Appendix C

NFSS Vicinity Property S

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Assessment Data

Excerpt from Comprehensive Radiological Survey
Off-Site Property S
Niagara Falls Storage Site

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COMPREHENSIVE RADIOLOGICAL SURVEY

OFF-SITE PROPERTY S
NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

Prepared for

U.S. Department of Energy
as part of the
Formerly Utilized Sites -- Remedial Action Program

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FINAL REPORT

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

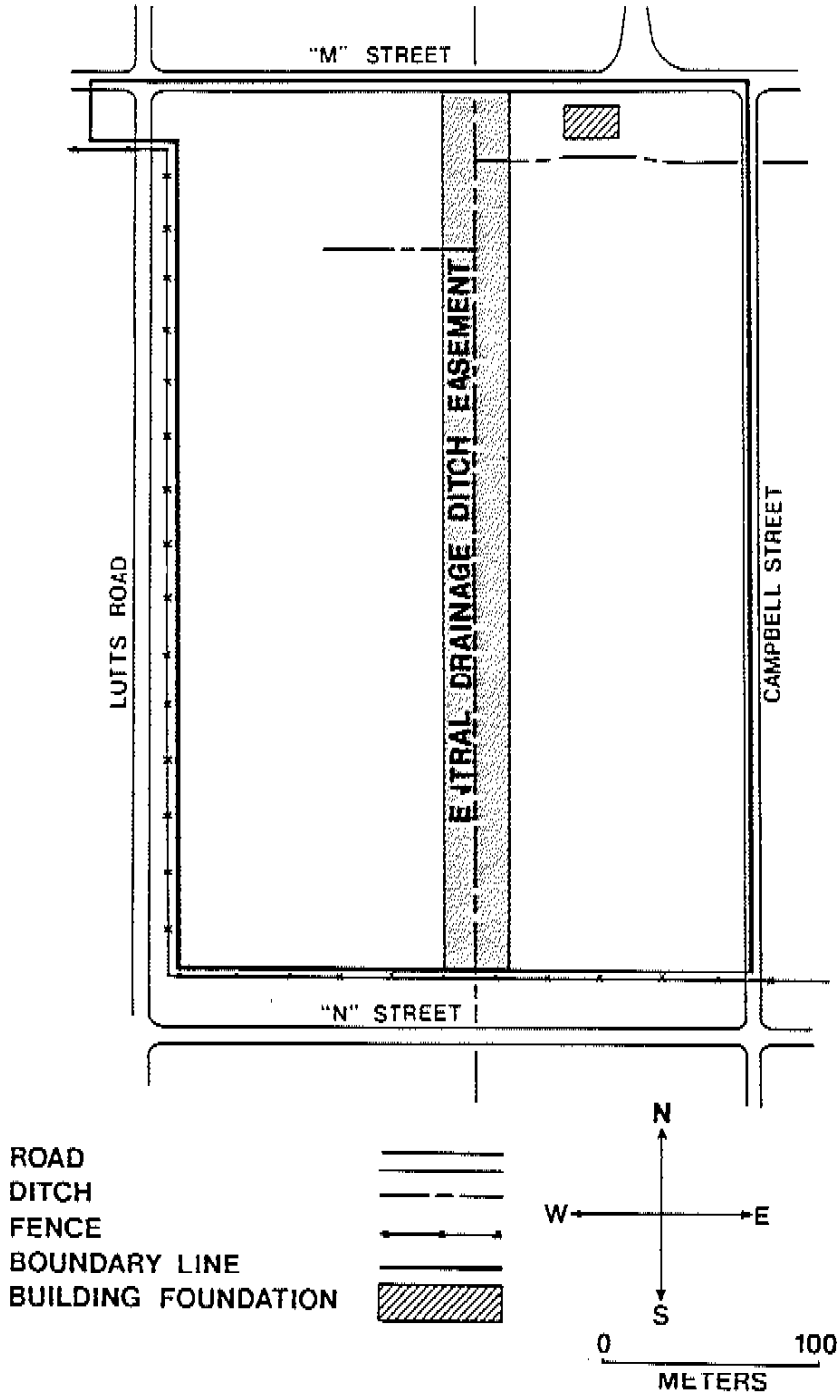

FIGURE 2. Plan View of Off-Site Property S, Indicating Prominent Surface Features. (Note: The Central Drainage Ditch and its Easement are Being Surveyed by Bechtel National, Inc., and are Therefore Excluded From the ORAU Survey.)

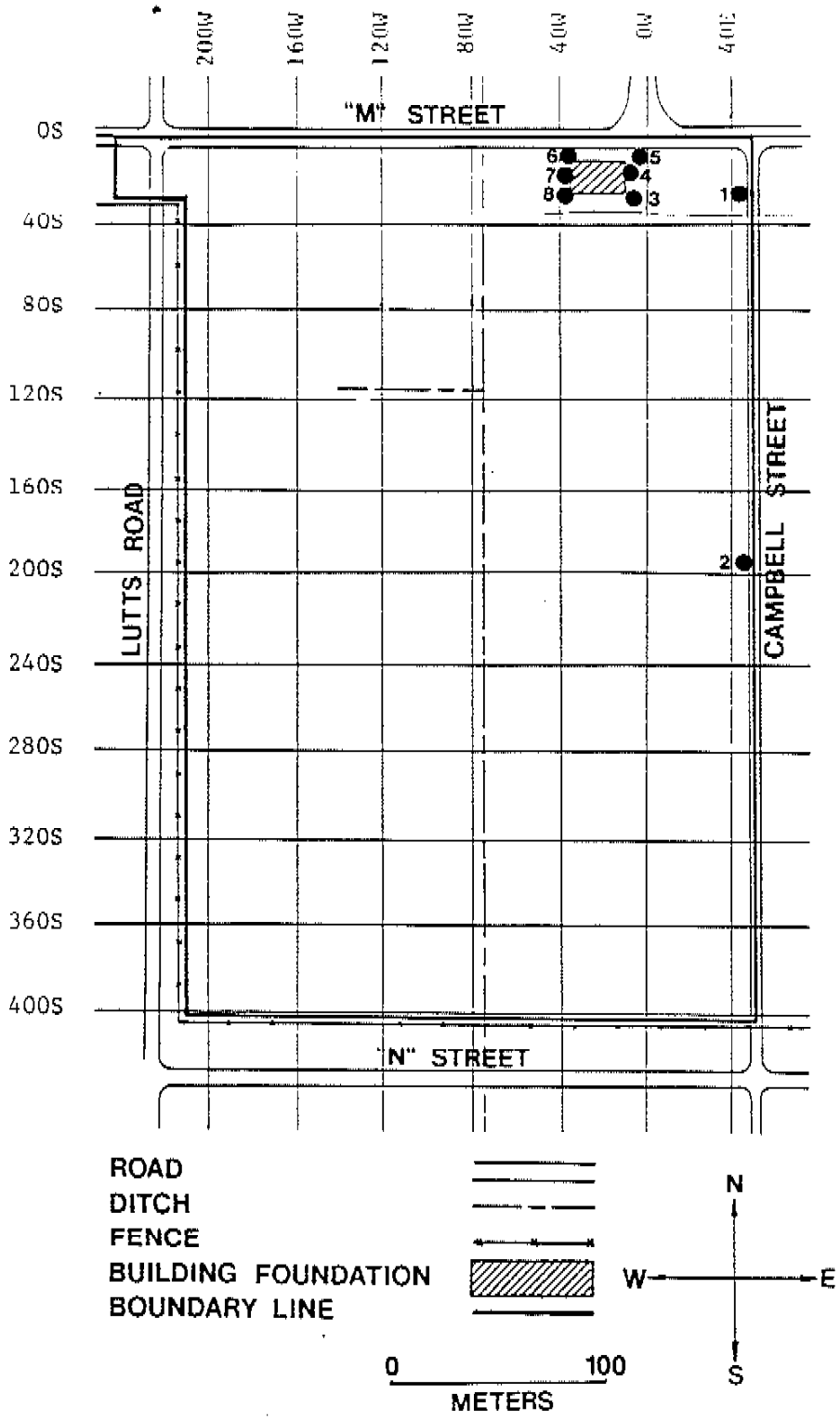

FIGURE 3. Areas of Elevated Direct Radiation Levels Identified by the Walkover Surface Scan.

