

FUSRAP 8119

OR.1

**VERIFICATION SURVEY  
OF  
PHASE II REMEDIAL ACTIONS  
ALBANY RESEARCH CENTER  
ALBANY, OREGON**

*Review/Comment  
To me by  
COE 2/13/91  
To DOE (A.W.)  
COE 2/12/91  
COC*

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**INTERIM REPORT**

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This report is based on work performed under contract number DE-AC05-76OR00033 with the U.S. Department of Energy.

This draft report has not been given full review and patent clearance, and the dissemination of its information is only for official use. No release to the public shall be made without the approval of the Office of Communication Resources, Oak Ridge Associated Universities.

## TABLE OF CONTENTS

	<u>PAGE</u>
List of Figures . . . . .	ii
List of Tables . . . . .	v
Introduction . . . . .	1
Site Description. . . . .	2
Procedures . . . . .	3
Data Interpretation and Sample Analysis . . . . .	6
Findings and Results . . . . .	6
Comparison of Survey Results with Guidelines. . . . .	7
Summary . . . . .	7
Reference. . . . .	50

## LIST OF FIGURES

	<u>PAGE</u>
FIGURE 1: Location of the Albany Research Center . . . . .	8
FIGURE 2: Plot Plan of the Albany Research Center . . . . .	9
FIGURE 3: Plot plan of Building 1, First Floor . . . . .	10
FIGURE 4: Building 1, Room 119, Indicating Measurement Locations on the Floor and East Wall . . . . .	11
FIGURE 5: Plot Plan of Building 1, Third Floor . . . . .	12
FIGURE 6: Building 1, Room 306, Indicating Measurement Locations on the Floor and North Wall . . . . .	13
FIGURE 7: Plot Plan of Building 3 . . . . .	14
FIGURE 8: Building 3, Room 101, Indicating Measurement Locations on the Floor . . . . .	15
FIGURE 9: Building 3, Room 103, Indicating Measurement Locations on the Floor . . . . .	16
FIGURE 10: Plot Plan of Building 17 . . . . .	17
FIGURE 11: Building 17, Open Storage Area, West End, Indicating Measurement Locations on the Floor and Lower Walls . . . . .	18
FIGURE 12: Plot Plan of Building 23, Basement. . . . .	19
FIGURE 13: Building 23 Basement, Southeast Corner, Indicating Measurement Locations on the Elevator Shaft-Floor and Lower Wall . . . . .	20
FIGURE 14: Building 23, Basement Tunnel, Indicating Measurement Locations . . . . .	21

**LIST OF FIGURES (Cont'd)**

	<u>PAGE</u>
FIGURE 15: Plot Plan of Building 23, Second Floor . . . . .	22
FIGURE 16: Building 23, Crusher Room, Second Floor, Indicating Measurement Locations. . . . .	23
FIGURE 17: Plot Plan of Building 24 . . . . .	24
FIGURE 18: Building 24, Room 103, Indicating Measurement Locations on the Floor and in the East, West and Middle Trenches . . . . .	25
FIGURE 19: Building 24, Room 104, Indicating Measurement Locations on the Northwest Corner of the Floor. . . . .	26
FIGURE 20: Building 24, Room 106, Indicating Measurement Locations on the Floor, Lower Walls, and Upper Walls. . . . .	27
FIGURE 21: Building 24, Room 106, Indicating Measurement Locations in Trenches 1 and 2. . . . .	28
FIGURE 22: Plot Plan of Building 25, First Floor . . . . .	29
FIGURE 23: Building 25, First Floor, Indicating Measurement Locations on the Floor in the Southwest Corner. . . . .	30
FIGURE 24: Plot Plan of Building 25, Mezzanine . . . . .	31
FIGURE 25: Building 24, Mezzanine, Indicating Measurement Locations in the Northwest Corner of the North Wall . . . . .	32
FIGURE 26: Building 25, Indicating Measurement Locations on the Scale Platform Located on the Mezzanine . . . . .	33
FIGURE 27: Plot Plan of Building 28, First Floor . . . . .	34
FIGURE 28: Building 28, Room 3, Indicating Measurement Locations on the Floor and North Wall. . . . .	35

**LIST OF FIGURES (Cont'd)**

	<u>PAGE</u>
FIGURE 29: Plot Plan of Building 29, First Floor . . . . .	36
FIGURE 30: Building 29, Room 106, Indicating Measurement Locations on the Floor Beneath Counters . . . . .	37
FIGURE 31: Building 29, Room 109, Indicating Measurement Locations on the Floor and South Wall . . . . .	38
FIGURE 32: Building 29, Room 111, Indicating Measurement Locations on the Floor and Drain Pedestals . . . . .	39
FIGURE 33: Building 29, Second Floor . . . . .	40
FIGURE 34: Building 29, Room 113, Indicating Measurement Locations on the HEPA Filter Bank . . . . .	41
FIGURE 35: Plot Plan of Building 31 . . . . .	42
FIGURE 36: Building 31, Room 2, Indicating Measurement Locations on the Floor, North Wall, and Counter Space . . . . .	43
FIGURE 37: Partial Plot Plan of Building 33 . . . . .	44
FIGURE 38: Building 33, Room 103, Indicating Measurement Locations on the Floor . . . . .	45
FIGURE 39: Building 33, Room 104, Indicating Measurement Locations on the Floor and Wall in the Northeast Corner . . . . .	46

## LIST OF TABLES

	<u>PAGE</u>
TABLE 1: Summary of Surface Activity Measurements . . . . .	47

**VERIFICATION SURVEY  
OF  
PHASE II REMEDIAL ACTIONS  
ALBANY RESEARCH CENTER  
ALBANY, OREGON**

**INTRODUCTION**

The Albany Research Center (ARC), located in Albany, Oregon, was established in 1943 and operated by the U.S. Bureau of Mines. The initial site activities were to investigate innovative approaches for developing strategic mineral resources in the United States as well as manufacturing processes and other metallurgical research.

In addition to these activities, ARC conducted operations for the Atomic Energy Commission (AEC) and the Energy Research and Development Administration (ERDA), predecessor agencies of the Department of Energy (DOE) during the period 1948 to 1978. Operations involved the melting, machining, welding, and alloying of thorium. Research activities also included the separation, purification, and processing of limited quantities of uranium. Waste materials generated from these activities; containing low levels of thorium, uranium, and their associated decay products, were treated and placed into temporary storage and/or disposed on-site. In addition to the work performed for the DOE predecessors, ARC currently conducts work with radioactive materials under the jurisdiction of the Nuclear Regulatory Commission.

As a result of the research operations, portions of the ARC became radioactively contaminated. In 1978, Argonne National Laboratory (ANL) conducted radiological surveys and the site was subsequently designated for remedial action under the DOE's Formerly Utilized Site Remedial Action Program (FUSRAP).

In 1984, Bechtel National, Inc. (BNI), the Project Management Contractor for FUSRAP, conducted additional radiological surveys of areas identified by ANL, to define the locations and levels of above-guideline contamination. Remedial action to decontaminate identified areas was initiated by BNI in mid 1987 and completed in February 1988. Eleven structures were addressed in the 1987/1988 (Phase I) remedial action activities; they were buildings 2, 4, 5, 17, 19, 23, 27, 28, 29, 30, and 31. During characterization and post-remedial action surveys, additional building surface areas, not previously considered under FUSRAP, were identified as having residual radioactive material contamination. The areas included in the Phase II remedial actions are in buildings 1, 2, 3, 4, 5, 17, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33 and 34 and the lime pit east of Building 31. Remedial action activities were initiated in these areas in August 1990 and are currently on-going.

It is the policy of DOE to perform independent verifications of the effectiveness of remedial actions conducted within FUSRAP. The Environmental Survey and Site Assessment Program of Oak Ridge Associated Universities (ORAU) was designated by DOE as the organization responsible for this task at the Albany Research Center. Verification of the Phase I remedial actions was conducted between August 1987 and April 1989 and is the subject of a separate report<sup>1</sup>. During the months of September and October an ORAU representative performed verification activities in Buildings 1, 3, 17, 23, 24, 25, 28, 29, 31, and 33. These activities included reviews of pertinent documents and independent radiological measurements and sampling of remediated areas. This interim report describes the procedures and findings of those activities.

## **SITE DESCRIPTION**

The ARC facility is located approximately 110 kilometers (70 miles) south of Portland, Oregon (Figure 1) on a 17-ha (42-acre) site of the former Albany College in Albany, Oregon. The site is bounded on the north by Queen Avenue, on the east by

Liberty Street, on the south by a tennis club facility, and on the west by Broadway Street (Figure 2). The site consists of three main areas: ARC proper, the main research facility; the former Biomass Research Facility which consists of approximately 0.8-ha (2-acre), located south of the main facility; and a 5.7-ha (14-acre) undeveloped area, known as the "Back Forty", occupying the south end of the facility. There are 34 buildings and several smaller structures located at the ARC. Most of the buildings are currently being utilized. Several of these buildings are interconnected through adjoining hallways and rooms.

## **PROCEDURES**

### **Objectives**

The objectives of the verification were to confirm that the surveys, sampling, analyses, and associated project documentation performed by the project management contractor, provide an accurate and complete description of the radiological condition of the property. Based on the verification findings, the determination was made as to whether additional remediation was necessary or that remedial actions were effective in meeting established release criteria.

### **Document Review**

The characterization report developed by BNI was reviewed for general thoroughness and accuracy and to determine the current radiological status of the site.

### **Survey Procedures**

1. Verification activities were conducted in parallel with or immediately following remedial actions and post-remedial action monitoring, to minimize

delays or interruptions in remedial action and restoration efforts. An ORAU representative conducted visual inspections, and independent measurements and sampling. Survey activities were conducted in accordance with current procedures in the ORAU ESSAP Survey Procedures Manual and the site specific survey plan.

2. Independent measurements and sampling were typically performed in 25 to 50% of the total area remediated. The actual fraction of the remediated area selected for independent survey was area specific and was based on such factors as the historical use of radiological materials at the site, decontamination procedures, and post-remedial action monitoring data. Based on findings as the work progressed, the scope of the survey was altered as necessary.
3. Verification measurements and sampling locations were referenced to the existing BNI grid system where possible. When necessary, a reference grid was established by ORAU. The size of the grid blocks varied according to the size of the area remediated or the size of the room. Typically, the grid consisted of either 1 m<sup>2</sup> or 4 m<sup>2</sup> grid blocks. Grid blocks were established on floors and lower walls (up to 2 m) in areas designated for remediation. The upper walls, ceilings, and remediated areas less than 10 m<sup>2</sup> were not gridded. Measurements made on these surfaces were referenced to prominent building features.
4. Surfaces of selected remediated areas were scanned in order to identify any residual contamination. Indoor building surfaces were scanned for elevated gamma radiation levels and for alpha and/or beta-gamma contamination, as appropriate. In some cases, dependent upon the history of radiological material usage, areas were scanned up to 100%. Areas of elevated activity,

identified by the scans, were brought to the attention of BNI for further investigation and when necessary, remediation.

5. Five point and single point alpha and/or beta-gamma activity measurements were performed in ten buildings. Particular attention was given to cracks, beams, piping, ledges, ducts, drains, and other surfaces where material might settle or accumulate. In gridded areas, five-point direct measurements for total alpha and beta-gamma activity were systematically performed at the center and at four points, midway between the center and the grid block corners. For remediated areas smaller than 10 m<sup>2</sup> and upper walls and ceilings, single-point measurements for total activity were performed. Smears for removable alpha and beta activity were collected at the highest direct measurement location in each grid block and at all single-point measurement locations.

As the ORAU representative completed each verification survey, a preliminary verification survey form was provided to BNI and ARC representatives. The form provided a permanent on-site record of the current radiological status of each remediated area as determined from the verification survey. Survey results were compared to the U. S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites, Remedial Action Program and Surplus Facilities Management Program Sites (Revision 2, March 1987) for thorium-232 which are:

1000 dpm/100 cm<sup>2</sup> average over 1 m<sup>2</sup>  
3000 dpm/100 cm<sup>2</sup> maximum in a 100 cm<sup>2</sup> area  
200 dpm/100 cm<sup>2</sup> removable

## **DATA INTERPRETATION AND SAMPLE ANALYSIS**

Samples and direct measurement data were returned monthly to the Oak Ridge, TN laboratory for analysis and interpretation. Data developed by the independent verification surveys was compared with the established remedial action guidelines to assure that remediation had been effective in meeting these guidelines.

## **FINDINGS AND RESULTS**

### **Surface Scans**

Surface scans were performed in remediated areas of Buildings 1, 3, 17, 23, 24, 25, 28, 29, 31, and 33. Surface scans identified three locations of elevated residual activity in Buildings 3, 24, and 25. Additional remediation was performed in Buildings 24 and 25 prior to final verification. A third location of elevated activity was in Building 3 Room 101 and was detected within a wooden tray used for mixing zircon sand mortar. The mortar exhibits naturally occurring elevated activity. As this material was not involved with AEC or ERDA activities and is used in an on-going process by ARC within Room 101, the tray was not subject to remedial action under FUSRAP.

### **Measurement of Surface Activity**

Surface activity measurements collected from Buildings 1, 3, 17, 23, 24, 25, 28, 29, 31, and 33 are summarized in Table 1. The highest grid block averages for total activity were  $<120$  dpm/100 cm<sup>2</sup> for alpha and  $<850$  dpm/100 cm<sup>2</sup> for beta-gamma. Total activity measurements ranged from  $<80$  to 440 dpm/100 cm<sup>2</sup> for alpha and  $<410$  to 1600 dpm/100 cm<sup>2</sup> for beta-gamma.

No removable activity was detected from samples collected. Removable activity ranged from <6 to 6 dpm/100 cm<sup>2</sup> for alpha and <13 dpm/100 cm<sup>2</sup> for beta.

### **COMPARISON OF SURVEY RESULTS WITH GUIDELINES**

Appendix C presents the general DOE surface contamination guidelines for residual radioactive material at a "Formerly Utilized Sites Remedial Action Program" (FUSRAP) site. The primary contaminant on building and equipment surfaces is thorium-232. The applicable guidelines are:

1000 dpm/100 cm<sup>2</sup>, averaged over 1 m<sup>2</sup> area  
3000 dpm/100 cm<sup>2</sup>, maximum in a 100 cm<sup>2</sup> area  
200 dpm/100 cm<sup>2</sup>, removable

All areas surveyed were within these guideline values.

### **SUMMARY**

During the months of September and October, a representative from ORAU's Environmental Survey and Site Assessment Program performed verification measurements at the Albany Research Center in Albany, Oregon. Data collected during these surveys indicate that the areas remediated by BNI during this period are within the established guidelines. However, many of the remediated areas contain internally contaminated piping which has not been addressed to date. As such, no conclusions can be made regarding the activity within the pipes and the effects removal of the piping may have on remediated areas.

