April 29, 2015

Mr. Ed Olson and Mr. Allan Timm
Minnesota Pollution Control Agency
Voluntary Investigation & Cleanup Program
520 Lafayette Road North
St. Paul, MN 55155

Re: Active Sub-Slab Venting System Modification Work Plan
MN Bio Business Center, Rochester, MN

Dear Mr. Olson and Mr. Timm:

On behalf of the City of Rochester and Landmark Environmental, LLC (Landmark) has prepared this Active Sub-Slab Venting System Modification Work Plan (Work Plan) for the above referenced property (Property). The Property location map is included as **Figure 1**. This Work Plan includes the results from pre-mitigation diagnostic testing conducted on the existing venting system on March 23, 2015. Based on the pre-mitigation diagnostic testing results, this Work Plan includes the proposed design modifications to convert the existing passive venting system to an active vapor mitigation system (VMS). This Work Plan is being submitted to the Minnesota Pollution Control Agency (MPCA) Voluntary Investigation and Cleanup (VIC) Program for review and approval.

Pre-Mitigation Diagnostic Testing Results

Pre-mitigation diagnostic testing activities were conducted by Landmark on March 23, 2015. The goal of the diagnostic testing was to assess the suitability of converting the existing passive venting system to an active VMS; to measure the pressure field extension as a function of applied vacuum at the stacks of each venting system; and, to specify the type of fans required for each existing venting system stack to provide adequate pressure field extension. Photos of the pre-mitigation diagnostic testing activities are shown in **Attachment 1**. **Figure 2** shows the basement level sub-slab – foundation venting and drainage system asbuilt drawing. **Figure 3** shows the basement asbuilt drawing with venting system riser piping sample ports V-1 through V-4, along with the Landmark soil gas (LSG) sampling locations LSG-7 through LSG-10. Sample ports V-1 through V-4 are located at a height of approximately 5 feet above the basement slab, and LSG-7 through 10 are located approximately 8 feet above the basement slab. Venting system V-4, shown on **Figure 3**, is actually located below the first floor slab and not below basement slab venting systems, V-1 through V-3. Pressure readings were collected at each of these locations during the pre-mitigation diagnostic testing event. **Figure 4** shows the second floor – foundation venting and DPE system asbuilt drawing.

The diagnostic testing process involved temporarily removing the turbine vent from each of the three 6-inch venting system PVC pipes shown in **Figure 4** and temporarily connecting an AMG Force and/or Fury fan to the outlet pipe. These fans was selected for testing based on its high

airflow and high pressure operating characteristics and for their low wattage. With the blower connected and powered on, a vacuum was applied at each venting system outlet pipe. The northern stack is connected to venting system V-4. The southern stack is connected to venting system V-2. The middle stack is connected to venting systems V-1 and V-3. Measurements of pressure differential were evaluated at permanent soil gas sampling ports (LSG-7, LSG-8, LSG-9, and LSG-10) and venting system riser pipes (V-1, V-2, V-3, and V-4) accessible from the basement of the Property building. Separate tests for each of the three existing venting systems, V-1 and V-3, V-2, and V-4, were conducted. In this manner, the pressure field extension was evaluated using a digital micro-manometer during each individual venting system test. Fan operating pressure readings at the stack location were recorded at the stack location; however, Landmark was not able to collect the data required to determine the actual flow rates of the fans during each test due to the testing conditions and elevated locations of the stacks, just below the 3rd floor.

An AMG Force fan was tested on system V-4 with the pressure field extension readings as shown on **Figure 5**. The fan pressure reading was -1.5 inches of water column (in. WC) with riser pipe readings ranging from 0 to -0.017 in. WC and pressure field extension readings from LSG-7 through LSG-10 ranging from -0.116 to 0.027 in WC. The pre-mitigation diagnostic testing results are provided in **Table 1**.

Based on the AMG Force blower curve, at a vacuum of -1.5 in WC the flow rate was approximately 215 cubic feet per minute (cfm), and near the maximum flow rate of 233 cfm and minimum pressure of 1 in. WC for the fan. The AMG Fury fan was used for the remaining tests based on its operational characteristics consisting of a maximum pressure of -2.7 in WC and maximum flow rate of 417 cfm.

Figure 6 shows the pressure field extension while testing the AMG Fury fan on the stack for venting systems V-1 and V-3. The fan pressure reading was -1.5 in. WC with a corresponding blower curve flow rate of 270 cfm. The riser pipe readings ranged from -0.025 to -1.023in. WC and pressure field extension readings from LSG-7 through LSG-10 ranged from 0.007 to -0.110 in WC. The pre-mitigation diagnostic testing results are provided in **Table 1**.

Figure 7 shows the pressure field extension while testing the AMG Fury fan on the stack for venting system V-2. The fan pressure reading was -1.5 in. WC with a corresponding blower curve flow rate of 270 cfm. The riser pipe readings ranged from -0.046 to -1.194 in. WC and pressure field extension readings from LSG-7 through LSG-10 ranged from 0.001 to -0.183 in WC. The pre-mitigation diagnostic testing results are provided in **Table 1**.

Since the fans were connected to the venting system stacks located outside the building, exhaust from the testing fans was not an issue. During diagnostic testing, exhaust from the fans was analyzed with a photoionization detector (PID). PID readings were not detected during the diagnostic testing event.

Active VMS Design

Based on the results of the pre-mitigation diagnostic tests, converting the existing passive venting systems to active VMS's was effective in creating a negative pressure field extension beneath the slab of the Property building. Therefore, the proposed VMS modifications include installing one AMG Fury fan on each of the three existing venting systems stacks located outside the building. There are a total of three 6-inch PVC venting system outlet pipes with turbine vents currently connected to the piping. These turbine vents will be removed and then replaced with AMG Fury fans. One AMG Fury fan will be connected to the stack for V-1 and V-3. One AMG Fury fan will be connected to the stack for V-2 and one AMG Fury fan will be connected to the stack for V-4. **Figure 8** shows the proposed active VMS layout. Pressure transducers will be installed on the inlet side of each fan so that fan pressure readings can be sent to a dedicated control panel with digital pressure reading displays.

