E.O. Lawrence Berkeley National Laboratory

United States Department of Energy

ENVIRONMENTAL RESTORATION PROGRAM

WORKPLAN FOR FURTHER INVESTIGATION IN THE VACUUM PUMP ROOM AREA FOR THE BUILDING 51 AND BEVATRON DEMOLITION PROJECT

for the
Lawrence Berkeley National Laboratory

August 2011
(Revised October 5, 2011)

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LIST OF ABBREVIATIONS

bgs	below ground surface
Berkeley Lab	Lawrence Berkeley National Laboratory
Cal/EPA	California Environmental Protection Agency
CAP	Corrective Action Program
CDPH	California Department of Public Health
CHHSLs	California Human Health Screening Levels
DNAPL	Dense Non-Aqueous-Phase Liquid
DTSC	Cal-EPA Department of Toxic Substances Control
EPA	US Environmental Protection Agency
ERP	Environmental Restoration Program
ESL	Environmental Screening Level
GAC	Granular Activated Carbon
ICMs	Interim Corrective Measures
mg/kg	milligrams per kilogram
MIPS	Membrane Interface Probe System
µg/L	micrograms per liter (10^{-6} grams per liter)
PCE	Tetrachloroethene (Perchloroethene)
PID	Photoionization Detector
RCRA	Resource Conservation and Recovery Act
SC	Office of Science
SOP	Standard Operating Procedure
TCE	Trichloroethene
VOCs	Volatile Organic Compounds
Water Board	San Francisco bay Region of the Regional Water Quality Control Board

1.0 INTRODUCTION

1.1 BACKGROUND

The Ernest Orlando Lawrence Berkeley National Laboratory (Berkeley Lab) Building 51, which housed the Bevatron, occupied approximately 2.25 acres in the west-central part of Berkeley Lab. During its operation from 1954 until 1993, the Bevatron was among the world's leading particle accelerators. In October 2003, the Secretary of Energy directed the Office of Science (SC) to develop a plan and a budget estimate for a project to demolish the Bevatron complex. The scope of the project includes the demolition and deactivation of Building 51 complex including removal and proper disposal of tunnels, shallow foundations, shield blocks, and the accelerator that existed within the building. The project area is primarily referred to as Building 51 in this workplan, but is also referred to as the Bevatron Complex or simply as the Bevatron.

The location of Building 51 is shown on Figure 1, which is an aerial view of the Building 51 area prior to the start of demolition activities. Demolition of the Bevatron Complex began in 2009. Except for the main floor slabs, some of the basement walls, tunnels, and some subsurface foundations, building demolition has been completed. Following demolition, the area will be converted to an undeveloped area for an indeterminate time until another use for this area is proposed, approved, and initiated.

From 1992 to 2000, the Berkeley Lab Environmental Restoration Program (ERP) identified and evaluated Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) at Building 51 as required by the Resource Conservation and Recovery Act (RCRA) Corrective Action Program (CAP). CAP activities were conducted under the oversight authority of the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC). Interim Corrective Measures (ICMs) were implemented in those areas that posed an imminent threat to human health or the environment. Corrective measures were subsequently implemented where required.

1.2 PURPOSE AND SCOPE

Prior to the current work, assessment, investigation, and remediation were conducted in those areas under Building 51 where it was necessary and required under the provisions of the RCRA CAP. The Bevatron Demolition Project includes assessment and characterization of potential subsurface contamination beneath the building footprint in compliance with Berkeley Lab's standard practice of evaluating potential impacts to human health or the environment at demolition/construction sites. The project also includes remediation of contamination as necessary to prepare the site for future use.

A workplan for initial characterization of subsurface contamination under Building 51 was therefore prepared and submitted to DTSC in November 2010 (Berkeley Lab, 2010). The DTSC provided comments on the workplan on February 22, 2011. At the beginning of April 2011, Berkley Lab provided DTSC with responses to their comments.

During the initial investigation, relatively high concentrations of volatile organic compounds (VOCs) were detected in the soil and groundwater in a limited area under the Building 51 Vacuum Pump Room. Therefore, on June 6, 2011, after the analytical results were received, Berkeley Lab informed DTSC about this finding. The results of the investigations conducted in the Vacuum Pump Room area are summarized in this workplan. All of the Building 51 investigation results have also been provided in the ERP Quarterly Progress Reports, which are submitted to the DTSC and are available on line at http://www.lbl.gov/ehs/erp/html/documents.shtml.

The purpose of this current workplan is to specify the additional characterization work that is necessary to identify the source(s), magnitude, and extent of contamination that has been detected in the Building 51 Vacuum Pump Room area.

2.0 SITE DESCRIPTION

2.1 PHYSIOGRAPHY AND DRAINAGE

Figure 2 shows the general layout of the facility prior to demolition. Prior to construction of the Bevatron, North Fork Strawberry Creek, which flows through Blackberry Canyon, passed between the current locations of Building 51 and Building 64. South of this area, a broader canyon containing an unnamed north-northwest-trending drainage passed through approximately the center of the present location of Building 51. Figure 3 shows the locations of the previously existing drainages and the primary areas of cut and fill.

Cut and fill to an elevation of 710 feet prepared the site for Bevatron construction. The hillside along the south and east edges of Building 51 was excavated, thereby obliterating the upper reaches of the unnamed northwest-trending drainage. Storm drains were placed in the bottom of Blackberry Canyon northeast of Building 51 and along the unexcavated parts of the unnamed drainage prior to placing fill in the canyons. Since the hillside excavation described above intercepted the water table, various hillside subdrains, wells and building tile drains were installed to convey intercepted groundwater to storm drains.

2.2 GEOLOGY

Two bedrock units (the Orinda Formation and the Great Valley Group) underlie the Bevatron Complex Area. The contact relations between these units are shown in plan view on Figure 3. Mudstones, sandstones, and shales of the Great Valley Group underlie the southwestern part of Building 51. The strata of the Great Valley Group dip north to north-northeast between 20° to 30° in this area. The Orinda Formation overlies the Great Valley Group along an apparent fault contact that passes beneath Building 51. Excavation records and boring logs indicate that this contact dips approximately 20° to the northeast. The Orinda Formation underlies the northeastern part of Building 51, and consists primarily of siltstones and fine-grained sandstones that have dips ranging from horizontal to approximately 60° northeast.

As shown on Figure 3, the Vacuum Pump Room was located at the east side of Building 51 in the area where the site was excavated to an elevation of 710 feet. To provide for

construction of the Air Ducts, which extend under the western end of the Vacuum Pump Room, the Air Duct floors were excavated to an elevation of 700 feet. Geologic cross sections through the Vacuum Pump Room area are shown on Figure 4 and Figure 5 and indicate that the Vacuum Pump Room is generally underlain by Orinda Formation bedrock. However, artificial fill has been placed behind the Air Duct walls under the Vacuum Pump Room, and behind the retaining walls that form the southern and western boundaries of the Vacuum Pump Room. The locations of the cross sections are shown on Figure 3.

2.3 HYDROGEOLOGY

The direction of groundwater flow in the Vacuum Pump Room area is generally from east to west as shown on Figure 6. The hydraulic conductivity of Orinda Formation siltstone is very low (on the order of 10^{-8} m/s), resulting in water levels in the wells screened in the bedrock taking many days to reach equilibrium. In contrast, the fill is much more permeable and provides a preferential pathway for contaminant migration. The depth to groundwater is about 4 to 5 feet beneath the Vacuum Pump Room's floor elevation of 710 feet. Currently groundwater is standing about one foot above the concrete floor slab inside the Air Ducts, at elevation of approximately 701 feet.

It is important to note that groundwater flow in the Building 51 area is largely controlled by the Bevatron subdrain systems. Shallow groundwater in areas uphill from the Bevatron Complex flows generally northwards and westwards towards Building 51, where it is intercepted by the perimeter subdrains. Outside of the Vacuum Pump Room area, the perimeter subdrain lies at an elevation of approximately 710 feet, approximately the elevation of the main floor level. As a result, groundwater is very shallow along the upslope perimeter of the Building 51 complex. An additional subdrain system is located at an elevation of approximately 698 feet along the west side of the Vacuum Pump Room under the Air Duct floor slab. This subdrain was apparently damaged in the early 1990s and no longer functions. West of the Bevatron Complex, groundwater is directed generally westwards towards the lower, unfilled portion of Blackberry Canyon. Groundwater elevation contours, interpreted flow directions, and the configuration of the main subdrain systems that capture water from the Vacuum Pump Room area are shown on Figure 6.

2.4 DEMOLITION PROJECT DEWATERING SYSTEM

Groundwater flowing into and accumulating in the eastern ends of the Air Duct tunnels is adversely affecting demolition activities in those areas. A dewatering system is therefore required to eliminate or reduce the inflow of groundwater. The planned dewatering system consists of five contiguous 2-foot diameter borings drilled to a depth of 20 feet (approximately 10 feet beneath the Air Duct floor) from inside the area of Vacuum Pump Room upgradient from the Air Duct tunnels. Four of the borings will be backfilled with gravel. Five-inch slotted PVC casing (15 ft. screen and 5 ft. riser) will be inserted in the fifth boring and a submersible pump installed in the casing for groundwater extraction. The annulus of the casing will be backfilled with gravel. An impermeable cover will be placed at the surface to prevent infiltration of surface water. The location and configuration of the proposed dewatering system are shown on Figure 7.

Extracted groundwater will be routed to the existing Building 51 groundwater treatment system. The system consists of two 1,000-pound granular activated carbon (GAC) canisters installed in series to help ensure that contamination will not be present at detectable concentrations in the post-treatment effluent. Samples are collected monthly from between the canisters and analyzed for VOCs. Effluent and influent samples are also collected at regular intervals. Ancillary equipment includes particulate filters; pressure gauges; flow totalizers; flow control, pressure relief, and back flow control valves; sampling ports; and electric power controls. The system is permitted by the East Bay Municipal Utility District (EBMUD) to discharge the treated water to the sanitary sewer. A schematic diagram of the system is shown on Figure 8.

3.0 PREVIOUS ENVIRONMENTAL INVESTIGATIONS AND REMEDIAL MEASURES

3.1 SUMMARY

Investigation of environmental contamination in the Vacuum Pump Room area was conducted during the latter half of 2010 and the first half of 2011. Results of that investigation are provided in Table A1 (VOCs in groundwater), A2 (VOCs in groundwater samples from angled borings), Table A3 (VOCs in soil) and Table A4 (VOCs in soil vapor), which are included as Attachment 1. Sampling locations and results are also provided on the figures that are referenced in the following sections.

3.2 GROUNDWATER CONTAMINATION

Concentrations of VOCs detected in groundwater in the Bevatron area are shown on Figure 9. Three main areas of VOC-contaminated groundwater are present in the Bevatron area. Corrective measures were approved for two of these areas (The Building 51/64 Groundwater Solvent Plume and the Building 51L Groundwater Solvent Plume) by the DTSC and have been implemented as part of the RCRA CAP.

A newly discovered area of groundwater contamination was recently identified under the Vacuum Pump Room and is the subject of this workplan. Several temporary groundwater sampling points were installed in and adjacent to the Vacuum Pump Room as part of the current investigation. In addition, grab groundwater samples were collected from several soil borings and from angled borings drilled through the Bevatron perimeter wall to target groundwater immediately beneath the perimeter drain. The locations of these sampling points and a summary of the groundwater analytical results are shown on Figure 10, which is an isoconcentration contour map of total VOCs detected in the groundwater in the Vacuum Pump Room area. The primary contaminant detected in all of the samples was trichloroethene (TCE). The maximum concentration of TCE in the groundwater (126,000 µg/L) was detected at temporary groundwater sampling point SB51-11-9. A sheen was observed in the first sample collected from the sampling point, indicating that dense nonaqueous-phase liquid (DNAPL) was likely present, and therefore the detected concentration is unlikely to be representative of dissolved VOC concentrations in

groundwater. The second groundwater sample collected from this sampling point had a much lower TCE concentration of 32,900 µg/L. Groundwater samples collected from boreholes within several feet of SB51-11-9 contained VOC concentrations orders of magnitude lower (maximum of 400 µg/L).

Based on the data collected to date, the lateral extent of groundwater contamination appears to be limited primarily to the Vacuum Pump Room area (Figure 10). It appears that the groundwater contamination is in part captured by the south perimeter subdrain system (Figure 6), which may explain the presence of VOCs that have been detected in the subdrain effluent. Effluent from the subdrain is currently captured in a catch basin inside the southwest edge of Building 51A and treated at a granular activated carbon (GAC) treatment system, as part of the DTSC approved corrective measures for the site. The extremely low hydraulic conductivity of the bedrock is also a likely contributing factor for the limited extent of this plume.

As reported in the preliminary investigation workplan (Berkeley Lab, 2010), water samples collected immediately prior to demolition of the Bevatron from the floor drain system under the Air Ducts contained in excess of 1,000 µg/L total VOCs (primarily TCE).

3.3 SOIL CONTAMINATION

Soil samples were collected from all of the temporary groundwater sampling points and soil borings drilled in and adjacent to the Vacuum Pump Room in 2010 and 2011. Soil sampling locations and a summary of the soil analytical results are shown on Figure 11. The primary contaminant detected in all of the samples was TCE, except for the two shallowest samples in the soil boring immediately outside the southeast corner of the Vacuum Pump Room. Those two samples contained primarily tetrachloroethene (PCE) and were collected adjacent to a small concrete sump that was located south of the Vacuum Pump Room at an elevation of 725 ft. The maximum detected concentration of TCE was 230 mg/kg, which was detected below the Vacuum Pump Room at a depth of 12 feet in SB51-11-9.

As shown on Figure 11, the lateral extent of contamination is well defined on the east side of the Vacuum Pump Room by the non-detectable to low concentrations of VOCs detected in three borings along that wall. However, the lateral extent of contamination is not as well defined to the north, west, and south. Cross sections A-A' (Figure 12) and B-B' (Figure 13) are drawn through

the areas containing the highest concentrations of VOCs in soil. With the exception of a boring drilled immediately adjacent to the south wall, significant contamination was not detected in shallow samples from the deep borings beneath the Vacuum Pump Room, but is only present at depths of approximately 11 feet or greater, close to the base of the fill unit that forms a thin layer beneath and adjacent to the Air Ducts. This may suggest that the contamination did not originate from within the Vacuum Pump Room. One hypothesis is that the contamination migrated downwards from releases that occurred near the cooling tower area south of the Vacuum Pump Room, as suggested by the moderately high levels of VOCs detected in soil samples collected in that area. This interpretation is illustrated on Figure 12 and is supported by the relatively high concentration of TCE (32 mg/kg) detected in SB51-11-31 in a sample collected at a depth of 3 feet below ground surface (bgs) near the base of the retaining wall. However, it is also possible that the contamination beneath the Vacuum Pump Room is from a separate source, possibly a release in the Air Duct area that migrated into adjacent soil beneath the Vacuum Pump Room. Further investigation is required to identify the source(s) of release.