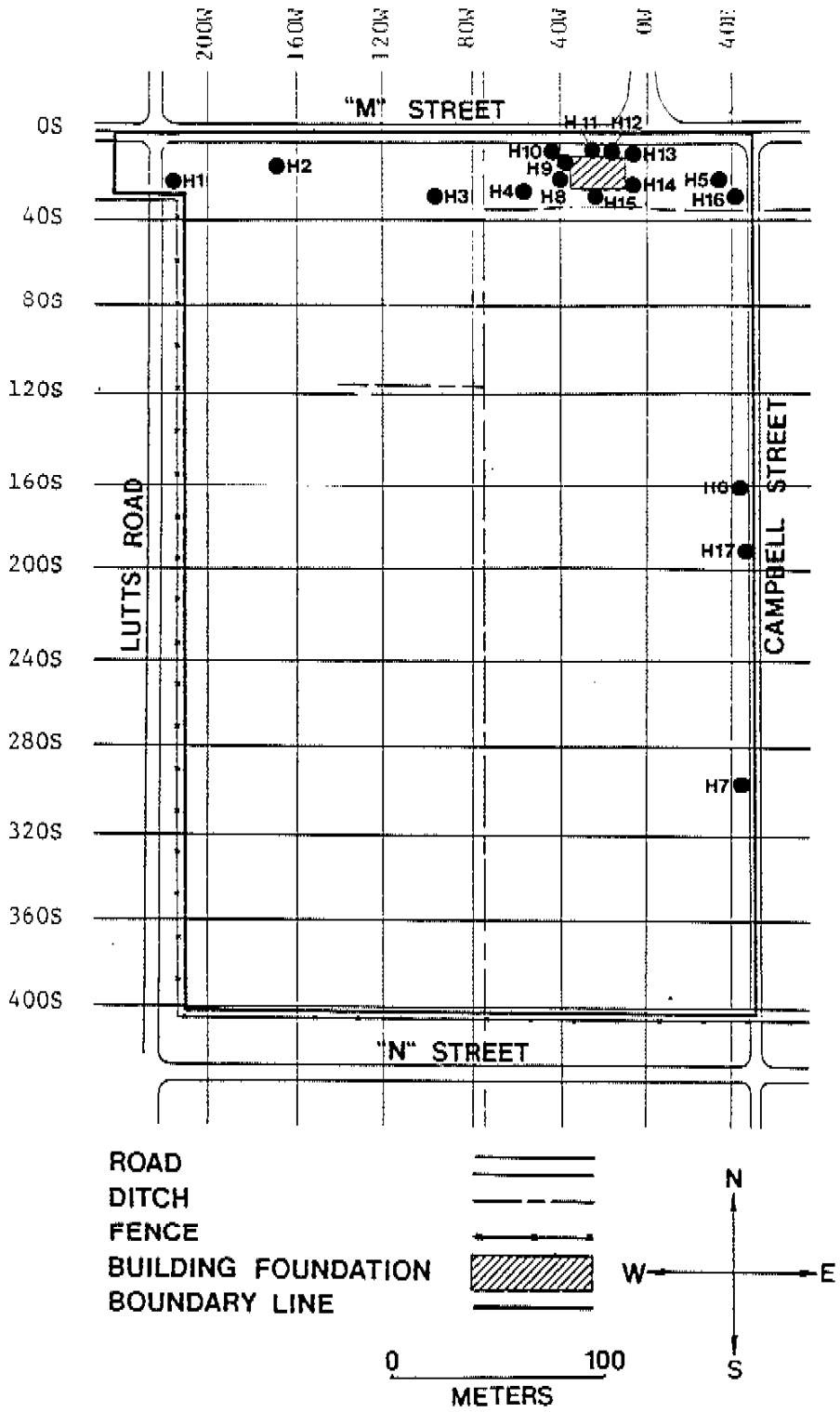

FIGURE 4. Locations of Borcholes for Subsurface Investigations

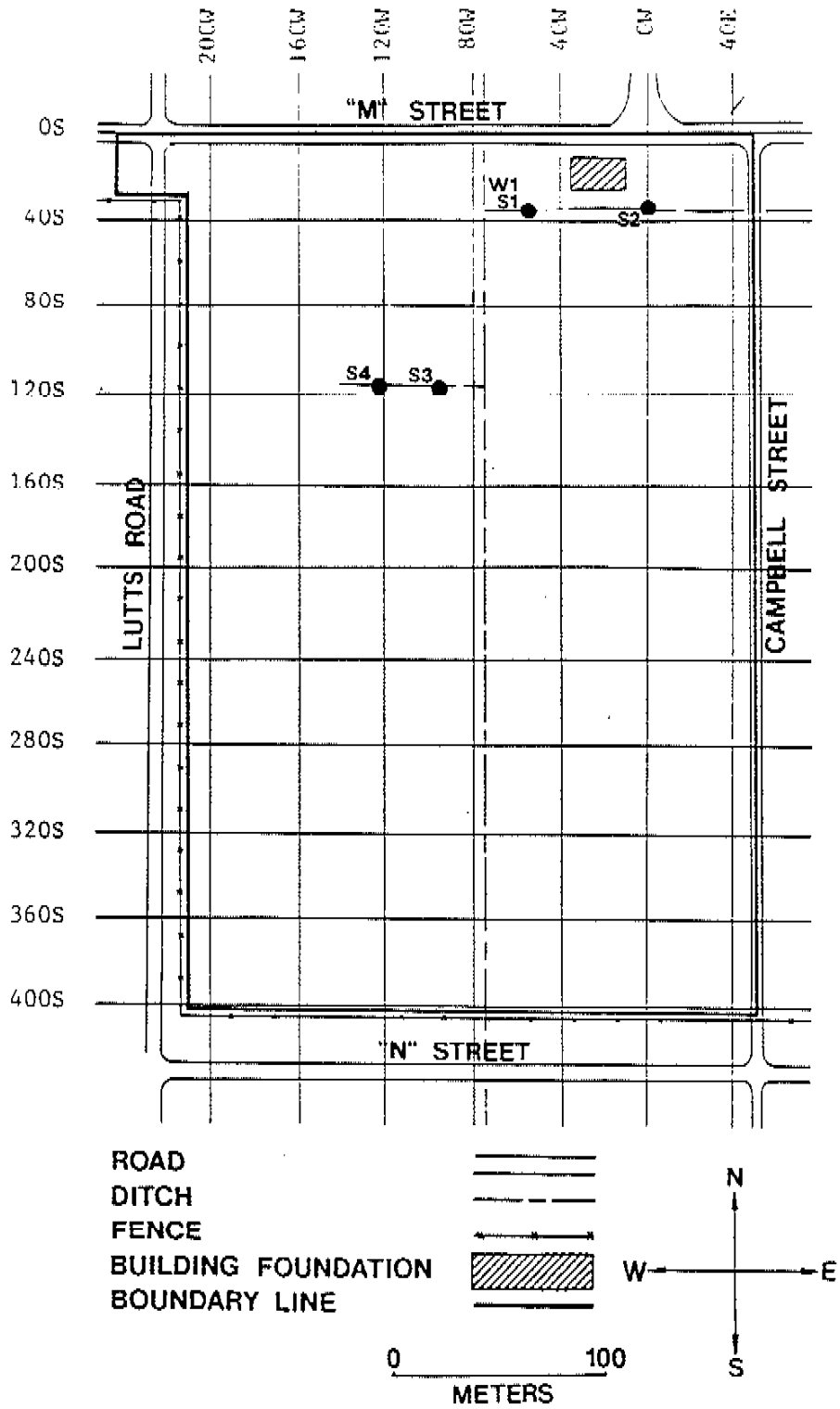

FIGURE 5. Locations of Surface Water (W1) and Sediment (S1-S4) Samples Collected from Drainage Ditches.

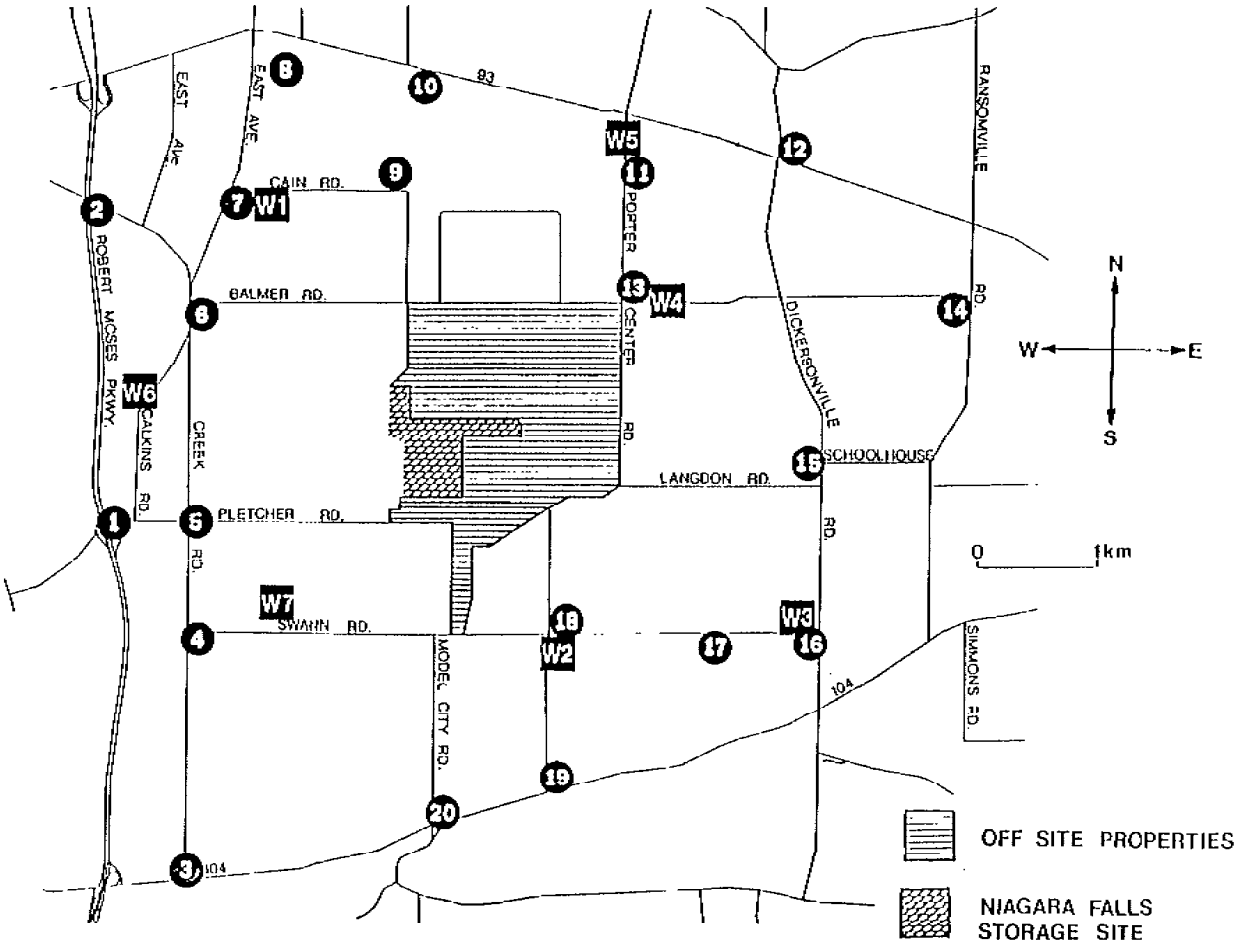

FIGURE 6. Map of Northern Niagara County, New York, Showing Locations of Background Measurements and Baseline Samples (#1-20: Soil Samples and Direct Measurements; W1-W7: Water Samples).