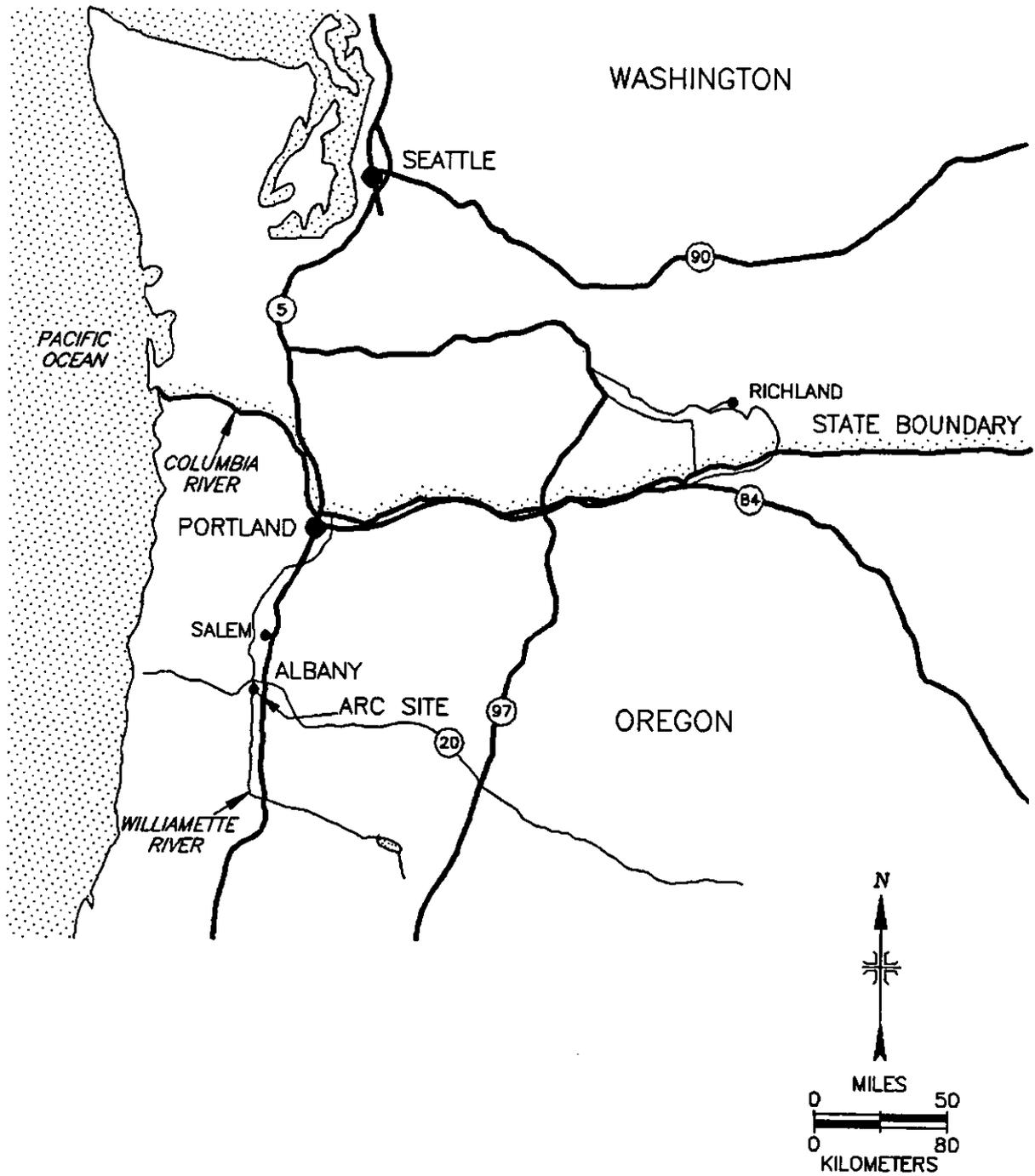


FIGURE 1: Location of the Albany Research Center

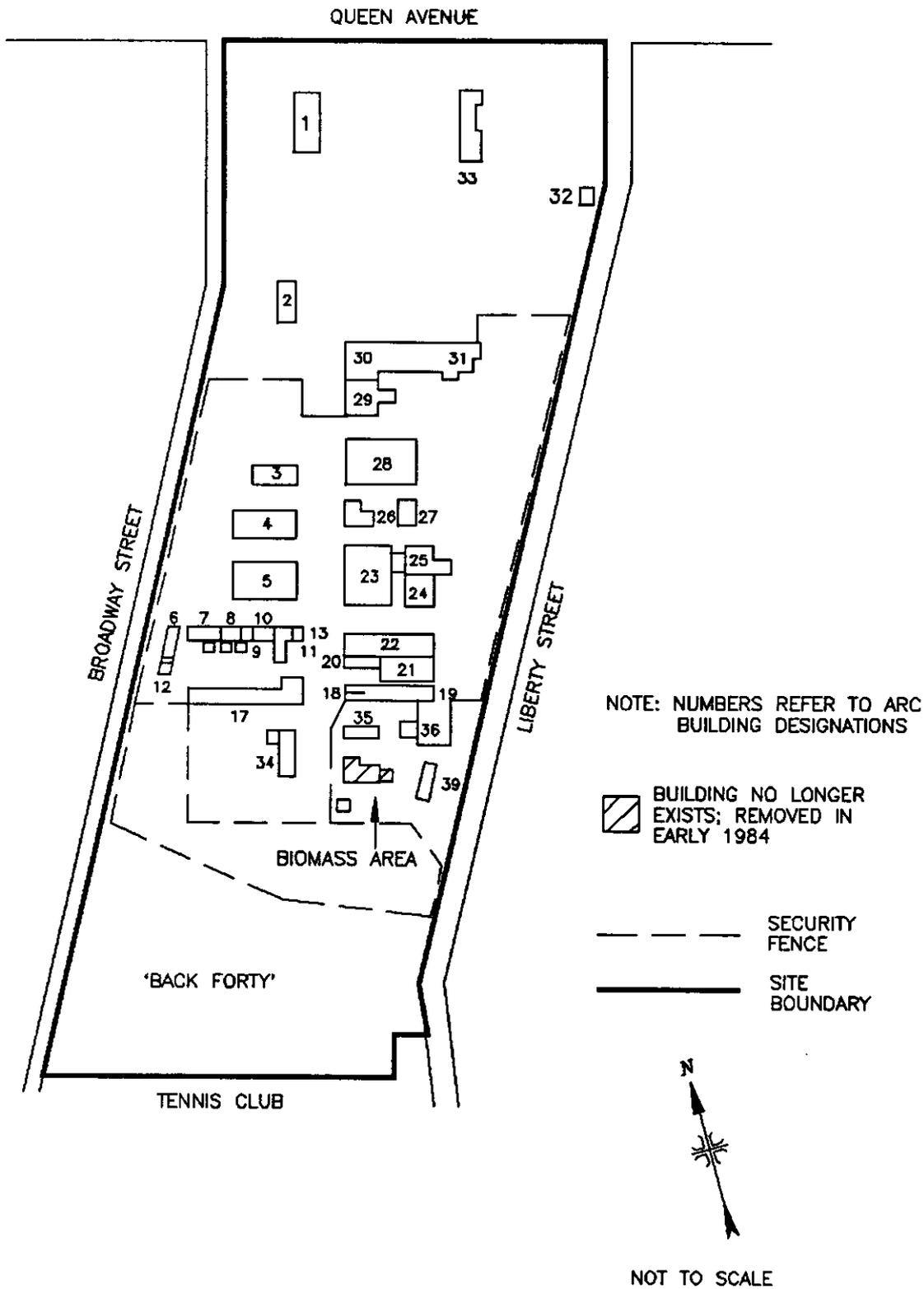


FIGURE 2: Plot Plan of the Albany Research Center

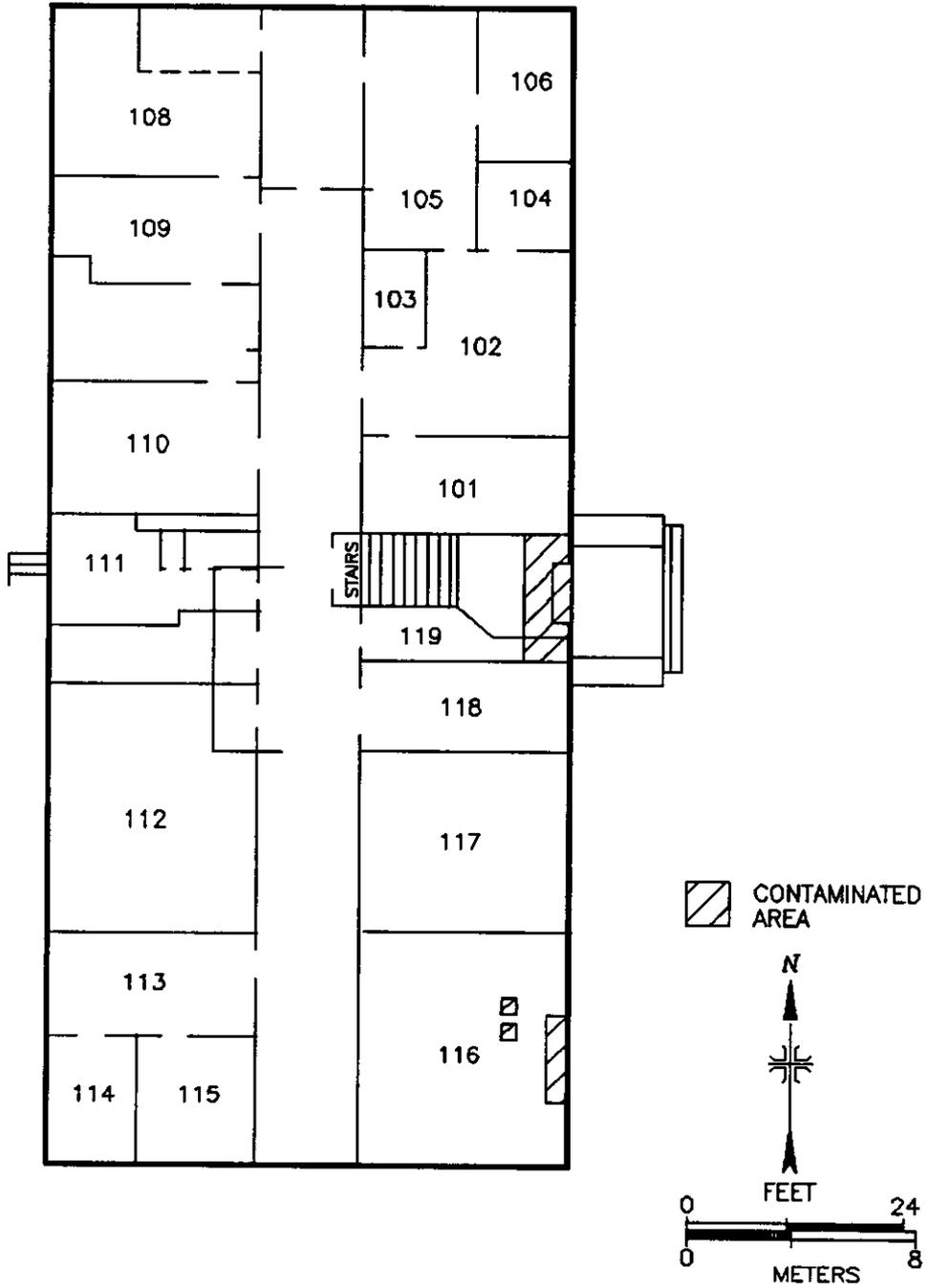


FIGURE 3: Plot Plan of Building 1, First Floor

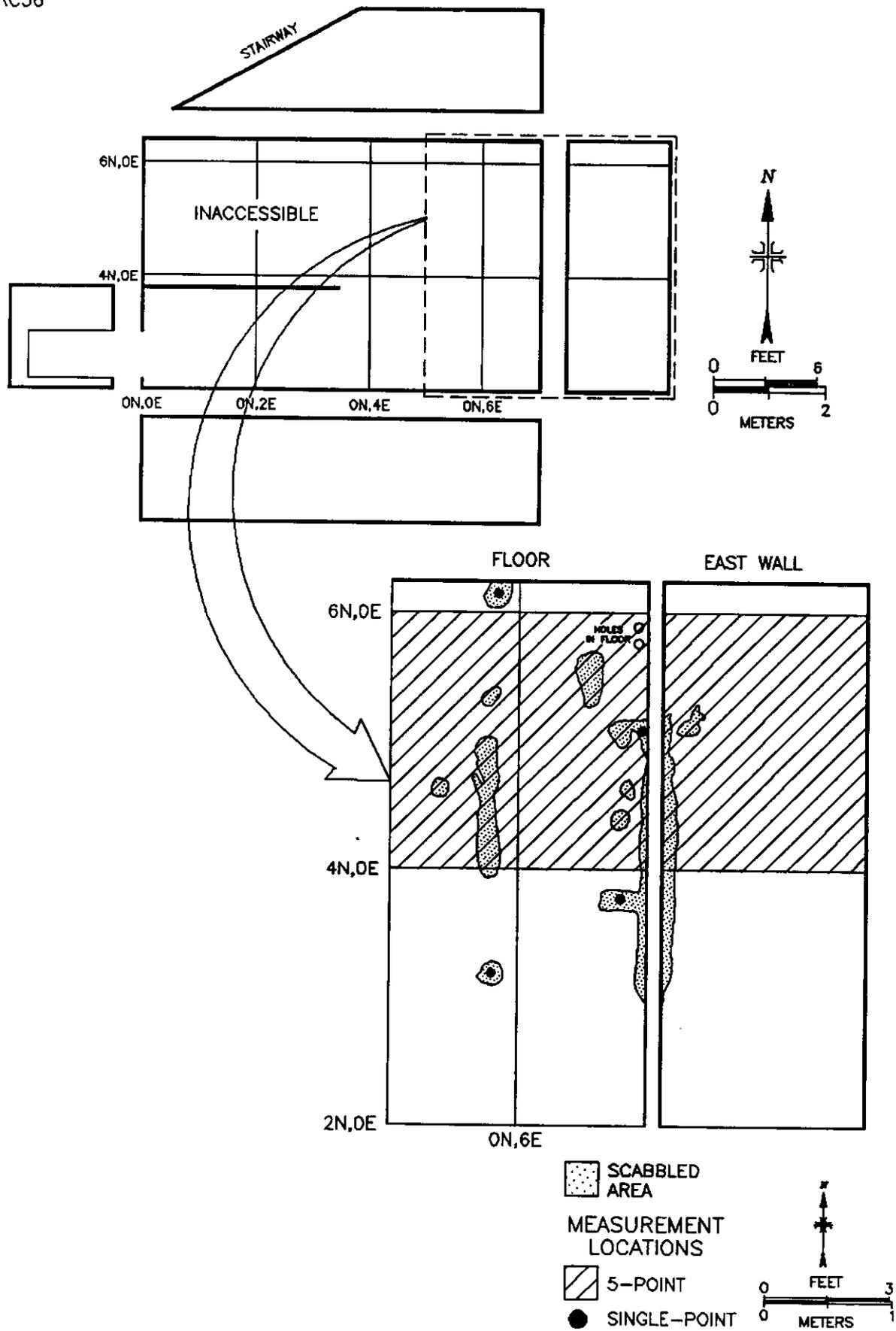


FIGURE 4: Building 1, Room 119, Indicating Measurement Locations on the Floor and East Wall

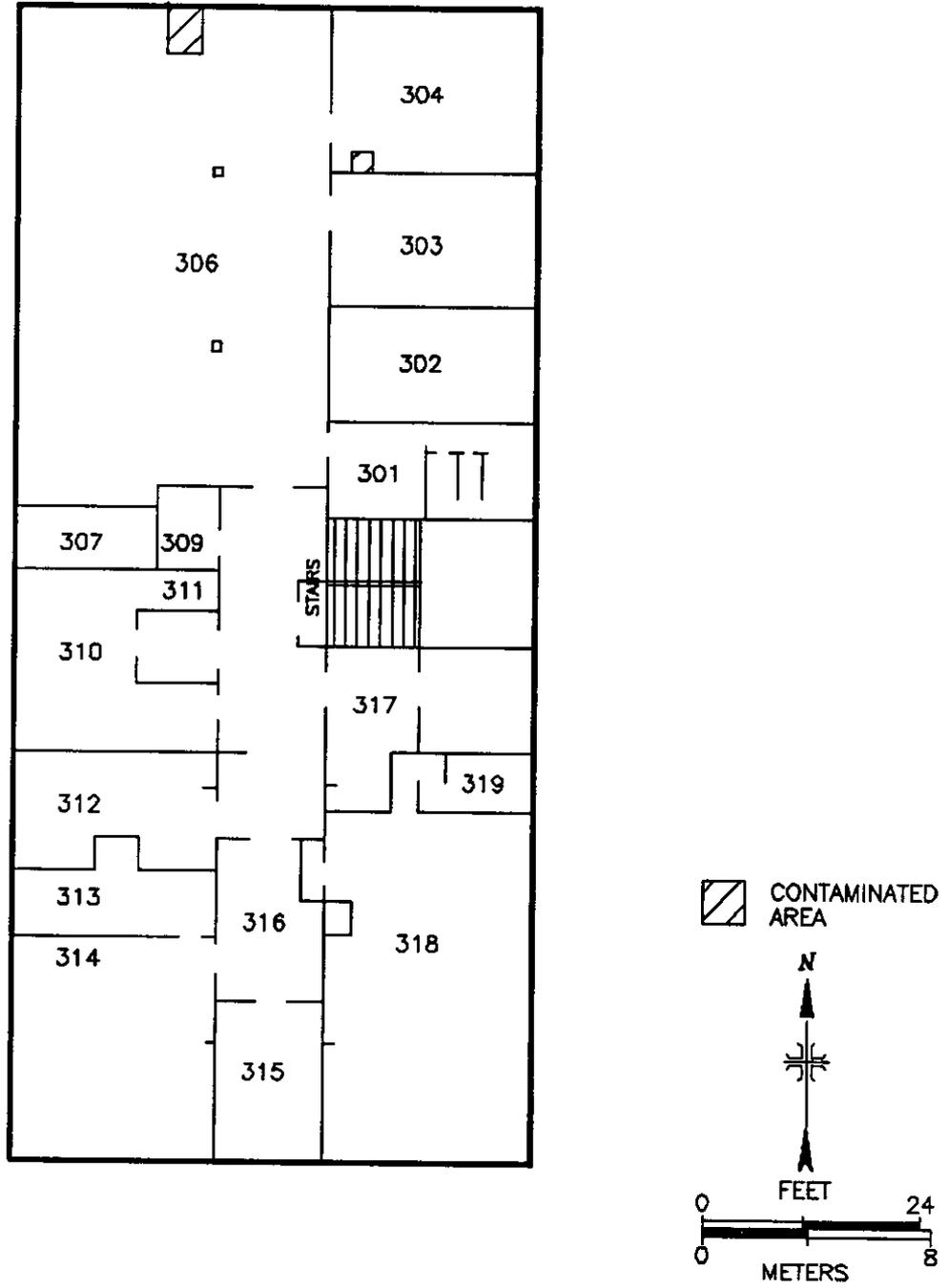


FIGURE 5: Plot Plan of Building 1, Third Floor

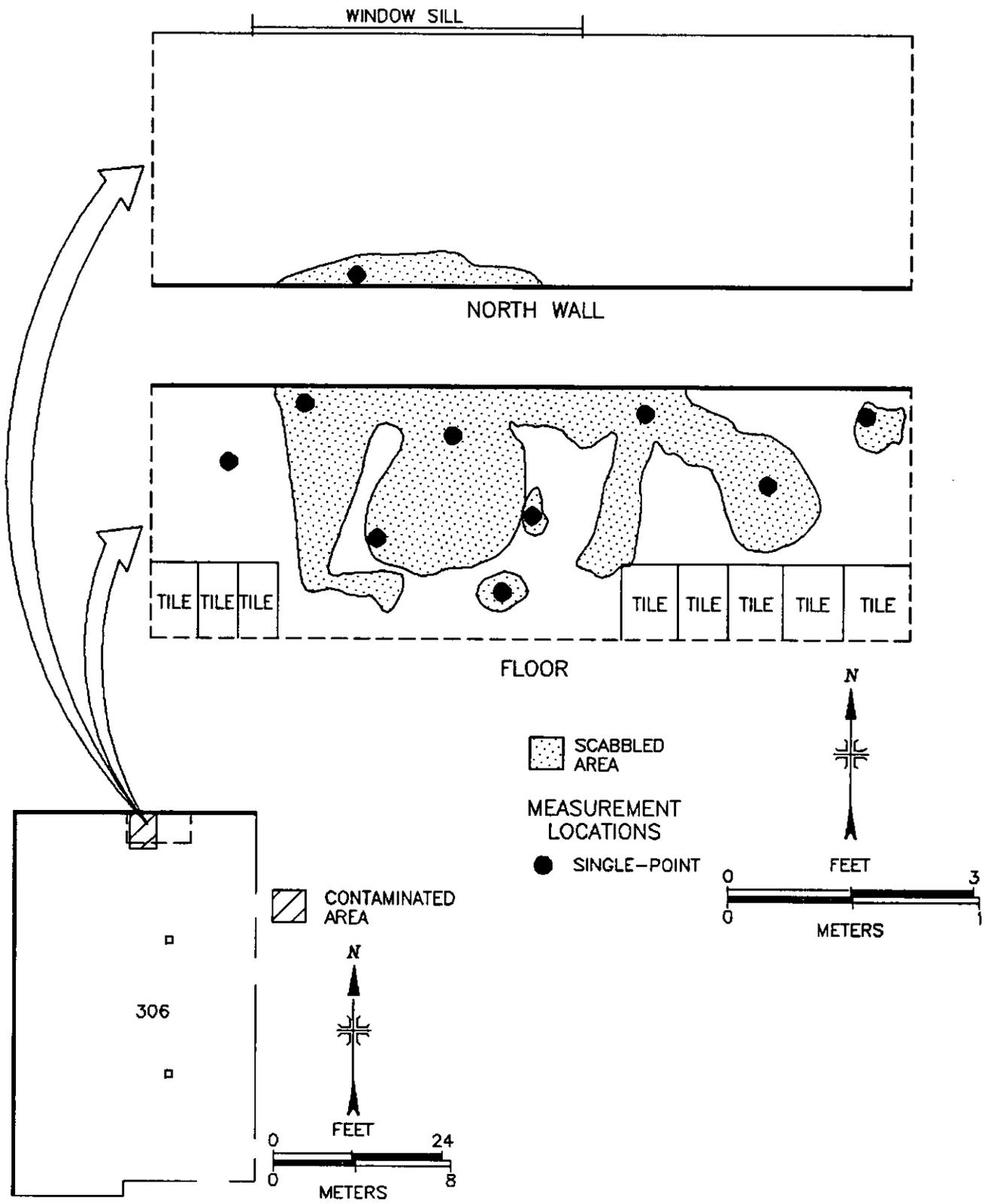


FIGURE 6: Building 1, Room 306, Indicating Measurement Locations on the Floor and North Wall

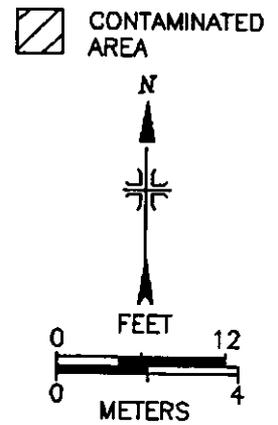
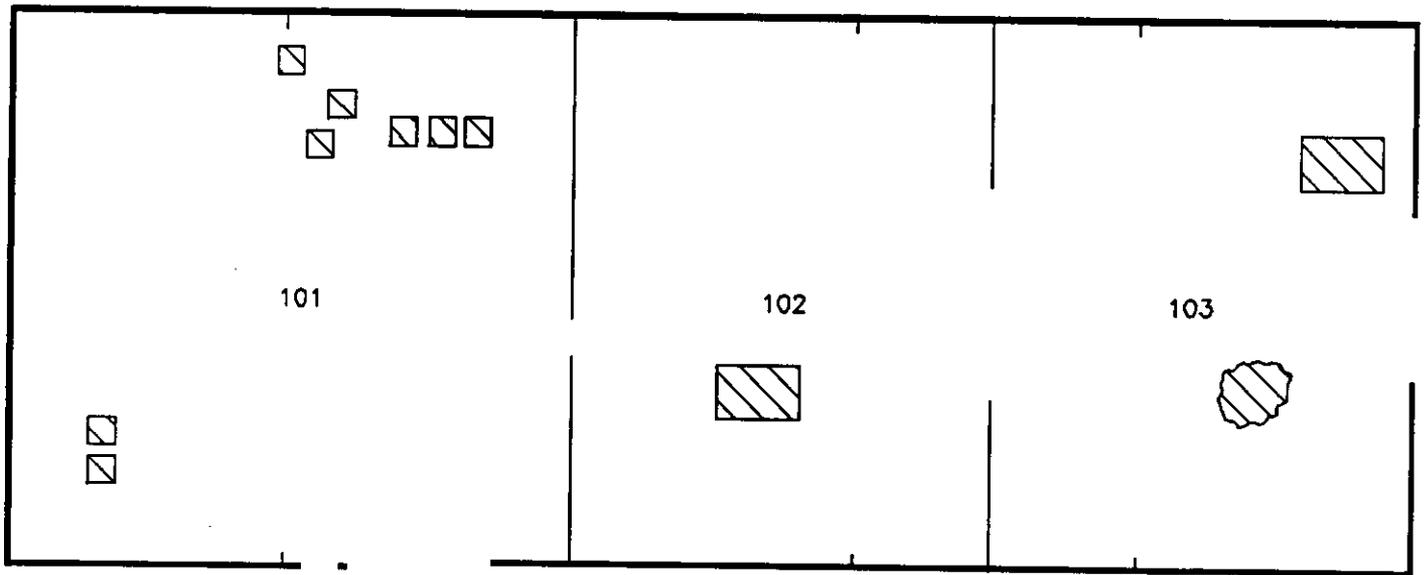