3.4 SOIL VAPOR CONTAMINATION

Several soil vapor probes were installed in the Vacuum Pump Room during early reconnaissance work in 2008 and one point was installed during 2010. No significant contamination was detected in those samples. However, concentrations of VOCs detected in the 2010 sample significantly exceeded California Human Health Screening Levels (CHHSLs) (Cal/EPA, 2005) and/or Regional Water Quality Control Board (Water Board) Environmental Screening Levels (ESLs) (http://www.swrcb.ca.gov/rwqcb2/esl.shtm).

Based on the soil vapor sampling results, Berkeley Lab initiated a more detailed investigation of potential contamination in the Vacuum Pump Room area. Results of the investigation are summarized in Section 3.2 and Section 3.3 for groundwater and soil, respectively. Several additional soil vapor probes were also installed in the cooling tower area to better define the lateral extent of contamination in that area.

Unfortunately, the artificial fill in the cooling tower area south of the Vacuum Pump Room was saturated close to the Vacuum Pump Room walls up to a depth of approximately 3 feet bgs. Therefore, soil vapor could not be recovered from most of the probes and the lateral distribution of

elevated soil gas could not be accurately determined. Notably however, the two most southerly vapor probes contained VOCs at concentrations substantially higher than was observed within the Vacuum Pump Room. These probes were located to the south of the southernmost soil and groundwater sampling points. These results also support the hypothesis that the primary source of the contamination was outside Building 51 to the south of the Vacuum Pump Room. Soil vapor sampling results are shown on Figure 14.

4.0 INVESTIGATION METHODS

4.1 PROCEDURES

All work will be performed in accordance with requirements of the ERP Quality Assurance Program Plan (Berkeley Lab, 2009a), Berkeley Lab Environmental Services Group Standard Operating Procedures (SOPs) (https://www.lbl.gov/ehs/esg/ControlledProcedures/controlledprocindex.shtml), and the Berkeley Lab ERP Health and Safety Program Plan (Berkeley Lab, 2009b).

A membrane interface probe system (MIPS) will be used to provide an initial assessment of the lateral and vertical extent of VOC contaminated soil. The MIPS consists of a heated probe carrying a permeable membrane that is pushed into the subsurface. VOCs in subsurface soil vapor cross the membrane, enter into a carrier gas stream, and are swept into gas-phase detectors at the surface for measurement. A continuous log is made of detector response with depth. The MIPS can also provide information on lithology. Vironex will be contracted to conduct the MIPS investigation.

Soil samples will generally be collected from borings at intervals of 5 feet or less. Soil from borings will be screened with a photo ionization detector (PID) to assess the potential presence of VOCs. Sampling depths may be modified or additional soil samples collected based on the results of the PID monitoring.

Where sufficient groundwater is present in any boring, grab groundwater samples will be collected and analyzed for the VOCs. At this time, there is no plan to install temporary groundwater sampling points as part of the current investigation. However, depending on field observations and other factors such as PID monitoring, a temporary groundwater sampling point(s) may be installed. Temporary groundwater sampling point construction details are provided in Attachment 2 for reference.

4.2 ANALYTICAL METHODS

Samples will be analyzed by laboratories that are certified by the State of California Department of Public Health (CDPH). Table 1 lists the analytical methods and contract required analysis codes to be used for the samples described in this workplan.

Table 1

Summary of Sampling Requirements

Sample Type	Analyte	Method	Contract Analysis Code(1)
Soil	VOC	EPA 5035B/8260	E8260
Groundwater	VOCs	EPA 8260	E8260
Soil Vapor	VOCs	TO15	

(1) These are Berkeley Lab laboratory contract analysis codes.

5.0 PROPOSED INVESTIGATION

5.1 OBJECTIVE OF PROPOSED WORK

The primary objectives of the proposed investigation are:

1. Identify the source(s) and migration pathways for the soil, groundwater, and soil vapor contamination detected in the Vacuum Pump Room area.
2. Characterize the lateral and vertical extent of contamination.

5.2 COOLING TOWER AREA CHARACTERIZATION

The cooling tower area to the south of the Vacuum Pump Room is considered to be the primary potential source area for the contamination detected in the Vacuum Pump Room area. Due to the presence of high water table in this area, soil vapor sampling does not appear to be a feasible method for characterizing the contamination. Therefore, a membrane interface probe system (MIPS) will be used to provide an initial assessment of the lateral and vertical extent of VOC contaminated soil in the cooling tower area. MIPS sampling will be conducted in a gridded pattern in the area of elevated soil vapor concentrations. The preliminary MIPS sampling locations are shown on Figure 15.

MIPS sampling will be initially conducted to a depth of approximately 20 feet (or refusal). Since the MIPS system produces real-time results, the sampling grid and sampling depths will likely be modified during field operations to “chase” the area of contamination. Step-out locations that may be sampled contingent on the initial results are identified on Figure 15. Subsequent to the MIPS investigation, direct-push soil borings may be installed to provide additional soil VOC concentration data to calibrate the MIPS results or to assess concentrations of contaminants in soil at specific locations based on the MIPS results.

If it is not possible to deploy the MIPS system effectively, then direct-push soil samples will be collected at the proposed MIPS sampling locations. Soil samples will be collected at a minimum of 5 foot depth intervals to a depth of 20 feet at each location using EPA Method 5035B.

5.3 VACUUM PUMP ROOM CHARACTERIZATION

Since the Vacuum Pump Room floor is underlain by Orinda Formation siltstones that are more difficult to penetrate than the fill underlying the cooling tower area, it may not be possible to deploy the MIPS system in this area. Three soil borings (either direct-push or augered borings) will therefore be advanced within the Vacuum Pump Room area at the locations shown on Figure 15. The purpose of these borings is to determine the northward and southward extent of contamination and for the easternmost boring to assess potential contamination in the area of a floor drain. Soil samples will be collected at a minimum of 5 foot depth intervals to a depth of 25 feet at each location and analyzed using EPA Method 5035B.

To evaluate the westward lateral extent of contamination beneath the Air Duct floor, shallow soil borings will be installed within the Air Ducts at the four locations shown on Figure 15. Results from these points may also help to determine if releases from the floor drains could constitute a secondary source of contamination. The two easternmost borings will be drilled along the alignment of the Air Duct floor drain line to depths of approximately 5 feet. Soil samples will be collected from all four borings immediately beneath the concrete slab and at depths of approximately 2 and 5 feet. As was described in Section 2.3, groundwater is currently flooding the Air Duct tunnels, which prevents the collection of the proposed soil samples. As discussed Section 2.4, dewatering of the Air Duct area is required for project demolition purposes. This dewatering should also allow access for soil sampling. Dewatering will be terminated after the soil samples have been collected from the Air Ducts and the demolition project is completed, unless approval is received from DTSC to continue the operation.

5.4 TENTATIVE SCHEDULE

Following is a preliminary schedule for the proposed work discussed in this Workplan. The schedule is tentative and may be revised.

August 16, 2011	Submit workplan to DTSC
August 25, 2011	Start fieldwork.

6.0 REFERENCES

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Figure 11. Total Volatile Organic Compounds Detected in Soil Borings, Vacuum Pump Room Area.

Figure 12. Geologic Cross Section A-A', Showing Sampling Results, Vacuum Pump Room Area.

Figure 13. Geologic Cross Section B-B', Showing Sampling Results, Vacuum Pump Room Area.

Figure 14. Isoconcentration Contour Map of Total Volatile Organic Compounds in Soil Vapor and Subslab Vapor, Vacuum Pump Room Area.

Figure 15. Proposed Locations for MIPS Borings, Soil Borings, and Dewatering System, Vacuum Pump Room Area.

MW51-96-16	Groundwater monitoring well
MW90-6	Properly destroyed monitoring well
T SB51-11-1	Temporary groundwater sampling point
T SB64-98-16	Properly destroyed sampling point
	Groundwater extraction well
	Soil boring
	Angled boring
PZ51-92-3	Piezometer
	Groundwater extraction well
GAC	Groundwater treatment system

NOTES:
All other symbols used are explained on the figures.

Symbols.ai
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Key to Symbols Used on Figures.

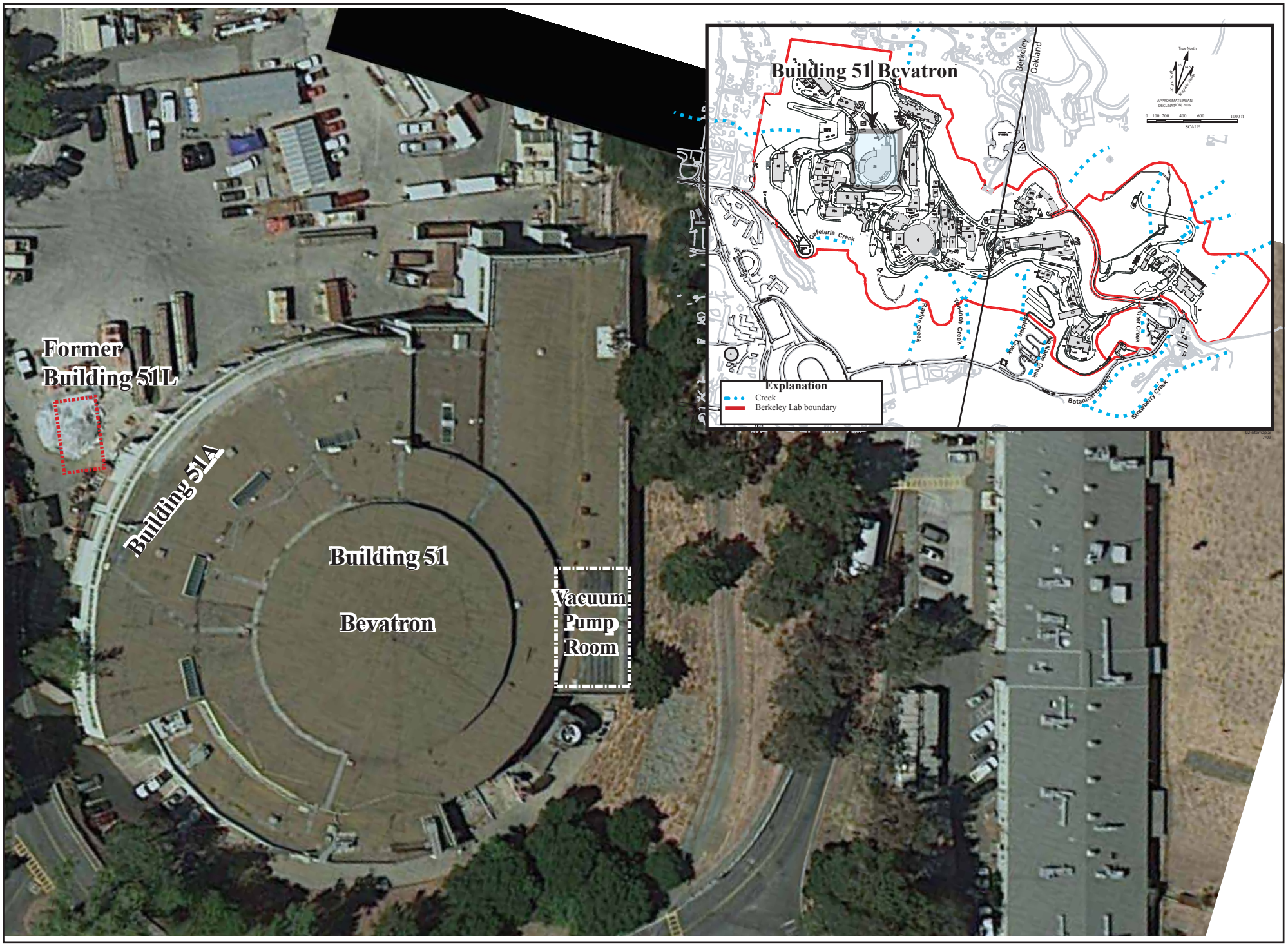


Figure 1. Location of Building 51 Bevatron, Lawrence Berkeley National Laboratory.

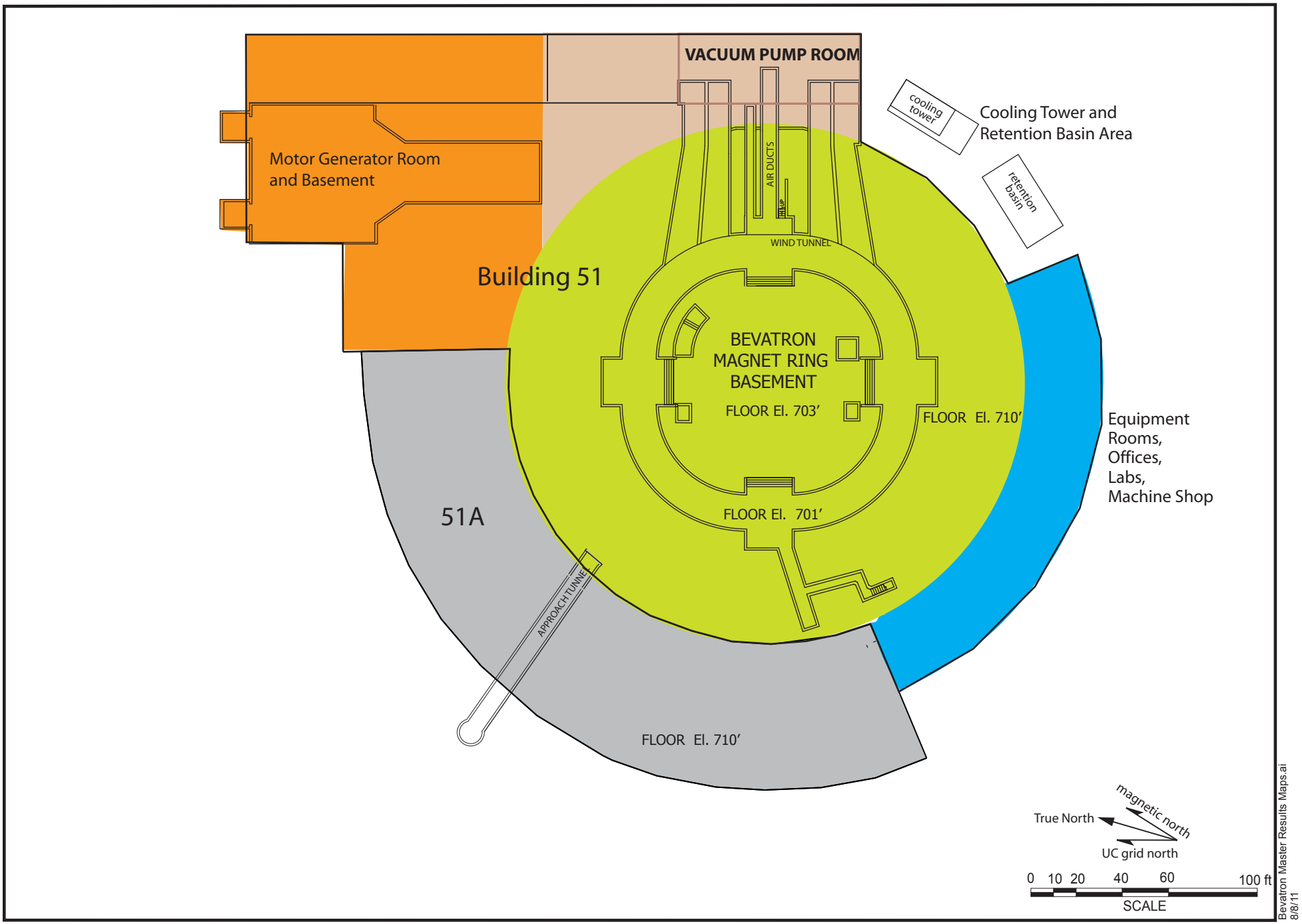


Figure 2. Layout of Bevatron Facility.