Advanced Diagnostic Testing and Post Mitigation Monitoring

After fan installation, advanced diagnostic testing will be performed to verify the systems are operating efficiently and as designed. Advanced diagnostic testing will include documenting the fan operating pressure readings and collecting pressure data from V-1, V-2, V-3, V-4, LSG-7, LSG-8, LSG-9, and LSG-10 on a monthly basis for 3 months. Long-term post-mitigation monitoring will included collecting pressure data from magnehelic, or U-tube manometers, installed at V-1, V-2, V-3, and V-4, on a quarterly basis by an environmental consultant or building maintenance personnel.

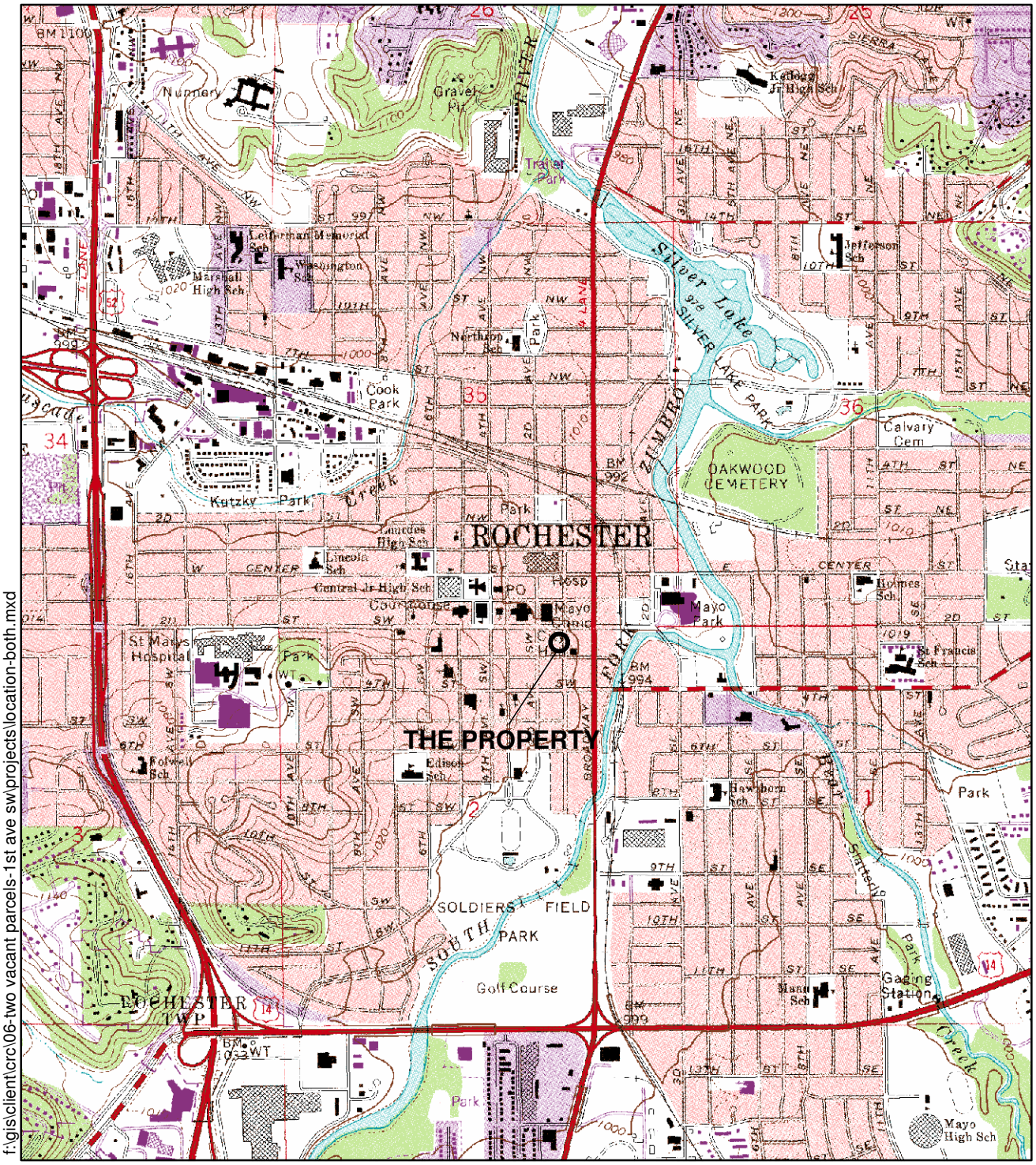
This active VMS is intended to conform to standard VMS principles and practices and is consistent with similar VMS's approved by the MPCA for comparable commercial/industrial buildings. Landmark is submitting these documents for the active VMS to the MPCA for review and approval. We request that the review and approval be completed as soon as possible in order to proceed with the installation of the active VMS system components.

