Figures

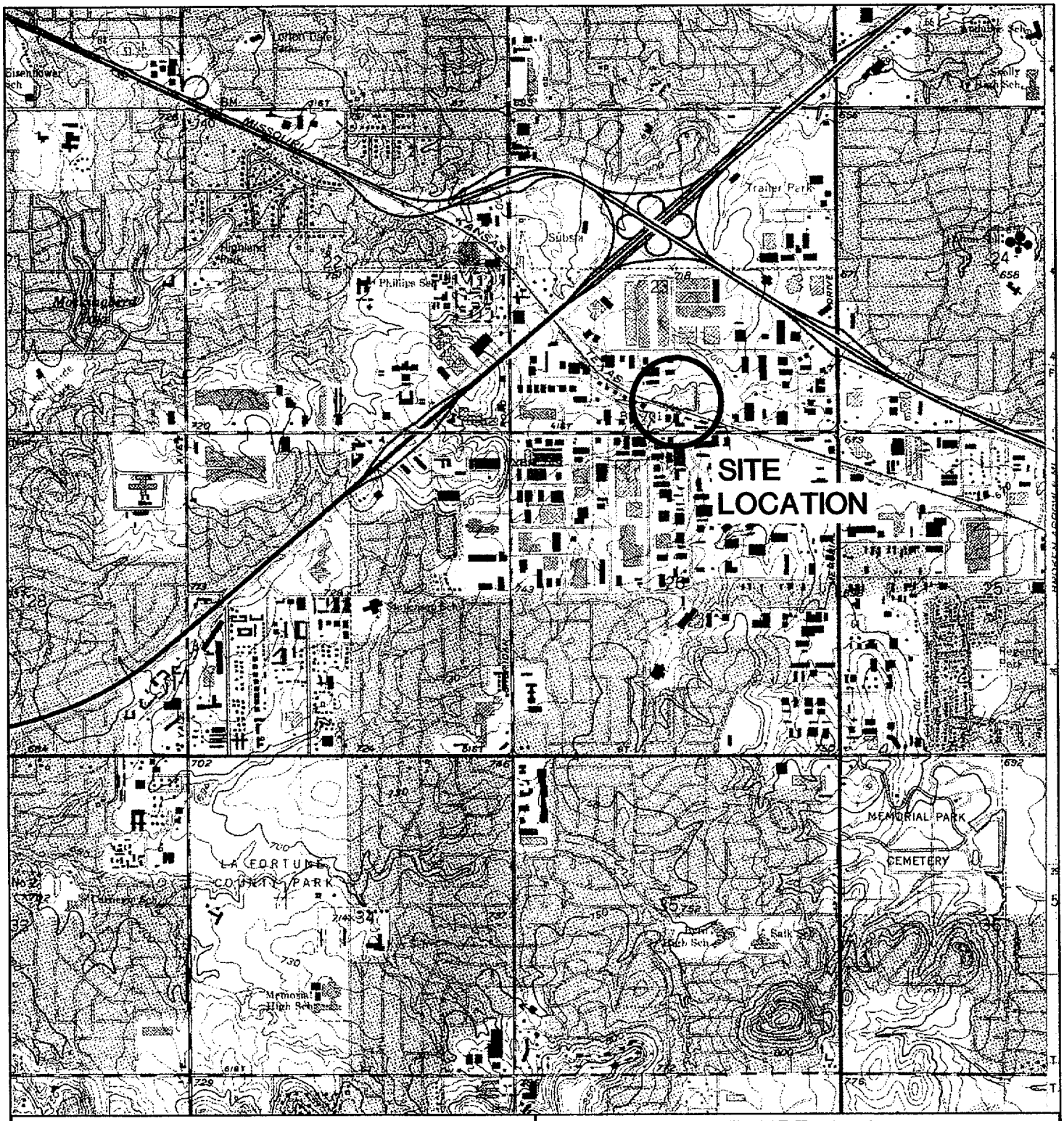

FIGURE 1–1
SITE LOCATION MAP

KAISER ALUMINUM SPECIALTY PRODUCTS
TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
BATON ROUGE, LOUISIANA

APPROVED	6/20/01
CHECKED	DEB 6/20/01
DRAWN	DEB 6/20/00
DRAWING NUMBER	5427001

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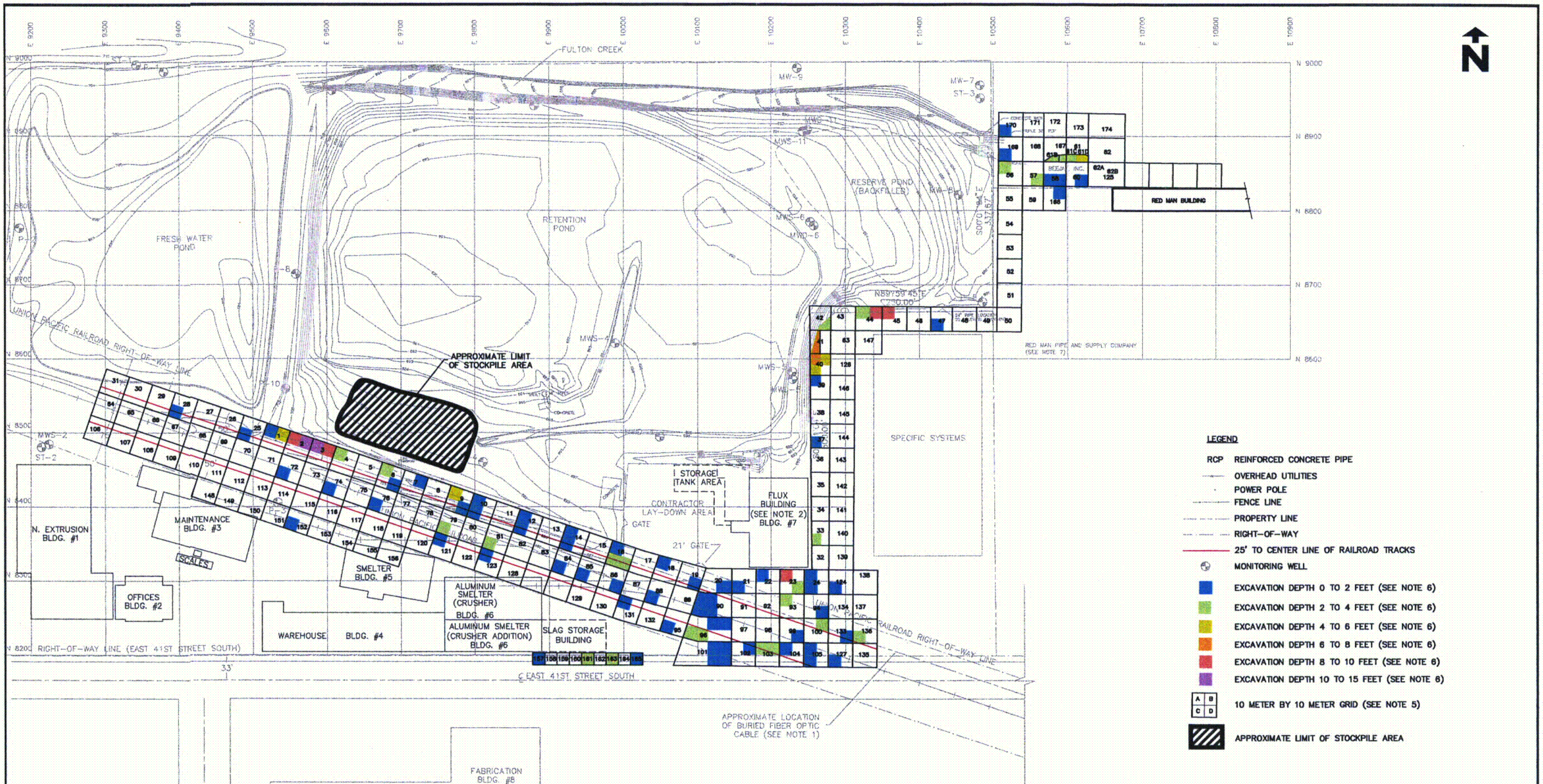
REFERENCE
USGS 7.5–MIN TOPOGRAPHIC QUADRANGLE
JENKS, OKLAHOMA
DATED 1952, PHOTOREVISED 1982



NOTES

1. SPRINT FIBER OPTIC CABLE IS LOCATED UNDERGROUND. THE LOCATION HAS BEEN FLAGGED AND SPRAY PAINTED ORANGE. FOR ADDITIONAL INFORMATION CALL 1-800-521-0579.
2. INFORMATION SHOWN MAY NOT BE COMPLETE. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE LOCATION OF ALL UTILITIES (ABOVE GROUND AND BELOW GROUND) AND OTHER INTERFERENCES WHICH MAY AFFECT THE WORK.
3. THE CONTRACTOR SHALL PAY FOR ALL COSTS TO REPAIR OR TO REPLACE MONITORING WELLS DAMAGED DURING REMEDIATION.
4. THE EXCAVATION DEPTHS SHOWN WERE OBTAINED BASED ON INFORMATION PRESENTED IN SECTION 1.3 OF THE PERFORMANCE SPECIFICATIONS.
5. SURVEY DATA FOR 10 METER BY 10 METER GRIDS CAN BE OBTAINED FROM APPENDIX E OF THE PERFORMANCE SPECIFICATIONS. LOCATIONS FOR GRIDS 157-165 ARE APPROXIMATE AND REQUIRE FIELD VERIFICATION.
6. REFER TO TABLE 1 OF THE PERFORMANCE SPECIFICATIONS FOR SPECIFIC QUARTER-GRID CONTAMINATION DEPTHS.
7. THE CONTRACTOR SHALL REFER TO SECTION 6.8 OF THE PERFORMANCE SPECIFICATIONS FOR COMPACTION SPECIFICATIONS FOR THE RED MAN PROPERTY. THE CONTRACTOR SHALL RESTORE DISTURBED SURFACES TO AT LEAST THEIR ORIGINAL LOAD BEARING CAPACITY DUE TO OPERATION OF HEAVY EQUIPMENT BY THE OWNER.

REFERENCES

1. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM PLAT OF SURVEY PREPARED BY DENTON & WHITE SURVEYING COMPANY SEALED ON FEBRUARY 14, 1964.
2. BUILDING LOCATIONS AND OUTLINES WERE DETERMINED FROM KAISER PLANT UTILITIES CUT-OFFS DIAGRAM, DATED 2/89.
3. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM TOPOGRAPHIC SURVEY OF PART OF THE SE/4 OF SECTION 23 TOWNSHIP 19 NORTH RANGE 13 EAST, OF THE I.B. & M., TULSA COUNTY, STATE OF OKLAHOMA, ACCORDING TO THE U.S. GOVERNMENT SURVEY THEREOF, AND KNOWN AS 7311 EAST 41st STREET SOUTH. (FILE: NFSK003.DWG REV. A)

C-1

SCALE - FEET
0 60 120 180

REVISION	DATE	DESCRIPTION

FIGURE 1-2
FINAL STATUS SURVEY PLAN
CHARACTERIZATION GRIDS
ADJACENT LAND AREA REMEDIATION
KAISER ALUMINUM
TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
BATON ROUGE, LOUISIANA

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DRAWING NUMBER
5427A406

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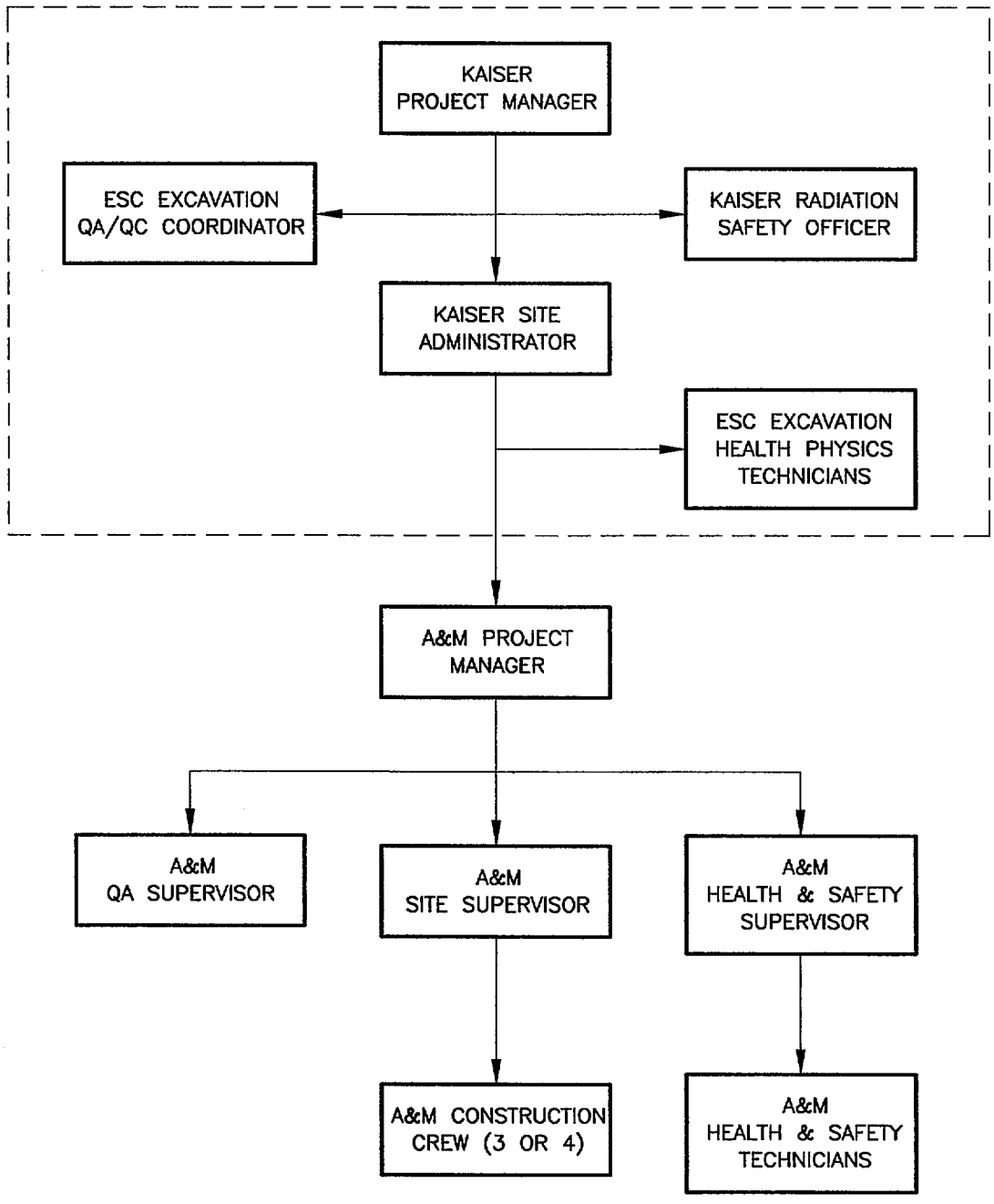

FIGURE 3–1
KAISER TULSA ADJACENT LAND
REMEDIATION PROJECT ORGANIZATION
KAISER ALUMINUM
TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
BATON ROUGE, LOUISIANA

APPROVED	6/29/01
CHECKED	6/29/01
DRAWN	GJA 6/15/01
DRAWING NUMBER	5427038

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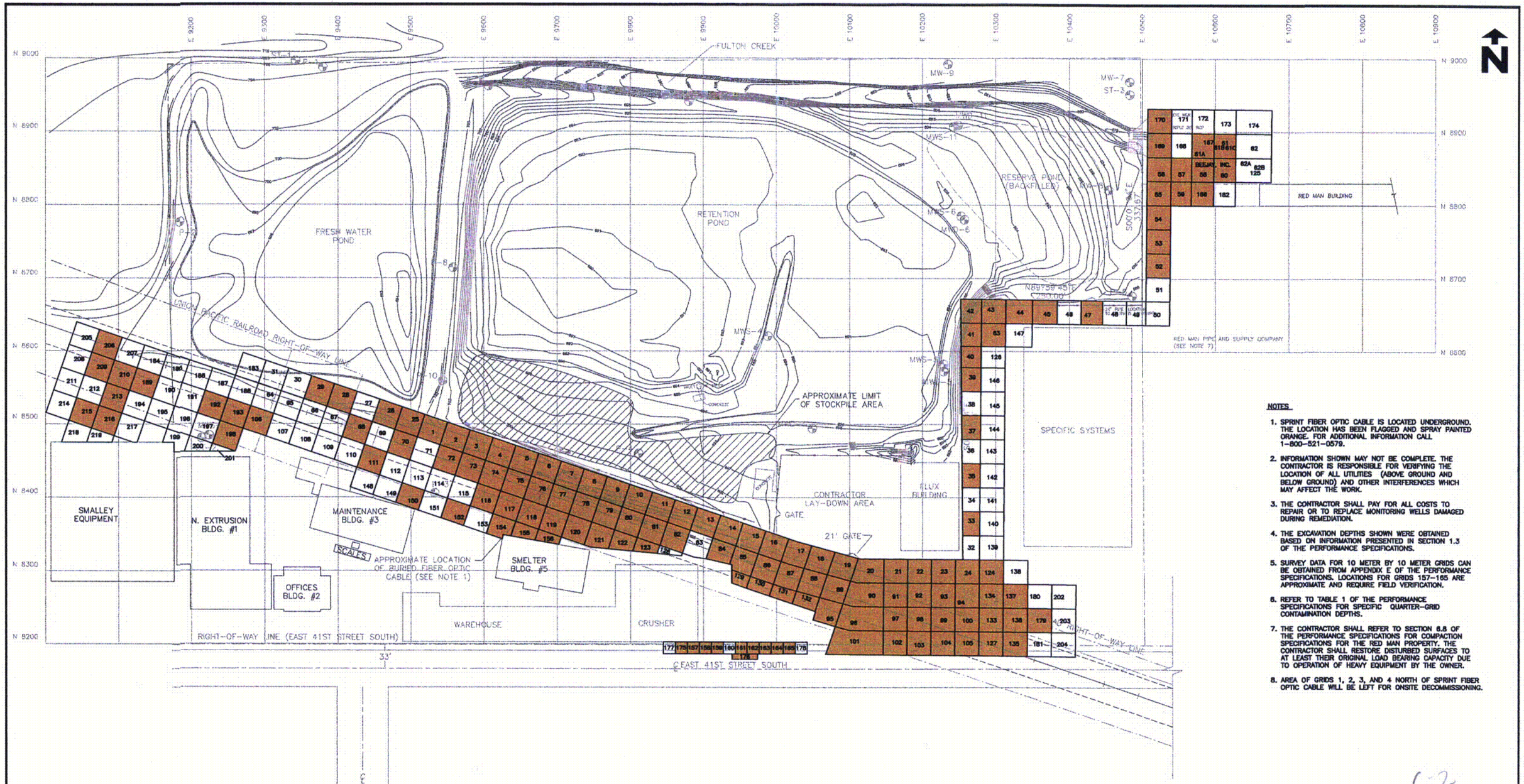

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8. AREA OF GRIDS 1, 2, 3, AND 4 NORTH OF SPRINT FIBER OPTIC CABLE WILL BE LEFT FOR ONSITE DECOMMISSIONING.

LEGEND

- RCP REINFORCED CONCRETE PIPE
- OVERHEAD UTILITIES
- POWER POLE
- MONITORING WELL
- FENCE LINE
- PROPERTY LINE
- RIGHT-OF-WAY
- 25' OFFSET OF RAILROAD CENTER LINE
- SURVEY UNIT BOUNDARY
- 10 METER BY 10 METER GRID (SEE NOTE 5)
- AFFECTED AREA
- UNAFFECTED AREA
- APPROXIMATE LIMIT OF STOCKPILE AREA

REFERENCES

1. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM PLAT OF SURVEY PREPARED BY DENTON & WHITE SURVEYING COMPANY SEALED ON FEBRUARY 14, 1964.
2. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM TOPOGRAPHIC SURVEY OF PART OF THE SE/4 OF SECTION 23 TOWNSHIP 19 NORTH RANGE 13 EAST, OF THE I.B. & M. TULSA COUNTY, STATE OF OKLAHOMA, ACCORDING TO THE U.S. GOVERNMENT SURVEY THEREOF, AND KNOWN AS 7311 EAST 41st STREET SOUTH. (FILE: NFSK003.DWG REV. A)

(-2

REVISION	DATE	DESCRIPTION

FIGURE 3-2
AFFECTED AND UNAFFECTED AREAS

ADJACENT LAND AREA REMEDIATION
KAISER ALUMINUM
TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
BATON ROUGE, LOUISIANA

APPROVED	
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DRAWN	GJA 6/13/01
DRAWING NUMBER	5427A415

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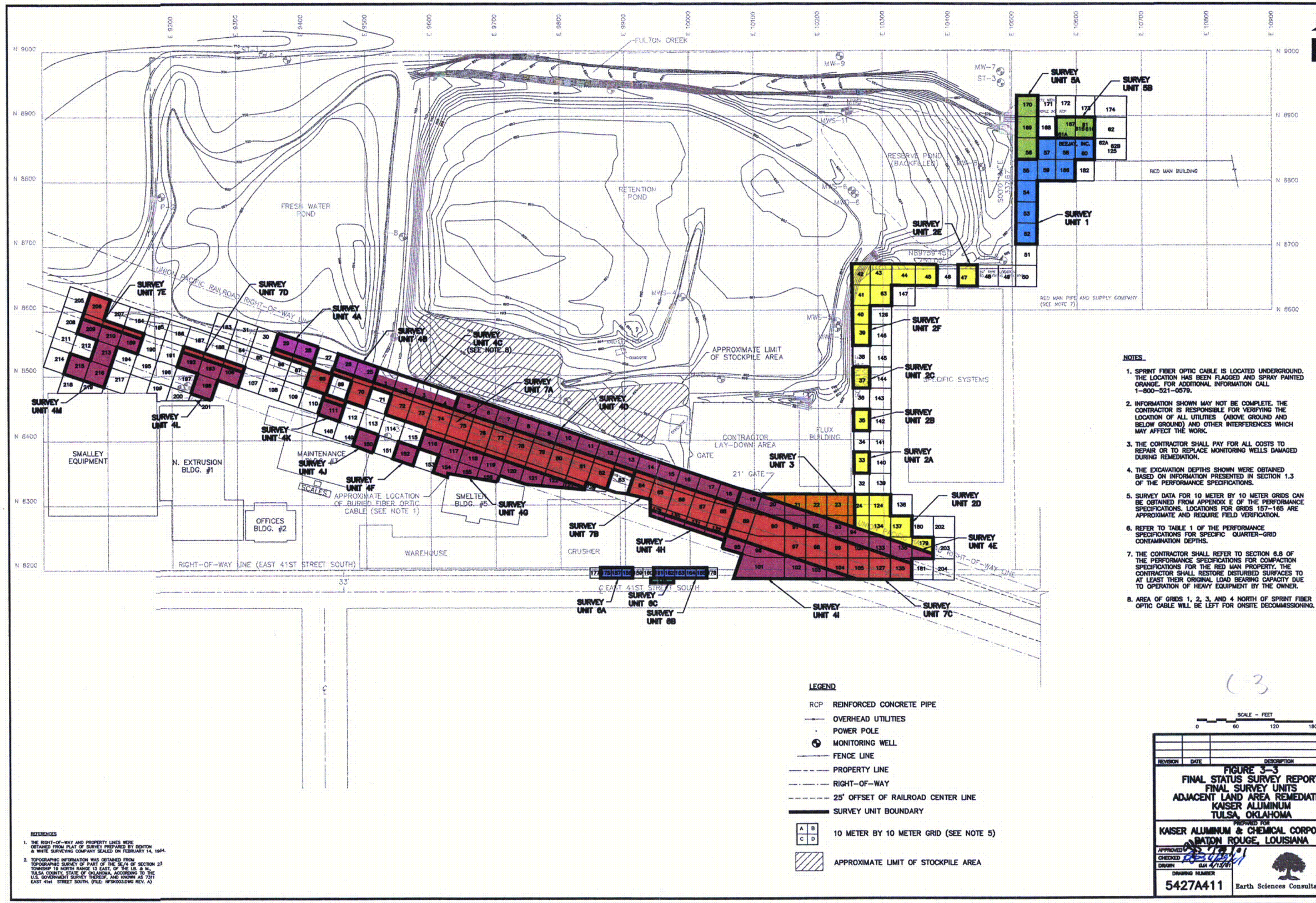

NOTES

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6. REFER TO TABLE 1 OF THE PERFORMANCE SPECIFICATIONS FOR SPECIFIC QUARTER-GRID CONTAMINATION DEPTHS.
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8. AREA OF GRIDS 1, 2, 3, AND 4 NORTH OF SPRINT FIBER OPTIC CABLE WILL BE LEFT FOR ONSITE DECOMMISSIONING.

LEGEND

- RCP REINFORCED CONCRETE PIPE
- OVERHEAD UTILITIES
- POWER POLE
- MONITORING WELL
- FENCE LINE
- PROPERTY LINE
- RIGHT-OF-WAY
- 25' OFFSET OF RAILROAD CENTER LINE
- SURVEY UNIT BOUNDARY
- A B C D — 10 METER BY 10 METER GRID (SEE NOTE 5)
- APPROXIMATE LIMIT OF STOCKPILE AREA

REFERENCES

1. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM PLAT OF SURVEY PREPARED BY DENTON & WHITE SURVEYING COMPANY SEALED ON FEBRUARY 14, 1964.
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(3

SCALE - FEET
0 60 120 180

REVISION	DATE	DESCRIPTION

FIGURE 3-3
FINAL STATUS SURVEY REPORT
FINAL SURVEY UNITS
ADJACENT LAND AREA REMEDIATION
KAISER ALUMINUM
TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
BATON ROUGE, LOUISIANA

APPROVED	
CHECKED	
DRAWN	GM 4/13/01
DRAWING NUMBER	5427A411

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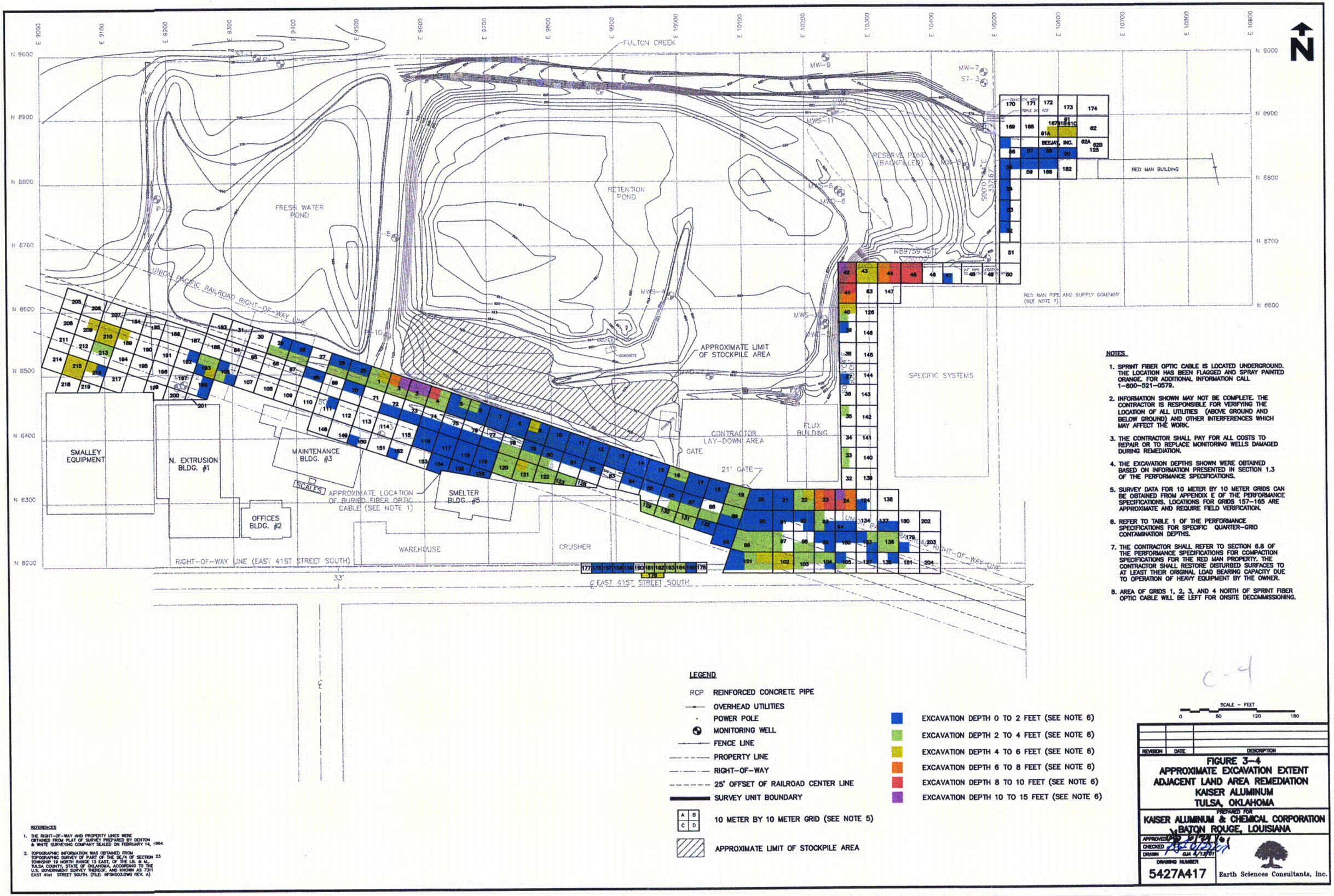

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8. AREA OF GRIDS 1, 2, 3, AND 4 NORTH OF SPRINT FIBER OPTIC CABLE WILL BE LEFT FOR ONSITE DECOMMISSIONING.