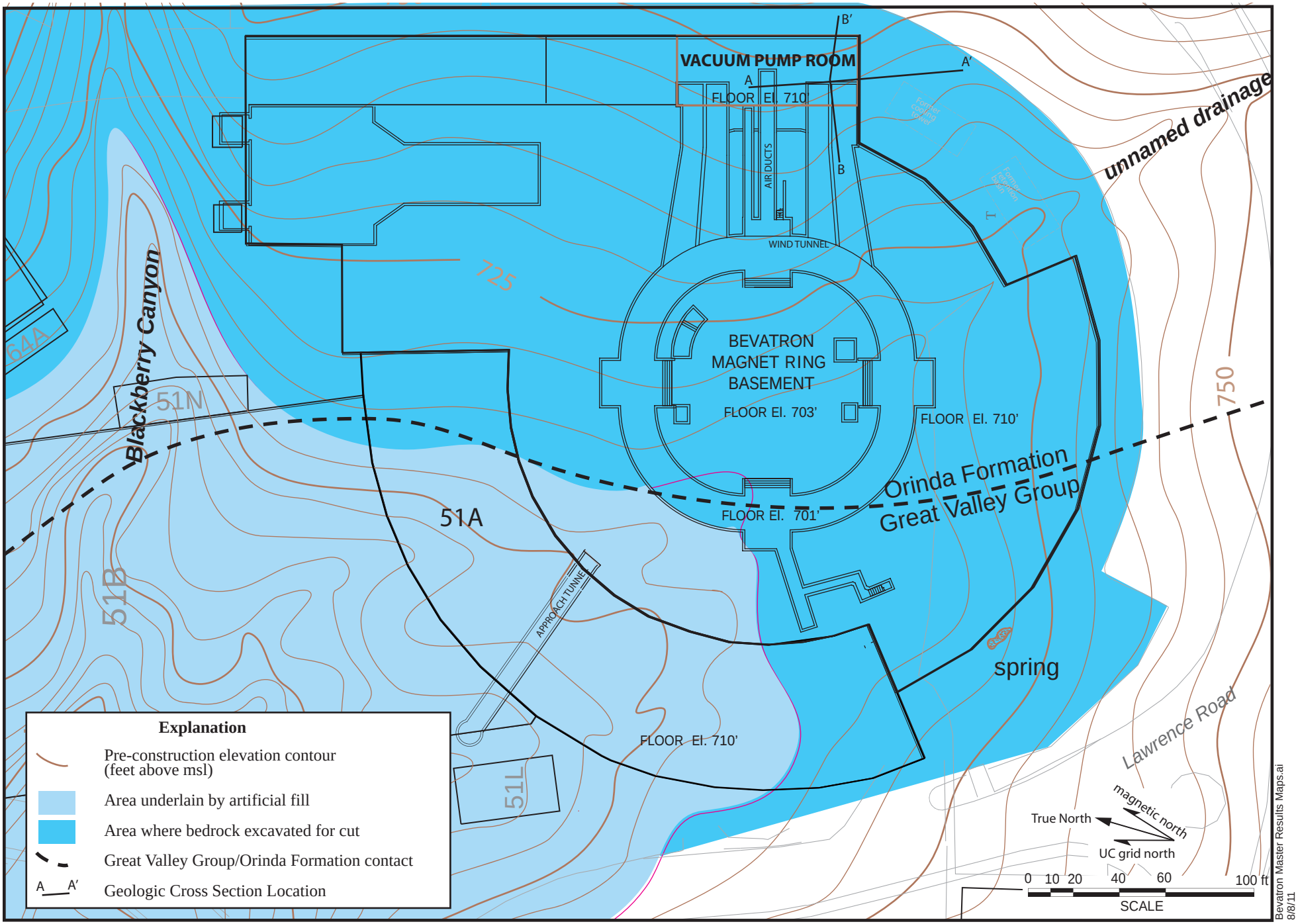


Figure 3. Pre-Construction Topography Showing Approximate Areas of Cut and Fill and Distribution of Principal Bedrock Units, Bevatron Area.

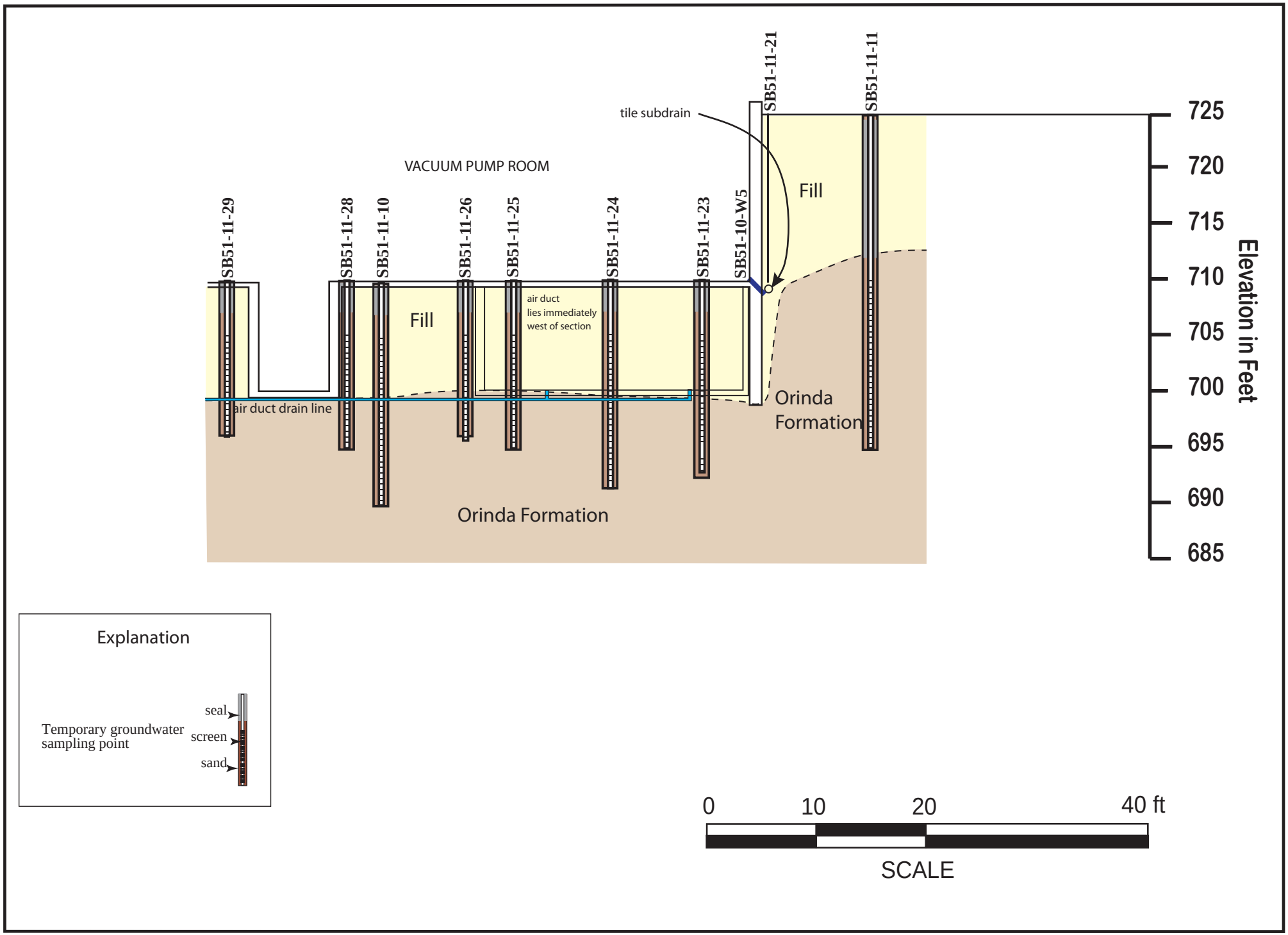


Figure 4. Geologic Cross Section A-A', Vacuum Pump Room Area.

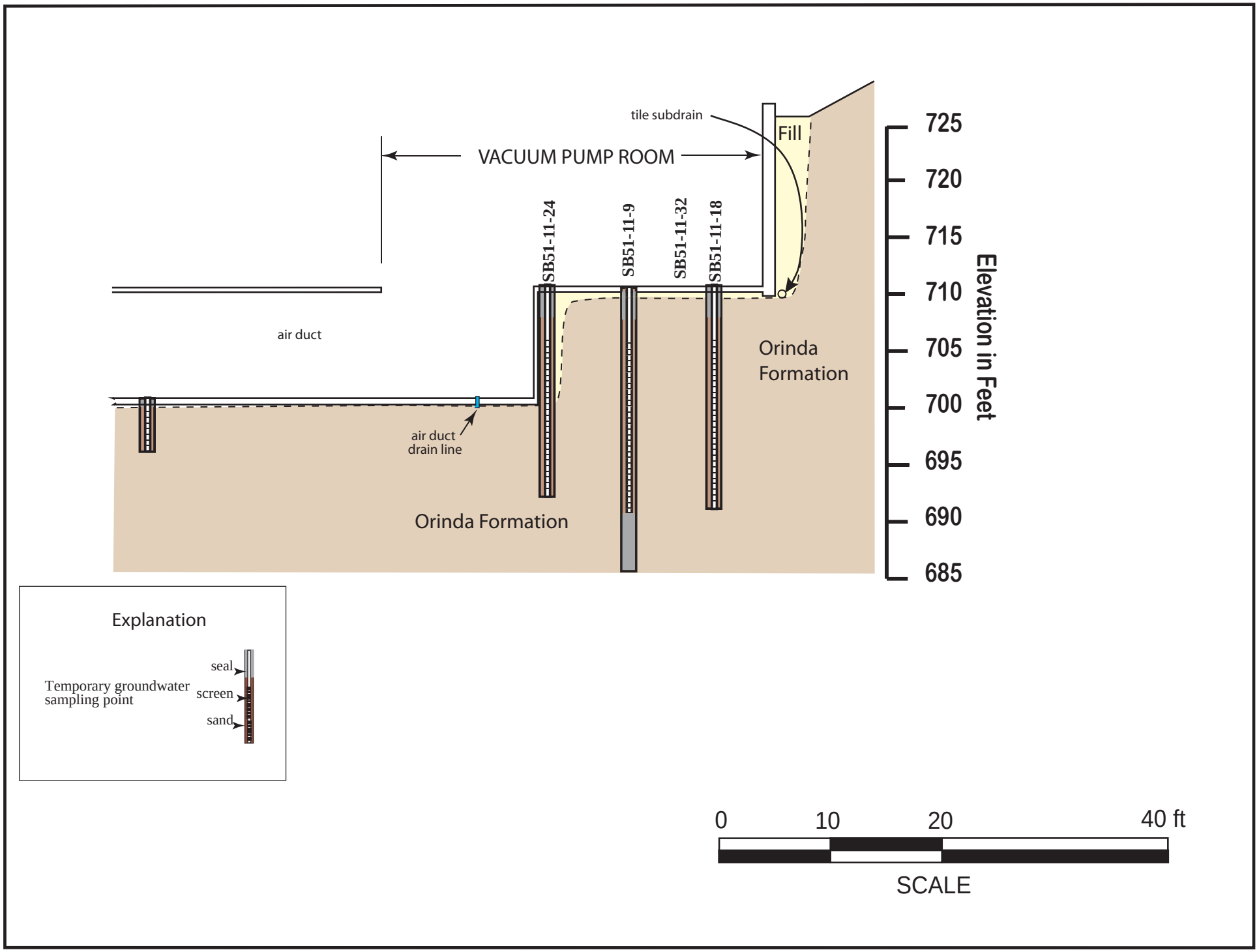


Figure 5. Geologic Cross Section B-B', Vacuum Pump Room Area.