FIGURE 7: Plot Plan of Building 3

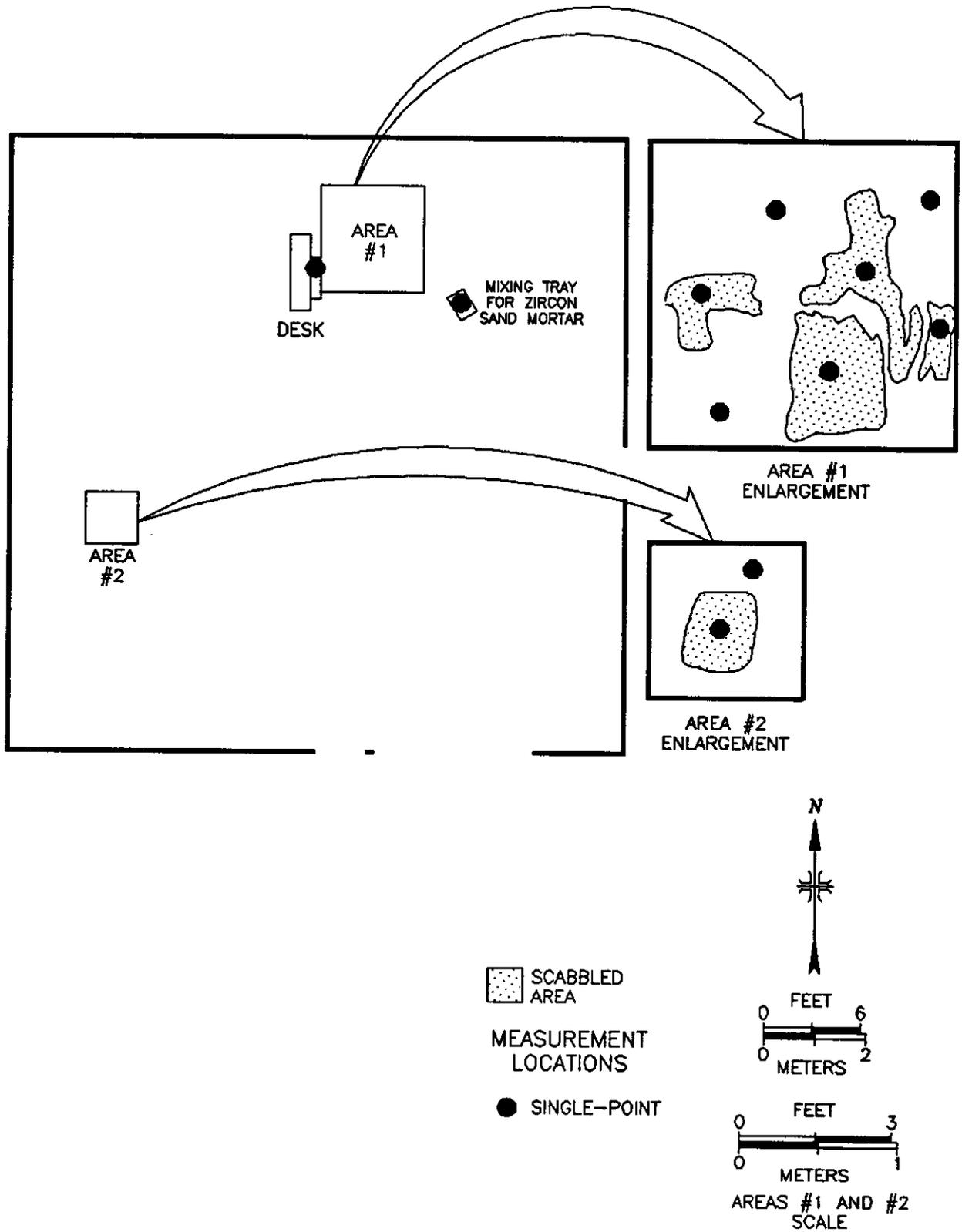


FIGURE 8: Building 3, Room 101, Indicating Measurement Locations on the Floor

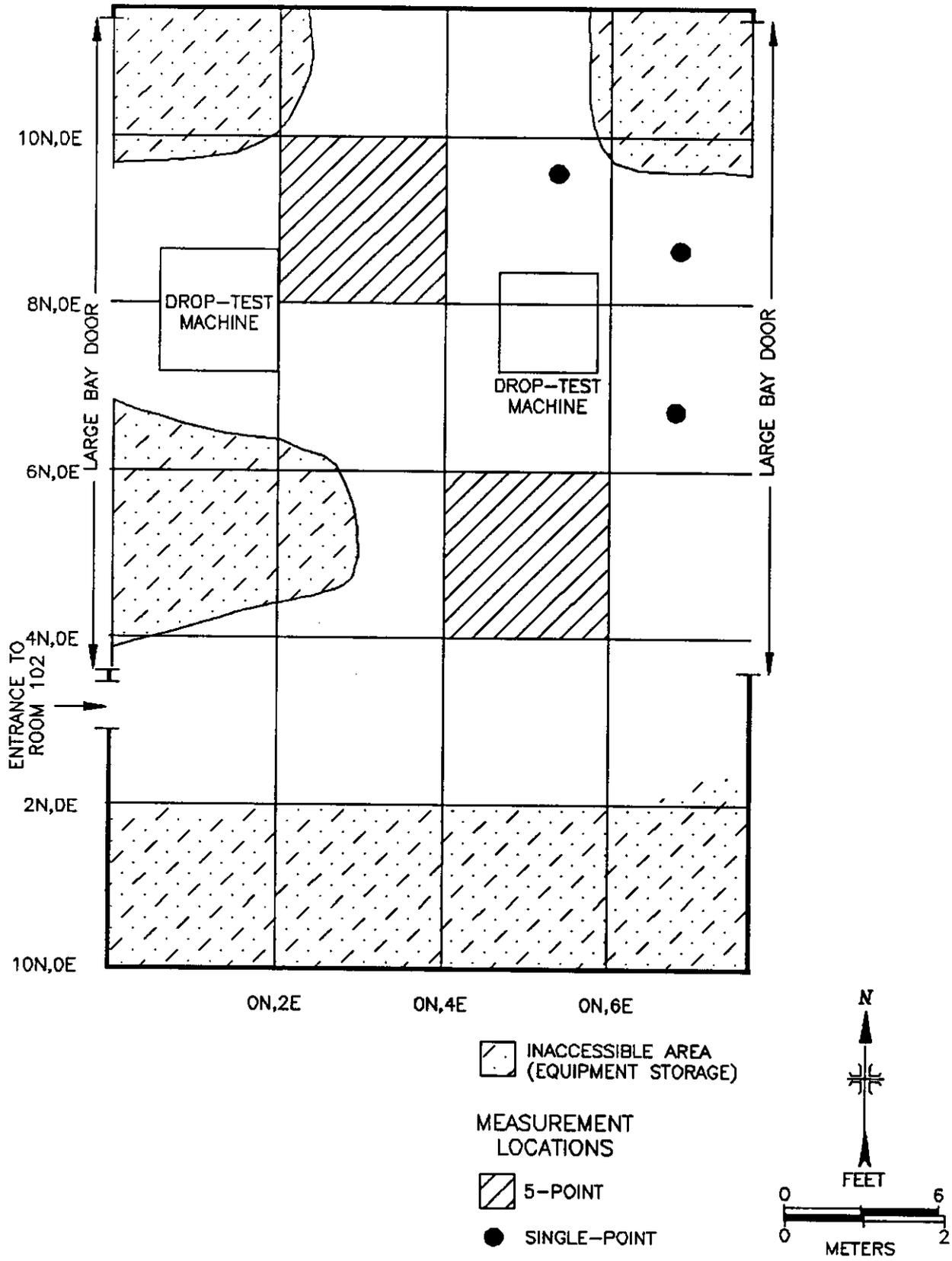


FIGURE 9: Building 3, Room 103, Indicating Measurement Locations on the Floor

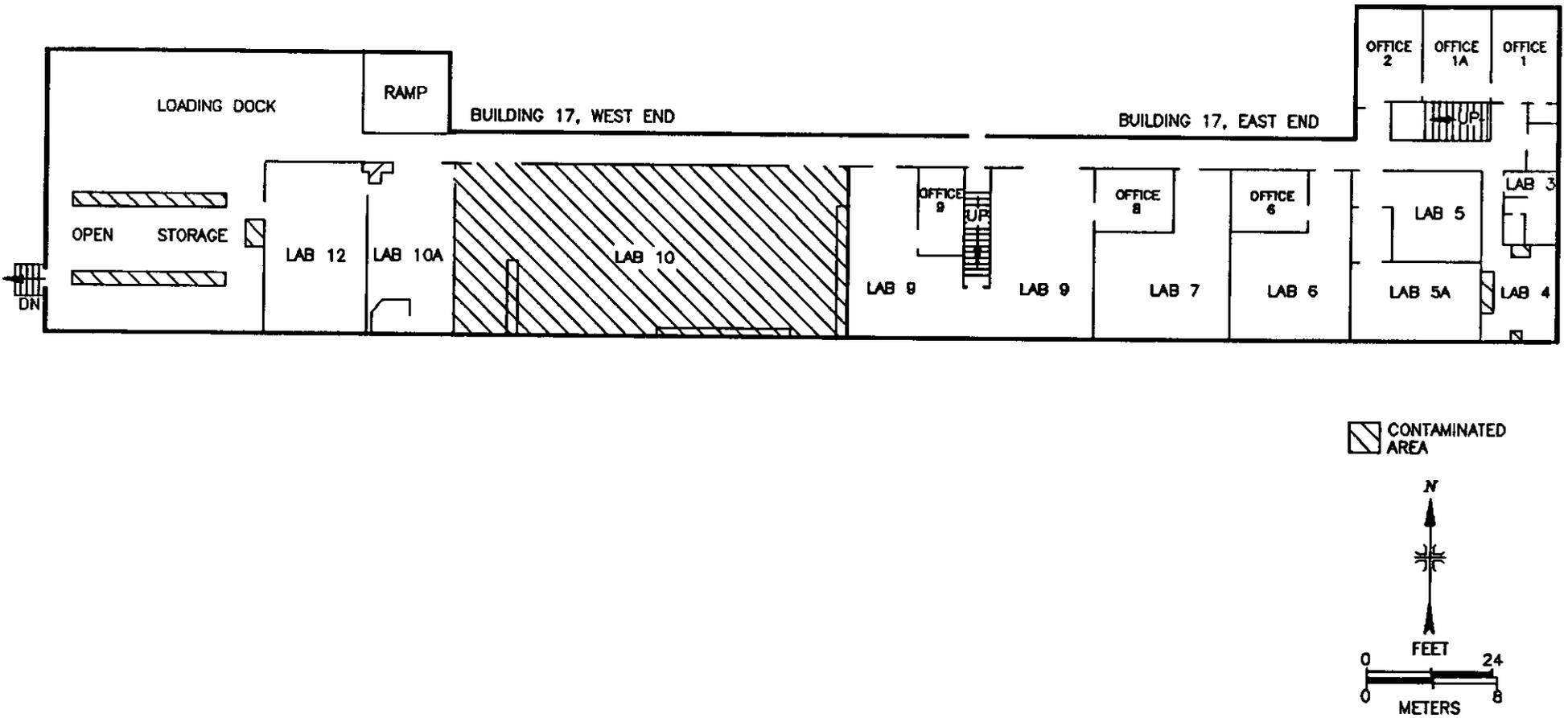


FIGURE 10: Plot Plan of Building 17



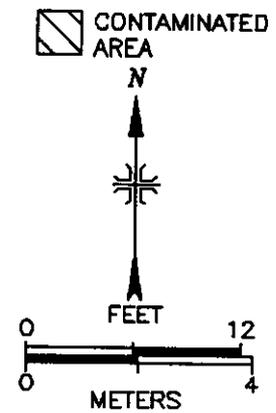
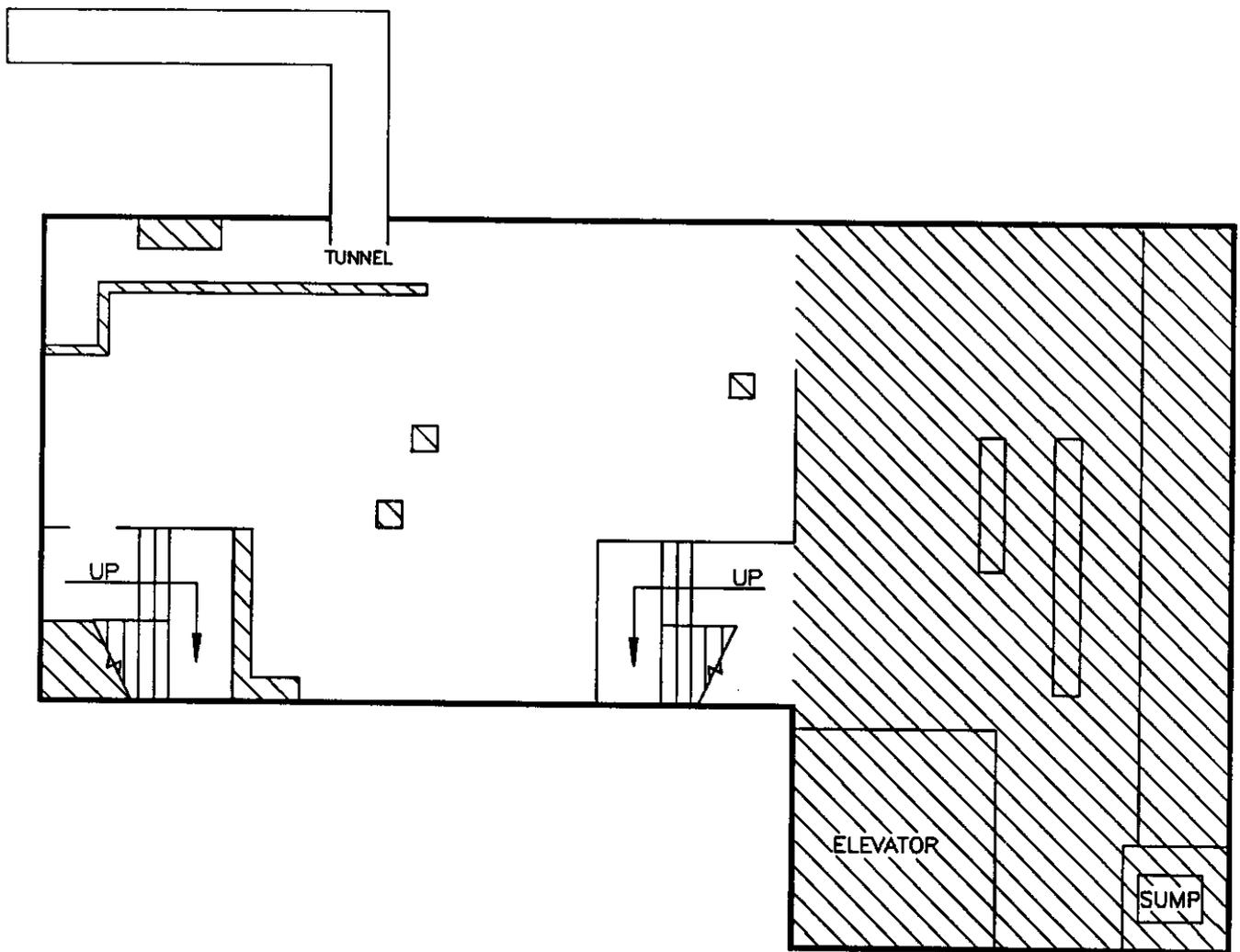
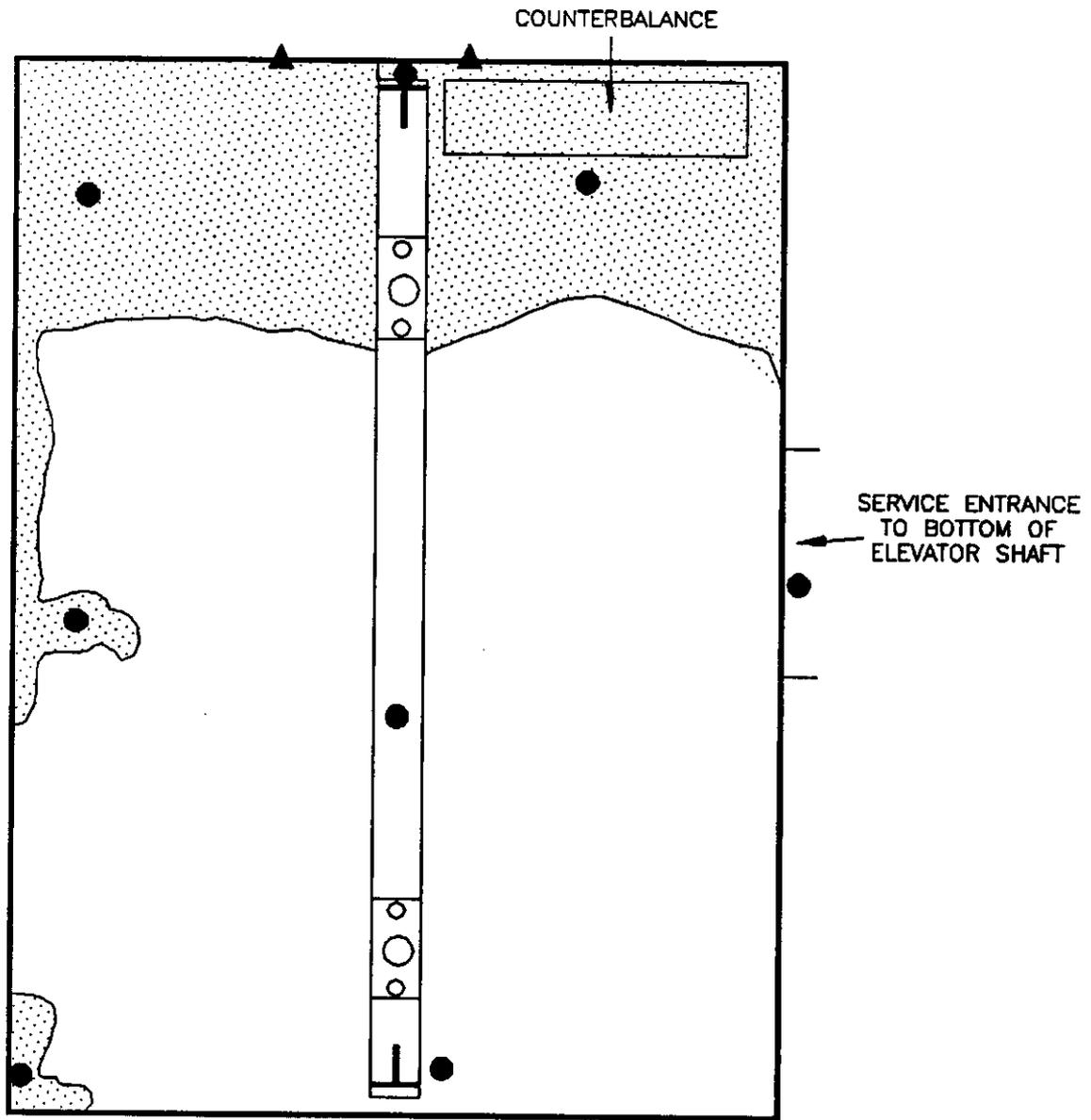


FIGURE 12: Plot Plan of Building 23, Basement



SCABBLED AREA

MEASUREMENT LOCATIONS

- SINGLE-POINT (FLOOR)
- ▲ SINGLE-POINT (LOWER WALL)

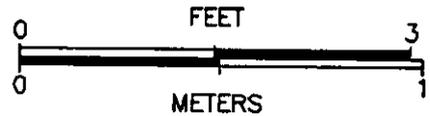


FIGURE 13: Building 23 Basement, Southeast Corner, Indicating Measurement Locations on the Elevator Shaft-Floor and Lower Wall