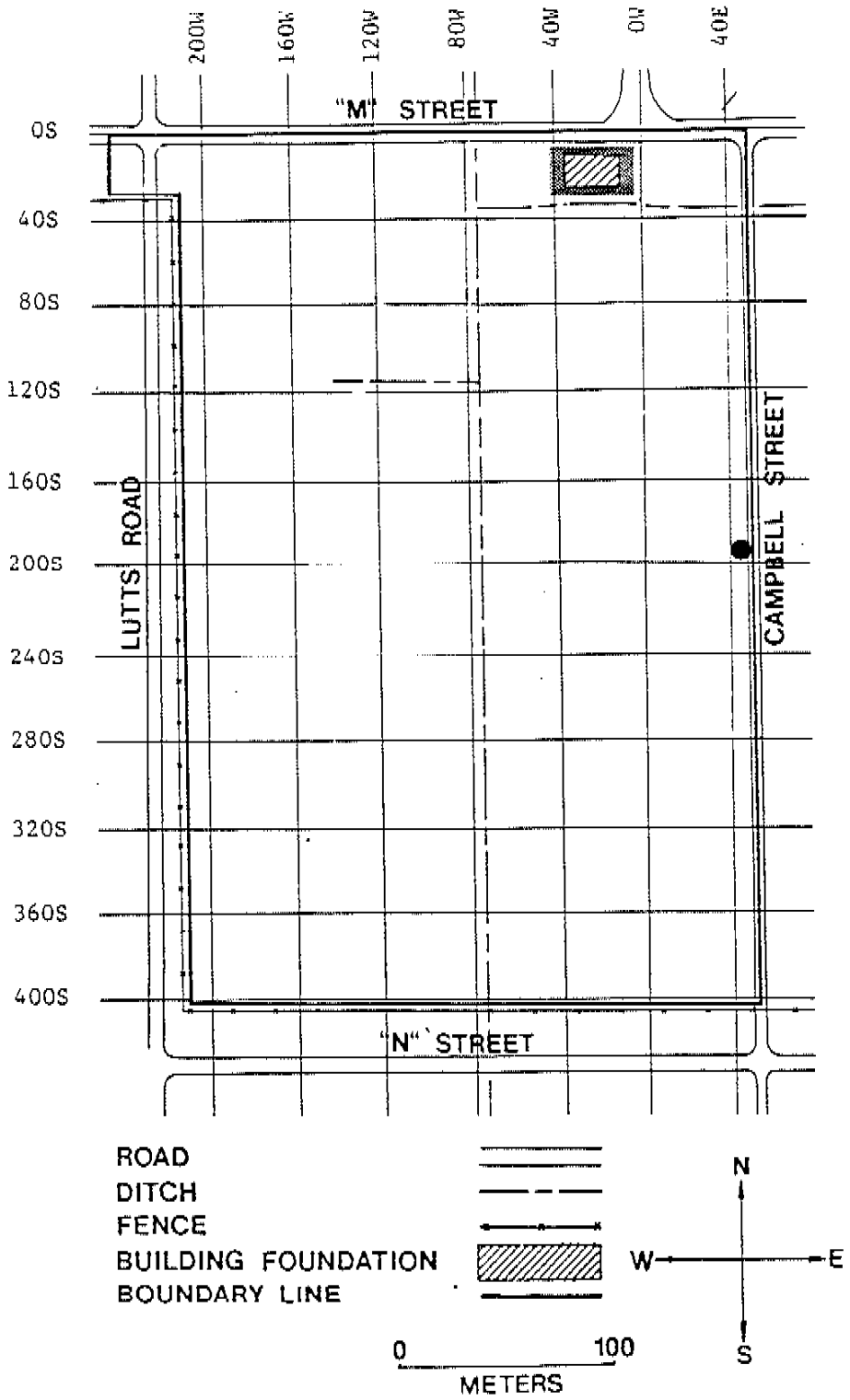

FIGURE 7. Locations (Shaded) on Property S Where Ra-226 Concentrations in Soil Exceed Guideline Levels. (Radionuclides are Either of Natural Origin or Would not Exceed Criteria When Averaged Over an Area of 100 m^2.)

TABLE 1-A

BACKGROUND EXPOSURE RATES
AND
RADIONUCLIDE CONCENTRATIONS IN BASELINE SOIL SAMPLES

Location[a]	Exposure Rate[b] (μR/h)	Radionuclide Concentrations (pCi/g)				
		Ra-226	U-235	U-238	Th-232	Cs-137
1	6.8	0.74 ± 0.16[c]	<0.19	<2.89	0.70 ± 0.46	0.29 + 0.08
2	6.8	0.75 ± 0.19	<0.19	<3.35	0.86 ± 0.24	0.24 ± 0.08
3	8.3	0.71 ± 0.18	0.46 ± 0.41	<3.72	0.88 ± 0.33	0.34 ± 0.09
4	7.9	0.67 ± 0.18	<0.22	<4.10	1.18 ± 0.35	0.12 ± 0.07
5	7.3	0.70 ± 0.16	<0.17	<3.34	0.68 ± 0.24	0.14 ± 0.07
6	7.7	0.50 ± 0.15	<0.16	<2.33	0.52 ± 0.38	0.17 ± 0.09
7	7.7	0.63 ± 0.13	<0.17	<2.73	0.83 ± 0.24	0.35 ± 0.08
8	7.6	0.59 ± 0.12	<0.14	<2.20	0.54 ± 0.23	<0.02
9	7.1	0.63 ± 0.20	<0.23	<4.16	0.83 ± 0.38	0.69 ± 0.11
10	7.1	0.70 ± 0.16	<0.19	<2.98	0.59 ± 0.25	0.69 ± 0.10
11	6.7	<0.09	<0.19	<2.83	0.49 ± 0.31	0.48 ± 0.14
12	7.1	0.48 ± 0.13	<0.16	<2.84	0.65 ± 0.26	0.68 ± 0.10
13	6.7	0.57 ± 0.14	<0.17	<2.36	0.49 ± 0.26	0.41 ± 0.08
14	6.8	0.68 ± 0.17	<0.19	<3.24	0.67 ± 0.25	0.70 ± 0.10
15	8.2	0.65 ± 0.14	<0.17	<3.20	0.72 ± 0.35	0.23 ± 0.08
16	7.4	0.91 ± 0.17	<0.71	<3.58	0.83 ± 0.28	0.61 ± 0.09
17	7.0	0.48 ± 0.14	<0.16	<2.73	0.32 ± 0.22	0.38 ± 0.08
18	7.7	0.73 ± 0.16	<0.18	6.26 ± 9.23	1.01 ± 0.44	0.32 ± 0.12
19	8.8	1.22 ± 0.22	<0.23	<3.79	1.08 ± 0.49	1.05 ± 0.13
20	8.6	0.83 ± 0.17	<0.21	<3.59	0.84 ± 0.29	0.08 ± 0.07
Range	6.8 to 8.8	<0.09 to 1.22	<0.14 to 0.46	<2.20 to 6.26	0.32 to 1.18	<0.02 to 1.05

[a] Refer to Figure 6.
[b] Measured at 1 m above the surface.
[c] Errors are 2σ based on counting statistics.

TABLE 1-B

RADIONUCLIDE CONCENTRATIONS IN BASELINE WATER SAMPLES

Location[a]	Radionuclide Concentrations (pCi/l)	
	Gross Alpha	Gross Beta
W1	0.95 ± 0.93 [b]	4.79 ± 1.15
W2	0.95 ± 0.94	9.17 ± 1.31
W3	0.55 ± 0.78	2.73 ± 1.05
W4	0.63 ± 0.89	5.37 ± 1.17
W5	0.73 ± 0.68	<0.64
W6	1.87 ± 1.84	14.3 ± 2.4
W7	1.16 ± 0.66	<0.63
Range	0.55 to 1.87	<0.63 to 14.3

[a] Refer to Figure 6.
[b] Errors are 2σ based on counting statistics.

TABLE 2

DIRECT RADIATION LEVELS MEASURED
AT 40 M GRID INTERVALS

Grid Location	Gamma Exposure Rates at 1 m Above the Surface (μR/h)	Gamma Exposure Rates at the Surface (μR/h)	Beta-Gamma Dose Rates at 1 cm Above the Surface (μrad/h)
0 , 50E[a]	12	12	12
0 , 40E	12	13	13
0 , 0	12	13	13
0 , 40W	13	12	15
0 , 52W[b]	13	13	17
0 , 97W[b]	12	13	13
0 ,120W	12	13	13
0 ,160W	12	12	12
0 ,200W	11	13	14
0 ,235W[a]	11	12	12
40S, 50E[a]	16	16	18
40S, 40E	11	12	12
40S, 0	11	11	15
40S, 40W	12	11	11
40S, 54W[b]	12	12	12
40S, 95W[b]	10	10	10
40S,120W	10	10	18
40S,160W	10	10	10
80S, 50E[a]	16	16	16
80S, 40E	10	10	10
80S, 4E[c]	10	10	10
80S, 40W	10	11	16
80S, 54W[b]	11	12	18
80S, 95W[b]	10	11	11
80S,120W	10	10	15
80S,165W[c]	9	10	10
80S,200W	10	10	11
120S, 50E	14	14	14
120S, 40E	9	9	9
120S, 0	10	10	12
120S, 40W	10	10	12
120S, 55W[b]	11	11	12
120S, 95W[b]	10	10	10
120S,120W	10	10	13
120S,160W	10	10	11
120S,200W	10	10	10
160S, 50E[a]	14	14	14
160S, 40E	10	10	11
160S, 0	11	10	12
160S, 40W	10	11	11
160S, 53W[b]	10	10	15

TABLE 2, cont.

DIRECT RADIATION LEVELS MEASURED
AT 40 M INTERVALS

Grid Location	Gamma Exposure Rates at 1 m Above the Surface (μR/h)	Gamma Exposure Rates at the Surface (μR/h)	Beta-Gamma Dose Rates at 1 cm Above the Surface (μrad/h)
160S, 96W[b]	10	10	15
160S,120W	10	10	10
160S,160W	10	10	10
160S,200W	10	9	9
200S, 50E[a]	16	16	16
200S, 40E	10	10	10
200S, 0	10	10	10
200S, 40W	10	10	16
200S, 54W[b]	10	10	10
200S, 97W[b]	10	11	11
200S,120W	10	10	10
200S,160W	9	9	11
200S,200W	10	10	10
240S, 50E[a]	13	16	18
240S, 40E	10	10	11
240S, 0	10	10	16
240S, 40W	10	10	10
240S, 53W[b]	10	10	14
240S, 95W[b]	10	11	11
240S,120W	10	10	10
240S,160W	9	9	11
280S, 50E[a]	16	16	16
280S, 40E	11	10	10
280S, 0	10	10	10
280S, 40W	10	10	12
280S, 54W[b]	10	11	11
280S, 95W[b]	10	10	13
280S,120W	10	11	11
280S,160W	10	10	10
280S,200W	9	10	12
320S, 50E[a]	15	16	16
320S, 40E	11	10	10
320S, 0	10	10	10
320S, 40W	10	11	13
320S, 51W[b]	11	11	11
320S, 95W[b]	10	10	11
320S,120W	10	10	10
320S,160W	9	10	12
320S,200W	10	10	10
360S, 50E[a]	16	16	16
360S, 40E	12	11	11

TABLE 2, cont.