Sincerely,

Jason D. Skramstad

Cc: Terry Spaeth, City of Rochester

Figures



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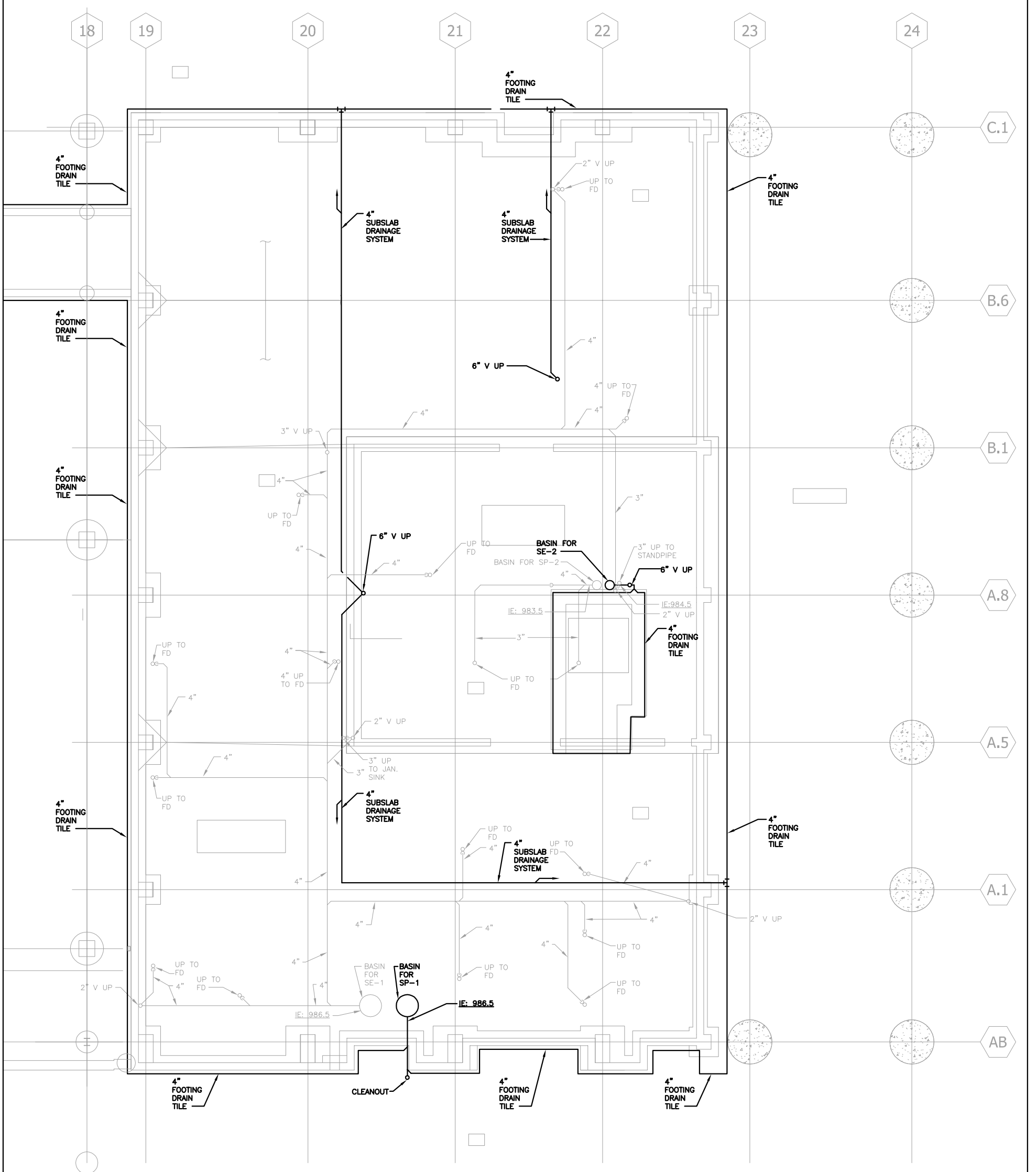
Source: Rochester, Minnesota Topographic Quadrangle, 7.5-Minute Series

N

2,000 1,000 0 2,000 Feet

FIGURE 1

PROPERTY LOCATION MAP
219 and 223 1ST Avenue Southwest
Rochester, Minnesota



NOTE: Drawing provided by HGA; however, the venting system was designed by Landmark Environmental LLC.

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LEGEND

——— Venting System

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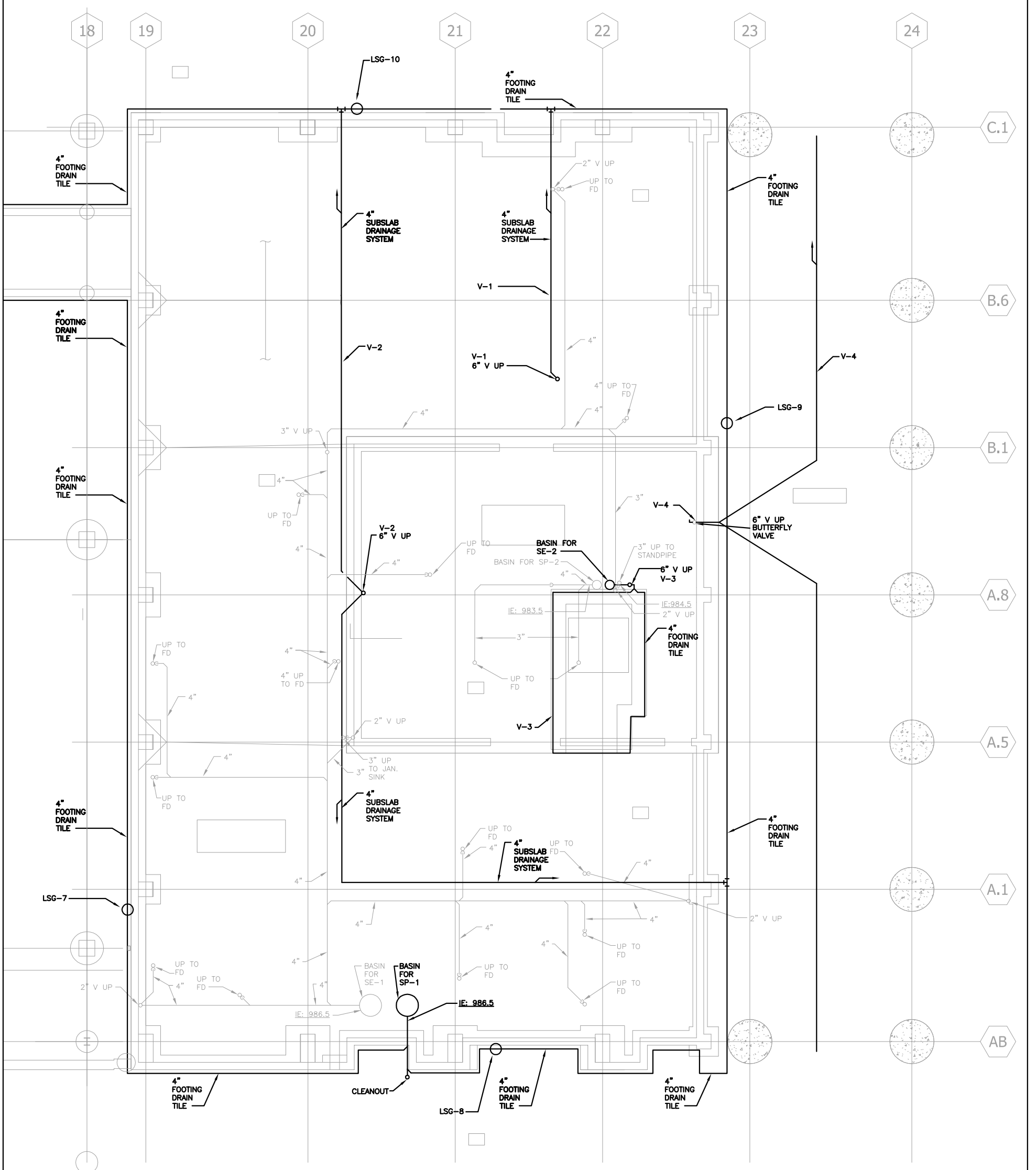
2042 W. 98th Street
Bloomington, MN 55431