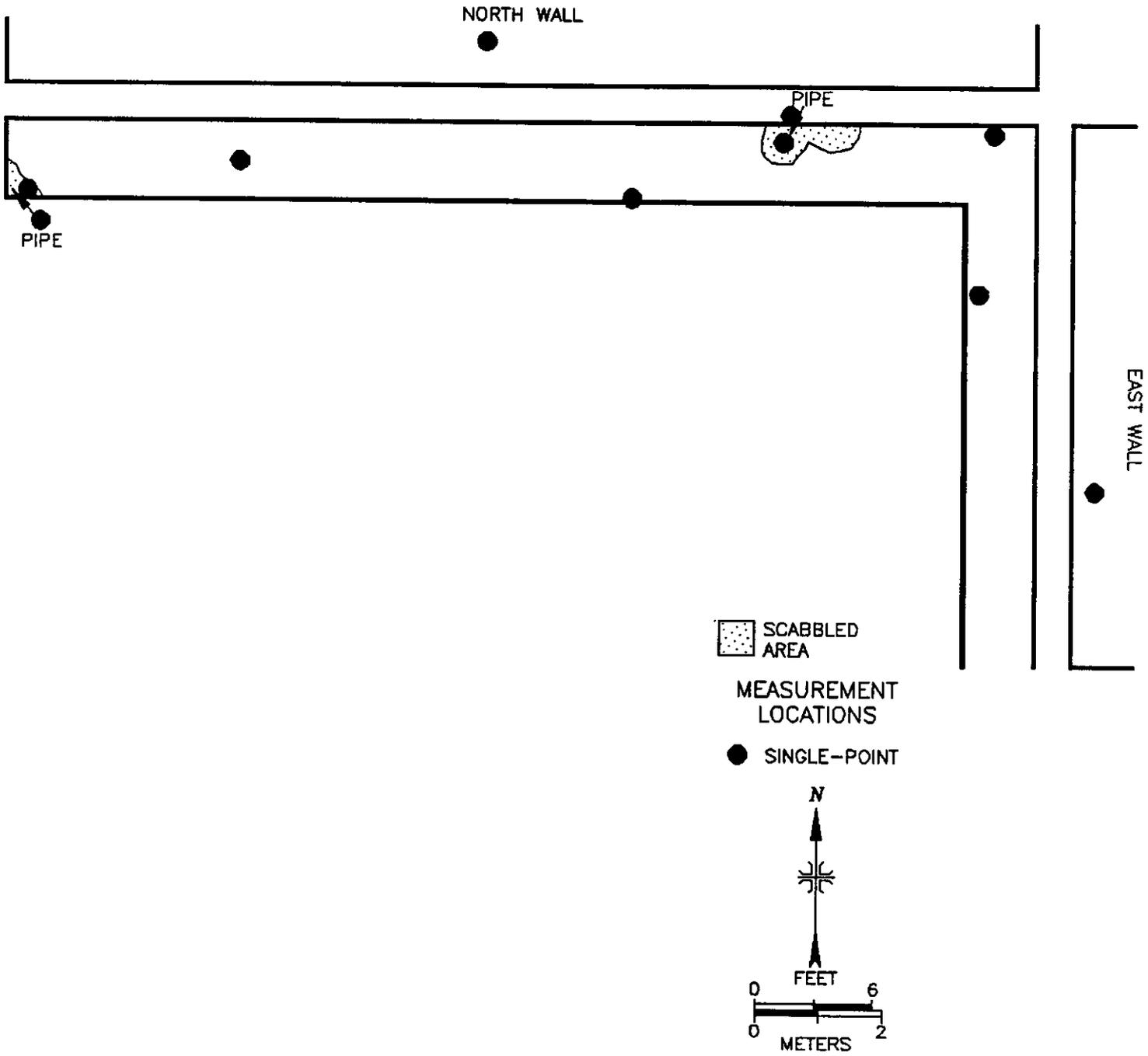


FIGURE 14: Building 23, Basement Tunnel, Indicating Measurement Locations

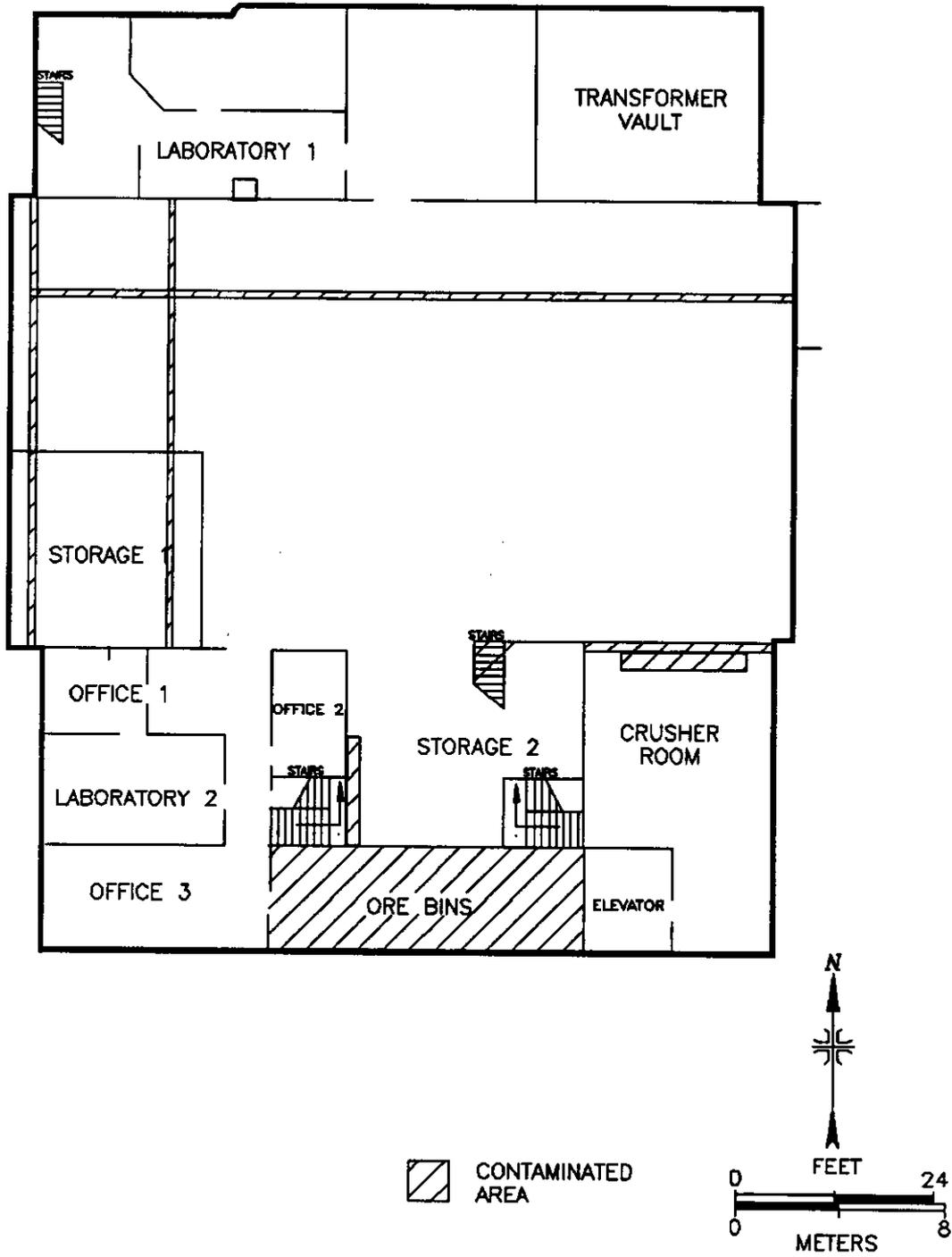


FIGURE 15: Plot Plan of Buidling 23, Second Floor

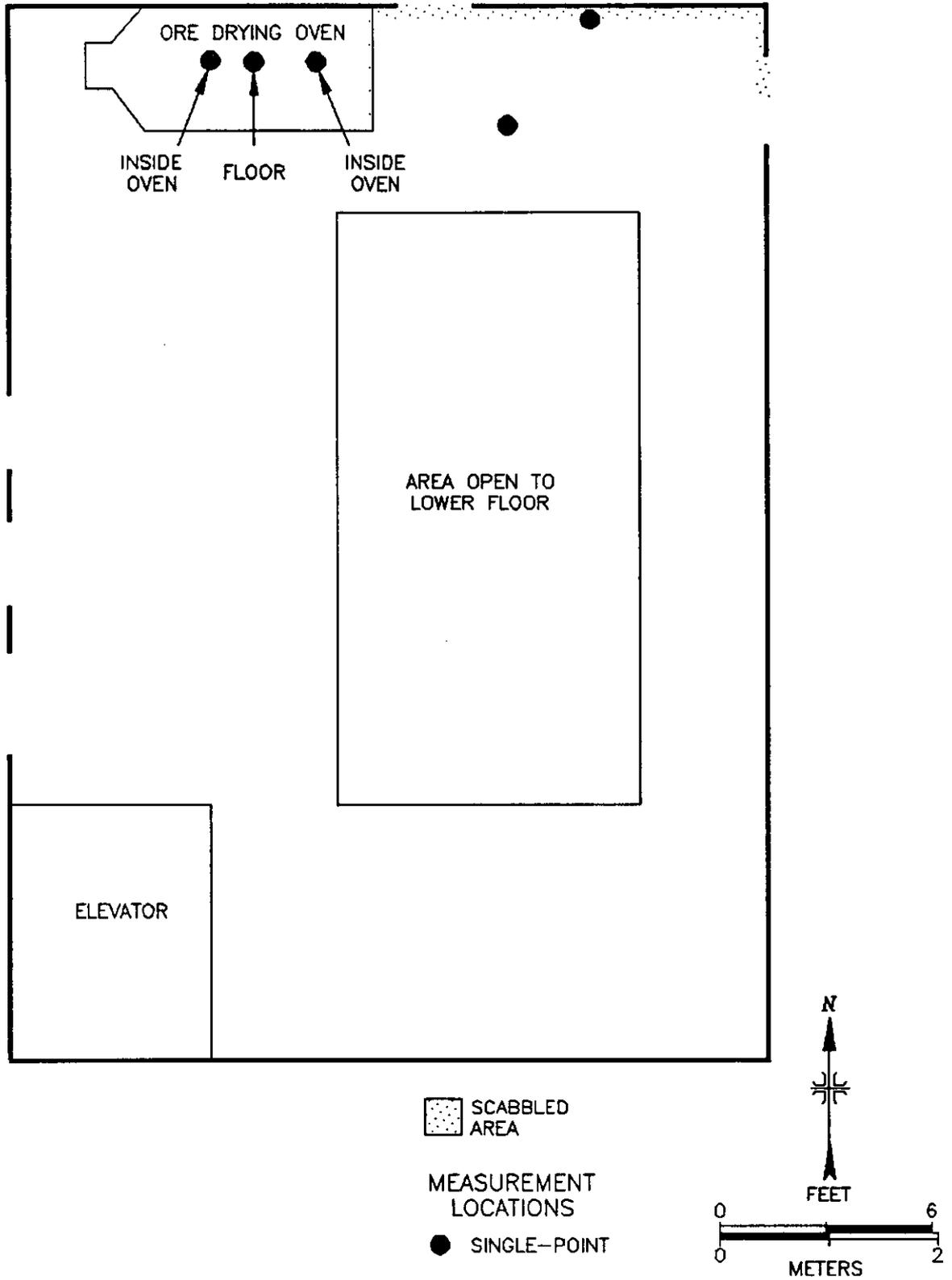
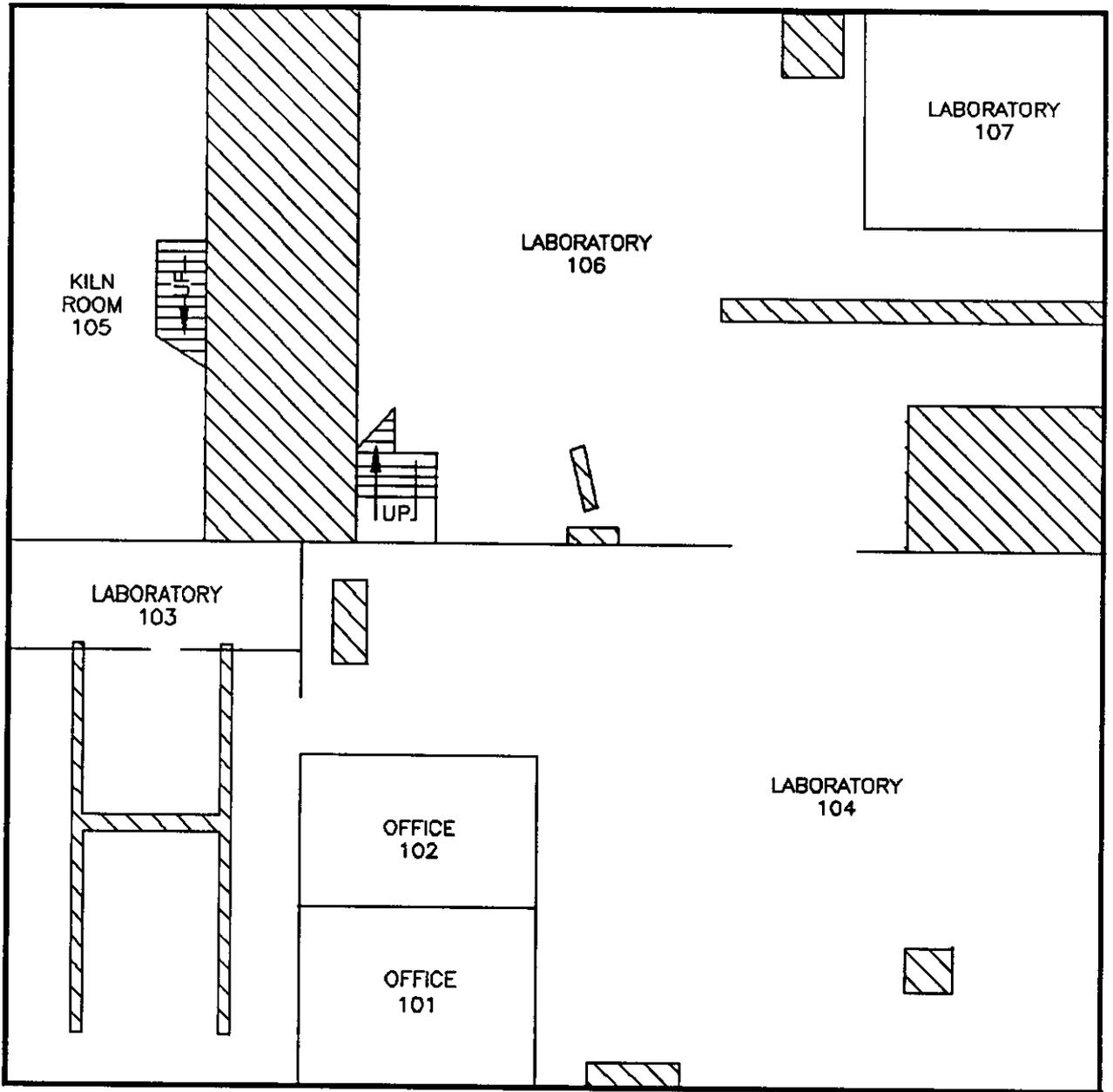


FIGURE 16: Building 23, Crusher Room, Second Floor, Indicating Measurement Locations



CONTAMINATED AREA

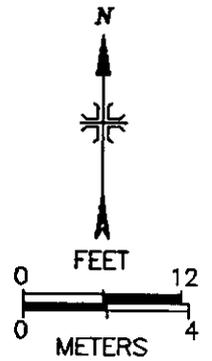


FIGURE 17: Plot Plan of Building 24

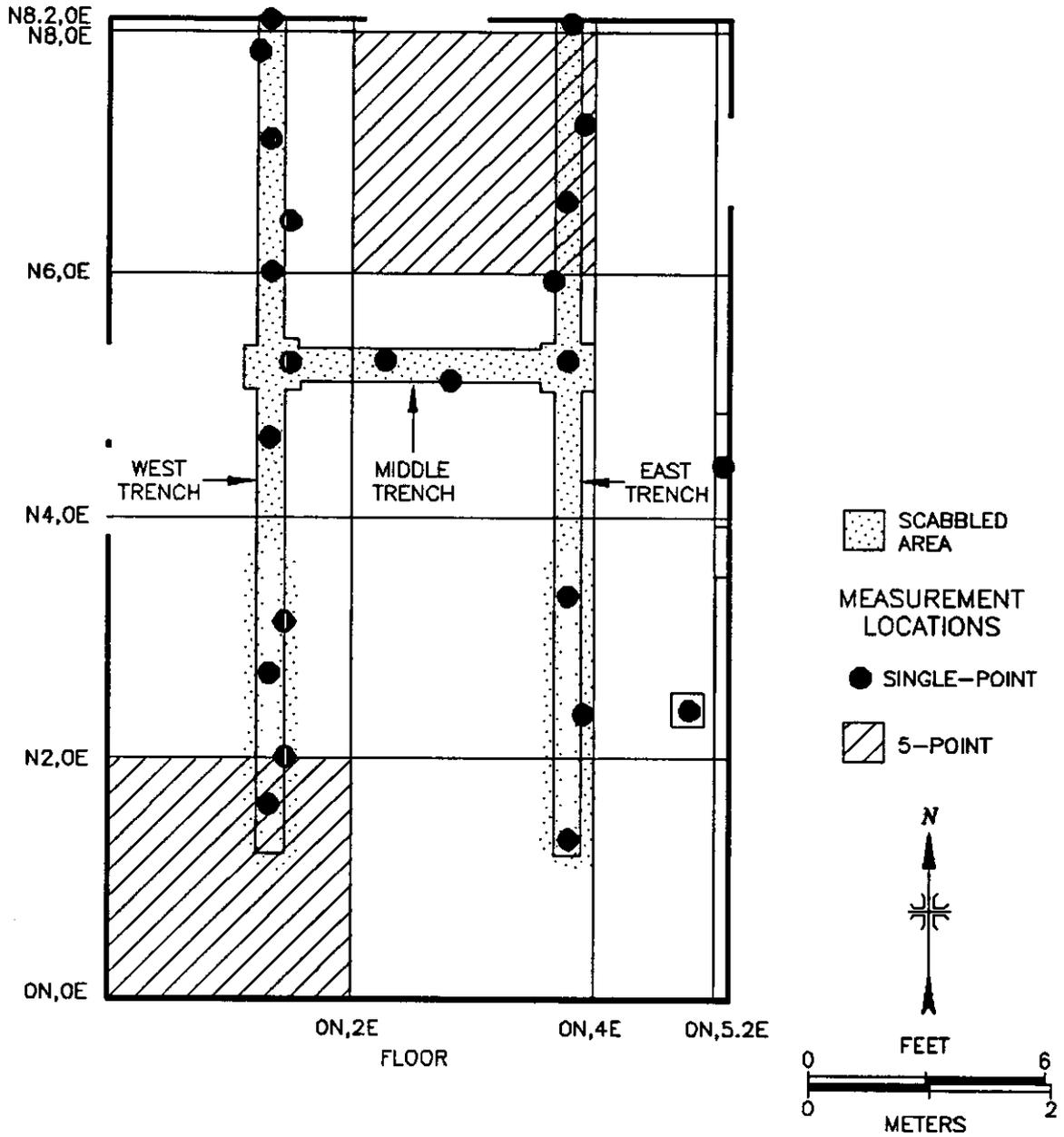


FIGURE 18: Building 24, Room 103, Indicating Measurement Locations on the Floor and in the East, West and Middle Trenches

