (30'-35')	Screen @ (30'-35')	Screen @ (30'-35')	Screen @ (30'-35')	Screen @ (30'-35')	Screen @ (25'-35')	Screen @ (10'-20')	Screen @ (14'-19')	Screen @ (24'-34')		
		Water Level @ 9.9'	Water Level @ 26.90'	Water Level @ 28.75'	Water Level @ 26.75'	Water Level @ 28.5'	Water Level @ 27.55'	Water Level @ 28.9'	Water Level @ 29.35'	Water Level @ 16.78'	Water Level @ 16.11'	Water Level @ 30.33'		
		2/19/2016	2/19/2016	2/22/2016	2/22/2016	2/22/2016	2/19/2016	2/22/2016	02/24/2016	02/24/2016	02/24/2016	02/24/2016		
Volatile Organic Compounds (VOCs) (µg/L)														
1,2-Dichloroethane	107-06-2	<1.0	<1.0	<1.0	<1.0	<1.0	**14.6**	<1.0	<1.0	<1.0	<1.0	<1.0	1	HRL-13
Tetrachloroethene	127-18-4	<1.0	<1.0	<1.0	<1.0	**2.5**	**1.7**	**12.3**	<1.0	<1.0	<1.0	<1.0	4	HBV-14
Trichloroethene	79-01-6	<0.40	<0.40	<0.40	<0.40	<0.40	**3.2**	<0.40	<0.40	<0.40	<0.40	<0.40	0.4	HRL-15
All other reported VOCs	---	<RL	<RL	<RL	<RL	<RL	<RL	<RL	<RL	<RL	<RL	<RL	---	---
Polycyclic-Aromatic Hydrocarbons (PAHs) (µg/L)														
Acenaphthene	83-32-9	---	<0.043	<0.044	<0.047	<0.073	<0.047	<0.051	---	<0.045	**0.19**	---	400	HBV-15
Acenaphthylene	208-96-8	---	<0.043	<0.044	<0.047	<0.073	<0.047	<0.051	---	<0.045	<0.049	---	NE	---
Anthracene	120-12-7	---	<0.043	<0.044	<0.047	<0.073	<0.047	<0.051	---	**0.38**	**0.22**	---	2,000	HRL-93
Benzo(a)anthracene	56-55-3	---	<0.043	<0.044	<0.047	**0.091**	<0.047	<0.051	---	<0.045	<0.049	---	cPAH	---
Benzo(a)pyrene	50-32-8	---	<0.043	<0.044	<0.047	**0.091**	<0.047	<0.051	---	<0.045	<0.049	---	cPAH	---
Benzo(b)fluoranthene	205-99-2	---	<0.043	<0.044	<0.047	**0.12**	<0.047	<0.051	---	<0.045	<0.049	---	cPAH	---
Benzo(g,h,i)perylene	191-24-2	---	<0.043	<0.044	<0.047	**0.076**	<0.047	<0.051	---	<0.045	<0.049	---	NE	---
Benzo(k)fluoranthene	207-08-9	---	<0.043	<0.044	<0.047	<0.073	<0.047	<0.051		<0.045	<0.049		cPAH	---
Chrysene	218-01-9	---	<0.043	<0.044	<0.047	**0.096**	<0.047	<0.051	---	<0.045	<0.049	---	cPAH	---
Dibenz(a,h)anthracene	53-70-3	---	<0.043	<0.044	<0.047	<0.073	<0.047	<0.051	---	<0.045	<0.049	---	cPAH	---
Fluoranthene	206-44-0	---	<0.043	<0.044	<0.047	**0.18**	<0.047	<0.051	---	**0.056**	**0.071**	---	70	HBV-15
Fluorene	86-73-7	---	<0.043 [1]	<0.044 [1]	<0.047 [1]	<0.073 [1]	<0.047 [1]	<0.051 [1]	---	**0.057**	**0.37**	---	300	HRL-93
Indeno(1,2,3-cd)pyrene	193-39-5	---	<0.043	<0.044	<0.047	<0.073	<0.047	<0.051	---	<0.045	<0.049	---	cPAH	---
Naphthalene	91-20-3	---	<0.043	<0.044	<0.047	**0.095**	<0.047	**0.11**	---	<0.045	**1.1**	---	70	HRL-13
Phenanthrene	85-01-8	---	<0.043	<0.044	<0.047	**0.12**	<0.047	<0.051	---	**0.19**	**0.39**	---	NE	---
Pyrene	129-00-0	---	<0.043	<0.044	<0.047	**0.18**	<0.047	<0.051	---	<0.045	<0.049	---	50	HBV-15
BaP Equivalent[c]	---	---	---	---	---	**0.1**	---	---	---	**0.0**	**0.0**	---	0.06	HBV-12
Metals (µg/L)														
Arsenic, Dissolved	7440-38-2	---	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	---	<20.0	<20.0	---	10	MCL
Barium, Dissolved	7440-39-3	---	**175**	**84.8**	**165**	**298**	**1,640**	**311**	---	**127**	**167**	---	2,000	HRL-93
Cadmium, Dissolved	7440-43-9	---	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	---	<3.0	<3.0	---	0.5	HRL-15
Chromium, Dissolved [d]	7440-47-3	---	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	---	<10.0	<10.0	---	20,000/100[d]	HRL-94
Lead, Dissolved	7439-92-1	---	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	---	<10.0	<10.0	---	15	MCL
Mercury, Dissolved	7439-97-6	---	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	---	<0.20	<0.20	---	2	MCL
Selenium, Dissolved	7782-49-2	---	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	---	<20.0	<20.0	---	30	HRL-93
Silver, Dissolved	7440-22-4	---	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	---	<10.0	<10.0	---	30	HRL-93
Other Parameters (µg/L)														
Diesel Range Organics (DRO)	---	**459**	<104	<120	**235**	**205**	<110	**235**	**1,550** [2]	**505** [2]	**986** [2]	**166**	200	HBV [e]
Gasoline Range Organics (GRO)	---	<200 [4]	<100 [3]	<100	<100	<100 [3]	<100	<100	<100	<100	<100	<100	200	HBV [e]

Notes
[1] [L2] Analyte recovery in the laboratory control sample (LCS) was below QC limits. Results may be biased low.
[2] [T6] High boiling point hydrocarbons are present in the sample.
[3] [pH] Post-analysis pH measurement indicates insufficient VOA sample preservation.
[4] The sample was analyzed at a dilution due to a large amount of sediment in the vials. - [pH] Post-analysis pH measurement indicates insufficient VOA sample preservation.
Drinking Water Criteria = The most conservative value for chronic or cancer exposures provided from the following sources including the Minnesota Department of Health (MDH) Health Risk Limit (HRL), MDH Health Based Value (HBV), MDH Risk Assessment Advice (RAA) or Maximum Contaminant Level (MCL). The year of promulgation is provided, if available. Values updated 12/29/15.
µg/L = Micrograms per liter.
< = Not detected at or above the laboratory reporting limit indicated.
---- = Not analyzed or calculated for this parameter or not applicable.
RL = Reporting limits for other parameters that are not listed individually in this table because their concentrations were below reporting limits provided in the laboratory report.
NE = Regulatory limit not established for this parameter.
cPAH = Individual regulatory limit not established for this carcinogenic PAH; included in BaP equivalent calculation.
[c] = Benzo(a)pyrene (BaP) equivalent is calculated based on the concentration and weighted toxicity of cPAHs; Minnesota Pollution Control Agency; 2009. If no cPAHs were detected above reasonable laboratory reporting limits the BaP equivalent is reported as 0 mg/kg per MPCA Remediation Division Policy; June 2011.
[d] = Reported result is total chromium, criteria for chromium III and chromium VI are provided.
[e] = Provisional MDH Health Based Value for total petroleum hydrocarbons (sum of DRO and GRO).

Exceeds Drinking Water Criteria

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Table 6
Soil Vapor Analytical Results
Proposed Soccer Stadium Project
Saint Paul, Minnesota
Project B1600941

Compound/Parameter	CAS No.	Sample Identifier, Depth of Sample, Location, and Date Collected					Residential ISV (µg/m^3)	10X Residential ISV (µg/m^3)	100X Residential ISV (µg/m^3)	10X Industrial ISV (µg/m^3)	100X Industrial ISV (µg/m^3)
		VP-101	**VP-102**	**VP-103**	**VP-104**	**VP-105**					
		(13'-15')	(8'-10')	(13'-15')	(8'-10')	(6'-8')					
		AB-8	AB-12	AB-13	AB-16	AB-18					
		02/17/2016	02/17/2016	02/17/2016	2/18/2016	2/19/2016					
Volatile Organic Compounds (VOCs) (µg/m^3)											
Acetone	67-64-1	**164**	**108**	**166**	**74.4**	**9.0**	31,000	310,000	3,100,000	870,000	8,700,000
Benzene	71-43-2	**32.3**	**16.3**	**38.8**	**44.4**	**2.1**	4.5	45	450	130	1,300
2-Butanone (MEK)	78-93-3	**56.4**	**32.4**	**49.1**	**13.3**	<4.5	5,000	50,000	500,000	100,000	1,000,000
Carbon disulfide	75-15-0	**4.9**	**4.5**	**6.4**	<1.2	**1.1**	700	7,000	70,000	20,000	200,000
Chloromethane	74-87-3	<0.56	**4.7**	**3.6**	<0.77	<0.63	90	900	9,000	3,000	30,000
Cyclohexane	110-82-7	**25.1**	**6.9**	**28.9**	**5.0**	<1.0	6,000	60,000	600,000	200,000	2,000,000
Dichlorodifluoromethane	75-71-8	**2.1**	**14.8**	**2.7**	**2.2**	**1,200** [2]	NE	NE	NE	NE	NE
Ethanol	64-17-5	**39.1**	**12.3**	**37.4**	**25.6**	<2.9	15,000	150,000	1,500,000	420,000	4,200,000
Ethylbenzene	100-41-4	**9.1**	**2.4**	**7.7**	**4.3**	<1.3	1,000	10,000	100,000	30,000	300,000
4-Ethyltoluene	622-96-8	**3.1**	<1.3	**2.1**	<1.8	<1.5	NE	NE	NE	NE	NE
n-Heptane	142-82-5	**64.6**	**18.1**	**63.2**	**22.4**	<1.2	NE	NE	NE	NE	NE
n-Hexane	110-54-3	**98.1**	**27.5**	**87.0**	**19.8**	<1.1	2,000	20,000	200,000	60,000	600,000
4-Methyl-2-pentanone (MIBK)	108-10-1	**8.2**	<5.6	<5.6	<7.6	<6.2	3,000	30,000	300,000	80,000	800,000
Naphthalene	91-20-3	**7.4**	<3.6	**4.3**	<9.8	<7.9	9	90	900	300	3,000
Isopropyl alcohol	67-63-0	**19.6**	**35.9**	**38.1**	**40.2**	**13.2**	7,000	70,000	700,000	200,000	2,000,000
Propylene	115-07-1	**495** [1]	**279** [1]	**508** [1]	**62.3**	**18.5**	3,000	30,000	300,000	80,000	800,000
Styrene	100-42-5	**2.8**	**1.2**	**2.7**	<1.6	<1.3	1,000	10,000	100,000	30,000	300,000
Tetrachloroethene	127-18-4	**27.0**	**129**	**36.2**	**23.7**	**48,600** [2]	2	20	200	300	3,000
Toluene	108-88-3	**39.5**	**16.6**	**42.6**	**45.7**	**2.0**	5,000	50,000	500,000	100,000	1,000,000
Trichloroethene	79-01-6	<0.74	<0.74	<0.74	<1.0	**59.9**	2	20	200	60	600
1,2,4-Trimethylbenzene	95-63-6	**10.1**	**2.2**	**5.5**	<4.6	<3.7	7	70	700	200	2,000
1,3,5-Trimethylbenzene	108-67-8	**2.5**	<1.3	**1.6**	**4.4**	**2.5**	6	60	600	200	2,000
m&p-Xylene	179601-23-1	**13.0**	**3.2**	**9.8**	**6.6**	**4.9**	100[a]	1,000[a]	10,000[a]	3,000[a]	30,000[a]
o-Xylene	95-47-6	**5.8**	**1.9**	**6.5**	**2.8**	**3.4**	100[a]	1,000[a]	10,000[a]	3,000[a]	30,000[a]
All other Reported VOCs	---	<RL	<RL	<RL	<RL	<RL	---	---	---	---	---

Notes

[1] [E] Analyte concentration exceeded the calibration range. The reported result is estimated.

[2] [A3] The sample was analyzed by serial dilution.

Intrusion Screening Value (ISV) is a Revised Interim ISV if established. ISVs updated 9/1/2015.

µg/m^3 = Micrograms per cubic meter.

< = Not detected at or above the laboratory reporting limit indicated.

---- = Not analyzed or calculated for this parameter or not applicable.

RL = Reporting limits for other parameters that are not listed individually in this table because their concentrations were below reporting limits provided in the laboratory report.

NE = Regulatory limit not established for this parameter.

[a] = Regulatory limit for combination of m, p, and o-xylenes.