FIGURE 2
BASEMENT LEVEL SUB-SLAB - FOUNDATION VENTING AND DRAINAGE SYSTEM ASBUILT DRAWING

221 FIRST AVENUE S.W.
ROCHESTER, MINNESOTA

Landmark Project Number: CRC			
Drawn: JDS	Checked: JDS	Designed: JDS	
Scale: NONE	Date: 6-1-2010	Revision: .	
Drawing Number: .	Sheet . Of .	Sheets .	



NOTE:
1) Drawing provided by HGA; however, the venting system was designed by Landmark Environmental LLC.
2) V-4 is located below the slab of the 1st floor.

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——— Venting System

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F:\PROJECTS\Crc-City of Rochester\CAD\2015 ACTIVE VENTING SYSTEM\FIG 3 - BASEMENT ASBUILT.DWG

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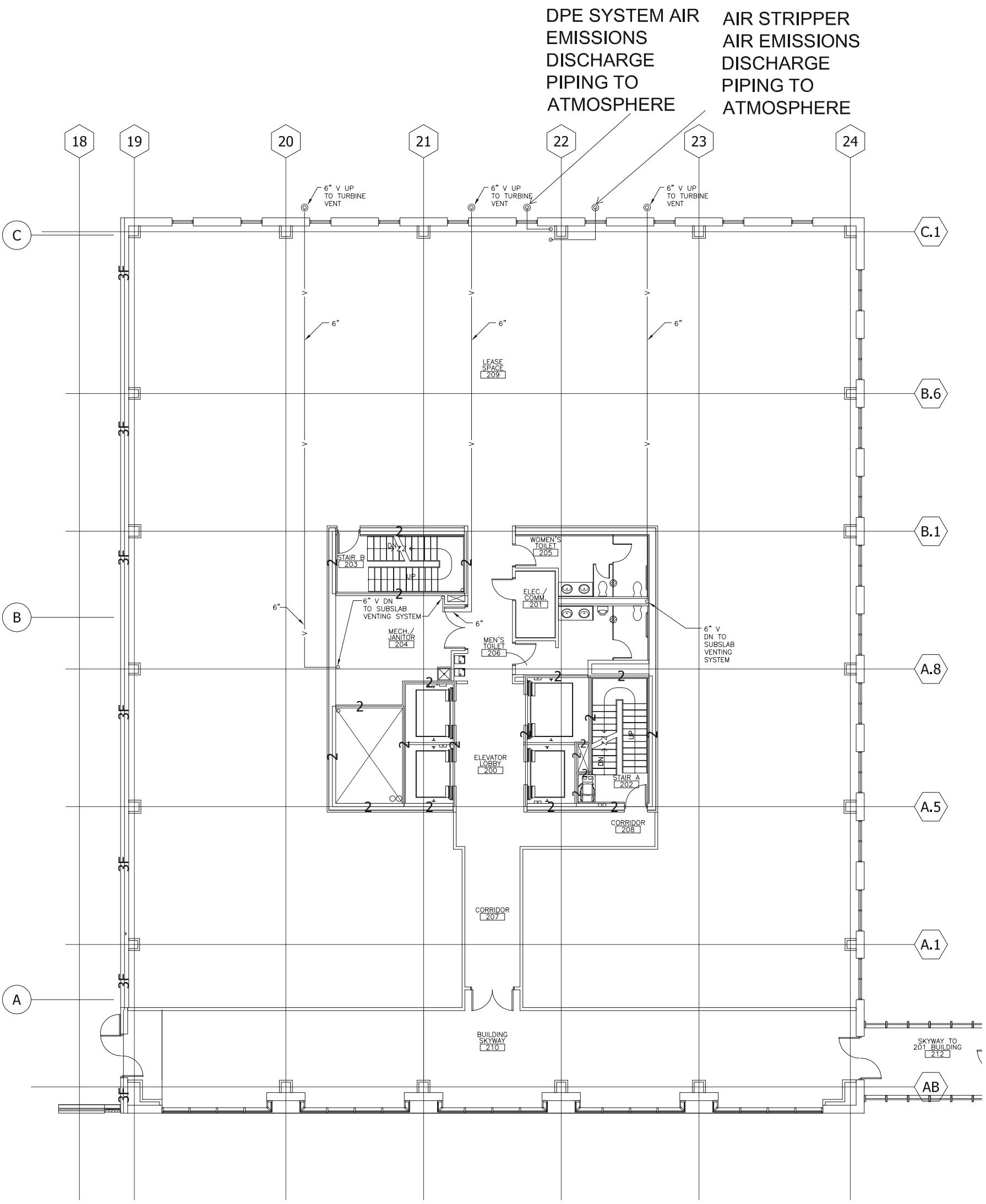
FIGURE 3
BASEMENT LEVEL ASBUILT DRAWING AND VENTING SYSTEM PRESSURE MONITORING LOCATIONS

221 FIRST AVENUE S.W.
ROCHESTER, MINNESOTA

Landmark Project Number: CRC			
Drawn: JDS	Checked: JDS	Designed: JDS	
Scale: NONE	Date: 6-1-2010	Revision: .	
Drawing Number: .	Sheet . Of .	Sheets .	



1 SECOND FLOOR PLAN
1/8"=1'-0"

NOTE: Drawing provided by HGA; however, the venting and DPE systems were designed by Landmark Environmental, LLC.