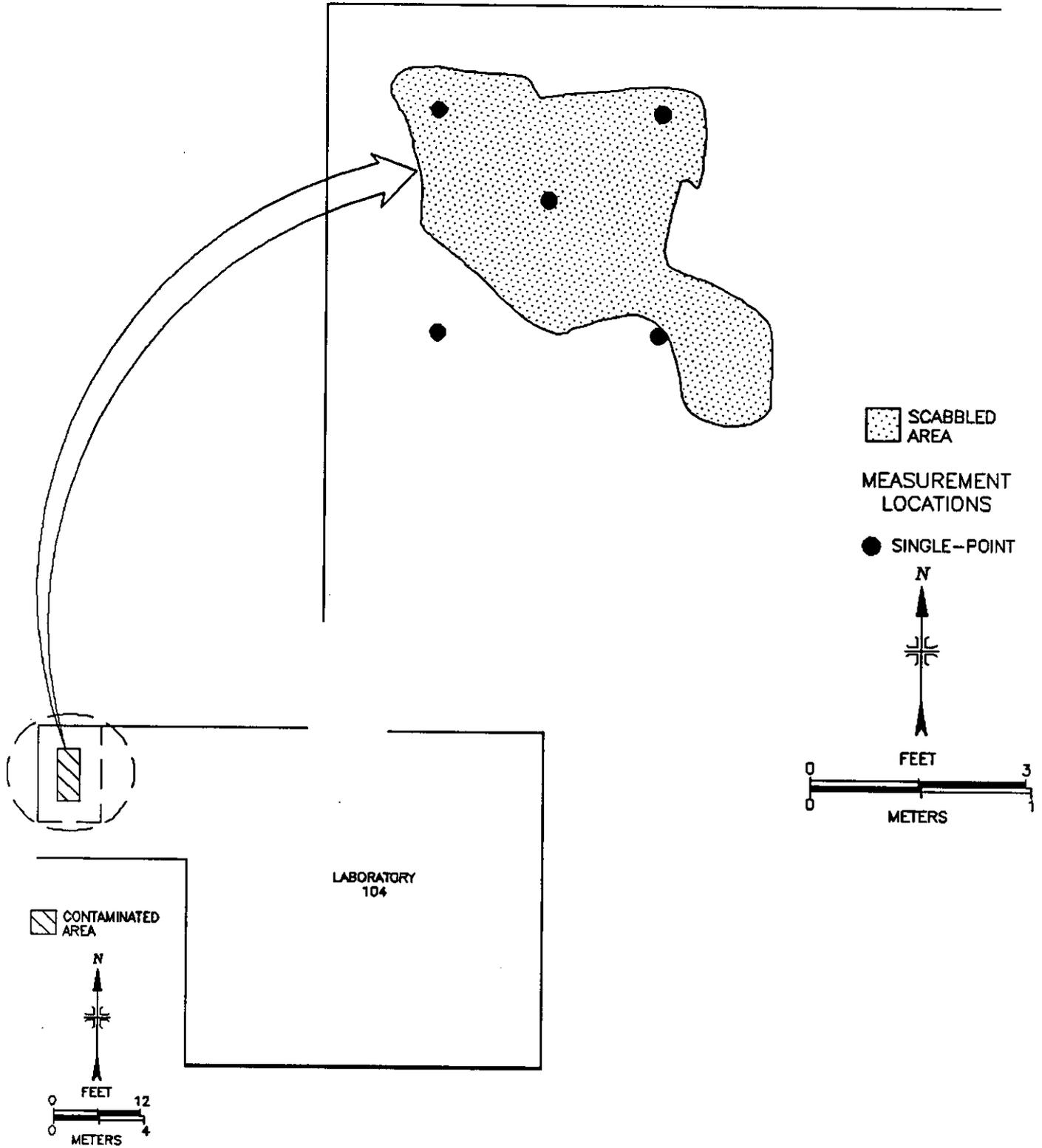


FIGURE 19: Building 24, Room 104, Indicating Measurement Locations on the Northwest Corner of the Floor

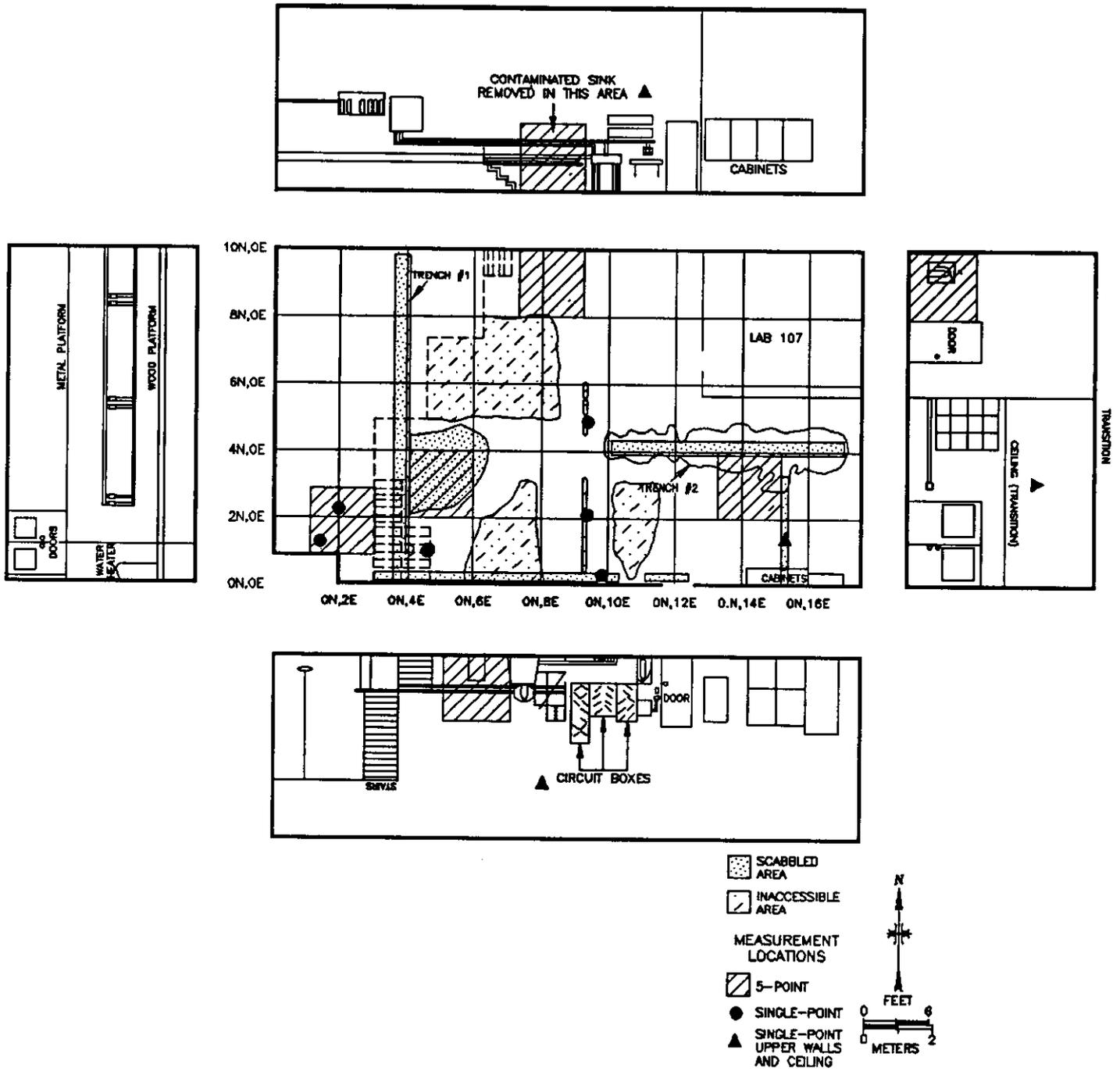


FIGURE 20: Building 24, Room 106, Indicating Measurement Locations on the Floor, Lower Walls, and Upper Walls

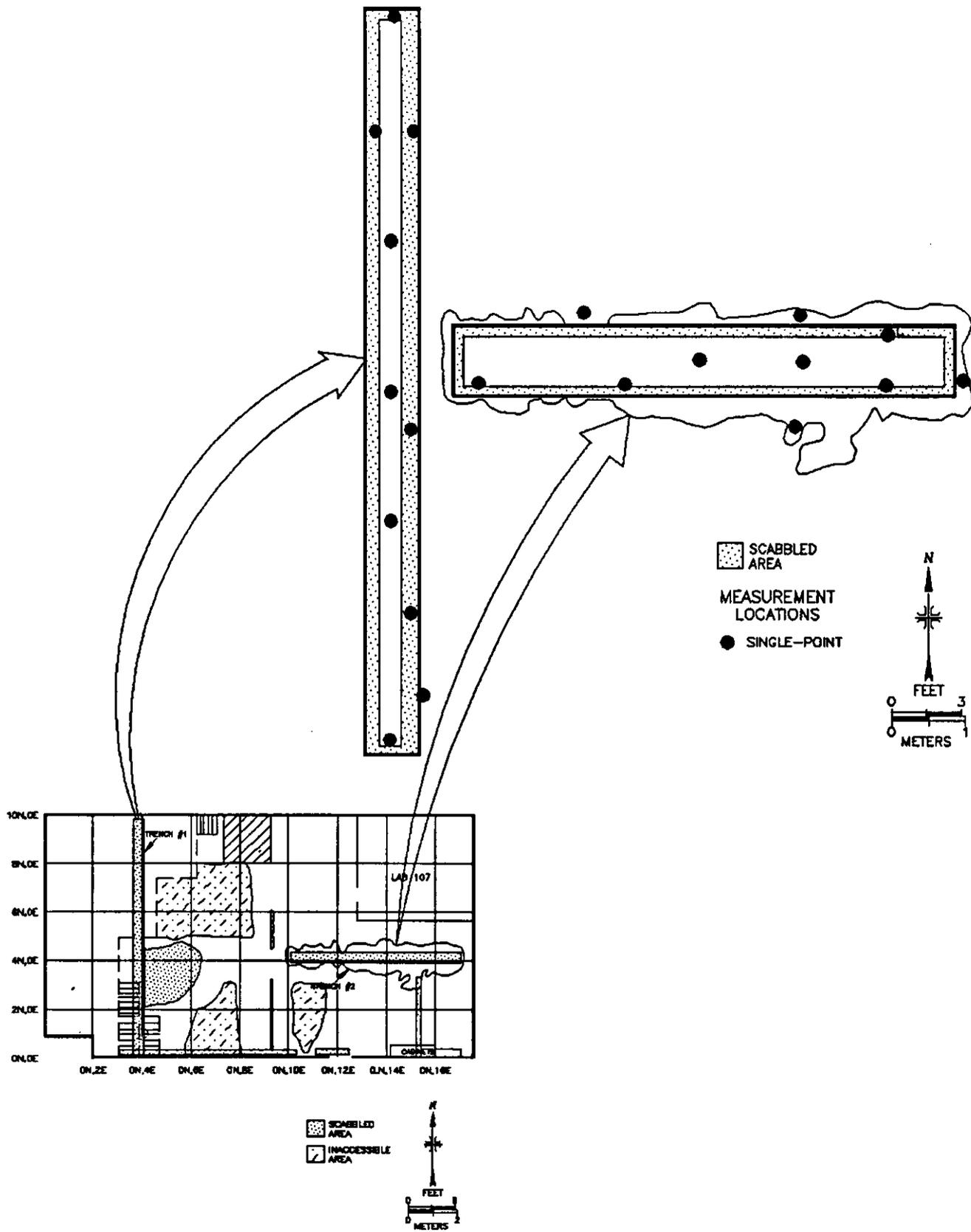


FIGURE 21: Building 24, Room 106, Indicating Measurement Locations in Trenches 1 and 2

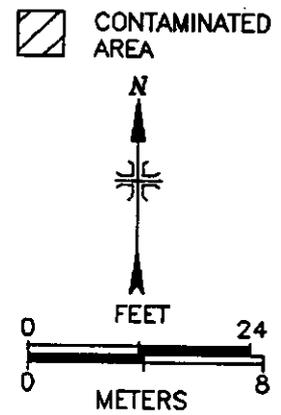
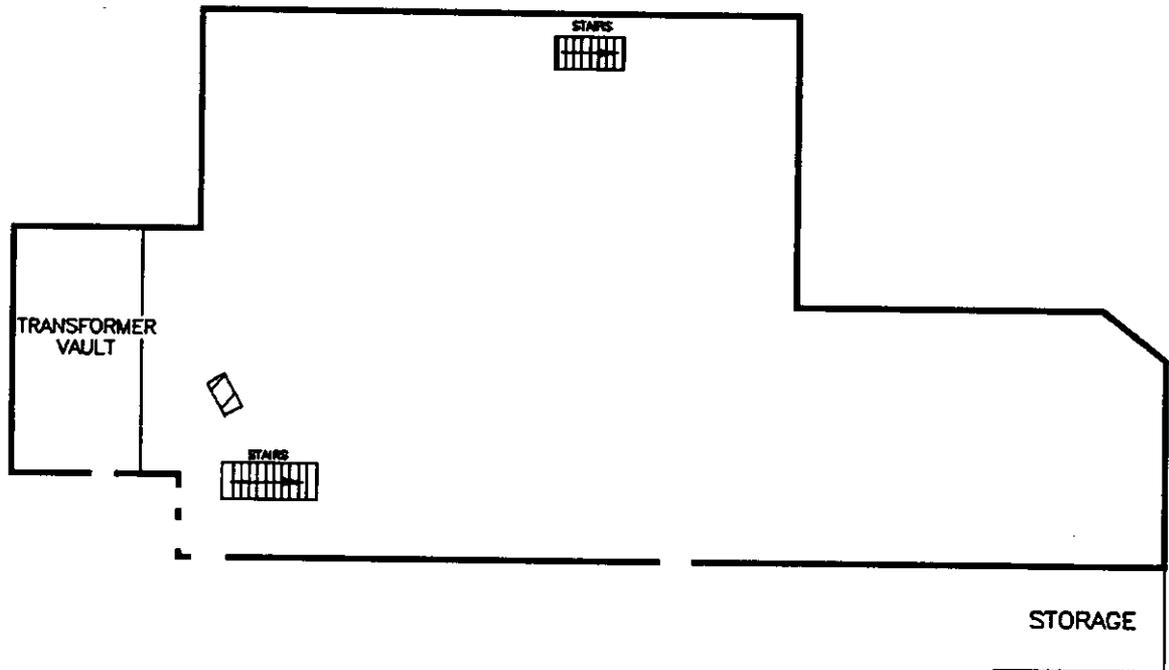


FIGURE 22: Plot Plan of Building 25, First Floor

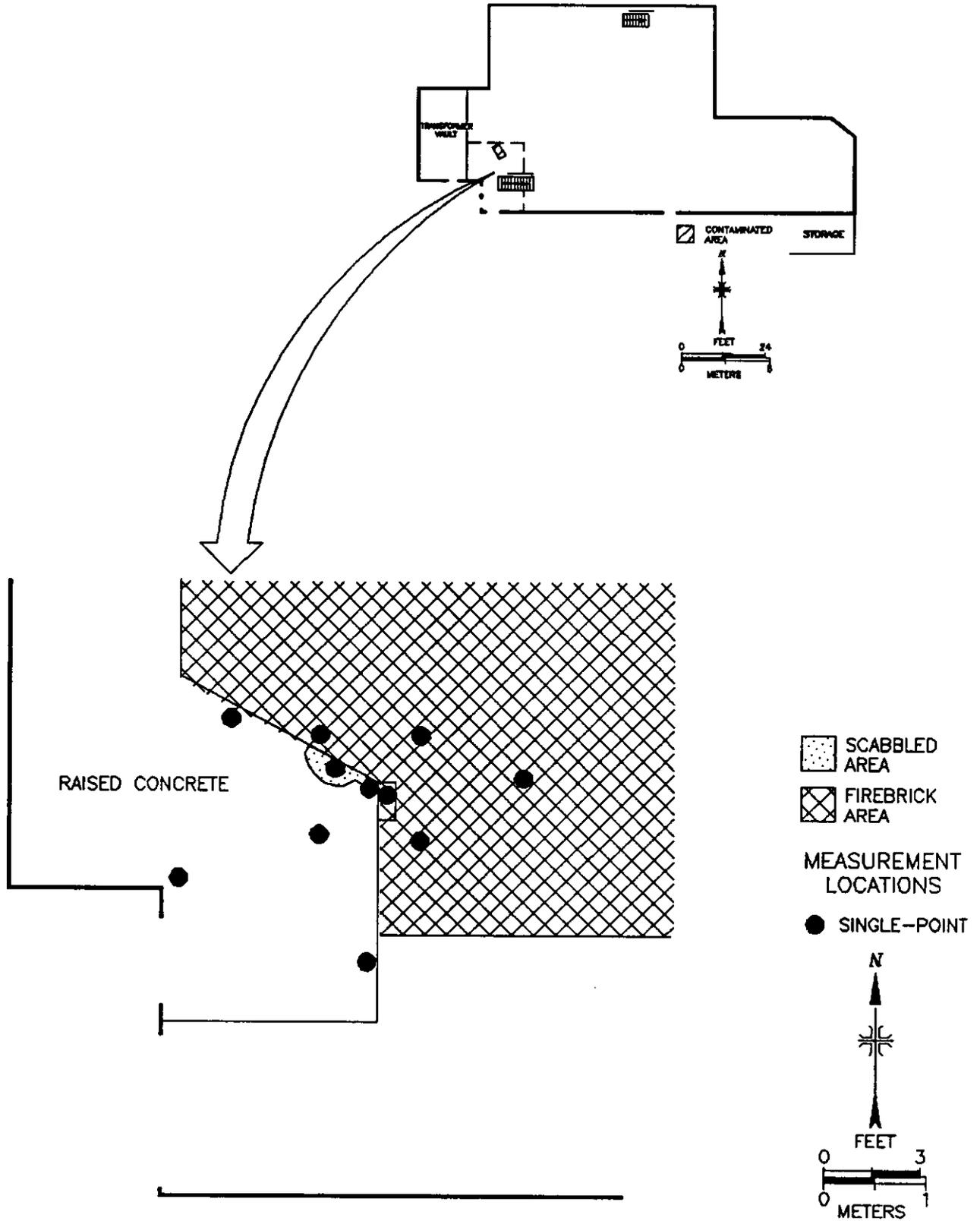


FIGURE 23: Building 25, First Floor, Indicating Measurement Locations on the Floor in the Southwest Corner

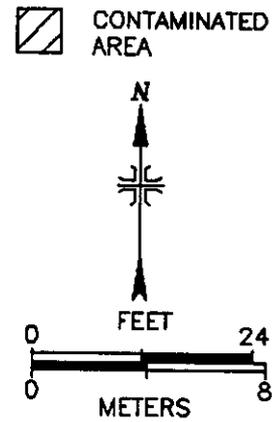
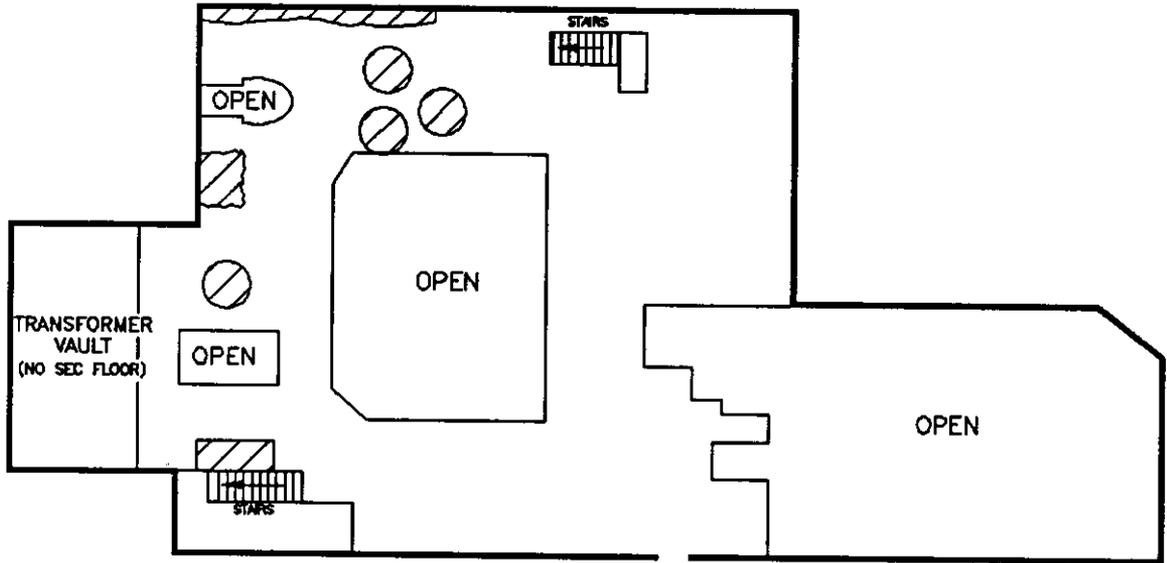


