

Rancho Seco

Final Status Survey Summary Report

November 1, 2007

Aux. Bldg. (-) 20' EI, Rm 44, Makeup Pump Room

Survey Unit F8130621

Prepared By: *D. Anderson* Date: 11/1/2007  
FSS Engineer

Reviewed By: *[Signature]* Date: 11/5/07  
Lead FSS Engineer

Approved By: *[Signature]* Date: 11-14-07  
Dismantlement Superintendent, Radiological

## FINAL STATUS SURVEY SUMMARY REPORT

### Survey Unit:

F8130621, Aux. Bldg. (-) 20' El, Rm 44, Makeup Pump Room

### Survey Unit Description:

**Operating History:** The reinforced concrete structure contained the RadWaste processing and supporting systems. The building contained six main elevations. Residual radioactive material was known to be present on all levels of the interior of the building. Operating records and the HSA document several events with the potential for a release of radioactivity inside this structure. One report documented contamination of the auxiliary building roof. The roof was later replaced.

**Site Characterization:** Direct measurements were made of each of the interior elevation surfaces as well as the exterior surfaces of the structure. These measurements confirmed the presence of plant-derived radionuclides. Direct measurements on the -47' elevation showed a mean gross activity level of 320,071 dpm/100 cm<sup>2</sup> and a maximum value of 5,720,000 dpm/100 cm<sup>2</sup>. Direct measurements on the -29' elevation showed a mean gross activity level of 544,756 dpm/100 cm<sup>2</sup> and a maximum value of 11,370,000 dpm/100 cm<sup>2</sup>. Direct measurements on the -20' elevation showed a mean gross activity level of 247,831 dpm/100 cm<sup>2</sup> and a maximum value of 10,080,000 dpm/100 cm<sup>2</sup>. Direct measurements on the grade elevation showed a mean gross activity level of 373,758 dpm/100 cm<sup>2</sup> and a maximum value of 5,800,000 dpm/100 cm<sup>2</sup>. Direct measurements on the +20' elevation showed a mean gross activity level of 85,408 dpm/100 cm<sup>2</sup> and a maximum value of 1,900,000 dpm/100 cm<sup>2</sup>. Direct measurements on the +40' elevation showed a mean gross activity level of 3,288 dpm/100 cm<sup>2</sup> and a maximum value of 24,781 dpm/100 cm<sup>2</sup>. Direct measurements on the building exterior, including the mezzanine roof, showed a mean gross activity level of 1,897 dpm/100 cm<sup>2</sup> and a maximum value of 2,990 dpm/100 cm<sup>2</sup>. (The roof had been replaced prior to the classification survey.) Based on the classification procedure (DSIP-0020) and levels of gross activity reported, the interior of the auxiliary building was determined to be a Class 1, 2 area and the exterior was a Class 2,3.

HSA Events: HSA Report pg. 63.

### Survey Unit Design Information:

The Survey Unit Design Parameters are presented in Table 1 below. The survey unit and measurement locations are depicted on the maps in Attachment 1. Direct measurement locations were determined using a random-start, fixed grid pattern and 277.8 m<sup>2</sup> were scanned for 100% coverage. Samples of removable contamination were collected at each direct measurement location. The instrumentation used for the survey along with the MDC values are listed in Tables 2-1 and 2-2 in Attachment 2.

**Table 1. Survey Unit Design Parameters**

<b>Survey Design Parameter</b>	<b>Value</b>	<b>Comment</b>
<b>Survey Area:</b>	F813	Aux. Bldg. (-) 20' El, Rm 44, Makeup Pump Room
<b>Survey Unit:</b>	0621	Structure Surface
<b>Class:</b>	1	LTP Table 5-4
<b>SU Area (m<sup>2</sup>):</b>	277.8	
<b>Evaluator:</b>	D. Anderson	
<b>DCGL (dpm/100 cm<sup>2</sup>):</b>	43,000	Gross Activity DCGL
<b>Area Factor:</b>	3.3	Class 1
<b>Design DCGL<sub>me</sub> (dpm/100 cm<sup>2</sup>):</b>	141,900	Class 1
<b>LBGR (dpm/100 cm<sup>2</sup>):</b>	37,786	Adjusted
<b>Design Sigma (dpm/100 cm<sup>2</sup>):</b>	1,738	
<b>Type I Error:</b>	0.05	
<b>Type II Error:</b>	0.05	
<b>Predominant Nuclide:</b>	Cs-137	Used Co-60 area factor as conservative measure.
<b>Sample Area (m<sup>2</sup>):</b>	6.94	Class 1
<b>Scan Area (m<sup>2</sup>):</b>	277.8	
<b>Scan Coverage (%):</b>	100%	Class 1
<b>Z<sub>1-α</sub>:</b>	1.645	
<b>Z<sub>1-β</sub>:</b>	1.645	
<b>Sign P:</b>	0.99865	
<b>Calculated Relative Shift:</b>	3	
<b>Relative Shift Used:</b>	3	Uses 3.0 if Relative Shift is >3
<b>N-Value:</b>	11	
<b>Design N-Value + 20%:</b>	14	NUREG-1575 Table 5-5
<b>Design Min Samples N:</b>	40	Class 1
<b>Grid Spacing L:</b>	2.6	Class 1

**Survey Results:**

A total of 42 direct measurements were made in F8130621. The results including mean, median, standard deviation and range are shown in Table 2. All direct measurements were less than the DCGL. None of the scan measurements indicated areas of elevated activity. Scan activity ranged from 1,502 to 35,271 dpm/100 cm<sup>2</sup> for floor, wall, ceiling and juncture surfaces, based on a surveyor efficiency of 0.5 and no background subtracted. Samples for removable surface activity were all less than 10% of the DCGL as shown in Table 3. Removable surface activity samples were counted for alpha activity and none was detected at the MDC shown in Table 2-1 of Attachment 2.

Table 2. Direct Measurement Results

Measurement ID	Gross Activity (dpm/100 cm <sup>2</sup> )
F8130621-C0001BD	1,919
F8130621-C0002BD	2,033
F8130621-C0003BD	2,179
F8130621-C0004BD	1,987
F8130621-C0005BD	1,821
F8130621-C0006BD	1,867
F8130621-C0007BD	2,708
F8130621-C0008BD	1,971
F8130621-C0009BD	2,246
F8130621-C0010BD	1,670
F8130621-C0011BD	4,342
F8130621-C0012BD	2,096
F8130621-C0013BD	1,489
F8130621-C0014BD	1,701
F8130621-C0015BD	1,634
F8130621-C0016BD	1,841
F8130621-C0017BD	2,402
F8130621-C0018BD	1,577
F8130621-C0019BD	1,468
F8130621-C0020BD	1,582
F8130621-C0021BD	1,421
F8130621-C0022BD	1,193
F8130621-C0023BD	3,875
F8130621-C0024BD	2,023
F8130621-C0025BD	2,557
F8130621-C0026BD	1,307
F8130621-C0027BD	3,797
F8130621-C0028BD	2,116
F8130621-C0029BD	1,582
F8130621-C0030BD	3,548
F8130621-C0031BD	1,603
F8130621-C0032BD	1,572
F8130621-C0033BD	1,738
F8130621-C0034BD	1,515
F8130621-C0035BD	1,784
F8130621-C0036BD	1,556
F8130621-C0037BD	1,188
F8130621-C0038BD	1,338
F8130621-C0039BD	1,452
F8130621-C0040BD	1,712
F8130621-C0041BD	1,452
F8130621-C0042BD	2,324
Mean:	1,981
Median:	1,761
Standard Deviation:	723
Range:	1,188 – 4,342

**Table 3. Removable Surface Activity Results**

<b>Measurement ID</b>	<b>Surface Beta Activity (dpm/100 cm<sup>2</sup>)</b>
F8130621C0001SM	4.86
F8130621C0002SM	2.29
F8130621C0003SM	9.98
F8130621C0004SM	9.98
F8130621C0005SM	4.86
F8130621C0006SM	2.29
F8130621C0007SM	13.83
F8130621C0008SM	11.27
F8130621C0009SM	4.86
F8130621C0010SM	3.58
F8130621C0011SM	39.47
F8130621C0012SM	30.49
F8130621C0013SM	-0.27
F8130621C0014SM	9.98
F8130621C0015SM	11.27
F8130621C0016SM	68.95
F8130621C0017SM	13.83
F8130621C0018SM	6.14
F8130621C0019SM	8.7
F8130621C0020SM	29.21
F8130621C0021SM	21.52
F8130621C0022SM	17.68
F8130621C0023SM	16.39
F8130621C0024SM	4.86
F8130621C0025SM	8.7
F8130621C0026SM	16.39
F8130621C0027SM	677.85
F8130621C0028SM	30.49
F8130621C0029SM	7.42
F8130621C0030SM	13.83
F8130621C0031SM	2.29
F8130621C0032SM	11.27
F8130621C0033SM	4.86
F8130621C0034SM	7.42
F8130621C0035SM	2.29
F8130621C0036SM	4.86
F8130621C0037SM	20.24
F8130621C0038SM	4.86
F8130621C0039SM	2.29
F8130621C0040SM	9.98
F8130621C0041SM	21.52
F8130621C0042SM	39.47
Mean:	29.34
Median:	9.98
Standard Deviation:	103.35
Range:	-0.27 to 677.85

**Survey Unit Data Assessment:**

The survey design required 42 direct measurements for the Sign Test. The critical value and the results of the Sign Test are presented in Table 4. The sample mean and median values were less than the DCGL. The sample standard deviation was less than the design standard deviation so no additional samples were required.