LEGEND

- RCP REINFORCED CONCRETE PIPE
- OVERHEAD UTILITIES
- POWER POLE
- MONITORING WELL
- FENCE LINE
- PROPERTY LINE
- RIGHT-OF-WAY
- 25' OFFSET OF RAILROAD CENTER LINE
- SURVEY UNIT BOUNDARY
- A B / C D — 10 METER BY 10 METER GRID (SEE NOTE 5)
- APPROXIMATE LIMIT OF STOCKPILE AREA

- EXCAVATION DEPTH 0 TO 2 FEET (SEE NOTE 6)
- EXCAVATION DEPTH 2 TO 4 FEET (SEE NOTE 6)
- EXCAVATION DEPTH 4 TO 6 FEET (SEE NOTE 6)
- EXCAVATION DEPTH 6 TO 8 FEET (SEE NOTE 6)
- EXCAVATION DEPTH 8 TO 10 FEET (SEE NOTE 6)
- EXCAVATION DEPTH 10 TO 15 FEET (SEE NOTE 6)

REFERENCES

1. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM PLAT OF SURVEY PREPARED BY DENTON & WHITE SURVEYING COMPANY SEALED ON FEBRUARY 14, 1964.
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C-4

SCALE - FEET
0 50 120 180

REVISION	DATE	DESCRIPTION

FIGURE 3-4
APPROXIMATE EXCAVATION EXTENT ADJACENT LAND AREA REMEDIATION KAISER ALUMINUM TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
BATON ROUGE, LOUISIANA

APPROVED	
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DRAWN	GM 4/13/01
DRAWING NUMBER	5427A417

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Figure 4-A
Stuctural Surface Survey of Railroad Tracks
Kaiser Adjacent Land Area Remediation

Soil Grid No.	RR Grid No.	A	B	C	Soil Grid No.	RR Grid No.	A	B	C	Soil Grid No.	RR Grid No.	A	B	C	Soil Grid No.	RR Grid No.	A	B	C
185	361	x			206	391	x												
	362					392			x										
	363					393													
	364		x			394		x											
	365					395													
	366					396	x												
	367			x		397			x										
	368					398													
	369					399		x											
	370					400													
184	371	x			205	401	x												
	372					402													
	373					403													
	374		x			404		x											
	375					405													
	376					406													
	377			x		407			x										
	378					408													
	379					409													
	380					410													
207	381	x																	
	382																		
	383																		
	384		x																
	385																		
	386																		
	387			x															
	388																		
	389																		
	390																		

Notes:
1. Soil grids are 10 meters in length.
2. Railroad grids are 1-meter-by-1-meter, labeled A - C from south to north.
3. 1-meter-by-1-meter grids numbered 1-330 move west to east.
4. 1-meter -by-1-meter grids numbered 331-410 move east to west.

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Figure 4-A
Stuctural Surface Survey of Railroad Tracks
Kaiser Adjacent Land Area Remediation

Soil Grid No.	RR Grid No.	A	B	C	Soil Grid No.	RR Grid No.	A	B	C	Soil Grid No.	RR Grid No.	A	B	C	Soil Grid No.	RR Grid No.	A	B	C
64	1	x			67	31	x			70	61	x			73	91	x		
	2					32					62			x		92			x
	3					33					63					93			
	4		x			34		x			64		x			94		x	
	5					35					65					95			
	6					36					66	x				96	x		
	7			x		37			x		67			x		97			x
	8					38					68					98			
	9					39					69		x			99		x	
	10					40					70					100			
65	11	x			68	41	x			71	71	x			74	101	x		
	12					42			x		72					102			x
	13					43					73					103			
	14		x			44		x			74		x			104		x	
	15					45					75					105			
	16					46	x				76					106	x		
	17			x		47			x		77			x		107			x
	18					48					78					108			
	19					49		x			79					109		x	
	20					50					80					110			
66	21	x			69	51	x			72	81	x			75	111	x		
	22					52					82			x		112			x
	23					53					83					113			
	24		x			54		x			84		x			114		x	
	25					55					85					115			
	26					56					86	x				116	x		
	27			x		57			x		87			x		117			x
	28					58					88					118			
	29					59					89		x			119		x	
	30					60					90					120			

Notes:

1. Soil grids are 10 meters in length.
2. Railroad grids are 1-meter-by-1-meter, labeled A - C from south to north.
3. 1-meter-by-1-meter grids numbered 1-330 move west to east.
4. 1-meter -by-1-meter grids numbered 331-410 move east to west.

Figure 4-A
Stuctural Surface Survey of Railroad Tracks
Kaiser Adjacent Land Area Remediation

Soil Grid No.	RR Grid No.	A	B	C	Soil Grid No.	RR Grid No.	A	B	C	Soil Grid No.	RR Grid No.	A	B	C	Soil Grid No.	RR Grid No.	A	B	C
76	121	x			79	151	x			82	181	x			85	211	x		
	122			x		152			x		182			x		212			x
	123					153					183					213			
	124		x			154		x			184		x			214		x	
	125					155					185					215			
	126	x				156	x				186	x				216	x		
	127			x		157			x		187			x		217			x
	128					158					188					218			
	129		x			159		x			189		x			219		x	
	130					160					190					220			
77	131	x			80	161	x			83	191	x			86	221	x		
	132			x		162			x		192					222			x
	133					163					193					223			
	134		x			164		x			194		x			224		x	
	135					165					195					225			
	136	x				166	x				196					226	x		
	137			x		167			x		197			x		227			x
	138					168					198					228			
	139		x			169		x			199					229		x	
	140					170					200					230			
78	141	x			81	171	x			84	201	x			87	231	x		
	142			x		172			x		202			x		232			x
	143					173					203					233			
	144		x			174		x			204		x			234		x	
	145					175					205					235			
	146	x				176	x				206	x				236	x		
	147			x		177			x		207			x		237			x
	148					178					208					238			
	149		x			179		x			209		x			239		x	
	150					180					210					240			

Notes:

1. Soil grids are 10 meters in length.
2. Railroad grids are 1-meter-by-1-meter, labeled A - C from south to north.
3. 1-meter-by-1-meter grids numbered 1-330 move west to east.
4. 1-meter -by-1-meter grids numbered 331-410 move east to west.

Figure 4-A
Structural Surface Survey of Railroad Tracks
Kaiser Adjacent Land Area Remediation

Soil Grid No.	RR Grid No.	A	B	C	Soil Grid No.	RR Grid No.	A	B	C	Soil Grid No.	RR Grid No.	A	B	C	Soil Grid No.	RR Grid No.	A	B	C
88	241	x			97	271	x			105	301	x			188	331	x		
	242			x		272			x		302			x		332			
	243					273					303					333			
	244		x			274		x			304		x			334		x	
	245					275					305					335			
	246	x				276	x				306	x				336			
	247			x		277			x		307			x		337			x
	248					278					308					338			
	249		x			279		x			309		x			339			
	250					280					310					340			
89	251	x			98	281	x			127	311	x			187	341	x		
	252			x		282			x		312			x		342			
	253					283					313					343			
	254		x			284		x			314		x			344		x	
	255					285					315					345			
	256	x				286	x				316	x				346			
	257			x		287			x		317			x		347			x
	258					288					318					348			
	259		x			289		x			319		x			349			
	260					290					320					350			
90	261	x			99	291	x			135	321	x			186	351	x		
	262			x		292			x		322			x		352			
	263					293					323					353			
	264		x			294		x			324		x			354		x	
	265					295					325					355			
	266	x				296	x				326	x				356			
	267			x		297			x		327			x		357			x
	268					298					328					358			
	269		x			299		x			329		x			359			
	270					300					330					360			

Notes:

1. Soil grids are 10 meters in length.
2. Railroad grids are 1-meter-by-1-meter, labeled A - C from south to north.
3. 1-meter-by-1-meter grids numbered 1-330 move west to east.
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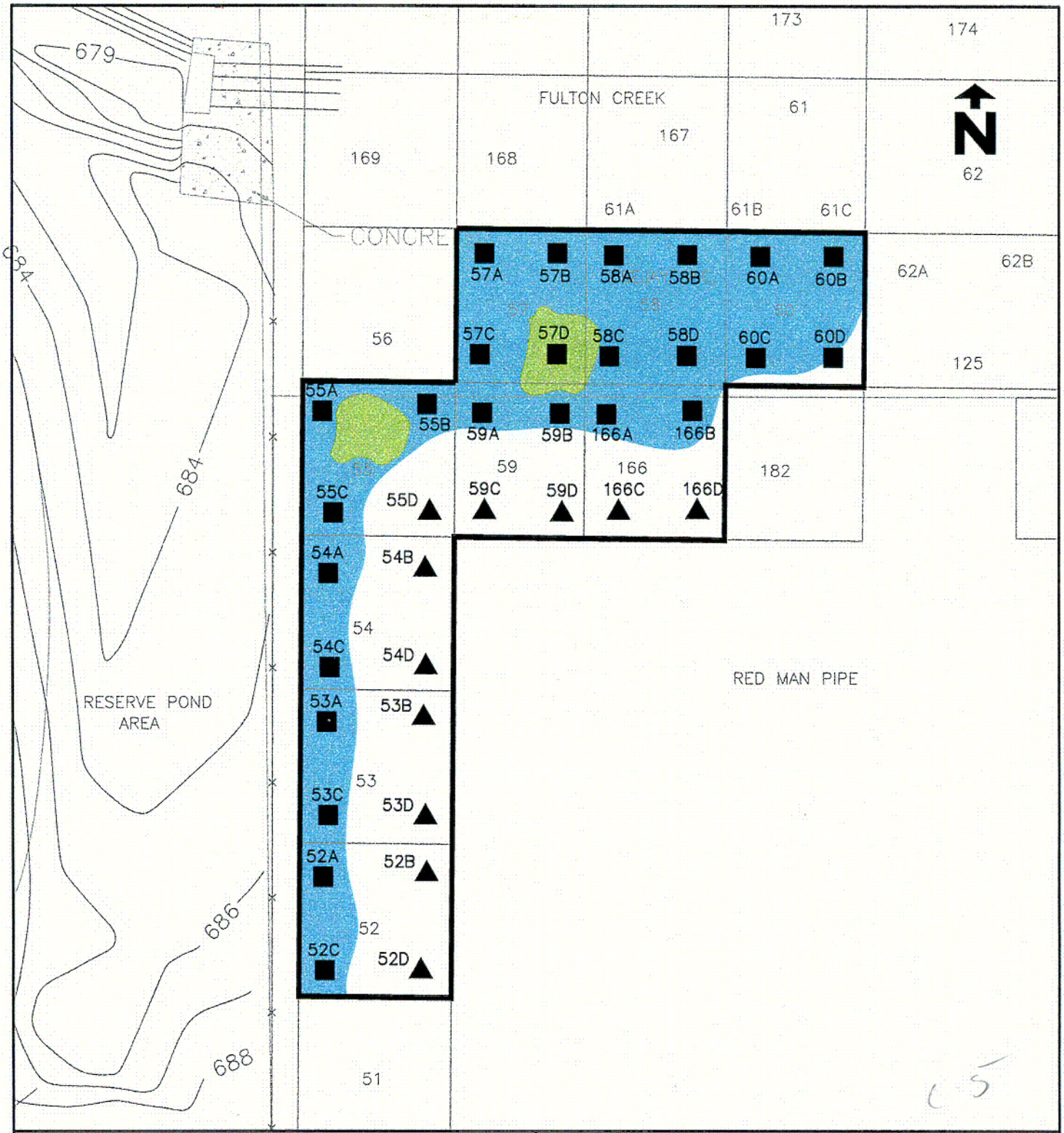

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4-1
SURVEY UNIT 1
FINAL SURVEY REPORT
KAISER ALUMINUM
TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
BATON ROUGE, LOUISIANA

APPROVED	6/29/01
CHECKED	6/29/01
DRAWN	GJA 6/6/01
DRAWING NUMBER	5427007

Earth Sciences Consultants, Inc.

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–2
SURVEY UNIT 2A
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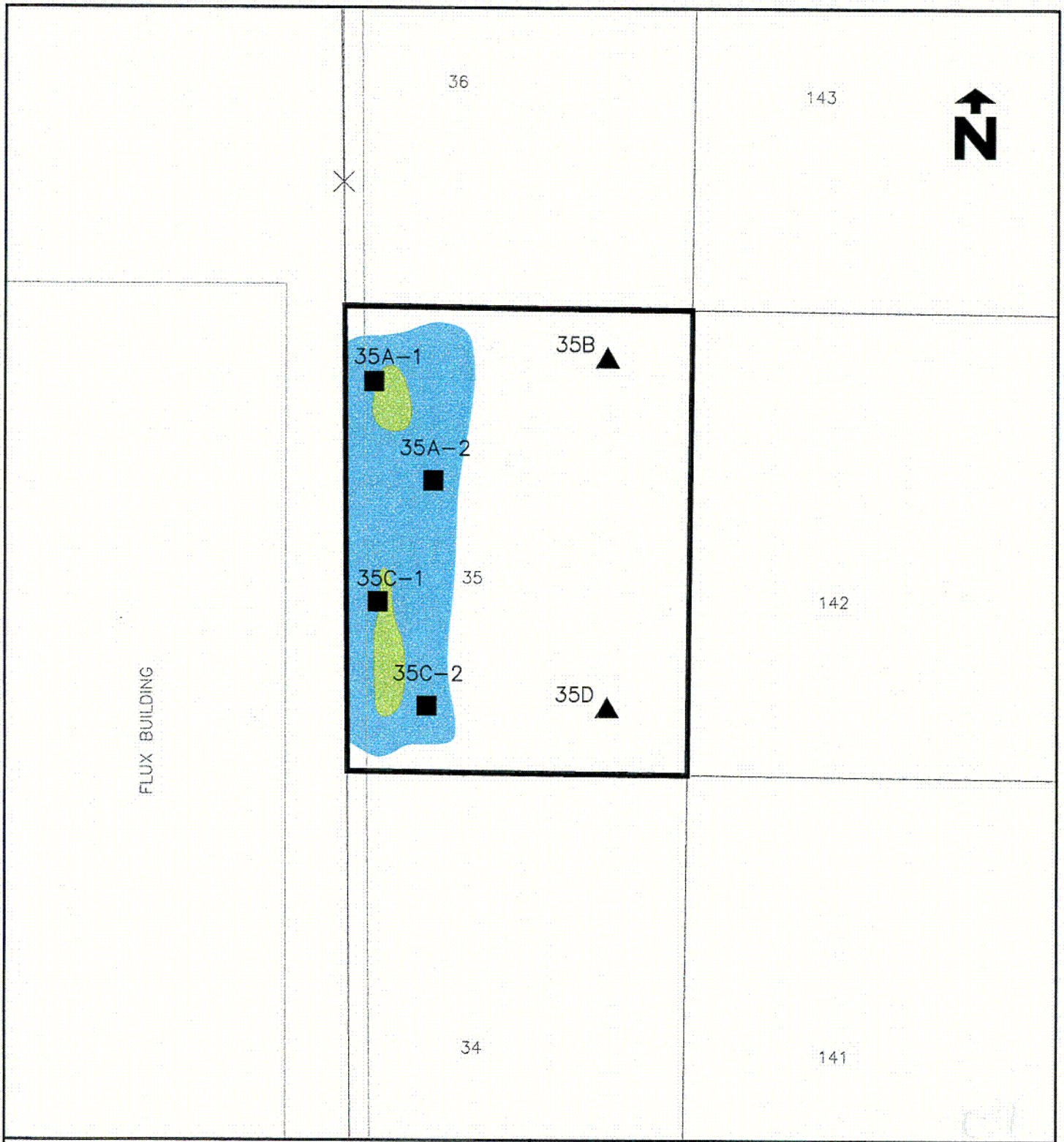

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–3
SURVEY UNIT 2B
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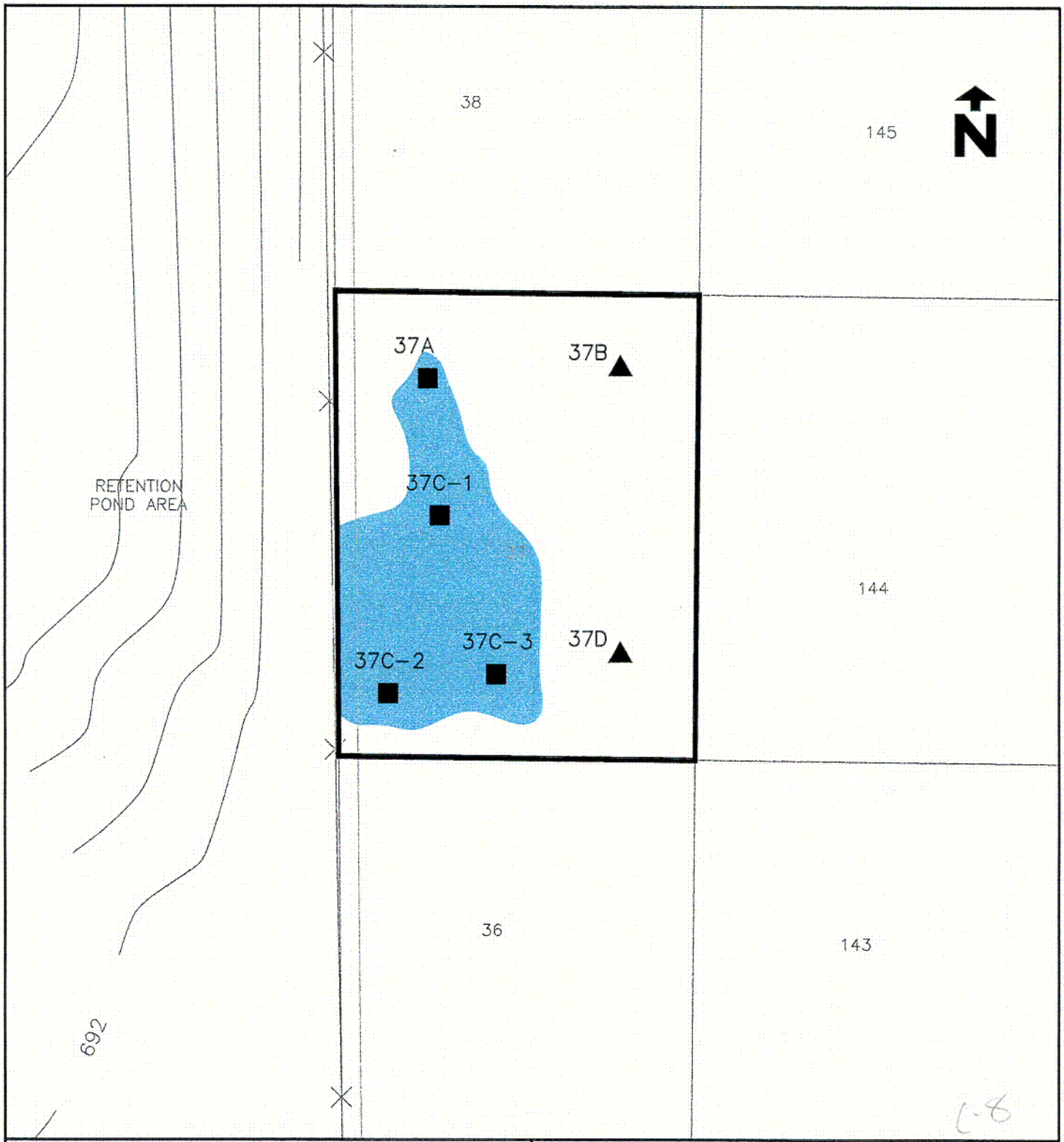

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4-4
SURVEY UNIT 2C
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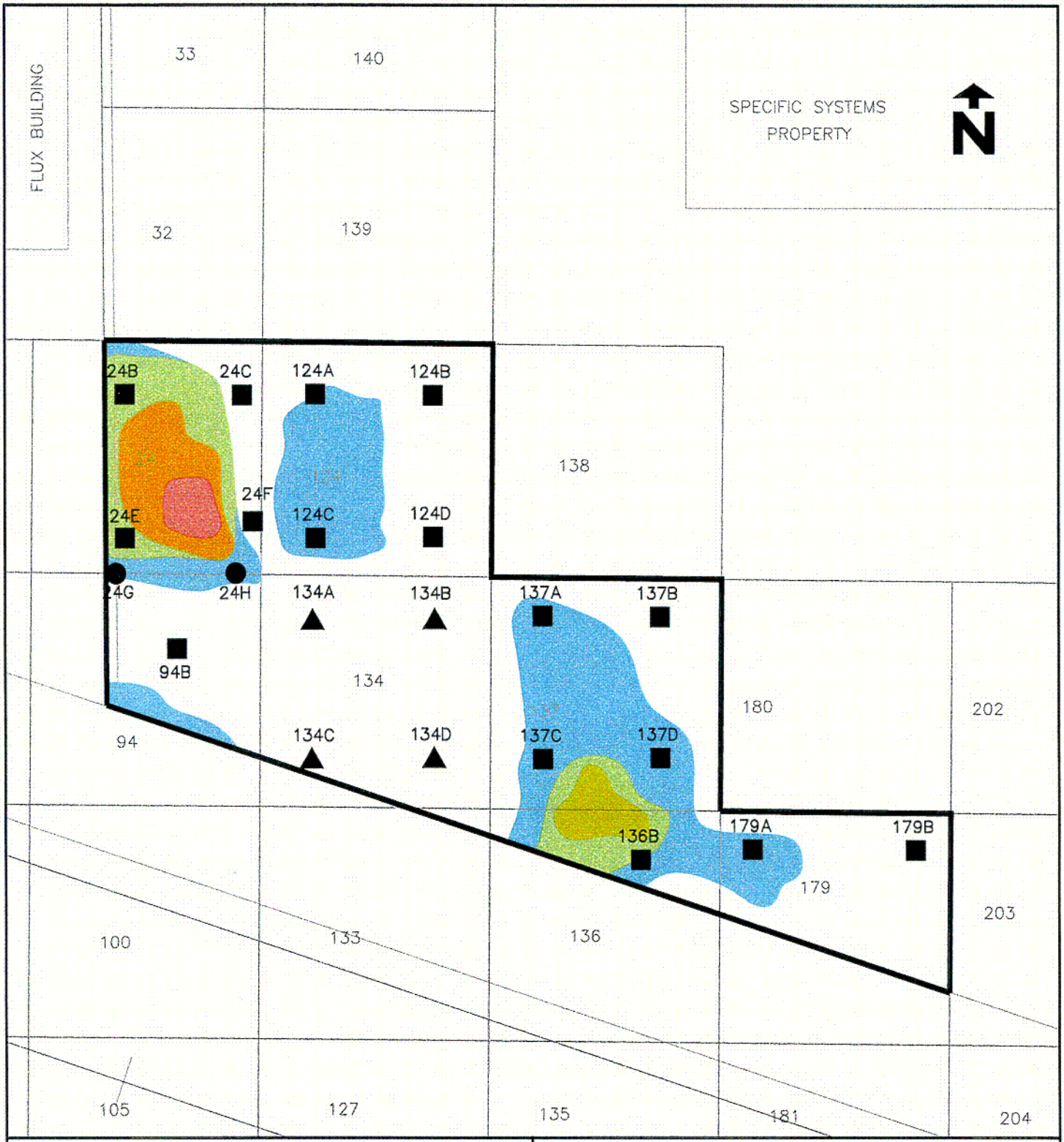

LEGEND

- SIDE WALL SOIL SAMPLE LOCATION
- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4-5
SURVEY UNIT 2D
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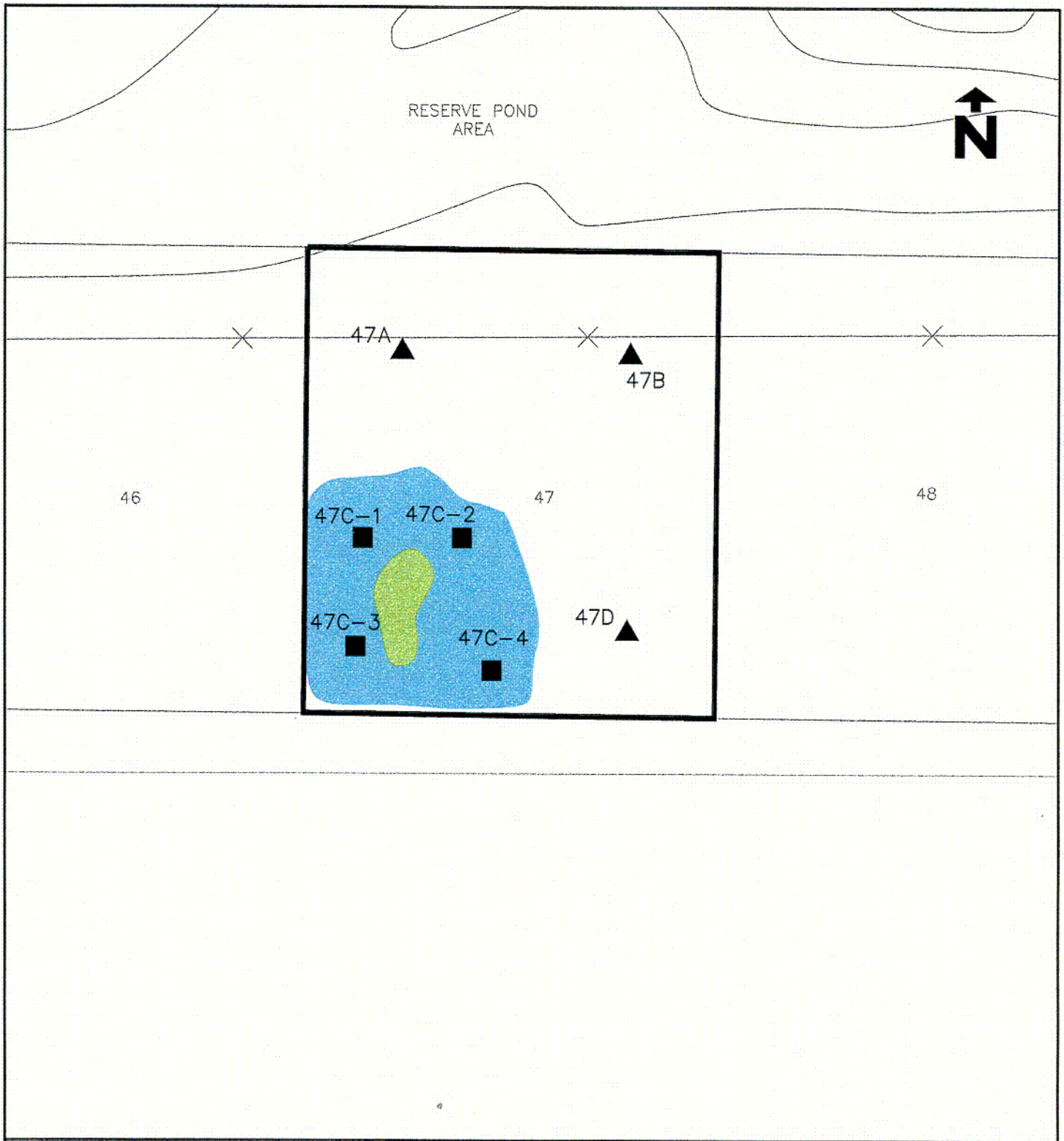