DIRECT RADIATION LEVELS MEASURED
AT 40 M INTERVALS

Grid Location	Gamma Exposure Rates at 1 m Above the Surface (μR/h)	Gamma Exposure Rates at the Surface (μR/h)	Beta-Gamma Dose Rates at 1 cm Above the Surface (μrad/h)
360S, 0	10	10	10
360S, 40W	11	10	15
360S, 53W[b]	11	10	11
360S, 95W[b]	10	10	10
360S,120W	10	10	11
360S,160W	9	10	12
360S,200W	10	10	10
400S, 50E[a]	16	16	17
400S, 40E	10	11	11
400S, 0	11	11	12
400S, 53W[b]	10	10	11
400S, 96W[b]	10	11	11
400S,120W	10	10	10
400S,160W	10	10	13
400S,200W	10	10	11

[a] Measurement performed at property boundary.
[b] Measurement performed at edge of drainage ditch easement.
[c] 40 m grid intersection not accessible; measurement performed at closest accessible point.

TABLE 3

DIRECT RADIATION LEVELS MEASURED AT 5 M GRID INTERVALS
IN THE VICINITY OF THE CONCRETE PAD

Grid Location	Gamma Exposure Rates at 1 m Above the Surface (μR/h)	Gamma Exposure Rates at the Surface (μR/h)	Beta-Gamma Dose Rates at 1 cm Above the Surface (μrad/h)
5S, 0	16	11	13
5S, 5W	11	11	11
5S, 10W	14	16	16
5S, 15W	11	10	11
5S, 20W	11	11	15
5S, 25W	10	12	12
5S, 30W	10	12	12
5S, 35W	11	13	15
5S, 40W	14	21	21
5S, 45W	10	12	15
5S, 50W	11	12	21
10S, 0	10	11	14
10S, 5W	11	12	12
10S, 10W	16	20	20
10S, 15W	12	16	16
10S, 20W	12	12	17
10S, 25W	13	12	12
10S, 30W	12	11	15
10S, 35W	13	11	18
10S, 40W	12	13	16
10S, 45W	12	12	12
10S, 50W	12	12	15
15S, 0	11	11	11
15S, 5W	13	12	44
15S, 10W	16	14	43
15S, 15W	14	12	12
15S, 20W	10	10	10
15S, 25W	10	11	11
15S, 30W	10	11	12
15S, 35W	12	12	12
15S, 40W	22	35	65
15S, 45W	14	13	13
15S, 50W	12	14	14
20S, 0	11	11	13
20S, 5W	13	12	15
20S, 10W	30	50	96
20S, 15W	12	10	11
20S, 20W	10	10	10
20S, 25W	11	10	10
20S, 30W	11	10	14

TABLE 3, cont.

DIRECT RADIATION LEVELS MEASURED AT 5 M GRID INTERVALS
IN THE VICINITY OF THE CONCRETE PAD

Grid Location	Gamma Exposure Rates at 1 m Above the Surface (μR/h)	Gamma Exposure Rates at the Surface (μR/h)	Beta-Gamma Dose Rates at 1 cm Above the Surface (μrad/h)
20S, 35W	11	10	10
20S, 40W	28	49	120
20S, 45W	12	11	16
20S, 50W	11	11	11
25S, 0	10	11	12
25S, 5W	19	21	64
25S, 10W	32	42	130
25S, 15W	20	19	42
25S, 20W	21	27	73
25S, 25W	22	23	52
25S, 30W	21	22	22
25S, 35W	24	22	75
25S, 40W	29	37	110
25S, 45W	17	12	15
25S, 50W	11	11	14
30S, 0	11	11	11
30S, 5W	12	11	11
30S, 10W	15	11	11
30S, 15W	16	12	12
30S, 20W	16	12	12
30S, 25W	19	12	14
30S, 30W	16	12	12
30S, 35W	16	13	13
30S, 40W	14	12	12
30S, 45W	11	11	11
30S, 50W	10	10	13

TABLE 4

DIRECT RADIATION LEVELS AT LOCATIONS
IDENTIFIED BY THE WALKOVER SURFACE SCAN

Location[a]	Grid Location	Exposure Rate (μR/h) Contact	Exposure Rate (μR/h) 1 m Above Surface	Surface Dose Rate (μrad/h)	Sample[b]	Contact Exposure Rate After Sample Removal (μR/h)
1	22S, 42E	24	16	40	B1 A & B	24
2	192S, 47E	41	22	100	B2	73
3	22S, 11W	88	82	82	B3	120
4	13S, 15W	28	19	44	B4	30
5	8S, 8W	38	18	61	B5	35
6	5S, 39W	28	17	35	B6	25
7	14S, 39W	38	27	69	B7	41
8	20S, 40W	75	30	100	B8	70

[a] Refer to Figure 3.
[b] Soil concentrations presented in Table 7.

TABLE 5

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL SAMPLES
FROM 40 M GRID INTERVALS

Grid Location	Radionuclide Concentrations (pCi/g)			
	Ra-226	U-235	U-238	Cs-137
7S, 40E[b]	2.28 ± 0.48[a]	<0.27	<1.06	1.69 ± 0.20
4S, 0 [b]	1.78 ± 0.43	<0.28	1.55 ± 0.99	0.71 ± 0.16
3S, 40W[b]	2.03 ± 0.38	<0.27	2.77 ± 2.01	0.63 ± 0.16
3S, 52W[b,c]	2.31 ± 0.39	<0.31	2.32 ± 1.82	0.53 ± 0.14
3S, 97W[b,c]	2.23 ± 0.41	<0.27	1.94 ± 2.20	0.73 ± 0.15
3S,120W[b]	2.90 ± 0.41	<0.31	<1.27	0.76 ± 0.16
3S,160W[b]	1.75 ± 0.36	<0.26	2.17 ± 1.97	0.70 ± 0.15
3S,200W[b]	1.48 ± 0.33	<0.24	1.93 ± 2.09	0.76 ± 0.14
40S, 40E	0.94 ± 0.31	0.40 ± 0.05	2.47 ± 1.19	0.28 ± 0.16
40S, 0	1.01 ± 0.38	<0.13	0.73 ± 0.83	0.21 ± 0.11
40S, 40W	0.66 ± 0.25	<0.24	1.58 ± 1.13	0.38 ± 0.11
40S, 54W[c]	0.96 ± 0.23	<0.50	1.06 ± 0.69	<0.09
40S, 95W[c]	0.61 ± 0.28	<0.22	1.47 ± 0.93	0.44 ± 0.15
40S,120W	1.05 ± 0.42	<0.21	<0.95	0.67 ± 0.14
40S,160W	0.81 ± 0.21	<0.49	0.96 ± 0.79	0.67 ± 0.10
40S,200W	0.85 ± 0.21	<0.52	0.88 ± 0.78	0.67 ± 0.14
80S, 40E	1.04 ± 0.34	<0.22	<0.94	0.86 ± 0.18
80S, 4E[b]	0.73 ± 0.28	<0.49	0.61 ± 1.04	0.21 ± 0.08
80S, 40W	0.59 ± 0.23	0.14 ± 0.08	1.72 ± 1.54	<0.04
80S, 54W[c]	0.69 ± 0.17	<0.51	0.83 ± 0.86	<0.07
80S, 95W[c]	0.76 ± 0.33	<0.20	1.76 ± 1.89	0.49 ± 0.11
80S,120W	0.84 ± 0.30	<0.51	0.67 ± 0.98	0.67 ± 0.12
80S,165W[b]	0.80 ± 0.26	<0.20	<1.02	0.68 ± 0.16
80S,200W	0.78 ± 0.23	<0.23	<0.97	0.69 ± 0.14
120S, 40E	0.74 ± 0.28	<0.27	<1.04	0.72 ± 0.15
120S, 0	0.95 ± 0.24	<0.27	1.47 ± 1.58	0.11 ± 0.12
120S, 40W	1.08 ± 0.33	<0.27	1.27 ± 1.98	0.39 ± 0.11

TABLE 5. cont.