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——— Venting And DPE System Piping

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FIGURE 4
SECOND FLOOR - FOUNDATION VENTING AND DPE SYSTEM ASBUILT DRAWING

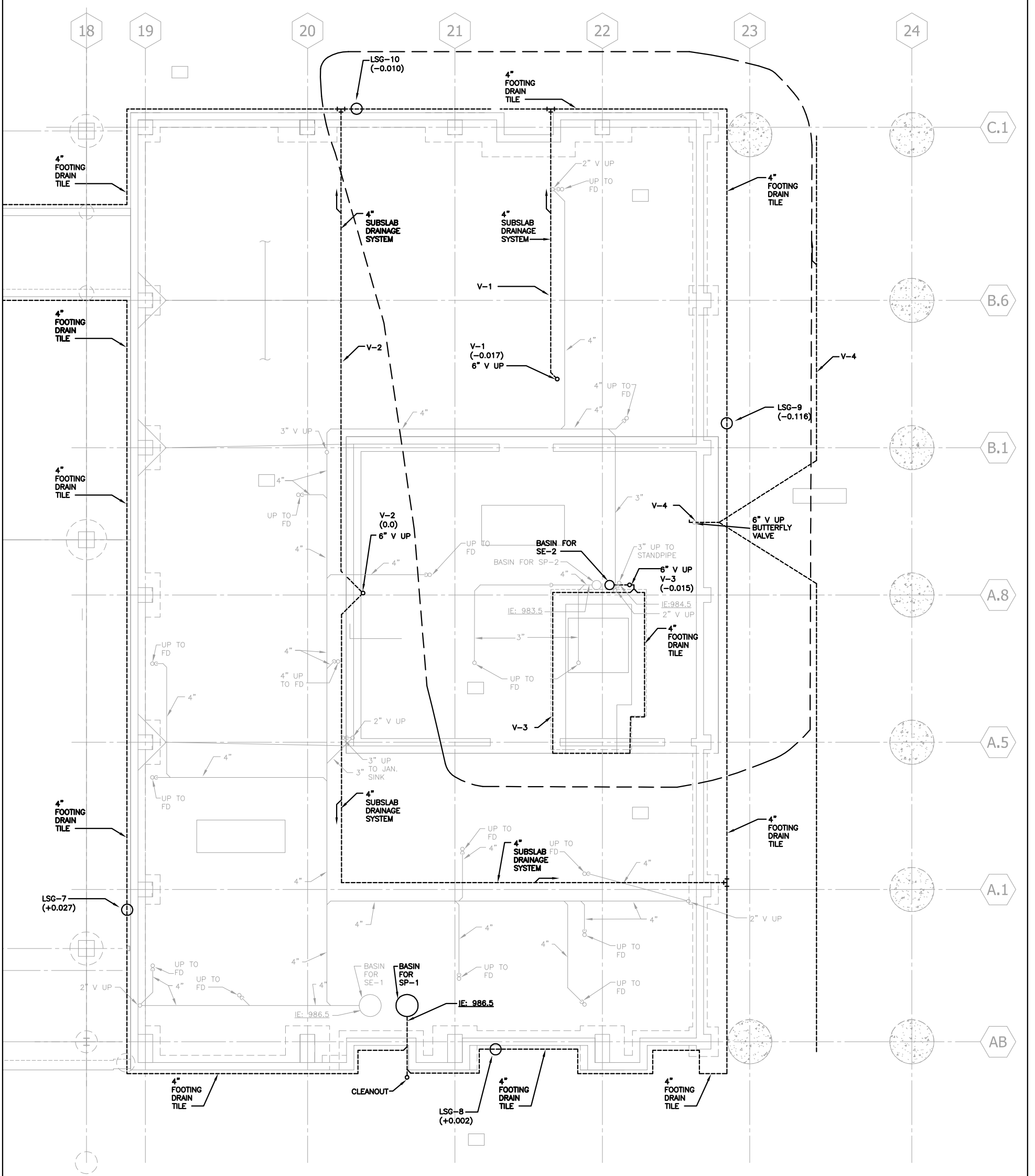
221 FIRST AVENUE S.W.
ROCHESTER, MINNESOTA

Landmark Project Number: CRC

Drawn: JDS | Checked: . | Designed: .

Scale: . | Date: 6-1-2010 | Revision: 00

Drawing Number: . | Sheet . Of . | Sheets .



NOTE:
1) Drawing provided by HGA; however, the venting system was designed by Landmark Environmental LLC.
2) AMG Force fan was used for pre-mitigation diagnostic testing for V-4.

F:\PROJECTS\Crc-City of Rochester\CAD\2015 ACTIVE VENTING SYSTEM\FIG 5 - V-4 PREMIT RESULTS.DWG

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——————— Venting System

— — — Pressure Field Extension

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FIGURE 5
BASEMENT LEVEL ASBUILT DRAWING AND V-4
PRE-MITIGATION DIAGNOSTIC TESTING RESULTS
221 FIRST AVENUE S.W.
ROCHESTER, MINNESOTA