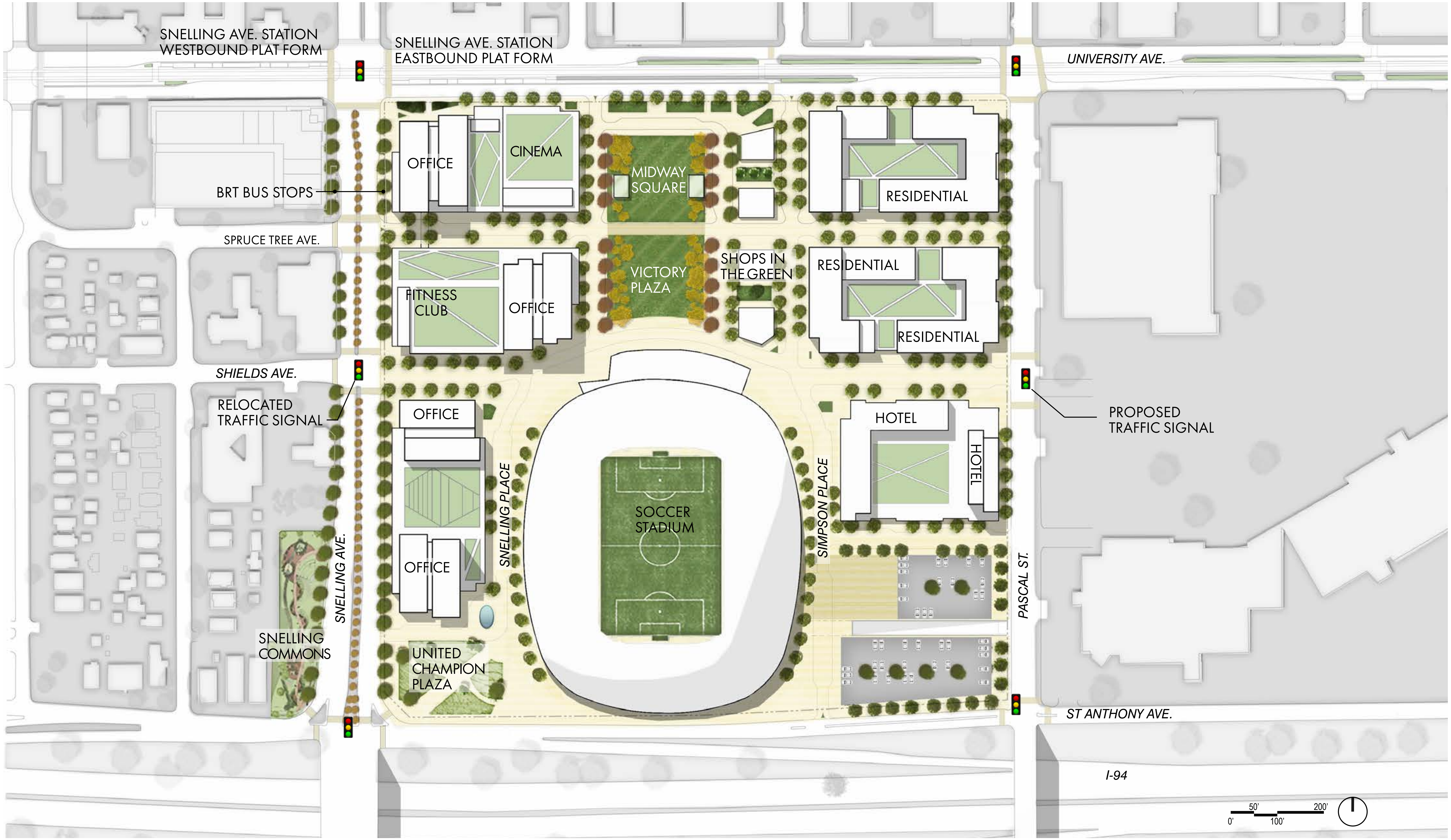
Exceeds 10X Residential ISV

Exceeds 100X Industrial ISV

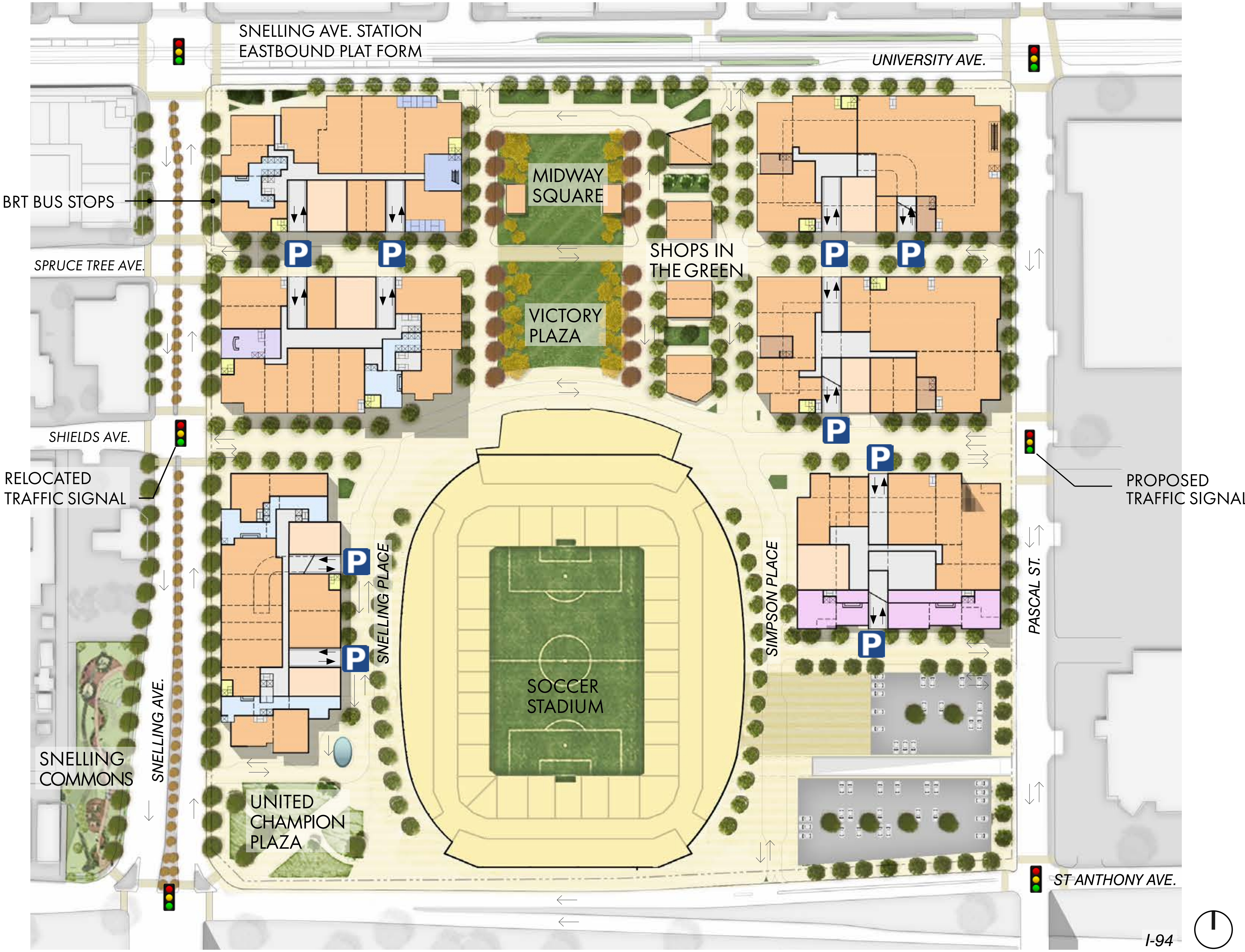
BRAUN INTERTEC

Appendix C
Preliminary Project Design Drawings

SITE PLAN

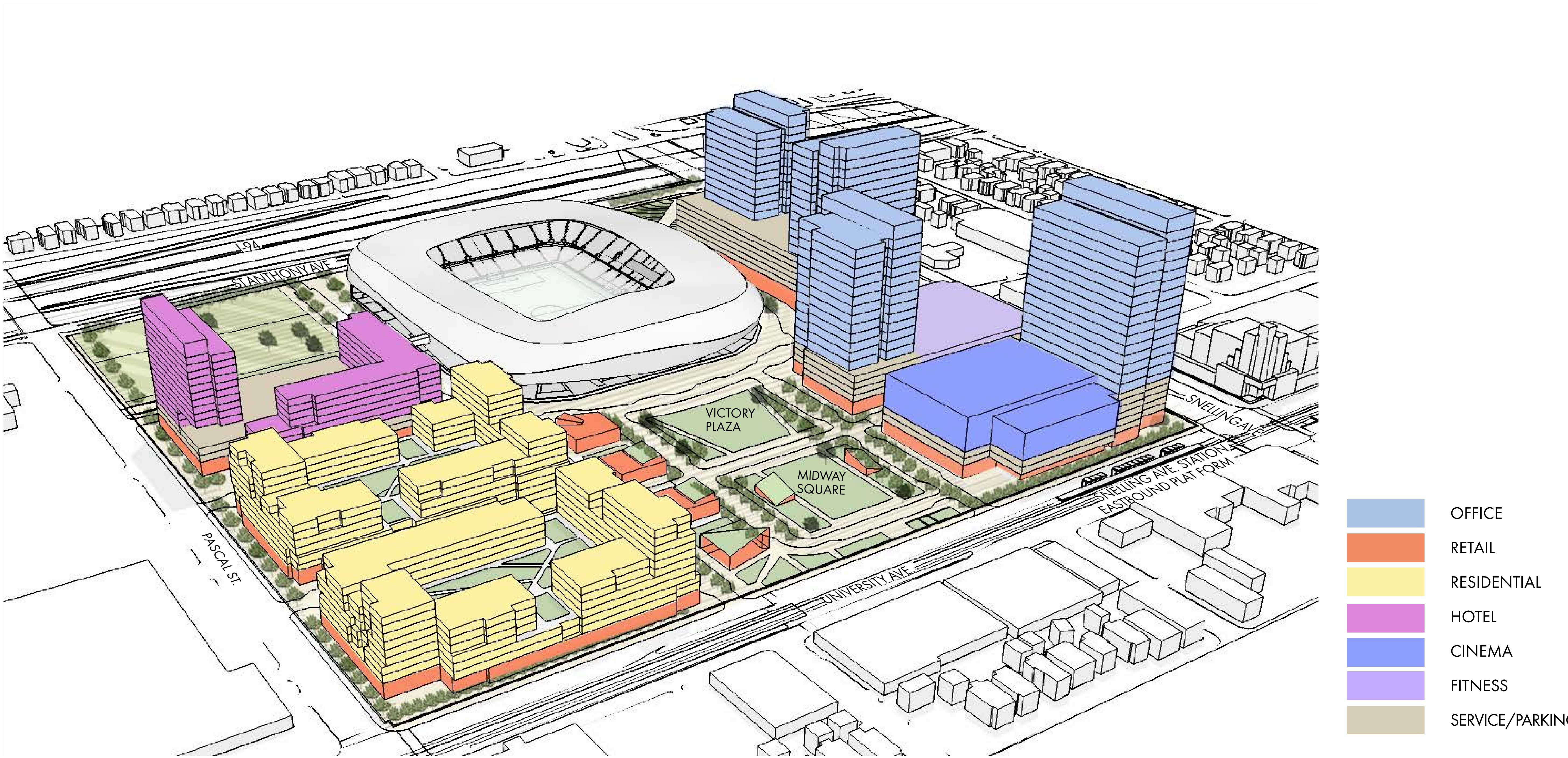

SNELLING AVE. STATION
WESTBOUND PLAT FORM
SNELLING AVE. STATION
EASTBOUND PLAT FORM
UNIVERSITY AVE.
OFFICE
CINEMA
MIDWAY
SQUARE
RESIDENTIAL
BRT BUS STOPS
SPRUCE TREE AVE.
FITNESS
CLUB
OFFICE
VICTORY
PLAZA
SHOPS IN
THE GREEN
RESIDENTIAL
RESIDENTIAL
SHIELDS AVE.
RELOCATED
TRAFFIC SIGNAL
OFFICE
HOTEL
HOTEL
PROPOSED
TRAFFIC SIGNAL
SNELLING PLACE
SOCCER
STADIUM
SIMPSON PLACE
OFFICE
SNELLING AVE.
PASCAL ST.
SNELLING
COMMONS
UNITED
CHAMPION
PLAZA
ST ANTHONY AVE.
I-94
50'
200'
0'
100'

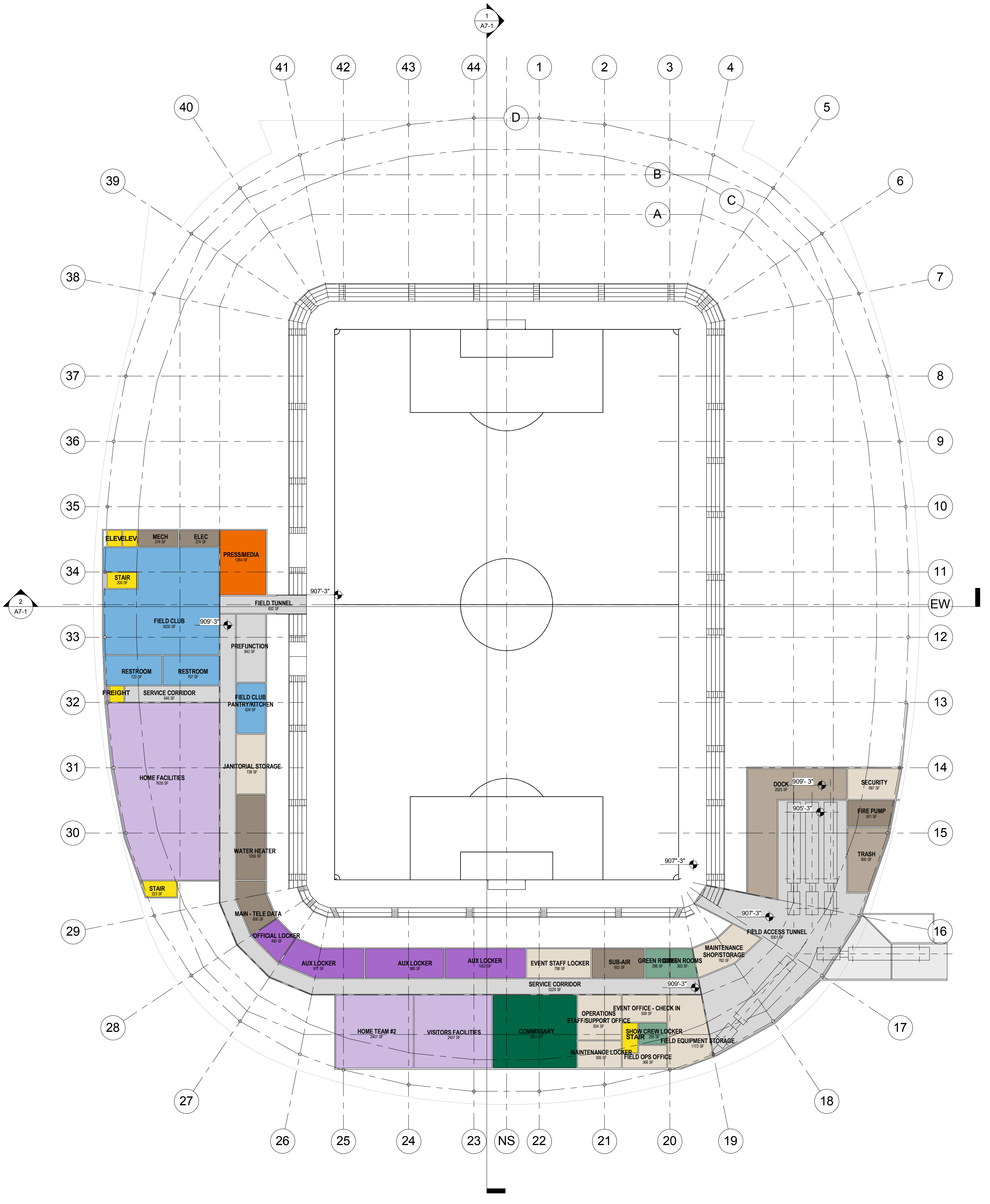
GROUND FLOOR PLAN



- OFFICE
- RETAIL
- RESIDENTIAL
- HOTEL
- CINEMA
- FITNESS
- LOADING
- PARKING/SERVICE
- CIRCULATION
- STADIUM

PROGRAM DIAGRAM

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ELEV
ELEV
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ELEC
274 SF
PRESS/MEDIA
1264 SF
STAIR
200 SF
FIELD TUNNEL
652 SF
907'-3"
FIELD CLUB
5030 SF
909'-3"
PREFUNCTION
842 SF
RESTROOM
723 SF
RESTROOM
707 SF
FREIGHT
SERVICE CORRIDOR
645 SF
FIELD CLUB
PANTRY/KITCHEN
624 SF
JANITORIAL STORAGE
738 SF
HOME FACILITIES
7635 SF
WATER HEATER
1056 SF
STAIR
223 SF
MAIN - TELE DATA
600 SF
OFFICIAL LOCKER
400 SF
AUX LOCKER
977 SF
AUX LOCKER
980 SF
AUX LOCKER
1002 SF
EVENT STAFF LOCKER
798 SF
SUB-AIR
653 SF
GREEN ROOMS
296 SF
GREEN ROOMS
303 SF
MAINTENANCE
SHOP/STORAGE
762 SF
SERVICE CORRIDOR
5229 SF
909'-3"
HOME TEAM #2
2407 SF
VISITORS FACILITIES
2407 SF
COMMISSARY
2601 SF
OPERATIONS
STAFF/SUPPORT OFFICE
834 SF
EVENT OFFICE - CHECK IN
509 SF
SHOW CREW LOCKER
255 SF
STAIR
FIELD EQUIPMENT STORAGE
1172 SF
MAINTENANCE LOCKER
505 SF
FIELD OPS OFFICE
368 SF
907"-3"
DOCK
2525 SF
909'- 3"
905'-3"
SECURITY
667 SF
FIRE PUMP
501 SF
TRASH
900 SF
907'-3"
FIELD ACCESS TUNNEL
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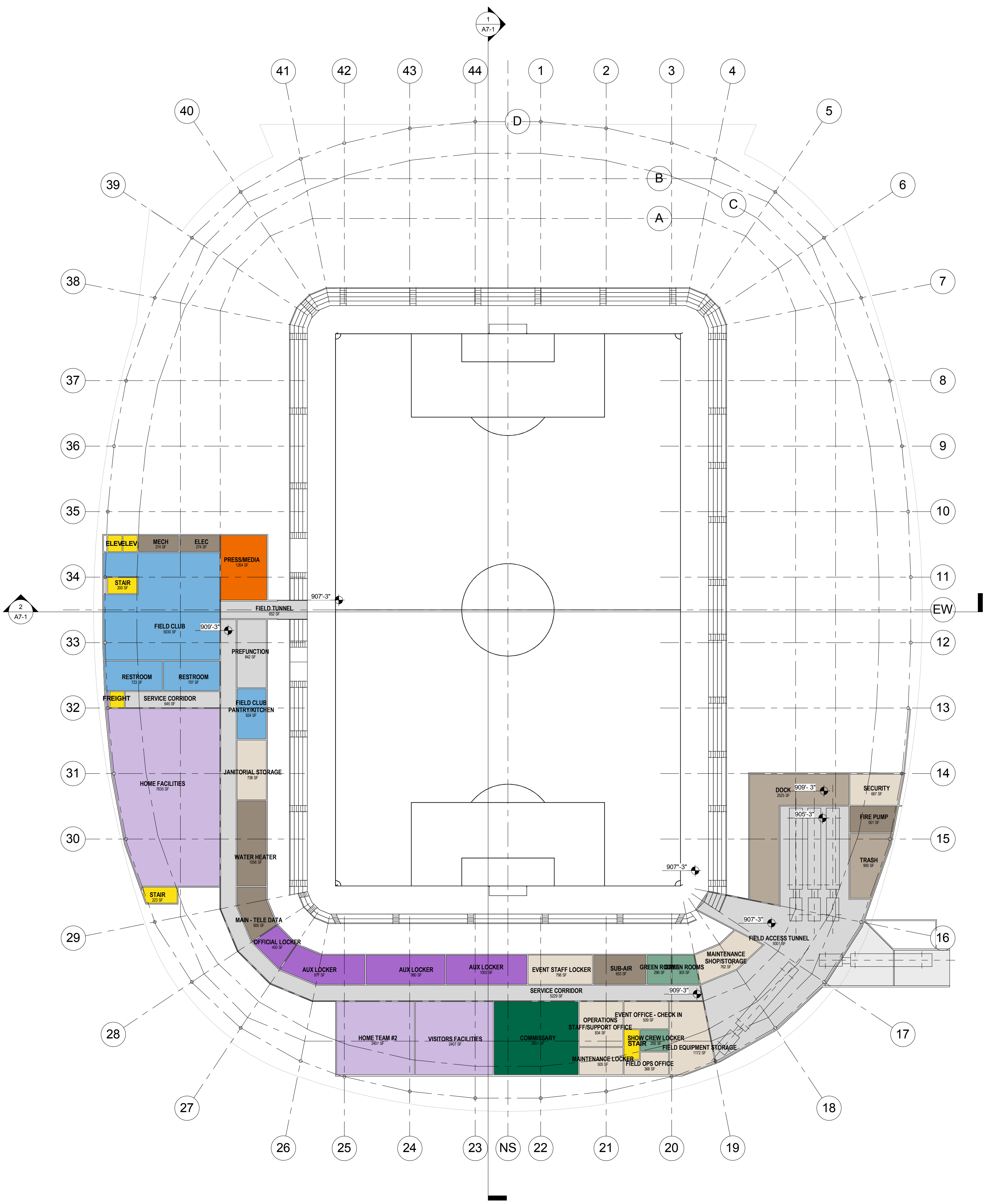
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PRESS/MEDIA
1264 SF
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738 SF
HOME FACILITIES
7635 SF
WATER HEATER
1056 SF
STAIR
223 SF
MAIN - TELE DATA
600 SF
OFFICIAL LOCKER
400 SF
AUX LOCKER
977 SF
AUX LOCKER
980 SF
AUX LOCKER
1002 SF
EVENT STAFF LOCKER
798 SF
SUB-AIR
653 SF
GREEN ROOMS
296 SF
GREEN ROOMS
303 SF
MAINTENANCE SHOP/STORAGE
762 SF
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909'-3"
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509 SF
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255 SF
STAIR
FIELD EQUIPMENT STORAGE
1172 SF
MAINTENANCE LOCKER
505 SF
FIELD OPS OFFICE
368 SF
907"-3"
FIELD ACCESS TUNNEL
9301 SF
907'-3"
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FIRE PUMP
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TRASH
900 SF

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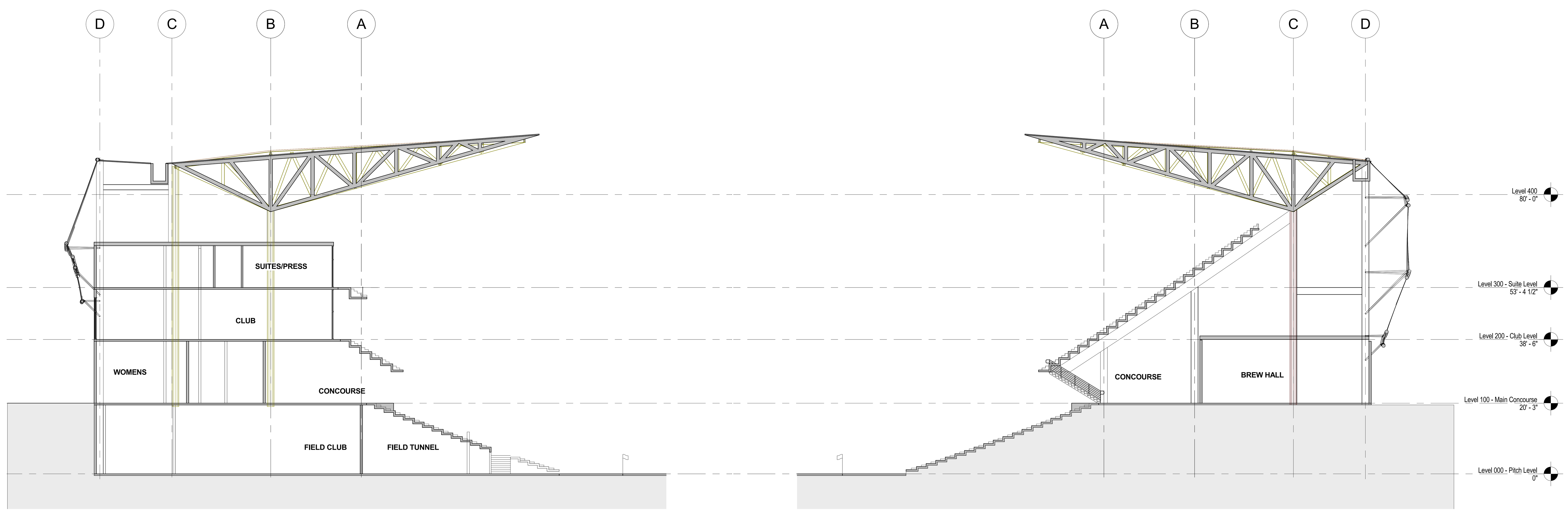
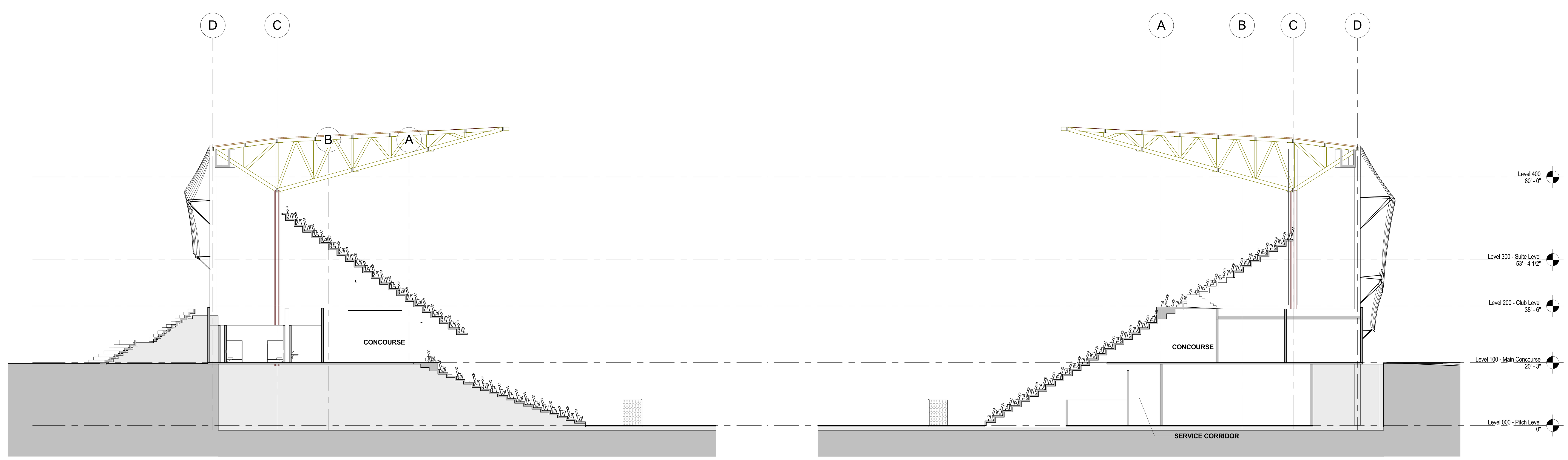