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL SAMPLES
FROM 40 M GRID INTERVALS

Grid Location	Radionuclide Concentrations (pCi/g)			
	Ra-226	U-235	U-238	Cs-137
120S, 55W[c]	0.78 ± 0.21	<0.51	1.44 ± 0.69	<0.07
120S, 95W[c]	0.45 ± 0.23	<0.44	<0.94	0.33 ± 0.10
120S,120W	0.85 ± 0.30	<0.29	1.70 ± 2.18	0.96 ± 0.16
120S,160W	0.74 ± 0.40	<0.33	1.78 ± 2.28	1.00 ± 0.17
120S,200W	0.66 ± 0.23	<0.27	1.61 ± 1.93	0.49 ± 0.11
160S, 40E	0.91 ± 0.30	<0.26	2.59 ± 1.66	0.67 ± 0.13
160S, 0	0.83 ± 0.23	<0.48	1.19 ± 0.81	<0.11
160S, 40W	0.70 ± 0.26	<0.21	<0.90	0.26 ± 0.11
160S, 53W[c]	0.70 ± 0.25	<0.27	<0.97	0.22 ± 0.13
160S, 96W[c]	0.79 ± 0.30	0.26 ± 0.12	5.12 ± 1.88	0.68 ± 0.13
160S,120W	0.94 ± 0.24	<0.20	1.24 ± 2.34	0.75 ± 0.14
160S,160W	0.99 ± 0.32	<0.30	2.72 ± 0.58	0.55 ± 0.20
160S,200W	0.54 ± 0.40	<0.20	<0.88	0.69 ± 0.14
200S, 40E	0.80 ± 0.26	<0.49	0.98 ± 0.91	0.78 ± 0.12
200S, 0	0.76 ± 0.21	<0.21	1.22 ± 1.64	0.70 ± 0.14
200S, 40W	0.78 ± 0.28	<0.29	<0.94	0.61 ± 0.14
200S, 54W[c]	0.95 ± 0.26	0.23 ± 0.12	<0.91	0.52 ± 0.19
200S, 97W[c]	0.53 ± 0.30	<0.24	<0.89	0.71 ± 0.14
200S,120W	0.65 ± 0.25	<0.25	2.25 ± 1.54	0.65 ± 0.14
200S,160W	0.45 ± 0.20	<0.34	0.63 ± 0.62	0.50 ± 0.10
200S,200W	0.73 ± 0.21	<0.51	1.51 ± 0.57	0.67 ± 0.11
240S 40E	0.91 ± 0.38	<0.25	2.02 ± 1.57	0.29 ± 0.11
240S, 0	0.79 ± 0.30	<0.21	<0.84	0.45 ± 0.12
240S, 40W	0.78 ± 0.33	<0.22	<0.88	0.38 ± 0.10
240S, 52W[c]	0.80 ± 0.33	<0.20	2.14 ± 1.31	0.78 ± 0.17
240S, 95W[c]	1.01 ± 0.30	<0.23	<0.89	0.64 ± 0.18
240S,120W	0.68 ± 0.21	0.27 ± 0.22	0.50 ± 0.78	0.78 ± 0.18
240S,160W	0.70 ± 0.30	<0.21	<0.81	0.24 ± 0.13
240S,200W	0.66 ± 0.23	<0.53	0.75 ± 0.94	0.64 ± 0.15

TABLE 5, cont.

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL SAMPLES
FROM 40 M GRID INTERVALS

Grid Location	Radionuclide Concentrations (pCi/g)			
	Ra-226	U-235	U-238	Cs-137
280S, 40E	0.79 ± 0.23	<0.47	1.12 ± 0.67	0.24 ± 0.09
280S, 0	0.81 ± 0.26	0.12 ± 0.07	1.62 ± 2.12	0.31 ± 0.09
280S, 40W	0.51 ± 0.35	<0.26	<0.87	0.52 ± 0.14
280S, 54W[c]	1.64 ± 0.31	0.24 ± 0.34	0.80 ± 0.45	0.95 ± 0.16
280S, 95W[c]	0.84 ± 0.30	<0.20	<0.93	0.60 ± 0.17
280S,120W	0.66 ± 0.28	<0.27	3.60 ± 1.65	0.44 ± 0.17
280S,160W	0.55 ± 0.18	<0.48	0.56 ± 1.29	0.50 ± 0.14
280S,200W	0.66 ± 0.23	0.19 ± 0.15	2.89 ± 1.28	0.69 ± 0.19
320S, 40E	0.91 ± 0.25	<0.22	2.17 ± 1.78	0.88 ± 0.18
320S, 0	1.01 ± 0.24	<0.54	0.61 ± 1.39	0.79 ± 0.15
320S, 40W	0.93 ± 0.25	<0.29	<0.29	0.71 ± 0.15
320S, 51W[c]	0.73 ± 0.28	<0.21	<0.95	0.78 ± 0.17
320S, 95W[c]	0.79 ± 0.28	0.53 ± 0.46	2.17 ± 1.42	0.66 ± 0.17
320S,120W	0.63 ± 0.29	<0.34	2.25 ± 1.55	0.87 ± 0.16
320S,160W	0.69 ± 0.26	<0.23	<0.83	0.95 ± 0.24
320S,200W	0.88 ± 0.26	<0.30	1.74 ± 1.12	0.57 ± 0.12
360S, 40E	1.03 ± 0.34	<0.23	<0.90	1.03 ± 0.19
360S, 0	0.69 ± 0.25	<0.50	1.03 ± 0.81	0.68 ± 0.12
360S, 40W	0.94 ± 0.25	<0.49	0.59 ± 1.07	0.67 ± 0.16
360S, 53W[c]	0.73 ± 0.28	0.26 ± 0.42	1.60 ± 0.92	0.80 ± 0.15
360S, 95W[c]	0.64 ± 0.25	<0.23	<0.96	0.58 ± 0.14
360S,120W	0.74 ± 0.21	<0.29	3.30 ± 1.62	0.68 ± 0.20
360S,160W	0.31 ± 0.25	<0.17	<0.71	0.61 ± 0.12
360S,200W	0.46 ± 0.30	<0.41	1.33 ± 0.69	0.42 ± 0.10
400S, 40E	1.03 ± 0.33	<0.25	<0.94	0.67 ± 0.15
400S, 0	0.74 ± 0.29	<0.22	<0.96	0.66 ± 0.13

TABLE 5, cont.

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL SAMPLES
FROM 40 M GRID INTERVALS

Grid Location	Radionuclide Concentrations (pCi/g)			
	Ra-226	U-235	U-238	Cs-137
400S, 40W	0.79 ± 0.52	<0.27	<0.96	0.80 ± 0.15
400S, 53W[c]	1.10 ± 0.28	<0.27	<1.05	0.63 ± 0.13
400S, 96W[c]	0.94 ± 0.23	<0.54	0.41 ± 0.13	0.76 ± 0.15
400S,120W	0.89 ± 0.28	0.25 ± 0.12	<0.98	0.52 ± 0.13
400S,160W	0.75 ± 0.28	<0.24	1.24 ± 2.06	0.79 ± 0.16
400S,200W	0.65 ± 0.30	<0.19	<0.93	0.81 ± 0.15

[a] Errors are 2σ based on counting statistics.
[b] 40 m grid intersection not accessible or soil not available; sample collected from nearest available location.
[c] Sampling at edge of drainage ditch easement.

TALBE 6

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL SAMPLES
FROM 5 M GRID INTERVALS
IN THE VICINITY OF THE CONCRETE PAD

Grid Location	Radionuclide Concentrations (pCi/g)			
	Ra-226	U-235	U-238	Cs-137
5S, 0	0.74 ± 0.30[a]	<0.54	1.59 ± 0.89	0.78 ± 0.16
5S, 5W	1.11 ± 0.31	<0.57	0.84 ± 1.17	0.66 ± 0.12
5S, 10W	5.13 ± 0.63	0.59 ± 0.82	1.86 ± 3.69	0.55 ± 0.18
5S, 15W	0.70 ± 0.23	<0.54	0.86 ± 0.85	0.32 ± 0.11
5S, 20W	1.13 ± 0.34	<0.29	<1.13	0.61 ± 0.17
5S, 25W	0.79 ± 0.30	<0.21	<0.95	0.53 ± 0.15
5S, 30W	1.11 ± 0.21	<0.51	1.30 ± 0.80	0.54 ± 0.12
5S, 35W	1.11 ± 0.28	0.21 ± 0.07	<1.03	0.36 ± 0.12
5S, 40W	3.19 ± 0.45	<0.28	2.45 ± 1.62	0.32 ± 0.13
10S, 0	1.15 ± 0.33	<0.28	1.59 ± 1.61	0.58 ± 0.20
10S, 5W	0.75 ± 0.16	<0.49	1.03 ± 0.63	0.05 ± 0.07
10S, 10W	2.31 ± 0.35	<0.31	2.24 ± 2.41	0.13 ± 0.10
10S, 15W	1.89 ± 0.39	<0.33	2.30 ± 1.24	0.18 ± 0.11
10S, 20W	0.91 ± 0.21	<0.26	1.88 ± 1.29	0.10 ± 0.08
10S, 25W	0.86 ± 0.28	<0.27	1.68 ± 1.13	0.13 ± 0.06
10S, 30W	1.01 ± 0.29	<0.23	2.55 ± 1.25	0.15 ± 0.09
10S, 35W	1.64 ± 0.34	<0.31	1.50 ± 0.99	0.13 ± 0.09
10S, 40W	0.95 ± 0.20	<0.54	0.63 ± 1.28	<0.10
10S, 45W	1.00 ± 0.34	<0.24	<0.94	<0.05
10S, 50W	1.48 ± 0.40	<0.26	1.67 ± 1.24	<0.05
15S, 0	1.03 ± 0.35	<0.29	2.00 ± 1.05	0.34 ± 0.10
15S, 5W	1.16 ± 0.30	<0.20	1.59 ± 2.01	0.24 ± 0.16
15S, 10W	0.98 ± 0.23	<0.45	0.97 ± 0.70	0.06 ± 0.07
15S, 15W	1.03 ± 0.25	<0.25	4.28 ± 2.12	0.34 ± 0.09
15S, 20W	0.99 ± 0.45	<0.30	1.38 ± 2.34	0.11 ± 0.07
15S, 25W	0.84 ± 0.26	<0.22	3.62 ± 1.15	0.08 ± 0.05

TABLE 6, cont.