Landmark Project Number: CRC			
Drawn: JDS	Checked: JDS	Designed: JDS	
Scale: NONE	Date: 6-1-2010	Revision: .	
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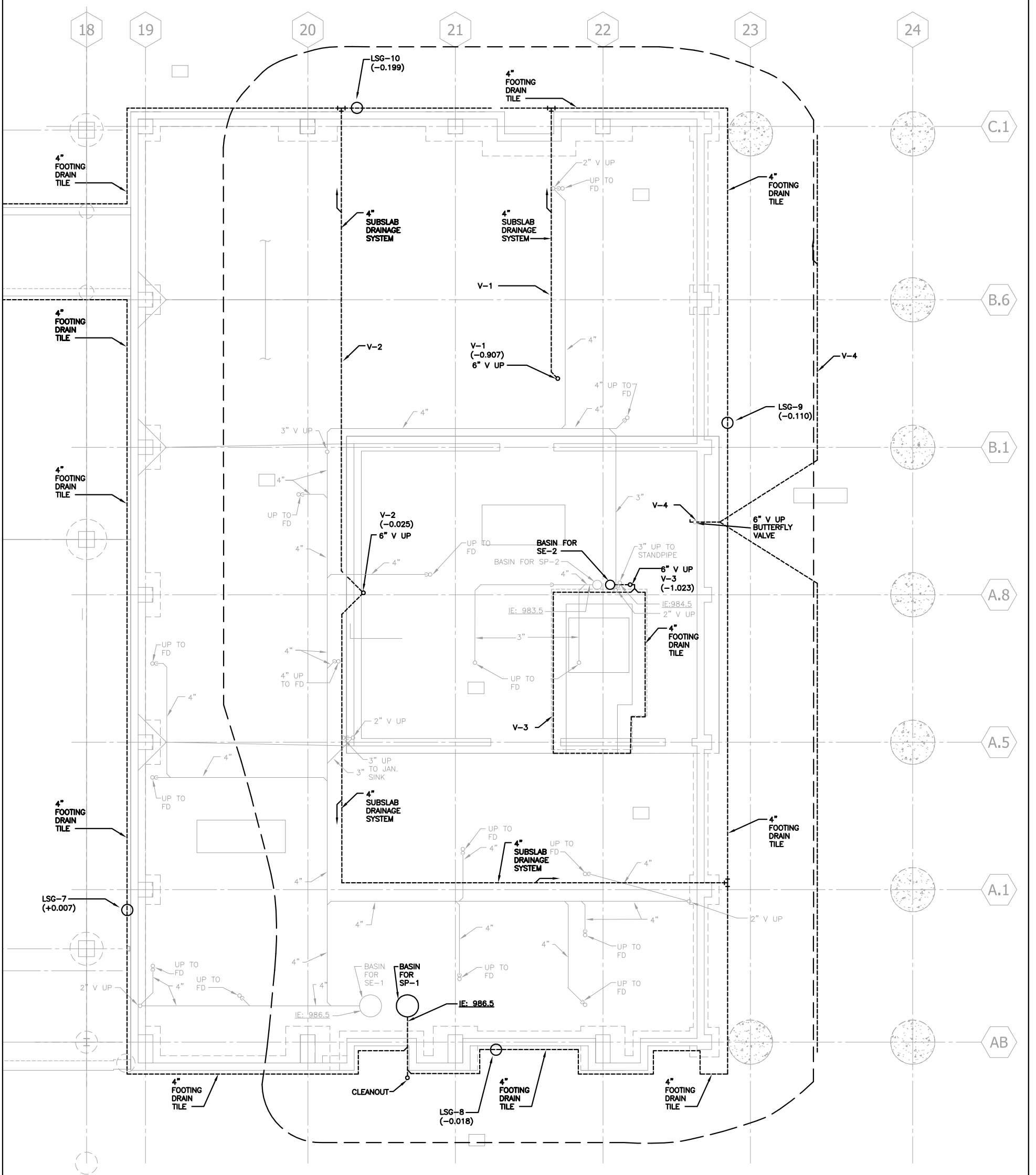

NOTE:
1) Drawing provided by HGA; however, the venting system was designed by Landmark Environmental LLC.
2) AMG Fury fan was used for pre-mitigation diagnostic testing for V-1 & V-3.

F:\PROJECTS\Crc-City of Rochester\CAD\2015 ACTIVE VENTING SYSTEM\FIG 6 - V-1 V-3 PREMIT RESULTS.DWG

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——— Venting System

– – – Pressure Field Extension

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FIGURE 6
BASEMENT LEVEL ASBUILT DRAWING AND V-1 and V-3
PRE-MITIGATION DIAGNOSTIC TESTING RESULTS

221 FIRST AVENUE S.W.
ROCHESTER, MINNESOTA

Landmark Project Number: CRC			
Drawn: JDS	Checked: JDS	Designed: JDS	
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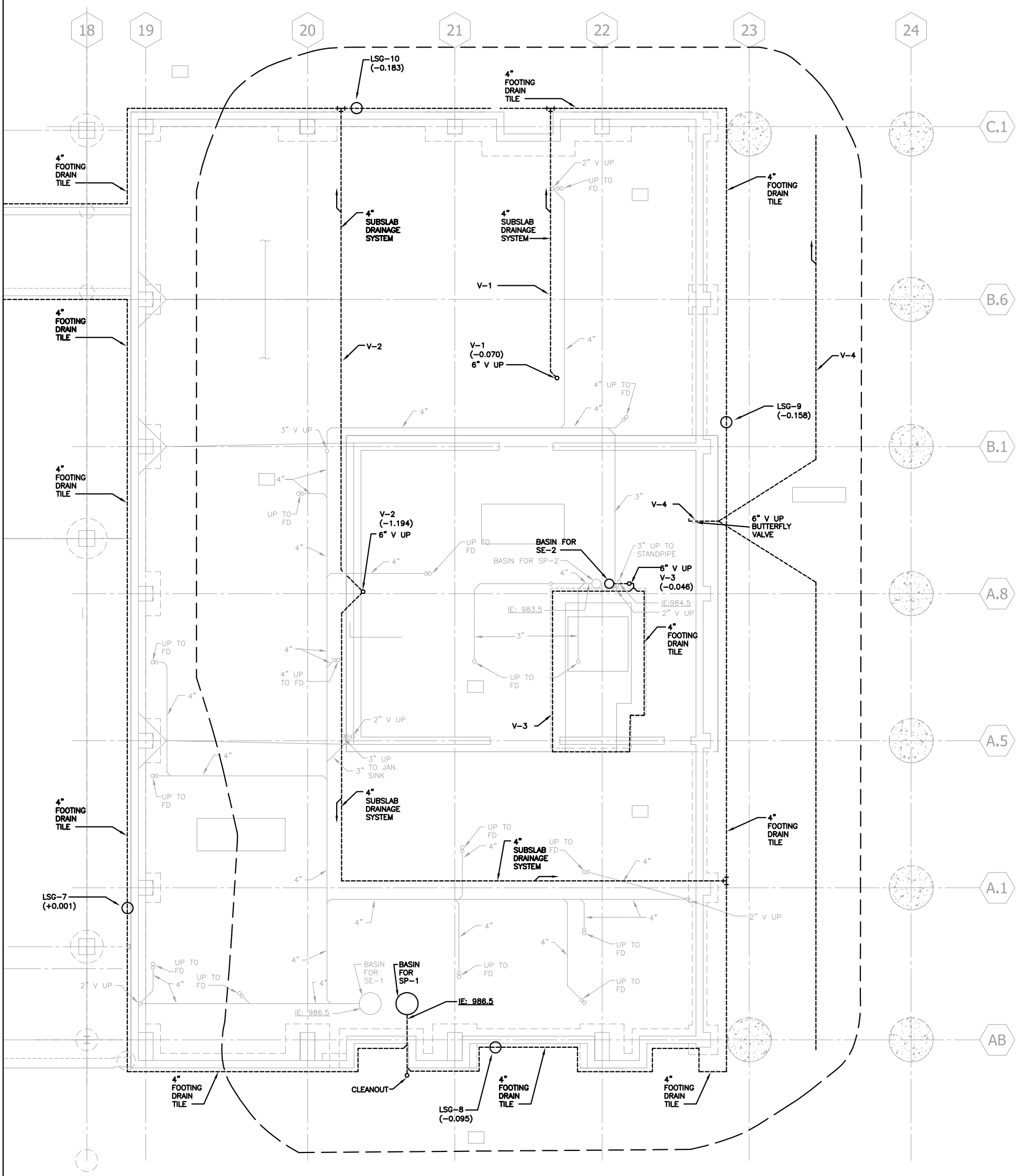