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4-6
SURVEY UNIT 2E
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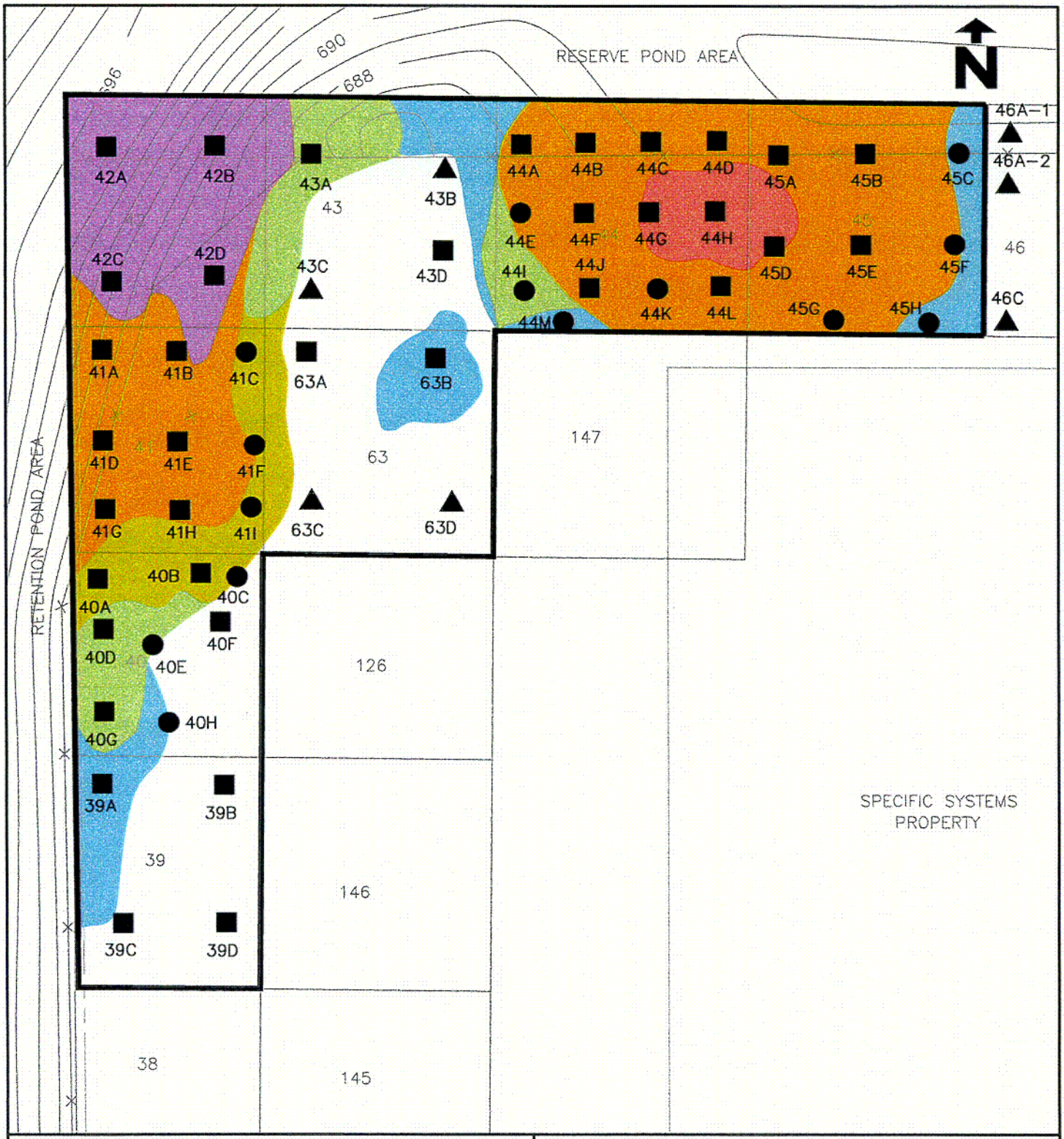

LEGEND

- SIDE WALL SOIL SAMPLE LOCATION
- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4-7
SURVEY UNIT 2F
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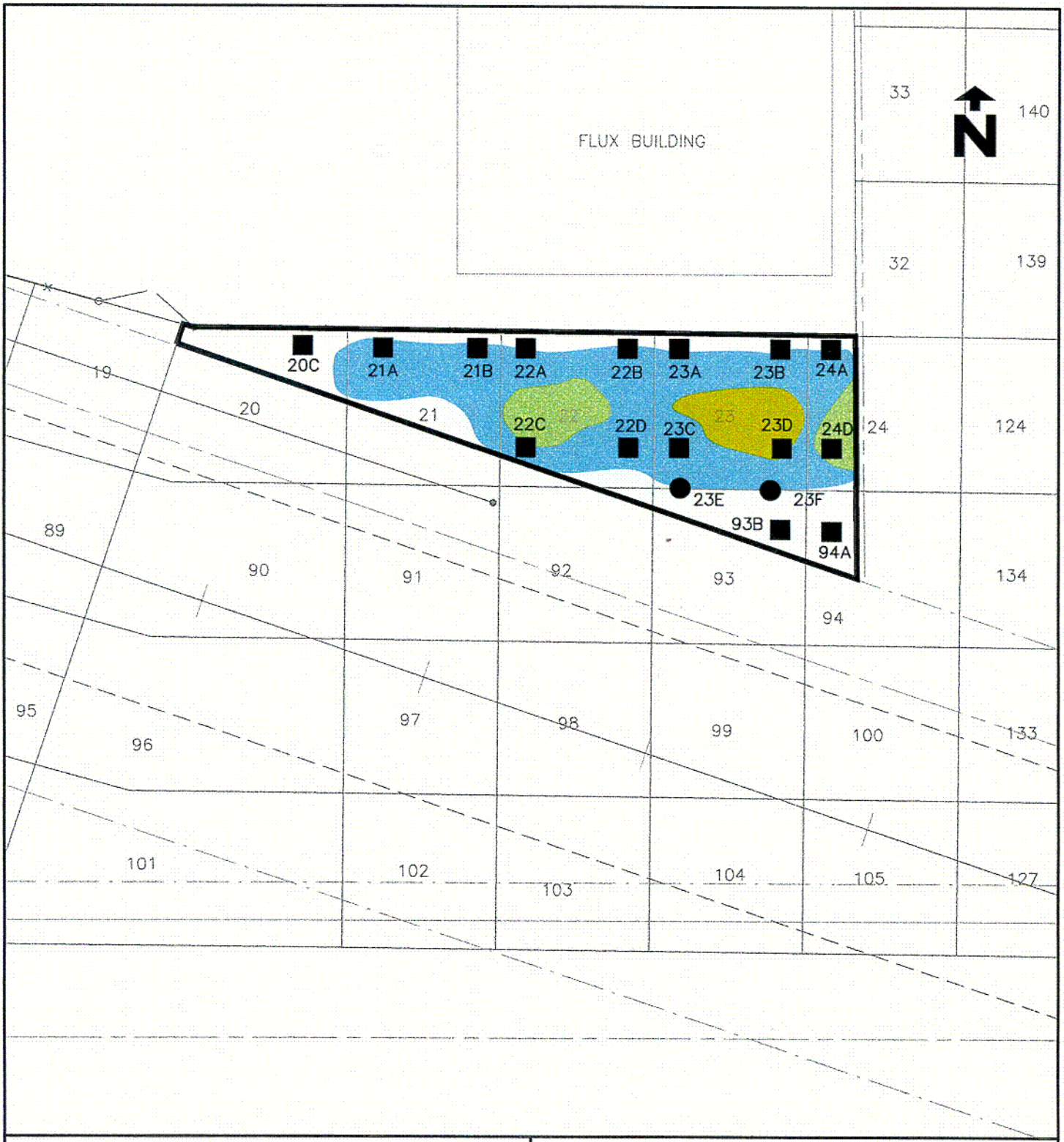

LEGEND

- SIDE WALL SOIL SAMPLE LOCATION
- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–8
SURVEY UNIT 3
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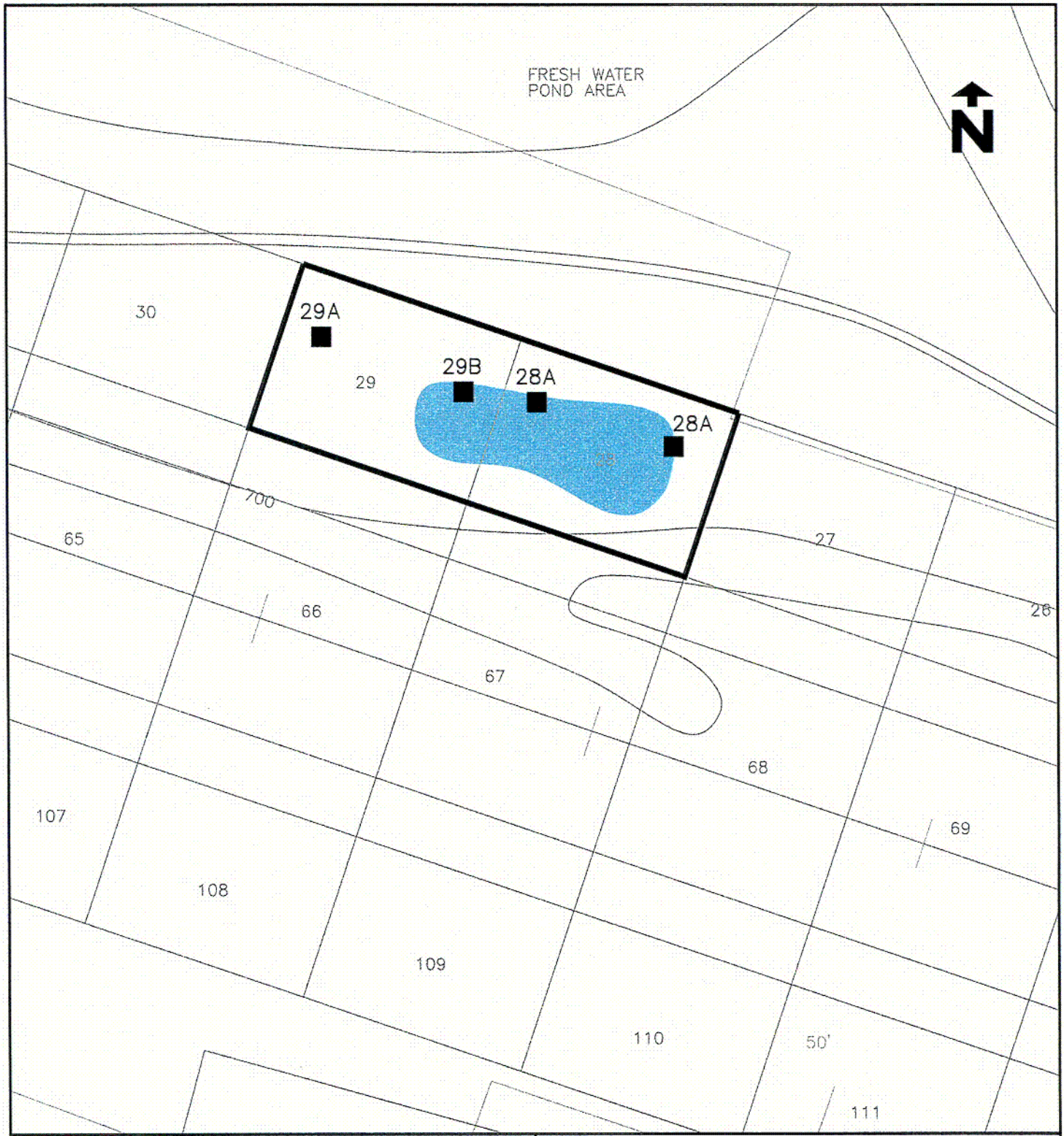

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4-9
SURVEY UNIT 4A
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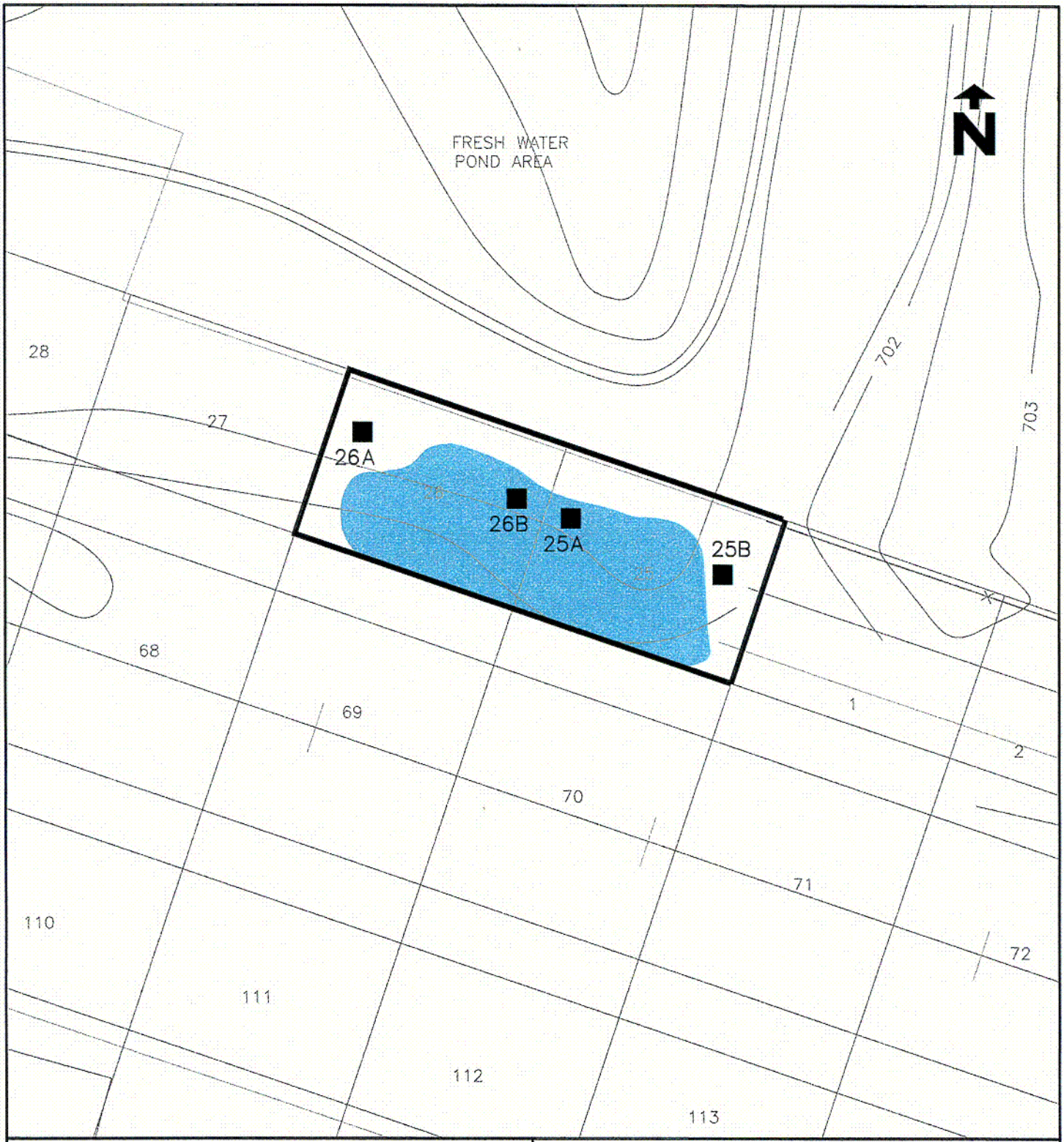

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4-10
SURVEY UNIT 4B
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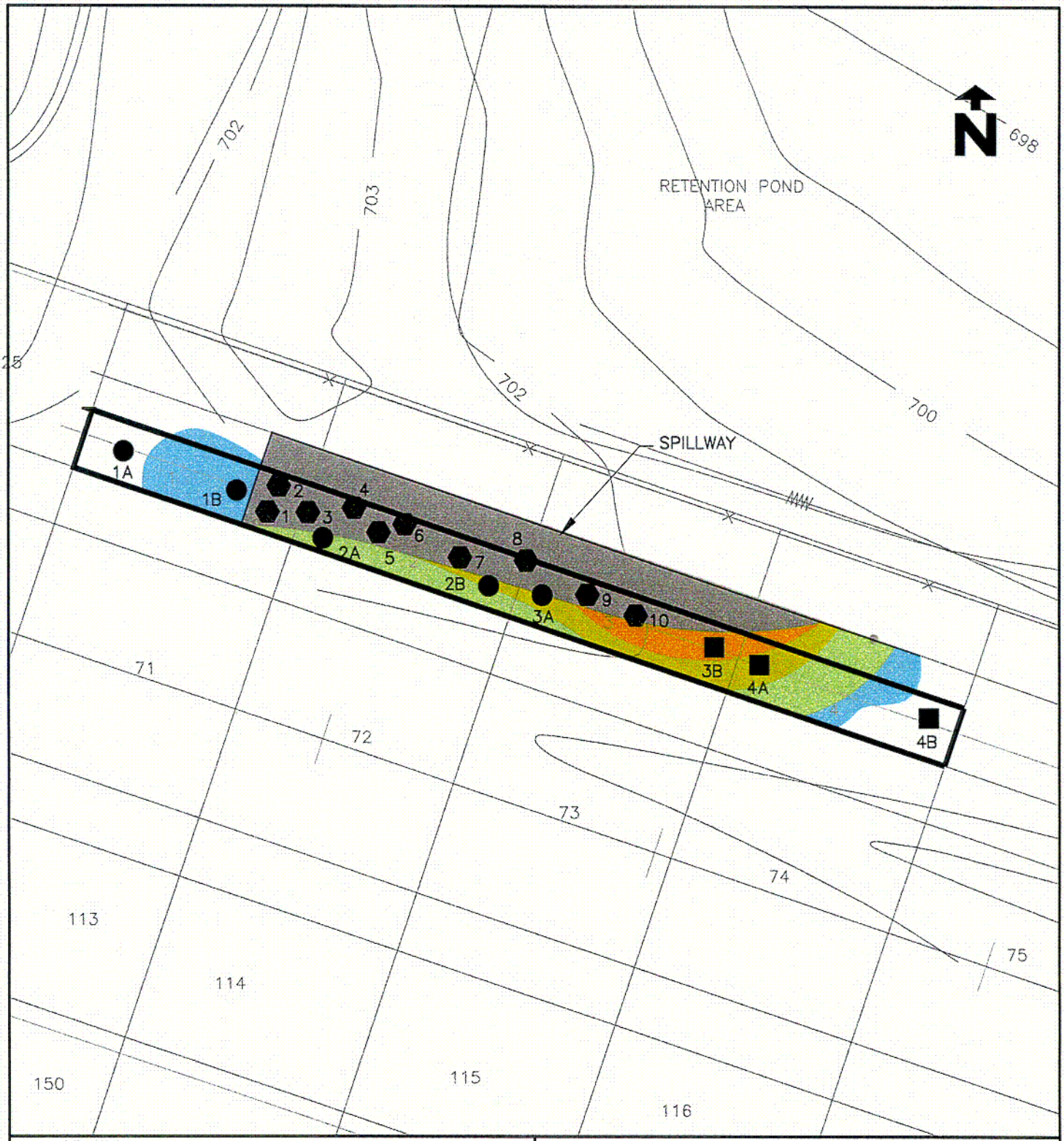

LEGEND

- FIXED/REMOVABLE α AND β/δ SURVEY LOCATION
- SIDE WALL SOIL SAMPLE LOCATION
- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4-11
SURVEY UNIT 4C
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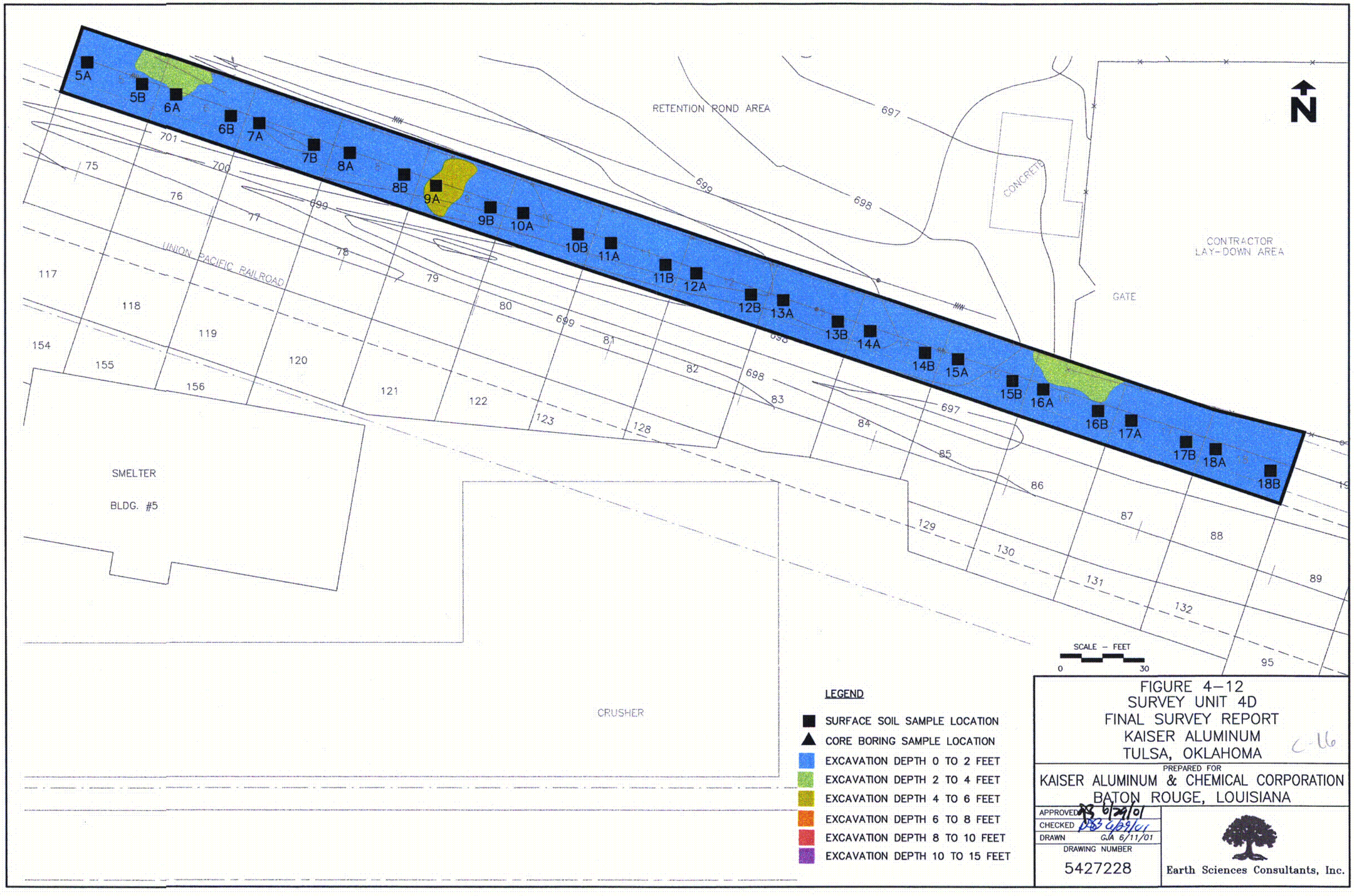

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–12
SURVEY UNIT 4D
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N

19A 19B 19C 19D 20A 20B 20D 20E 20F 21C 21D 90C 91A 91B 92A 92B 92D 93A 93C 93D 94C 94D 100A 100B 133A 133B 133D 136A 136C 136D 179C 179D

18 19 20 21 22 23 24 32 139 124 138 89 90 91 92 93 94 134 137 180 95 96 97 98 99 100 133 135 179 101 102 103 104 105 127 135 181

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4-13
SURVEY UNIT 4E
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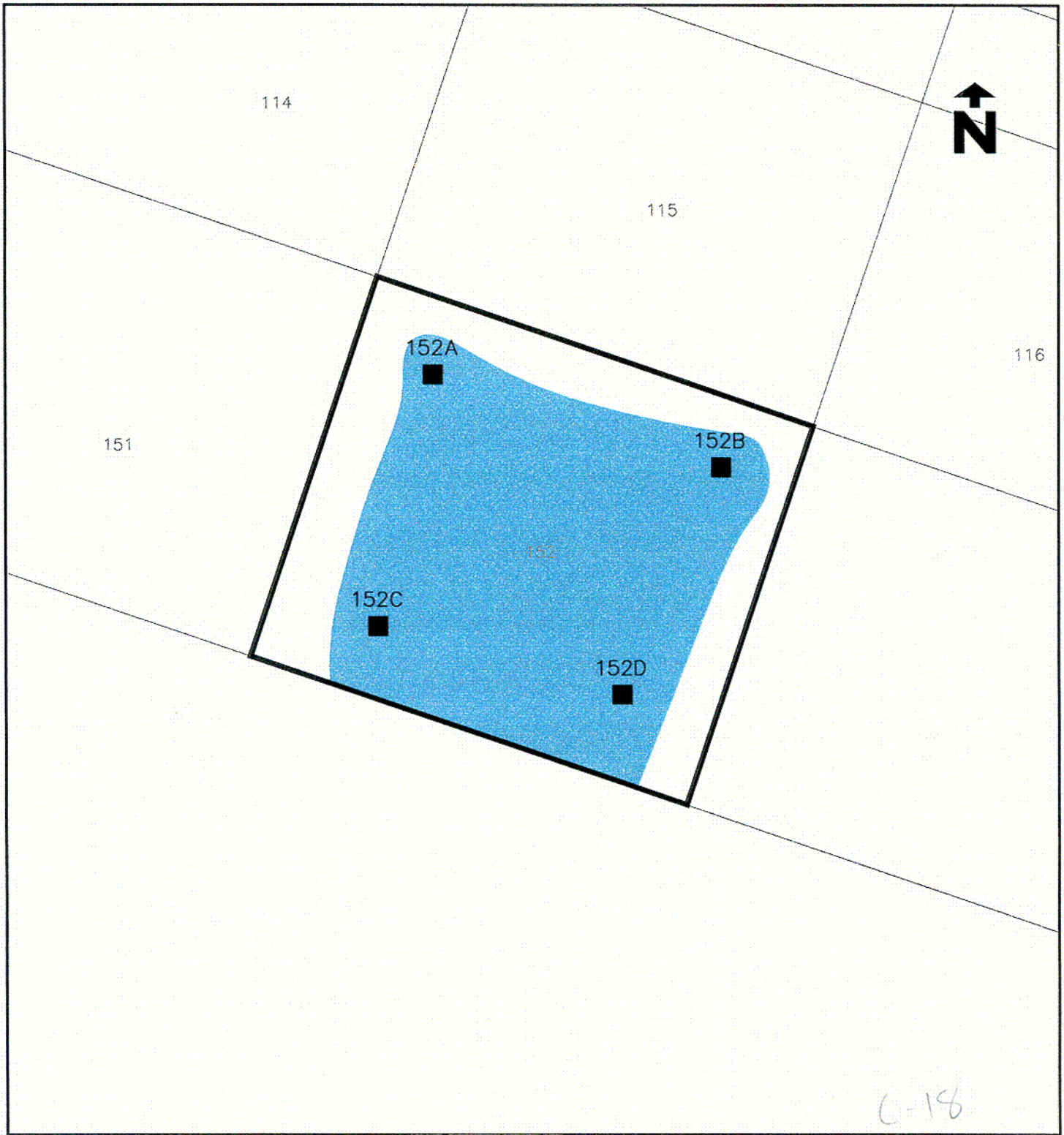