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL SAMPLES
FROM 5 M GRID INTERVALS
IN THE VICINITY OF THE CONCRETE PAD

Grid Location	Radionuclide Concentrations (pCi/g)			
	Ra-226	U-235	U-238	Cs-137
15S, 30W	0.91 ± 0.28	0.18 ± 0.11	2.22 ± 1.71	<0.06
15S, 35W	0.96 ± 0.29	<0.28	1.28 ± 1.49	0.30 ± 0.14
15S, 40W	5.25 ± 0.80	<0.52	5.28 ± 2.72	0.43 ± 0.19
15S, 45W	0.96 ± 0.25	<0.28	1.25 ± 1.62	0.29 ± 0.09
15S, 50W	1.90 ± 0.36	<0.26	2.94 ± 2.43	0.44 ± 0.16
20S, 0	0.68 ± 0.15	0.30 ± 0.03	1.17 ± 1.67	0.36 ± 0.12
20S, 5W	0.88 ± 0.20	<0.48	<1.09	0.43 ± 0.08
20S, 10W	26.9 ± 1.1	<0.99	25.8 ± 3.7	1.15 ± 0.20
20S, 15W	b	b	b	b
20S, 20W	b	b	b	b
20S, 25W	b	b	b	b
20S, 30W	b	b	b	b
20S, 35W	b	b	b	b
20S, 40W	34.9 ± 1.2	<1.16	34.2 ± 4.4	0.40 ± 0.17
20S, 45W	0.84 ± 0.30	<0.23	1.36 ± 1.70	0.54 ± 0.13
20S, 50W	0.98 ± 0.23	<0.52	1.26 ± 0.72	0.68 ± 0.15
25S, 0	0.55 ± 0.19	<0.21	<0.84	0.40 ± 0.15
25S, 5W	1.04 ± 0.28	<0.31	2.37 ± 1.84	0.64 ± 0.16
25S, 10W	31.5 ± 1.0	1.94 ± 1.30	15.2 ± 1.9	0.65 ± 0.14
25S, 15W	5.51 ± 0.59	<0.93	3.19 ± 2.39	0.46 ± 0.15
25S, 20W	16.7 ± 0.9	1.86 ± 1.27	11.6 ± 1.4	0.41 ± 0.13
25S, 25W	2.98 ± 0.48	<0.41	2.88 ± 3.32	0.78 ± 0.16
25S, 30W	6.89 ± 0.68	<0.55	3.47 ± 1.94	0.55 ± 0.19
25S, 35W	2.55 ± 0.38	<0.25	2.99 ± 2.60	0.48 ± 0.18
25S, 40W	15.3 ± 0.8	0.96 ± 1.00	11.2 ± 2.3	0.98 ± 0.17
25S, 45W	0.78 ± 0.29	<0.55	1.12 ± 0.79	0.78 ± 0.15
25S, 50W	1.45 ± 0.31	<0.24	1.63 ± 1.88	0.07 ± 0.11

TABLE 6, cont.

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL SAMPLES
FROM 5 M GRID INTERVALS
IN THE VICINITY OF THE CONCRETE PAD

Grid Location	Radionuclide Concentrations (pCi/g)			
	Ra-226	U-235	U-238	Cs-137
30S, 0	0.91 ± 0.35	<0.55	1.45 ± 1.08	0.65 ± 0.14
30S, 5W	0.95 ± 0.29	<0.24	<0.97	0.64 ± 0.13
30S, 10W	0.71 ± 0.28	<0.20	1.80 ± 2.59	0.57 ± 0.16
30S, 15W	0.59 ± 0.43	<0.28	<1.03	0.59 ± 0.24
30S, 20W	0.70 ± 0.20	<0.27	2.47 ± 1.67	0.45 ± 0.12
30S, 25W	0.83 ± 0.34	<0.28	2.25 ± 1.19	0.75 ± 0.16
30S, 30W	0.95 ± 0.31	<0.27	<0.93	0.51 ± 0.14
30S, 35W	0.70 ± 0.26	0.32 ± 0.51	<0.85	0.54 ± 0.15
30S, 40W	0.98 ± 0.25	<0.47	1.10 ± 0.79	<0.25
30S, 45W	1.06 ± 0.29	<0.27	1.52 ± 1.27	0.70 ± 0.18
30S, 50W	0.65 ± 0.20	<0.52	0.97 ± 0.75	0.12 ± 0.08

[a] Errors are 2σ based on counting statistics.
[b] Sample not available due to presence of concrete pad.

TABLE 7

RADIONUCLIDE CONCENTRATIONS IN SURFACE SAMPLES
FROM LOCATIONS IDENTIFIED BY THE WALKOVER SCAN

Sample[a] No.	Grid Location	Radionuclide Concentrations (pCi/g)[b]			
		Ra-226	U-235	U-238	Cs-137
B1-A (Gravel)	22S, 42E	8.47 ± 0.71[c]	<0.48	9.68 ± 4.04	0.65 ± 0.16
B1-B (Rock)	22S, 42E	168 ± 7	10.3 ± 11.1	126 ± 23	<0.64
B2	192S, 47E	62.3 ± 1.8	<1.46	12.2 ± 7.2	1.59 ± 0.24
B3	22S, 1W	32.1 ± 1.2	<0.91	32.2 ± 4.9	0.92 ± 0.18
B4	13S, 15W	11.6 ± 0.7	<0.58	6.21 ± 4.04	0.53 ± 0.13
B5	8S, 8E	23.7 ± 1.1	<0.98	22.0 ± 3.7	0.55 ± 0.16
B6	5S, 39W	15.9 ± 0.8	<0.82	15.5 ± 4.5	0.34 ± 0.12
B7	14S, 39W	4.33 ± 0.42	<0.81	2.56 ± 1.56	0.23 ± 0.15
B8	20S, 40W	33.2 ± 1.2	<1.10	26.6 ± 4.0	0.26 ± 0.15

[a] Refer to Figure 3.
[b] Refer to Table 4 for direct radiation levels.
[c] Errors are 2σ based on counting statistics.

TABLE 8

RADIONUCLIDE CONCENTRATIONS IN BOREHOLE SOIL SAMPLES

Borehole[a] No.	Grid Location	Depth (m)	Radionuclide Concentrations (pCi/g)			
			Ra-226	U-235	U-238	Cs-137
H1	27S,220W	Surface	1.18 ± 0.73[b]	<0.29	1.59 ± 1.39	0.40 ± 0.10
		0.5	0.78 ± 0.26	<0.21	2.01 ± 1.49	<0.03
		1.0	0.78 ± 0.20	<0.21	0.91 ± 1.79	<0.03
		2.0	0.83 ± 0.29	<0.23	<0.82	<0.04
		3.0	1.03 ± 0.24	<0.27	<0.85	<0.03
H2	16S,173W	Surface	0.88 ± 0.20	<0.26	1.70 ± 0.79	<0.03
		0.5	0.65 ± 0.24	<0.18	0.63 ± 0.37	<0.03
		1.0	0.90 ± 0.19	<0.16	0.52 ± 1.60	<0.04
		2.0	0.74 ± 0.18	<0.17	0.51 ± 0.29	<0.03
		3.0	0.76 ± 0.24	<0.20	0.87 ± 0.89	<0.03
H3	32S, 97W	Surface	0.73 ± 0.23	<0.20	1.41 ± 1.48	0.10 ± 0.05
		0.5	0.96 ± 0.26	<0.24	0.64 ± 0.51	<0.03
		1.0	0.84 ± 0.21	<0.21	1.45 ± 0.51	<0.03
		2.0	1.14 ± 0.39	<0.33	2.58 ± 3.65	<0.06
		3.0	0.85 ± 0.28	<0.20	1.08 ± 1.85	<0.03
H4	25S, 52W	Surface	0.96 ± 0.29	<0.29	<0.92	<0.03
		0.5	0.85 ± 0.25	<0.17	1.49 ± 1.45	<0.04
		1.0	0.80 ± 0.23	<0.28	<0.88	<0.04
		2.0	0.94 ± 0.33	<0.22	1.00 ± 0.74	<0.03
		3.0	0.64 ± 0.19	<0.20	1.35 ± 1.66	<0.04
H5	22S, 30E	Surface	0.70 ± 0.23	<0.22	1.62 ± 1.75	0.19 ± 0.07
		0.5	0.91 ± 0.24	<0.20	0.83 ± 1.41	<0.03
		1.0	0.69 ± 0.24	<0.20	1.02 ± 0.67	<0.03
		2.0	1.39 ± 0.41	<0.32	2.05 ± 1.99	<0.05

TABLE 8, cont.

RADIONUCLIDE CONENTRATIONS IN BOREHOLE SOIL SAMPLES

Borehole No.	Grid Location	Depth (m)	Radionuclide Concentrations (pCi/g)			
			Ra-226	U-235	U-238	Cs-137
H6	160S, 45E	Surface	0.67 ± 0.25	<0.20	2.44 ± 1.69	<0.03
		0.5	0.84 ± 0.20	<0.20	1.07 ± 0.75	<0.04
		1.0	0.78 ± 0.24	<0.20	<0.82	<0.04
		2.0	0.77 ± 0.21	<0.22	1.17 ± 0.80	<0.03
H7	296S, 45E	Surface	1.26 ± 0.33	<0.25	4.63 ± 2.11	0.68 ± 0.13
		0.5	0.90 ± 0.19	<0.24	2.04 ± 0.62	<0.04
		1.0	0.91 ± 0.31	<0.22	1.90 ± 0.61	<0.04
H8	19S, 40W	Surface	21.7 ± 0.8	1.78 ± 0.99	17.8 ± 1.5	0.32 ± 0.10
		0.5	3.43 ± 0.55	<0.23	2.37 ± 2.13	<0.02
		1.0	1.70 ± 0.33	<0.35	<1.19	<0.05
H9	14S, 37W	Surface	6.73 ± 0.58	<0.37	4.56 ± 2.53	0.33 ± 0.09
		0.5	2.30 ± 0.34	<0.26	2.30 ± 1.74	<0.04
		1.0	1.55 ± 0.36	<0.25	1.16 ± 0.56	<0.04
H10	8S, 41W	Surface	0.91 ± 0.20	<0.21	2.98 ± 1.23	0.04 ± 0.08
		0.5	0.88 ± 0.19	<0.29	1.59 ± 1.71	<0.04
		1.0	1.08 ± 0.26	<0.24	1.00 ± 0.53	<0.04
H11	13S, 23W	Surface	0.89 ± 0.19	<0.20	0.74 ± 0.65	<0.04
		0.5	0.69 ± 0.25	<0.20	1.39 ± 1.76	<0.04
		1.0	0.89 ± 0.29	<0.23	1.66 ± 1.70	<0.04
H12	13S, 19W	Surface	1.93 ± 0.35	<0.23	2.14 ± 1.09	0.19 ± 0.10
		0.5	0.83 ± 0.29	<0.23	<0.86	<0.04
		1.0	0.92 ± 0.26	<0.23	1.59 ± 1.77	<0.04

TABLE 8, cont.