2 Transverse Section
1/16" = 1'-0"



1 Longitudinal Section - Baseline Skin Section
1/16" = 1'-0"

FOR REFERENCE ONLY - NOT FOR CONSTRUCTION

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POPULOUS™ Inc.
Formerly HOK Sport Venue Event
Architecture, Planning,
Interiors, Programming
300 Wyandotte, Suite 200
Kansas City, Missouri 64105
816/ 221-1500

Minnesota Soccer

Enter address here

Issue Date

REVISIONS

NO.	DATE	DESCRIPTION

A	D
B	C

PROJECT NO. Project Number

ISSUED BY: POPULOUS™

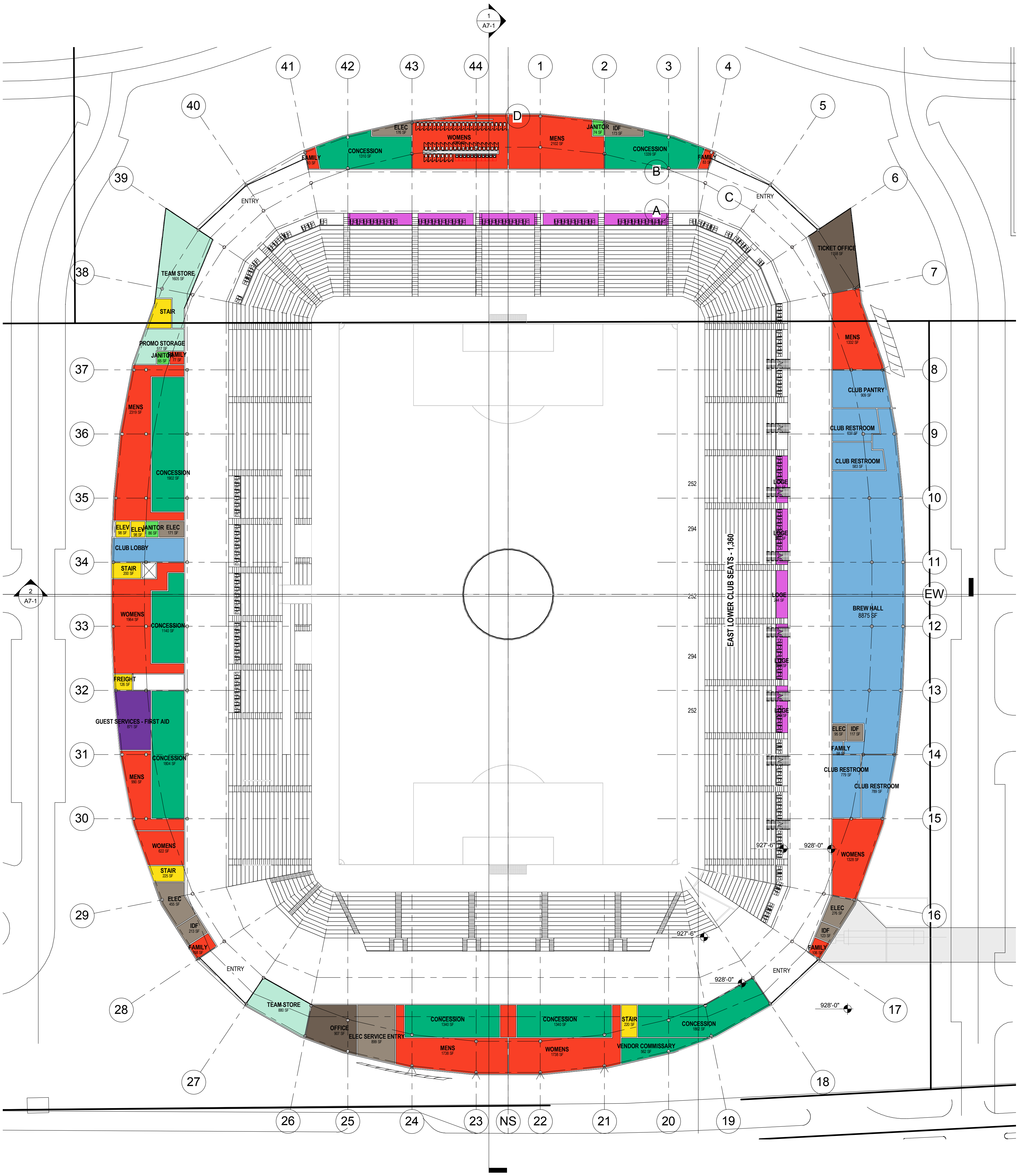
ISSUED DATE: 10/20/10

SHEET TITLE:

Building Sections

DISCIPLINE - CATEGORY - SUB CATEGORY - SHEET

A7-1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ELEC
WOMENS
MENS
JANITOR
IDF
CONCESSION
FAMILY
ENTRY
TICKET OFFICE
TEAM STORE
STAIR
PROMO STORAGE
JANITOR
FAMILY
MENS
CONCESSION
ELEV
ELEV
JANITOR
ELEC
CLUB LOBBY
STAIR
WOMENS
CONCESSION
FREIGHT
GUEST SERVICES - FIRST AID
CONCESSION
MENS
WOMENS
STAIR
ELEC
IDF
FAMILY
ENTRY
TEAM STORE
OFFICE
ELEC SERVICE ENTRY
CONCESSION
CONCESSION
STAIR
CONCESSION
MENS
WOMENS
VENDOR COMMISSARY
ENTRY
FAMILY
IDF
ELEC
WOMENS
CLUB RESTROOM
CLUB RESTROOM
FAMILY
ELEC
IDF
BREW HALL
8875 SF
CLUB RESTROOM
CLUB RESTROOM
CLUB PANTRY
MENS
LOGE
EAST LOWER CLUB SEATS - 1,360
252
294
252
294
252
927'-6"
928'-0"
927'-6"
928'-0"
928'-0"
EW
NS

Appendix D
Proposed Methods and Procedures

A. Purpose

The objective of this Standard Operating Procedure (SOP) is to establish a consistent method and format for the use and control of documentation generated during field activities. Field notes, records, and photographs are intended to provide sufficient information that can be used to recreate the field activities and collection of environmental data. The information placed in these documents and/or records should be factual, detailed, and free of personal opinions.

A.1. Scope and Applicability

This SOP is applicable to Phase I Environmental Site Assessments (ESAs), Phase II ESAs, remedial investigations, and Response Action Plan (RAP) implementation. Documentation includes Field Report Form, additional field forms that are part of method SOPs, and photographs.

A.2. Personnel Responsibilities

The project manager (or designee) is responsible for properly preparing field personnel to perform the field work and to oversee that field documentation is collected in accordance with this SOP, site-specific or project-specific planning documents, and other applicable SOPs.

Field personnel are responsible for understanding and implementing this SOP during field activities, as well as completing appropriate Field Report Form to properly document the field activities. Field observations should be discussed with the project manager on a daily basis. If conditions change from initial expectations, a call should also be made to the project manager. Field personnel should document field activities and record field measurements as they occur and complete documentation prior to leaving the site. Field personnel are responsible for tracking the location of field documentation. Field personnel are responsible for preserving original documentation until it is provided to the project manager and placed into the permanent file or archived. Field personnel are responsible for distributing copies (or electronically preserving copies) of the documentation in a timely manner.

B. Health and Safety

Field work should be performed in accordance with the *Braun Intertec Corporate Health and Safety Manual Standard Operating Procedures* and the site-specific health and safety plan (HASP), if applicable.

C. Referenced SOPs

- None

D. Equipment and Supplies

- Field Report Form (see Attachment A) or field logbook
- Waterproof and/or indelible ink pens
- Cell phone camera or digital camera

E. Procedure

This SOP primarily addresses documentation using the Field Report Form (see Attachment A) or field logbook. However, procedures discussed in this SOP are applicable to other types of field documentation collected. Other field records and forms (e.g., soil boring logs, Chain-of-Custody records, water sample collection records, soil vapor monitoring forms) are discussed in the specific SOP associated with that particular activity and are not described in this SOP.

E.1. Field Report Form

Field personnel will keep accurate written records of their daily activities in chronological order on a Field Report Form that will be sufficient to recreate the project field activities without reliance on memory. Entries should be legible and written in black, waterproof or indelible ink. Each page should be numbered sequentially, dated, and signed by the field author. There should be no blank lines on a page. If only part of a page is used, the remainder of the page should have an "X" drawn over it. The completion of each day's work and the end of the field project should be clearly indicated with "END DAY" or "END FIELD INVESTIGATION."

If pre-printed adhesive labels or other added information are glued or taped onto a Field Report Form, the note taker should sign the addition. The signature should begin on the addition and extend onto the Field Report Form page so that the addition cannot be removed without detection.

At a minimum the following information should be recorded for <u>each project</u>:

- Site/project name
- Site location
- Site project number
- Name of project manager
- Full name of Field Report Form author
- Names of other Braun Intertec personnel on site and their role (full name and initials)
- Name of subcontractors performing work for Braun Intertec (or whose work Braun Intertec is monitoring) and the full name and phone number of their site superintendent

At a minimum, the following information should be recorded <u>each day</u>:

- Date
- Purpose of the day's activities
- Pertinent weather conditions (temperature, precipitation events, wind direction and speed, general air quality, particularly any ambient odors). Significant weather changes during the day should be noted
- Full name and initials of Field Report Form author, if different from previous day
- Full name and initials of other Braun Intertec personnel on site and their role, if different from previous day
- Documentation of exclusion zone setup and decontamination procedures, if applicable
- Record safety related monitoring information, including the time and location of the measurements or observations
- If not Level D, record the Personal Protective Equipment (PPE) level in which work is conducted and change in levels and the reason for the change

- Names, phone numbers, and affiliation of all site visitors and their reason for visiting, as well as their time of arrival(s) and departure(s). The project manager should be notified immediately if regulators (e.g., Minnesota Pollution Control Agency [MPCA], Environmental Protection Agency [EPA], Occupational Safety & Health Administration [OSHA]) visit the site. [Note: "all site visitors" means those who are inspecting or observing our work or the work we are overseeing. It is not intended to include unrelated site activities or personnel.]
- Persons contacted, name, and reason for contact, and decisions made. If the person contacted is not Braun Intertec personnel, also record the phone number.

E.2. Environmental Media Sampling Data

The information below should be recorded on specific forms if they are required by the data collection method SOP, but use of the form should be documented on the Field Report Form. The following information should be recorded:

- A chronological description of field observations and sampling events (i.e., date and time)
- Sampling locations (referenced/scaled drawings or global positioning system [GPS] coordinates, if not logged) should be identified. The project manager should provide the sample nomenclature system to the field personnel for consistency and continuity on sites with multiple rounds of data collection.
- Specific data associated with sample acquisition (e.g., field parameter measurements, field screening data, and HASP monitoring data)
- Source of samples, matrix, sample identification, sample container types and preservatives (including ice), field quality assurance/quality control sample collection, preparation, and origin
- Conditions that could adversely impact samples, such as smoke, wind, rain, or dust
- Make, model, and serial number of field instruments should be recorded in the Field Report Form or in a separate calibration log along with calibration data
- Deviations from the work plan and/or SOPs
- Sketches or scaled diagrams
- Process diagrams
- Waste generated and management methods (i.e., investigation derived waste [IDW]).

E.3. Sketches and Scaled Diagrams

Draw a site map using accurate measurements or make notes on a photocopy of an existing site map. The site map should include:

- Site boundaries (or features such as street curbs, fence lines etc. that can later be related to site boundaries)
- Street names or other references that can be related to a site location map
- Investigation and well locations with dimensions to site landmarks
- Major structures with dimensions
- North arrow
- Scale
- Date
- Initials of field personnel

E.4. Photographs

Subject

Photographs should be taken to document existing conditions pertinent to the subject evaluation or remediation at a project site. Except when specifically required, it is unnecessary to photograph processes that are described by SOPs, but rather photograph the results of the process.

Composition

The three most common mistakes to avoid in providing photographic documentation are (1) too few photographs, (2) poor quality photographs, and (3) lack of subject identification in photographs. Photographic documentation should tell the story with as little need for narrative as possible.

When photographing several similar subjects or details that are not necessarily well identified in an establishing shot, such as a test excavations or test excavation spoil piles, it is recommended that you place a clip board with an identifying description in at least the first in the sequence of photographs of that subject or detail.

Scale

Where there are insufficient objects of widely known scale in a photograph, one should be placed in the photograph to provide scale. Some examples include a coin, ruler, clipboard, or cell phone.

Photographic Log

The following information should be recorded in the Field Report Form or field logbook:

- Site name, location, and field task
- Name of photographer
- Date and time the photograph was taken (verify the date/time stamp is correct if using a digital camera)
- Sequential number of the photograph
- Brief description of the subject of the photograph
- Site plan or site sketch showing the location from which the photograph was taken and the direction the photographer was facing.

E.5. Additional Field Forms/Records

Additional field records may be required for some field events. As an example, these may include soil boring logs during drilling, well construction and development records, groundwater purge and sample collection records, water level measurement records, instrument calibration records, sample container labels, sample container security tags and seals, Chain-of-Custody forms, field equipment calibration and maintenance logs and commercial shipping manifests. Use of these records described in the SOPs associated with the particular activity.

Prior to beginning field activities, field personnel will coordinate with the project manager, or designee, to determine which SOPs will be used and identify additional field forms that are required. These additional records will be maintained in a field file throughout the duration of the field activities. Copies of the records will be forwarded to the project manager (or designee) on a daily basis, if practical to do so.

E.6. Corrections

If an error is made in an entry in the field records, corrections will be made by drawing a SINGLE straight line through the error, entering the correct information, initialing, and dating the change. Materials that obliterate the original information, such as correction fluids, tapes or markers are prohibited. If the reason for the change is not obvious, provide a brief explanation.

E.7. Data and Records Management

Field records should be forwarded to the project manager or designated staff on a daily basis, if practical. The project manager should review progress and results in detail on a daily basis and evaluate the quality of the documentation. The field personnel should scan the field records and place them in the project folder in OnBase. This preserves documentation in the event that the Field Report Form is lost, stolen, or damaged. Copies of the field notes should be maintained in accordance with the Braun Intertec Records Retention Policy and Procedures. Photographs should be uploaded to the EnCon DRAFTS project folder as soon as possible.

Individual logbooks may be assigned to large projects. These logbooks will be returned to the project manager at the completion of field work and archived with the project file. Logbooks assigned to individual personnel for recording multiple project information from multiple projects should be provided to the designated EnCon project assistant for archiving when the logbooks are filled. Each logbook should have a table of contents (TOC) and be kept up to date by the personnel to which the book is assigned.

The TOC for each logbook should list the project names and locations, project numbers, inclusive dates and logbook page numbers.

E.8. Quality Assurance/Quality Control

All personnel that perform field work will be trained in the use of this SOP. Project managers or project staff who use the field notes for interpreting data and preparing reports should provide immediate feedback to those recording field information to reinforce conformance with the SOP and correct deficiencies. Periodic random audits of all field personnel documentation will be performed by the quality assurance (QA) manager or designees.

F. References

U.S. Environmental Protection Agency, Region 4, Science and Ecosystem Support Division, Athens, Georgia, Operating Procedure: Logbooks, SESDPROC-010-R3, October 31, 2007.

BRAUN INTERTEC

The Science You Build On.

FIELD REPORT FORM

Sheet ____ of ____

Project No. __________________ Project Name ____

Project Manager ______________________________ Date ____________ Time onsite _________ Time offsite _________

Form Author _________________________________ Other Braun Intertec Staff ____________________________________

Project Location ____

Weather & Temperature ____

Others (subcontractors, site superintendent, etc. [Time on-site/Time off-site]) _______________________________________

____

Field/PPE Equipment used (include ID#) ____

Work Completed (include field scope, unexpected issues, action items, log of communication, and site sketch if necessary):

Signature: ____________________________

A. Purpose

The objective of this Standard Operating Procedure (SOP) is to establish a consistent method and format for visual identification and description of soil samples collected in the field. This SOP is applicable to soil samples collected during completion of soil borings (see SOP 203 – Soil Boring Observation and Sampling) and test trench excavations (see SOP 211 – Test Pit and Test Trench Observation and Sampling).

B. Health and Safety

Field work should be performed in accordance with the *Braun Intertec Corporate Health and Safety Manual Standard Operating Procedures* and the site-specific health and safety plan (HASP).

C. Referenced SOPs

- SOP 101 – Field Notes and Documentation
- SOP 203 – Soil Boring Observation and Sampling
- SOP 208 – Soil Grab Sample Collection
- SOP 209 – Soil Composite Sample Collection
- SOP 210 – Soil Stockpile Sampling
- SOP 211 – Test Pit and Test Trench Observation and Sampling

D. Equipment and Supplies

- Soil boring or test trench log forms (see SOP 203 – Soil Boring Observation and Sampling or SOP 211 – Test Pit and Test Trench Observation and Sampling)
- Field report form (see SOP 101 – Field Notes and Documentation) or field logbook
- Waterproof and/or indelible ink pens

E. Procedure

As soil samples are collected in the field, a visual identification and description will be completed as described below. The *Standard Practice for Description and Identification of Soils* (American Society for Testing and Materials [ASTM] D2488-00) was used to prepare this SOP, and soil descriptions should follow that document as applicable.

When visually describing soils in the field, the following information should be provided at a minimum; however, more detailed descriptions are encouraged.