FIGURE 24: Plot Plan of Building 25, Mezzanine

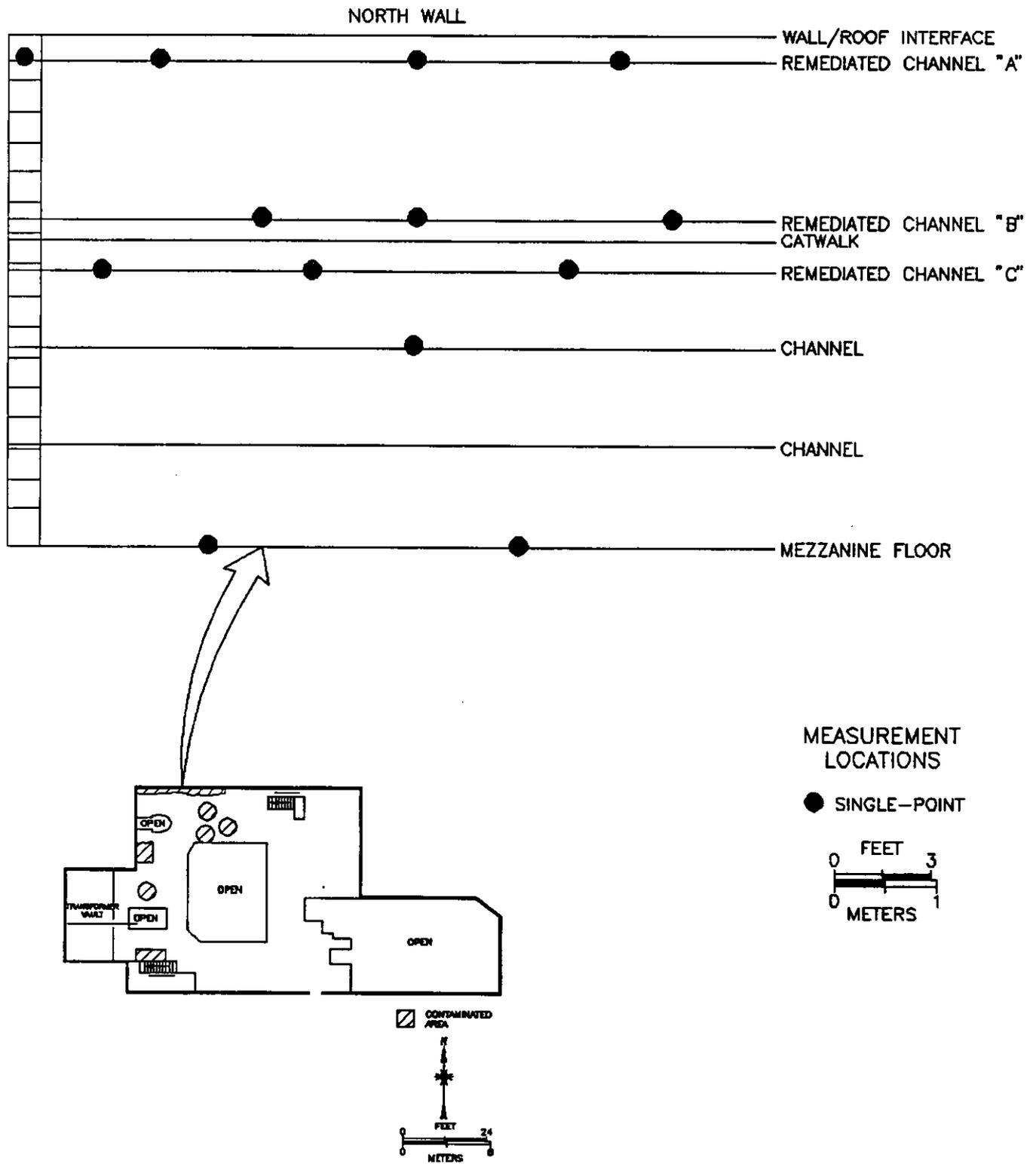
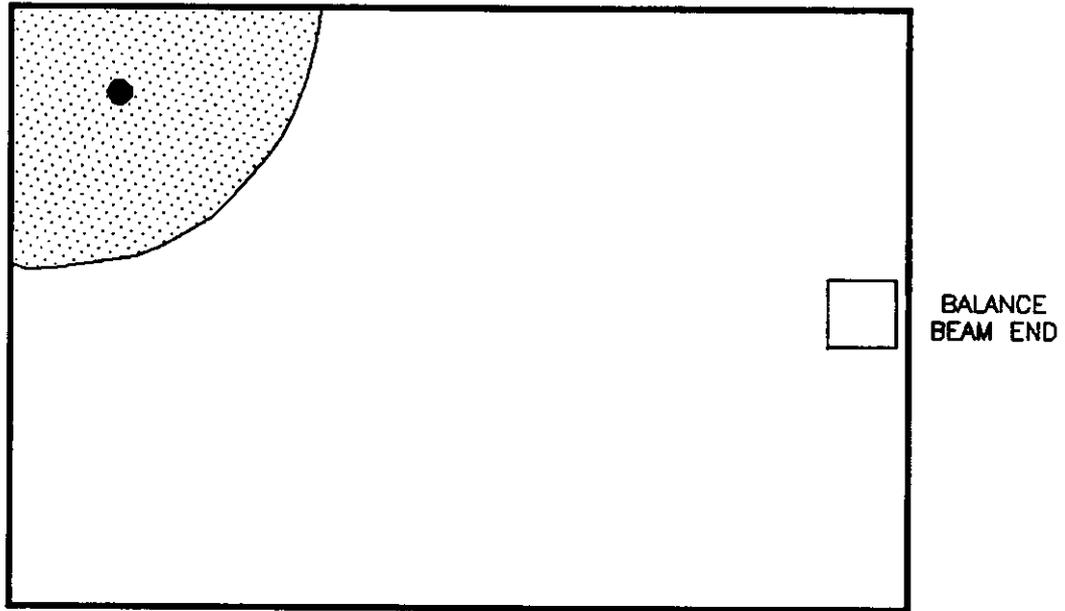


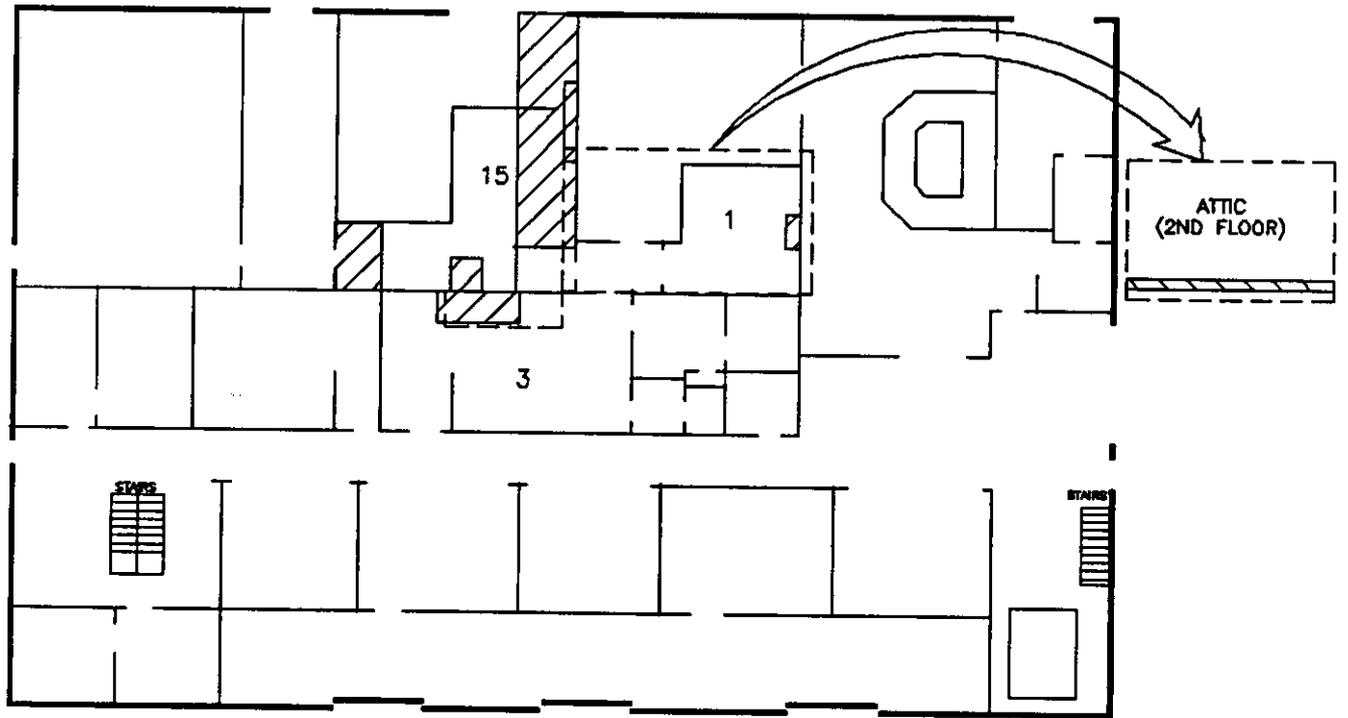
FIGURE 25: Building 24, Mezzanine, Indicating Measurement Locations in the Northwest Corner of the North Wall



SCABBLED AREA  
MEASUREMENT LOCATIONS  
● SINGLE-POINT



FIGURE 26: Building 25, Indicating Measurement Locations on the Scale Platform Located on the Mezzanine



 CONTAMINATED AREA

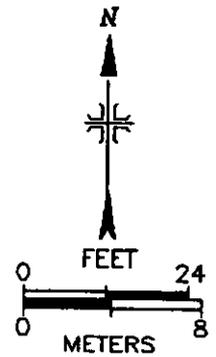


FIGURE 27: Plot Plan of Building 28, First Floor

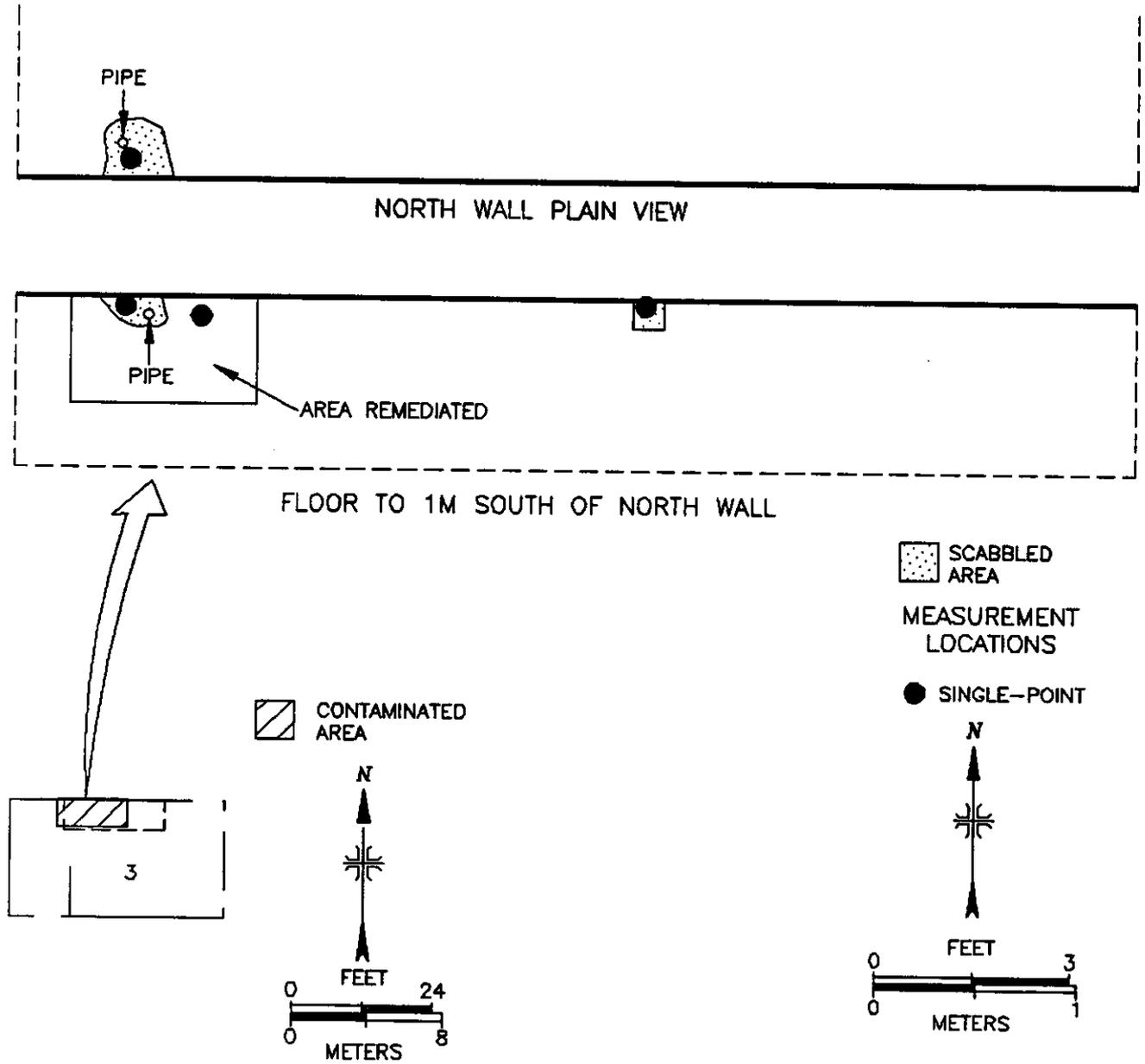


FIGURE 28: Building 28, Room 3, Indicating Measurement Locations on the Floor and North Wall

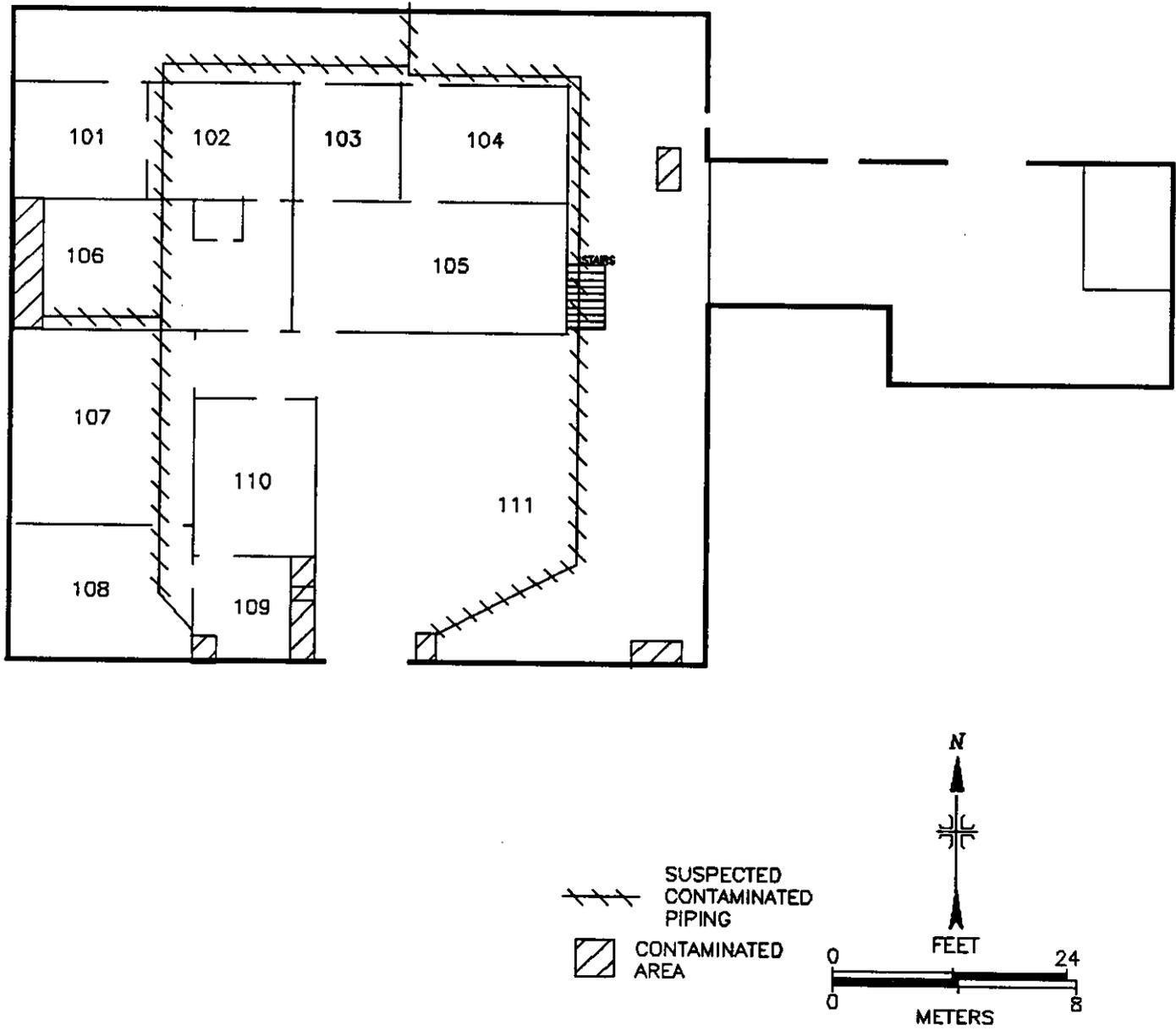


FIGURE 29: Plot Plan of Building 29, First Floor

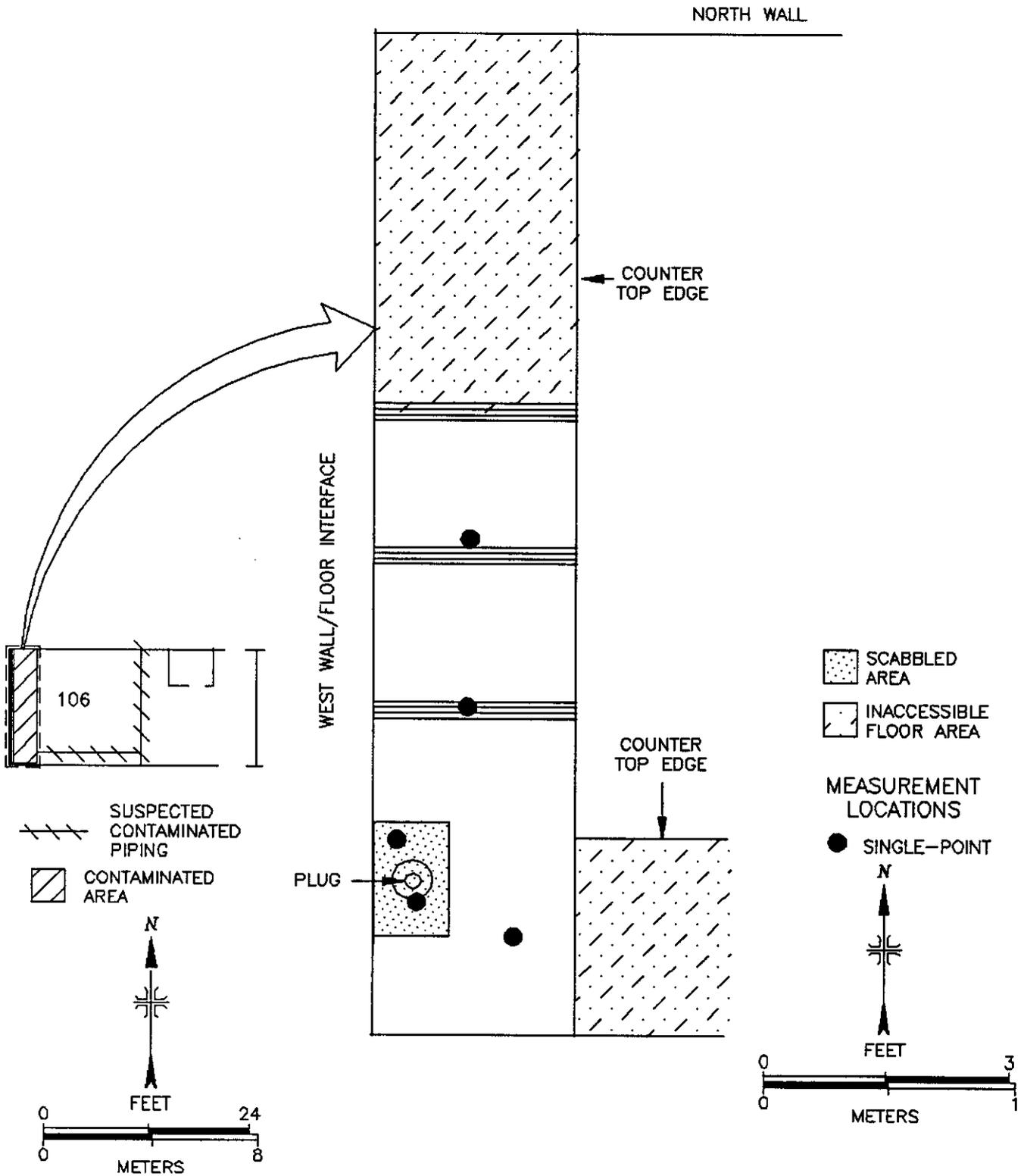


FIGURE 30: Building 29, Room 106, Indicating Measurement Locations on the Floor Beneath Counters