**Table 4. Data Assessment Results**

<b>Survey Results Parameter</b>	<b>Value</b>	<b>Comment</b>
<b>Material Background Used</b> (dpm/100 cm <sup>2</sup> ):	N/A	Average Ambient BKG = 0
<b>Ambient Background Used</b> (dpm/100 cm <sup>2</sup> ):	N/A	
<b>Actual Direct Measurements (N):</b>	42	
<b>Median</b> (dpm/100 cm <sup>2</sup> ):	1,761	
<b>Mean</b> (dpm/100 cm <sup>2</sup> ):	1,981	
<b>Direct Measurement Standard Deviation</b> (dpm/100 cm <sup>2</sup> ):	723	Based on samples and backgrounds.
<b>Total Standard Deviation</b> (dpm/100 cm <sup>2</sup> ):	723	
<b>Maximum</b> (dpm/100 cm <sup>2</sup> ):	4,342	
<b>Material Type:</b>	N/A	Background Subtract Not Applied
<b>Sign Test Final N Value:</b>	42	
<b>S+ Value:</b>	42	
<b>Critical Value:</b>	26	
<b>Sufficient Samples Collected:</b>	Yes	
<b>Maximum Value &lt; DCGL:</b>	Yes	Class 1
<b>Median Value &lt; DCGL:</b>	Yes	
<b>Mean Value &lt; DCGL:</b>	Yes	
<b>Maximum Value &lt; DCGL<sub>mc</sub>:</b>	Yes	
<b>Total Standard Deviation &lt;= Sigma:</b>	Yes	
<b>Pass the Sign Test?</b>	Yes	
<b>Reject the Null Hypothesis?</b>	Yes	
<b>Does the Survey Unit Pass All Criteria?</b>	Yes	



**Survey Unit Investigations and Results:**

No investigations were required for either direct or scan measurements and no investigation results are reported.

**ALARA Statement:**

As stated in Chapter 4 of the LTP, as long as the residual activity within the survey unit is less than the DCGL (i.e. the survey unit average activity is less than the DCGL and the EMC criterion has been met), the ALARA criterion has been met.

**Changes in Initial Survey Unit Assumptions:**

The survey unit was designed as a Class 1 structure survey and the sample results are consistent with that classification. The variability of the survey results was less than the characterization data used for survey design. No potential areas of elevated activity were detected. Therefore the EMC criterion was met.

**Conclusion:**

The FSS of this survey unit was properly designed as a Class 1 survey based on Table 5-4 of the LTP. The required number of direct measurements was made and the scan coverage met the requirement of Table 5-6 of the LTP. No direct measurements exceeded the DCGL of 43,000 dpm/100 cm<sup>2</sup> and none of the removable surface activity measurements exceeded 10% of the DCGL. No investigations were required.

The direct measurement data support rejection of the null hypothesis, providing high confidence that the survey unit satisfied the release criteria and that the data quality objectives were met.

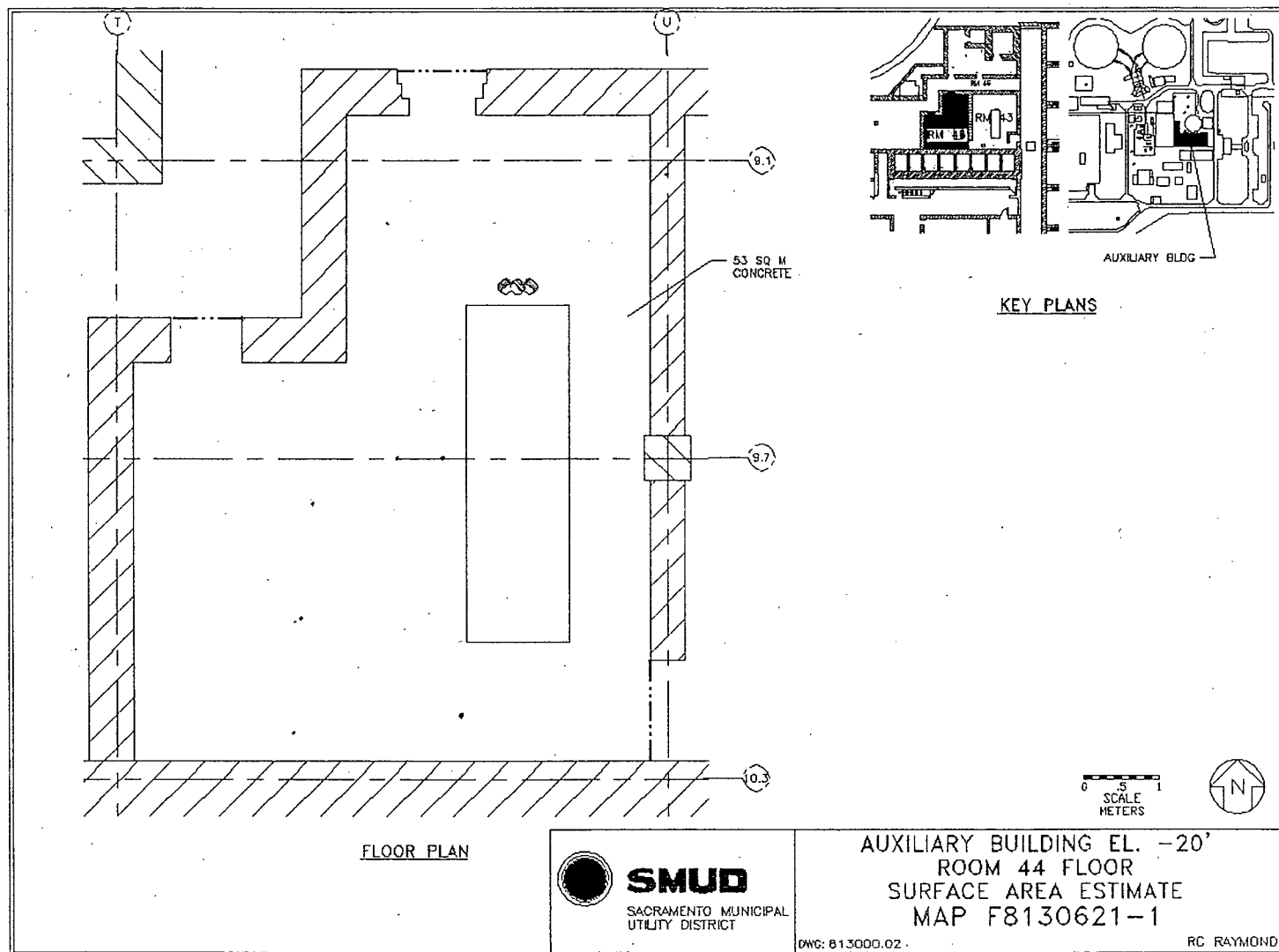
It is concluded that survey unit F8130621 meets the release criteria of 10CFR20.1402.