NOTE:
1) Drawing provided by HGA; however, the venting system was designed by Landmark Environmental LLC.
2) AMG Fury fan was used for pre-mitigation diagnostic testing for V-2.

F:\PROJECTS\Crc-City of Rochester\CAD\2015 ACTIVE VENTING SYSTEM\FIG 7 - V-2 PREMIT RESULTS.DWG

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——— Venting System

— — — Pressure Field Extension

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Bloomington, MN 55431

FIGURE 7
BASEMENT LEVEL ASBUILT DRAWING AND V-2
PRE-MITIGATION DIAGNOSTIC TESTING RESULTS
221 FIRST AVENUE S.W.
ROCHESTER, MINNESOTA

Landmark Project Number: CRC			
Drawn: JDS	Checked: JDS	Designed: JDS	
Scale: NONE	Date: 6-1-2010	Revision: .	
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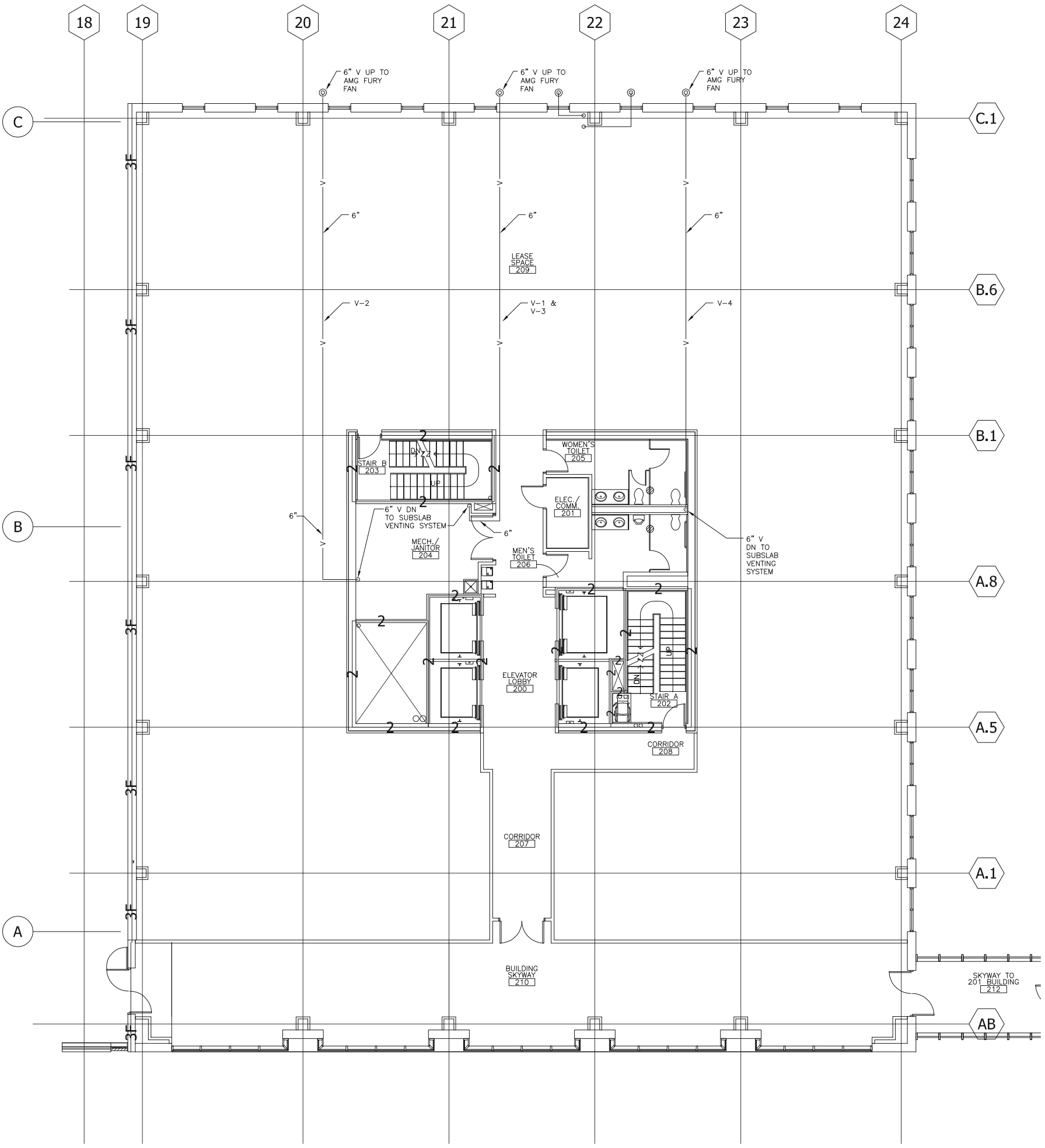

1 SECOND FLOOR PLAN
1/8"=1'-0"

NOTE: Drawing provided by HGA; however, the venting and DPE systems were designed by Landmark Environmental, LLC.