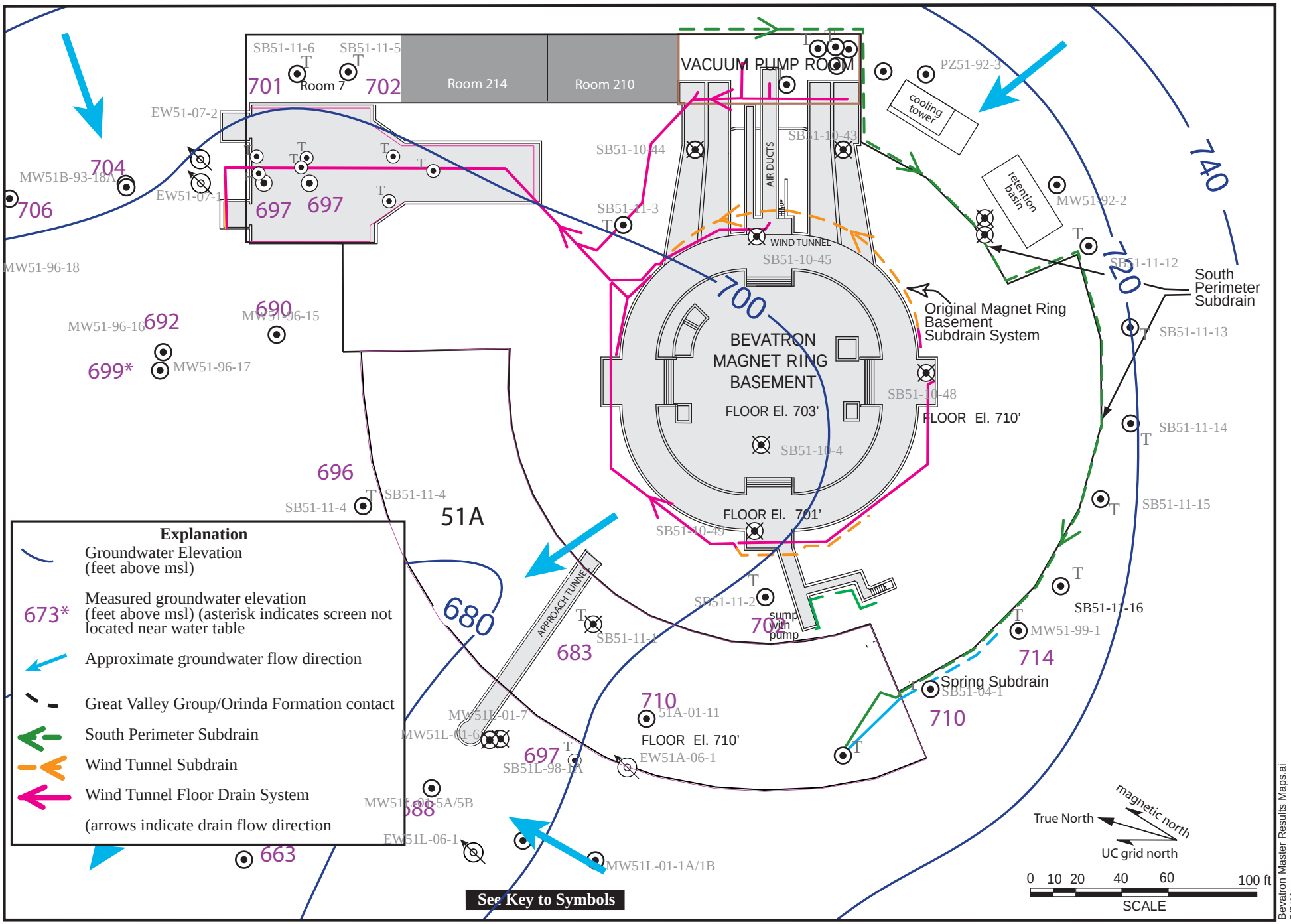


Figure 6. Groundwater Elevation Map, March 2011, Showing Approximate Groundwater Flow Directions and Subdrain Layout, Bevatron Area.

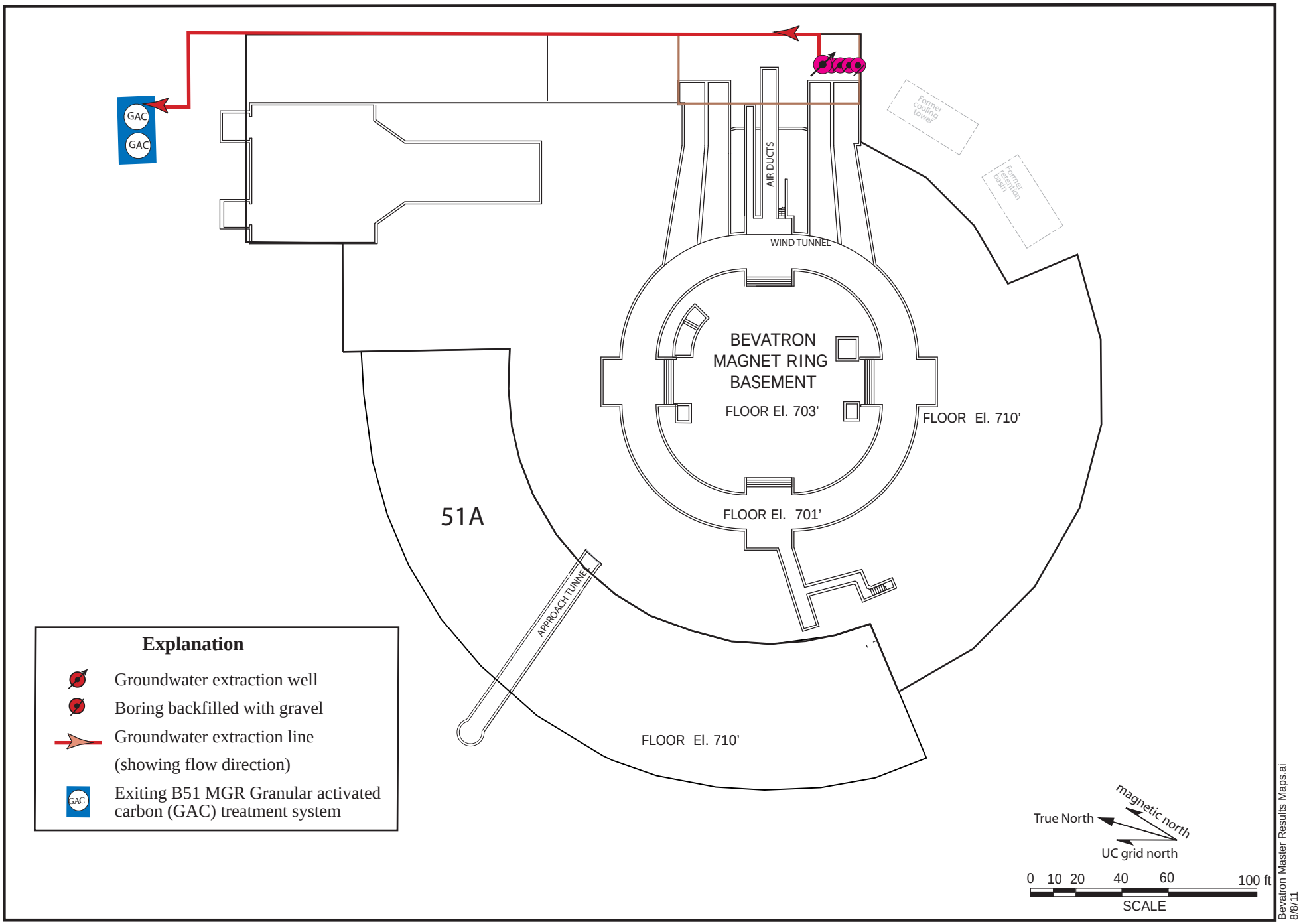
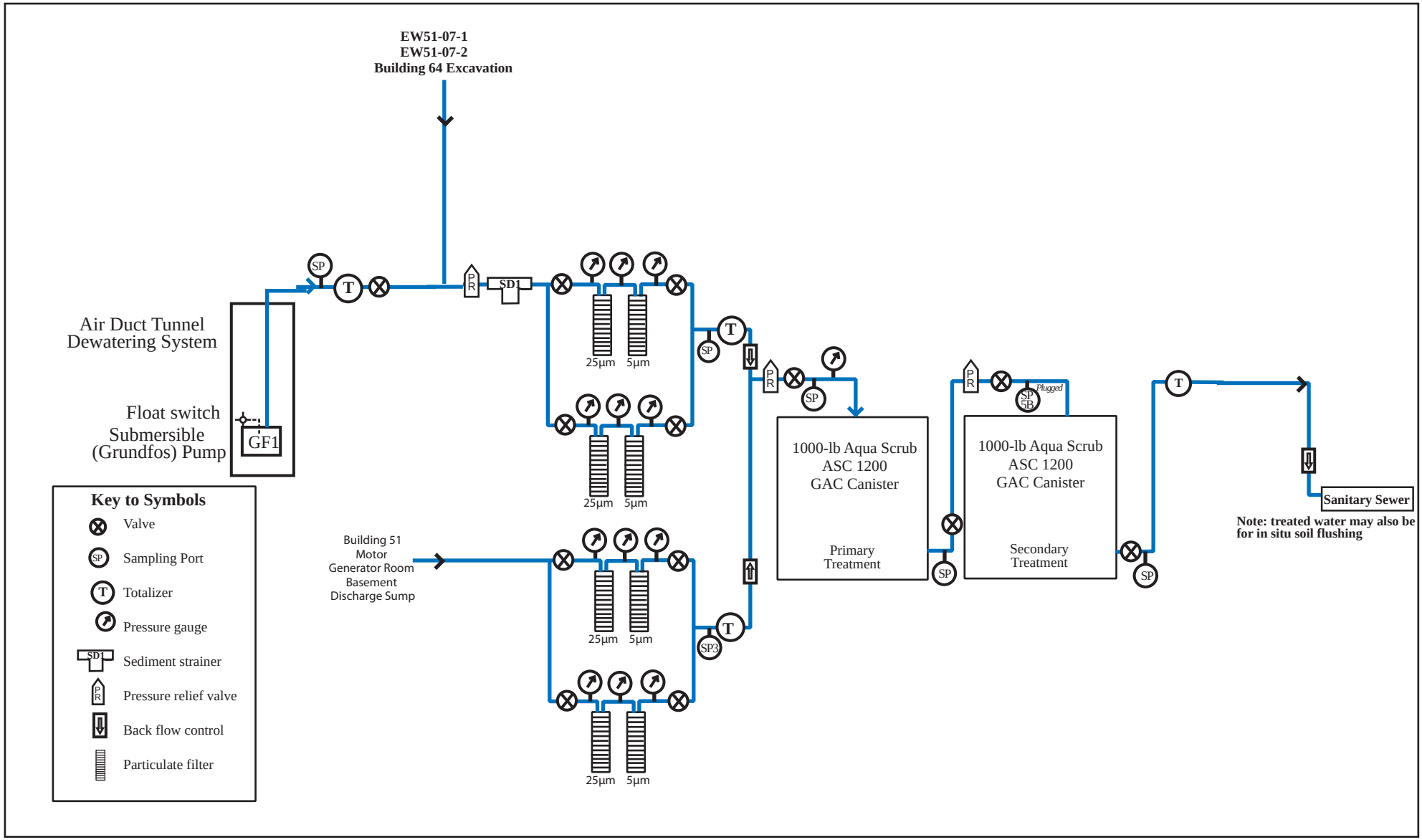


Figure 7. Configuration of Planned Demolition Project Dewatering System.



1-8-b51mgroom.ai
11/07

Figure 8. Schematic Diagram of Building 51 GroundwaterTreatment System.

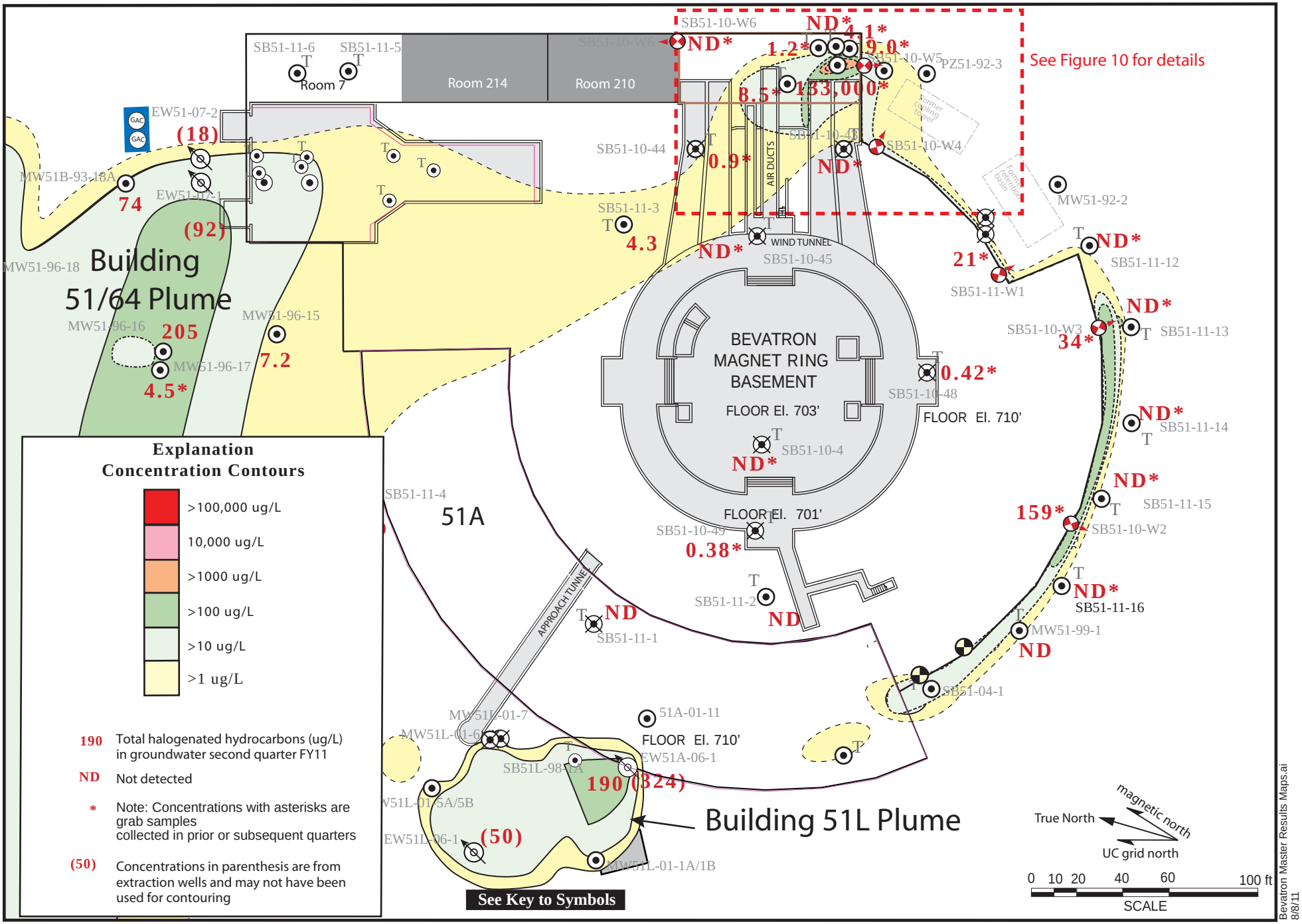


Figure 9. Concentrations of Volatile Organic Compounds Detected in Groundwater (ug/L).