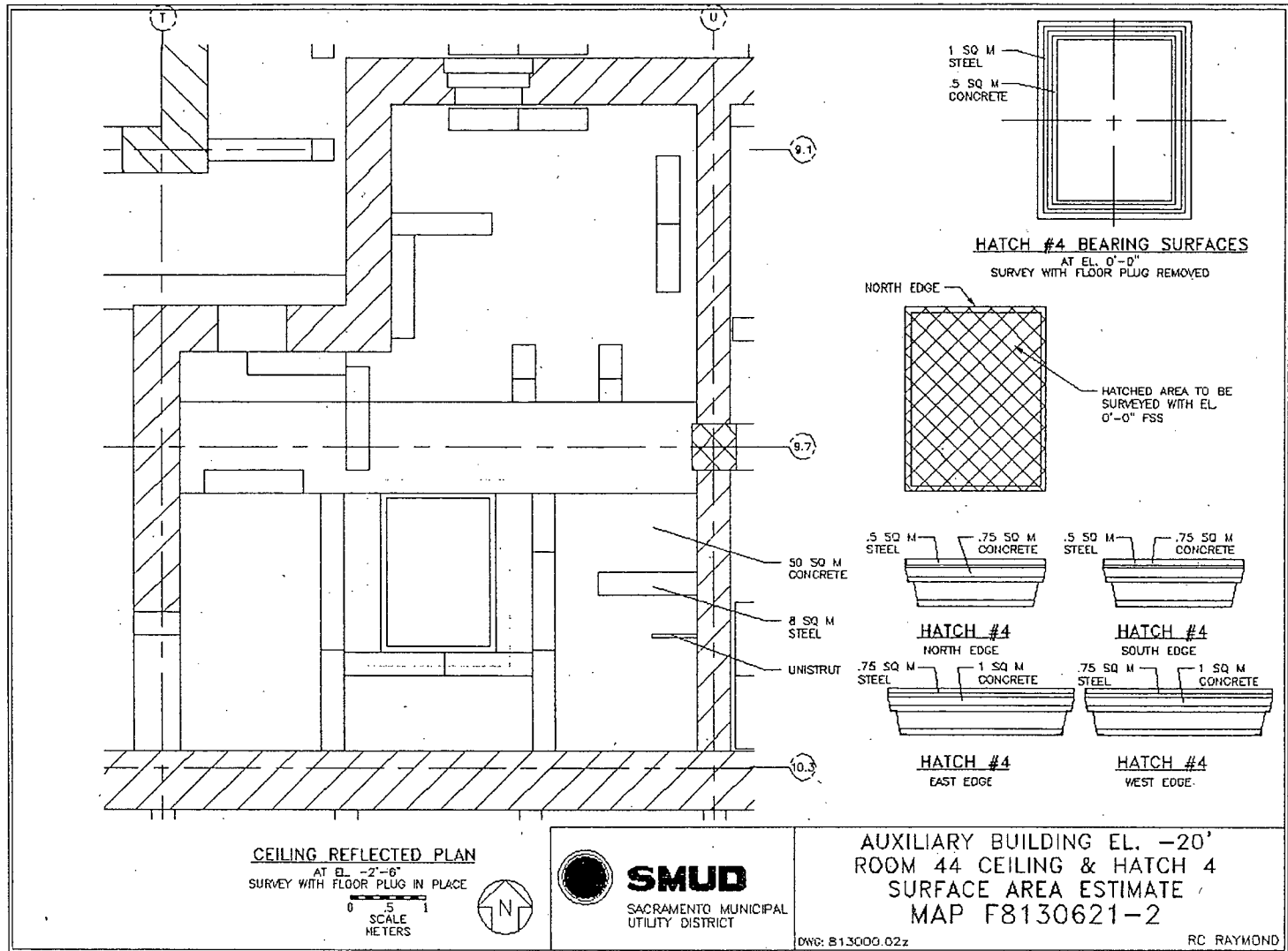
**Attachment 1**

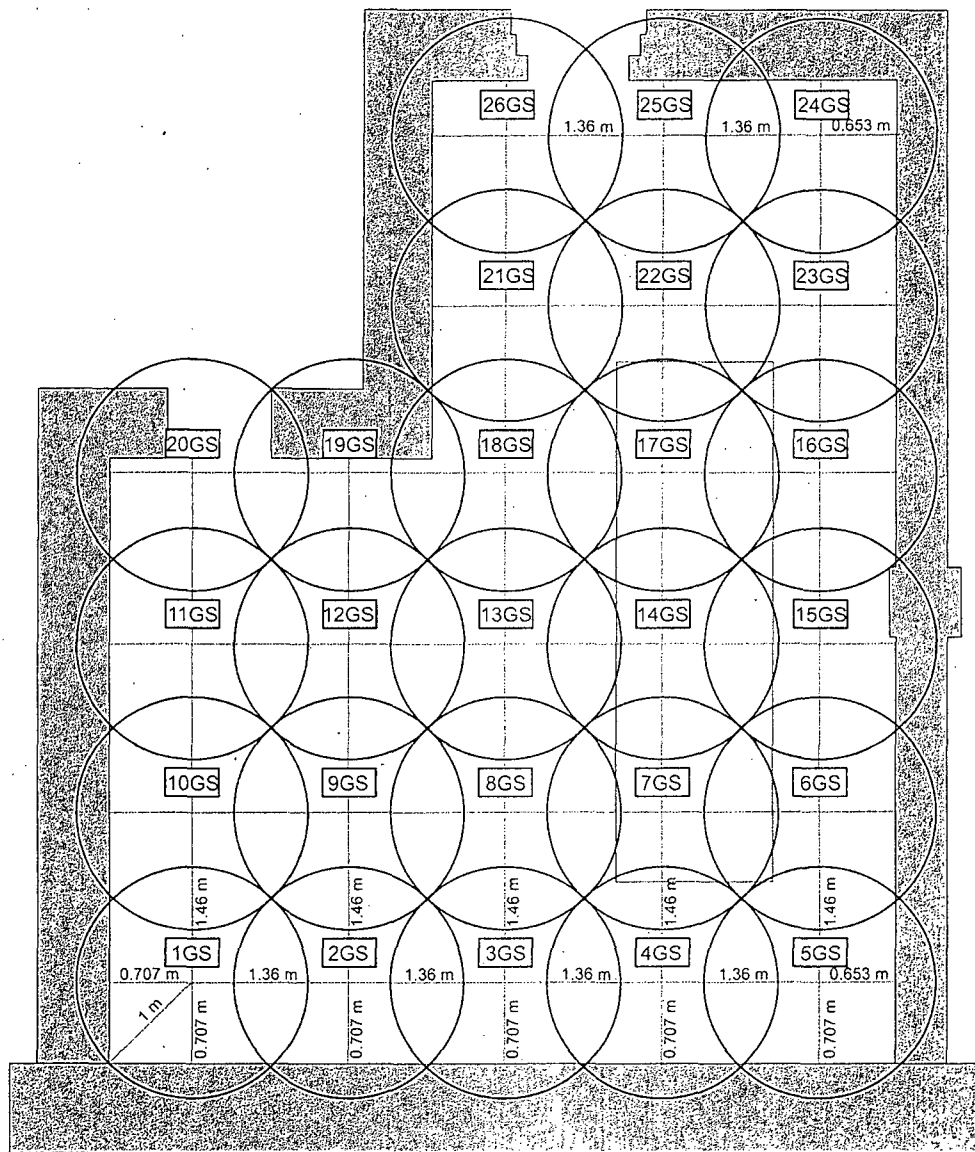
**Maps**

**November 1, 2007**

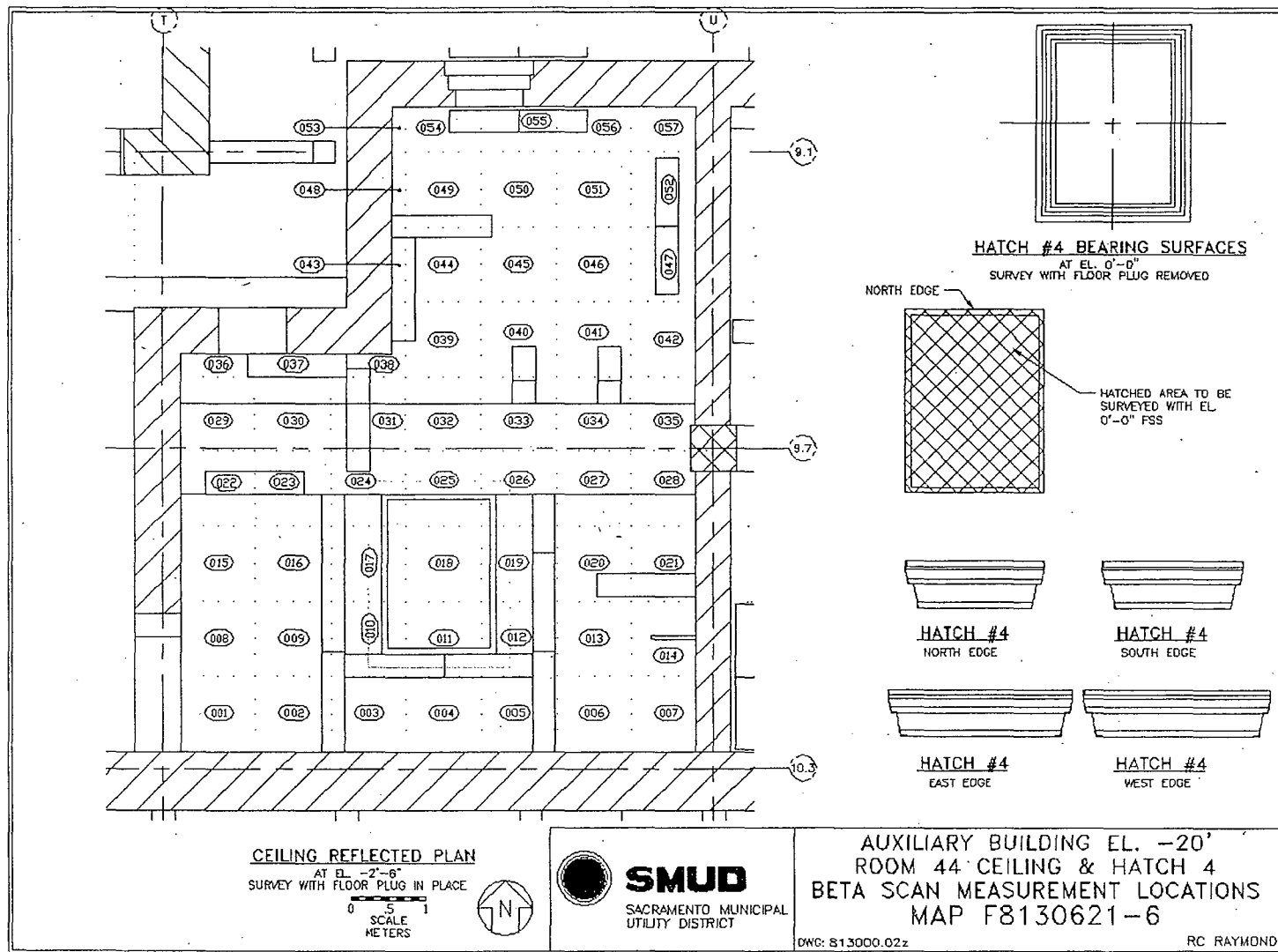
**Survey Unit F8130621**

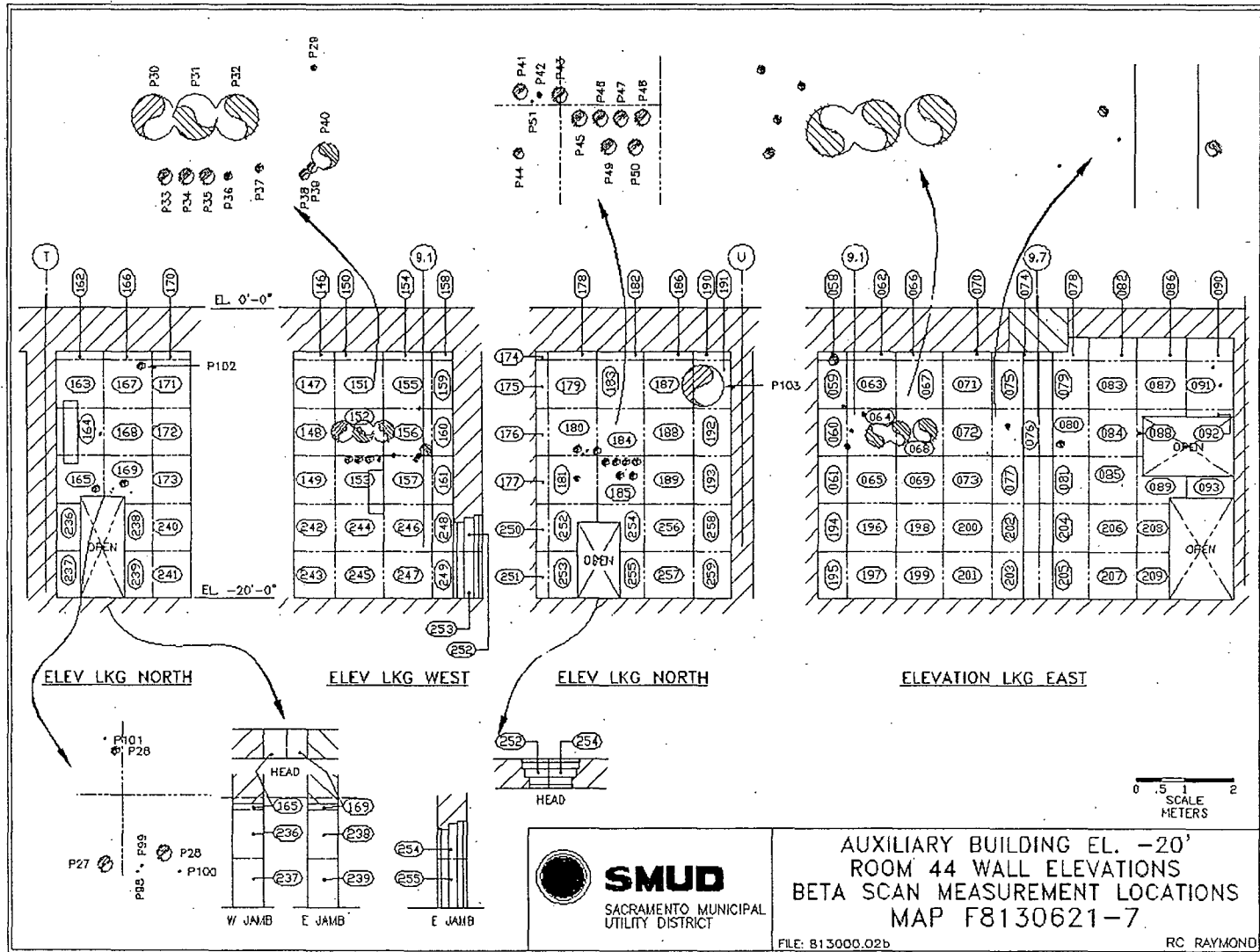