Prepare the soil description **in the order shown**. All field personnel should have a laminated copy of the Field Guide for Soil and Stratigraphic Analysis and use this field guide for classification of soil.

E.1. Main Soil

A description of the main soil group name using the United Soil Classification System (USCS) nomenclature (e.g., gravel, sand, silt, clay, silty sand, clayey sand, organic soil, etc.).

E.3. Group Symbol

List the Group Symbol in parenthesis after the main soil group name. Group symbols include the following:

- CL = Lean Clay; Lean Clay with Sand
- ML = Silt; Silt with Sand
- CH = Fat Clay
- OL/OH = Organic Soils
- GW/GP = Well Graded Gravel/Poorly Graded Gravel
- GP-SM = Poorly Graded Gravel with Silt
- GP-SC = Poorly Graded Gravel with Clay
- GM= Silty Gravel
- GC = Clayey Gravel
- SW/SP = Well Graded Sand/Poorly Graded Sand
- SP-SM = Poorly Graded Sand with Silt
- SP-SC = Poorly Graded Sand with Clay
- SM = Silty Sand
- SC = Clayey Sand

E.4. Color

Describe the color of the main soil group (e.g., brown, gray, etc.). Preferably, the color should be identified using a Munsell® Soil Color Chart. The soil color should be described for moist samples. If the soil sample contains layers or patches of varying colors (e.g., mottled), this should be noted and representative colors shall be described. If the color described is for dry soils, this must be noted on the log.

E.5. Moisture

Describe the overall moisture of the soil sample using the terms dry, moist, or wet (do not use the term "saturated"):

- Dry = absence of moisture, dusty, dry
- Moist = damp, but no visible water
- Wet = visible water; usually soil is below the water table or perched water

E.6. Percentage by Weight

Describe the percentage by weight of the soil type(s) present in the sample using ASTM adjectives based on the percentages present within the sample:

- Trace = < 5%
- Few = 5 to 10%
- Little = 10 to 25%
- Some = 30 to 45%
- Mostly = 50 to 100%

E.7. Grain Size

Coarse-grained Soil

If the soil is coarse-grained (i.e., sand or gravel), include a brief description of the predominant particle grain size(s) (e.g., fine, medium, coarse) (see field guide).

Fine-grained Soil

If the soil is fine-grained (i.e., clay or silt), describe the consistency based on finger pressure:

- Very soft = thumb will penetrate soil more than 1 inch
- Soft = thumb will penetrate soil about 1 inch
- Firm = thumb will penetrate soil about 1/4 inch
- Hard = thumb will not indent soil, but thumbnail will easily make a mark
- Very hard = thumbnail will not indent soil

E.8. Plasticity

Describe the plasticity of the soil sample as follows:

- Nonplastic = A 1/8-inch (3-mm) thread cannot be rolled at any water content.
- Low = The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
- Medium = The thread is easily rolled and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
- High = It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

E.9. Structure

Describe any structures present in the soil sample as follows:

- Stratified = alternating layer of varying materials or color layers at least 1/4 inch or greater, note thickness.
- Laminated = alternating layer of varying materials or color layers less than 1/4 inch thick, note thickness.
- Fissured = Breaks along definite planes of fracture with little resistant to fracturing.
- Slickensided = Fracture planes appear polished or glossy.
- Blocky = cohesive soil that can be broken down into angular lumps which resist further breakdown.
- Lensed = Inclusions of small pockets of different soils such as small lenses of sand scattered in a mass of clay, note thickness.
- Homogeneous = same color and appearance throughout.

E.10. Mottling

Mottling is a patchwork of different colors in mineral soil (usually orange or rust against a background of grey or blue) which indicates periods of anaerobic (wet) conditions. If mottling is present, note the fraction of the sample that is mottled (e.g., 1/2 mottled and the color of the mottle).

E.11. Cementation

Note if any cementation is present.

E.12. Unusual Materials or Debris

Note the presence of any unusual materials or debris (e.g., bricks, glass, wood). Include the specific depth interval of the occurrence of unique material in the description or in the Remarks. See SOP 203 – Soil Boring Observation and Sampling, SOP 210 – Soil Stockpile Sampling, and SOP 211 – Test Pit and Test Trench Observation and Sampling for additional information.

E.13. Odor

Indicate any odors that are present such as organic or unusual odors. Soils that have a significant amount of organic content usually have a distinct color and odor. If the odor is of decaying vegetation, state that there is an "organic odor" present. If the odor is unusual (petroleum, herbicides, chemicals) describe the odor intensity (strong, moderate, mild, no odor) and a general descriptor. However, do not use specific chemical names to describe the odor. For example stating that "a strong chemical odor is present from 2 to 3 feet below ground surface (bgs)" is correct; however, stating that the soil "has a gasoline odor" is NOT correct.

Note: When smelling soil, do not inhale deeply or repeatedly; the chemicals present may represent a health risk.

E.14. Fill

If the soil is fill or probable fill, note in brackets (e.g., [fill], [probable fill]).

Waste/debris terminology should be as specific and descriptive as possible (e.g., concrete and glass vs. demolition debris). Category names of waste/debris should not be used. Imprecise or incorrect terminology may cause undue concern among regulators. Several important distinctions should be drawn:

- **Wood:** The term wood should not be used alone. Differentiate between tree/brush waste and lumber. To the extent feasible, lumber should be further qualified as unadulterated or treated and the type of treatment described (e.g., painted, green treated, brown treated, creosote, etc).
- **Debris:** The term debris should not be used alone. Most often, the term is used to refer to demolition debris; however, the distinction should be drawn between demolition debris consisting of road/paving demolition debris and building demolition debris.

  - Note and carefully describe the presence of concrete pieces or blocks, bricks, bituminous, recycled gravel, pipe, or tubing.
  - Asbestos is more frequently associated with building demolition debris; although, it can also be present with road/paving materials, particularly in cementitious utility conduits.
  - Household waste or garbage should be noted as such if present.

- **Sizes/Amounts:** Qualitative terms like small, medium, large, etc., should be avoided in favor of dimensions (i.e., inches, feet, etc), unless they are defined by ASTM or other commonly understood conventions. When reasonable, descriptions of sizes and percentages should be quantitative (e.g., "3 to 4 feet" or "less than 1 percent [%]") rather than qualitative (e.g., "large") or semi-quantitative (e.g., "several," or "a few").

E.15. Example

The following are examples of correct visual soil classifications:

- Silty sand (SM), dark brown (10YR 3/3), moist, mostly sand with some low plasticity fines and trace gravel, sand grains are fine to medium grained, firm, homogeneous.
- Clay (CL), gray (7.5YR 5/1), wet, mostly fines with trace sand, medium to high plasticity, soft, laminated, moderate chemical odor(s) [fill].
- Poorly Graded Sand (SP), dark brown (10YR 3/3), moist, mostly coarse-grained sand, trace fine sand, non-plastic, homogenous, debris present [debris fill]. Debris present from 4 to 5 feet bgs. Debris content is 25-30 % of the material and consists mostly of concrete (4 to 6 inches in diameter), and some broken glass (< 1 inch in diameter).

E.16. Groundwater

If and when groundwater is encountered, note the depth to water in the log.

E.17. Collecting Soil Samples

If soil samples are collected for laboratory analysis, refer to the appropriate SOPs including SOP 203 – Soil Boring Observation and Sampling, SOP 208 – Soil Grab Sample Collection, SOP 209 – Soil Composite Sample Collection, SOP 210 – Soil Stockpile Sampling, and SOP 211 – Test Pit and Test Trench Observation and Sampling.

E.18. Geotechnical Logs

To ensure consistent logs across Braun Intertec disciplines, soil samples will be collected and classified by a Braun Intertec Geotechnical Engineer. The Geotechnical Engineer's log is a supplement to the field log and is not meant to be a replacement for the field log.

Place one or more representative portions of each two-foot interval into sealable moisture-proof containers (jars or quart-sized polyethylene sealable bags) without ramming or distorting any apparent stratification. Seal the containers to prevent evaporation of soil moisture.

Affix labels to the containers indicating job designation, boring number, and sample depth. If there is a soil change within the interval, collect a soil sample for each stratum and note its depth.

Deliver the samples to the soil classification lab in the Bloomington office. Include a copy of the soil boring log form.

E.19. Data and Records Management

Observations should be documented in accordance with SOP 101 – Field Notes and Documentation.

E.20. Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) procedures described in the work plan should be followed.

A. Purpose

This Standard Operating Procedure (SOP) describes procedure for screening soil potentially contaminated with volatile organic chemicals, such as petroleum, and/or hazardous substances that can be ionized within the energy range of the photoionization detector (PID) lamp being used. The purpose of the bag headspace procedure is to assist with site soil characterization of organic chemical contamination, soil sample selection for laboratory analysis, and soil management during excavation.

A.1. Scope and Applicability

This procedure should be used during field activities where bag headspace procedures are required by regulatory guidance or site-specific work plans. This procedure is used for soil characterization and not for health and safety monitoring.

A.2. Summary of Method

A quart-size polyethylene bag with a tight sealing closure is filled with soil (approximately 1 cup) and immediately closed leaving air in the top portion of the bag (headspace). Organic vapors are allowed to accumulate in the headspace for approximately 10 minutes at room temperature. The bag is opened slightly and the tip of the PID probe is inserted to the middle of the headspace. The highest PID response observed is recorded in the field notes.

A.3. Definitions

Background Readings: The PID measurement of ambient air and bag headspace reading without soil in the bag.

Ionization energy (IE): The energy required to displace an electron and "ionize" a compound. Replaces old term *Ionization Potential* (IP).

Photoionization Detector (PID): The PID is a portable, nonspecific, vapor/gas detector employing the principle of photoionization to detect and measure real-time concentrations of a variety of chemical compounds, both organic and inorganic, in air.

B. Health and Safety

Field work should be performed in accordance with the Braun Intertec Corporate Health and Safety Manual Standard Operating Procedures and the site-specific health and safety plan (HASP).

C. Referenced SOPs

- SOP 101 – Field Notes and Documentation
- SOP 201 – Classification of Soil
- SOP 204 – Calibration of 580B PID
- SOP 205 – Calibration of MiniRAE PID

D. Equipment and Supplies

- Quart-size polyethylene sealable bags
- PID with appropriate lamp (10.6 or 11.7 electron volts [eV])
- Field report form (see SOP 101 – Field Notes and Documentation) or field logbook
- Waterproof and/or indelible ink pens
- Personal Protective Equipment (PPE)

E. Procedure

E.1. Preparation

PID lamps with two different light energy (in eV) are available for use. The 11.7 eV lamp measures the broadest range of compounds, while the 10.6 eV lamp is somewhat more selective. The standard lamp used is 10.6 eV unless otherwise specified by the technical project manager.

Calibrate the PID onsite at least daily to yield total organic vapors in parts per million (ppm) using an isobutylene standard. If field personnel are at multiple project locations in one day, calibrate the PID upon arrival to each project location. See either SOP 204 – Calibration of 580B PID or SOP 205 – Calibration of MiniRAE PID for calibration procedures. Record the lamp IE, standard used, date, time and results of the daily calibration.

E.2. Collection

- Visually examine the soil for staining or sheens. Note observations in field logbook. Describe the type and general amount of debris, if present, in the field logbook (see SOP 201 – Classification of Soil).
- Do not intentionally smell the soil for odors, but note unintentional olfactory indication of contamination in the field logbook.
- Collect soil samples in increments according to instructions established by the project manager or the site-specific work plan.
- **Soil samples for laboratory analysis should not be collected from the sealable bag used for headspace analysis.**
- While wearing proper PPE (Nitrile gloves at a minimum), field personnel should fill approximately one-quarter of a quart-size polyethylene sealable bag with a tight sealing closure (about 1 cup of soil), leaving air in the upper portion of the sealable bag (the volume ratio of soil: headspace should be 1:3). Close the quart-size polyethylene sealable bag immediately, making sure all soil is clear from the path of the bag's seal. Break apart the soil while vigorously shaking the bag for 15 seconds, avoiding puncturing a hole in the bag or tearing apart the zipper.
- Allow the headspace to develop in the sealable bag at room temperature (e.g., approximately 50 °F or greater) for 10 to 20 minutes. If the temperature is below approximately 50 °F, allow the headspace to develop within a heated vehicle or building. Record the ambient temperature during headspace screening.
- Vigorously shake the sealable bag again for 15 seconds. Open the sealable bag slightly, enough for the end of the PID probe tip to enter the bag and insert the tip to the middle of the headspace, avoiding contact with the soil and/or potential moisture from condensation in the sealable bag. Watch the PID screen for the highest reading (ppm). The maximum reading should appear in less than 5 seconds. Record the maximum PID reading reached in the field notes. Record the actual PID reading, do not round the number.
- In addition to screening a soil sample, a background PID headspace reading should be established in the field. Under the same conditions as the screened soil sample (heated vehicle or building, etc.), take an empty quart-size polyethylene sealable bag, puff it up with air, and insert the probe of the PID in the same way as the soil sample. Watch the screen of the PID for the highest PID reading (ppm). Record the maximum PID reading reached in the field notes. Record the actual PID reading, do not round the number.

E.3. Cautions

PIDs provide non-specific measurement of the presence of organic compounds including the following: aromatics, ketones and aldehydes, amines and amides, chlorinated hydrocarbons, sulfur compounds, saturated and unsaturated hydrocarbons, and alcohols. The light energy in eV emitted by the PID lamp must be greater than the IE of the compound(s) of interest. However, 11.7-eV lamps should only be used when compounds with IEs over 10.6 eV are expected and are the primary contaminants. Examples include carbon tetrachloride, methylene chloride, chloroform, and 1,1,1-trichloroethane.

Consult the NIOSH Guide to Chemical Hazards for ionization potentials for most common contaminants. The PID will not measure the following: radiation, air (N_2, O_2, CO_2, H_2O), natural gas (methane, ethane, propane), acid gases (HCl, HF, HNO_3), common toxics (CO, HCN, SO_2), freons, ozone, hydrogen peroxide, polychlorinated biphenyls (PCBs), or greases.

E.4. Interferences

Excessive moisture in the headspace may cause a false positive response on the PID due to condensation in the sensor causing current leakage across the electrodes. The problem is exacerbated by dirty, bent out of shape, or corroded electrodes. This problem tends to manifest itself by a “drift” upward of the measurement, rather than a sharp response to the presence of an organic vapor. Humidity from wet soil also absorbs UV light and may dampen response when vapors are present. The warming of cold, wet samples tends to cause excessive humidity in the headspace, and if the PID is colder than the samples, condensation in the PID can result. Avoid getting condensate or soil in the inlet probe (use a PID dust filter to avoid getting soil in the inlet probe). Avoid getting soil in the grooves of the bag seal, so that it will close securely.

E.5. Data and Records Management

Field data should be recorded and managed in accordance with SOP 101 – Field Notes and Documentation. Documentation should include the following:

- Calibration: date, time, calibration standard, and result
- Maintenance performed, if any
- Background readings: ambient air and quart-size polyethylene sealable bag
- Ambient air temperature at which headspace screened
- Sample identification information per sample method SOP
- General observations: condensed moisture in the bag, unusual odors associated with the soil sample and/or ambient air

E.6. Quality Assurance/Quality Control

Field personnel should check the PID maintenance log before beginning each new job to make sure that scheduled maintenance is current. Erratic PID responses in the field should be evaluated, and field maintenance performed or the PID should be replaced. The PID should be calibrated daily in the field.

Field personnel should perform a humidity response test prior to PID use. Two quick methods for humidity response tests include exhaling gently into the PID for 10 to 15 seconds or cupping your clean hand over the PID inlet probe, since the moisture from your hand provides a fairly continuous high humidity stream (see Photographs 1 and 2). Do not block the air intake for the PID. The PID should show little to no response from these test. If the PID shows more than 5 ppm, the probe, lamp, and sensor may need cleaning. Record the results of the humidity response test in the field logbook.

Ambient air quality at the work site should be checked and recorded as should a headspace sample of an empty polyethylene sealable bag. All quality assurance (QA) checks should be documented in the field logbook.

Quality assurance/quality control (QA/QC) procedures described in the work plan should be followed.

F. References

Addressing PID Instruments Moisture Sensitivity: Humidity Effect on PID Instruments, Technical Note TN-163, RAE Systems by Honeywell; San Jose, CA, February, 2014.

Minnesota Pollution Control Agency, Soil Sample Collection and Analysis Procedures, Field Screening Procedures. Guidance Document 4-04, c-prp4-04. Petroleum Remediation Program, Minnesota Pollution Control Agency; St. Paul, MN, September, 2008.

NIOSH, Pocket Guide to Chemical Hazards, NIOSH Publications; Cincinnati, OH, September 2007.

Photograph 1: Humidity Response Test

Photograph 2: Humidity Response Test

A. Purpose

The purpose of this Stand Operating Procedure (SOP) is to provide the procedure to calibrate a Thermo Environmental 580B photoionization detector (PID). Proper calibration of the PID will help produce consistent and defensible field measurements.

B. Health and Safety

Review the safety data sheets (SDS) for isobutylene span gas. The use of the Thermo Environmental 580B PID should be in accordance with the *Braun Intertec Corporate Health and Safety Manual Standard Operating Procedures* and the site-specific health and safety plan (HASP).

C. Referenced SOPs

- SOP 101 – Field Notes and Documentation

D. Equipment and Supplies

- Thermo Environmental 580B PID with appropriate lamp
- Clean moisture filter
- Isobutylene span gas (100 parts per million [ppm])
- Regulator
- Polyethylene tubing with T-joint
- Bound Calibration Record (in PID case)
- Field report form (see SOP 101 – Field Notes and Documentation) or field logbook
- Waterproof and/or indelible ink pens

E. Procedure

E.1. Prior to Leaving Office

Prior to leaving the office, ensure that the PID has power and the span gas canister is full.

Attach the regulator to the 100 ppm isobutylene span gas. The regulator has a gauge on it to show how much span gas remains in the canister. The gauge should show more than 50 pounds per square inch (PSI) of gas. If not, replace the canister with a new one.

E.2. To Turn On

Inspect the moisture filter for dirt and replace it with a clean filter if necessary. Attach the probe with a clean filter to the PID.

Plug in the PID by inserting the metal connector (which should be hanging from the PID by an aluminum chain) into the outlet that is labeled RUN/CHG. Make sure that the raised tab on the metal connector lines up with the red mark at either the top or the bottom of the RUN/CHG outlet. The screen of the PID should read:

LAMP OUT
580 VER 3.1

Turn on the PID by pressing the ON/OFF button and holding it until there is a whirring sound or the screen reads:

MAX PPM = 0000
PPM = 000.0

NOTE: If this screen does not appear, the PID lamp has not lit. Turn off the PID by pressing the ON/OFF button until the whirring sound has resided. Remove the metal connector from the RUN/CHG outlet for several seconds. Repeat the process until the lamp lights or replace the PID.