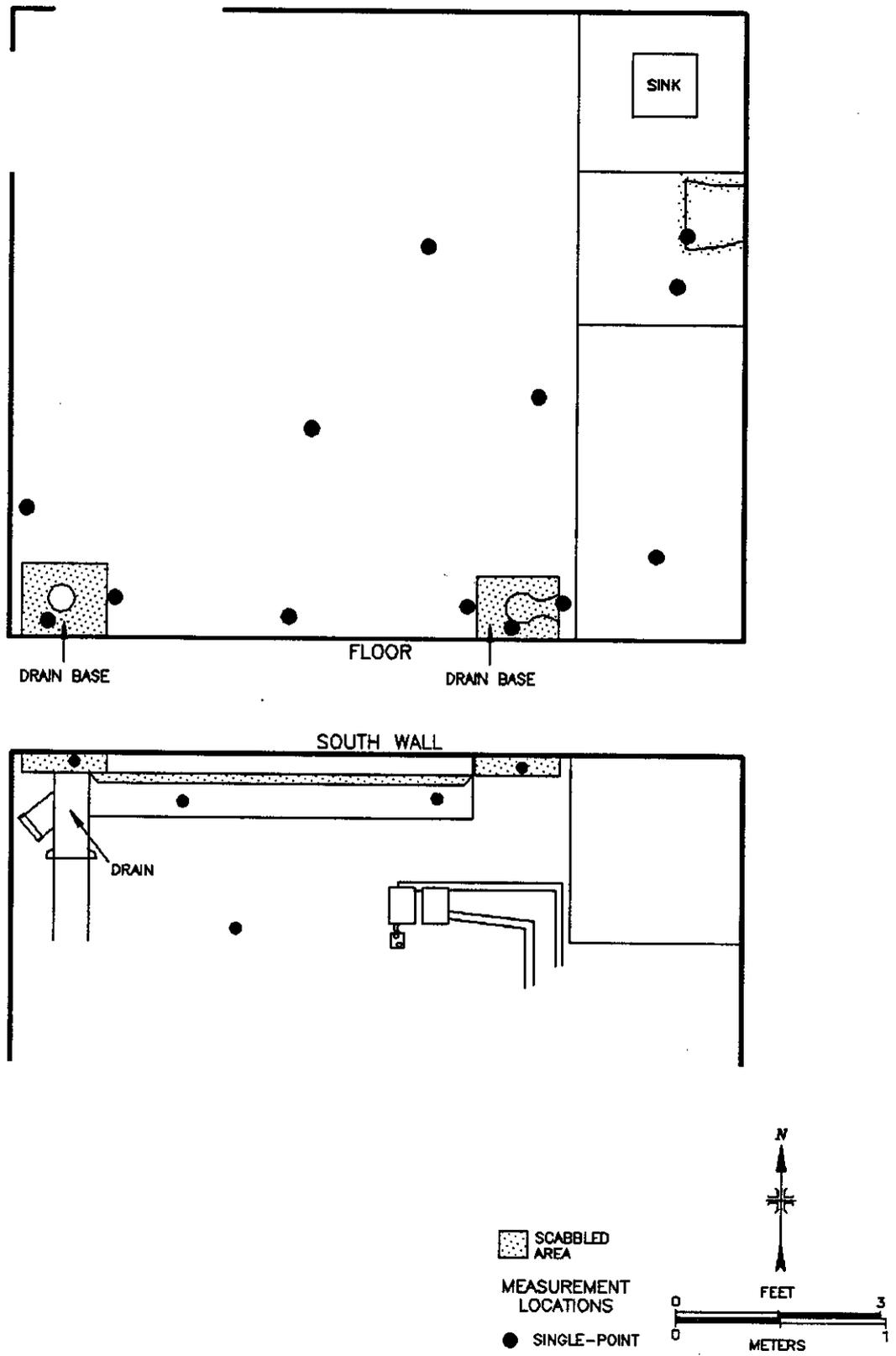


FIGURE 31: Building 29, Room 109, Indicating Measurement Locations on the Floor and South Wall

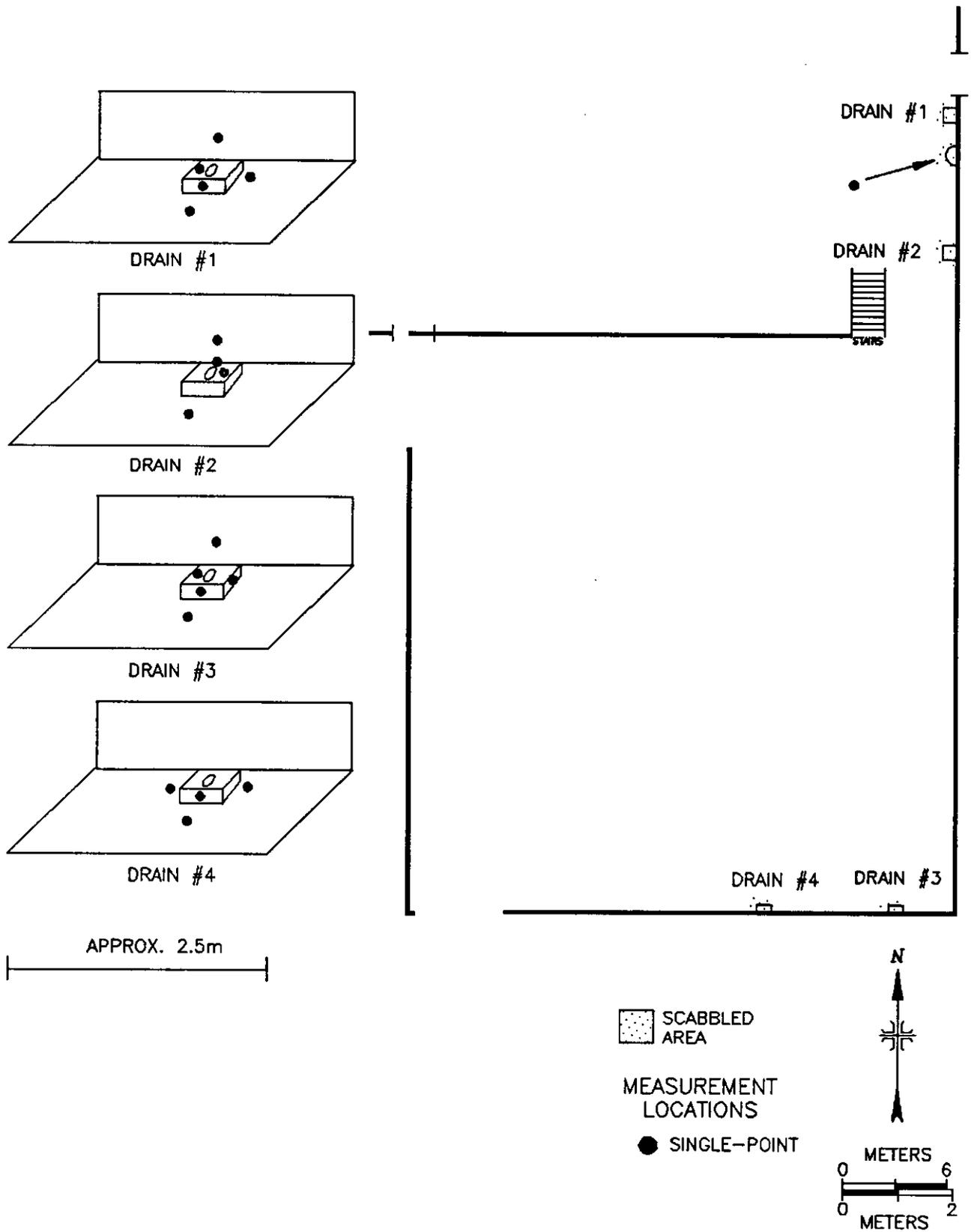


FIGURE 32: Building 29, Room 111, Indicating Measurement Locations on the Floor and Drain Pedestals

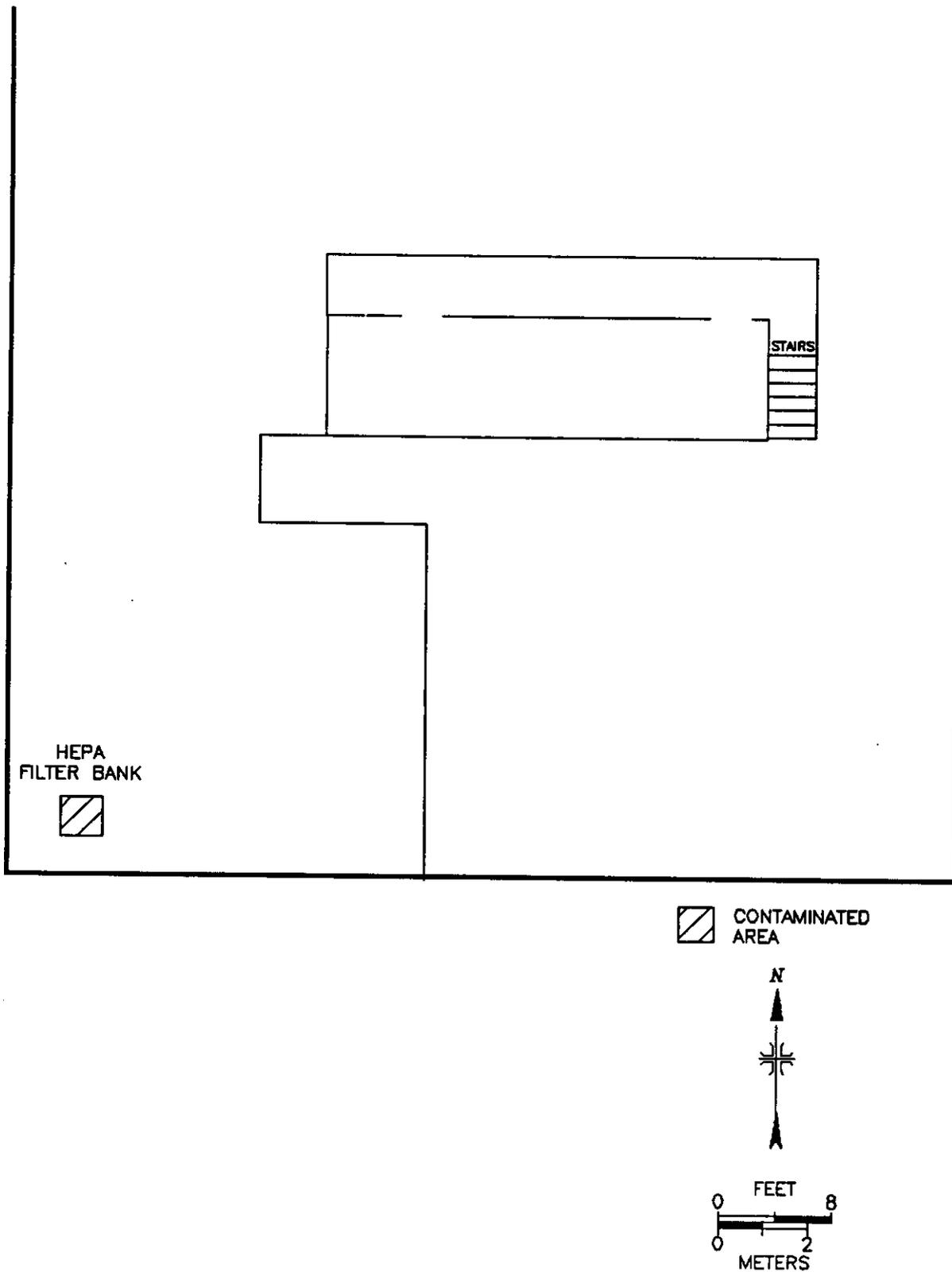


FIGURE 33: Building 29, Second Floor

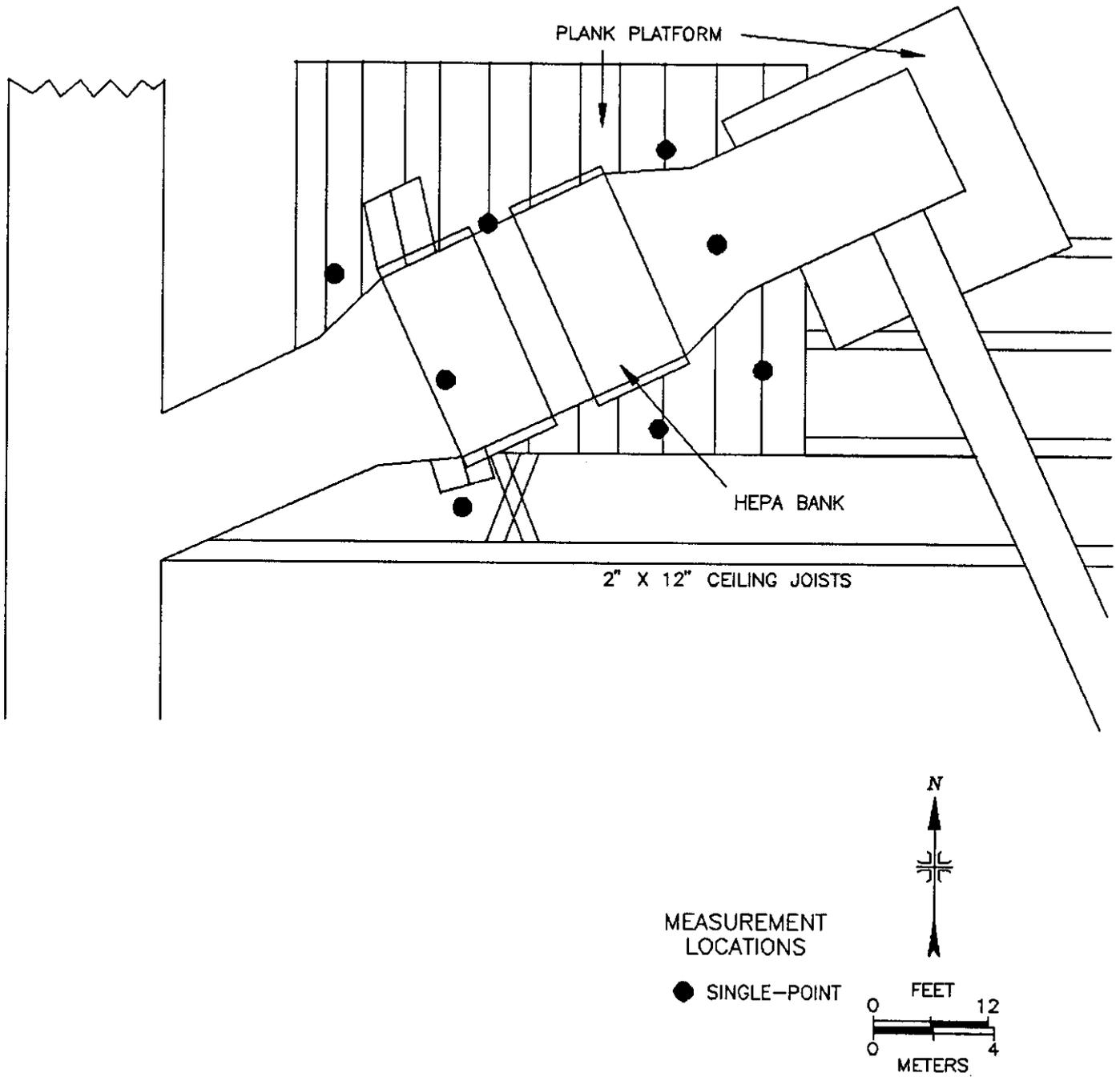


FIGURE 34: Building 29, Room 113, Indicating Measurement Locations on the HEPA Filter Bank

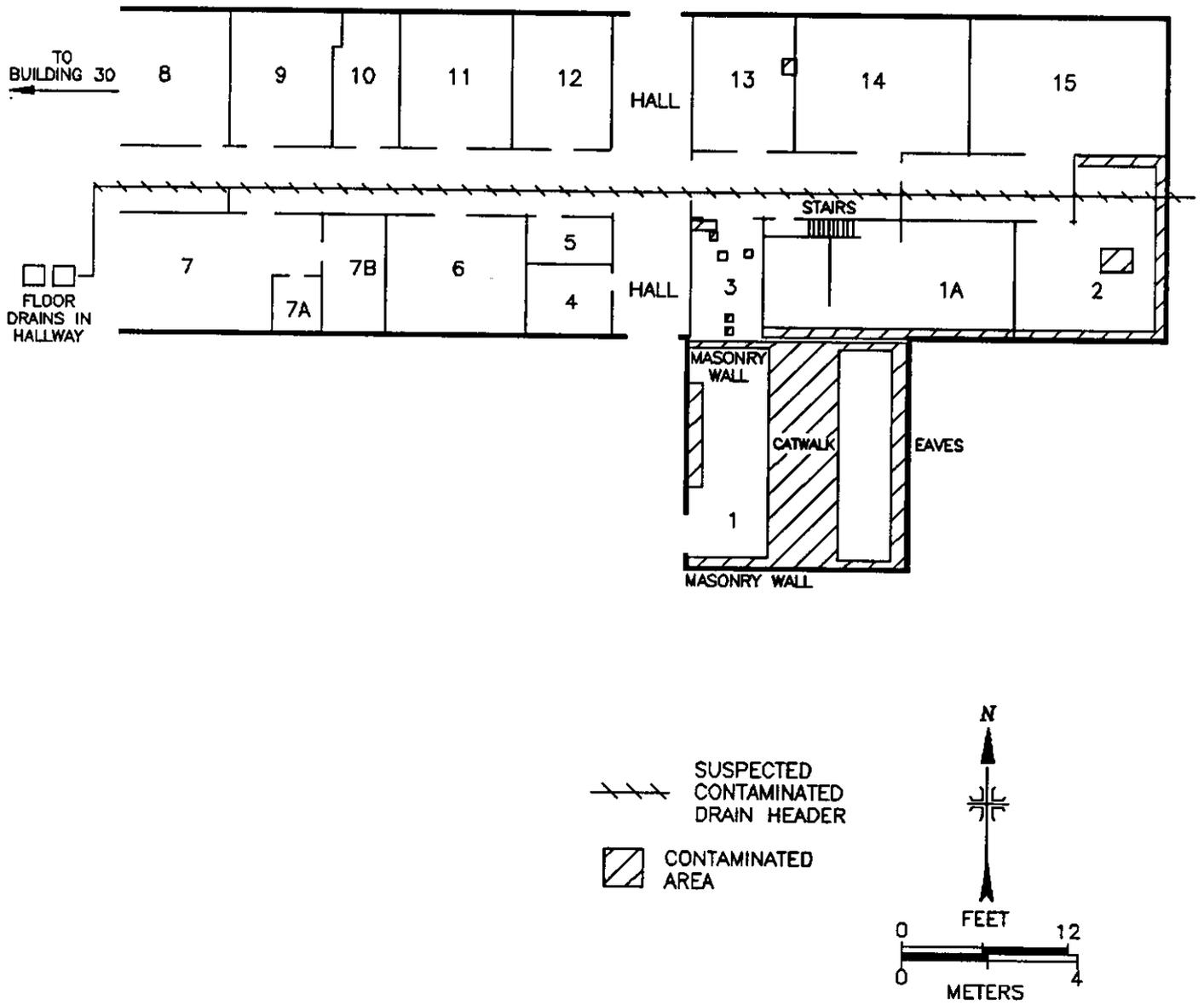


FIGURE 35: Plot Plan of Building 31

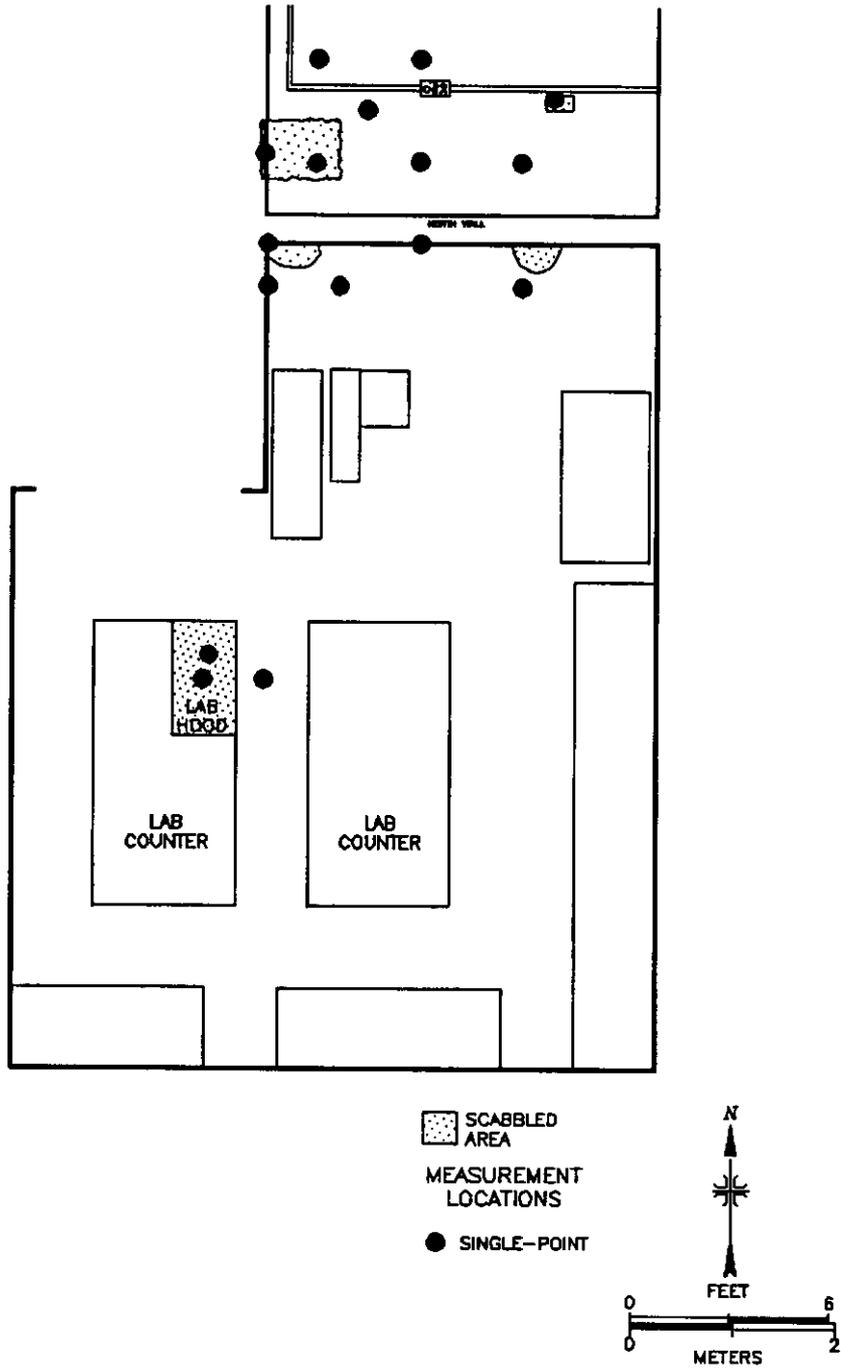


FIGURE 36: Building 31, Room 2, Indicating Measurement Locations on the Floor, North Wall, and Counter Space