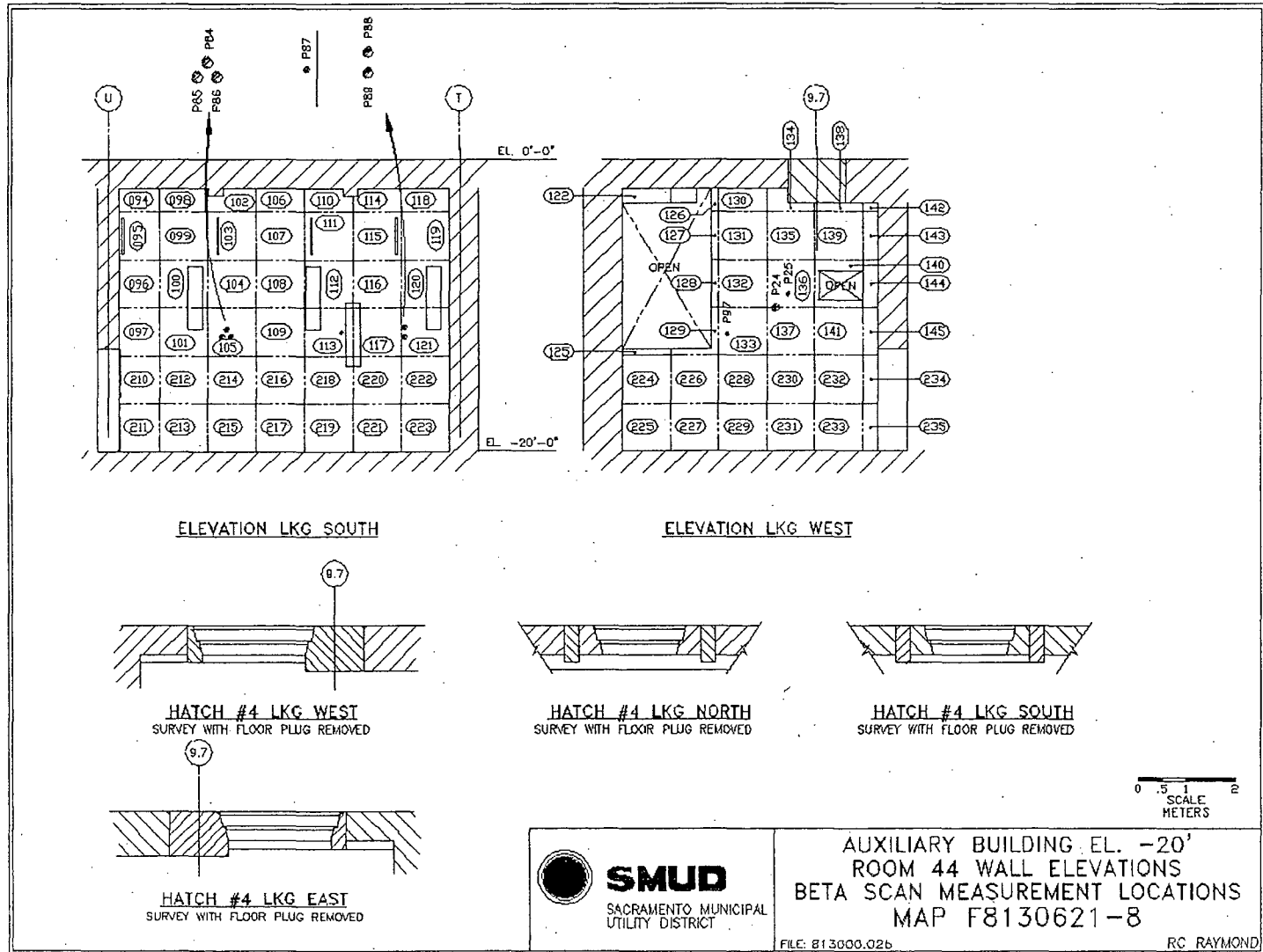




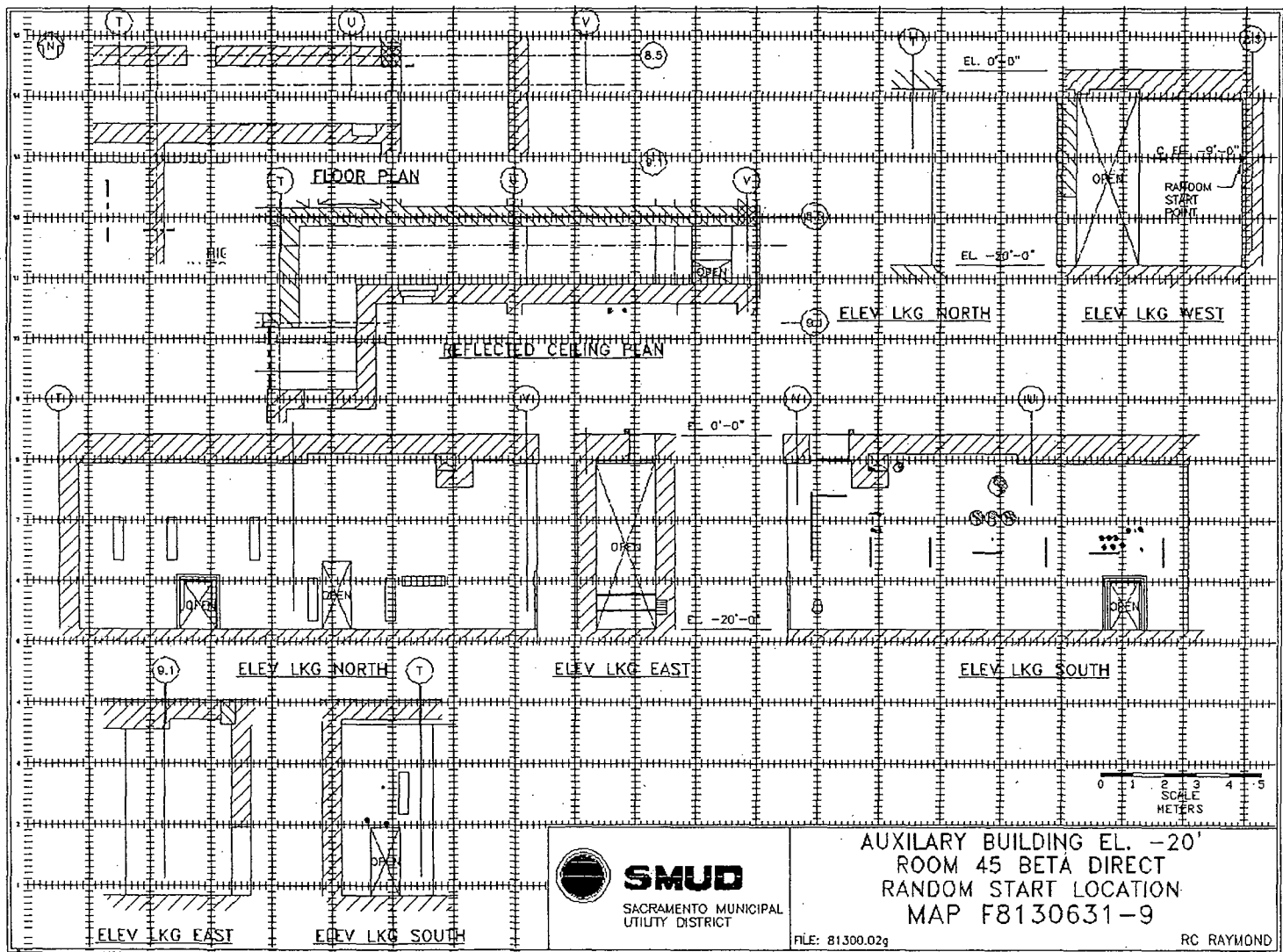
Map F8130621-5, Auxiliary Building -20' El.  
 Rm 44, Makeup Pump Room Floor  
 Gamma Scan Measurements  
 F8130621C0001GS to F8130621C0026GS  
 3.142 sq. meter field of view