C-18

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–14
SURVEY UNIT 4F
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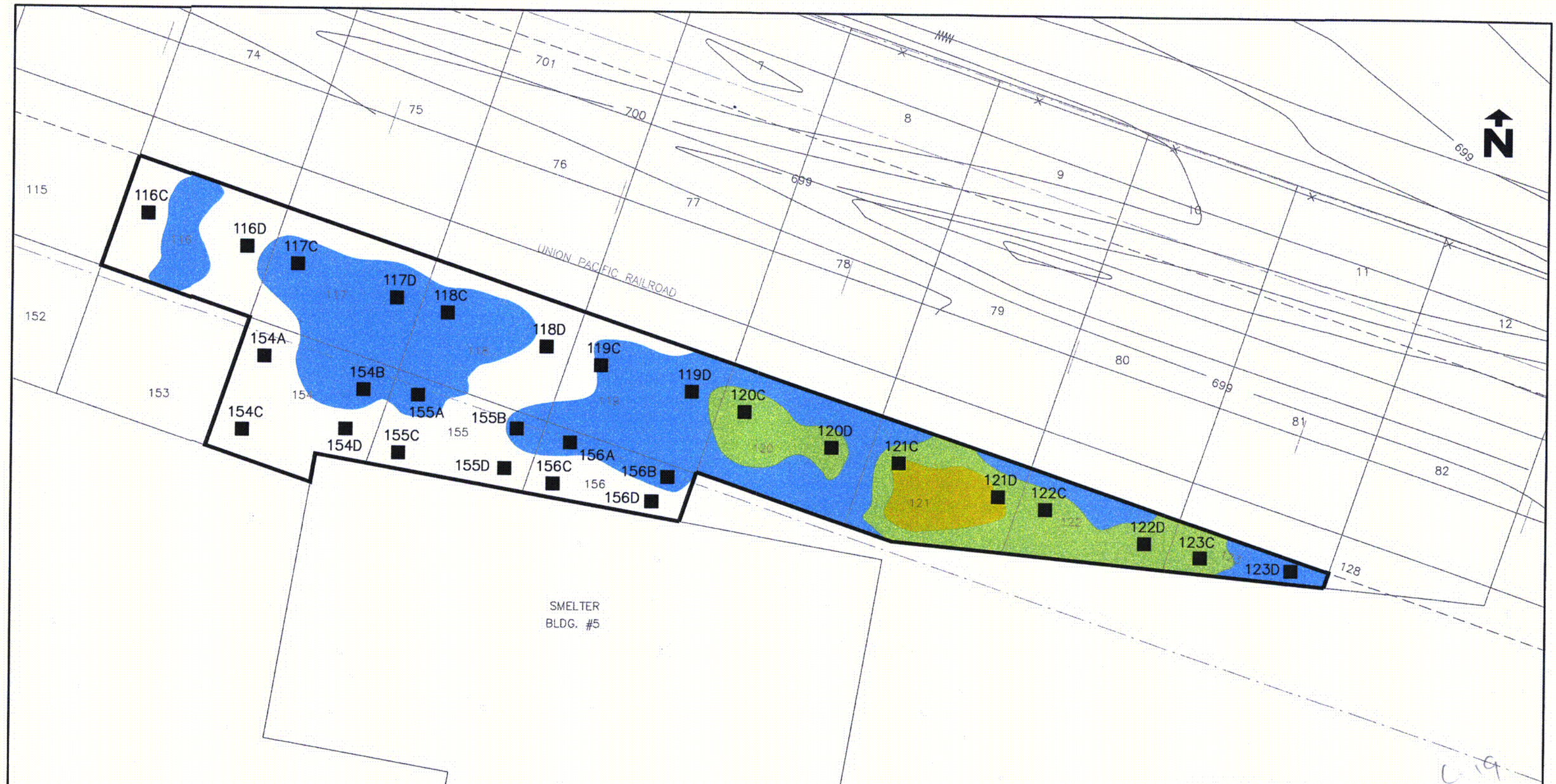

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–15
SURVEY UNIT 4G
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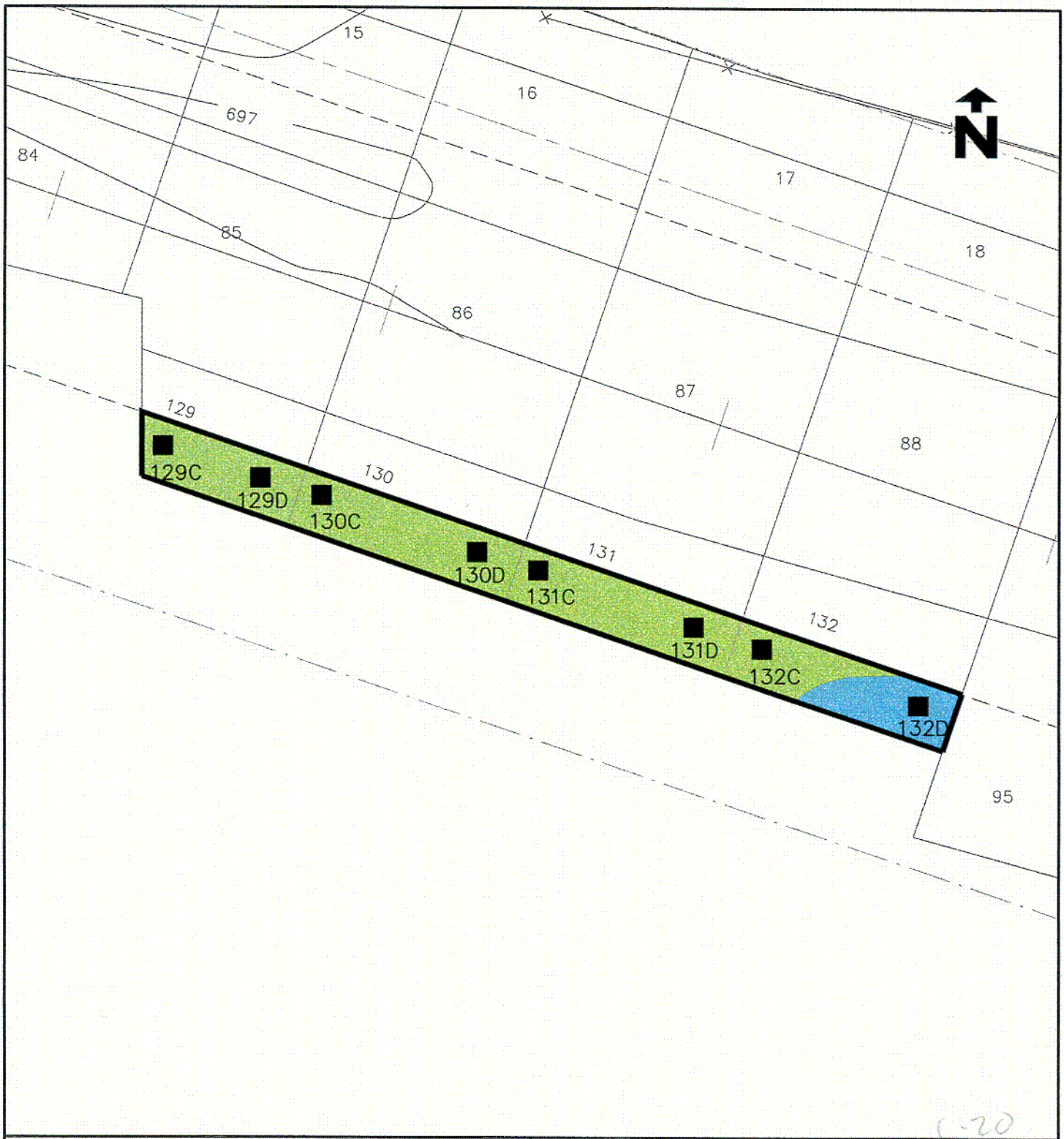

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–16
SURVEY UNIT 4H
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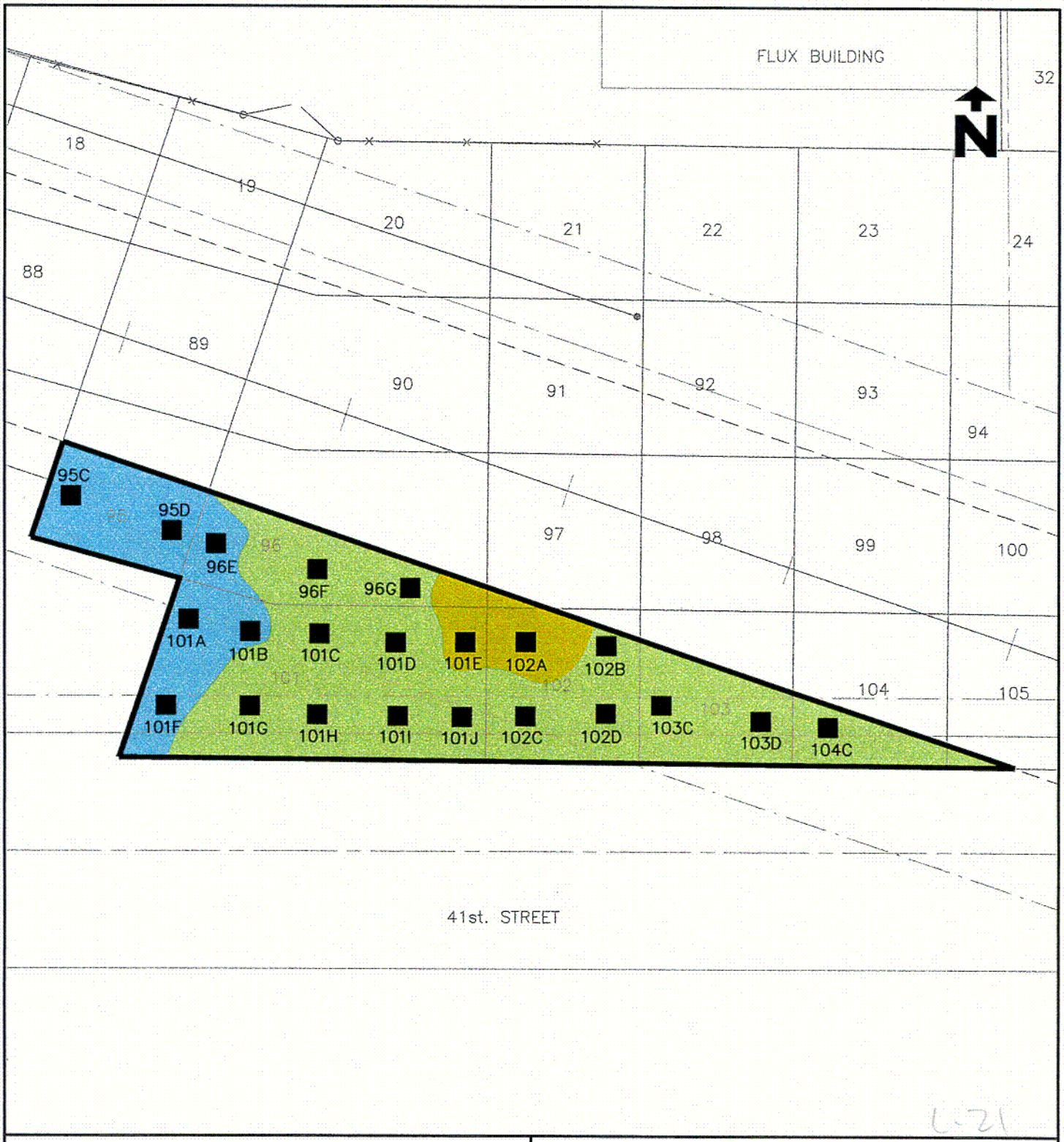

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–17
SURVEY UNIT 41
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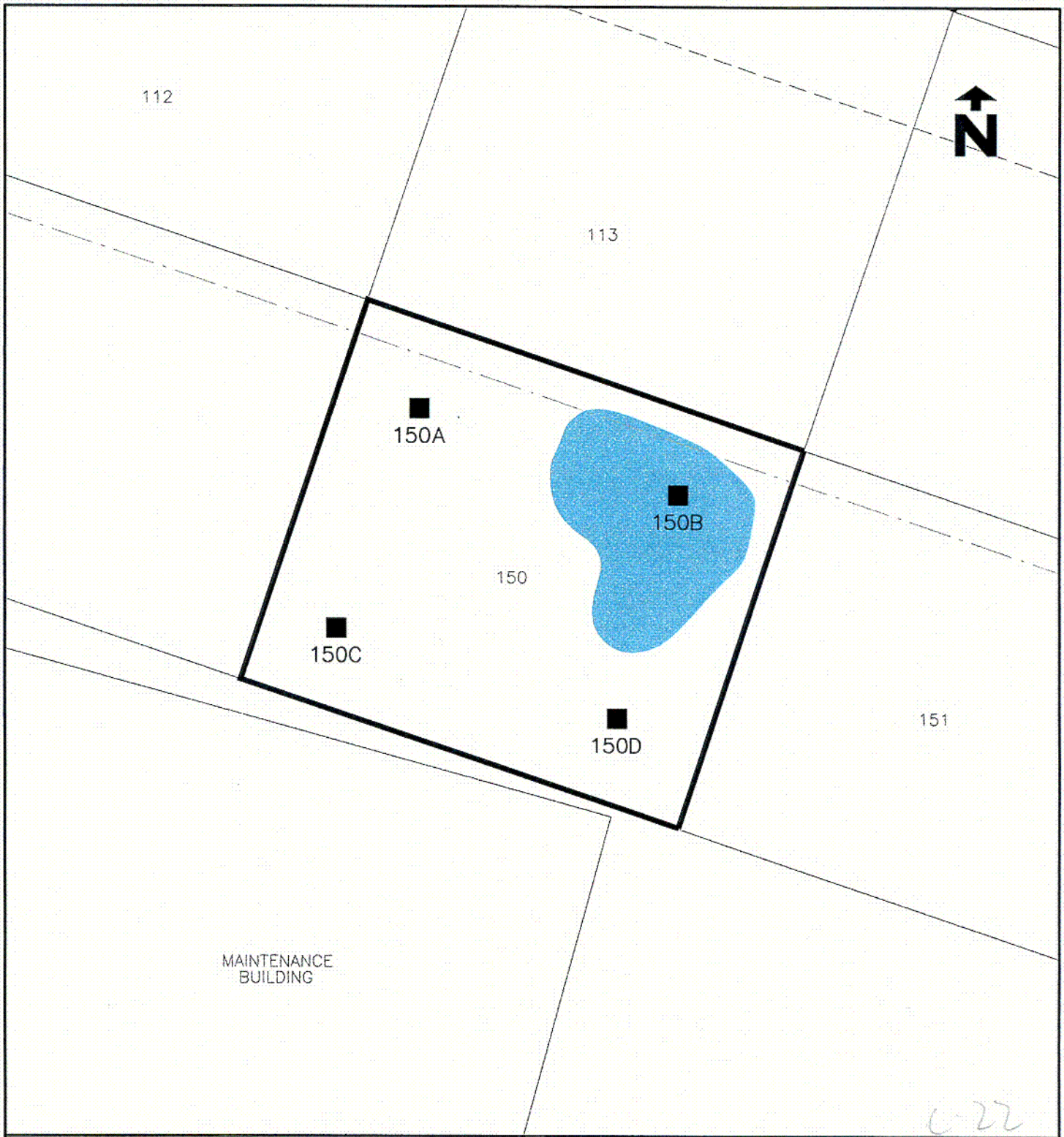

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–18
SURVEY UNIT 4J
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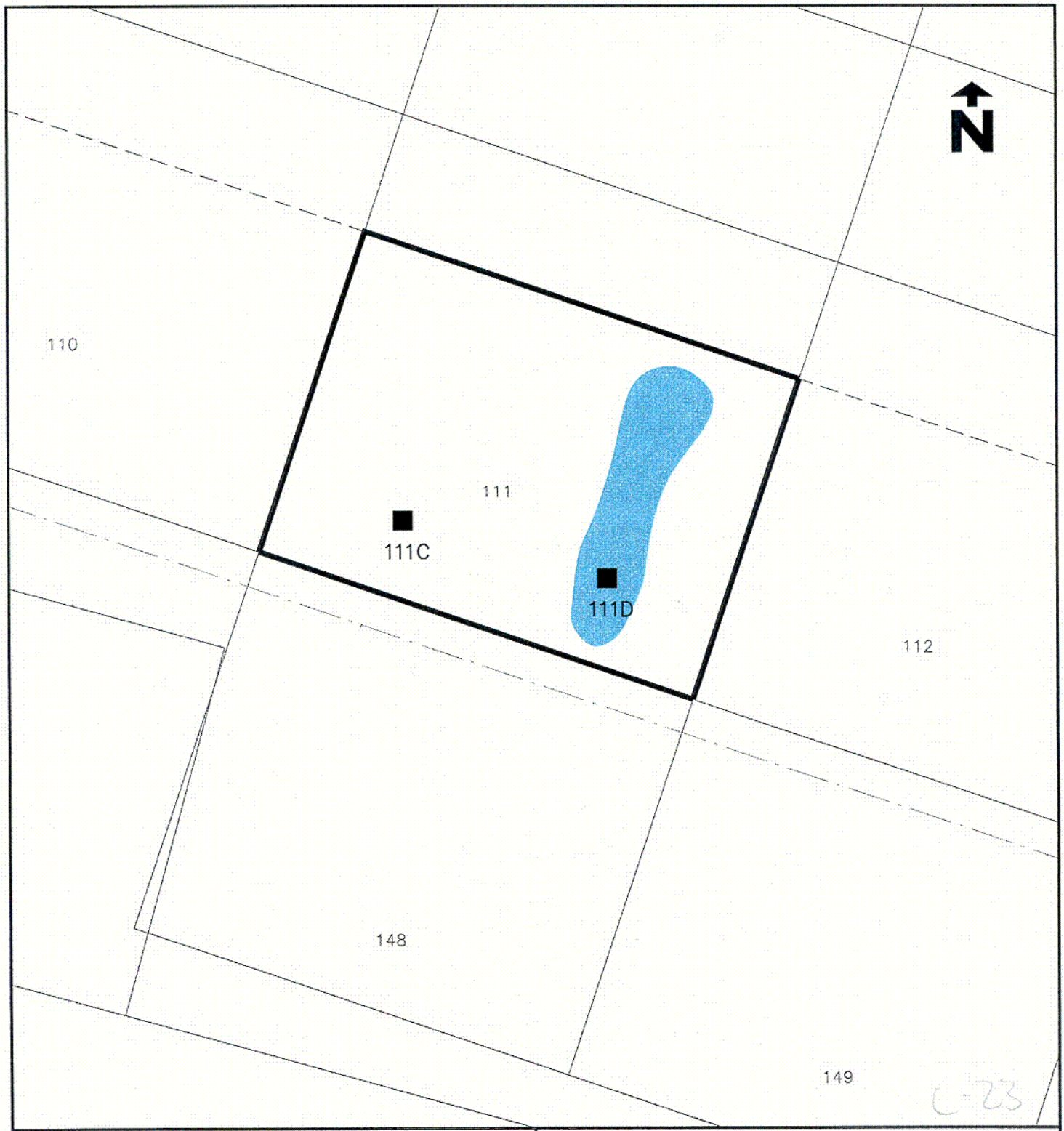

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–19
SURVEY UNIT 4K
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LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–20
SURVEY UNIT 4L
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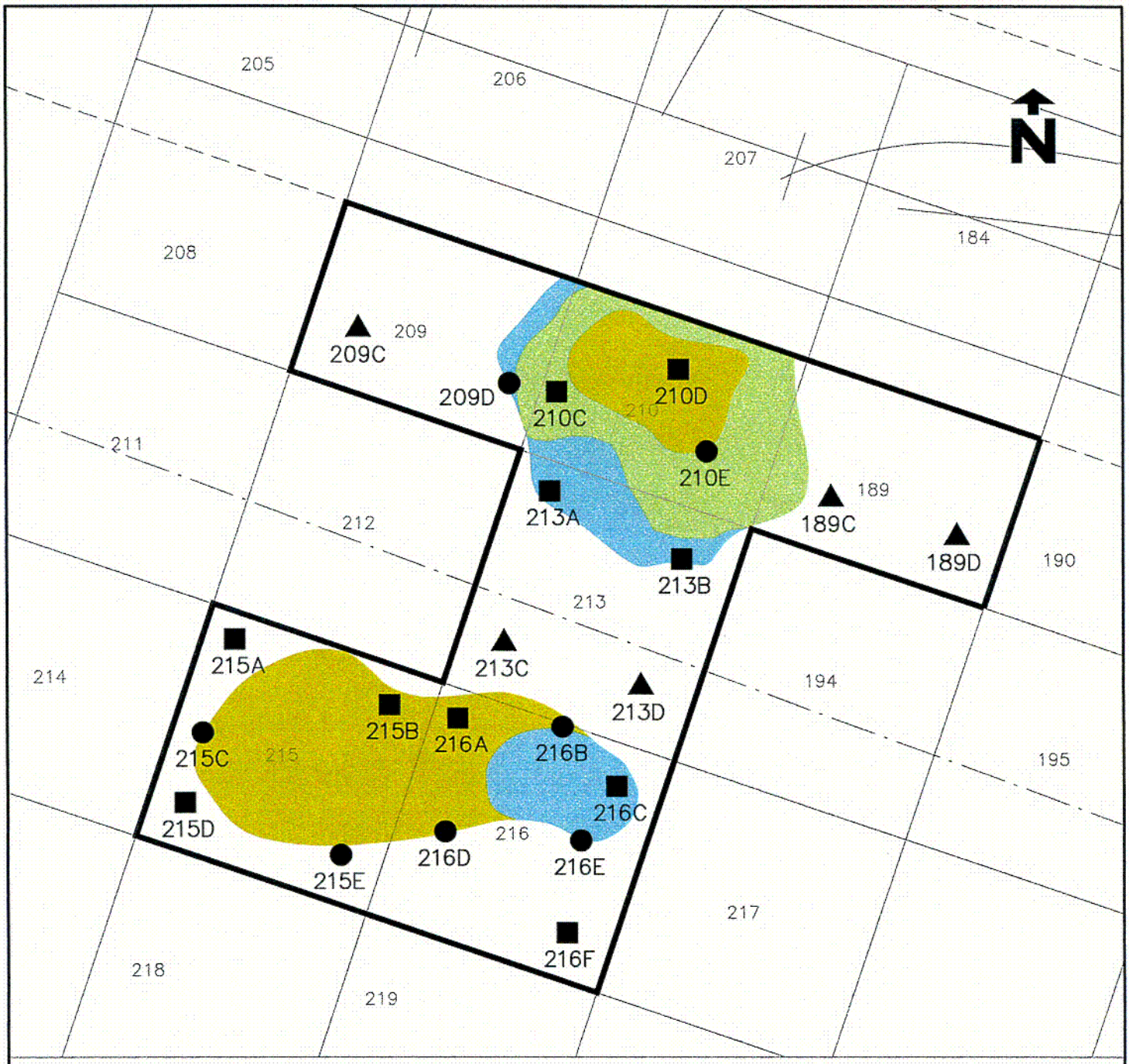

LEGEND

- SIDE WALL SOIL SAMPLE LOCATION
- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4-21
SURVEY UNIT 4M
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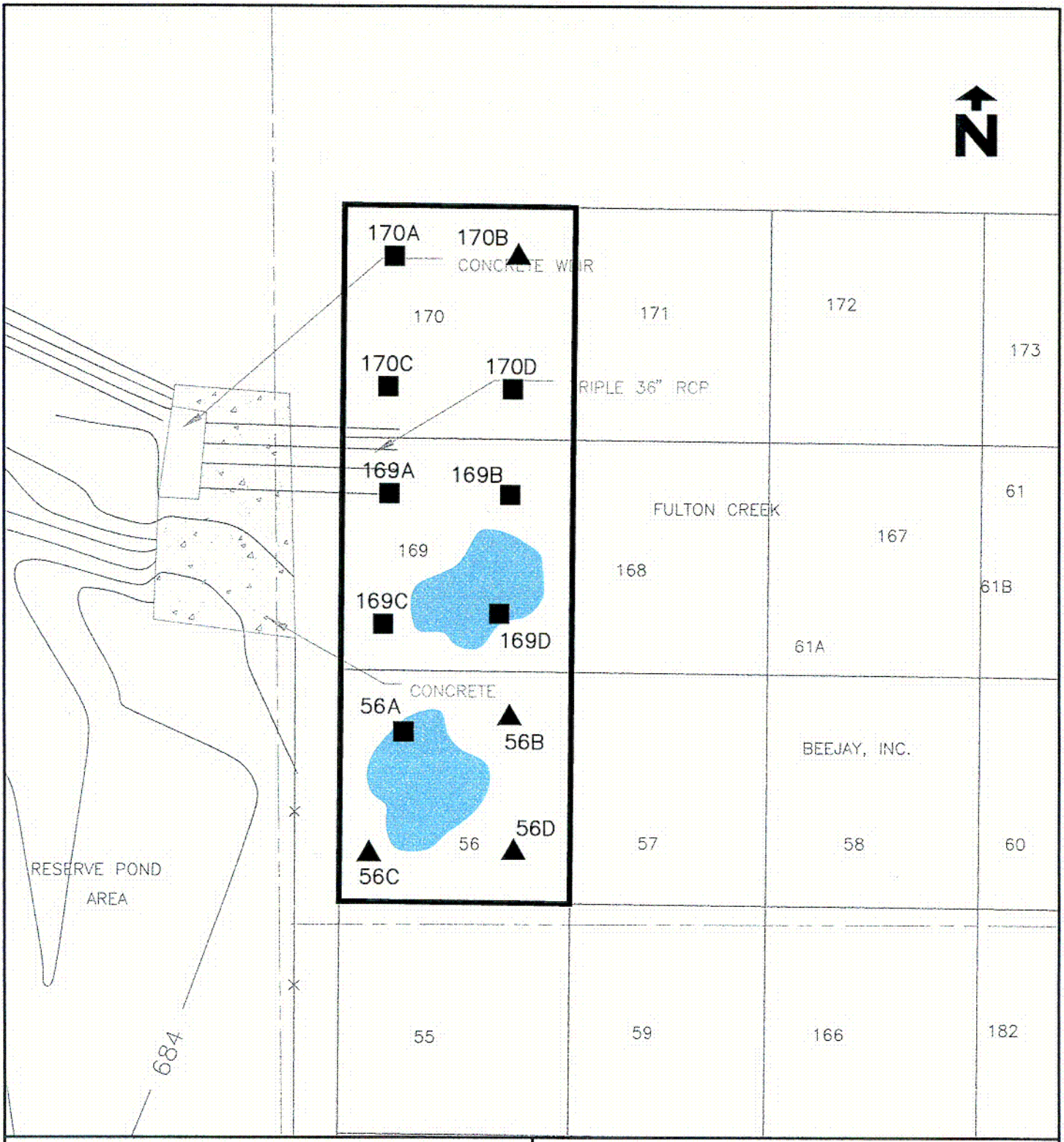