E.3. To Calibrate

Press the MODE/STORE button until the screen reads:

LOG THIS VALUE?
MAX PPM = 0000

Press the -/CRSR button four times until the screen reads:

"RESET" TO
CALIBRATE

Press the RESET button. The screen will read:

RESTORE BACKUP
+ = YES

Press the -/CRSR button until the screen reads:

ZERO GAS
RESET WHEN READY

Press the RESET button. The screen will read:

MODEL 580 ZEROING

Wait for the PID to zero itself. It should take less than one minute. When the screen reads:

SPAN PPM = 0100
"+" TO CONTINUE

Press the +/INC button. The screen will read:

SPAN GAS
"RESET" WHEN READY

Attach the regulator to the 100 ppm isobutylene span gas. The regulator has a gauge on it to show how much span gas remains in the canister. The gauge should show more than 50 PSI gas. If not, do not use it because the calibration may not work, replace the canister with a new one. Attach one end of the polyethylene tubing to the top of the regulator. Tubing should have a T-joint on it to provide span gas at atmospheric pressure during calibration. Attach the other end of the tubing to the PID probe. Press and turn the "Control Button" of the regulator until the span gas can be heard being released from the canister. Press "RESET." The screen will read:

MODEL 580
CALIBRATING

Calibration should take approximately one minute. When the PID is calibrated, the screen will read:

"RESET"
TO CALIBRATE

Press the MODE/STORE button once. The screen will show the value at which the PID calibrated. The screen should read:

MAX PPM = 100.0
PPM = 100.0

NOTE: The MAX PPM is the maximum reading the PID reached while calibrating. Turn off the span gas by pressing and twisting the control button on the regulator until the gas does not escape from the canister any longer.

Wait for the reading to drop as fresh air enters the tubing. If the reading does not drop below 1.0 ppm, repeat the calibration. If it does drop below 1.0, record the lowest number displayed as the Ambient Air Reading in the Calibration Log. Turn the span gas back on and wait for the reading to stabilize. If the reading is not within ±5 ppm of 100 ppm, repeat the calibration. If the reading is within ±5 ppm of 100 ppm, turn off the gas and record the number displayed as the Span Gas Reading on the Calibration Log.

Turn off the span gas again. Release the tubing from the PID probe and regulator. Unscrew the regulator from span gas canister.

Complete the calibration information in the bound Calibration Record. Also note in field notes that the calibration was completed. If the calibration does not complete normally, or if the instrument will not produce the expected reading during the calibration, note the failure and attempted remedy in the Calibration Record. After attempting a remedy, repeat the calibration from the beginning. If the calibration does not produce the expected result contact the office to obtain instructions for other potential remedies or to obtain a replacement PID. Do not use a PID that does not calibrate properly.

E.4. To Turn Off

Turn off the PID by pressing the ON/OFF button and holding it until there is no whirring sound or the screen reads:

LAMP OUT
580 VER 3.1

Unplug the PID by removing the metal connector (which should be attached to the PID by an aluminum chain) out of the outlet that is labeled RUN/CHG.

E.5. Data and Records Management

Observations should be documented in accordance with SOP 101 – Field Notes and Documentation.

E.6. Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) procedures described in the work plan should be followed.

A. Purpose

The purpose of this Standard Operating Procedure (SOP) is to provide the procedure to calibrate a MiniRAE 3000 or MiniRAE Lite Photoionization Detector (PID). Proper calibration of the PID will help produce consistent and defensible field measurements.

B. Health and Safety

Review the safety data sheets (SDS) for isobutylene span gas. The use of the MiniRAE 3000 or MiniRAE Lite PID should be in accordance with the *Braun Intertec Corporate Health and Safety Manual Standard Operating Procedures* and the site-specific health and safety plan (HASP).

C. Referenced SOPs

- SOP 101 – Field Notes and Documentation

D. Equipment and Supplies

- MiniRAE 3000 or MiniRAE Lite PID with appropriate lamp
- Clean moisture filter
- Isobutylene span gas (100 parts per million [ppm])
- Regulator
- Polyethylene tubing with T-connection
- Bound Calibration Record (in PID case)
- Field report form (see SOP 101 – Field Notes and Documentation) or field logbook
- Waterproof and/or indelible ink pens

E. Procedure

E.1. Prior to Leaving Office

Prior to leaving the office, ensure that the PID has power and the span gas canister is full.

Attach the regulator to the 100 ppm isobutylene span gas. The regulator has a gauge on it to show how much span gas remains in the canister. The gauge should show more than 50 pounds per square inch (PSI) of gas. If not, replace the canister with a new one.

E.2. To Turn On

Check the probe tip for dirt or other obstructions. Clean as necessary.

Check the moisture filter for visible dirt. Replace as necessary.

Screw the probe tip and filter assembly onto the PID.

There are three buttons on the screen face of the PID:

- MODE (Φ)
- **Y/+**
- **N/-**

There is one button on the body of the instrument:

- LIGHT

Press and hold the center MODE button for a few seconds, then release. The screen will flash through a series of screens. Screens will display:

RAE
SYSTEMS

PGM-7320
VOL 01.01

MINIRAE 3000
SN 952-001736

Self test….

Test Passed!

Ready…Start Sampling?

Press the **Y/+** key.

An audible whirring sound will begin, which is the air pump inside the PID.

NOTE: If the screen displays “Lamp” alarm, the internal lamp has failed to light. Wait for several minutes until it lights. If the “Lamp” display remains, turn off the PID, and retry turning on the instrument.

E.3. To Calibrate

Press and hold the MODE (Φ) and **N/-** buttons at the same time for approximately two (2) seconds. The screen will display:

ENTER PASSWORD ________

Do not enter a password. Press MODE (Φ), or enter, again. The screen will give the options of:

CALIBRATION
ZERO CALIB (highlighted)
SPAN CALIB

Press the **Y/+** key to select Zero Calibration. Be sure the PID is in "zero" (i.e., fresh) air.

Press the **Y/+** key again to start the zero air calibration. Zeroing starts a 30 second countdown. When complete the screen says:

Zeroing Is Done!
Reading = 0.0 PPM

Then the screen will give the options of:

Calibration
Zero Calib
Span Calib (highlighted)

Press **Y/+** to select Span Calibration. The screen will display:

C. Gas = Isobutylene
Span = 100 ppm
Please apply Gas 1

Attach the regulator to the 100 ppm isobutylene span gas. The regulator has gauge on it to show how much span gas remains in the canister. The gauge should show more than 50 PSI gas. If not, do not use it because the calibration may not work, replace the canister with a new one. Attach one end of the polyethylene tubing to the top of the regulator. Tubing should have a T-joint on it to provide span gas at atmospheric pressure during calibration. Attach the other end of the tubing to the PID probe. Push in and twist the control button on the regulator until the gas can be heard escaping the canister.

As soon as the tubing is in place, the PID may begin a 30 second countdown. Press "start" if the countdown does not begin automatically. After 30 seconds the screen will display:

Span 1 is done
Reading ___.___ppm.

Turn off the span gas by pressing and twisting the control button on the regulator until the gas does not escape from the canister any longer.

Wait for the reading to drop as fresh air enters the tubing. If the reading does not drop below 1.0 ppm, repeat the calibration. If it does drop below 1.0, record the lowest number displayed as the Ambient Air Reading in the Calibration Log. Turn the span gas back on and wait for the reading to stabilize. If the reading is not within ±5 ppm of 100 ppm, repeat the calibration. If the reading is within ±5 ppm of 100 ppm, turn off the gas and record the number displayed as the Span Gas Reading on the Calibration Log.

Release the tubing from the PID probe and regulator. Unscrew the regulator from span gas canister.

Complete the calibration information in the bound Calibration Record. Also note in field notes that the calibration was completed.

If the calibration does not complete normally, or if the instrument will not produce the expected readings during the calibration verification, note the failure and attempted remedy on the Calibration Record. After attempting a remedy, repeat the calibration. If the calibration does not produce the expected result contact the office to obtain instructions for other potential remedies or to obtain a replacement PID. Do not use a PID that does not calibrate properly.

E.4. To Turn Off

Press and hold the MODE (Φ) button. The instrument will count down for 5 seconds. The lights and/or alarm may flash and sound during the countdown. Release the MODE (Φ) button when the screen displays:

UNIT OFF!

E.5. Data and Records Management

Observations should be documented in accordance with SOP 101 – Field Notes and Documentation.

E.6. Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) procedures described in the work plan should be followed.

A. Purpose

The following Standard Operating Procedure (SOP) for the collection of grab soil samples is intended to be used by Braun Intertec field personnel for the purposes of soil sample collection. Grab sampling techniques should always be used to collect samples for volatile organic compounds (VOC), gasoline range organics (GRO), diesel range organics (DRO) or other analyses that require collection of a generally undisturbed portion of soil. Grab sampling techniques may also be used to collect other analytes such as semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and metals. Grab samples should be collected prior to collection of other sample aliquots as soon as possible after the sampling interval is retrieved. Soil samples collected in the field during investigations for characterization and/or documentation of site conditions are integral to the services provided to clients and regulatory agencies.

This SOP is applicable for soil samples collected from soil borings (SOP 203 – Soil Boring Observation and Sampling), test pits and test trenches (SOP 211 – Test Pit and Test Trench Observation and Sampling), stockpiles (SOP 210 – Soil Stockpile Sampling), and/or excavations.

B. Health and Safety

Field work should be performed in accordance with the *<u>Braun Intertec Corporate Health and Safety Manual Standard Operating Procedures</u>* and the site-specific health and safety plan (HASP), if applicable.

C. Referenced SOPs

- SOP 101 – Field Notes and Documentation
- SOP 203 – Soil Boring Observation and Sampling
- SOP 210 – Soil Stockpile Sampling
- SOP 211 – Test Pit and Test Trench Observation and Sampling
- SOP 308 – Trip Blanks
- SOP 602 – Chain-of-Custody Procedures
- SOP 603 – Sample Shipping

D. Equipment and Supplies

- Coring device (one for each soil sample collected)
- Portable digital scale, if necessary
- Appropriate laboratory-supplied container and preservative (when applicable)
- Sample labels
- Sample coolers
- Ice
- Temperature blanks (one per sample cooler)
- Trip blanks, if necessary (see SOP 308 – Trip Blanks)
- Field report form (see SOP 101 – Field Notes and Documentation) or field logbook
- Chain-of-Custody (COC) forms (see SOP 602 – Chain-of-Custody Procedure)
- Custody seals
- Cell phone camera or digital camera
- Personal Protective Equipment (PPE)

The following table provides details regarding analytical parameters and the type of laboratory-supplied containers and applicable preservative.

Analytical Parameter (holding time)	Bottle Type and Preservation Type
DRO (10 days)*	4-oz. glass jar, pre-weighed and unpreserved
8 RCRA Metals or 13 Priority Pollutant Metals (6 Months, except mercury 28 days)	4-oz. glass jar, unpreserved
GRO (14 days)**	40-milliliter (mL) glass vial, with 10 mL methanol pre-weighed
PCBs (14 days)***	4-oz. glass jar unpreserved
SVOCs (14 days)****	4-oz. glass jar unpreserved
VOCs (14 days)**	40-mL glass vial, with 10 mL methanol, pre-weighed

*DRO soil samples collected in 60-mL pre-weighed containers must be filled with 25 to 35 grams or soil.
**VOC and GRO soil samples collected in 40-mL pre-weighed containers should contain between 8 to 11 grams of soil.
***PCBs – Polychlorinated Biphenyls
****SVOCs – Semi-volatile Organic Compounds

All soil samples must have a single unpreserved sample collected (5-10 gram minimum) for dry weight analysis (i.e., moisture sample).

E. Procedure

E.1. Bottle Order

Several days before field work is scheduled to begin contact the laboratory to order sample containers and soil coring devices by phone or email. It may be a good idea to order extra bottles to allow for breakage, extra samples, etc. If you are unsure of the required sample volumes or proper laboratory sample containers for specific analytical parameters, ask that a written description be included with the bottle order which clarifies sample requirements.

Upon receipt of the sample coolers and before you leave for the field, check the contents of the cooler to be sure that you have the appropriate sample containers and that extra containers are included, if requested. Be sure you are aware of sample volume and container requirements.

E.2. Cooler Preparation

Place ice or a frozen cold pack into each sample cooler before collecting any samples. Double-bag the ice in sealable gallon bags or sealed garbage bags to avoid potential contact of water in the cooler with sample containers.

Place a temperature blank into each cooler and under the sealed bags of ice. If the cooler will contain VOCs samples ensure that a trip blank is placed into the cooler with the samples.

E.3. Labeling Sample Containers

Prior to collecting soil grab samples, complete the sample label for the laboratory-supplied containers. The sample label must have the following information:

- Project Number (listed under "Client")
- Sample Name (listed under "Sample ID")
- Date Sample Collected (listed under "Collection Date")
- Sampler's Initials (listed under "Collected by")
- Time Sample Collected (listed under "Time")

Additionally, some laboratory-supplied sample containers (e.g., DRO, GRO, and VOCs) have been pre-weighed by the laboratory. It is important to make sure that the pre-weighed sample containers have their weight listed on the sample label and that the weight is visible.

E.4. Soil Sampling

Select sample location/interval per the Work/Sampling Plan. Don new disposable gloves and scrape off a layer of soil to expose a fresh surface. Follow procedures listed below for each specific parameter.

E.5. Volatile Organic Compounds/Gasoline Range Organics Soil Grab Sample Collection

- Place an electronic scale that has been calibrated that day prior to use on a flat surface.
- Turn on the electronic scale.
- Before filling the first jar, verify the accuracy of the scale. Place a pre-weighed sample container on the scale. Compare the reading to the weight on the container. If within 5 grams, the scale can be used for the rest of the day. If not within 5 grams, remove the container, turn the scale off, then on, and repeat the test. If still not within 5 grams, use a different scale.
- Remove cap from pre-weighed, pre-preserved 40-milliliter (mL) sample vial.
- Place 40-mL vial on electronic scale and press "tare" button to zero electronic scale.
- Electronic scale should read 0.0g – leave sample vial on electronic scale.
- Use the lab provided Terra Core® sampler (5- or 10-gram) or 10-mL syringe with the top cut off (approximately 10 grams when full) for collecting a sample. The laboratory may provide a different sampling device than described above; whichever device is provided, the goal is to have **8 to 11 grams** of soil in the sample jar for VOC/GRO analysis.
- Scrape off upper layer of soil to expose underlying soil. Remove the syringe cap and push the syringe into the freshly exposed soil until the soil column entering the syringe has forced the top of the plunger to the stopping point against the top of the syringe cradle.
- Wipe all debris from the outside of the syringe and remove any soil that extends outside the mouth of the syringe, so the soil sample is flush with the mouth of the syringe.
- Carefully place the mouth of the syringe against the top of the open 40-mL vial and gently extrude the sample into the vial. (Note: to prevent the methanol preservative from splashing out of the bottle, hold the syringe against the top of the vial until the sample has fallen into the preservative.) Try to avoid getting soil on the threads of the vial. Clean the threads if necessary and cap the vial immediately.

- Weigh the sample bottle. Tolerances and field actions required are presented in the table below:

Actual Sample Weight	Volume of Methanol	Field Action
< 8 grams	10 mLs	Add soil to reach 10 grams
8 – 11 grams	10 mLs	None required
> 11 to < 20 grams	10 mLs	None required. Laboratory will add methanol to reach 1:1 ratio
20 or > grams	10 mLs	Discard bottle and resample

- Cap the sample container. Gently swirl, do not shake, sample vial to fully immerse soil into methanol.
- Fill out the label on the vial completely, including project number, sample I.D., date, time and sampler's initials. Record the information on the Chain-of-Custody form and in the field notebook.
- Collect at least two vials of soil sample for each analysis (VOCs or GRO). Therefore, if the work plan requires only VOCs then you will fill two vials; if the work plan calls for VOCs and GRO you will fill four vials (two vials for each analyte).
- Manually fill a plastic snap-top tube (or similar unpreserved bottle) with soil from the same sampling interval/matrix as each sample. Remove soil particles from the rim of the snap tube so the cap will close securely and close the cap. This jar is for moisture calculation to be submitted with VOCs/GRO soil sample containers and should be labeled the same as the VOC/GRO sample jars. All soil samples for VOCs or GRO analysis require an accompanying moisture calculation jar. Only one moisture jar is required per soil sample (i.e., one moisture jar is sufficient for both VOCs and GRO analysis).
- Place a trip blank into the cooler with the VOCs/GRO samples; see SOP 308 – Trip Blanks.
- Store, transport, and maintain sample custody per SOP 602 – Chain-of-Custody Procedures.

E.6. Diesel Range Organics Soil Grab Sample Collection

- Place a calibrated electronic scale on a flat surface.
- Turn on the electronic scale.
- Before filling the first jar, verify the accuracy of the scale. Place a pre-weighed sample container on the scale. Compare the reading to the weight on the container. If within 5 grams, the scale can be used for the rest of the day. If not within 5 grams, remove the container, turn the scale off, then on, and repeat the test. If still not within 5 grams, use a different scale.
- Remove cap from pre-weighed, unpreserved sample container.
- Place empty DRO bottle on electronic scale and press "tare" button to zero electronic scale.
- Electronic scale should read 0.0g – leave DRO bottle on electronic scale.
- Use the laboratory provided coring device such as a Terra Core® sampler (5- or 10-gram) or 10-mL syringe with the top cut off (approximately 10 grams when full) for collecting a sample. The laboratory may provide a different coring device than described above; whichever coring device is provided, the goal is to have **25 to 35 grams** of soil in a 4-oz. sample jar for the Wisconsin DRO method and Environmental Protection Agency (EPA) Method 8015, Total Petroleum Hydrocarbon (50 to 70 grams in an 8-oz. jar).
- Scrape off upper layer of soil to expose underlying soil. Push the coring device into the freshly exposed soil until the soil column entering the coring device has filled to the top of the plunger (Terra Core) or the 10-mL line (cut off Syringe).
- Wipe all debris from the outside of the coring device and remove any soil that extends outside the mouth of the coring device, so the soil sample is flush with the mouth of the coring device.
- Extrude soil sample from the coring device into the DRO bottle. Collected soil sample should have a cumulative weight between **25 and 35 grams (4-oz. jar)**. Repeat the steps above as necessary to achieve necessary soil sample weight. If more than 35 grams of soil are collected, discard all the soil in

sample jar and recollect the sample. Try to avoid getting soil on the threads of the sample jar. Clean the threads if necessary and cap the sample jar immediately after sample collection.
- Repeat the above steps to fill a second DRO sample container. Two soil sample jars may be required for this analytical method.
- Fill one unpreserved sample container (typically a small plastic jar provided by the lab) with soil from the same sampling interval/matrix as each sample. This jar is for moisture calculation to be submitted with DRO soil sample containers and should be labeled the same as the DRO sample jars. All soil samples for DRO analysis require an accompanying moisture calculation jar.

E.7. Metals Soil Grab Sample Collection

- One open-top, 4- or 8-oz. unpreserved jar.
- Using a clean stainless-steel spoon, scoopula, or gloved hand, thoroughly mix or homogenize the interval to be sampled, and fill the unpreserved sample containers with the collected soil sample. Avoid filling the sample containers with gravel or rocks.
- Wipe soil from the container threads. Close the flip-top of the unpreserved sample container.
- Note: if several analyses are being performed for a single soil sample, the collection and submission of one moisture calculation jar is sufficient for all of the analyses for that one soil sample.

E.8. PCBs/SVOCs Soil Grab Sample Collection

- Open 4-oz., unpreserved sample container.
- Using a clean stainless-steel spoon, scoopula, or gloved hand, thoroughly mix or homogenize the interval to be sampled, and fill the unpreserved sample containers with the collected soil sample. Try to fill the sample containers with soil and not gravel or rocks.
- Wipe soil from the container threads. Reseal the 4-oz. sample container with the lid.
- Note: if several analyses are being performed for a single soil sample, the collection and submission of one moisture calculation jar is sufficient for all of the analyses for that one soil sample.