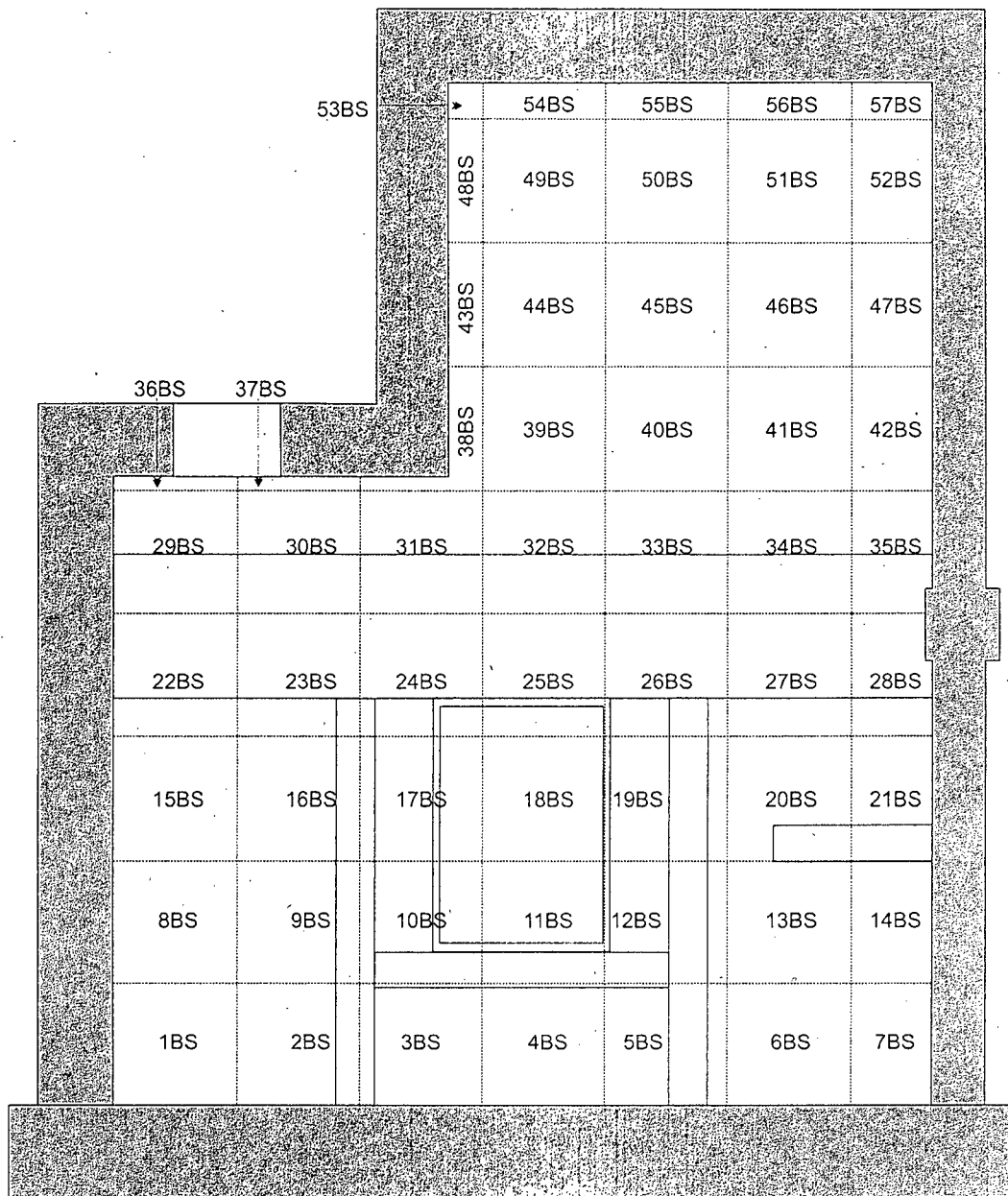










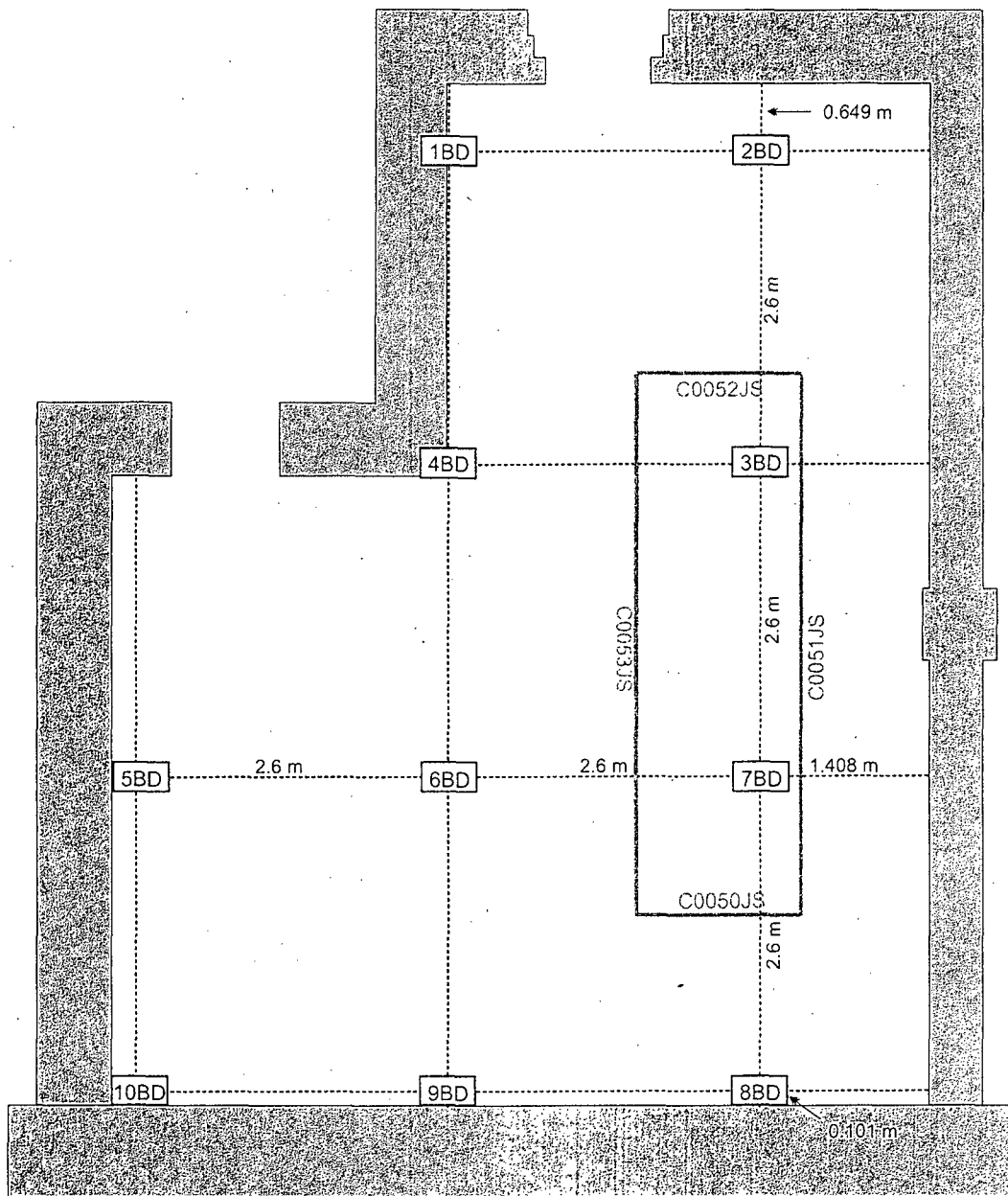


N



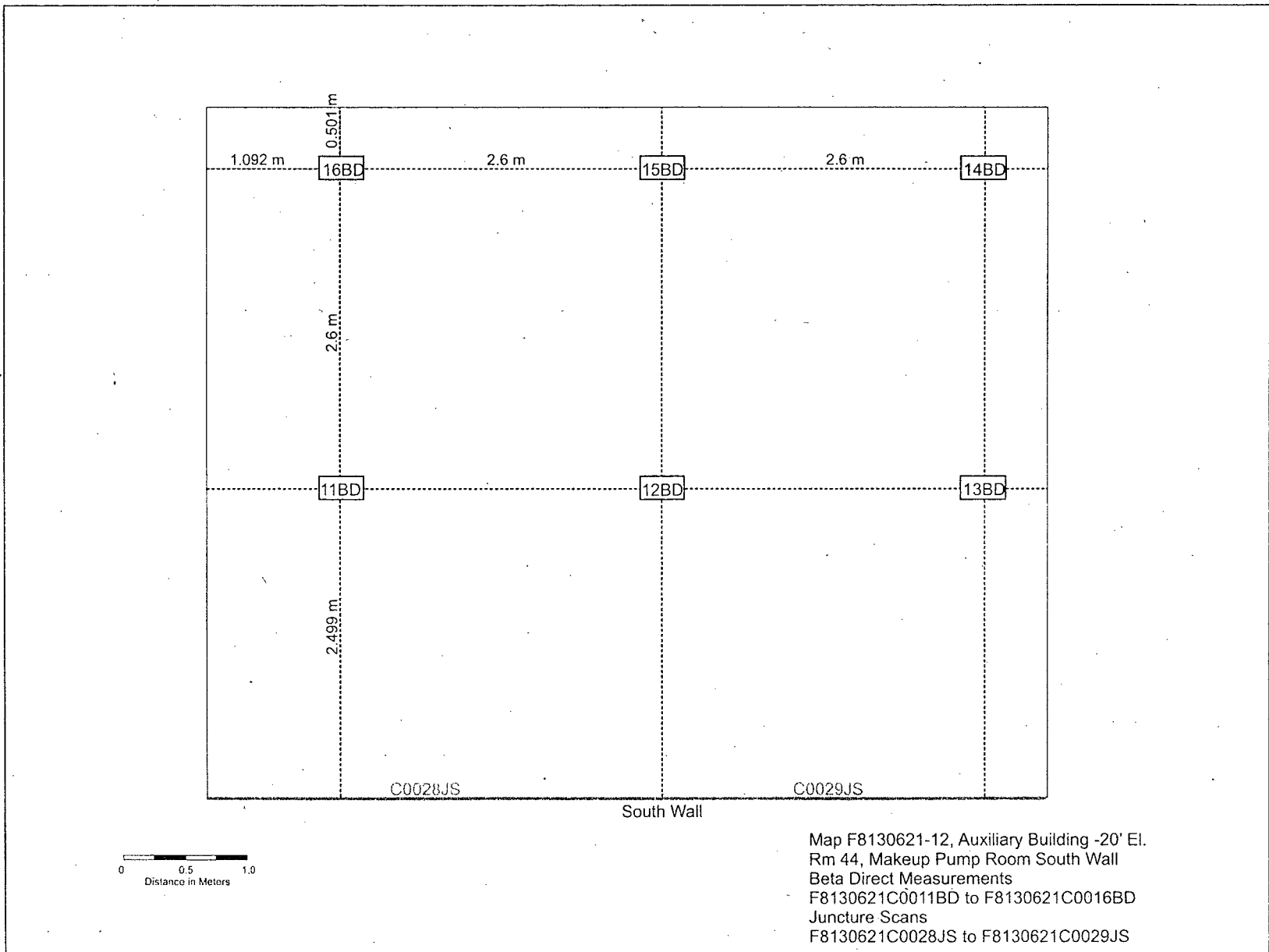
0 0.5 1.0  
Distance in Meters