LEGEND

- SUFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–22
SURVEY UNIT 5A
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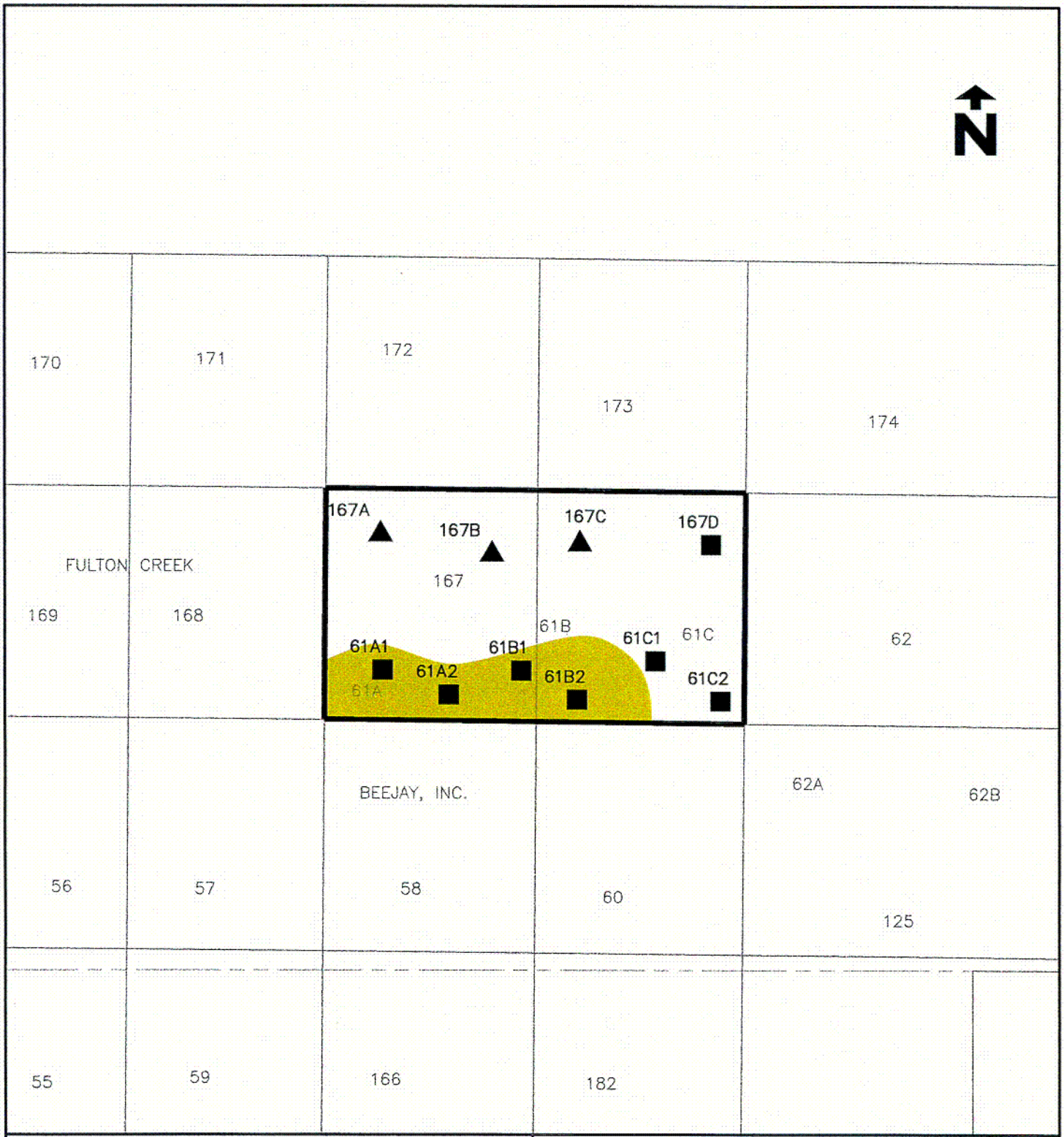

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4-23
SURVEY UNIT 5B
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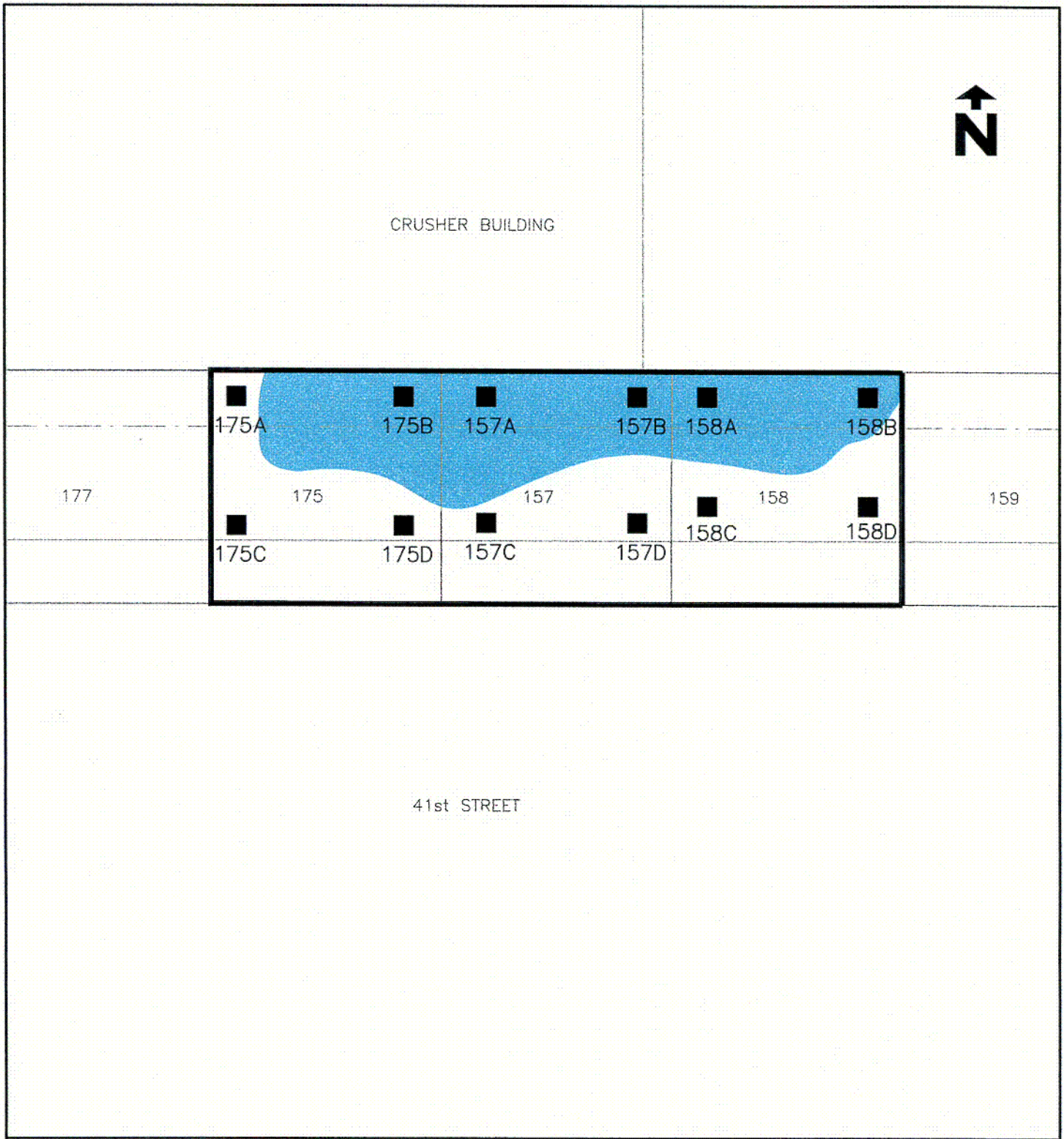

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–24
SURVEY UNIT 6A
FINAL SURVEY REPORT
KAISER ALUMINUM
TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
BATON ROUGE, LOUISIANA

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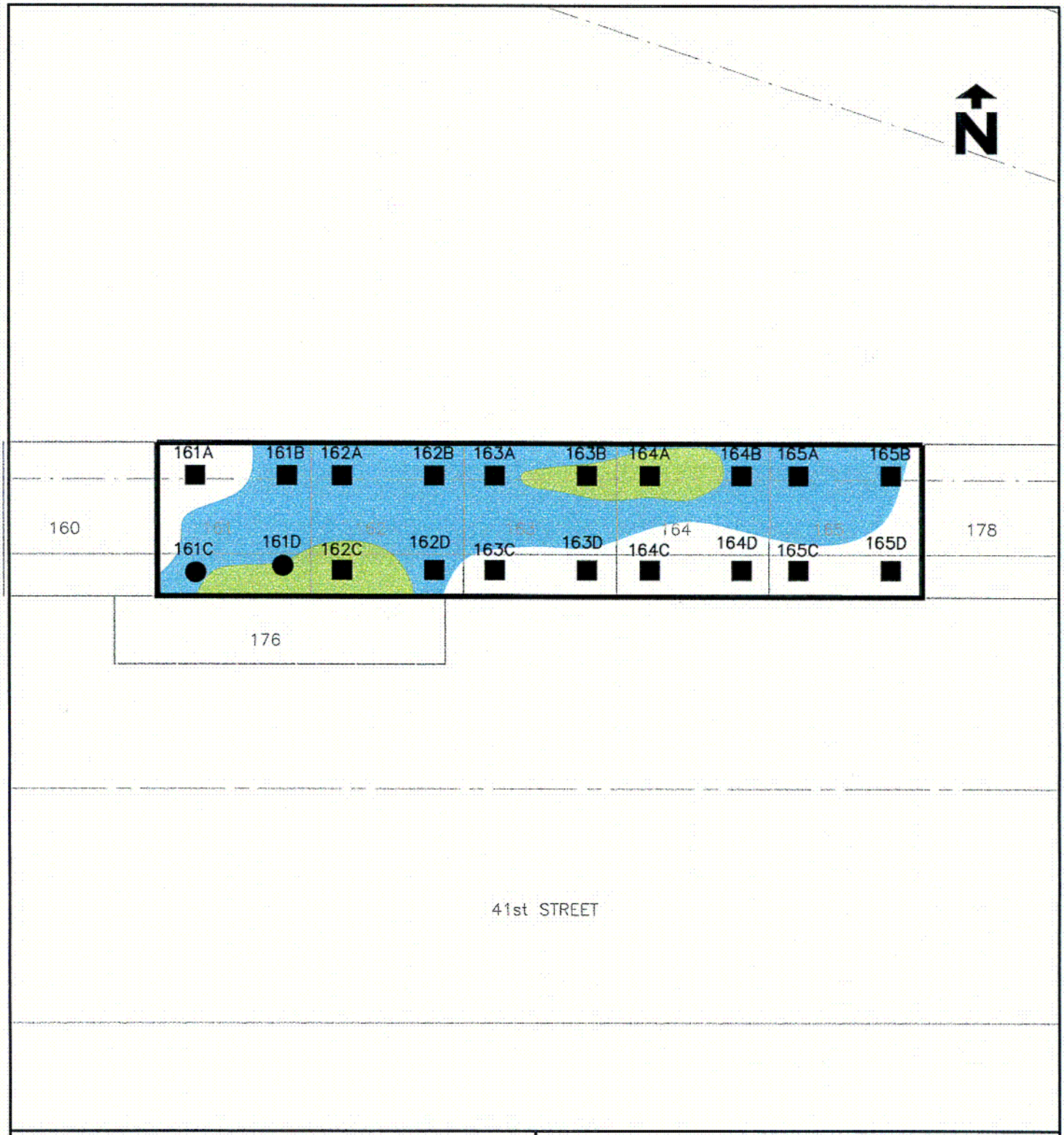

LEGEND

- SIDE WALL SOIL SAMPLE LOCATION
- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–25
SURVEY UNIT 6B
FINAL SURVEY REPORT
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TULSA, OKLAHOMA

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DRAWING NUMBER	5427031

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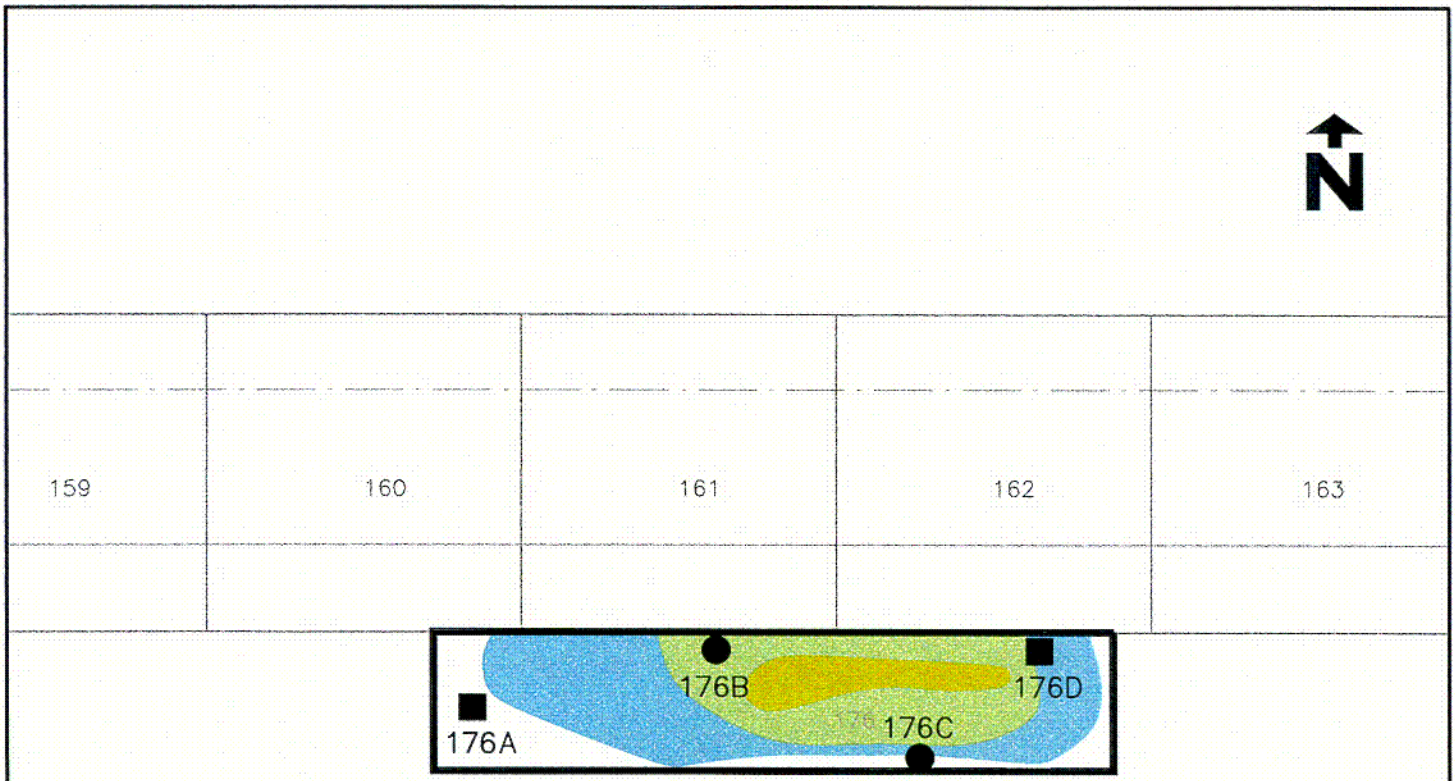

LEGEND

- SIDE WALL SOIL SAMPLE LOCATION
- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4-26
SURVEY UNIT 6C
FINAL SURVEY REPORT
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TULSA, OKLAHOMA

C-30

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RETENTION POND AREA

VAULT

6" PIPES

CONCRETE

N

SPILLWAY

GUY ANCHORS

UNION PACIFIC RAILROAD

MAINTENANCE BLDG. #3

SCALES

SMELTER BLDG. #5

OFFICES BLDG. #2

WAREHOUSE

LEGEND

- SECONDARY SOIL SAMPLE LOCATION
- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4-27
SURVEY UNIT 7A
FINAL SURVEY REPORT
KAISER ALUMINUM
TULSA, OKLAHOMA

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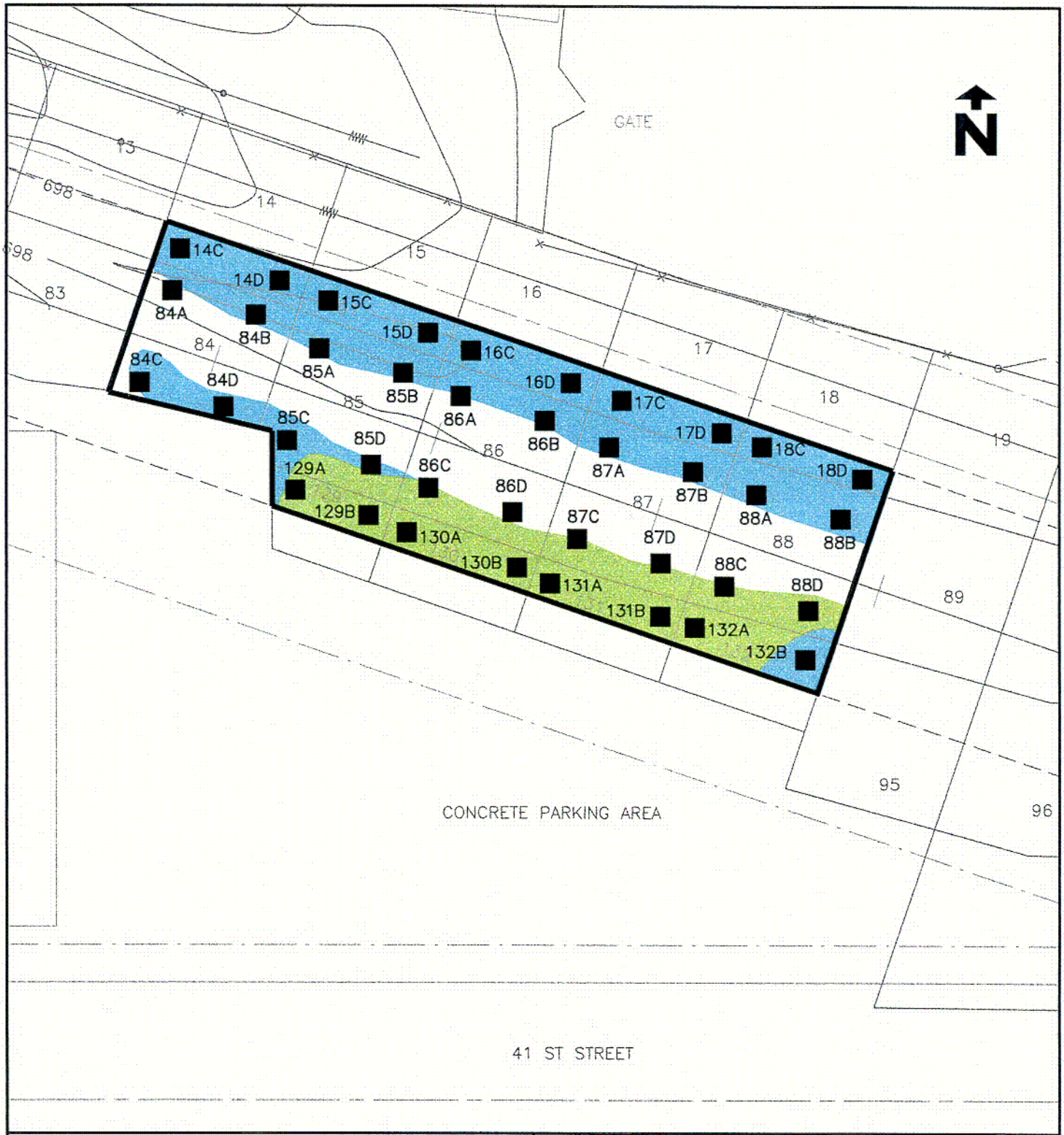

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4-28
SURVEY UNIT 7B
FINAL SURVEY REPORT
KAISER ALUMINUM
TULSA, OKLAHOMA

L-32

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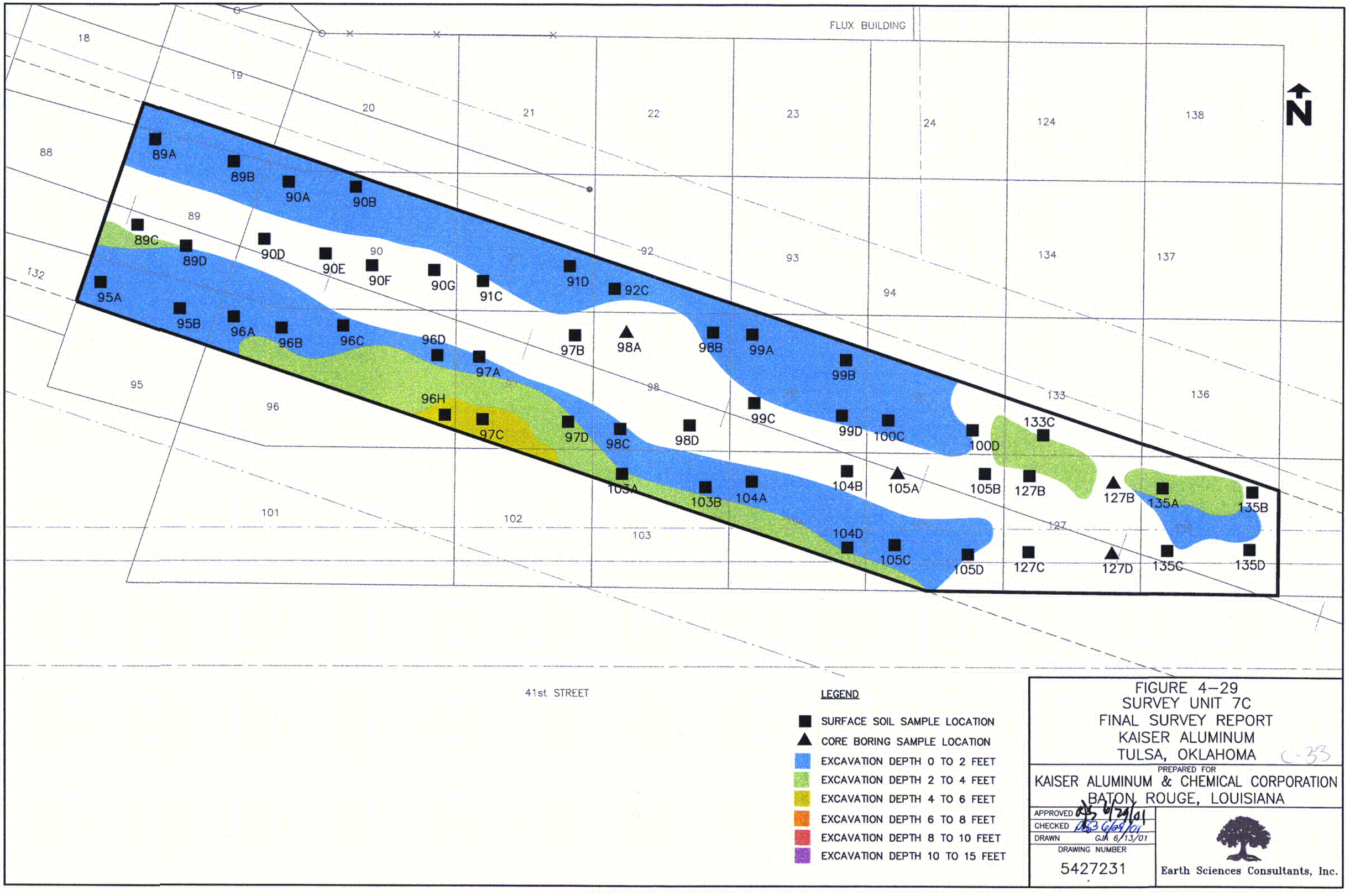

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–29
SURVEY UNIT 7C
FINAL SURVEY REPORT
KAISER ALUMINUM
TULSA, OKLAHOMA C-33

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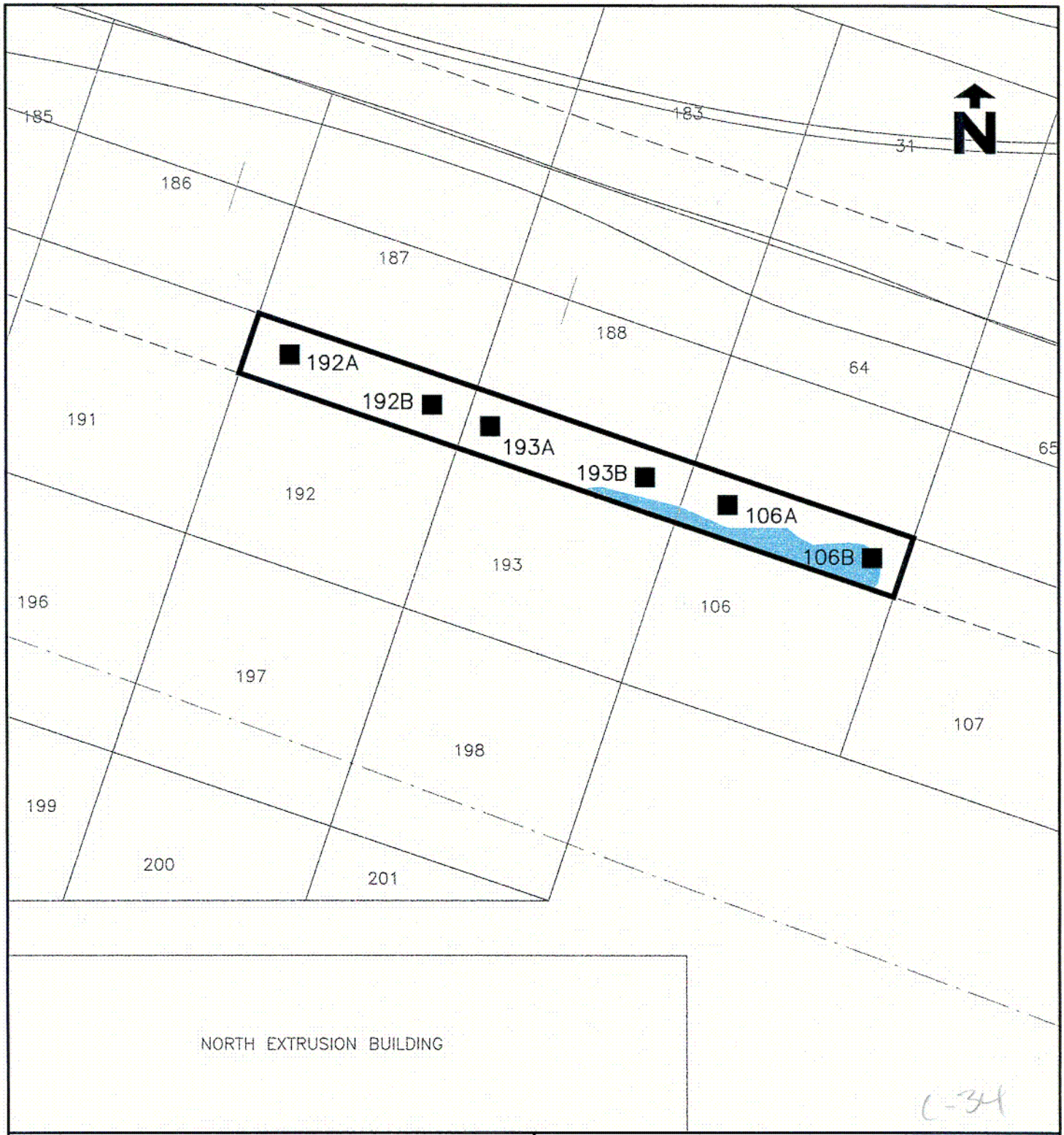

LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–30
SURVEY UNIT 7D
FINAL SURVEY REPORT
KAISER ALUMINUM
TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
BATON ROUGE, LOUISIANA