RADIONUCLIDE CONCENTRATIONS IN BOREHOLE SOIL SAMPLES

Borehole No.	Grid Location	Depth (m)	Radionuclide Concentrations (pCi/g)			
			Ra-226	U-235	U-238	Cs-137
H13	13S, 9W	Surface	0.18 ± 0.26	<0.18	1.56 ± 1.42	0.06 ± 0.05
		0.5	0.78 ± 0.38	<0.21	2.38 ± 1.78	<0.04
		1.0	0.79 ± 0.24	<0.21	1.01 ± 0.51	<0.03
H14	22S, 10W	Surface	4.34 ± 0.40	0.66 ± 0.45	3.74 ± 0.67	0.23 ± 0.10
		0.5	0.83 ± 0.40	<0.25	1.14 ± 1.80	<0.03
		1.0	1.09 ± 0.23	<0.21	<0.87	<0.03
H15	25S, 25W	Surface	1.08 ± 0.25	<0.20	1.87 ± 1.98	0.06 ± 0.10
		0.5	0.84 ± 0.24	<0.22	1.71 ± 0.66	0.05 ± 0.08
		1.0	0.91 ± 0.24	<0.29	2.81 ± 0.62	<0.04
H16	23S, 41E	Surface	0.99 ± 0.25	<0.23	1.14 ± 0.52	0.09 ± 0.09
		0.5	0.89 ± 0.26	<0.20	<0.85	<0.04
		1.0	0.95 ± 0.24	<0.20	<0.75	<0.03
H17	193S, 46E	Surface	0.84 ± 0.23	<0.28	1.18 ± 1.99	<0.04
		0.5	0.84 ± 0.28	<0.24	1.05 ± 1.69	<0.04
		1.0	1.04 ± 0.23	<0.27	2.34 ± 0.62	<0.05

[a] Refer to Figure 4.
[b] Errors are 2σ based on counting statistics.

TABLE 9

RADIONUCLIDE CONCENTRATIONS IN WATER SAMPLES

Sample No.	Sample Type	Grid Location	Radionuclide Concentrations (pCi/l) Gross Alpha[a]	Gross Beta	Ra-226
W1	Surface[b] (Drainage Ditch)	35S, 54W	15.1 ± 2.1[d]	41.4 ± 3.1	0.27 ± 0.06
W2	Subsurface (Borehole H1)[c]	27S,220W	6.87 ± 3.17	26.3 ± 3.7	0.28 ± 0.06
W3	Subsurface (Borehole H2)[c]	16S,173W	2.52 ± 2.66	<2.75	---[e]
W4	Subsurface (Borehole H3)[c]	32S, 97W	4.21 ± 2.32	19.7 ± 3.8	---
W5	Subsurface (Borehole H4)[c]	25S, 52W	3.49 ± 3.20	7.70 ± 3.69	---
W6	Subsurface (Borehole H5)[c]	22S, 30E	<3.32	15.6 ± 7.5	---
W7	Subsurface (Borehole H7)[c]	296S, 45E	<1.70	7.99 ± 4.12	---

[a] Large amounts of dissolved solids resulted in relatively poor detection sensitivities.
[b] Refer to Figure 5.
[c] Refer to Figure 4.
[d] Errors are 2σ based on counting statistics.
[e] Dash indicates the analysis was not performed.

TABLE 10

RADIONUCLIDE CONCENTRATIONS IN SEDIMENT SAMPLES FROM DRAINAGE DITCHES

Sample[a] No.	Grid Location	Radionuclide Concentrations (pCi/g)			
		Ra-226	U-235	U-238	Cs-137
S1	35S, 54W	0.81 ± 0.23[b]	<0.49	0.57 ± 1.36	0.08 ± 0.10
S2	35S, 0	1.19 ± 0.29	0.08 ± 0.11	<0.83	0.15 ± 0.07
S3	118S, 95W	0.69 ± 0.24	<0.39	0.49 ± 0.51	0.25 ± 0.06
S4	118S,120W	0.99 ± 0.26	<0.23	<0.99	1.27 ± 0.20

[a] Refer to Figure 5.
[b] Errors are 2σ based on counting statistics.

Excavated Area

Excerpt from Post-Remedial Action Report for the Niagara Falls Storage Site Vicinity Properties 1983 and 1984

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DOE/OR/20722-84

Formerly Utilized Sites Remedial Action Program (FUSRAP)
Contract No. DE-ACO5-810R20722

POST-REMEDIAL ACTION REPORT FOR THE NIAGARA FALLS STORAGE SITE VICINITY PROPERTIES - 1983 AND 1984

Lewiston, New York

December 1986

Bechtel National, Inc.

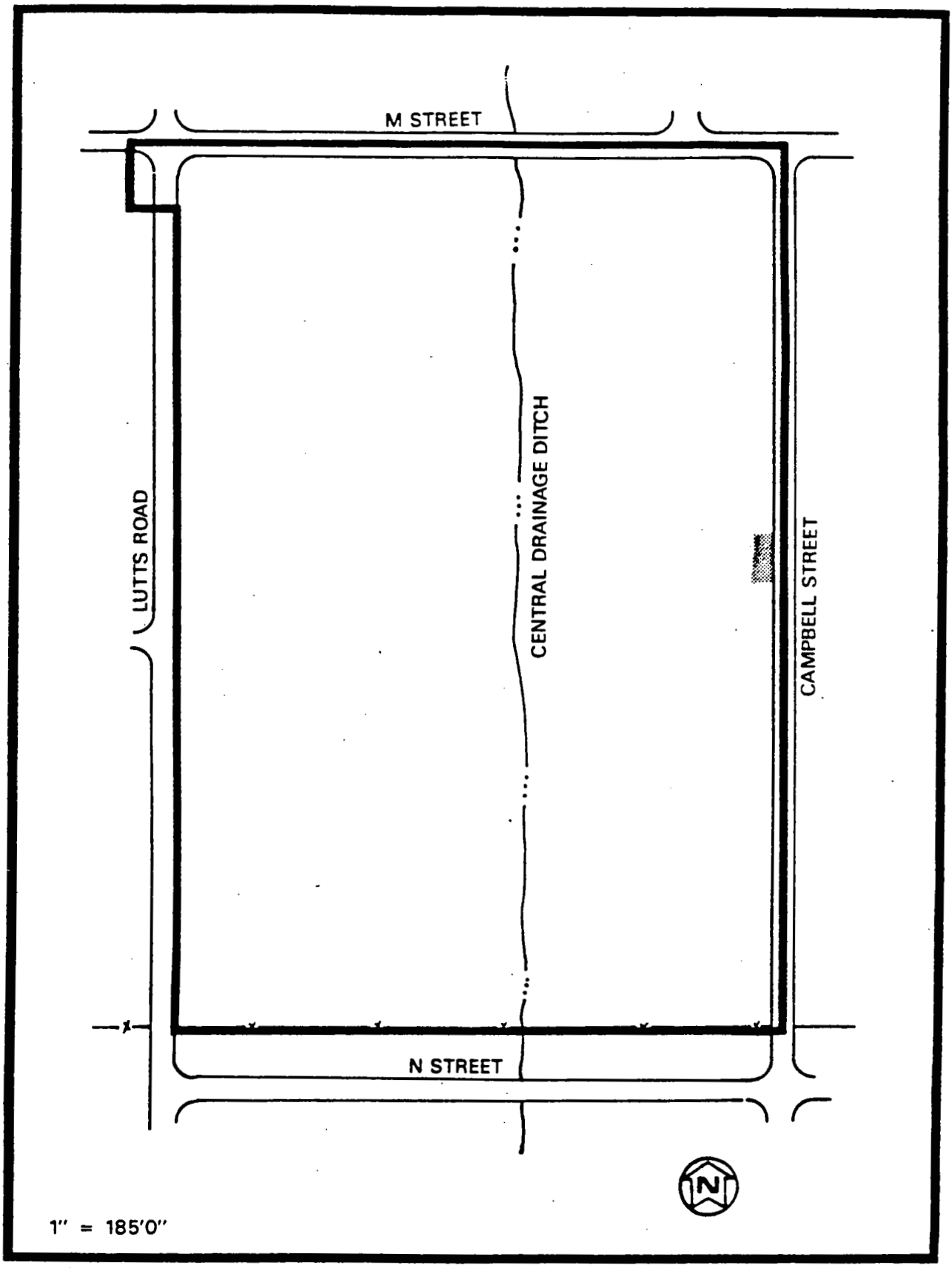
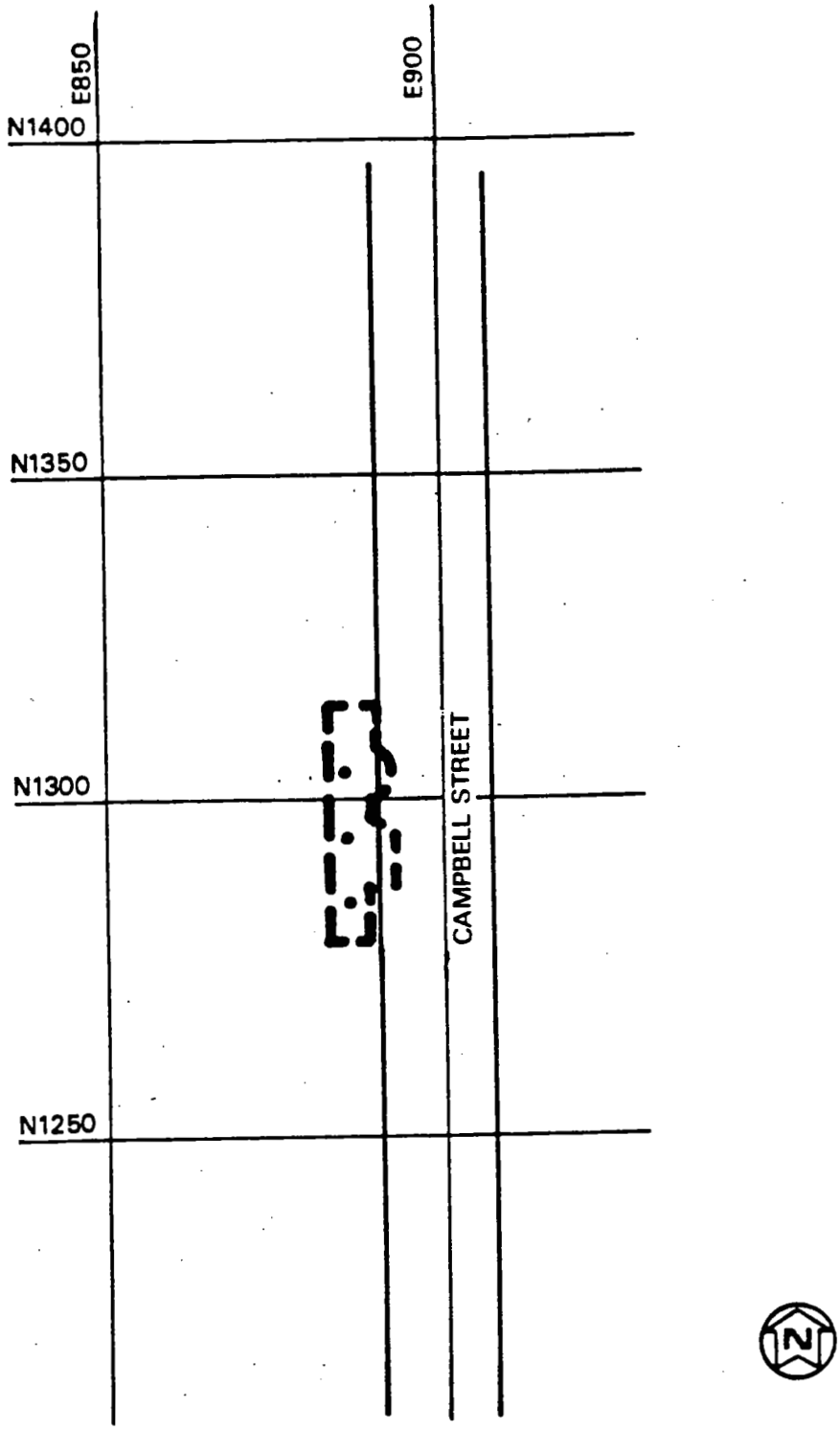