E.9. Alternative En Core® Sampling Method for Volatile Sample Aliquots

An En Core® Sampler (sampler) is a single-use sampling device that allows the collection of a soil sample directly into the sampler. The sampler containing the soil sample is delivered to the analytical laboratory without chemically preserving the sample in the field. An En Core® T-Handle (T-handle) is used with the sampler obtain the soil sample. For VOC sample aliquots, a 5-gram sampler will be used to collect soil samples, and typically three 5-gram samplers will be submitted to the laboratory from each sample interval.

The following procedure is used to collect a soil sample using the sampler and T-handle.

- Prior to collecting a soil sample, hold the coring body on the sampler and push the plunger rod down until the small o-ring rests against tabs. This will assure that the plunger moves freely.
- Depress the locking level on the En Core T-handle. Place the sampler, plunger end first, into the open end of T-handle, aligning the two slots on the coring body with the two locking pins in the T-handle. Twist the coring body clockwise to lock the pins in the slots. Check to ensure the sampler is locked in place and ready for use.
- Turn the T-handle with the "T" up and the coring body of the sampler down. This positions the plunger bottom flush with the bottom of the coring body. Using the T-handle, push the sampler into soil until coring body is completely full. When full, the small o-ring will be centered in the T-handle viewing hole. Remove the sampler from the soil and wipe excess soil from the coring body exterior.
- Cap the coring body while it is still on the T-handle. Push the cap over flat area of the ridge. Push and twist the cap to lock the arm in place. The cap must be seated to seal the sampler.

- Remove the capped sampler by depressing the locking level on the T-handle while twisting and pulling the sampler from the T-handle.
- Lock the plunger by rotating the extended plunger rod fully counter-clockwise until the wings rest firmly against the tabs.
- Attach the completed label to the cap on the coring body of the sampler.
- Return the full sampler to the zipper bag. Seal the bag and place the bag on ice. Samples must be delivered to the laboratory within 48 hours of sample collection.

E.10. Sample Delivery

Arrange for pick-up/drop off of soil samples in laboratory-provided coolers to the analytical laboratory. If shipping of soil samples to the analytical laboratory is required, follow SOP 603 – Sample Shipping.

E.11. Data and Records Management

Soil samples collected in the field should be recorded in the field report form or field logbook (see SOP 101 – Field Notes and Documentation), on the field log, soil boring log, test trench log, etc., and on the COC (see SOP 602 – Chain-of-Custody Procedures). Information recorded in the field report form or field logbook and on the COC should be identical to the information listed on the sample container label(s). Additionally, it is useful to note how many soil sample containers were filled for each uniquely identified soil grab sample.

Note the presence of any pieces of bituminous in the samples, no matter how small, particularly in samples to be analyzed for DRO or SVOCs.

E.12. Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) procedures described in the work plan should be followed.

A. Purpose

The following Standard Operating Procedure (SOP) for the collection of composite soil samples is intended to be used by Braun Intertec field personnel for the purposes of composite soil sample collection. This SOP establishes a reproducible process for composite soil sample collection with the intent of maintaining integrity of the subsequent laboratory analytical procedures.

Compositing is the process of physically combining and homogenizing several individual soil aliquots of the same volume or weight.

This SOP is applicable to soil samples collected for the purposes of documenting the presence and/or concentration of regulated compounds in soil. Check the work plan or consult the project manager to determine if composite samples are required. This SOP is applicable for soil samples collected from soil borings (SOP 203 – Soil Boring Observation and Sampling), test pits and test trenches (SOP 211 – Test Pit and Test Trench Observation and Sampling), stockpiles (SOP 210 – Soil Stockpile Sampling), and/or excavations.

Specifically, this SOP is applicable for soil samples that might be analyzed for non-volatile parameters, including, but not limited to:

- Metals
- Semi-volatile organic compounds (SVOCs)
- Polychlorinated biphenyls (PCBs)
- Pesticides or herbicides

This SOP is not applicable to sampling volatile organic compounds (VOCs), gasoline range organics (GRO), diesel range organics (DRO), or other volatile analytes. VOCs, GRO, and DRO should be collected as grab samples, see SOP 208 – Soil Grab Sample Collection.

B. Health and Safety

Field work should be performed in accordance with the *Braun Intertec Corporate Health and Safety Manual Standard Operating Procedures* and the site-specific health and safety plan (HASP).

C. Referenced SOPs

- SOP 101 – Field Notes and Documentation
- SOP 203 – Soil Boring Observation and Sampling
- SOP 208 – Soil Grab Sample Collection
- SOP 210 – Soil Stockpile Sampling
- SOP 211 – Test Pit and Test Trench Observation and Sampling
- SOP 602 – Chain-of-Custody Procedures
- SOP 603 – Sample Shipping
- SOP 701 – Decontamination of Sampling Equipment

D. Equipment and Supplies

- Shovel, if necessary
- Gallon-size plastic bag or stainless-steel bowl
- Stainless-steel spoon or scoopula, if necessary
- Plastic cups or quart-sized plastic bags
- Appropriate laboratory-supplied containers

- Sample labels
- Sample coolers
- Ice
- Temperature blanks (one per sample cooler)
- Chain-of-Custody (COC) forms (see SOP 602 – Chain-of-Custody Procedure)
- Custody seals
- Field report form (see SOP 101 – Field Notes and Documentation) or field logbook
- Waterproof and/or indelible ink pens
- Decontamination equipment (see SOP 701 – Decontamination of Sampling Equipment)
- Cell phone camera or digital camera
- Personal Protective Equipment (PPE)

The following table provides details regarding analytical parameters and the type of laboratory-supplied containers.

Analytical Parameter (holding time)	Bottle Type and Preservation Type	Number of Containers
8 RCRA Metals or 13 Priority Pollutant Metals (6 Months)	40-mL Plastic Flip cap, unpreserved	1
PCBs (14 days)	4-oz. Glass jar, unpreserved	1
SVOCs (14 days)	4-oz. Glass jar, unpreserved	1
Pesticides (14 days)	4-oz. Glass jar, unpreserved	1
Herbicides (14 days)	4-oz. Glass jar, unpreserved	1

All soil samples must have an unpreserved sample collected in a separate unpreserved container for dry weight analysis.

E. Procedure

E.1. Bottle Order

Several days before field work is scheduled to begin contact the laboratory to order sample containers by phone or email. It is a good idea to order extra bottles to allow for breakage, extra samples, etc. If you are unsure of the required sample volumes or proper laboratory sample containers for specific analytical parameters, ask that a written description be included with the bottle order which clarifies sample requirements.

Upon receipt of the sample coolers and before you leave for the field, check the contents of the cooler to be sure that you have the appropriate sample containers and that extra containers are included, if requested. Be sure you are aware of sample volume and container requirements.

E.2. Cooler Preparation

Place ice or a frozen cold pack into each sample cooler before collecting any samples. Double-bag the ice in sealable gallon bags or sealed garbage bags to avoid potential contact of water in the cooler with sample containers.

Place a temperature blank into each cooler and under the sealed bags of ice.

E.3. Labeling Sample Containers

Prior to collecting soil composite samples, complete the sample label for the laboratory-supplied containers. The sample label must have the following information:

- Project Number (listed under "Client")
- Sample Name (listed under "Sample ID")
- Date Sample Collected (listed under "Collection Date")
- Sampler's Initials (listed under "Collected by")
- Time Sample Collected (listed under "Time")

If not already present, affix the appropriate sample label to the laboratory-supplied sample container.

E.4. Soil Sampling

- Assess and approximate the size of soil from which the composite soil sample will be collected.
- Identify the number aliquots and splitting protocol using the work plan or consult the project manager.
- Prior to sampling, decontaminate the shovel, spoon or scoopula, and stainless-steel bowl or other appropriate container following SOP 701 – Decontamination of Sampling Equipment. In addition, decontaminate all sampling and compositing equipment before collecting each additional sample.
- Don new disposable gloves. Using a gloved hand or decontaminated shovel, spoon or scoopula, acquire the appropriate number of aliquots. The aliquots should be approximately the same size and weight. Place aliquots in the decontaminated stainless-steel bowl or appropriate container that will not introduce contaminants to the samples. Mix the aliquots until thoroughly homogenized, removing rocks or gravel.
- Using a gloved hand, spoon or scoopula, fill unpreserved sample containers with the collected soil sample.
- Fill one open flip-top (or similar), unpreserved jar with the remaining homogenized soil for the percent moisture calculation sample.
- Note: if several analyses are being performed for a single soil sample, the collection and submission of one moisture calculation jar is sufficient for all of the analyses for that one soil sample.
- Place the homogenized soil into the appropriate sample containers. Wipe the threads clean, close the jar, and place the sample on ice.

E.5. Sample Delivery

Arrange for pick-up/drop off of soil samples in laboratory-provided coolers to the analytical laboratory. If shipping of soil samples to the analytical laboratory is required, follow SOP 603 – Sample Shipping.

E.6. Data and Records Management

Soil samples collected in the field should be recorded in the field report form or field logbook (see SOP 101 – Field Notes and Documentation), on the field log sheet, soil boring log, test trench log, etc., and on the COC (see SOP 602 – Chain-of-Custody Procedures). Information recorded in the field report form field logbook and on the COC should be identical to the information listed on the sample container label(s).

Additionally, it is useful to note how many soil sample containers were filled for each uniquely identified soil composite sample.

Note the presence of any pieces of bituminous in the samples, no matter how small, particularly in samples to be analyzed for SVOCs.

E.7. Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) procedures described in the work plan should be followed.

A. Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish a consistent method and format for stockpile sampling. If samples are to be collected for laboratory analysis, the SOP for the selected sampling methods and parameters should be employed (i.e., soil grab or soil composite).

A.1. Scope and Applicability

This procedure should be used to characterize and evaluate stockpiled material for reuse or disposal options.

A.2. Summary of Method

Determine the approximate volume of the stockpile. Determine an appropriate number of soil samples based on the approved work plan, site-specific conditions, and/or the appropriate regulatory program guidelines. Equally divide the stockpile into segments equaling the number of samples to be collected. Grab samples are collected from representative portions of the stockpile, typically for volatile and sometimes semi-volatile organic compound analysis in accordance with SOP 208 – Soil Grab Sample Collection. Composite samples are collected in accordance with SOP 209 – Soil Composite Sample Collection, for non-volatile and for most semi-volatile organic compound analyses.

B. Health and Safety

Field work should be performed in accordance with the *Braun Intertec Corporate Health and Safety Manual Standard Operating Procedures* and the site-specific health and safety plan (HASP).

In addition to potential exposure to hazardous substances, stockpile sampling presents safety risks due to working near excavating equipment, potential stockpile sloughing, and slip hazards while climbing on the stockpile to collect samples.

C. Referenced SOPs

- SOP 101 – Field Notes and Documentation
- SOP 201 – Classification of Soil
- SOP 202 – Organic Vapor Soil Screening
- SOP 208 – Soil Grab Sample Collection
- SOP 209 – Soil Composite Sample Collection
- SOP 701 – Decontamination of Sampling Equipment

D. Equipment and Supplies

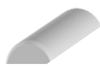
- Shovel/hand auger
- Permanent marker
- Wire Flags or wooden stakes
- Global Positioning System (GPS) unit and measuring tape
- Photoionization detector (PID) with appropriate lamp (see SOP 202 – Organic Vapor Soil Screening)
- Soil sampling equipment (see SOP 208 – Soil Grab Sample Collection and SOP 209 – Soil Composite Sample Collection)
- Field report form (see SOP 101 – Field Notes and Documentation) or field logbook
- Waterproof and/or indelible ink pens
- Cell phone camera or digital camera
- Personal Protective Equipment (PPE)

E. Procedure

E.1. Volume of Stockpile

Speak with the project manager or contractor to get the estimated cubic yards of the stockpile. Use the following information to estimate the volume if it is unknown or to confirm estimates by others.

- For an elongated stockpile, determine the shape of the end face and calculate the area of the face in square feet.

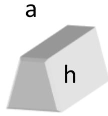


area of a semicircle face = 1/2 πr^2

r

OR

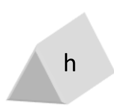
a



area of a trapezoid face = (h * [a+b]) / 2

b

OR



area of a triangle face = 1/2 bh

b

- Measure the length (L) of the stockpile in feet.
- Multiply length by area of face (in square feet) and divide by 27 to calculate volume in cubic yards.
- For a cone-shaped stockpile, the volume is calculated by the following formula: (1/3) $\pi r^2 h$. Then divide by 27 to convert to cubic yards.

(Note: Although there are many variables such as soil type, moisture conditions, presence of debris, etc., as a rule of thumb, to convert cubic yards to tons, 1 cubic yard of soil weighs about 1.5 tons. One cubic yard of concrete weighs about 2 tons.)

E.2. Number of Samples

The project work plan, regulatory guidance, and site-specific circumstances should be taken into account when determining the appropriate number of samples to collect from the stockpile. If more than one sample will be collected, divide the stockpile into equal sections and collect the samples from each section. Use paint or stakes to mark divisions of the stockpile.

E.3. Soil Description

The material encountered in the stockpile should be documented (see SOP 201 – Classification of Soil). Describe the type and approximate percentage of soil fill (matrix) and non-soil fill (debris) types present. Photoionization detector (PID) screening should be conducted on all samples collected from the stockpile (see SOP 202 – Organic Vapor Soil Screening).

E.4. Soil Sampling

- Don new disposable gloves. Use a clean/decontaminated shovel or hand auger to dig approximately 0.5 to 1 foot into the stockpile at each location to obtain a fresh soil sample (see SOP 701 – Decontamination of Sampling Equipment). Excavation equipment or drilled soil borings can be used to collect samples from larger stockpiles.
- The project work plan and site-specific circumstances should be taken into account when determining sampling techniques. Refer to the project manager, approved work plan, or landfill requirements for sampling parameters.
- Soil samples collected for volatile organic compounds (VOCs), diesel range organics (DRO), and gasoline range organics (GRO) require collection of grab samples from representative portions of the stockpile. Soil samples collected for all other analysis requires collection of composite samples. Soil samples for chemical analysis should be collected in accordance with SOP 208 – Soil Grab Sample Collection and SOP 209 – Soil Composite Sample Collection.
- Mark each sample location on a map and mark each location with a flag. Use the GPS unit and/or measuring tape to determine the location of stockpiles and each sample location.

E.5. Cautions

Stockpiles should be constructed and maintained to prevent erosion and impacts to storm water and surface water.

Stockpiles should be clearly labeled and identified by use of stakes, lathe, flagging, temporary fencing, etc. to avoid inadvertent mismanagement of the stockpiled material. A site sketch showing the approximate locations of stockpiles should be maintained and photographs should be used where helpful.

E.6. Interferences

Once a stockpile is sampled, additional soil should not be added to the stockpile. If additional soil is added, the initial sample is no longer representative of the stockpile.

E.7. Data and Records Management

Observations should be documented in accordance with SOP 101 – Field Notes and Documentation.

E.8. Quality Assurance Quality Control

Quality assurance/quality control (QA/QC) procedures described in the work plan should be followed.

A. Purpose

The purpose of this Standard Operating Procedure is to check for contamination of gasoline range organics (GRO) and volatile organic compounds (VOCs) during handling, storage, and shipment from the laboratory to the field and back to the laboratory. If contaminants are reported in the trip blank it may indicate that the investigative samples from that sampling event have been contaminated during handling, transportation, or shipment.

B. Health and Safety

Field work should be performed in accordance with the *Braun Intertec Corporate Health and Safety Manual Standard Operating Procedures* and the site-specific health and safety plan (HASP).

C. Referenced SOPs

- SOP 101 – Field Notes and Documentation
- SOP 602 – Chain-of-Custody Procedures

D. Equipment and Supplies

- Field report form (see SOP 101 – Field Notes and Documentation) or field logbook
- Waterproof and/or indelible ink pens
- Chain-of-Custody (COC) Form (see SOP 602 – Chain-of-Custody Procedure)
- For Water Sampling:
  - Two laboratory-prepared 40-milliliter (mL) glass vials with organic-free water in hydrochloric (HCl) acid preservative. Commonly provided in a small bubble-wrap bag.
- For Soil Sampling:
  - One laboratory-prepared 40-mL glass container with methanol preservative. Commonly provided in a small bubble-wrap bag.

E. Procedure

- The laboratory should prepare and provide VOC trip blanks with every bottle order. If it is necessary to prepare a trip blank in the office or in the field, note the exception in the field report form or field logbook and the investigation report. **Note: New trip blanks must be provided along with the laboratory bottle order for a specific project. Trip blanks prepared for a prior sampling event cannot be used.**
- Label sample containers using the identifier "TB," "TB-#," or a blind identifier, as necessary.
- Ensure a trip blank is located in each cooler to be used to hold the investigative samples. Preserve and handle the trip blank(s) in the same manner as investigative samples.
- Include a sample called "TB," "TB-#," or "Trip Blank" on the COC Form. Do not include a date or time for the sample. Check the appropriate column to indicate that the trip blank should be analyzed for GRO and/or VOCs per the investigation work plan (see SOP 602 – Chain-of-Custody Procedures).

E.1. Data and Records Management

Observations should be documented in accordance with SOP 101 – Field Notes and Documentation.

E.2. Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) procedures described in the work plan should be followed.

A. Purpose

The purpose of the Chain-of-Custody (COC) Standard Operating Procedure (SOP) is to control environmental samples from the time they are collected until custody of the samples is accepted by the laboratory sample custodian. COC documentation serves three main purposes:

- Communicates the analytical instructions from the sampler to the analytical laboratory.
- Provides a permanent record of samples provided to the laboratory.
- Documents that samples were handled only by authorized personnel and were not available for tampering prior to analysis.

A.1. Scope and Applicability

Although few environmental samples will ever be used in criminal or civil litigation cases, most samples are collected in support of government-regulated activities. In addition, it is possible that the results of the sample analyses will be used in future litigation even if none was contemplated at the time the samples were collected. Therefore, it is important that a record of sample possession (i.e., COC) be maintained, so that control of the samples from the time of collection to the time of sample laboratory check-in can be demonstrated.

Laboratory-related sample control is described in laboratory operating and quality-control documents and is not discussed in this standard operating procedure (SOP).

This procedure should be used for control of environmental samples that include, but are not limited to those of groundwater (see SOP 311 – Groundwater Sample Collection), surface water (see SOP 314 – Surface Water Sampling), soil (see SOP 208 – Soil Grab Sample Collection and SOP 209 – Soil Composite Sample Collection), air (see SOP 402 – Indoor Air Sampling), soil vapor (see SOP 403 – Soil Vapor Sampling from a Borehole and with a Hand Probe and SOP 405 – Sub-Slab Soil Vapor Sampling), and waste.

A.2. Summary of Method

Environmental samples are collected using methods specified in the work plan or other SOPs. The samples are collected in sampling containers for the desired analyses, preserved as appropriate, and a label is affixed to each container specifying the project name and number, sample identification, date and time of collection, and sample collector. The information is entered onto the COC Form and the desired analyses are indicated on the form, which also serves as the analytical request. Sample custody (possession) is maintained individually until the samples are delivered to the laboratory sample check-in. Transfer of custody is documented on the COC Form by printed name, signature, date and time.