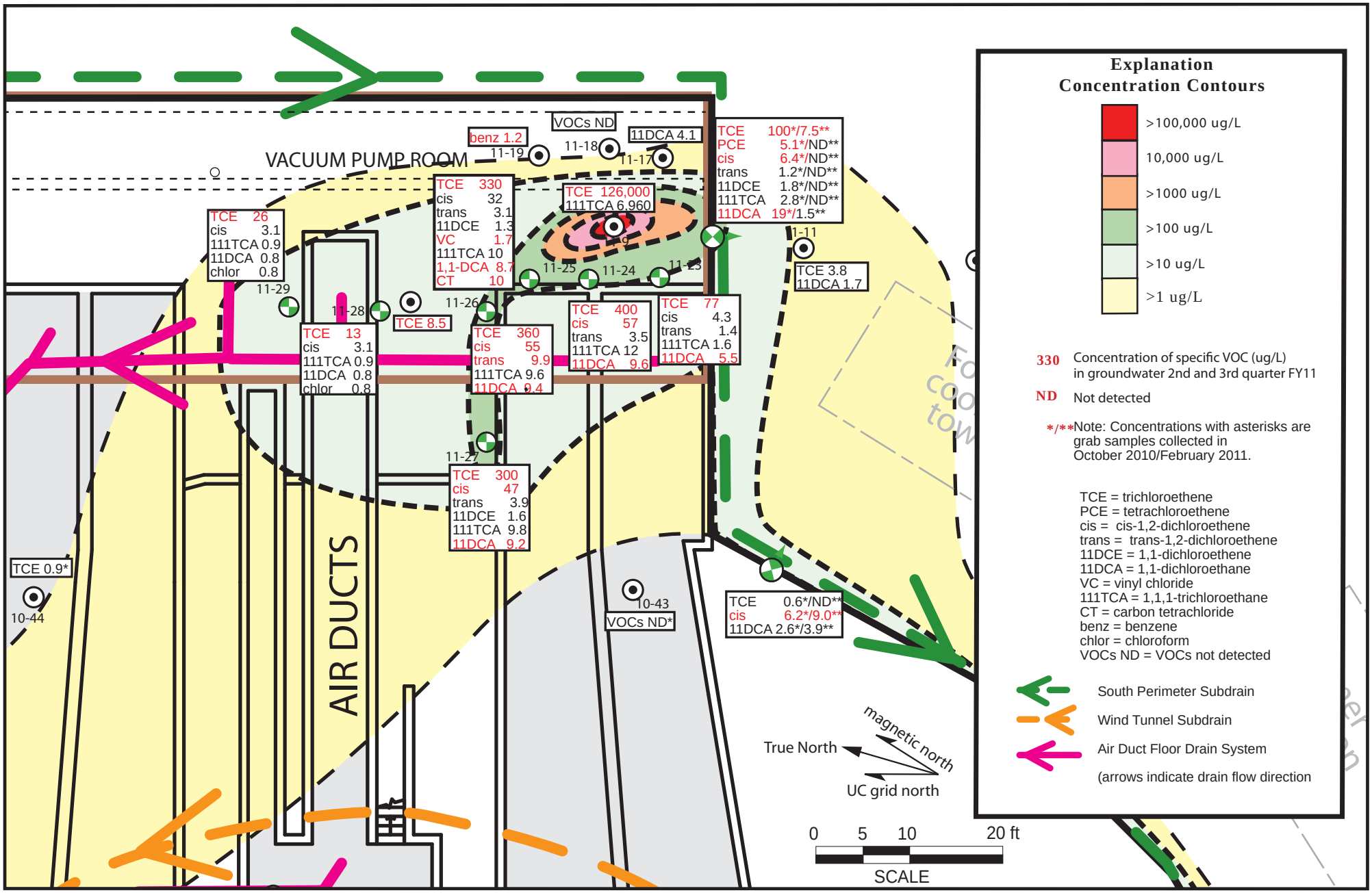


Figure 10. Isoconcentration Contour Map of Total Volatile Organic Compounds in Groundwater, Vacuum Pump Room Area.

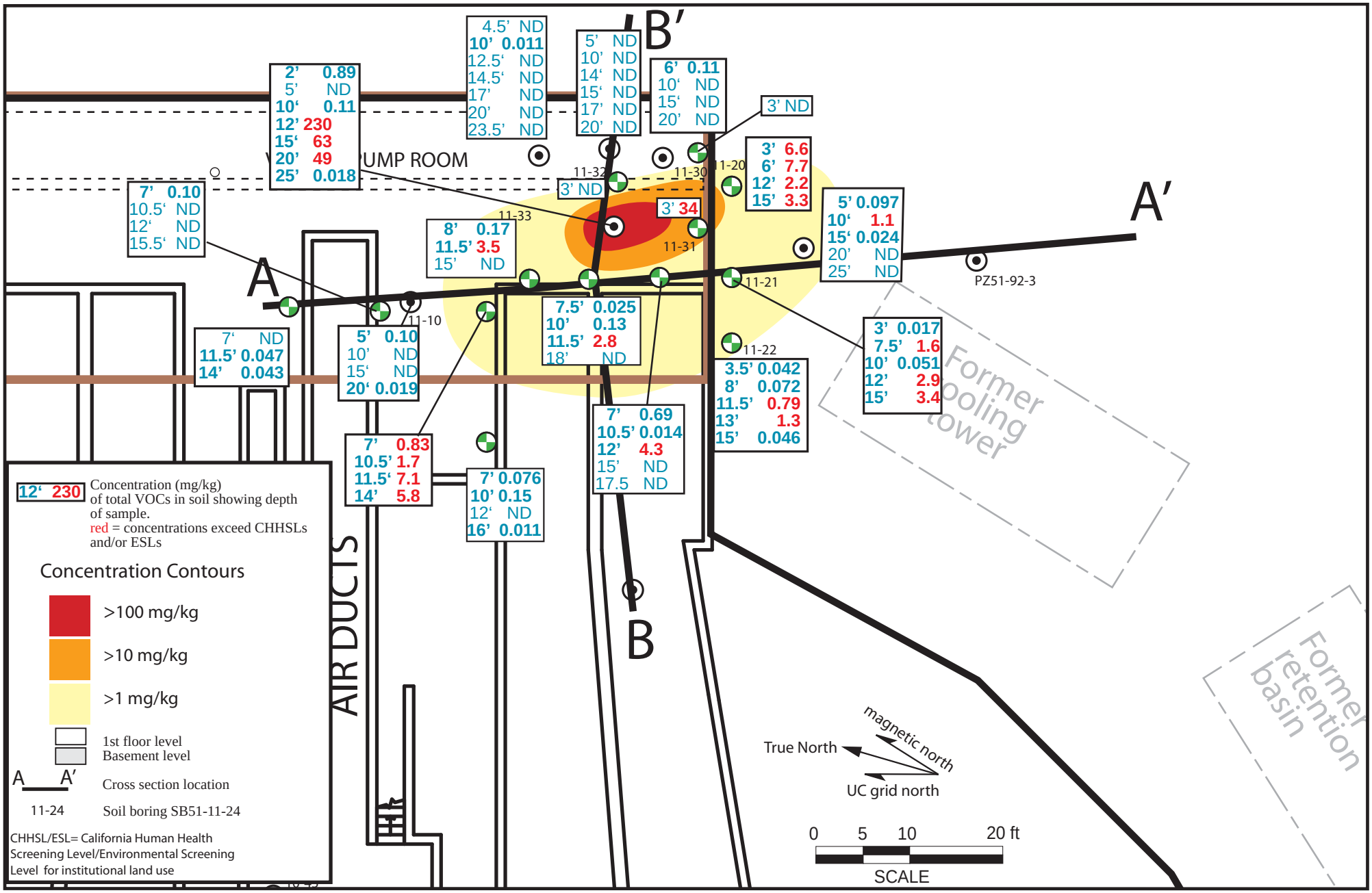


Figure 11. Total Volatile Organic Compounds Detected in Soil Borings, Vacuum Pump Room Area.

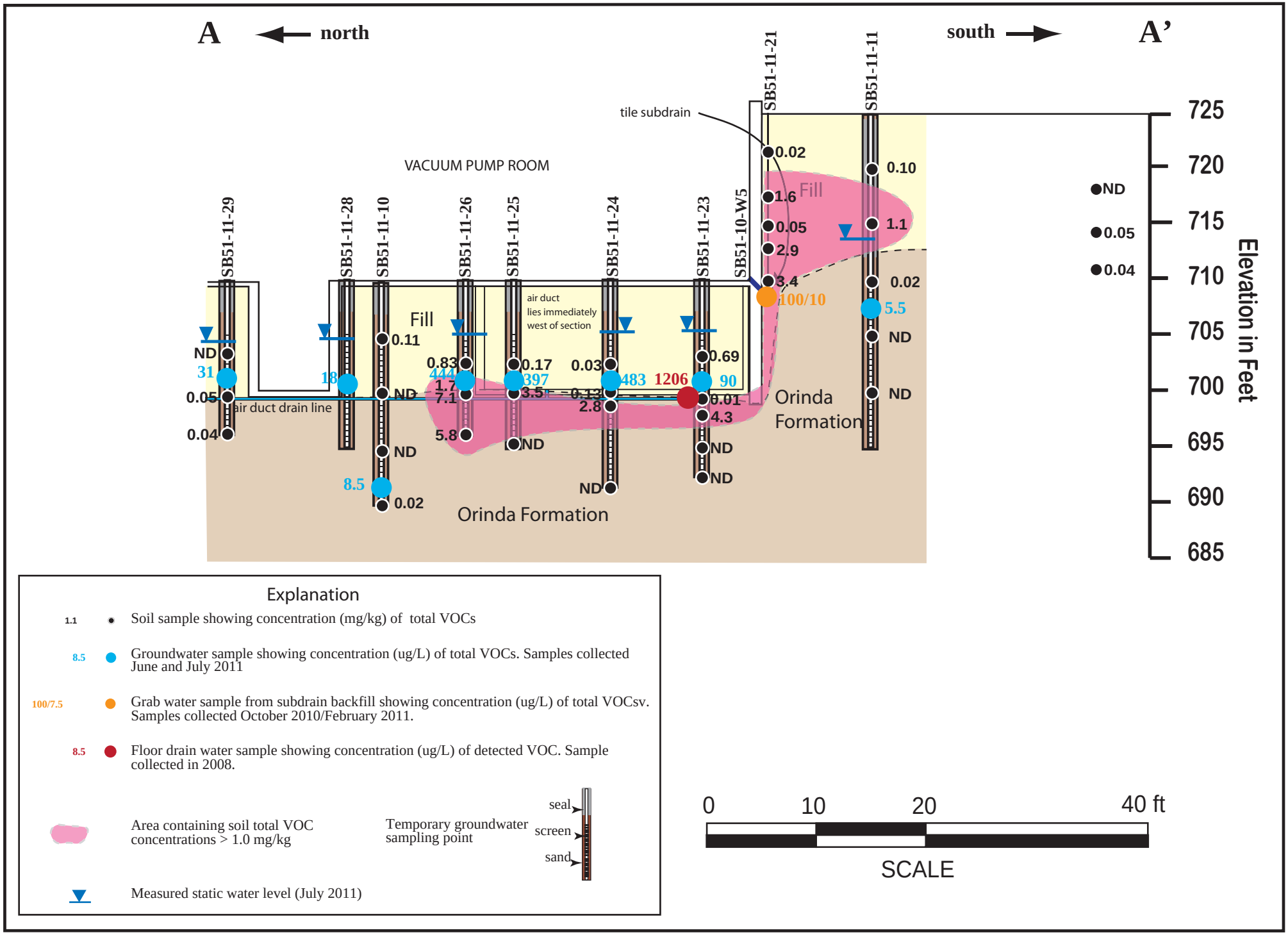


Figure 12. Geologic Cross Section A-A' Showing Sampling Results, Vacuum Pump Room Area.

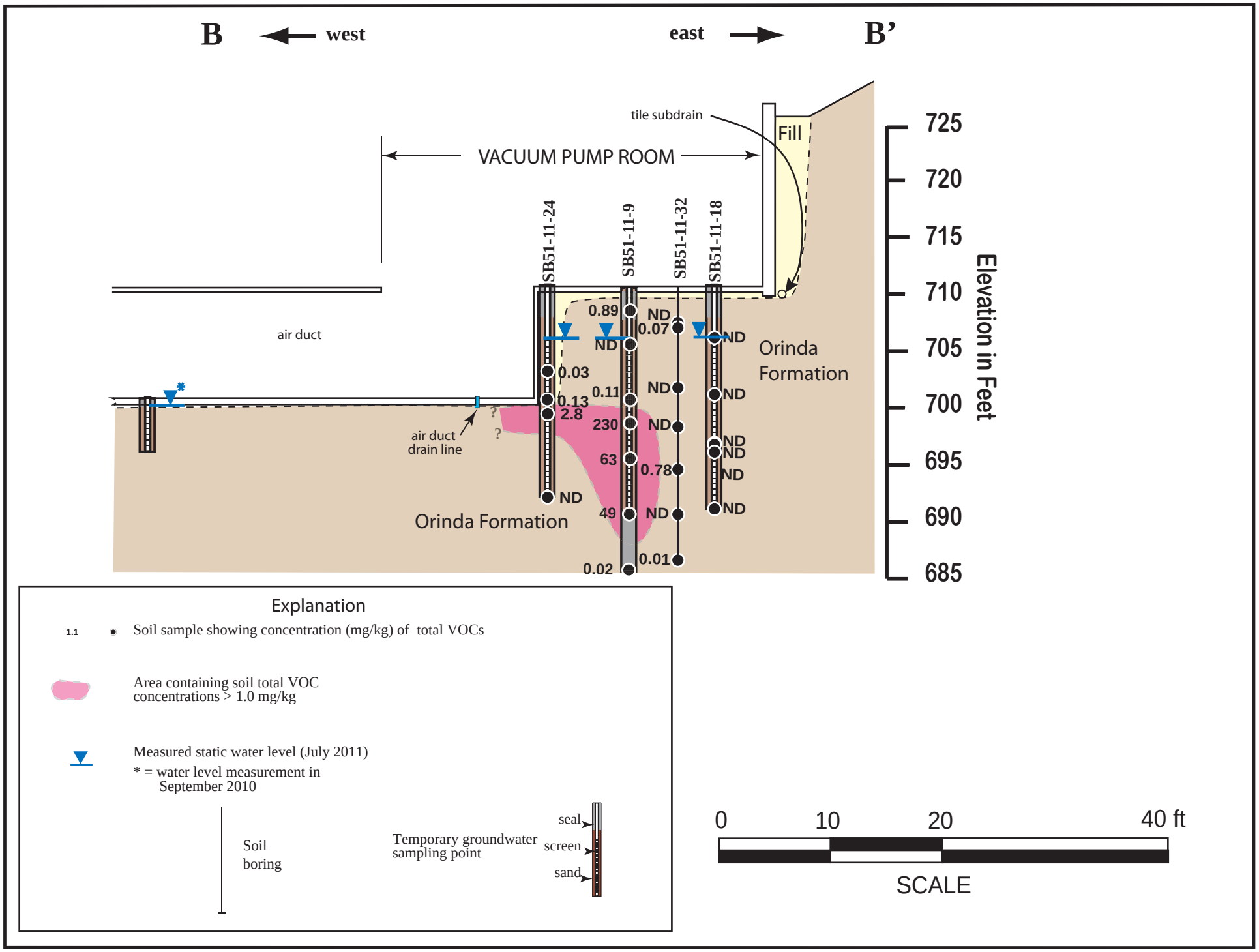


Figure 13. Geologic Cross Section B-B' Showing Sampling Results,Vacuum Pump Room Area.