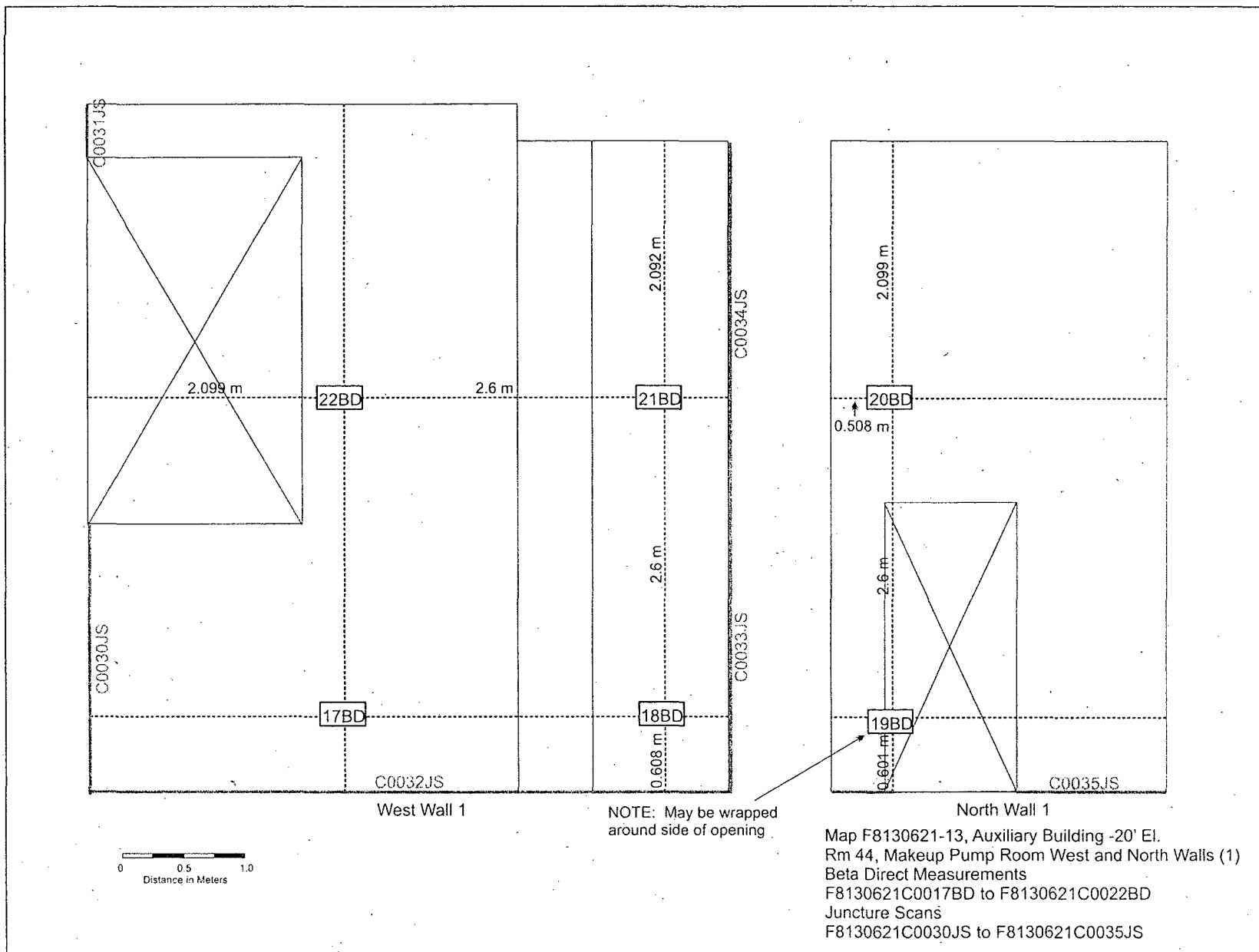
Map F8130621-10, Auxiliary Building -20' EI.  
Rm 44, Makeup Pump Room  
Ceiling Beta Scan Measurements  
F8130621C0001BS to F8130621C0057BS