A.3. Personnel Qualifications and Responsibilities

The sampler is responsible for understanding, implementing and documenting activities related to this SOP during field activities. The sampler is responsible for transmitting a copy of field notes that have not been forwarded to the project manager or designee, as well as a copy of the COC Form(s) immediately after sample check-in. If there is more than one sampler, the lead field sampler assumes these responsibilities.

A.4. Definitions

Chain-of-Custody Procedure: A procedure whereby a sample or set of samples is maintained under physical possession or control.

Custody: Samples and data are considered to be in your custody when:

- They are in your physical possession,
- They are in your view, after being in your physical possession,
- They are in your physical possession and then locked in a room or vehicle so that tampering cannot occur, or
- They are kept in a secured area, with access restricted to authorized personnel only.

Chain-of-Custody Form: Form used to record sample identification information, test(s) requested, result reporting instructions, and sample custody.

Sample: A portion of an environmental or source matrix that is collected and used to characterize the matrix.

B. Health and Safety

Field work should be performed in accordance with the *Braun Intertec Corporate Health and Safety Manual Standard Operating Procedures* and the site-specific health and safety plan (HASP).

Department of Transportation (DOT), United States Postal Service (USPS), and Federal Aviation Administration (FAA) shipping/labeling regulations must be followed for shipped samples.

C. Referenced SOPs

- SOP 208 – Soil Grab Sample Collection
- SOP 209 – Soil Composite Sample Collection
- SOP 314 – Surface Water Sampling
- SOP 402 – Indoor Air Sampling
- SOP 403 – Soil Vapor Sampling from a Borehole and with a Hand Probe
- SOP 405 – Sub-Slab Soil Vapor Sampling

D. Equipment and Supplies

- Field report form (see SOP 101 – Field Notes and Documentation) or field logbook
- Waterproof or indelible ink pens
- Sample labels
- Custody seals
- Chain-of-Custody (COC) forms (see SOP 602 – Chain-of-Custody Procedure)

E. Procedure

E.1. General Guidelines

- Keep the number of people involved in collecting and handling samples and data to a minimum.
- Only personnel associated with the project should handle samples and data.
- Always document the transfer of samples and data from one person to another on the COC Form.
- Always accompany samples and data with the COC Form.
- Samples should be uniquely identified, legibly, in permanent ink.
- Fill out the COC Form as completely as possible. The sample identification information on the sample containers must match the COC Form.
- Use a separate COC Form for each cooler.

E.2. Completing CCO Form

The COC Form should be filled out by the sampler or designee as the samples are being collected and containerized.

E.3. Securing Samples

If you cannot maintain personal possession of the samples prior to sample check-in, they may be secured. A locked vehicle is considered controlled access (i.e., secured). A cooler sitting on the tailgate of a pickup truck or under an unlocked topper, out of direct view of the custodian is not secure. An unsecured cooler in a locked hotel room is also not within controlled access as hotel staff have access to the room. In this case, the cooler could be padlocked or custody seals could be used to secure the samples or cooler.

E.4. Data and Records Management

The original COC Form is maintained by the laboratory in accordance with their file retention guidance. A copy of the record should be provided to the project manager or designee with a copy of the sampling field notes by the sampler immediately after sample check-in.

E.5. Quality Assurance Quality Control

Quality assurance/quality control (QA/QC) procedures described in the work plan should be followed.

The project manager or designee should review the COC Form as soon as possible after sample check-in to verify that the information on the COC Form is correct.

A. Purpose

The purpose of this Standard Operating Procedure (SOP) is to describe the procedure used for proper packaging methods and shipment of samples by overnight carrier via Chain-of-Custody (COC) procedures (see SOP 602 – Chain-of-Custody Procedures).

A.1. Scope and Applicability

If samples cannot be delivered to the laboratory in person and must be shipped, the following procedures should be used.

This procedure should be used for shipping of environmental samples that include, but are not limited to those of groundwater (see SOP 311 – Groundwater Sample Collection), surface water (see SOP 314 – Surface Water Sampling), soil (see SOP 208 – Soil Grab Sample Collection and SOP 209 – Soil Composite Sample Collection), air (see SOP 402 – Indoor Air Sampling), soil vapor (see SOP 403 – Soil Vapor Sampling from a Borehole and with a Hand Probe and SOP 405 – Sub-Slab Soil Vapor Sampling), and waste.

A.2. Summary of Method

Environmental samples are collected using methods specified in the work plan or other SOPs. The samples are collected in sampling containers for the desired analyses, preserved as appropriate, and a label is affixed to each container specifying the project name and number, sample identification, date and time of collection, and sample collector. The information is entered onto the COC Form and the desired analyses are indicated on the record, which also serves as the analytical request. Sample custody (possession) is maintained individually until the samples are delivered to the laboratory sample check-in. Transfer of custody is documented on the COC Form by printed name, signature, date, and time.

A.3. Personnel Qualifications and Responsibilities

The sampler is responsible for understanding, implementing, and documenting activities related to this SOP during field activities. The sampler is responsible for transmitting a copy of field notes that have not been forwarded to the project manager or designee, as well as a copy of the COC Form(s) immediately after samples are shipped. If there is more than one sampler, the lead sampler assumes these responsibilities.

A.4. Definitions

Chain-of-Custody Procedure: A procedure whereby a sample or set of samples is maintained under physical possession or control.

Custody: Samples and data are considered to be in your custody when:

- They are in your physical possession.
- They are in your view, after being in your physical possession.
- They are in your physical possession and then locked up so that tampering cannot occur.
- They are kept in a secured area, with access restricted to authorized personnel only.

Chain-of-Custody Form: Form used to record sample identification information, test(s) requested, result reporting instructions and sample custody.

B. Health and Safety

Field work should be performed in accordance with the *Braun Intertec Corporate Health and Safety Manual Standard Operating Procedures* and the site-specific health and safety plan (HASP).

Department of Transportation (DOT), United States Postal Service (USPS), and Federal Aviation Administration (FAA) shipping/labeling regulations must be followed for shipped samples.

C. Referenced SOPs

- SOP 208 – Soil Grab Sample Collection
- SOP 209 – Soil Composite Sample Collection
- SOP 308 – Trip Blanks
- SOP 314 – Surface Water Sampling
- SOP 402 – Indoor Air Sampling
- SOP 403 – Soil Vapor Sampling from a Borehole and with a Hand Probe
- SOP 405 – Sub-Slab Soil Vapor Sampling
- SOP 602 – Chain-of-Custody Procedures

D. Equipment and Supplies

- Sample coolers or similar shipping containers
- Protective wrapping and packaging materials
- Ice
- Appropriate laboratory-supplied containers and preservatives (when applicable)
- Sample labels
- Temperature blanks (one per sample cooler)
- Trip blanks, if necessary (see SOP 308 – Trip Blanks)
- Gallon-size plastic bags
- Waterproof and/or indelible ink pens
- COC Forms (see SOP 602 – Chain-of-Custody Procedure)
- Custody seals
- Packaging tape
- Shipping labels for the exterior of the shipping container
- Bill of lading for selected carrier

E. Procedure

E.1. General Guidelines

- Sample containers should be placed inside of sealable plastic bags to reduce the potential for cross contamination, breakage, and melted ice getting into the samples.
- The drain plug on the cooler, if present, should be taped shut from the inside and outside.
- A layer of protective material such as bubble wrap should be placed in the bottom of the cooler.

E.2. Cooler Guidelines

- If possible, place all contents of the cooler into a large plastic bag that is tied or taped shut to avoid melted ice from leaking out of the cooler during shipping.
- Sample containers should be placed upright in the cooler, and protective material such as bubble wrap should be placed around the sample containers. Do not stack glass containers or lay them on their side, as doing so increases the chance of them breaking.
- Fill the cooler no more than 50 percent with sample containers. Fill all the remaining void space in the cooler with protective material and ice to avoid breakage during transport. At least 1/3 of total cooler space should be taken up by ice. When in doubt, use more ice.
- Ice that is double bagged in sealable plastic bags should be distributed over the top of the samples.
- Additional protective material should then be added to the cooler.
- Ensure that a temperature blank bottle and trip blank (if needed) is in each cooler and included on the COC Form.

E.3. COC Guidelines

- The sampler should relinquish the samples by signing and indicating the date and time that the samples were relinquished to the shipper. The shipping company agent is not required to sign the COC Form.
- Field personnel should retain a copy of the COC Form and attach it to the field notes.
- The COC Form should be placed in a sealable plastic bag and taped to the inside of the cooler lid. At least one COC Form should be placed in each cooler that is sent to the laboratory.

E.4. Custody Seal Guidelines

- Close the top of the cooler and rotate/shake the cooler to verify that the contents are packed so that they do not move. Add additional protective material if needed and reclose.
- Place one custody seal on the front and on the back of the cooler in such a way that the opening of the cooler will destroy the seal.
- Tape the cooler shut with clear packing tape, wrapping all the way around each end. Be sure to tape over the custody seals.

E.5. Shipping Guidelines

- Samples sent by private carrier (UPS, FedEx, etc.) will be accompanied by a bill of lading or other shipping document. Shipping documentation should be saved as part of the permanent record. DOT, USPS, and FAA shipping/labeling regulations must be followed. The contents should be described on the shipping documents. Fill out the correct shipping paperwork with the correct shipping address for the laboratory and tape to the top of the cooler, and wrap packing tape around the entire cooler. Retain copies of all shipment records as provided by the shipper.
- The cooler should be shipped to "Laboratory Sample Receiving" marked "Deliver to addressee only," and the laboratory should be notified of its approximate delivery date and time.
- Deliver the cooler or have the cooler picked up by an overnight carrier that guarantees 24-hour delivery. Consideration should be given to the expected delivery date and the weather.

E.6. Data and Records Management

The original request for COC Form is maintained by the laboratory in accordance with their file retention guidance. A copy of the record should be provided to the project manager or designee with a copy of the sampling field notes by the field personnel immediately after sample check-in.

E.7. Quality Assurance Quality Control

Quality assurance/quality control (QA/QC) procedures described in the work plan should be followed.

The project manager or designee should review the COC Form as soon as possible after sample check-in to verify that the information on the COC Form is correct.

A. Purpose

The purpose of the Standard Operating Procedure (SOP) is the procedure of decontaminating reusable equipment involved in soil, groundwater, and soil vapor activities. Reusable equipment must be properly decontaminated to provide chemical analysis results which are reflective of the actual concentrations present at sampling locations, and to minimize the potential for cross-contamination between sampling locations and the transfer of contamination off-site.

Applicable soil SOPs include SOP 203 – Soil Boring Observation and Sampling, SOP 208 – Soil Grab Sample Collection, SOP 209 – Soil Composite Sample Collection, SOP 210 – Soil Stockpile Sampling, and SOP 211 – Test Pit and Test Trench Observation and Sampling.

Applicable water SOPs include SOP 301 – Water Level Measurement, SOP 302 – LNAPL Level Measurement, SOP 303 – Monitoring Well Development, SOP 304 – Slug Testing, SOP 309 – Field Filtering of Groundwater Samples, SOP 310 – Monitoring Well and Piezometer Installation, SOP 311 – Groundwater Sample Collection, SOP 312 – Well Purging and Stabilization, SOP 314 – Surface Water Sampling, and SOP 316 – Calibration of Water Meters.

The applicable soil vapor SOP includes SOP 405 – Sub-Slab Soil Vapor Sampling.

Be sure to follow the site-specific sampling plan that may require special cleaning or rinsing methods, and/or special handling and disposal of wash and rinse water (also see SOP 702 – Management of Investigation Derived Waste). Additional rinses with solvents such as hexane, acetone, or acid may be required by the site-specific sampling plan, but are not covered in this SOP.

B. Health and Safety

Field work should be performed in accordance with the *Braun Intertec Corporate Health and Safety Manual Standard Operating Procedures* and the site-specific health and safety plan (HASP).

Nitrile gloves should be worn during decontamination activities to reduce the incidence of skin contact with potentially contaminated soil/groundwater and to reduce the risk of cross-contamination. In certain situations, long-sleeved rubber gloves may be needed to prevent contact.

C. Referenced SOPs

- SOP 101 – Field Notes and Documentation
- SOP 203 – Soil Boring Observation and Sampling
- SOP 208 – Soil Grab Sample Collection
- SOP 209 – Soil Composite Sample Collection
- SOP 210 – Soil Stockpile Sampling
- SOP 211 – Test Pit and Test Trench Observation and Sampling
- SOP 301 – Water Level Measurement
- SOP 302 – LNAPL Level Measurement
- SOP 303 – Monitoring Well Development
- SOP 304 – Slug Testing
- SOP 309 – Field Filtering of Groundwater Samples
- SOP 310 – Monitoring Well and Piezometer Installation
- SOP 311 – Groundwater Sample Collection
- SOP 312 – Well Purging and Stabilization
- SOP 314 – Surface Water Sampling
- SOP 316 – Calibration of Water Meters

- SOP 405 – Sub-Slab Soil Vapor Sampling
- SOP 702 – Management of Investigation Derived Waste

D. Equipment and Supplies

- Clean tap water (for washing and rinsing soil sampling equipment)
- Distilled or deionized water (for washing and rinsing groundwater sampling equipment)
- Clean container for wash water (bucket, spray bottle, etc.)
- Phosphate-free detergent (i.e., Alconox or Liquinox in bulk containers or individual packets)
- Scrub brush (soil sampling equipment decontamination)
- Paper towels
- Field report form (see SOP 101 – Field Notes and Documentation) or field logbook
- Personal Protective Equipment (PPE)

E. Procedures

E.1. Soil Sampling Equipment

E.1.a. Hand Tools

Hand tools used for sampling include shovels, hand trowels, hand augers, etc. Before collecting each new soil sample, clean the equipment as follows:

- Remove loose or attached soil from the tool with a gloved hand, paper towel, or brush.
- Wash and brush the tool in a solution of phosphate-free detergent in tap water.
- Rinse the tool with tap water.
- Inspect for remaining particles or surface film, and repeat cleaning and rinsing procedures if necessary.

E.1.b. Direct-Push Sampling Equipment and Split Spoon Sampler

The drilling contractor is responsible for cleaning reusable sampling equipment; however, field personnel must ensure that proper procedures are followed. Prior to collecting each sample the reusable sampling equipment should be cleaned as follows:

- Remove loose or attached soil from the sampler components.
- Wash the sampler components in a solution of phosphate-free detergent in tap water.
- Rinse the sampler components with tap water.
- Inspect for remaining particles or surface film, and repeat cleaning and rinsing procedures if necessary.

E.1.c. Drill Rig Auger Flights

The drilling contractor is responsible for providing clean auger equipment; however, field personnel must ensure that proper procedures are followed. Prior to each use the auger flights should be cleaned as follows:

- Remove loose or attached soil from the auger flight.
- Wash the auger flight with a pressure washer and clean tap water.
- Inspect for remaining particles or surface film, and repeat cleaning and rinsing procedures if necessary.

E.2. Groundwater Sampling Equipment

E.2.a. Groundwater Measuring and Sampling Equipment

This procedure applies to all reusable equipment that will be placed into a well (including water level indicators, transducers, slugs, groundwater sample equipment, and pumps). Groundwater measuring and sampling equipment should be decontaminated after use at each well or sampling point as follows:

- Wash the exterior with a solution of phosphate-free detergent in distilled or deionized water.
- Rinse with distilled or deionized water.
- Inspect for remaining particles or surface film and repeat cleaning and rinsing procedures if necessary.
- Do not wipe dry.

E.3. Product Interface Probe

The product interface probe is only used in wells that may contain light non-aqueous phase liquid (LNAPL). Prior to each use the product interface probe should be cleaned as follows:

- After fluid levels in each well are measured, wipe the probe and tape with a paper towel.
- After returning to the office, clean the probe and tape in a solution of phosphate-free detergent and tap water. Allow the probe and tape to soak in the solution up to 24 hours, if possible.

E.4. Vapor Sampling Equipment

E.4.a. Vapor Pins® – Used for Sub-Slab Soil Gas Sampling

This office-only procedure applies solely to the Vapor Pin® itself that will be used to obtain a soil gas sample. Once the Vapor Pin® has been used it will be brought back to the office and cleaned as follows:

- Remove the silicone sleeve and discard.
- Wash the Vapor Pin® in a hot water and phosphate-free detergent wash.
- Bake in an oven to a temperature of 130°C (266°F) for at least one hour.

E.5. Data and Records Management

Observations should be documented in accordance with SOP 101 – Field Notes and Documentation.

E.6. Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) procedures described in the work plan should be followed.

Appendix E
Vapor Control Systems Details

Appendix E
Vapor Control Systems Details

A vapor intrusion mitigation system (VIMS) will be installed in all new buildings with occupied spaces such as the stadium field-grade indoor spaces and the adjacent office and hotel spaces. The portions of the development with vapor intrusion mitigation systems are shown on **Figure E-1**.

The following vapor intrusion mitigation system component details will apply to buildings constructed for the project. The details shown on **Figure E-1** depict the typical components of the vapor intrusion mitigation systems.