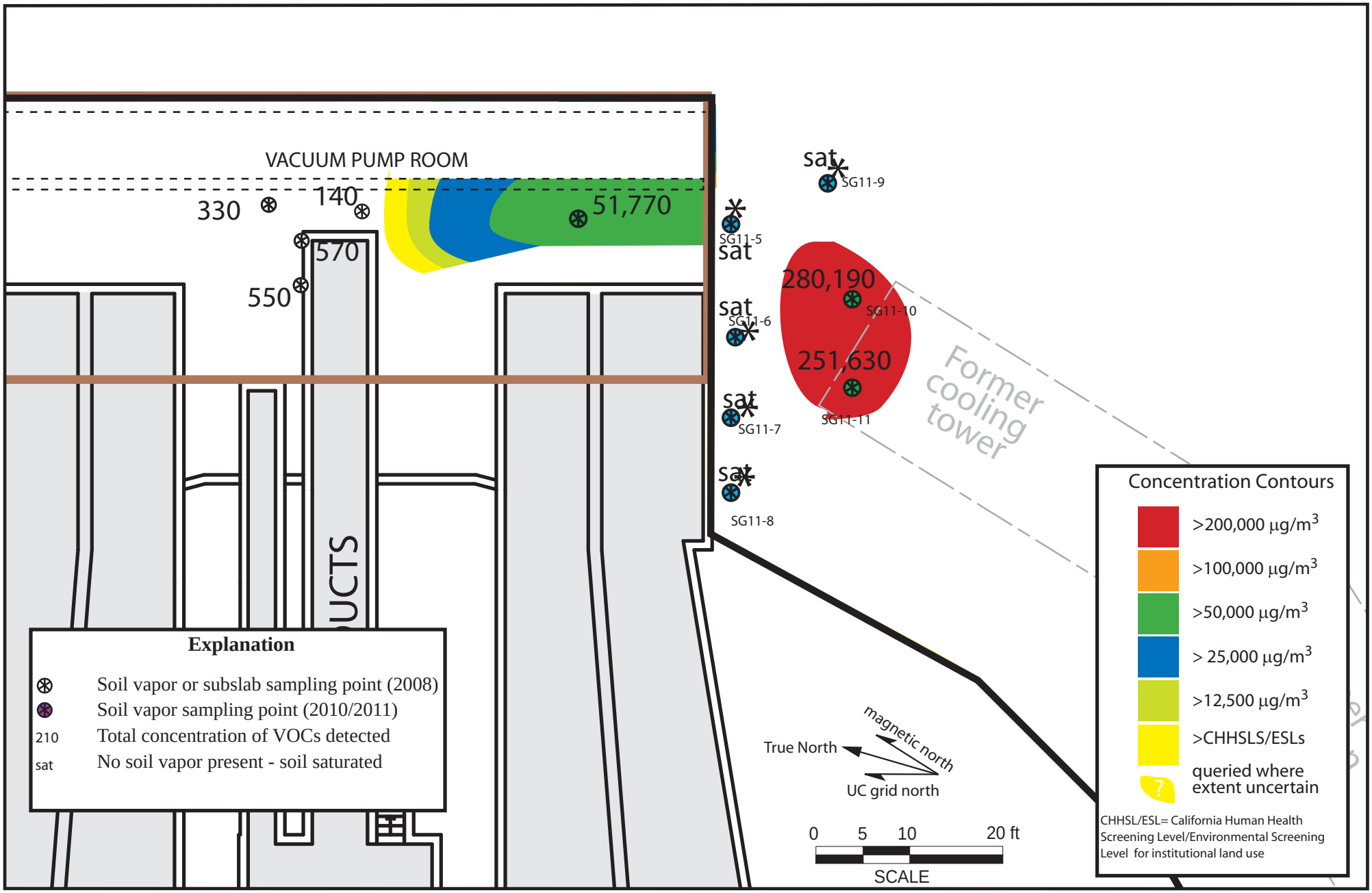


Figure 14. Isoconcentration Contour Map of Total Volatile Organic Compounds in Soil Vapor and Subslab Vapor, Vacuum Pump Room Area.

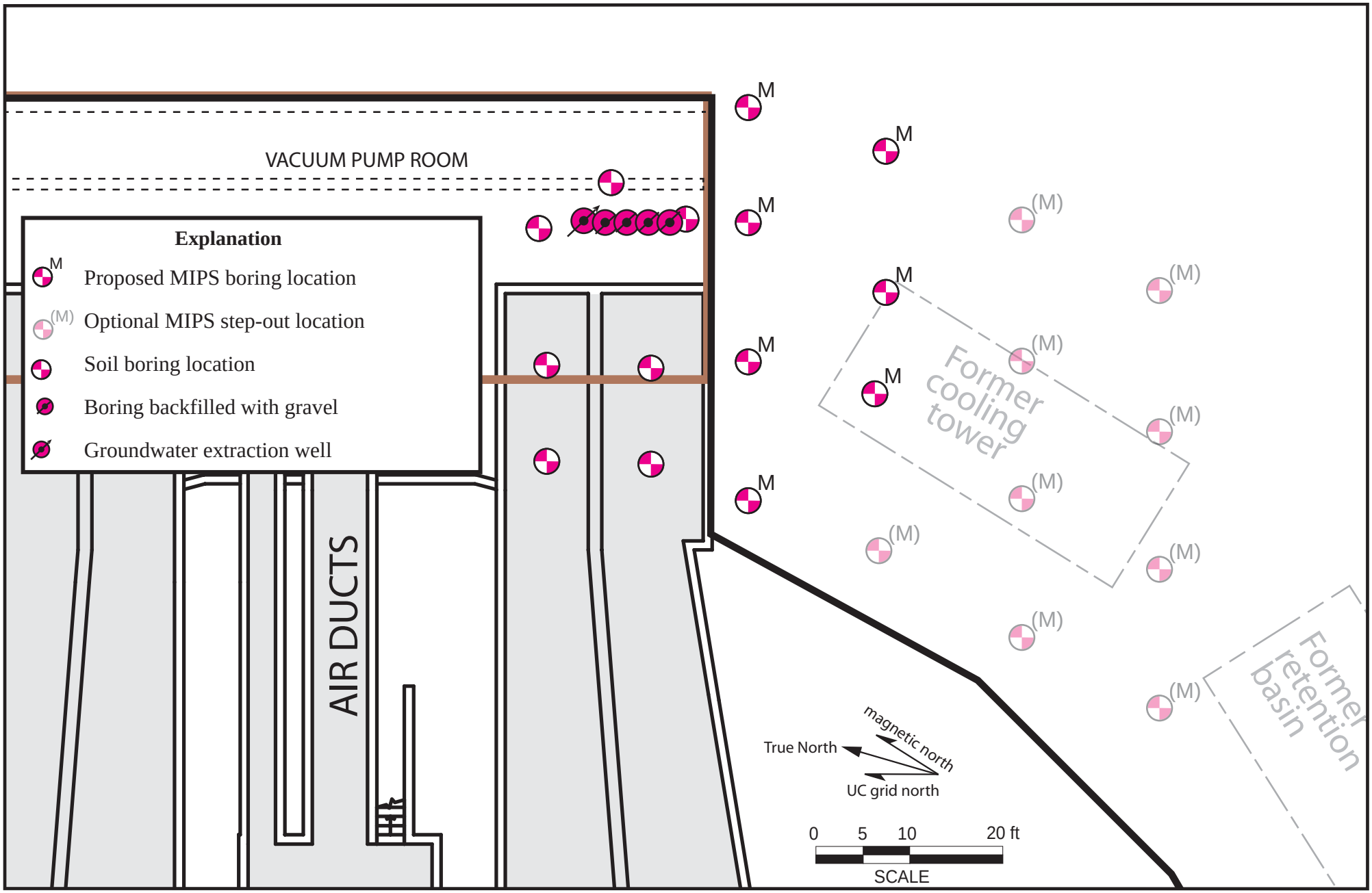


Figure 15. Proposed Locations for MIPS Borings, Soil Borings, and Dewatering System, Vacuum Pump Room Area.

ATTACHMENT 1
ANALYTICAL RESULTS

Table A1
Groundwater Sampling Results - Building 51 and Bevatron Demolition Area
Volatile Organic Compounds - EPA Method 8260
2010-2011**
(concentrations in µg/L)

Constituent	MCL	SB51-10-43 Oct-10^	SB51-10-44 Oct-10^	SB51-10-45 Oct-10?	SB51-10-48 Oct-10?	SB51-10-49 Oct-10?	SB51-11-1 Feb-11	SB51-11-1 Jun-11	SB51-11-2 Feb-11	SB51-11-3 Feb-11	SB51-11-4 Feb-11	SB51-11-5 Jun-11	SB51-11-6 Jun-11	SB51-11-9 Jun-11	SB51-11-10 Jun-11
Aromatic or Non-Halogenated Hydrocarbons															
Benzene	1	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2000	<1
n-Butylbenzene							<1	<1	<1	<1	<1	<1	<1	<2000	<1
sec-Butylbenzene							<1	<1	<1	<1	<1	<1	<1	<2000	<1
ter-Butylbenzene							<1	<1	<1	<1	<1	<1	<1	<2000	<1
Chlorobenzene	70	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2000	<1
Ethylbenzene	300	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2000	<1
Isopropylbenzene							<2	<2	<2	<2	<2	<2	<2	<4000	<2
p-Isopropyltoluene							<1	<1	<1	<1	<1	<1	<1	<2000	<1
Naphthalene							<2	<2	<2	<2	<2	<2	<2	<4000	<2
n-Propylbenzene							<1	<1	<1	<1	<1	<1	<1	<2000	<1
Toluene	150	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2000	<1
Xylenes, total	1750	<1	<1	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4000	<2
1,2,4-Trimethylbenzene							<1	<1	<1	<1	<1	<1	<1	<2000	<1
Total Aromatic Hydrocarbons															
Halogenated Non-Aromatic Hydrocarbons															
Bromodichloromethane	80	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2000	<1
Bromomethane	80	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	<20000	<10
Carbon Tetrachloride	0.5	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2000	<1
Chloroethane		<1	<1	<1	<1	<1	<30	<30	<30	<30	<30	<30	<30	<60000	<30
Chloroform	80	<0.5	<0.5	<1	<1	<1	<3	<3	<3	<3	<3	<3	<3	<6000	<3
Chloromethane		<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	<20000	<10
1,1-Dichloroethane	5	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2000	<1
1,2-Dichloroethane	0.5	<0.5	<0.5	<1	<1	<1	<2	<2	<2	<2	<2	<2	<2	<4000	<2
1,1-Dichloroethene	6	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2000	<1
cis-1,2-Dichloroethene	6	<0.5	<0.5				<1	<1	<1	1.7	<1	<1	<1	<2000	<1
trans-1,2-Dichloroethene	10	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2000	<1
1,2-Dichloropropane	5	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2000	<1
Methylene Chloride	5	<10	<10	<5	<5	<5	<1	<1	<1	<1	<1	<1	<1	<2000	<1
1,1,1,2-Tetrachloroethane		<0.5	<0.5	<1	<1	<1	<2	<2	<2	<2	<2	<2	<2	<4000	<2
1,1,2,2-Tetrachloroethane	1	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2000	<1
Tetrachloroethene	5	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2000	<1
1,1,1-Trichloroethane	200	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	6960	<1
1,1,2-Trichloroethane	5	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2000	<1
2,2-Dichloropropane				<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1
Trichloroethene	5	<0.5	0.9	<1	<1	<1	<1	<1	<1	2.6	<1	<1	<1	126000	8.5
Freon-113	1200	<2	<2	<5	<5	<5	<1	<1	<1	<1	<1	<1	<1	<2000	<1
Vinyl Chloride	0.5	<0.5	<0.5	<5	<5	<5	<1	<1	<1	<1	<1	<1	<1	<2000	<1
Total Halogenated Hydrocarbons			0.9			0.0				4.3				132,960	8.5
Total Concentration of VOCs			0.9			23				4.3				132,960	8.5
Acetone		<10	<10	<5	<5	5.45[B]									

MCL: Maximum contaminant level for drinking water (deter
All analyses by LBNL EML unless otherwise noted
^= Analysis by Curtis & Tompkins Ltd
?= Analysis by GEL Laboratories LLC
ND= Preliminary Data - Not Detected
* = Analysis by BC Laboratories
**Sampling results are from 2nd Quarter, Fiscal Year 2011 (Jan-Mar 2011) except for grab samples.