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DRAWING NUMBER	5427036

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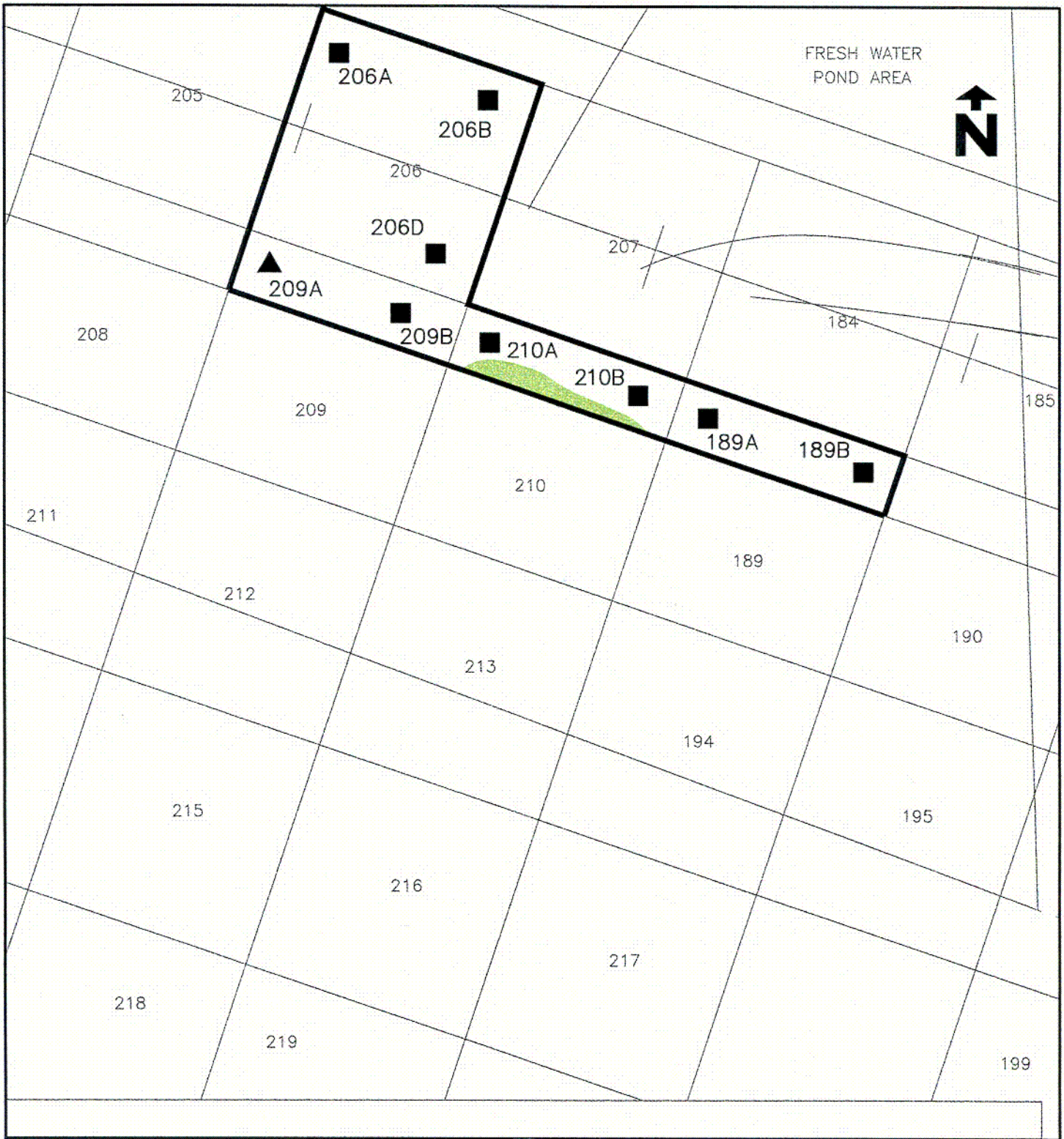
C-34



LEGEND

- SURFACE SOIL SAMPLE LOCATION
- CORE BORING SAMPLE LOCATION
- EXCAVATION DEPTH 0 TO 2 FEET
- EXCAVATION DEPTH 2 TO 4 FEET
- EXCAVATION DEPTH 4 TO 6 FEET
- EXCAVATION DEPTH 6 TO 8 FEET
- EXCAVATION DEPTH 8 TO 10 FEET
- EXCAVATION DEPTH 10 TO 15 FEET

FIGURE 4–31
SURVEY UNIT 7E
FINAL SURVEY REPORT
KAISER ALUMINUM
TULSA, OKLAHOMA

C-35

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BATON ROUGE, LOUISIANA

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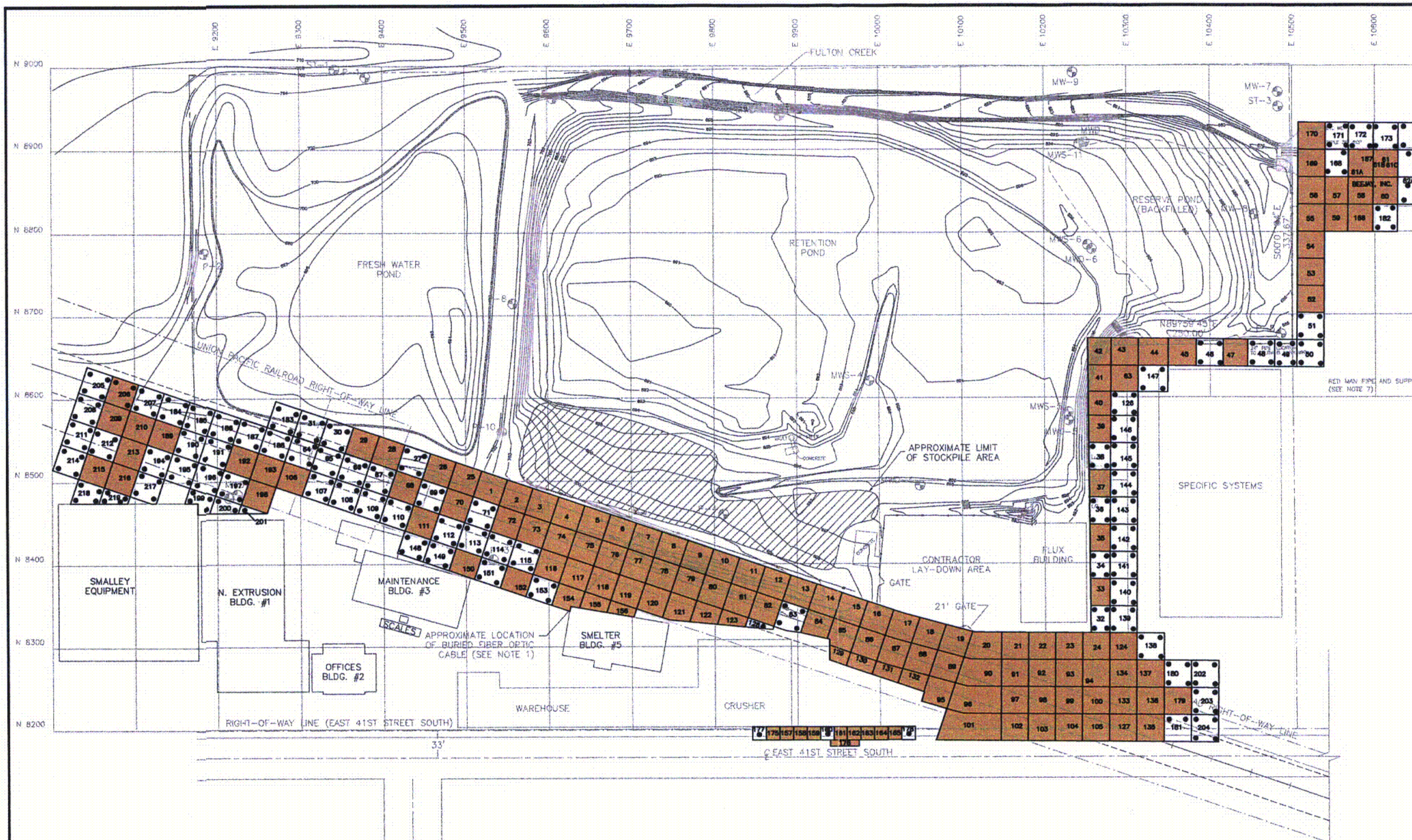
DRAWN	GJA 6/11/01
DRAWING NUMBER	5427037

Earth Sciences Consultants, Inc.



NOTES

1. SPRINT FIBER OPTIC CABLE IS LOCATED UNDERGROUND. THE LOCATION HAS BEEN FLAGGED AND SPRAY PAINTED ORANGE. FOR ADDITIONAL INFORMATION CALL 1-800-521-0579.
2. INFORMATION SHOWN MAY NOT BE COMPLETE. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE LOCATION OF ALL UTILITIES (ABOVE GROUND AND BELOW GROUND) AND OTHER INTERFERENCES WHICH MAY AFFECT THE WORK.
3. THE CONTRACTOR SHALL PAY FOR ALL COSTS TO REPAIR OR TO REPLACE MONITORING WELLS DAMAGED DURING REMEDIATION.
4. THE EXCAVATION DEPTHS SHOWN WERE OBTAINED BASED ON INFORMATION PRESENTED IN SECTION 1.3 OF THE PERFORMANCE SPECIFICATIONS.
5. SURVEY DATA FOR 10 METER BY 10 METER GRIDS CAN BE OBTAINED FROM APPENDIX E OF THE PERFORMANCE SPECIFICATIONS. LOCATIONS FOR GRIDS 157-165 ARE APPROXIMATE AND REQUIRE FIELD VERIFICATION.
6. REFER TO TABLE 1 OF THE PERFORMANCE SPECIFICATIONS FOR SPECIFIC QUARTER-GRID CONTAMINATION DEPTHS.
7. THE CONTRACTOR SHALL REFER TO SECTION 6.8 OF THE PERFORMANCE SPECIFICATIONS FOR COMPACTION SPECIFICATIONS FOR THE RED MAN PROPERTY. THE CONTRACTOR SHALL RESTORE DISTURBED SURFACES TO AT LEAST THEIR ORIGINAL LOAD BEARING CAPACITY DUE TO OPERATION OF HEAVY EQUIPMENT BY THE OWNER.
8. AREA OF GRIDS 1, 2, 3, AND 4 NORTH OF SPRINT FIBER OPTIC CABLE WILL BE LEFT FOR ONSITE DECOMMISSIONING.

C-36

LEGEND

- RCP REINFORCED CONCRETE PIPE
- OVERHEAD UTILITIES
- POWER POLE
- MONITORING WELL
- FENCE LINE
- PROPERTY LINE
- RIGHT-OF-WAY
- 25' OFFSET OF RAILROAD CENTER LINE
- SURVEY UNIT BOUNDARY
- UNAFFECTED SAMPLE LOCATION
- 10 METER BY 10 METER GRID (SEE NOTE 5)
- AFFECTED AREA
- UNAFFECTED AREA
- APPROXIMATE LIMIT OF STOCKPILE AREA

SCALE - FEET
0 60 120 180

REFERENCES

1. THE RIGHT-OF-WAY AND PROPERTY LINES WERE OBTAINED FROM PLAT OF SURVEY PREPARED BY DENTON & WHITE SURVEYING COMPANY SEALED ON FEBRUARY 14, 1964.
2. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM TOPOGRAPHIC SURVEY OF PART OF THE SE/4 OF SECTION 23 TOWNSHIP 19 NORTH RANGE 13 EAST, OF THE I.B. & M., TULSA COUNTY, STATE OF OKLAHOMA, ACCORDING TO THE U.S. GOVERNMENT SURVEY THEREOF, AND KNOWN AS 7311 EAST 41st STREET SOUTH. (FILE: NFSK003.DWG REV. A)

REVISION	DATE	DESCRIPTION

FIGURE 4-32
UNAFFECTED AREA SAMPLE LOCATIONS

ADJACENT LAND AREA REMEDIATION
KAISER ALUMINUM
TULSA, OKLAHOMA

PREPARED FOR
KAISER ALUMINUM & CHEMICAL CORPORATION
BATON ROUGE, LOUISIANA

APPROVED [illegible]
CHECKED [illegible]
DRAWN GA 6/18/01
DRAWING NUMBER
5427A423

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Appendix A

Cross Calibration of Micro-R Meters

CROSS CALIBRATION OF PRESSURIZED ION CHAMBER AND PORTABLE SURVEY METERS

Introduction

Cross calibration in this case is a comparison of measurements obtained with a Pressurized Ion Chamber and portable survey meters.

Portable survey meters are commonly calibrated against a ^{137}Cs point source. Sometimes a ^{226}Ra source is used when surveying for naturally occurring radioactive material. Ideally, portable survey meters are calibrated against the radionuclide of interest or a source of similar energy. Traceable sources of thorium (^{232}Th and ^{228}Th) are difficult if not impossible to procure. Additionally, when large areas of contamination are to be surveyed, calibration with an extended source is preferred rather than calibration against a point source. For these reasons it is essentially impossible to adequately calibrate portable survey meters for conducting a survey over an extended source of thorium contamination.

Pressurized Ion Chambers (PIC) are recognized as very precise and accurate gamma detectors. Comparing PIC measurements with portable survey meter readings over an extended thorium source is the most practical calibration technique.

Calibration/Survey Technique

Arrangements were made to transport a PIC (SN 303, Model 112) to the Kaiser Aluminum and Chemical Corporation site (Tulsa, Oklahoma); a copy of the calibration certificate is attached. At the site, measurement points were identified and readings were collected with the PIC as follows: three onsite locations (inside the fence on Kaiser property), three offsite locations (outside the fence), and one background location. At each of these locations, additional measurements were recorded using five different portable survey meters. The measurements were conducted on May 11, 1999.

Results

Table 1 is a comparison of the survey results from the PIC and the five portable survey meters for each location. Table 2 includes the PIC results and a general location description for each measurement point. Figure 1 is a plot of the reading results. A plot of the reading results ranging up to 20 microroentgen per hour is included in Figure 2.

Table 1

Radiation Measurement Comparisons
of a PIC and Five Portable Survey Meters
Over Extended Thorium Source

Location	PIC Model 112 SN 303	(Kaiser) Ludlum Model 3 SN113203		(KOH) Bicron mrem SN B709J		(KOH) Ludlum Model 19 SN 156479		(Scott) Ludlum Model 3-97 SN 48469		(Morton) Ludlum Model 12 SN 20854	
	µR/HR	µR/HR	Scale	µR/HR	Scale	µR/HR	Scale	µR/HR	Scale	µR/HR	Scale
1	88.7	120	10X	65	1X	120	250	110	10X	150	100X
2	159.1	230	10X	110	1X	200	250	170	10X	260	100X
3	60.0	3	10X	45	1X	75	250	80	10X	100	100X
4	15.7	25	1X	9	.1X	18	25	18	1X	28	10X
5	18.8	35	1X	10	.1X	23	50	27	1X	40	100x
6	11.9	20	1X	7	.1X	15	25	15	1X	22	10X
7	9.7	10	1X	4	.1X	8	25	8	1X	10	10X

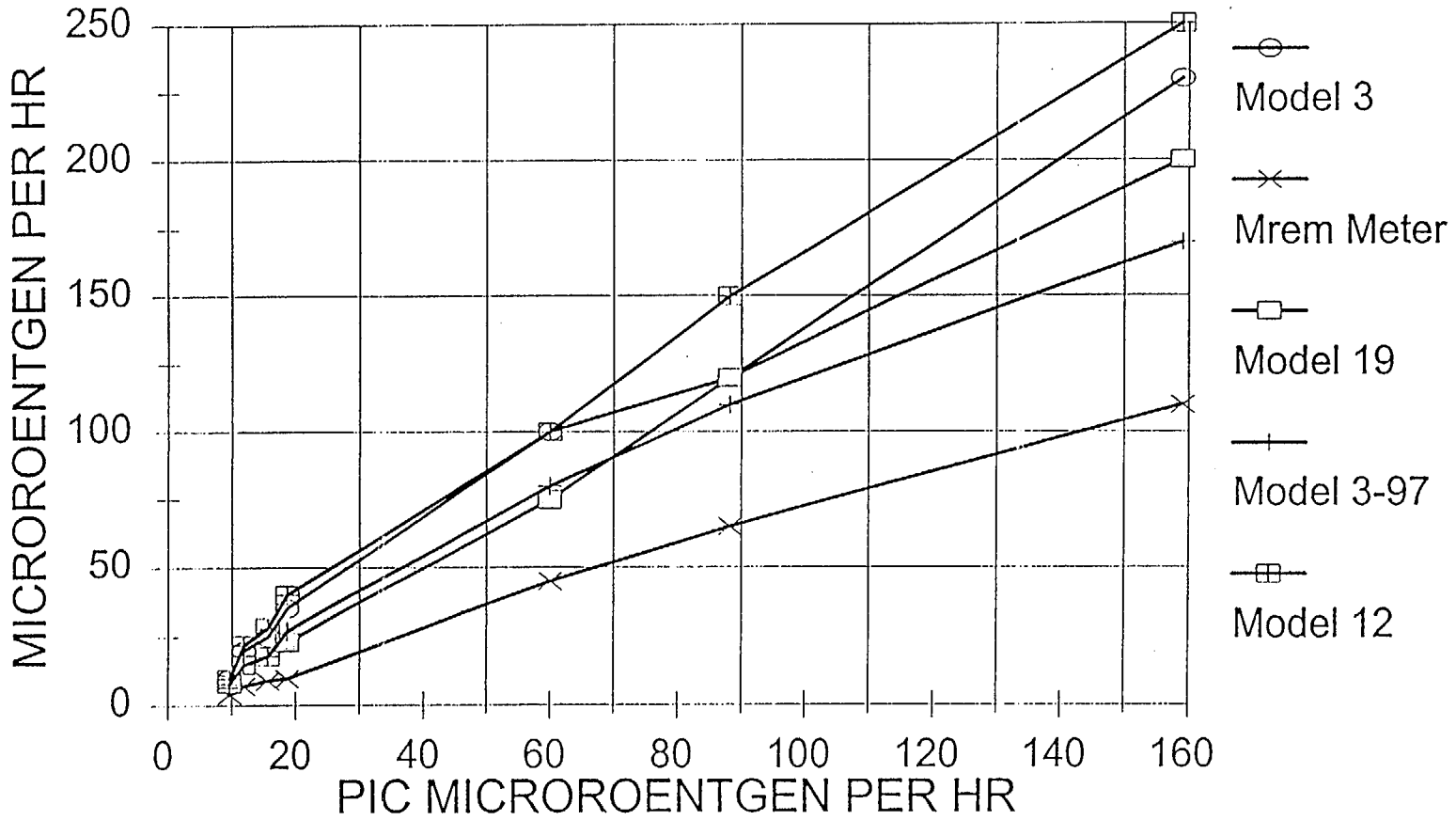
Table 2

Measurement Location Description and PIC Readings

LOCATION	PIC MODEL 112 SN 303 READINGS (µR/HR)	LOCATION DESCRIPTION
1	88.7	DUE NORTH OF EAST-WEST FENCE POST #16 FROM EAST END; AT SOUTH EDGE OF CLEAR ROCK AREA (ROAD).
2	159.1	28 PACES EAST OF LOCATION 1; SOUTH EDGE OF CLEAR ROCK AREA (ROAD)
3	60.0	11 /12 PACES NORTHEAST ; 45 DEGREE ANGLE FROM WELL P-4
4	15.7	8 PACES DIRECTLY SOUTH OF BURIED CABLE SIGN; APPROX. 6 FEET WEST OF ROAD INTO FLUX BUILDING AREA
5	18.8	3 PACES SOUTH OF CORNER POST AT EAST-WEST AND NORTH-SOUTH FENCE TO POND AREA ON RAILROAD RIGHT-OF-WAY
6	11.9	10 PACES SOUTH AND 1 PACE EAST OF SOUTHWEST CORNER OF FLUX BUILDING
7	9.7	BEHIND "GEORGE AND GEORGE" PROPERTY; SITE OF 30 BACKGROUND CORING LOCATION

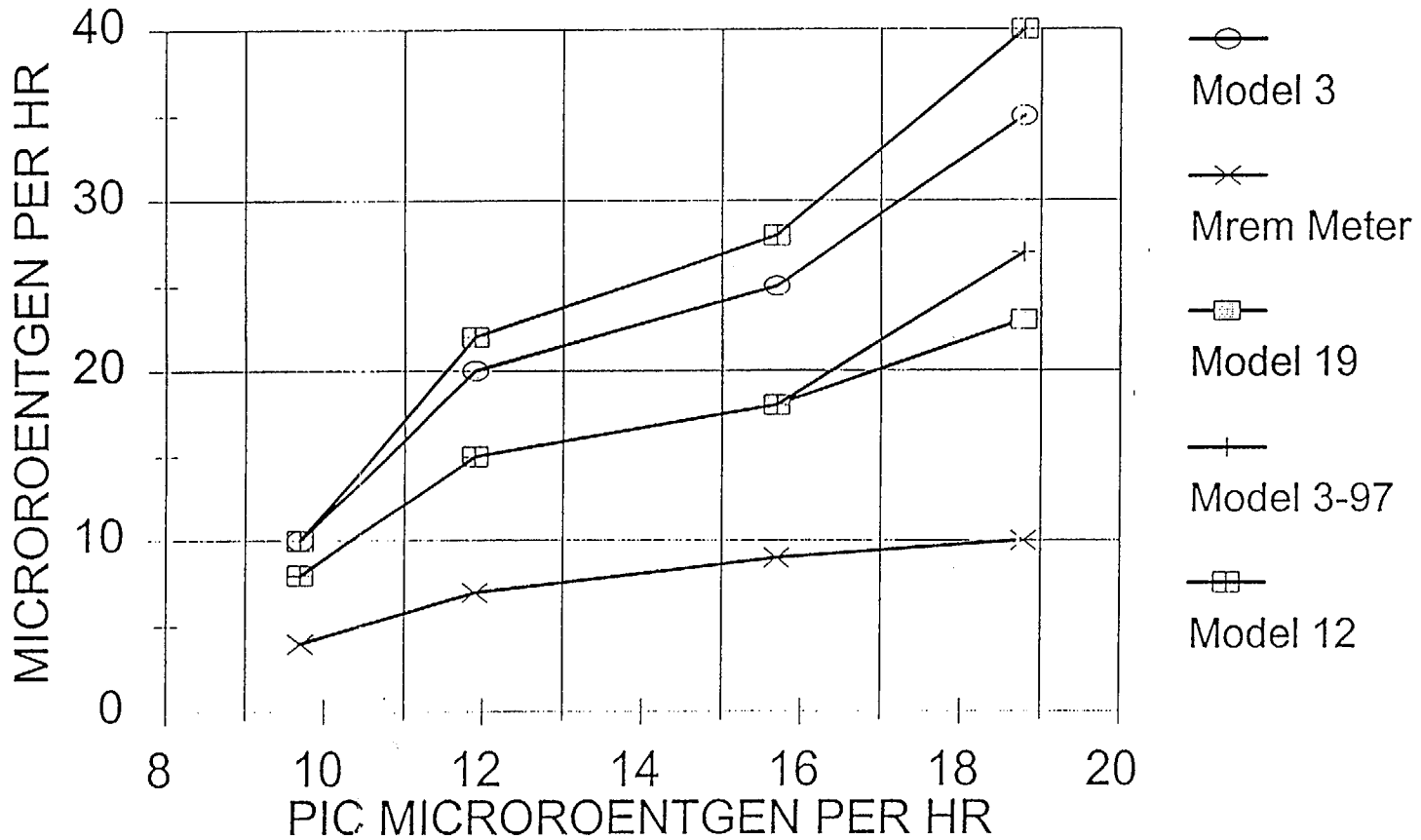
PIC vs PORTABLE METERS

Figure 1



PIC vs PORTABLE METERS

Figure 2



Each measurement point has been marked with a steel stake and topped with a two-inch metal plate. As long as these locations and markers remain undisturbed, they can and should be used as future calibration points for portable survey meters.

L. Max Scott, PhD, CHP
ADA Consultants
July 1999

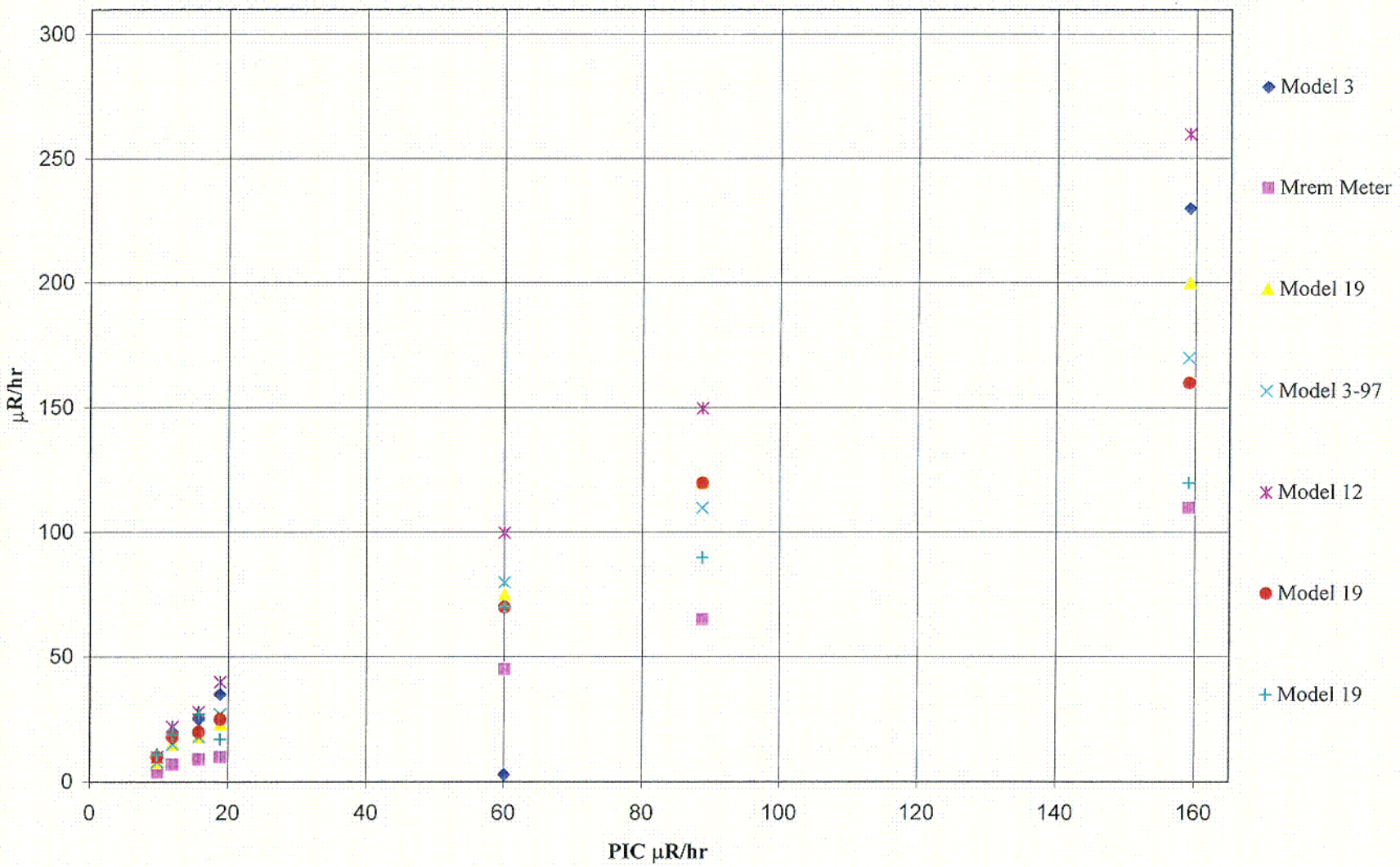
Attachment: Calibration Certificate

Table 1

Location	PIC Model 112 SN 303	Kaiser Ludlum Model 3 SN 13203		KOH Bicron MREM SN B709J		KOH Ludlum Model 19 SN 156479		Scott Lud. Mod. 3-97 SN 48469		Morton Ludlum Model 12 SN 20854		ESC @ 1 meter Ludlum Model 19 SN 104630		ESC on contact Ludlum Model 19 SN 104630	
	µR/hr	µR/hr	Scale	µR/hr	Scale	µR/hr	Scale	µR/hr	Scale	µR/hr	Scale	µR/hr	Scale	µR/hr	Scale
1	88.7	120	10x	65	1x	120	250	110	10x	150	100x	120	250	90	250
2	159.1	230	10x	110	1x	200	250	170	10x	260	100x	160	250	120	250
3	60	3	10x	45	1x	75	250	80	10x	100	100x	70	250	70	250
4	15.7	25	1x	9	.1x	18	25	18	1x	28	10x	20	25	27	25
5	18.8	35	1x	10	.1x	23	50	27	1x	40	100x	25	50	17	50
6	11.9	20	1x	7	.1x	15	25	15	1x	22	10x	18	25	19	25
7	9.7	10	1x	4	.1x	8	25	8	1x	10	10x	10	25	11	25

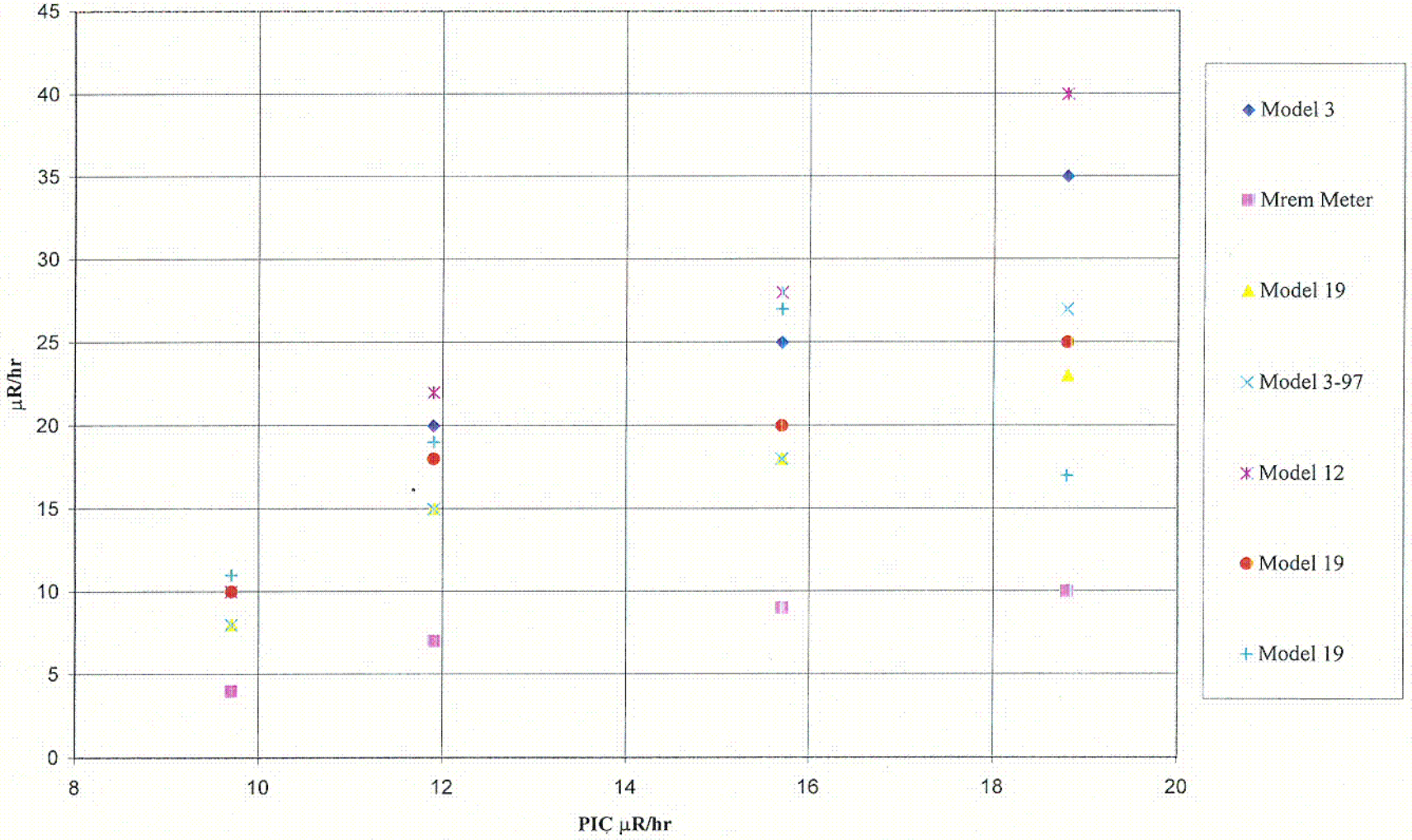
PIC vs. Portable Meters

Figure 1



PIC vs. Portable Meters

Figure 2



Appendix B

Analytical QA/QC

Appendix B
Analytical QA/QC

In accordance with the Final Status Survey Plan (Reference 11), a number of samples, equal to a minimum of 10 percent of samples submitted for laboratory analysis as part of the survey, will be submitted as part of the QA/QC program. Also in accordance with Reference 11, approximately one third of these samples were to be blank samples, one third spiked samples, and one third split samples. These QA/QC samples are defined as follows:

1. Blank Samples – A blank sample consisted of soil or soil-like material known to be unaffected by site processes. The blank sample material used was off-site backfill and soil samples taken from an off-site location approximately one-half mile from the site.