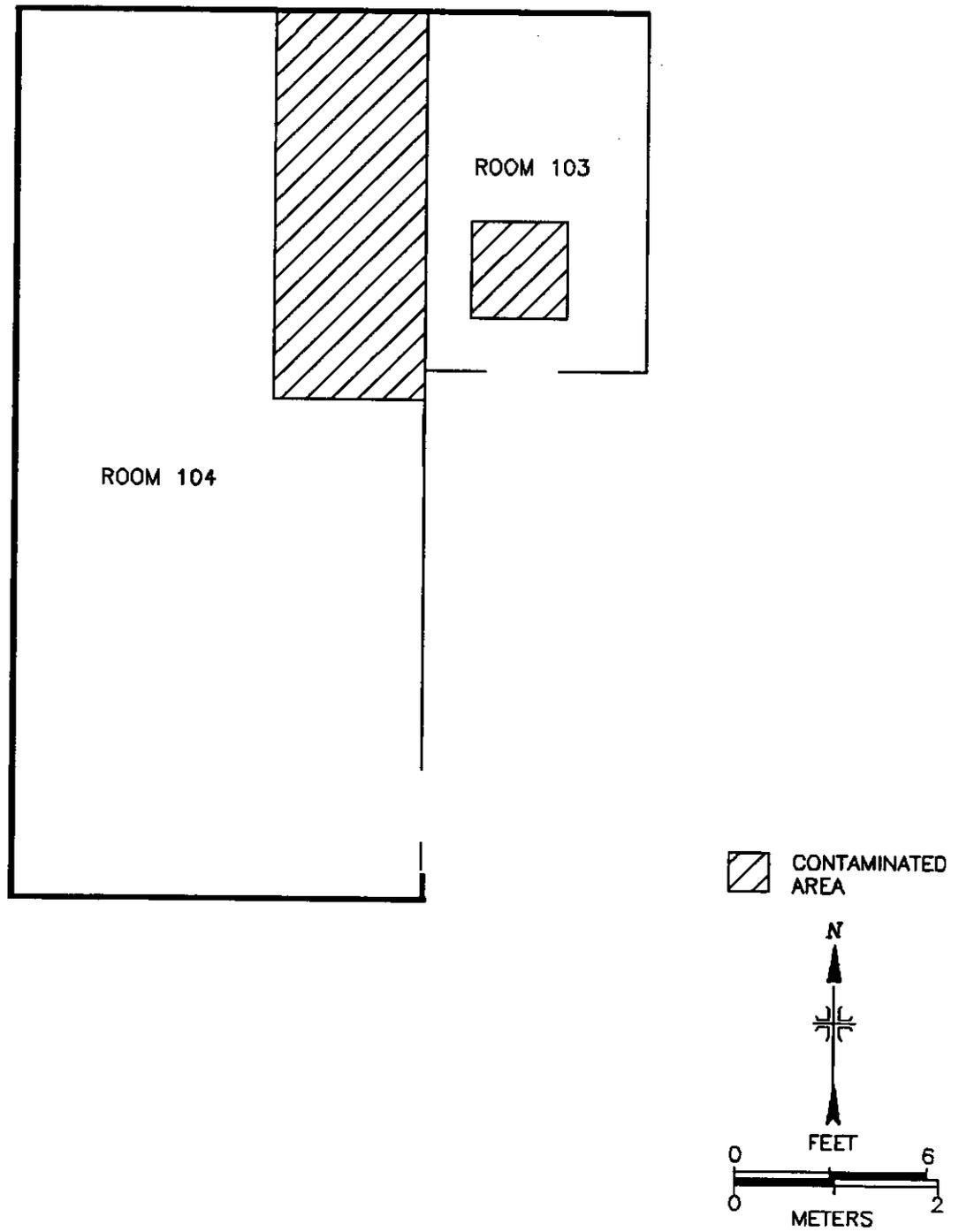


FIGURE 37: Partial Plot Plan of Building 33

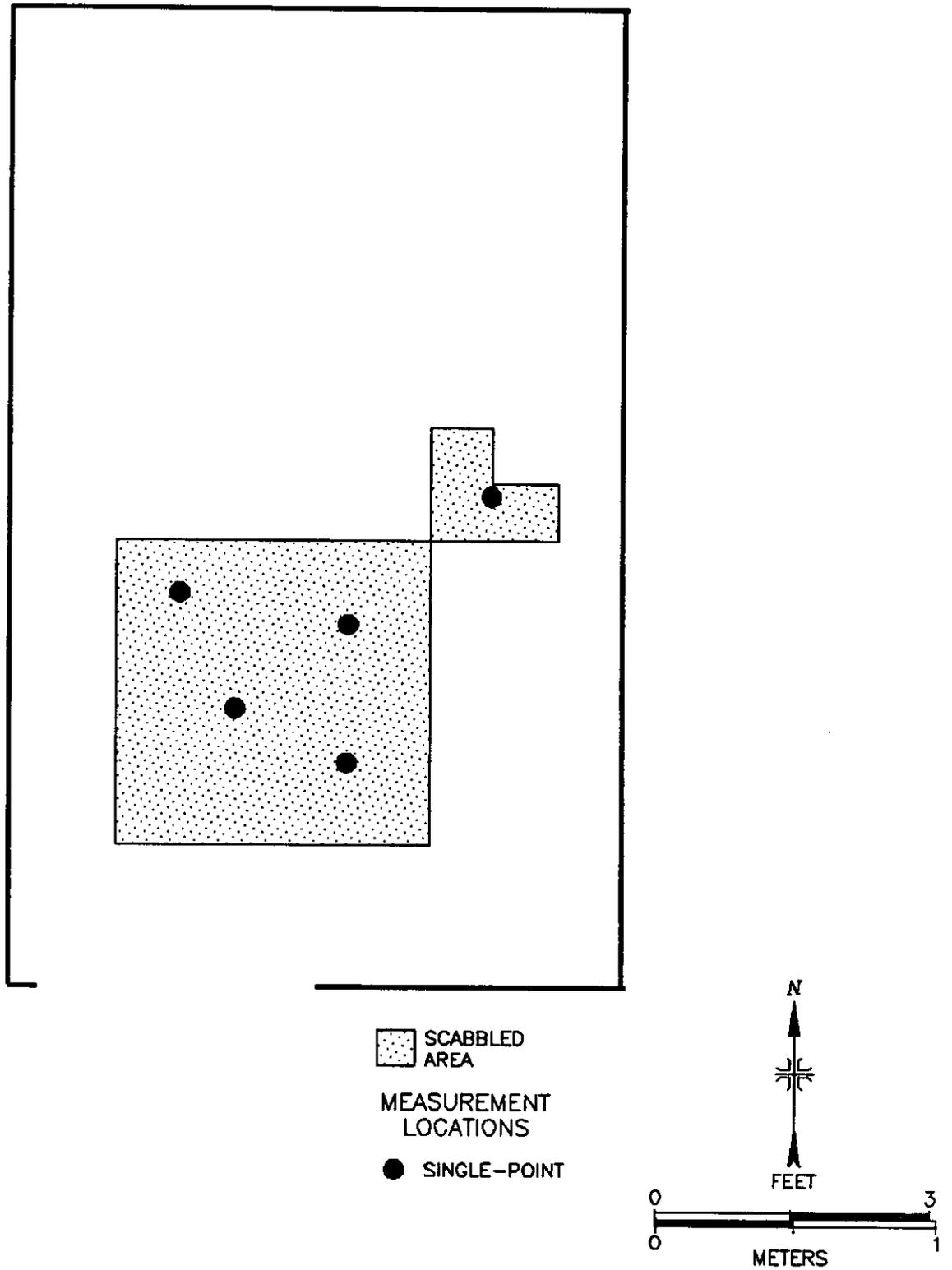


FIGURE 38: Building 33, Room 103, Indicating Measurement Locations on the Floor

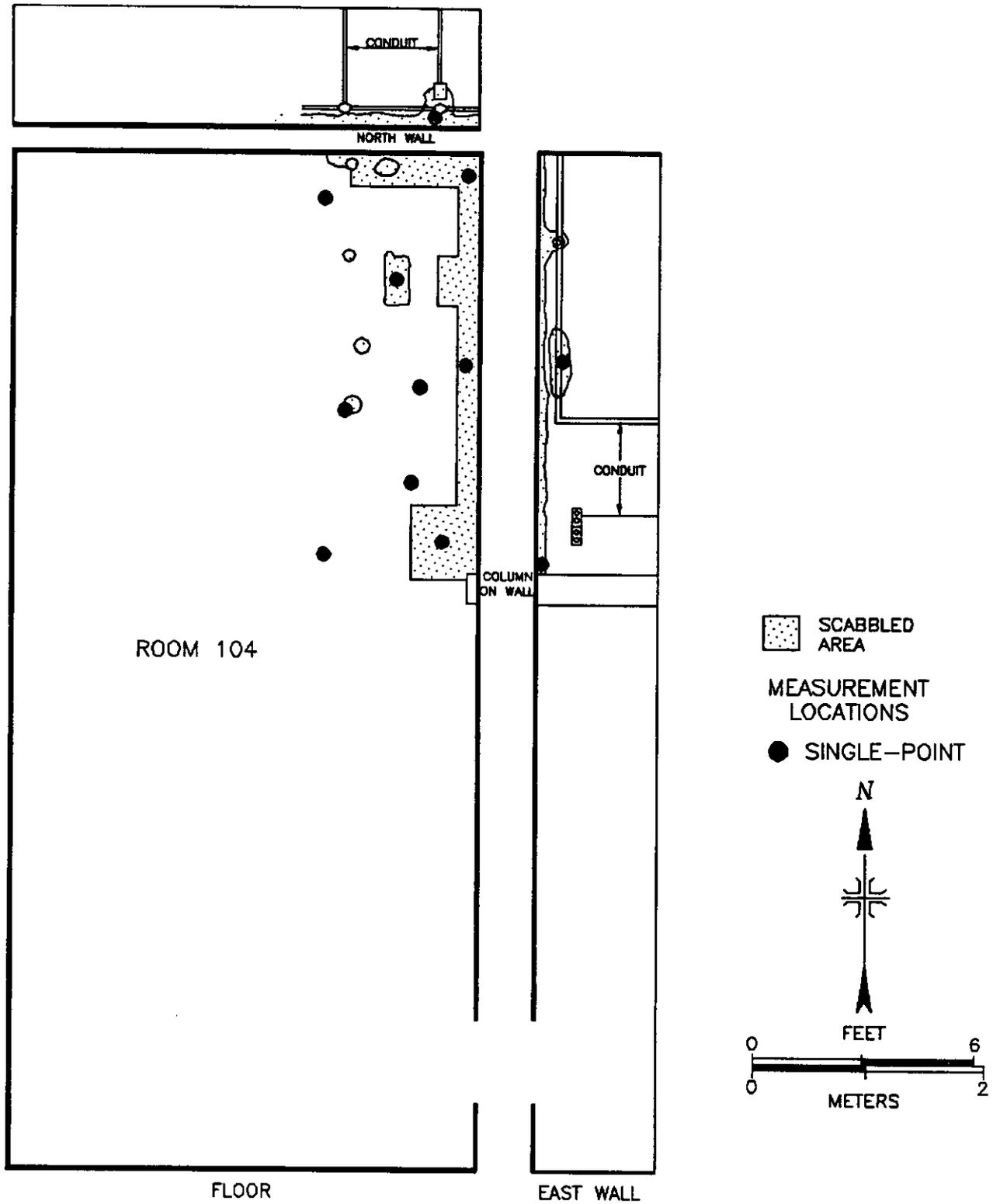


FIGURE 39: Building 33, Room 104, Indicating Measurement Locations on the Floor and Wall in the Northeast Corner

**TABLE I**  
**SUMMARY OF SURFACE ACTIVITY MEASUREMENTS**  
**ALBANY RESEARCH CENTER**  
**ALBANY, OREGON**

BLDG.	ROOM	LOCATION*	# OF GRID BLKS OR LOCATIONS MEASURED	HIGHEST GRID BLOCK AVERAGE DPM/100 cm <sup>2</sup>		TOTAL ACTIVITY DPM/100 cm <sup>2</sup>		REMOVABLE ACTIVITY DPM/100 cm <sup>2</sup>	
				$\alpha$	$\beta$	$\alpha$ range	$\beta$ - $\gamma$ range	$\alpha$ range	$\beta$ - $\gamma$ range
1	119	FLOOR	1 <sup>1/4</sup> *	< 80	< 850	< 80-98	< 850	< 6	< 13
		LOWER WALL	1 <sup>b</sup>	< 80	< 850	< 80-110	< 850	< 6	< 13
	306	FLOOR	9 <sup>c</sup>	N/A <sup>d</sup>	N/A	< 80	< 850-920	< 6	< 13
		LOWER WALL	1 <sup>c</sup>	N/A	N/A	< 80	< 850	< 6	< 13
3	101	FLOOR	11 <sup>c</sup>	N/A	N/A	< 80	< 850	< 6	< 13
	103	FLOOR	2 <sup>b/3</sup> <sup>c</sup>	< 80	450	< 80	< 410-600	< 6	< 13
17	west storage	FLOOR	3 <sup>b</sup>	< 80	< 440	< 80	< 410-560	< 6	< 13
		LOWER WALL	2 <sup>b</sup>	< 80	< 410	< 80	< 410	< 6	< 13
23	crusher room	FLOOR	2 <sup>c</sup>	N/A <sup>d</sup>	N/A	90	500-540	< 6	< 13
		OVEN RACKS	3 <sup>c</sup>	N/A	N/A	< 80	< 410-480	< 6	< 13
		ELEVATOR SHAFT	10 <sup>c</sup>	N/A	N/A	< 80	< 410-670	< 6	< 13
		BASEMENT TUNNEL	10 <sup>c</sup>	N/A	N/A	< 80	< 410-770	< 6	< 13
24	103	FLOOR	2 <sup>b/23</sup> <sup>c</sup>	< 80	< 850	< 80-440	< 850	< 6	< 13
		LOWER WALL	1 <sup>b</sup>	< 80	< 850	< 80	< 850	< 6	< 13
	104	FLOOR	1 <sup>b</sup>	< 80	< 850	< 80	< 850	< 6	< 13

TABLE 1 (continued)  
 SUMMARY OF SURFACE ACTIVITY MEASUREMENTS  
 ALBANY RESEARCH CENTER  
 ALBANY, OREGON

BLDG.	ROOM	LOCATION*	# OF GRID BLKS OR LOCATIONS MEASURED	$\alpha$ HIGHEST GRID BLOCK AVERAGE DPM/100 cm <sup>2</sup>	$\beta$	$\alpha$ range TOTAL ACTIVITY DPM/100 cm <sup>2</sup>	$\beta$ range REMOVABLE ACTIVITY DPM/100 cm <sup>2</sup>
24	106	FLOOR	4/6 <sup>c</sup>	120	500	< 80-140	< 410-610
		LOWER WALL	3 <sup>c</sup>	< 80	< 410	< 80	< 410
		UPPER WALL	1 <sup>c</sup>	< 80	< 410	< 80	< 410
		TRENCH 1	10 <sup>c</sup>	N/A	N/A	< 80-110	< 410-800
		TRENCH 2	10 <sup>c</sup>	N/A	N/A	< 80	< 410
25	mezz	FLOOR	1/8 <sup>c</sup>	< 80	740	< 80	< 410-1600
		LOWER WALL	1 <sup>c</sup>	N/A	N/A	< 80	< 410
		UPPER WALL	10 <sup>c</sup>	N/A	N/A	< 80-230	< 410-550
28	3	FLOOR	3 <sup>c</sup>	N/A	N/A	< 80-340	< 850
		LOWER WALL	3 <sup>c</sup>	N/A	N/A	< 80	< 850
29	106	FLOOR	5 <sup>c</sup>	N/A	N/A	< 80-90	≤ 850
	109	FLOOR	15 <sup>c</sup>	N/A	N/A	< 80	< 850
		LOWER WALL	5 <sup>c</sup>	N/A	N/A	< 80	< 850
	111	FLOOR	21 <sup>c</sup>	N/A	N/A	< 80	< 850-1000
	113	EQUIPMENT	8 <sup>c</sup>	N/A	N/A	< 80	< 850
31	2	FLOOR	5 <sup>c</sup>	N/A	N/A	< 80	580-710
		LOWER WALL	1/3 <sup>c</sup>	< 80	750	< 80	< 410-1000

TABLE 1 (cont.)  
 SUMMARY OF SURFACE ACTIVITY MEASUREMENTS  
 ALBANY RESEARCH CENTER  
 ALBANY, OREGON

BLDG.	ROOM	LOCATION*	# OF GRID BLKS OR LOCATIONS MEASURED	HIGHEST GRID BLOCK AVERAGE DPM/100 cm <sup>2</sup>		TOTAL ACTIVITY DPM/100 cm <sup>2</sup>		REMOVABLE ACTIVITY DPM/100 cm <sup>2</sup>	
				$\alpha$	$\beta$	$\alpha$ range	$\beta$ - $\gamma$ range	$\alpha$ range	$\beta$ - $\gamma$ range
33	103	FLOOR	5 <sup>c</sup>	N/A	N/A	< 80	< 850	< 6	< 13
	104	FLOOR	9 <sup>c</sup>	N/A	N/A	< 80	< 850-1200	< 6	< 13
		LOWER WALL	3 <sup>c</sup>	N/A	N/A	< 80	< 850	< 6	< 13

\*REFER TO FIGURES  
<sup>a</sup>FIVE POINT MEASUREMENT  
<sup>b</sup>SINGLE-POINT MEASUREMENT  
<sup>c</sup>N/A: NOT APPLICABLE

## REFERENCE

1. P.R. Cotten, Verification of Remediation, Albany Research Center, Albany, Oregon, October 1989.