* = Analysis by BC Laboratories
(D) = Duplicate sample
[J]: Value is estimated
[B]: Analyte was detected in the associated blank

< = concentration less than reporting limit (RL)
= not analyzed
ND= Not Detected

Table A1 (cont)
Groundwater Sampling Results - Building 51 and Bevatron Demolition Area
Volatile Organic Compounds - EPA Method 8260
2010-2011**
(concentrations in µg/L)

SB51-11-12	SB51-11-14	SB51-11-15	SB51-11-16	SB51-11-17	SB51-11-18	SB51-11-19	SB51-11-23	SB51-11-24	SB51-11-25	SB51-11-26	SB51-11-27	SB51-11-28	SB51-11-29	SB51L-98-1A	51-96-16
Jul-11^	Jul-11^	Jul-11^	Jul-11^	Jun-11	Jun-11	Jun-11	Jul-11^	Jul-11^	Jul-11^	Jul-11^	Jul-11^	Jul-11^	Jul-11^	Mar-11	Jan-11^
<0.5	<0.5	<0.5	<0.5	<1	<1	1.2		<2.5	<1.3	<3.6	<1.3	<0.5	<0.5	<1	3.5
				<1	<1	<1								<1	
				<1	<1	<1								<1	
				<1	<1	<1								<1	
<0.5	<0.5	<0.5	<0.5	<1	<1	<1		<2.5	<1.3	<3.6	<1.3	<0.5	<0.5	<1	
<0.5	<0.5	<0.5	<0.5	<1	<1	<1		<2.5	<1.3	<3.6	<1.3	<0.5	<0.5	<1	<0.5
				<2	<2	<2								<2	
				<1	<1	<1								<1	
				<2	<2	<2								<2	
				<1	<1	<1								<1	
<0.5	<0.5	<0.5	<0.5	<1	<1	<1		<2.5	<1.3	<3.6	<1.3	<0.5	<0.5	<1	<0.5
<1	<1	<1	<1	<2	<2	<2		<5	<2.5	<7.1	<2.5	<1	<1	<2	<1
				<1	<1	<1								<1	
						1.2									3.5
<0.5	<0.5	<0.5	<0.5	<1	<1	<1	ND	<2.5	<1.3	<3.6	<1.3	<0.5	<0.5	<1	<0.5
<1	<1	<1	<1	<10	<10	<10	ND	<5	<2.5	<7.1	<2.5	<1	<1	<10	<10
<0.5	<0.5	<0.5	<0.5	<1	<1	<1	ND	<2.5	<1.3	<3.6	<1.3	<0.5	<0.5	<1	<0.5
<1	<1	<1	<1	<30	<30	<30	ND	<5	<2.5	<7.1	<2.5	<1	<1	<30	<1
<0.5	<0.5	<0.5	<0.5	<3	<3	<3	ND	<2.5	<1.3	<3.6	<1.3	0.8	0.6	<3	<0.5
<1	<1	<1	<1	<10	<10	<10	ND	<5	<2.5	<7.1	<2.5	<1	<1	<10	
<0.5	<0.5	<0.5	<0.5	4.1	<1	<1	5.5	9.6	8.7	9.4	9.2	0.8	3.0	11.9	0.8
<0.5	<0.5	<0.5	<0.5	<2	<2	<2	ND	<2.5	<1.3	<3.6	<1.3	<0.5	<0.5	<2	<0.5
<0.5	<0.5	<0.5	<0.5	<1	<1	<1	ND	<2.5	1.3	<3.6	1.6	<0.5	<0.5	<1	0.5
<0.5	<0.5	<0.5	<0.5	<1	<1	<1	4.3	57	32	55	47	3.1	12	77.9	48
<0.5	<0.5	<0.5	<0.5	<1	<1	<1	1.4	3.5	3.1	9.9	3.9	<0.5	5.3	8.9	8.5
<0.5	<0.5	<0.5	<0.5	<1	<1	<1	ND	<2.5	<1.3	<3.6	<1.3	<0.5	<0.5	<1	<0.5
<10	<10	<10	<10	<1	<1	<1	ND	<50	<25	<71	<25	<10	<10	<1	<10
<0.5	<0.5	<0.5	<0.5	<2	<2	<2	ND	<2.5	<1.3	<3.6	<1.3	<0.5	<0.5	<2	<0.5
<0.5	<0.5	<0.5	<0.5	<1	<1	<1	ND	<2.5	<1.3	<3.6	<1.3	<0.5	<0.5	<1	<0.5
<0.5	<0.5	<0.5	<0.5	<1	<1	<1	ND	<2.5	<1.3	<3.6	<1.3	<0.5	<0.5	4.1	<0.5
<0.5	<0.5	<0.5	<0.5	<1	<1	<1	1.6	12	10	9.6	9.8	0.9	<0.5	<1	<0.5
<0.5	<0.5	<0.5	<0.5	<1	<1	<1	ND	<2.5	<1.3	<3.6	<1.3	<0.5	<0.5	<1	<0.5
				<1	<1	<1	ND							<1	
<0.5	<0.5	<0.5	<0.5	<1	<1	<1	76.9	400	330	360	300	13	26	87	0.8
<2	<2	<2	<2	<1	<1	<1	ND	<10	<5	<14	<5	<2	<2	<1	<2
<0.5	<0.5	<0.5	<0.5	<1	<1	<1	ND	<2.5	1.7	<3.6	2.0	<0.5	<0.5	<1	14
				4.1		0.0	90	482	387	444	374	19	47	190	73
				4.1		1.2		482	387	444	374	19	47	190	76
<10	<10	<10	<10					<10	<10	<10	<10	<10	<10		<10

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B: Analyte was detected in the associated blank

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= not analyzed
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Table A1 (cont)
Groundwater Sampling Results - Building 51 and Bevatron Demolition Area
Volatile Organic Compounds - EPA Method 8260
2010-2011**
(concentrations in µg/L)

51-96-17			51-96-18			51B-93-18A		EW51-07-1		EW51-07-2		EW51A-06-1			EW51L-06-1			
Jan-11^	Feb-11	Mar-11	Jan-11^	Feb-11	Mar-11	Mar-11	(D)*	Jan-11^	Mar-11	Jan-11^	Mar-11	Jan-11^	Feb-11	Mar-11	Jan-11^	Feb-11	Mar-11	Mar-11
<0.5	<1	<1	<0.5	<1	<1	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<1	<0.5	<1	<1	<1
	<1	<1		<1	<1	<1			<1		<1		<1	<1		<1	<1	<1
	<1	<1		<1	<1	<1			<1		<1		<1	<1		<1	<1	<1
	<1	<1		<1	<1	<1			<1		<1		<1	<1		<1	<1	<1
								<0.5	<1	<0.5	<1	<0.5	<1	<1	<0.5	<1	<1	<1
<0.5	<1	<1	<0.5	<1	<1	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<1	<0.5	<1	<1	<1
	<2	<2		<2	<2	<2			<2		<2		<2	<2		<2	<2	<2
	<1	<1		<1	<1	<1			<1		<1		<1	<1		<1	<1	<1
	<2	<2		<2	<2	<2			<2		<2		<2	<2		<2	<2	<2
	<1	<1		<1	<1	<1			<1		<1		<1	<1		<1	<1	<1
<0.5	<1	<1	<0.5	<1	<1	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<1	<0.5	<1	<1	<1
<1	<2	<2	<1	<2	<2	<2	<1	<1	<2	<1	<2	<1	<2	<2	<1	<2	<2	<2
	<1	<1		<1	<1	<1			<1		<1		<1	<1		<1	<1	<1
<0.5	<1	<1	<0.5	<1	<1	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<1	<0.5	<1	<1	<1
<10	<10	<10	<10	<10	<10	<10	<0.5	<1	<10	<1	<10	<1	<10	<10	<1	<10	<10	<10
<0.5	<1	<1	<0.5	<1	<1	<1	<0.5	<0.5	<1	<0.5	<1	14	26.3	16.4	1.4	<1	5.5	4.2
<1	<30	<30	<1	<30	<30	<30	<0.5	<1	<30	<1	<30	<1	<30	<30	<1	<30	<30	<30
<0.5	<3	<3	<0.5	<3	<3	<3	<0.5	<0.5	<3	<0.5	<3	2.5	6.5	3.4	4.6	<3	5.4	3.4
								<1	<10	<1	<10	<1	<10	<10	<1	<10	<10	<10
0.8	1.5	1.6	2.4	2.9	5.6	3.3	3.9	2.9	<1	1.6	2.4	1.3	<1	<1	2	1.3	1.5	1.4
<0.5	<2	<2	<0.5	<2	<2	<2	<0.5	<0.5	<2	<0.5	<2	<0.5	<2	<2	<0.5	<2	<2	<2
<0.5	<1	<1	1.4	1.3	1.8	<1	<0.5	1.7	<1	<0.5	<1	1.1	<1	<1	<0.5	<1	<1	<1
0.8	1.8	1.6	<0.5	<1	<1	49.1	49	55	12.7	2	4.7	9.4	12.7	5.9	13	5.8	10.1	7.9
<0.5	<1	<1	<0.5	<1	<1	9.4	10	3.3	<1	<0.5	<1	<0.5	<1	<1	<0.5	<1	<1	<1
<0.5	<1	<1	<0.5	<1	<1	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<1	<0.5	<1	<1	<1
<10	<1	<1	<10	<1	<1	<1	<1	<10	<1	<10	<1	<10	<1	<1	<10	<1	<1	<1
<0.5	<1	<1	<0.5	<1	<1			<0.5	<2	<0.5	<2	<0.5	<2	<2	<0.5	<2	<2	<2
<0.5	<1	<1	<0.5	<1	<1	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<1	<0.5	<1	<1	<1
<0.5	<1	<1	59	29.4	29.7	<1	<0.5	<0.5	<1	<0.5	<1	5.7	7.8	3.2	<0.5	<1	<1	<1
<0.5	<1	<1	<0.5	<1	<1	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<1	<0.5	<1	<1	<1
<0.5	<1	<1	<0.5	<1	<1	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<1	<0.5	<1	<1	<1
	<1	<1		<1	<1	<1			<1		<1		<1	<1		<1	<1	<1
<0.5	<1	<1	8.6	6	7.3	7.9	9.5	29	9.2	12	11.3	120	271	145	14	5.3	27.4	16.3
<2	<1	<1	<2	<1	<1	<1	<0.5	<2	<1	<2	<1	<2	<1	<1	<2	<1	<1	<1
<0.5	1.2	<1	<0.5	<1	<1	1.1	1.2	<0.5	<1	<0.5	<1	<0.5	<1	<1	<0.5	<1	<1	<1
1.6	4.5	3.2	71	40	44	71	74	92	22	16	18	154	324	174	35	12	50	33
1.6	4.5	3.2	71	40	44	71	74	92	22	16	18	154	324	174	35	12	50	33
<10			<10				<10	<10		<10		<10						

MCL: Maximum contaminant level for * = Analysis by BC Laboratories
All analyses by LBNL EML unless othe (D) = Duplicate sample
^= Analysis by Curtis & Tompkins J: Value is estimated
?= Analysis by GEL Laboratories l B: Analyte was detected in the associated blank
ND= Preliminary Data - Not Detected
* = Analysis by BC Laboratories
**Sampling results are from 2nd Quarter, Fiscal Year 2011 (Jan-Mar 2011) except for grab samples.

< = concentration less than reporting limit (RL)
= not analyzed
ND= Not Detected

Table A2
Groundwater Sampling Results - Building 51 and Bevatron Angle Borings
Volatile Organic Compounds

(concentrations in ug/L)

			VOCs						
			1,1-DCA	1,1-DCE	**cis-1,2-DCE**	trans-1,2-DCE	1,1,1-TCA	**PCE**	**TCE**
		MCL	5	5	6	10	200	5	5
Location		Date							
SB51-10-W2	EML	3/11/11	1.3	<1	14.7	<1	<1	97	45.5
SB51-10-W3	CT	10/6/10	7.4	1.3	36	<1	1.6	130	110
SB51-10-W3	EML	3/11/11	3.2	<1	1.2	<1	<1	8.8	20.6
SB51-10-W4	CT	10/7/10	2.6	<0.5	6.2	<0.5	<0.5	<0.5	0.6
SB51-10-W4	EML	3/11/11	3.9	<1	9	<1		<1	<1
SB51-10-W5	CT	10/2/10	19	1.8	6.4	1.2	2.8	5.1	100
SB51-10-W5	EML	3/11/11	1.5	<1	<1	<1	<1	<1	7.5
SB51-10-W6	EML	3/11/11	<1	<1	<1	<1	<1	<1	<1
SB51-11-W1	EML	3/11/11	2.1	<1	3.5	<1	<1	2.7	12.5

All analyses by LBNL EML unless otherwise noted
CT= Analysis by Curtis & Tompkins Ltd

<	= Less than Quantitation Limit
	= not analyzed

Table A3
Soil Sampling Results -Building 51 Vacuum Pump Room Area
Volatile Organic Compounds
(concentrations in mg/kg)

Location	Sample ID	Depth (ft)	Lab	Date	8260 TCE	PCE	cis-1,2-DCE	1,1-DCE	1,1-DCA	Other Analytes
SB51-11-9	SB51-11-9-2'	2	CT	4/29/11	0.34		0.55			ND
	SB51-11-9-5'	5	CT	4/29/11	ND	ND	ND	ND	ND	ND
	SB51-11-9-10'	10	CT	4/29/11	ND	ND	ND	ND	ND	Acetone=0.096 Benzene=0.0097
	SB51-11-9-12'	12	CT	4/29/11	230	ND	ND	ND	ND	ND
	SB51-11-9-15'	15	CT	4/29/11	63	ND	ND	ND	ND	ND
	SB51-11-9-20'	20	CT	4/29/11	47	ND	ND	ND	ND	1,1,1-TCA=1.9
	SB51-11-9-25'	25	CT	4/29/11	0.018	ND	ND	ND	ND	ND
SB51-11-10	SB51-11-10-5'	5	CT	4/29/11	0.095	ND	0.0056	ND	ND	ND
	SB51-11-10-10'	10	CT	4/29/11	ND	ND	ND	ND	ND	ND
	SB51-11-10-15'	15	CT	4/29/11	ND	ND	ND	ND	ND	ND
	SB51-11-10-20'	20	CT	4/29/11	ND	ND	ND	ND	ND	Benzene=0.019
SB51-11-11	SB51-11-11-5'	5	CT	4/29/11	0.0076	ND	0.021	ND	ND	ND
	SB51-11-11-10'	10	CT	4/29/11	1.1	ND	ND	ND	ND	ND
	SB51-11-11-15'	15	CT	4/29/11	ND	ND	ND	ND	0.012	2-Butanone=0.012
	SB51-11-11-20'	20	CT	4/29/11	ND	ND	ND	ND	ND	ND
	SB51-11-11-25'	25	CT	4/29/11	ND	ND	ND	ND	ND	ND
	SB51-11-11-30'	30	CT	4/29/11	ND	ND	ND	ND	ND	ND
SB51-11-17	SB51-11-17-6'	6	CT	5/26/11	0.063	ND	ND	0.013	0.013	Benzene=0.0068 1,1,1-TCA=0.012 Freon 113=0.006
	SB51-11-17-10'	10	CT	5/26/11	ND	ND	ND	ND	ND	ND
	SB51-11-17-15'	15	CT	5/26/11	ND	ND	ND	ND	ND	ND
	SB51-11-17-20'	20	CT	5/26/11	ND	ND	ND	ND	ND	ND
SB51-11-18	SB51-11-18-5'	5	CT	5/26/11	ND	ND	ND	ND	ND	ND
	SB51-11-18-10'	10	CT	5/26/11	ND	ND	ND	ND	ND	ND
	SB51-11-18-14'	14	CT	5/26/11	ND	ND	ND	ND	ND	ND
	SB51-11-18-15'	15	CT	5/26/11	ND	ND	ND	ND	ND	ND
	SB51-11-18-17'	17	CT	5/26/11	ND	ND	ND	ND	ND	ND
	SB51-11-18-20'	20	CT	5/26/11	ND	ND	ND	ND	ND	ND
SB51-11-19	SB51-11-19-4.5'	4.5	CT	5/26/11	ND	ND	ND	ND	ND	ND
	SB51-11-19-10'	10	CT	5/26/11	ND	ND	ND	ND	ND	Methylene Chloride=0.011
	SB51-11-19-12.5'	12.5	CT	5/26/11	ND	ND	ND	ND	ND	ND
	SB51-11-19-14.5'	14.5	CT	5/26/11	ND	ND	ND	ND	ND	ND
	SB51-11-19-17.5'	17.5	CT	5/26/11	ND	ND	ND	ND	ND	ND
	SB51-11-19-20'	20	CT	5/26/11	ND	ND	ND	ND	ND	Benzene=0.014