2. Spike Samples – A spike sample consisted of dross material taken from one of three uniformly mixed stock samples.

3. Split Samples – During final sampling, an aliquot of soil was mixed and used to fill a bag sent to the lab for analysis and a bag used to archive some of the sample. A split sample consisted of soil taken from the archive bag and submitted for analytical analysis.

Ten percent of the 921 samples submitted for gamma spectroscopy analysis as part of this report is equal to 92 samples. A total of 131 samples were submitted as QA/QC samples, exceeding the minimum requirement of 92 samples. One third of the minimum of 92 (31) samples was required for each QA/QC category. A total of 42 blank samples, 37 spike samples, and 52 split samples were submitted for gamma spectroscopy analysis, exceeding the minimum required for each type.

Table B-1 lists the results of the 42 blank samples. The average activity concentration of the 42 blanks (Th-232 = 0.783 $\pm$ 0.48 picocurie per gram [pCi/g] [2 sigma error]) compare favorably with site established background of 1.1 $\pm$ 0.30 pCi/g Th-232.

Table B-2 lists results of the 37 spike samples. The spike samples were taken from three separate stocks: PD#1, PD#2, and PD#3. The precision within the stocks was excellent. Refer to Table B-2 for the average, standard deviation, median, minimum, and maximum for each group.

Table B-3 lists results of the 52 split samples. The samples are compared to the result of the first sample analyzed. The percent change listed in Table B-3 is the percent relative bias of the split sample analytical

result to the original sample analytical result. The average percent relative bias for the 52 sets of samples is 15 percent. This difference includes the inherent difference between two aliquots of the same sample.

In addition to the split samples taken in accordance with the survey plan, 44 additional split samples were taken with the Nuclear Regulatory Commission (NRC). The results of the project's analytical analyses and the NRC's analytical analyses are presented in Table B-4. The percent relative bias statistic of the project's analyses to that of the NRC was calculated. The average percent relative bias for the 44 sets of samples is 33 percent. This difference includes the inherent difference in the two analytical laboratory's (the project's and the NRC's), as well as the difference between two aliquots of the same sample.

Table B-1
Quality Control Samples - Blanks
Soil Concentrations
Kaiser Adjacent Land Remediation

Sample Location	Sample Type	Analytical Results Gross Conc. Th-232 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit	Conc. Th-232 (pCi/g)	Unity (-)
1	CF	4.84E-01	2.90E-02	1.20E-01	0.00E+00	0.00
2	CF	1.71E-01	1.60E-02	8.90E-02	0.00E+00	0.00
3	CF	7.47E-01	3.60E-02	1.45E-01	0.00E+00	0.00
4	BKHS	4.43E-01	7.50E-02	2.00E-01	0.00E+00	0.00
5	BKHS	5.79E-01	6.70E-02	2.40E-01	0.00E+00	0.00
6	CF	1.18E+00	1.53E-01	5.84E-01	8.00E-02	0.04
7	BKHS	1.05E+00	1.25E-01	4.74E-01	0.00E+00	0.00
8	CF	7.65E-01	9.50E-02	3.98E-01	0.00E+00	0.00
9	BKHS	5.19E-01	1.64E-01	3.83E-01	0.00E+00	0.00
10	BKHS	8.50E-01	1.19E-01	4.10E-01	0.00E+00	0.00
11	CF	9.90E-01	1.69E-01	5.22E-01	0.00E+00	0.00
12	CF	1.36E-01	2.41E-01	4.78E-01	0.00E+00	0.00
13	CF	9.40E-01	1.81E-01	4.39E-01	0.00E+00	0.00
14	CF	7.31E-01	1.00E-01	4.06E-01	0.00E+00	0.00
15	CF	4.62E-01	1.04E-01	3.79E-01	0.00E+00	0.00
16	CF	8.24E-01	7.20E-02	1.40E-01	0.00E+00	0.00
17	CF	9.16E-01	2.18E-01	5.12E-01	0.00E+00	0.00
18	CF	9.69E-01	1.51E-01	5.92E-01	0.00E+00	0.00
19	CF	8.56E-01	1.30E-01	4.44E-01	0.00E+00	0.00
20	CF	9.97E-01	1.95E-01	5.99E-01	0.00E+00	0.00
21	CF	1.11E+00	1.68E-01	6.50E-01	1.00E-02	0.00
22	CF	1.20E+00	1.45E-01	4.30E-01	1.00E-01	0.04
23	CF	7.24E-01	8.20E-02	3.34E-01	0.00E+00	0.00
24	CF	9.22E-01	9.50E-02	3.28E-01	0.00E+00	0.00
25	CF	4.10E-01	1.73E-01	4.80E-01	0.00E+00	0.00
26	CF	7.63E-01	1.20E-01	4.49E-01	0.00E+00	0.00
27	CF	8.89E-01	1.35E-01	4.63E-01	0.00E+00	0.00
28	CF	1.17E+00	1.48E-01	4.02E-01	7.00E-02	0.03
29	CF	7.44E-01	1.03E-01	3.97E-01	0.00E+00	0.00
30	CF	8.96E-01	1.15E-01	4.14E-01	0.00E+00	0.00
31	CF	7.37E-01	2.11E-01	7.25E-01	0.00E+00	0.00
32	CF	5.47E-01	9.40E-02	3.91E-01	0.00E+00	0.00
33	CF	6.31E-01	1.16E-01	4.07E-01	0.00E+00	0.00
34	CF	7.15E-01	1.17E-01	3.49E-01	0.00E+00	0.00
35	CF	8.79E-01	1.99E-01	4.23E-01	0.00E+00	0.00

Table B-1
Quality Control Samples - Blanks
Soil Concentrations
Kaiser Adjacent Land Remediation

Sample Location	Sample Type	Analytical Results Gross Conc. Th-232 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit	Conc. Th-232 (pCi/g)	Unity (-)	
36	CF	9.98E-01	1.27E-01	4.92E-01	0.00E+00	0.00	
37	CF	8.47E-01	1.20E-01	4.25E-01	0.00E+00	0.00	
38	CF	7.99E-01	1.16E-01	4.87E-01	0.00E+00	0.00	
39	CF	8.18E-01	1.89E-01	4.69E-01	0.00E+00	0.00	
40	CF	8.89E-01	1.13E-01	3.68E-01	0.00E+00	0.00	
41	CF	8.64E-01	1.87E-01	3.74E-01	0.00E+00	0.00	
42	CF	7.35E-01	9.80E-02	2.91E-01	0.00E+00	0.00	
Degrees of Freedom:	41	7.83E-01			6.19E-03	0.00	Average
		2.42E-01			2.20E-02	0.01	Std Deviation
		1.36E-01			0.00E+00	0.00	Minimum
		1.20E+00			1.00E-01	0.04	Maximum
t value*		8.21E-01			0.00E+00	0.00	Median
1.68		8.46E-01			1.19E-02	0.01	m_a 95%CL
2.02		8.59E-01			1.30E-02	0.01	m_a 97.5%C

*Look up value from Table 1 in Appendix B of NUREG/CR-5849.

Notes: Background value of 1.1 pCi/g Th-232 subtracted from Gross Th-232 result.

Background value of 9 μR/hr subtracted from Gross Exposure Rate measurements.

CF = Clean fill.

BKHS = Bishop Kelly High School soil.

Th-232 is calculated using the analytical data and correcting for background. The measured background value is 1.1 pCi/g Th-232.

Unity is calculated by summing the fractions of Th-232, Th-228, and Th-230 activity concentrations divided by their respective acceptance criteria, i.e., Th-232 + Th-228 / 10 pCi/g + Th-230 / 14 pCi/g.

The average and standard deviation of unity is calculated for each final survey grid.

Finally, the average, standard deviation, median, and m_a (95 and 97.5% confidence level) are calculated for the entire survey unit.

The average and standard deviation calculation for the entire survey unit include the weighted average calculated for any grids that contain elevated area

Table B-2
Quality Control Samples - Spikes
Soil Concentrations
Kaiser Adjacent Land Remediation

Sample Location	Sample Type	Analytical Results Gross Conc. Th-232 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit	Conc. Th-232 (pCi/g)	Unity (-)	
1	PD#1	5.41E+01	1.15E+00	1.06E+00	5.30E+01	23.85	
2	PD#1	6.45E+01	1.48E+00	1.08E+00	6.34E+01	28.53	
3	PD#1	5.82E+01	1.45E+00	9.88E-01	5.71E+01	25.70	
4	PD#1	5.46E+01	1.47E+00	1.06E+00	5.35E+01	24.08	
5	PD#1	5.92E+01	1.66E+00	1.14E+00	5.81E+01	26.15	
6	PD#1	5.49E+01	1.49E+00	1.53E+00	5.38E+01	24.21	
7	PD#1	5.37E+01	1.28E+00	9.05E-01	5.26E+01	23.67	
8	PD#1	5.53E+01	1.32E+00	3.17E-01	5.42E+01	24.39	
9	PD#1	5.23E+01	1.18E+00	2.81E-01	5.12E+01	23.04	
10	PD#1	5.49E+01	1.57E+00	1.57E+00	5.38E+01	24.21	
11	PD#1	5.25E+01	1.41E+00	9.42E-01	5.14E+01	23.13	
Degrees of Freedom:	10	5.58E+01			5.47E+01	24.63	Average
		3.56E+00			3.56E+00	1.60	Std Deviation
		5.23E+01			5.12E+01	23.04	Minimum
		6.45E+01			6.34E+01	28.53	Maximum
t value*		5.49E+01			5.38E+01	24.21	Median
1.81		5.72E+01			5.61E+01	25.25	μ_α 95%CL
2.23		5.75E+01			5.64E+01	25.38	μ_α 97.5%C

Sample Location	Sample Type	Analytical Results Gross Conc. Th-232 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit	Conc. Th-232 (pCi/g)	Unity (-)	
12	PD#2	4.74E+01	1.58E+00	1.06E+00	4.63E+01	20.84	
13	PD#2	4.25E+01	1.26E+00	8.76E-01	4.14E+01	18.63	
14	PD#2	4.18E+01	1.24E+00	8.34E-01	4.07E+01	18.32	
15	PD#2	4.70E+01	1.69E+00	1.08E+00	4.59E+01	20.66	
16	PD#2	4.36E+01	1.48E+00	1.24E+00	4.25E+01	19.13	
17	PD#2	4.64E+01	1.42E+00	1.41E+00	4.53E+01	20.39	
Degrees of Freedom:	5	4.48E+01			4.37E+01	19.66	Average
		2.44E+00			2.44E+00	1.10	Std Deviation
		4.18E+01			4.07E+01	18.32	Minimum
		4.74E+01			4.63E+01	20.84	Maximum
t value*		4.50E+01			4.39E+01	19.76	Median
2.02		4.57E+01			4.46E+01	20.08	μ_α 95%CL
2.57		4.59E+01			4.48E+01	20.17	μ_α 97.5%C

Table B-2
Quality Control Samples - Spikes
Soil Concentrations
Kaiser Adjacent Land Remediation

Sample Location	Sample Type	Analytical Results Gross Conc. Th-232 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit	Conc. Th-232 (pCi/g)	Unity (-)	
18	PD#3	3.43E+01	1.06E+00	7.87E-01	3.32E+01	14.94	
19	PD#3	3.76E+01	1.42E+00	1.24E+00	3.65E+01	16.43	
20	PD#3	3.35E+01	1.19E+00	1.29E+00	3.24E+01	14.58	
21	PD#3	3.72E+01	1.42E+00	1.26E+00	3.61E+01	16.25	
22	PD#3	3.79E+01	1.31E+00	1.08E+00	3.68E+01	16.56	
23	PD#3	4.57E+01	1.64E+00	9.28E-01	4.46E+01	20.07	
24	PD#3	3.59E+01	1.26E+00	1.30E+00	3.48E+01	15.66	
25	PD#3	3.73E+01	1.38E+00	7.26E-01	3.62E+01	16.29	
26	PD#3	3.98E+01	1.16E+00	7.01E-01	3.87E+01	17.42	
27	PD#3	3.66E+01	1.23E+00	8.48E-01	3.55E+01	15.98	
28	PD#3	3.96E+01	1.28E+00	7.07E-01	3.85E+01	17.33	
29	PD#3	3.66E+01	1.30E+00	9.39E-01	3.55E+01	15.98	
30	PD#3	3.32E+01	1.23E+00	1.15E+00	3.21E+01	14.45	
31	PD#3	3.29E+01	9.58E-01	6.09E-01	3.18E+01	14.31	
32	PD#3	3.08E+01	8.96E-01	5.84E-01	2.97E+01	13.37	
33	PD#3	3.45E+01	9.96E-01	6.48E-01	3.34E+01	15.03	
34	PD#3	2.71E+01	1.01E+00	6.81E-01	2.60E+01	11.70	
35	PD#3	3.94E+01	1.28E+00	7.55E-01	3.83E+01	17.24	
36	PD#3	3.29E+01	9.55E-01	6.40E-01	3.18E+01	14.31	
37	PD#3	3.36E+01	1.23E+00	2.01E+00	3.25E+01	14.63	
Degrees of Freedom:	19	3.58E+01			3.47E+01	15.62	Average
		3.93E+00			3.93E+00	1.77	Std Deviation
		2.71E+01			2.60E+01	11.70	Minimum
		4.57E+01			4.46E+01	20.07	Maximum
t value*		3.63E+01			3.52E+01	15.82	Median
1.73		3.73E+01			3.62E+01	16.31	μ_α 95%CL
2.09		3.77E+01			3.66E+01	16.45	μ_α 97.5%C

*Look up value from Table 1 in Appendix B of NUREG/CR-5849.

Notes: Background value of 1.1 pCi/g Th-232 subtracted from Gross Th-232 result.
Background value of 9 µR/hr subtracted from Gross Exposure Rate measurements.
PD = Pond dross.

Th-232 is calculated using the analytical data and correcting for background. The measured background value is 1.1 pCi/g Th-232.
Unity is calculated by summing the fractions of Th-232, Th-228, and Th-230 activity concentrations divided by their respective acceptance criteria, i.e., Th-232 + Th-228 / 10 pCi/g + Th-230 / 14 pCi/g.
The average and standard deviation of unity is calculated for each final survey grid.
Finally, the average, standard deviation, median, and μ_α (95 and 97.5% confidence level) are calculated for the entire survey unit.
The average and standard deviation calculation for the entire survey unit include the weighted average calculated for any grids that contain elevated area

Table B-3
Quality Control Samples - Splits
Soil Concentrations
Kaiser Adjacent Land Remediation

Sample Location	Sample Type	Analytical Results Gross Conc. Th-232 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit	Conc. Th-232 (pCi/g)	Unity (-)	% Change
166B	SFS	1.16E+00	1.18E-01	3.62E-01	6.00E-02	0.03	30.54
166B	FS	1.67E+00	6.10E-02	1.08E-01	5.70E-01	0.26	
54C	SFS	7.31E-01	8.30E-02	2.13E-01	0.00E+00	0.00	10.53
54C	FS	8.17E-01	9.40E-02	2.24E-01	0.00E+00	0.00	
59B	SFS	6.02E-01	9.90E-02	2.43E-01	0.00E+00	0.00	17.08
59B	FS	7.26E-01	1.12E-01	2.44E-01	0.00E+00	0.00	
60C	SFS	5.38E-01	8.20E-02	4.50E-02	0.00E+00	0.00	4.44
60C	FS	5.63E-01	1.04E-01	3.81E-01	0.00E+00	0.00	
37C	SFS	1.01E+00	1.57E-01	4.31E-01	0.00E+00	0.00	76.27
37C	FS	5.73E-01	8.50E-02	2.17E-01	0.00E+00	0.00	
60C	SFS	9.02E-01	1.27E-01	3.64E-01	0.00E+00	0.00	67.66
60C	FS	5.38E-01	8.20E-02	4.50E-02	0.00E+00	0.00	
42D	SFS	8.41E-01	9.10E-02	3.07E-01	0.00E+00	0.00	22.84
42D	FS	1.09E+00	1.33E-01	4.47E-01	0.00E+00	0.00	
40A	SFS	6.55E-01	8.30E-02	2.43E-01	0.00E+00	0.00	11.61
40A	FS	7.41E-01	1.05E-01	4.57E-01	0.00E+00	0.00	
124B	SFS	1.36E+00	1.64E-01	3.20E-01	2.60E-01	0.12	32.04
124B	FS	1.03E+00	1.42E-01	4.72E-01	0.00E+00	0.00	
41D	SFS	4.73E-01	8.40E-02	2.48E-01	0.00E+00	0.00	52.03
41D	FS	9.86E-01	8.60E-02	3.11E-01	0.00E+00	0.00	
41B	SFS	8.41E-01	8.10E-02	2.70E-01	0.00E+00	0.00	18.45
41B	FS	7.10E-01	1.15E-01	4.55E-01	0.00E+00	0.00	
37A	SFS	6.84E-01	1.17E-01	3.40E-01	0.00E+00	0.00	15.24
37A	FS	8.07E-01	7.20E-02	2.59E-01	0.00E+00	0.00	
22C	SFS	2.01E+00	2.50E-01	5.55E-01	9.10E-01	0.41	17.54
22C	FS	1.71E+00	1.32E-01	3.14E-01	6.10E-01	0.27	
77C	SFS	3.91E+00	3.04E-01	4.48E-01	2.81E+00	1.26	2.89
77C	FS	3.80E+00	3.05E-01	5.07E-01	2.70E+00	1.22	
77B	SFS	1.11E+00	1.46E-01	4.35E-01	1.00E-02	0.00	68.10
77B	FS	3.48E+00	2.38E-01	5.73E-01	2.38E+00	1.07	

Table B-3
Quality Control Samples - Splits
Soil Concentrations
Kaiser Adjacent Land Remediation

Sample Location	Sample Type	Analytical Results Gross Conc. Th-232 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit	Conc. Th-232 (pCi/g)	Unity (-)	% Change
22B	SFS	2.69E+00	2.97E-01	5.62E-01	1.59E+00	0.72	39.55
22B	FS	4.45E+00	2.35E-01	5.57E-01	3.35E+00	1.51	
10B	SFS	1.88E+00	2.01E-01	5.11E-01	7.80E-01	0.35	12.57
10B	FS	1.67E+00	1.58E-01	4.93E-01	5.70E-01	0.26	
22A	SFS	3.02E+00	2.35E+00	4.50E-01	1.92E+00	0.86	35.05
22A	FS	4.65E+00	2.68E-01	4.80E-01	3.55E+00	1.60	
23A	SFS	8.00E-01	1.39E-01	5.12E-01	0.00E+00	0.00	2.68
23A	FS	8.22E-01	1.24E-01	3.99E-01	0.00E+00	0.00	
74A	SFS	1.79E-01	7.20E-02	3.11E-01	0.00E+00	0.00	54.68
74A	FS	3.95E-01	9.50E-02	3.11E-01	0.00E+00	0.00	
17C	SFS	8.73E-01	1.22E-01	3.02E-01	0.00E+00	0.00	2.24
17C	FS	8.93E-01	1.06E-01	3.35E-01	0.00E+00	0.00	
73A	SFS	ND	ND	3.90E-01	ND	0.00	N/A
73A	FS	BDL	7.30E-02	2.69E-01	BDL	0.00	
162B	SFS	6.66E-01	8.40E-02	2.84E-01	0.00E+00	0.00	20.43
162B	FS	8.37E-01	1.17E-01	4.56E-01	0.00E+00	0.00	
10C	SFS	2.28E+00	2.59E-01	5.00E-01	1.18E+00	0.53	34.48
10C	FS	3.48E+00	2.13E-01	5.57E-01	2.38E+00	1.07	
80B	SFS	6.72E-01	1.52E-01	5.67E-01	0.00E+00	0.00	5.75
80B	FS	7.13E-01	1.04E-01	3.91E-01	0.00E+00	0.00	
164D	SFS	1.15E+00	1.24E-01	2.86E-01	5.00E-02	0.02	40.76
164D	FS	8.17E-01	1.27E-01	4.12E-01	0.00E+00	0.00	
121A	SFS	8.40E-01	1.99E-01	4.23E-01	0.00E+00	0.00	13.22
121A	FS	9.68E-01	2.08E-01	4.18E-01	0.00E+00	0.00	
78D	SFS	9.89E-01	1.42E-01	3.31E-01	0.00E+00	0.00	3.04
78D	FS	1.02E+00	1.22E-01	4.79E-01	0.00E+00	0.00	
162D	SFS	9.75E-01	1.24E-01	4.23E-01	0.00E+00	0.00	20.73
162D	FS	1.23E+00	1.63E-01	3.14E-01	1.30E-01	0.06	
157B	SFS	8.43E-01	1.73E-01	4.46E-01	0.00E+00	0.00	2.68
157B	FS	8.21E-01	2.18E-01	5.22E-01	0.00E+00	0.00	

Table B-3
Quality Control Samples - Splits
Soil Concentrations
Kaiser Adjacent Land Remediation

Sample Location	Sample Type	Analytical Results Gross Conc. Th-232 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit	Conc. Th-232 (pCi/g)	Unity (-)	% Change
73B	SNRC	3.64E+00	2.30E-01	5.67E-01	2.54E+00	1.14	6.91
73B	NRC	3.91E+00	3.28E-01	5.60E-01	2.81E+00	1.26	
74D	SNRC	7.19E+00	4.89E-01	7.98E-01	6.09E+00	2.74	725.49
74D	NRC	8.71E-01	3.74E-01	6.56E-01	0.00E+00	0.00	
123A	SNRC	5.41E+00	3.13E-01	5.06E-01	4.31E+00	1.94	3.91
123A	NRC	5.63E+00	3.01E+00	6.74E+00	4.53E+00	2.04	
45D	SFS	1.16E+00	1.40E-01	3.91E-01	6.00E-02	0.03	12.12
45D	FS	1.32E+00	1.62E-01	5.54E-01	2.20E-01	0.10	
45C	SFS	1.27E+00	2.16E-01	5.11E-01	1.70E-01	0.08	19.81
45B	FS	1.06E+00	1.99E-01	5.06E-01	0.00E+00	0.00	
44L	SFS	9.18E-01	1.31E-01	3.99E-01	0.00E+00	0.00	22.20
44L	FS	1.18E+00	1.33E-01	3.80E-01	8.00E-02	0.04	
44C	SFS	2.01E+00	1.84E-01	4.95E-01	9.10E-01	0.41	12.61
44C	FS	2.30E+00	1.82E-01	3.56E-01	1.20E+00	0.54	
44A	SFS	1.92E+00	1.65E-01	4.08E-01	8.20E-01	0.37	2.67
44A	FS	1.87E+00	1.75E-01	4.42E-01	7.70E-01	0.35	
23D	SFS	9.33E-01	2.25E-01	5.88E-01	0.00E+00	0.00	21.60
23D	FS	1.19E+00	1.69E-01	3.36E-01	9.00E-02	0.04	
61C2	SFS	6.70E-01	1.25E-01	4.77E-01	0.00E+00	0.00	38.72
61C2	FS	4.83E-01	2.10E-01	4.80E-01	0.00E+00	0.00	
7A	SFS	1.33E+00	2.06E-01	4.34E-01	2.30E-01	0.10	42.09
7A	FS	9.36E-01	1.66E-01	5.55E-01	0.00E+00	0.00	
40D	SFS	7.99E-01	1.48E-01	5.21E-01	0.00E+00	0.00	13.90
40D	FS	9.28E-01	1.54E-01	5.28E-01	0.00E+00	0.00	
89D	SFS	1.04E+00	2.13E-01	4.73E-01	0.00E+00	0.00	11.86
89D	FS	1.18E+00	1.41E-01	4.66E-01	8.00E-02	0.04	
102D	SFS	1.10E+00	1.53E-01	5.06E-01	0.00E+00	0.00	16.03
102D	FS	1.31E+00	1.55E-01	4.13E-01	2.10E-01	0.09	
111C	SFS	7.07E-01	8.00E-02	4.52E-01	0.00E+00	0.00	17.98
111C	FS	8.62E-01	9.40E-02	3.67E-01	0.00E+00	0.00	

Table B-3
Quality Control Samples - Splits
Soil Concentrations
Kaiser Adjacent Land Remediation

Sample Location	Sample Type	Analytical Results Gross Conc. Th-232 (pCi/g)	Uncert. (+/- pCi/g)	Detection Limit	Conc. Th-232 (pCi/g)	Unity (-)	% Change	
166A	SFS	3.01E+00	2.33E-01	3.29E-01	1.91E+00	0.86	48.28	
166A	FS	2.03E+00	6.40E-02	1.40E-01	9.30E-01	0.42		
3D	SFS	1.39E+00	1.28E-01	3.80E-01	2.90E-01	0.13	4.51	
3D	FS	1.33E+00	2.20E-02	4.71E-01	2.30E-01	0.10		
37B	SFS	1.38E+00	2.90E-01	5.26E-01	2.80E-01	0.13	230.14	
37B	FS	4.18E-01	1.03E-01	3.44E-01	0.00E+00	0.00		
61B2	SFS	8.45E-01	9.10E-02	2.88E-01	0.00E+00	0.00	21.58	
61B2	FS	6.95E-01	1.09E-01	4.34E-01	0.00E+00	0.00		
78A	SFS	3.43E+00	2.17E-01	3.82E-01	2.33E+00	1.05	7.52	
78A	FS	3.19E+00	3.03E-01	4.44E-01	2.09E+00	0.94		
101F	SFS	1.12E+00	1.94E-01	4.46E-01	2.00E-02	0.01	30.00	
101F	FS	1.60E+00	1.56E-01	3.93E-01	5.00E-01	0.23		
26B	SFS	1.02E+00	1.33E-01	3.67E-01	0.00E+00	0.00	13.56	
26B	FS	1.18E+00	1.52E-01	3.76E-01	8.00E-02	0.04		
24F	SFS	1.37E+00	1.48E-01	4.47E-01	2.70E-01	0.12	2.84	
24F	FS	1.41E+00	1.10E-01	2.30E-01	3.10E-01	0.14		
Degrees of Freedom:	103	1.51E+00			5.79E-01	0.26	14.65	Average
		1.24E+00			1.14E+00	0.51	109.33	Std Deviation
		1.79E-01			0.00E+00	0.00	-68.10	Minimum
		7.19E+00			6.09E+00	2.74	725.49	Maximum
t value*		1.04E+00			0.00E+00	0.00	-6.33	Median
1.67		1.72E+00			7.66E-01	0.34	32.57	μ_α 95%CL
2.00		1.76E+00			8.03E-01	0.36	36.09	μ_α 97.5%C

*Look up value from Table 1 in Appendix B of NUREG/CR-5849.