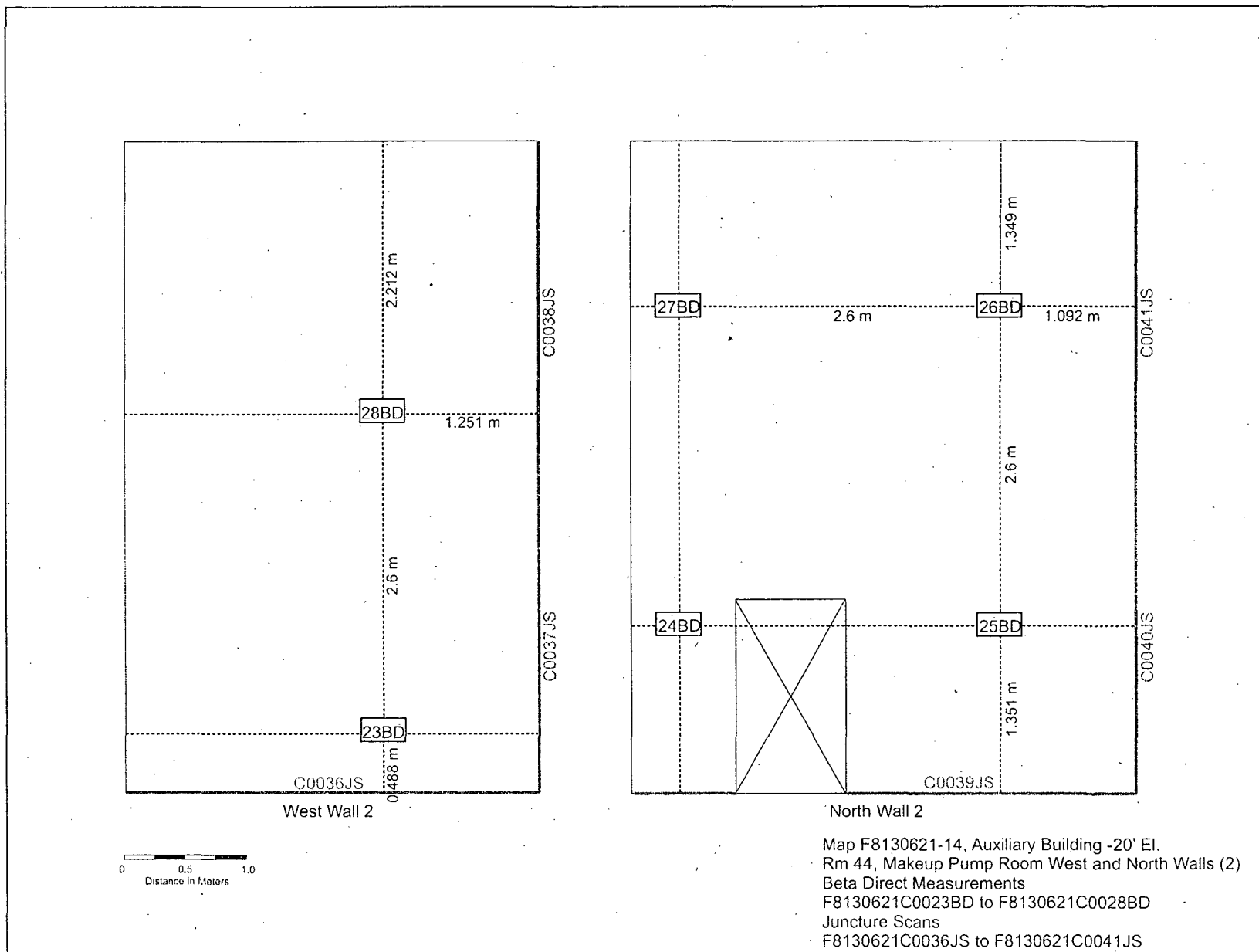


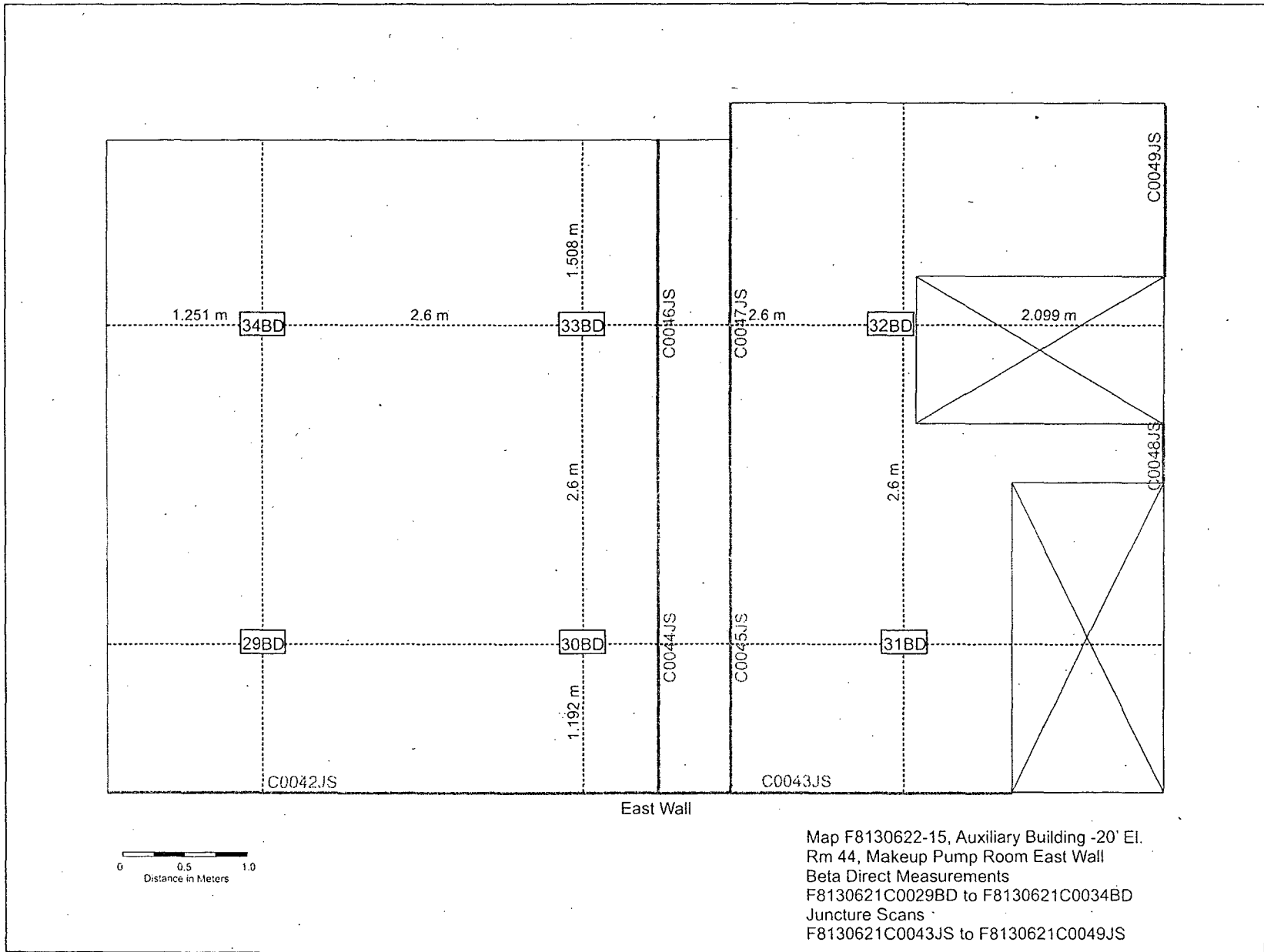
0 0.5 1.0  
Distance in Meters

Map F8130621-11, Auxiliary Building -20' El.  
Rm 44, Makeup Pump Room Floor  
Beta Direct Measurements  
F8130621C0001BD to F8130621C0010BD  
Juncture Scans  
F8130621C0050JS to F8130621C0053JS