Table A3 (cont)
Soil Sampling Results -Building 51 Vacuum Pump Room Area
Volatile Organic Compounds
(concentrations in mg/kg)

SB51-11-20	SB51-11-20-3'	3	CT	7/12/11	1.2	5.3	0.091	0.015	0.023	1,1,1-TCA=0.0071
	SB51-11-20-6'	6	CT	7/12/11	6.3	1.3	0.068	0.0086	0.014	1,1,1-TCA=0.0044
	SB51-11-20-12'	12	CT	7/12/11	1.2	1	0.024	ND	0.0086	1,1,1-TCA=0.0046
	SB51-11-20-15'	15	CT	7/12/11	1.4	1.8	0.063	ND	0.0072	ND
SB51-11-21	SB51-11-21-3'	3	CT	7/12/11	0.017			ND		ND
	SB51-11-21-7.5'	7.5	CT	7/12/11	1.2	0.28	0.0089	ND	0.012	ND
	SB51-11-21-10'	10	CT	7/12/11	0.044	0.007		ND		ND
	SB51-11-21-12'	12	CT	7/12/11	2.5	0.23	0.013	ND	0.023	1,1,1-TCA=0.0049
	SB51-11-21-15'	15	CT	7/12/11	3.1	0.31	0.011	ND	0.019	1,1,1-TCA=0.0047 Benzene=0.0074
SB51-11-22	SB51-11-22-3.5'	3.5	CT	7/12/11	0.042	ND	ND	ND		ND
	SB51-11-22-8'	8	CT	7/12/11	0.068	0.0041	ND	ND		ND
	SB51-11-22-11.5'	11.5	CT	7/12/11	0.55	0.02	ND	ND	0.0065	Benzene=0.036
	SB51-11-22-13'	13	CT	7/12/11	1.1	0.015	ND	ND	0.0066	ND
	SB51-11-22-15'	15	CT	7/12/11	0.04	0.0048	ND	ND	0.008	ND
SB51-11-23	SB51-11-23-7'	7	CT	7/25/11	ND	ND	0.69	ND		ND
	SB51-11-23-10.5'	10.5	CT	7/25/11	0.0066	ND	ND	ND	0.0072	ND
	SB51-11-23-12'	12	CT	7/25/11	4.3	ND	0.012	0.0046	0.015	trans-1,2-DCE=0.021
	SB51-11-23-15'	15	CT	7/25/11	ND	ND	ND	ND	ND	ND
	SB51-11-23-17.5'	17.5	CT	7/25/11	ND	ND	ND	ND	ND	ND
SB51-11-24	SB51-11-24-7.5'	7.5	CT	7/25/11	0.16	ND	0.086	ND	ND	ND
	SB51-11-24-10'	10	CT	7/25/11	0.11	ND	0.033	ND	ND	ND
	SB51-11-24-11.5'	11.5	CT	7/25/11	2.8	ND	ND	ND	ND	1,1,1-TCA=0.011
	SB51-11-24-18'	18	CT	7/25/11		ND	ND	ND	ND	ND
SB51-11-25	SB51-11-25-8'	8	CT	7/25/11	0.017	ND	ND	ND	ND	ND
	SB51-11-25-11.5'	11.5	CT	7/25/11	3.5	ND	0.013	ND	0.0064	1,1,1-TCA=0.013 trans-1,2-DCE=0.0085
	SB51-11-25-15'	15	CT	7/25/11	ND	ND	ND	ND	ND	ND
SB51-11-26	SB51-11-26-7'	7	CT	7/25/11	0.82	ND	0.0093	ND		ND
	SB51-11-26-10.5'	10.5	CT	7/25/11	1.4	ND	0.27	ND	0.0051	ND
	SB51-11-26-11.5'	11.5	CT	7/25/11	1.2	ND	0.02	ND	0.012	trans-1,2-DCE=0.0052
	SB51-11-26-14'	14	CT	7/25/11	5.7	ND	0.06	0.0071	0.019	1,1,1-TCA=0.01 trans-1,2-DCE=0.085

Table A3 (cont)
Soil Sampling Results -Building 51 Vacuum Pump Room Area
Volatile Organic Compounds
(concentrations in mg/kg)

SB51-11-27	SB51-11-27-7'	7	CT	7/25/11	0.076	ND	ND	ND	ND	ND
	SB51-11-27-10'	10	CT	7/25/11	0.15	ND	0.01	ND	ND	1,1,1-TCA=0.0041 Benzene=0.01
	SB51-11-27-12'	12	CT	7/25/11	ND	ND	ND	ND	ND	ND
	SB51-11-27-16'	16	CT	7/25/11	ND	ND	ND	ND	ND	Benzene=0.011
SB51-11-28	SB51-11-28-7'	7	CT	7/25/11	0.095	ND	0.0047	ND	ND	ND
	SB51-11-28-10.5'	10.5	CT	7/25/11	ND	ND	ND	ND	ND	ND
	SB51-11-28-12'	12	CT	7/25/11	ND	ND	ND	ND	ND	ND
	SB51-11-28-15.5'	15.5	CT	7/25/11	ND	ND	ND	ND	ND	ND
SB51-11-29	SB51-11-29-7'	7	CT	7/25/11	ND	ND	ND	ND	ND	ND
	SB51-11-29-11.5'	11.5	CT	7/25/11	0.047	ND	ND	ND	ND	ND
	SB51-11-29-14'	14	CT	7/25/11	0.028	ND	0.0053	ND	ND	Methylene Chloride=0.01
SB51-11-30	SB51-11-30-3'	3	CT	8/8/11	ND	ND	ND	ND	ND	ND
SB51-11-31	SB51-11-31-3'	3	CT	8/8/11	32	ND	2.2	ND	ND	ND
SB51-11-32	SB51-11-32-3'	3	CT	8/8/11	ND	ND	ND	ND	ND	ND

CT= Analysis by Curtis & Tompkins Ltd ND = concentration less than reporting limit (RL)

Table A4
Building 51 Soil Vapor Sampling Results - Vacuum Pump Room Area
Modified EPA Method TO-15

2010/2011

(concentrations in µg/m^3)

		1,1-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	1,1,1-TCA	Benzene	PCE	TCE	Toluene	Vinyl Chloride	2-Propanol*
Industrial Land Use				**44,400**	**88,700**	**2,790,000**	**122**	**603**	**1,770**	**378,000**	**44.8**	
Industrial Land Use		**5,100**	**120,000**	**20,000**	**41,000**	**1,300,000**	**280**	**1,400**	**4,100**	**180,000**	**100**	
Location	**Date**											
SG51-10-34	9/29/2014	730	760	23,000	730	550	<37	<79	**12,000**	<44	**14,000**	<110
(D)	9/29/2014	720	730	23,000	710	540	<37	<79	**12,000**	<44	**16,000**	<110
SG51-11-10	8/3/2015	**24,000**	55,000	15,000	32,000	<280	**290**	<340	**150,000**	<190	**3,900J**	<500
SG51-11-11	8/3/2015	**18,000**	26,000	9,900	14,000	<260	240	**2,500**	**180,000**	<180	**990J**	<470

All samples were analyzed by Air Toxics LTD.

CHHSL: California Human Health Screening Level for Commercial/Industrial land use (California EPA, 2005)

ESL: Environmental Screening Level for Commercial/Industrial land use (Water Board, 2008)

J: estimated value

< = concentration Less than reporting limit

* 2-Propanol used as leak detection tracer during sampling.

ATTACHMENT 2

TYPICAL TEMPORARY GROUNDWATER SAMPLING POINT CONSTRUCTION DETAILS

Temporary Groundwater Sampling Point Construction Details

Temporary groundwater sampling points will be constructed with 2-inch diameter PVC casing installed in an 8 1/2-inch diameter boring using hollow stem auger drilling equipment. Additional details are provided in Table 1 (Construction Materials) and shown on Figure 1. Construction details may be modified based on the actual site conditions encountered during drilling.

Upon completion of drilling, the total depth of the boring will be confirmed with a weighted tape measure. The top of the casing will be cut approximately 6 inches below grade. The bentonite pellets will be hydrated with drinking water and allowed to set for a minimum of one hour. The sampling point will be marked so that it can be easily seen and identified and the location will be surveyed. Groundwater samples will be collected from the sampling points following well development.

Table 1

Temporary Groundwater Sampling Point Construction Materials

Well Item	Materials
Screen	2-inch ID, 0.010-inch factory slotted Schedule 40 PVC pipe.
Casing	2-inch flush-threaded Schedule 40 PVC pipe (5-foot or 10-foot) sections).
Filter Pack	2/12 or 1/20 Monterey sand depending on formation grain size formation.
Bentonite Seal	0.25-inch or 0.375-inch bentonite pellets
Grout Seal	2 pounds bentonite powder: 6.5 pounds water: 94 pounds Portland cement.
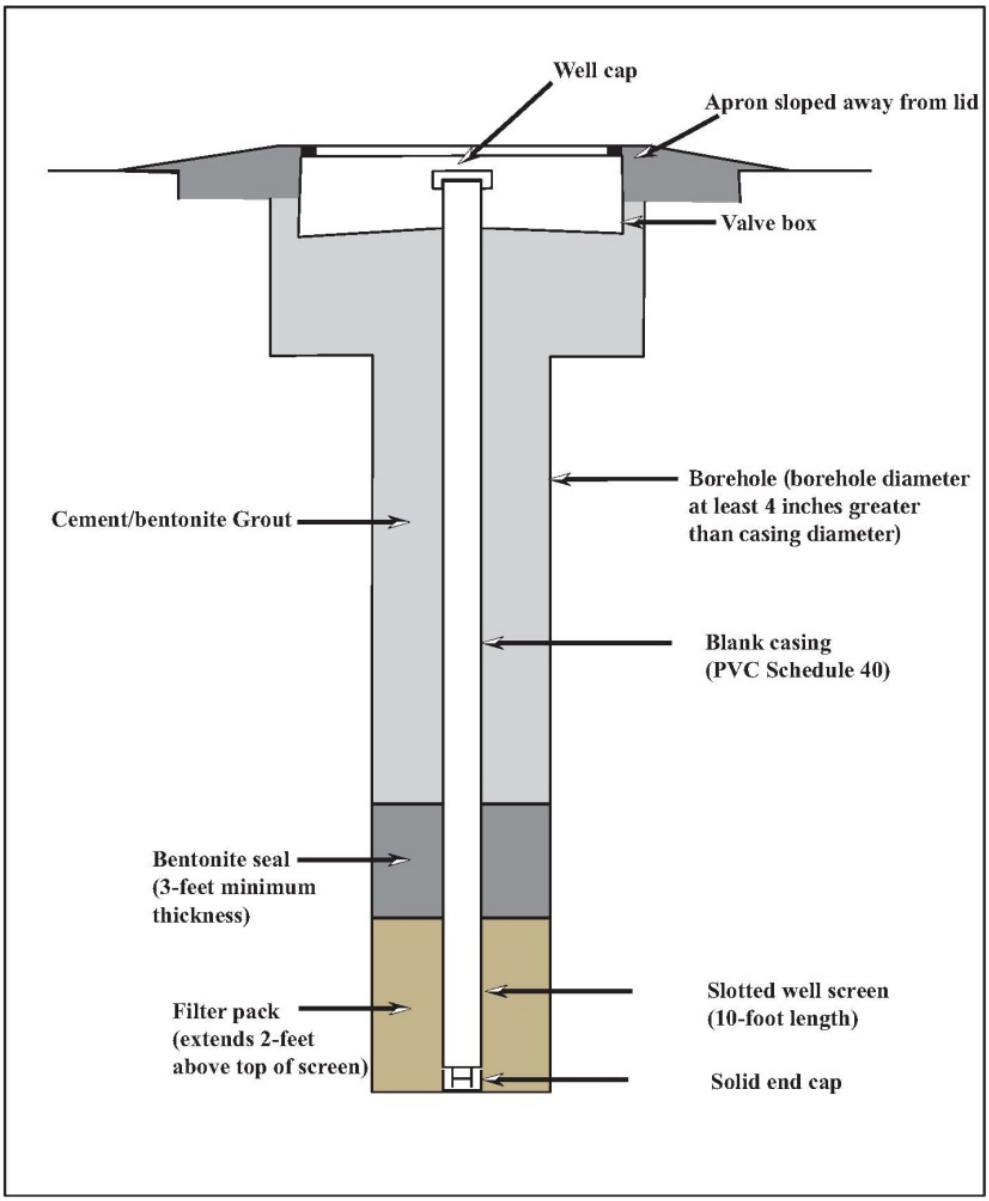
Figure 1.
Typical Well Construction Details