FIGURE 26 EXCAVATED AREA ON PROPERTY S



EXCAVATION DEPTH WAS 1 FOOT

FIGURE 27 POST-REMEDIAL ACTION SAMPLING LOCATIONS ON PROPERTY S

TABLE 9

POST-REMEDIAL ACTION SAMPLING RESULTS

FOR PROPERTY S

Grid Coordinates		Concentrations (pCi/g ±/- 1 sigma)		
E, W	N, S	Uranium-238	Radium-226	Thorium-232
E0885	N1305	A	2.8 ± 0.3	0.9 ± 0.2
E0886	N1285	5.3 ± 0.4	5.3 ± 0.4	1.1 ± 0.2
E0895	N1295	A	5.3 ± 0.4	0.8 ± 0.3

'A' denotes less than detectable activity

Verification Data

Excerpt from Verification of 1983 and 1984 Remedial Actions Niagara Falls Storage Site Vicinity Properties, Lewiston, New York, December 1989

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VERIFICATION
OF
1983 AND 1984 REMEDIAL ACTIONS
NIAGARA FALLS STORAGE SITE
VICINITY PROPERTIES
LEWISTON, NEW YORK

Prepared by

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FINAL REPORT

December 1989

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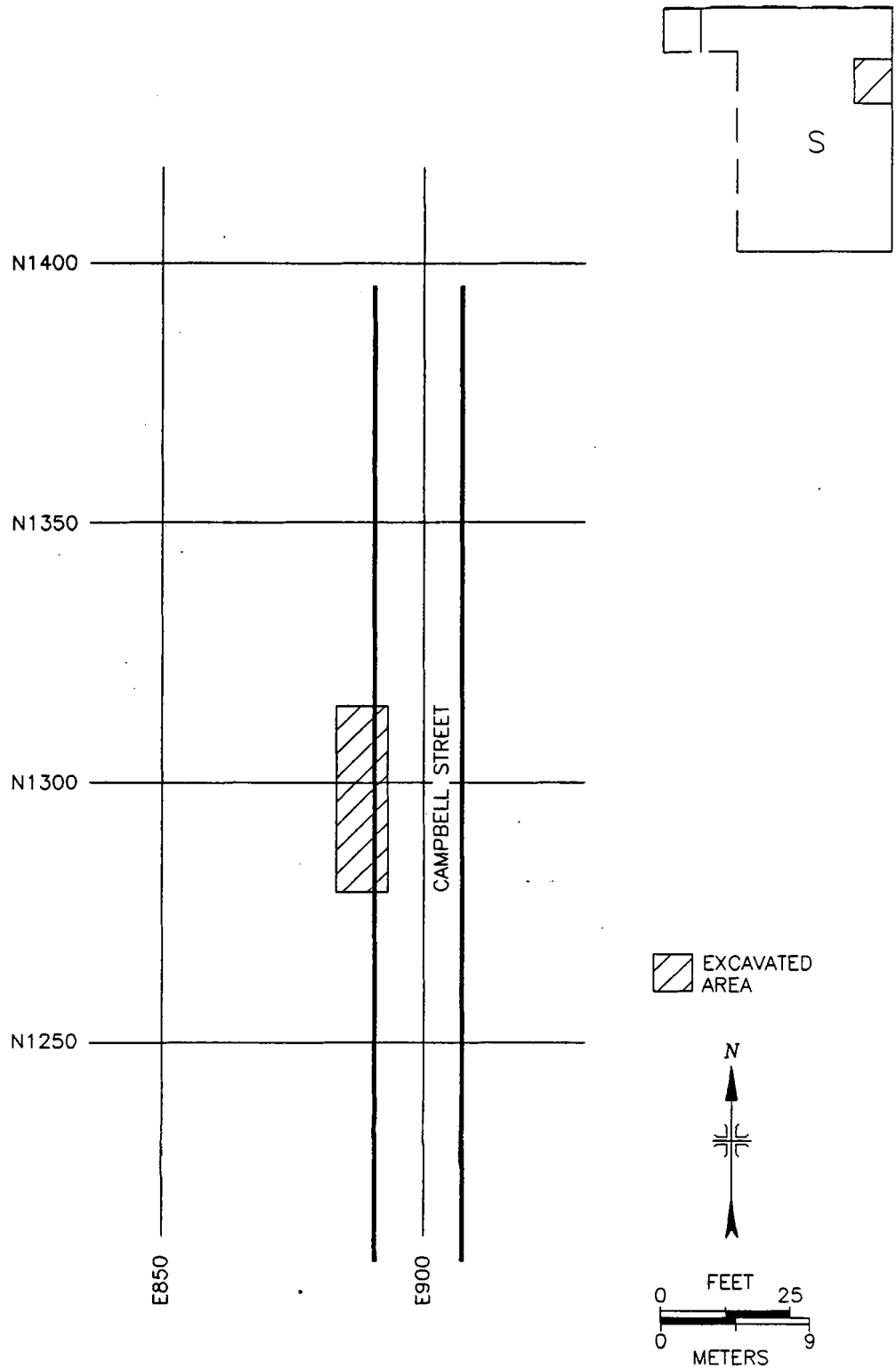

FIGURE 15: Plot Plan of Remediated Section of Vicinity Property S

TABLE 1 (continued)

RESULTS OF CONFIRMATORY ANALYSES ON SOIL SAMPLES
NIAGARA FALLS STORAGE SITE VICINITY PROPERTIES
LEWISTON, NEW YORK

Property	Sample ID[a]	Grid Location	Analysis By	Radionuclide Concentration(pCi/g)[b] Ra-226	U-238	Th-232
	63	S2320, E3660	BNI	0.6 ± 0.2	<MDA	0.7 ± 0.2
			ORAU	0.6 ± 0.2	1.1 ± 0.6	0.7 ± 0.4
	69	S2330, E3690	BNI	0.6 ± 0.2	<MDA	0.7 ± 0.2
			ORAU	0.6 ± 0.2	1.1 ± 0.6	0.7 ± 0.4
R	2	S3140, W 607	BNI	4.0 ± 0.4	<MDA	1.1 ± 0.6
			ORAU	3.8 ± 0.5	<0.8	0.5 ± 0.3
	6	S3140, W 527	BNI	1.3 ± 0.2	<MDA	<MDA
			ORAU	1.2 ± 0.3	<0.7	1.6 ± 0.5
S	3	N1305, E 885	BNI	2.8 ± 0.6	<MDA	0.9 ± 0.4
			ORAU	2.1 ± 0.3	1.5 ± 0.9	1.0 ± 0.4
V	2	N3709, E1138	BNI	0.8 ± 0.2	<MDA	1.1 ± 0.4
			ORAU	0.9 ± 0.3	6.9 ± 1.3	1.0 ± 0.5
X	312	N 640, W 410	BNI	1.2 ± 0.2	1.3 ± 3.6	0.8 ± 0.4
			ORAU	1.0 ± 0.3	4.3 ± 2.0	1.4 ± 0.4
	4	N 690, W 420	BNI	1.0 ± 0.2	<MDA	0.7 ± 0.2
			ORAU	0.9 ± 0.3	2.9 ± 1.4	0.7 ± 0.3
	9	N 710, W 400	BNI	1.1 ± 0.2	<MDA	1.3 ± 0.4
			ORAU	0.8 ± 0.2	2.1 ± 2.2	1.3 ± 0.3
West Ditch	67	N 820, W 170.5	BNI	0.9 ± 0.2	<MDA	1.2 ± 0.6
			ORAU	1.0 ± 0.2	0.3 ± 1.1	0.9 ± 0.4
	125	N1560, W 170	BNI	1.3 ± 0.4	<MDA	1.2 ± 0.6
			ORAU	1.5 ± 0.3	1.5 ± 1.3	1.0 ± 0.3
	128	N1600, W 160	BNI	<MDA	<MDA	0.9 ± 1.2
			ORAU	78.7 ± 1.8	9.3 ± 12.5	0.9 ± 1.1
	200	N2220, W 110	BNI	1.3 ± 0.4	<MDA	0.6 ± 0.4
			ORAU	1.4 ± 0.3	1.3 ± 1.1	1.1 ± 0.4
	252	W2500, E 090	BNI	1.0 ± 0.2	<MDA	0.8 ± 0.4
			ORAU	1.0 ± 0.3	2.2 ± 1.4	1.2 ± 0.4

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