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——— Venting And DPE System Piping

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FIGURE 8
SECOND FLOOR - ACTIVE VENTING SYSTEM

221 FIRST AVENUE S.W.
ROCHESTER, MINNESOTA

Landmark Project Number: CRC			
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Scale: .	Date: 6-1-2010	Revision: 00	
Drawing Number: .		Sheet . Of .	Sheets .

Table

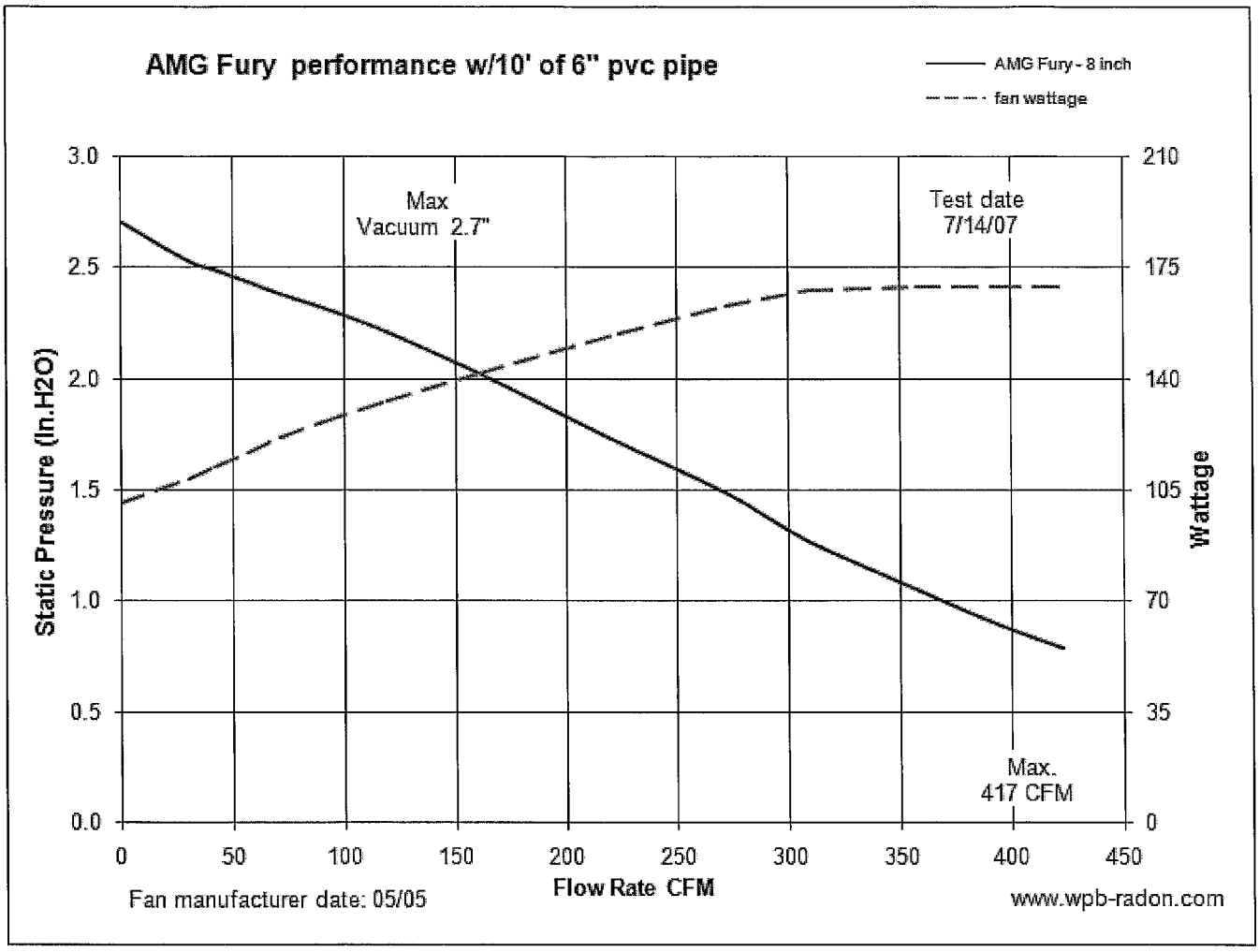
TABLE 1
Pre-Mitigation Diagnostic Testing Results
221 First Avenue S.W.
Rochester, MN

Venting System Outlet Pipe	PV-1 & PV-3	PV-2	PV-4
Date Sampled	March 23, 2015		
Type of Fan	AMG Fury	AMG Fury	AMG Force
Well Head Pressure Reading (Inches of WC)	-1.5	-1.5	-1.5
PID Reading	0.0	0.0	0.0
Monitoring Point Location	**Pressure Readings (Inches WC)**		
PV-1	-0.907	-0.070	-0.017
PV-2	-0.025	-1.194	0
PV-3	-1.023	-0.046	-0.015
LSG-7	0.007	0.001	0.027
LSG-8	-0.018	-0.095	0.002
LSG-9	-0.110	-0.158	-0.116
LSG-10	-0.199	-0.183	-0.01

Notes:
PV-1 & PV-3 connected to same venting piping

Appendix A

Fan Specifications


AMG Fury performance w/10' of 6" pvc pipe
AMG Fury - 8 inch
fan wattage
Max
Vacuum 2.7"
Test date
7/14/07
Max.
417 CFM
Static Pressure (In.H2O)
Wattage
Flow Rate CFM
3.0
2.5
2.0
1.5
1.0
0.5
0.0
210
175
140
105
70
35
0
0
50
100
150
200
250
300
350
400
450
Fan manufacturer date: 05/05
www.wpb-radon.com

Appendix B

Photos

Pre-Mitigation Diagnostic Testing Photos
MN Bio Business Center
Rochester, MN

Close up existing rotary turbine ventilators connected to passive venting system.

Scissor lift required to access stacks for pre-mitigation diagnostic testing.

Pre-mitigation diagnostic testing pipe modifications.

Scissor lift required to access stacks for pre-mitigation diagnostic testing.

Pre-mitigation diagnostic testing pipe modifications with AMG Fury fan on top of scissor lift.