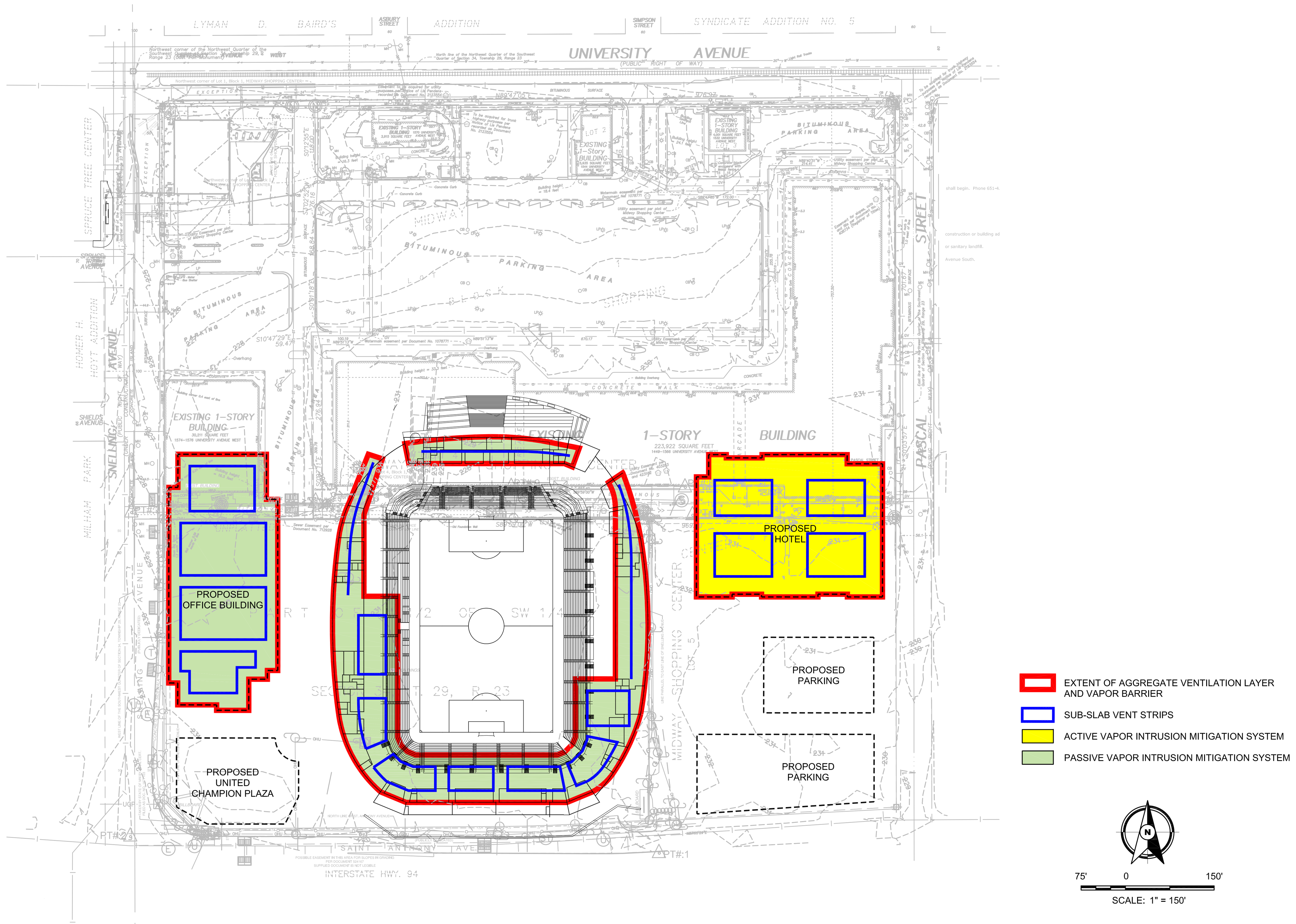
1. Sub-slab aggregate ventilation layer consisting of 6-inches of coarse filter aggregate (pea rock) beneath the entire floor slab and vapor barrier.
2. Composite vapor collection strips below the floor slab and vapor barrier.
    a. 12” wide x 1” thick with non-woven fabric cover over HDPE core. Distributed as J-Drain MVP by JDR Enterprises, Inc. of Alpharetta, Georgia or an approved equivalent.
3. Vapor barrier consisting of 15 mil poly sheeting beneath the entire floor slab.
    a. Distributed as Stego Wrap by Stego Industries or an approved equivalent.
    b. Join sections of vapor barrier and seal penetrations in vapor barrier with manufacturer-approved tape.
    c. Attach to grade beams with manufacturer-approved tape.
    d. Seal around pipes and other penetrations in vapor barrier with pipe boots in accordance with manufacturer's instructions.
4. Vapor barrier on the outside of sub-grade walls.
    a. Material to be determined. May be a sheet or spray-on material depending on cost and design criteria.
5. Sub-slab vapor sample collection/pressure check points (detail not shown on figure).
    a. Located throughout building every 4,000 SF at locations to be determined.
    b. Consists of a port open to the Ventilation Layer connected by piping to an above-slab pipe with a removable cap.
    c. Once the cap is removed the pipe can be sampled or checked for the presence of vacuum.
6. Exhaust pipe(s) to locations at least 20 feet from any human occupancy, window, air intake or the roof, if possible.
    a. Transitions from vapor collection strips to rigid PVC 4-inch diameter, schedule 40 PVC (from vent strip manufacturer) as needed.

   b. Vertical 4-inch PVC pipe (or other pipe to meet building code) from the transitions to the roof.
   c. Exhaust
      i. Option 1: At the roof with open PVC pipe extended 1 foot above the roof or
      ii. Option 2: At an outside wall with no nearby windows or air intakes.
7. Powered exhaust will be provided for the VIMS for the hotel building constructed on the Midway East Parcel.
   a. The sub-slab portions of the VIMS will be installed and tested to determine the appropriate blower size for each exhaust pipe. The blower will be sized to provide adequate vacuum throughout the ventilation layer.
   b. Exhaust
      i. Option 1: At the roof at least 20 feet from any human occupancy, window or air intake or
      ii. Option 2: At an outside wall with no nearby windows or air intakes.

Following completion of the buildings the effectiveness of the VIMS in each structure will be evaluated by testing both the sub-slab soil gas and indoor air as described below.

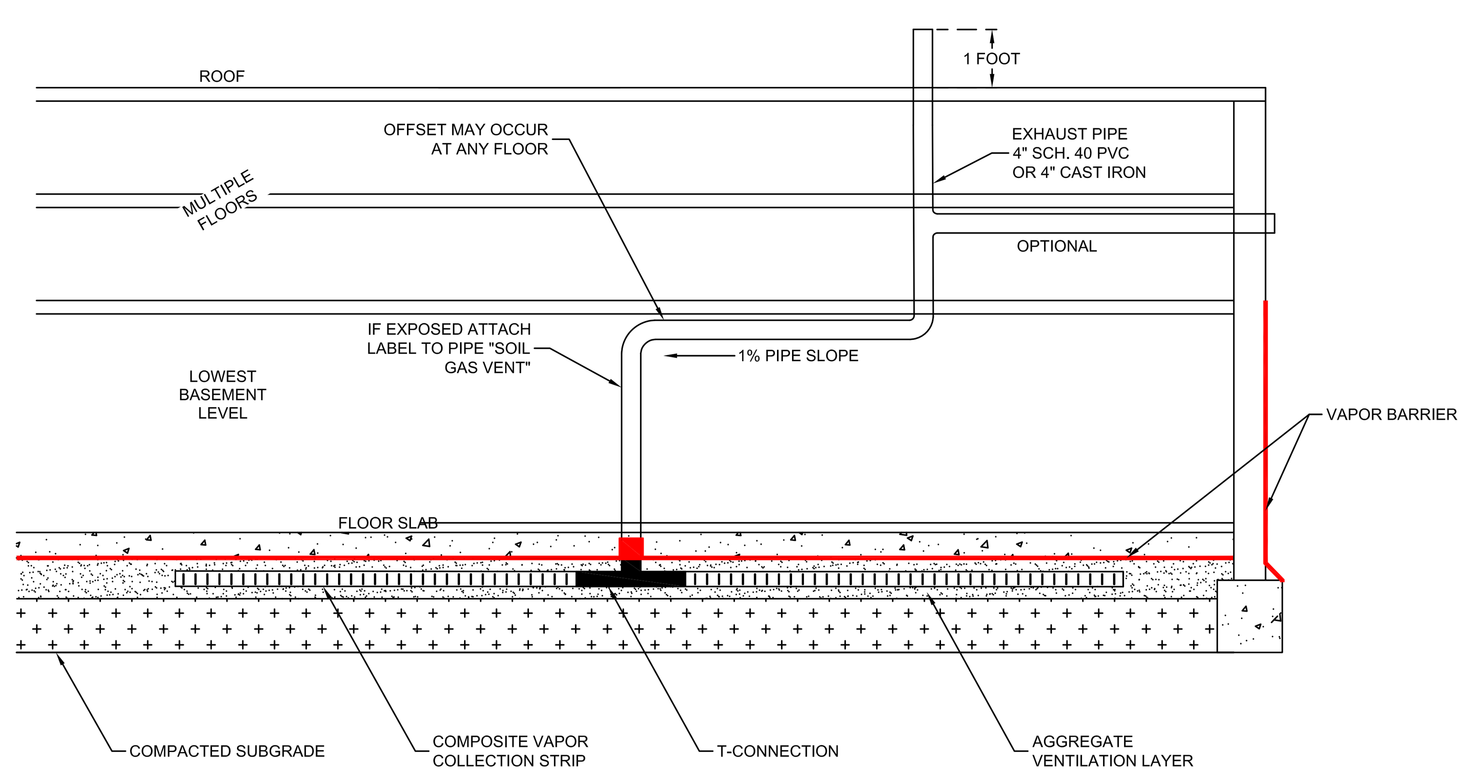
1. Indoor
   a. In the lowest level (occupied or parking)
   b. One 30-minute sample per area
2. Sub-Slab
   a. At each Sub-slab vapor collection point
   b. Check vacuum relative to indoor air
   c. Collect sub-slab grab sample
3. Test for VOCs by TO-15, Minnesota List
4. 1 sampling event within 30 days of completion, 2nd sampling event 6 months later
5. Compare all results to current ISVs, prepare report with recommendations for changes to VIMS and/or additional sampling.

DRAFT
Not For Construction



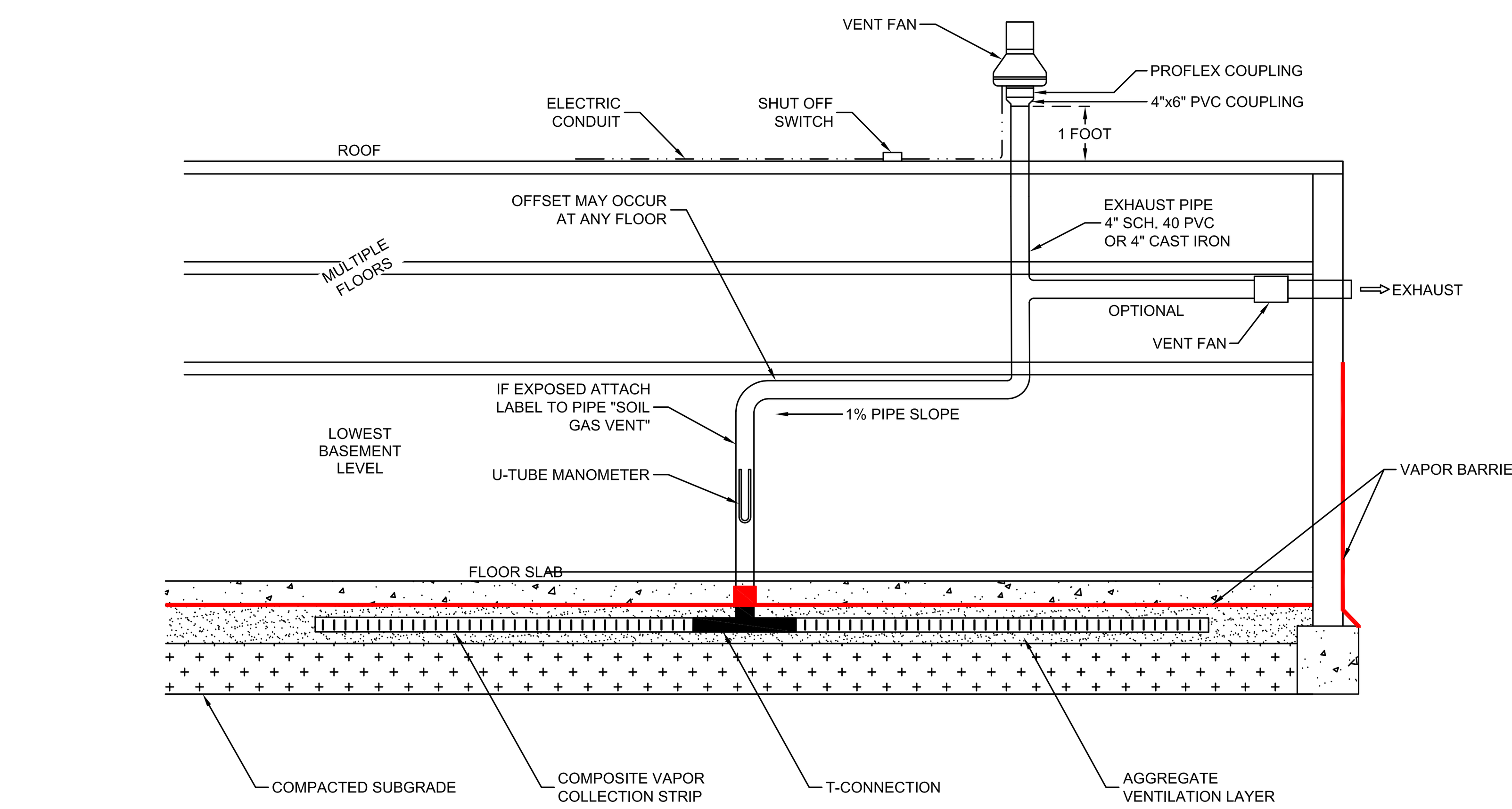
1 / E-1 CONCEPTUAL PLAN VIEW

SCALE: 1" = 150'



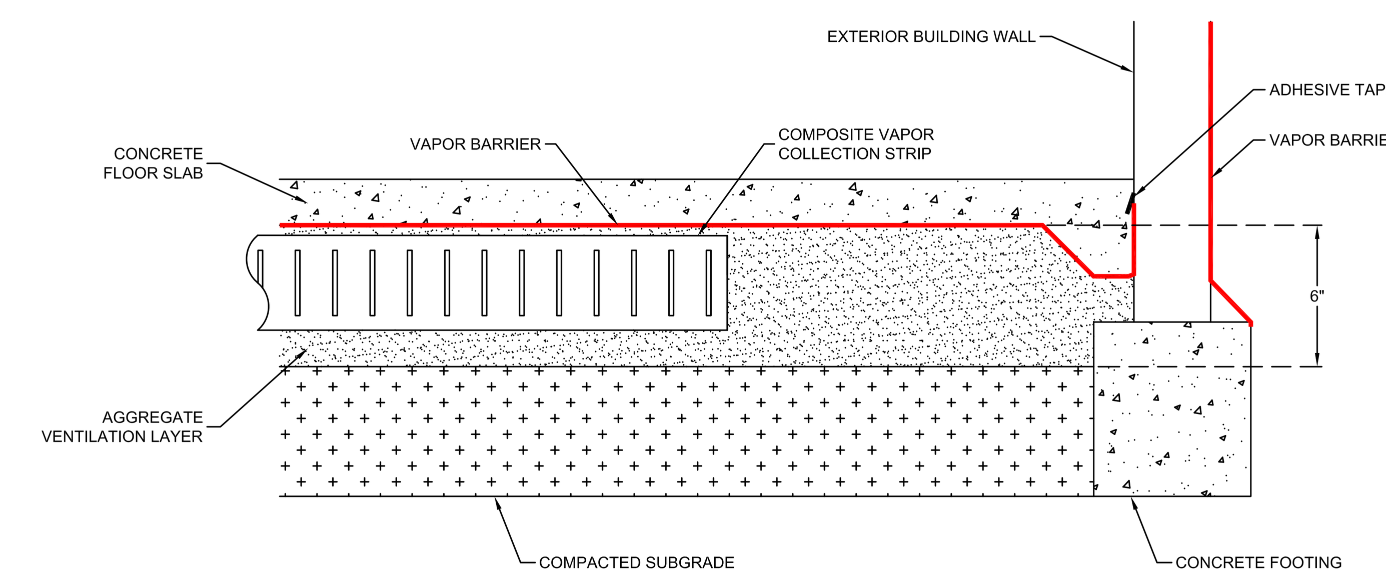
2 / E-1 TYPICAL PASSIVE VAPOR INTRUSION MITIGATION SYSTEM SCHEMATIC

SCALE: NONE



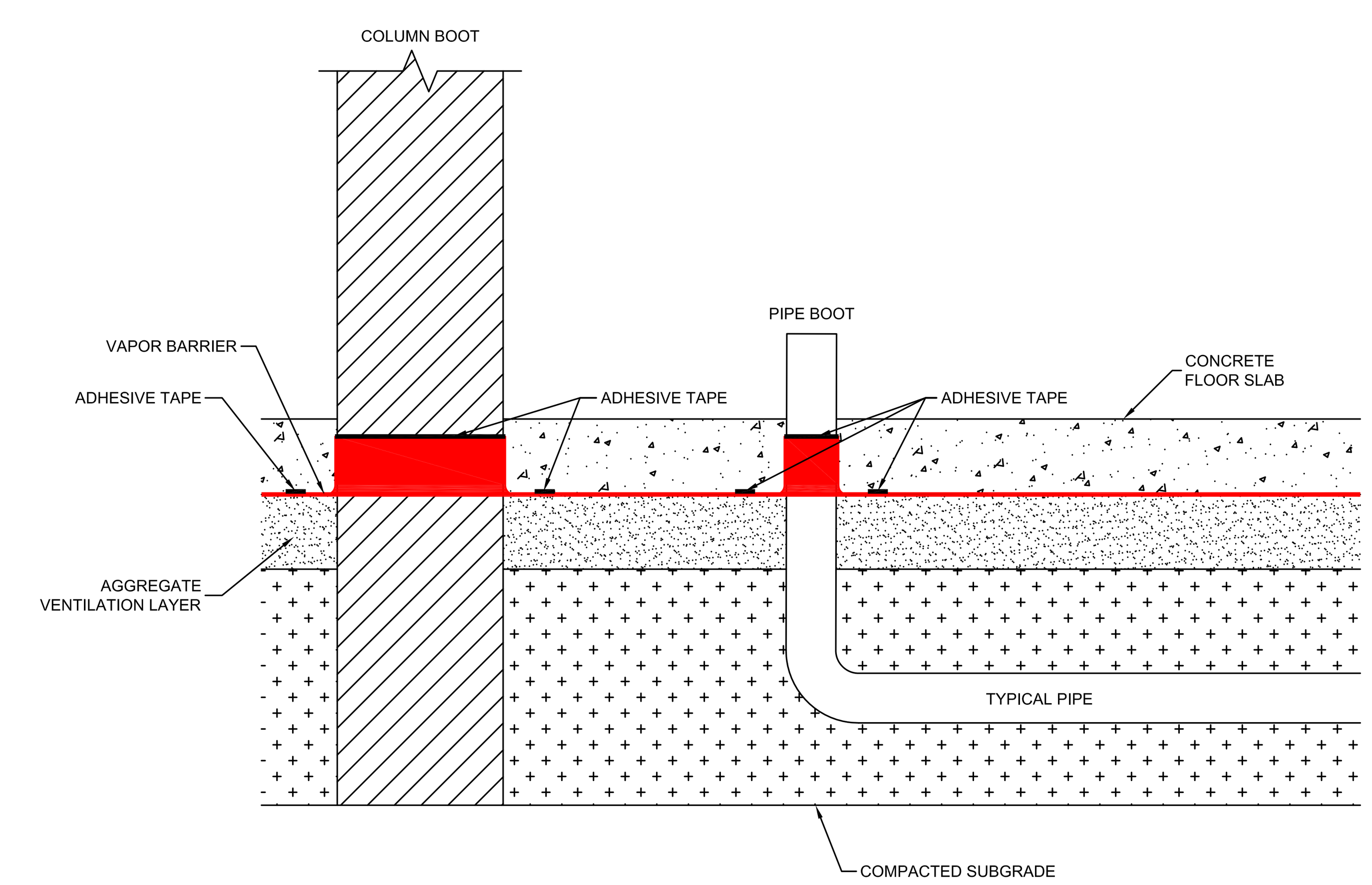
3 / E-1 TYPICAL ACTIVE VAPOR INTRUSION MITIGATION SYSTEM SCHEMATIC

SCALE: NONE



4 / E-1 SUB-SLAB COMPONENT DETAIL

SCALE: NONE



5 / E-1 TYPICAL COLUMN AND PLUMBING PENETRATION DETAILS

SCALE: NONE

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Revisions

Rev:	Date:

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

BRUCE P. SCHAEPE

Date: ______ License No. 40463

Project No: B1600941

Drawing No: B1511122-00

Scale:	AS SHOWN
Drawn By:	BJB
Date Drawn:	3/14/16
Checked By:	BPS
Last Modified:	3/14/16

CONCEPTUAL PLAN AND TYPICAL COMPONENT SCHEMATIC
VAPOR INTRUSION MITIGATION SYSTEM
PROPOSED SOCCER STADIUM PROJECT
400 SNELLING AVENUE NORTH
SAINT PAUL, MINNESOTA

Sheet: of — Fig: E-1