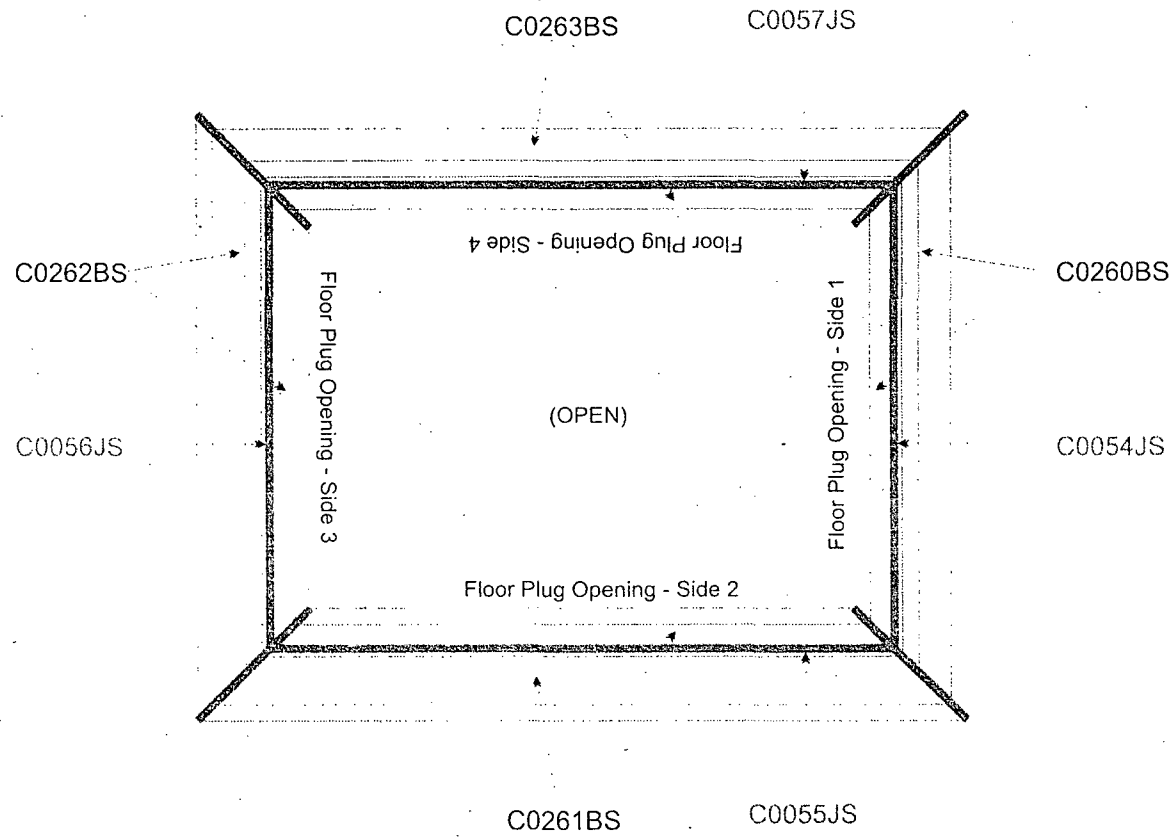




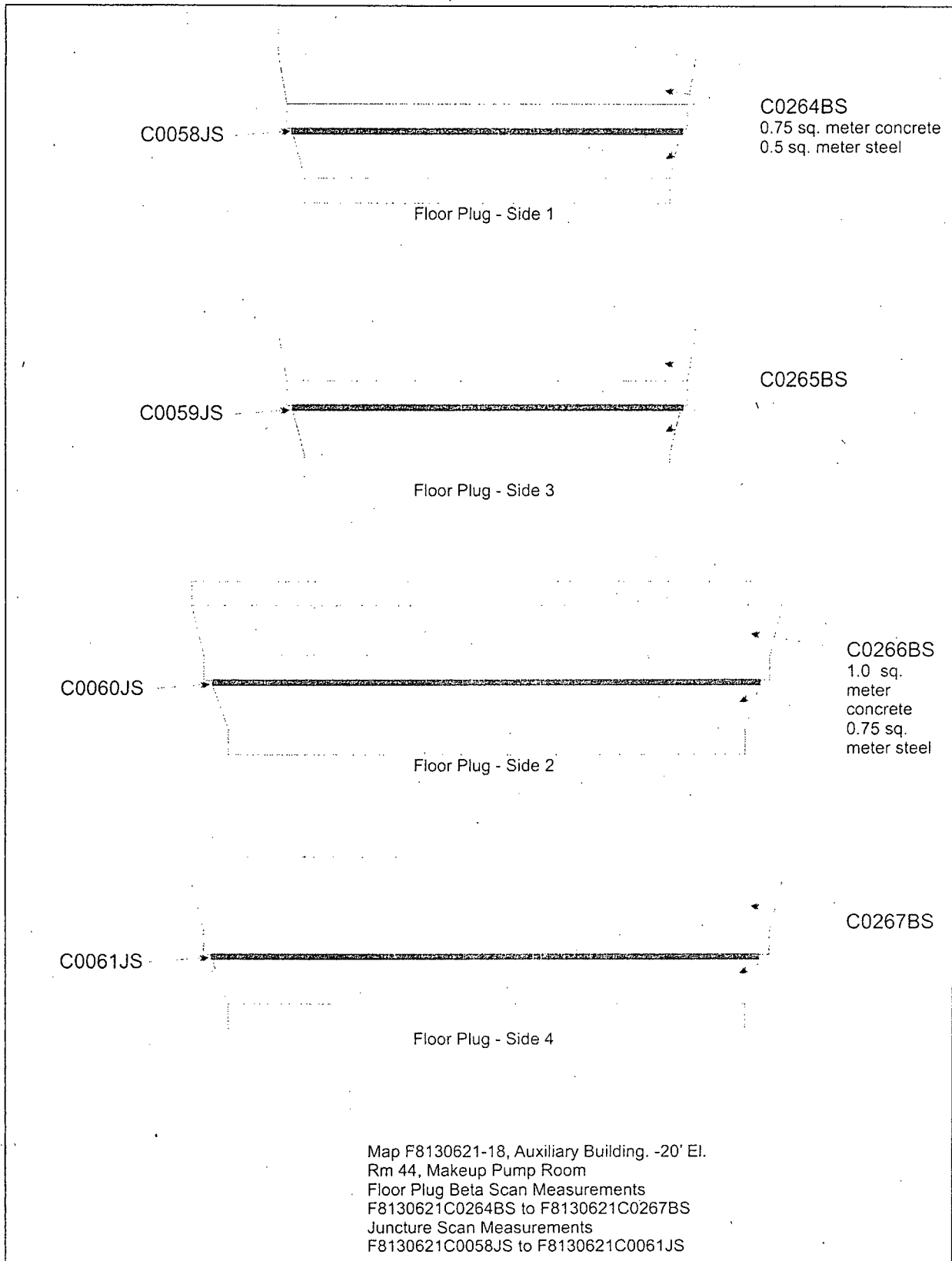








Map F8130621-17, Auxiliary Building. -20' El.  
 Rm 44, Makeup Pump Room  
 Floor Plug Opening Beta Scan Measurements  
 F8130621C0260BS to F8130621C0263BS  
 Juncture Scan Measurements  
 F8130621C0054JS to F8130621C0057JS



**Attachment 2**

**Instrumentation**

**November 1, 2007**

**Survey Unit F8130621**

Table 2-1. Survey Unit Instrumentation

Instrument Model; Serial No.	Detector Model; Serial No.	MDC Static (dpm/100 cm <sup>2</sup> )	MDC Scan (dpm/100 cm <sup>2</sup> )
M2350; 180733	43-94; 148620	2,630	4,580
M2350; 175834	43-68B; 190482 <sup>1</sup>	433	1,033
M2350; 180738	43-68B; 160051 <sup>1</sup>		
M2350; 175834	43-68B; 148634 <sup>1</sup>		
M2350; 149802	43-68B; 148453 <sup>1</sup>		
M2350; 149802	43-68B; 148453 <sup>2</sup>	433	1,084
M2350; 203465	43-68/5B; 148942 <sup>1</sup>	433	1,033
M2350; 203465	43-116-1B; 216073 <sup>3</sup>	491	739
M2350; 149794	43-116-1B; 216072 <sup>3</sup>		
M2350; 149802	43-116-1B; 190173 <sup>3</sup>		
M2350; 180738	43-116-1B; 190643 <sup>3</sup>		
M2350; 203465	43-116-1B; 216073 <sup>4</sup>	472	3,492
M2350; 149802	43-116-1B; 190173 <sup>4</sup>		
M2350; 203465	43-116-1B; 216073 <sup>5</sup>	796	5,895
M2350; 149794	43-116-1B; 216072 <sup>5</sup>		
M2350; 149802	43-116-1B; 190173 <sup>5</sup>		
Tennelec; 0401171	N/A	5 dpm $\alpha$ , 11 dpm $\beta$	N/A

<sup>1</sup>43-68B Concrete surfaces

<sup>2</sup>43-68B Concrete penetrations

<sup>3</sup>43-116-1B Concrete junctures

<sup>4</sup>43-116-1B Metal penetrations

<sup>5</sup>43-116-1B Concrete penetrations

Table 2-1. Survey Unit Instrumentation

Instrument	Detector Serial No.	MDC (dpm/100 cm <sup>2</sup> )
InSpector	08051294	691 dpm/100 cm <sup>2</sup> Cs-137 416 dpm/100 cm <sup>2</sup> Co-60
ISOCS	2983947	831 dpm/100 cm <sup>2</sup> Cs-137 1,140 dpm/100 cm <sup>2</sup> Co-60

**Table 2-2. Investigation Criteria and DCGL**

<b>Parameter</b>	<b>Value (dpm/100 cm<sup>2</sup>)</b>
Investigation Criteria - Direct	141,900
Investigation Criteria – Scan	141,900
DCGL <sub>W</sub>	43,000
DCGL <sub>EMC</sub>	141,900

<b>Instrument</b>	<b>Parameter</b>	<b>Value (dpm/100 cm<sup>2</sup>) To detect a 100 cm<sup>2</sup> hot spot at the EMC Criterion within the detector field of view</b>
ISOCS	Investigation Criteria - Scan	Concrete – 190,000 dpm/100 cm <sup>2</sup> Cs-137 64,000 dpm/100 cm <sup>2</sup> Co-60

**Attachment 3**

**Investigation**

**November 1, 2007**

**Survey Unit F8130621**

**(none required)**

**Attachment 4**

**Data Assessment**

**November 1, 2007**

**Survey Unit F8130621**