Notes: Background value of 1.1 pCi/g Th-232 subtracted from Gross Th-232 result.
Background value of 9 µR/hr subtracted from Gross Exposure Rate measurements.
FS = Final sample.
SFS = Duplicate final sample.
NRC = Samples taken with the NRC.
SNRC = Duplicate counts of thr NRC samples.

Th-232 is calculated using the analytical data and correcting for background. The measured background value is 1.1 pCi/g Th-232.
Unity is calculated by summing the fractions of Th-232, Th-228, and Th-230 activity concentrations divided by their respective acceptance criteria, i.e., Th-232 + Th-228 / 10 pCi/g + Th-230 / 14 pCi/g.
The average and standard deviation of unity is calculated for each final survey grid.
Finally, the average, standard deviation, median, and μ_α (95 and 97.5% confidence level) are calculated for the entire survey unit.
The average and standard deviation calculation for the entire survey unit include the weighted average calculated for any grids that contain elevated areas.

Table B-4
Comparison of NRC Laboratory Results and
Kaiser Adjacent Land Remediation Laboratory Results

	All Samples			
	Sample ID	Outreach Th-232 (pCi/g)	ORISE Th-233 (pCi/g)	Percent Relative Bias
1	25D	2.67	4.12	-35
2	25C	1.84	2.44	-25
3	27A	0.716	1.13	-37
4	28C	1.02	1.58	-35
5	29B	1.33	1.44	-8
6	71C	1.05	1.36	-23
7	72D	0.883	1.41	-37
8	73B	3.91	7.53	-48
9	74D	8.71	25.6	-66
10	75A	1.45	1.33	9
11	76A	1.8	1.91	-6
12	77B	1.1	1.6	-31
13	78D	1.26	1.34	-6
14	78C	1.22	1.5	-19
15	79B	0.794	1.33	-40
16	80A	1.05	1.26	-17
17	81A	0.998	1.17	-15
18	82B	0.649	0.88	-26
19	83C	1.25	6.57	-81
20	84D	0.9	1.26	-29
21	119A	1.28	1.67	-23
22	120A	1.01	1.36	-26
23	121A	0.885	1.21	-27
24	122C	0.945	1.4	-33
25	123A	5.63	28.9	-81
26	142	1.32	1.31	1
27	143	0.813	1.14	-29
28	144	1	1.21	-17
29	152C	0.525	1.6	-67
30	47A	0.678	1.1	-38
31	47D	0.429	1.2	-64
32	42D	0.841	1.1	-24
33	40A	0.655	1.2	-45
34	41B	0.841	1.4	-40
35	41D	0.473	1.5	-68
36	37C	0.684	1.4	-51
37	166A	2.03	3.9	-48
38	58B	1.28	1.9	-33
39	60C	0.563	1.2	-53
40	54C	0.817	1.8	-55
41	161A	1.02	1.12	-9
42	BKHS 01	0.443	0.7	-37
43	BKHS 02	0.579	1.2	-52
44	162D	0.845	0.7	21
	Average:	1.37	2.91	-33
	Std dev.:	1.46	5.55	22

Appendix C

Survey Instrumentation QA/QC

Applied Health Physics, Inc.

2986 Industrial Blvd., Bethel Park, Pa 15102 Phone: (412) 835-9555 Fax: (412) 835-9559

CALIBRATION CERTIFICATE

Applied Health Physics, Inc.		**Contact**	Todd Mobley	**PO #**	
2986 Industrial Blvd.		**Contact Phone:**	(412) 835-9555	**Calibration Date**	8/31/00
		Contact	Celia Rajkovich		
		Contact Phone:			
Bethel Park	PA 15102				

Instrument SN	104630	**Probe SN**	N/A
Manufacturer	Ludlum	**Probe Manufacturer**	Ludlum
Model	19	**Probe Model**	Internal Scintillator

Scale 1 25

Source	Reading
Background	Background

Scale 2 50

Source	Reading
Background	Background

Scale 3 250

Source	Reading
Background	Background
200	200

Scale 4 500

Source	Reading
200	200
400	370

Scale 5 5000

Source	Reading
2000	2200
4000	3600

Scale 6

Source	Reading

Units for above readings: uR/hr

Battery Check: 46 uR/h **Check Source:** N/A

Technician: C. Barto Cynthia Barto

Exposure/Dose Rate **Electronic Calibration** **Efficiency Check** **Quality Assurance:** T. Mobley

Cs-137 ☐ **Ra-226** ☑ **MP-500 S#94932** ☐

Alpha % N/A

Beta % N/A

Gamma % N/A

Geometry to Source: Perpendicular

Receiving comments: OK

Maintenance comments and scale adjustments: Calibrated for lease to Earth, Inc.

Temperature: 80.8

Humidity % 58

Note: If no scale adjustments are listed, readings are as found.

Calibration Due Date: 2/28/01

Notice: Applied Health Physics, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology under Nuclear Regulatory Commission License # 37-09135-01 and PA State License # PA-0228. This Calibration system conforms to the requirements of NRC regulation 10-CFR-34, 10-CFR-35, ANSI/NCSL Z540-1-1994, ANSI-STD N323A-1997 and N323-1978. This certificate is an essential record and should be maintained for inspection by the regulatory agency.

Earth Sciences Consultants, Inc.
One Triangle Lane
Export, PA 15632
(724) 733-3000

Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument S/N:	19
Instrument S/N:	104630
Detector S/N:	n/a
Detector S/N:	n/a
Calibration Due:	2/28/01

Source S/N:	99.2193
Source DPM:	n/a
Radiation Detected:	gamma
Acceptable Range: (Refer to ESC/HPM-2-1)	285
	349

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
10/2/00	10	330	320	D.Baker	None
10/3/00	13	335	322	D.Baker	None
10/4/00	12	320	308	D.Baker	None
10/5/00	12	335	323	D.Baker	None
10/6/00	11	330	319	D.Baker	None
10/7/00	11.5	300	288.5	D.Baker	None
10/9/00	13.5	300	286.5	D.Baker	None
10/10/00	13.5	310	296.5	D.Baker	None
10/11/00	13	300	287	D.Baker	None
10/12/00	13	300	287	D.Baker	None
10/13/00	13.5	310	296.5	D.Baker	None
10/14/00	13	300	287	D.Baker	None
10/16/00	12.5	310	297.5	D.Baker	None
10/17/00	13	310	297	D.Baker	None
10/18/00	13	300	287	D.Baker	None
10/19/00	12.5	310	297.5	D.Baker	None
10/20/00	13	320	307	D.Baker	None
10/23/00	13	300	287	D.Baker	None

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Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument S/N:	19
Instrument S/N:	104630
Detector S/N:	n/a
Detector S/N:	n/a
Calibration Due:	2/28/01

Source S/N:	99.2193
Source DPM:	n/a
Radiation Detected:	gamma
Acceptable Range: (Refer to ESC/HPM-2-1)	285 – 349

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
11/2/00	12	300	288	D.Baker	None
11/3/00	12	310	298	D.Baker	None
11/6/00	12.5	300	287.5	D.Baker	None
11/7/00	12.5	310	297.5	D.Baker	None
11/8/00	13	300	287	D.Baker	None
11/9/00	13	310	297	D.Baker	None
11/10/00	13	300	287	D.Baker	None
11/13/00	12.5	310	297.5	D.Baker	None
11/14/00	12.5	300	287.5	D.Baker	None
11/15/00	13	300	287	D.Baker	None
11/16/00	13.5	300	286.5	D.Baker	None
11/17/00	13	310	297	D.Baker	None
11/18/00	13	310	297	D.Baker	None
11/20/00	13.5	300	286.5	D.Baker	None
11/21/00	13	310	297	D.Baker	None

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Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	19		Source S/N:	99.2193
Instrument S/N:	104630		Source DPM:	n/a
Detector Model:	n/a		Radiation Detected:	gamma
Detector S/N:	n/a		Acceptable Range:	285
Calibration Due:	2/28/01		(Refer to ESC/HPM-2-1)	349

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
12/1/00	10	300	290	Todd Brautigam	None
12/4/00	9	310	301	Todd Brautigam	None
12/5/00	9	300	291	Todd Brautigam	None
12/6/00	9	300	291	Todd Brautigam	None
12/7/00	9	315	306	Todd Brautigam	None
12/8/00	9	315	306	Todd Brautigam	None
12/9/00	10	315	305	Todd Brautigam	None
12/11/00	10	310	300	Todd Brautigam	None
12/12/01	10	310	300	Todd Brautigam	None
12/13/01	10	310	300	Todd Brautigam	None
12/14/01	10	315	305	Todd Brautigam	None
12/15/01	11	320	309	Todd Brautigam	None
12/16/01	11	300	289	Todd Brautigam	None
12/17/01	11	310	299	Todd Brautigam	None
12/18/01	10	310	300	Todd Brautigam	None
12/19/01	10	320	310	Todd Brautigam	None
12/20/01	10	315	305	Todd Brautigam	None
12/21/01	10	310	300	Todd Brautigam	None
12/22/01	9	310	301	Todd Brautigam	None

Earth Sciences Consultants, Inc.
One Triangle Lane
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(724) 733-3000

Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument S/N:	19
Instrument S/N:	104630
Detector S/N:	n/a
Detector S/N:	n/a
Calibration Due:	2/28/01

Source S/N:	99.2193
Source DPM:	n/a
Radiation Detected:	gamma
Acceptable Range: (Refer to ESC/HPM-2-1)	285
	349

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
1/3/01	12	300	288	D.Baker	None
1/4/01	12	310	298	D.Baker	None
1/5/01	12.5	310	297.5	D.Baker	None
1/8/01	13	310	297	D.Baker	None
1/9/01	13.5	310	296.5	D.Baker	None
1/10/01	13	310	297	D.Baker	None
1/11/01	13	310	297	D.Baker	None
1/12/01	12.5	310	297.5	D.Baker	None
1/15/01	13	320	307	D.Baker	None
1/16/01	13	310	297	D.Baker	None
1/17/01	12.5	310	297.5	D.Baker	None
1/18/01	13	310	297	D.Baker	None
1/19/01	13	310	297	D.Baker	None
1/20/01	13	300	287	D.Baker	None
1/21/01	12.5	310	297.5	D.Baker	None
1/22/01	13	310	297	D.Baker	None
1/23/01	13	310	297	D.Baker	None
1/24/01	13	310	297	D.Baker	None
1/25/01	12.5	310	297.5	D.Baker	None
			0		

Applied Health Physics,Inc.

2986 Industrial Blvd., Bethel Park, Pa 15102 Phone: (412) 835-9555 Fax: (412) 835-9559

CALIBRATION CERTIFICATE

Applied Health Physics, Inc.		**Contact**	Todd Mobley	**PO #**	
2986 Industrial Blvd.		**Contact Phone:**	(412) 835-9555	**Calibration Date**	1/29/01
		Contact	Cindy Barto		
		Contact Phone:			
Bethel Park	PA 15102				

Instrument SN	104630	**Probe SN**	N/A
Manufacturer	Ludlum	**Probe Manufacturer**	Ludlum
Model	19	**Probe Model**	Internal Scintillator

Scale 1 25

Source	Reading
Background]	Background

Scale 2 50

Source	Reading
Background	Background

Scale 3 250

Source	Reading
Background	Background
200	220

Scale 4 500

Source	Reading
200	210
400	380

Scale 5 5000

Source	Reading
2000	2200
4000	3600

Scale 6

Source	Reading

Units for above readings: uR/hr

Battery Check: 42 uR/h **Check Source:** N/A **Technician:** C. Barto

Cynthia Barto

Exposure/Dose Rate **Electronic Calibration** **Efficiency Check** **Quality Assurance:** T. Mobley

Cs-137 ☐ **Ra-226** ☑ **MP-500 S#94932** ☐

Alpha % N/A

Beta % N/A

Gamma % N/A

Geometry to Source: Perpendicular

Receiving comments: N/A

Maintenance comments and scale adjustments: Audio & reset OK
Calibrated for lease to Earth Sciences.

Temperature: 73.7

Humidity % 27

Note: If no scale adjustments are listed, readings are as found.

Calibration Due Date: 7/29/01

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Earth Sciences Consultants, Inc.
One Triangle Lane
Export, PA 15632
(724) 733-3000

Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument S/N:	19
Instrument S/N:	104630
Detector S/N:	n/a
Detector S/N:	n/a
Calibration Due:	7/29/01

Source S/N:	99.2193
Source DPM:	n/a
Radiation Detected:	gamma
Acceptable Range: (Refer to ESC/HPM-2-1)	285
	307

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
1/30/01	11	300	289	D.Baker	Re-Cal.
1/31/01	10	310	300	D.Baker	None
2/1/01	10	310	300	D.Baker	None
2/2/01	11	300	289	D.Baker	None
2/3/01	10	310	300	D.Baker	None
2/4/01	10	310	300	D.Baker	None
2/5/01	10	310	300	D.Baker	None
2/6/01	10	310	300	D.Baker	None
2/7/01	11	300	289	D.Baker	None
2/8/01	11	310	299	D.Baker	None
2/9/01	11	310	299	D.Baker	None
2/10/01	11	300	289	D.Baker	None
2/11/01	10	310	300	D.Baker	None
2/12/01	11	300	289	D.Baker	None
2/13/01	10	310	300	D.Baker	None
2/14/01	11	310	299	D.Baker	None
2/15/01	10	300	290	D.Baker	None
2/16/01	10	310	300	D.Baker	None
2/17/01	10	300	290	D.Baker	None
2/18/01	11	310	299	D.Baker	None
2/19/01	10	310	300	D.Baker	None
2/21/01	10	300	290	D.Baker	None
2/22/01	10	310	300	D.Baker	None

Applied Health Physics,Inc.

2986 Industrial Blvd., Bethel Park, Pa 15102 Phone: (412) 835-9555 Fax: (412) 835-9559

CALIBRATION CERTIFICATE

Applied Health Physics, Inc.		**Contact**	Todd Mobley	**PO #**	N/A
2986 Industrial Blvd.		**Contact Phone:**	(412) 835-9555	**Calibration Date**	3/12/01
		Contact	Cindy Barto		
		Contact Phone:			
Bethel Park	PA 15102				

Instrument SN	104630	**Probe SN**	N/A
Manufacturer	Ludlum	**Probe Manufacturer**	Ludlum
Model	19	**Probe Model**	Internal Scintillator

Scale 1 25

Source	Reading
BKG	BKG

Scale 2 50

Source	Reading
BKG	BKG

Scale 3 250

Source	Reading
BKG	BKg
200	200

Scale 4 500

Source	Reading
200	200
400	400

Scale 5 5000

Source	Reading
2000	2000
4000	3600

Scale 6

Source	Reading

Units for above readings: uR/hr

Battery Check: 42uR/hr **Check Source:** N/A **Technician:** V. Petriano

Exposure/Dose Rate **Electronic Calibration** **Efficiency Check** **Quality Assurance:** C. Barto

Cs-137 ☐ **Ra-226** ☑ **MP-500** ☑ **S#94932**

Alpha % N/A

Beta % N/A

Gamma % N/A

Geometry to Source: Perpendicular/Electronic

Receiving comments: None

Maintenance comments and scale adjustments: Lower scales pulsed for linearity

Temperature: 73.99

Humidity % 28%

Note: If no scale adjustments are listed, readings are as found.

Calibration Due Date: 9/12/01

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One Triangle Lane
Export, PA 15632
(724) 733-3000

Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument S/N:	19
Instrument S/N:	104630
Detector S/N:	n/a
Detector S/N:	n/a
Calibration Due:	7/29/01

Source S/N:	99.2193
Source DPM:	n/a
Radiation Detected:	gamma
Acceptable Range: (Refer to ESC/HPM-2-1)	285
	307

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
2/27/01	10	300	290	D.Baker	None
2/28/01	10	310	300	D.Baker	None
3/1/01	9	300	291	D.Baker	None
3/2/01	10	310	300	D.Baker	None
3/3/01	10	300	290	D.Baker	None
3/4/01	10	300	290	D.Baker	None
3/5/01	9	310	301	D.Baker	None
3/6/01	9	310	301	D.Baker	None
3/7/01	10	310	300	D.Baker	None
3/8/01	10	300	290	D.Baker	None
					Elc.Calibration
					Cal Due: 9-12-01
3/13/01	10	310	300	D.Baker	None
3/14/01	10	300	290	D.Baker	None
3/15/01	9	310	301	D.Baker	None
3/16/01	9	300	291	D.Baker	None
3/19/01	10	300	290	D.Baker	None
3/20/01	9	310	301	D.Baker	None
3/26/01	9	300	291	D.Baker	None
3/27/01	9	300	291	D.Baker	None
3/28/01	10	300	290	D.Baker	None
3/29/01	9	310	301	D.Baker	None
3/30/01	9	310	301	D.Baker	None

Earth Sciences Consultants, Inc.
One Triangle Lane
Export, PA 15632
(724) 733-3000

Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument S/N:	19
Instrument S/N:	104630
Detector S/N:	n/a
Detector S/N:	n/a
Calibration Due:	9/12/01

Source S/N:	99.2193
Source DPM:	n/a
Radiation Detected:	gamma
Acceptable Range: (Refer to ESC/HPM-2-1)	285 – 307

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
4/2/01	9	300	291	D.Baker	None
4/3/01	9	300	291	D.Baker	None
4/4/01	10	310	300	D.Baker	None
4/5/01	10	310	300	D.Baker	None
4/6/01	10	310	300	D.Baker	None
4/7/01	9	300	291	D.Baker	None
4/9/01	9	300	291	D.Baker	None
4/20/01	9	300	291	D.Baker	None
4/21/01	9	300	291	D.Baker	None
5/7/01	9	310	301	D.Baker	None
5/8/01	10	310	300	D.Baker	None
5/9/01	10	310	300	D.Baker	None
5/10/01	10	310	300	D.Baker	None
5/11/01	10	300	290	D.Baker	None
5/29/01	9	310	301	D.Baker	None
5/30/01	9	300	291	D.Baker	None

Applied Health Physics, Inc.

2986 Industrial Blvd., Bethel Park, Pa 15102 Phone: (412) 835-9555 Fax: (412) 835-9559

CALIBRATION CERTIFICATE

Applied Health Physics, Inc.		**Contact**	Todd Mobley	**PO #**	
2986 Industrial Blvd.		**Contact Phone:**	(412) 835-9555	**Calibration Date**	9/ 5/00
		Contact	Celia Rajkovich		
		Contact Phone:			
Bethel Park	PA 15102				

Instrument SN	75448	**Probe SN**	112016
Manufacturer	Ludlum	**Probe Manufacturer**	Ludlum
Model	2221	**Probe Model**	44-10

Scale 1 X1

Source	Reading
200	200
400	401

Scale 2 X10

Source	Reading
2000	1984
4000	4002

Scale 3 X100

Source	Reading
20000	19864
40000	40038

Scale 4 X1K

Source	Reading
200000	198656
400000	400384

Scale 5

Source	Reading

Scale 6

Source	Reading

Units for above readings: CPM

Battery Check: 5.0 **Check Source:** N/A **Technician:** C. Barto Cynthia Barto

Exposure/Dose Rate **Electronic Calibration** **Efficiency Check** **Quality Assurance:** T. Mobley

Cs-137 ☐ **Ra-226** ☑ **MP-500** ☑ **S#94932**

Alpha %

Beta %

Gamma %

Geometry to Source: Perpendicular/Electronic

Receiving comments: OK

Maintenance comments and scale adjustments:
Count Rate Efficiency = 95000CPM/mR/h Ra-226
Probe efficiency = 19.7% Ra-226
Audio OK
High voltage set @1115
Calibrated for Earth Sciences

Temperature: 78.2

Humidity % 42

Note: If no scale adjustments are listed, readings are as found.

Calibration Due Date: 3/5/01

Notice: Applied Health Physics, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology under Nuclear Regulatory Commission License # 37-09135-01 and PA State License # PA-0228. This Calibration system conforms to the requirements of NRC regulation 10-CFR-34, 10-CFR-35, ANSI/NCSL Z540-1-1994, ANSI-STD N323A-1997 and N323-1978. This certificate is an essential record and should be maintained for inspection by the regulatory agency.

Earth Sciences Consultants, Inc.
One Triangle Lane
Export, PA 15632
(724) 733-3000

Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	2221
Instrument S/N:	75448
Detector Model:	44-10-C
Detector S/N:	112016
	3/5/01

Source S/N:	99.2193
Source DPM:	na
Radiation Detected:	gamma
Acceptable Range: (Refer to ESC/HPM-2-1)	214228/238394 scaler
	203707/248975 rate

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
10/2/00	3382	232421	229039	D.Baker	none
10/3/00	2909	228999	226090	D.Baker	none
10/4/00	3021	227773	224752	D.Baker	none
10/5/00	2989	227989	225000	D.Baker	none
10/6/00	3001	228019	225018	D.Baker	none
10/7/00	2933	232978	230045	D.Baker	none
10/9/00	2964	238035	235071	D.Baker	none
10/10/00	2928	229868	226940	D.Baker	none
10/11/00	2909	239003	236094	D.Baker	none
10/12/00	3003	239771	236768	D.Baker	none
10/13/00	2839	233467	230628	D.Baker	Change Battery
10/14/00	3333	227332	223999	D.Baker	none
10/16/00	3634	224142	220508	D.Baker	none
10/17/00	3206	224698	221492	D.Baker	none
10/18/00	3416	235986	232570	D.Baker	none
10/19/00	3394	231649	228255	D.Baker	none
10/20/00	3479	236190	232711	D.Baker	none
10/23/00	3398	231949	228551	D.Baker	none

Earth Sciences Consultants, Inc.
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Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	2221
Instrument S/N:	75448
Detector Model:	44-10-C
Detector S/N:	112016
	3/5/01

Source S/N:	99.2193
Source DPM:	na
Radiation Detected:	gamma
Acceptable Range: (Refer to ESC/HPM-2-1)	214228/238394 scaler
	203707/248975 rate

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
11/2/00	3334	232549	229215	D.Baker	none
11/3/00	3290	228359	225069	D.Baker	none
11/6/00	3303	218107	214804	D.Baker	none
11/7/00	3303	218367	215064	D.Baker	none
11/8/00	3504	221708	218204	D.Baker	none
11/9/00	3375	222942	219567	D.Baker	none
11/10/00	3479	221546	218067	D.Baker	none
11/13/00	3891	228676	224785	D.Baker	none
11/14/00	3294	227970	224676	D.Baker	done at 35 deg. F
11/15/00	3647	232335	228688	D.Baker	none
11/16/00	3409	238989	235580	D.Baker	none
11/17/00	3426	237482	234056	D.Baker	none
11/18/00	3367	234451	231084	D.Baker	none
11/20/00	3316	229168	225852	D.Baker	none
11/21/00	3396	234891	231495	D.Baker	none

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Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	2221		Source S/N:	99.2193
Instrument S/N:	75448		Source DPM:	na
Detector Model:	44-10-C		Radiation Detected:	gamma
Detector S/N:	112016		Acceptable Range:	214228/238394 scaler
Calibration Due:	3/5/01		(Refer to ESC/HPM-2-1)	203707/248975 rate

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
12/1/00	3299	220914	217615	Todd Brautigam	
12/4/00	3308	231429	228121	Todd Brautigam	
12/5/00	3232	227232	224000	Todd Brautigam	
12/6/00	3377	224004	220627	Todd Brautigam	
12/7/00	3473	219758	216285	Todd Brautigam	
12/8/00	3373	223562	220189	Todd Brautigam	
12/9/00	3486	226575	223089	Todd Brautigam	
12/11/00	3545	234750	231205	Todd Brautigam	
12/12/01	3345	232491	229146	Todd Brautigam	
12/13/01	3467	229948	226481	Todd Brautigam	
12/14/01	3501	225476	221975	Todd Brautigam	
12/15/01	3469	219998	216529	Todd Brautigam	
12/16/01	3356	220873	217517	Todd Brautigam	
12/17/01	3394	238477	235083	Todd Brautigam	
12/18/01	3548	226547	222999	Todd Brautigam	
12/19/01	3467	225476	222009	Todd Brautigam	
12/20/01	3399	234971	231572	Todd Brautigam	
12/21/01	3426	220154	216728	Todd Brautigam	
12/22/01	3487	230465	226978	Todd Brautigam	

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Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	2221
Instrument S/N:	75448
Detector Model:	44-10-C
Detector S/N:	112016
Calibration Due:	3/5/01

Source S/N:	99.2193
Source DPM:	na
Radiation Detected:	gamma
Acceptable Range: (Refer to ESC/HPM-2-1)	214228/238394 scaler
	203707/248975 rate

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
1/3/01	3227	232676	229449	D.Baker	none
1/4/01	3308	233200	229892	D.Baker	none
1/5/01	3309	228477	225168	D.Baker	none
1/8/01	3365	232553	229188	D.Baker	none
1/9/01	3369	233112	229743	D.Baker	none
1/10/01	3201	233723	230522	D.Baker	none
1/11/01	3324	225100	221776	D.Baker	none
1/12/01	3378	224819	221441	D.Baker	none
1/15/01	3424	219661	216237	D.Baker	none
1/16/01	3390	221069	217679	D.Baker	none
1/17/10	3406	234570	231164	D.Baker	none
1/18/01	3358	225487	222129	D.Baker	none
1/19/01	3315	224457	221142	D.Baker	none
1/20/01	3345	222107	218762	D.Baker	none
1/21/01	3254	221864	218610	D.Baker	none
1/22/01	3158	222468	219310	D.Baker	none
1/23/01	3365	227783	224418	D.Baker	none
1/24/01	3186	228011	224825	D.Baker	none
1/25/01	3208	226948	223740	D.Baker	none

Applied Health Physics,Inc.

2986 Industrial Blvd., Bethel Park, Pa 15102 Phone: (412) 835-9555 Fax: (412) 835-9559

CALIBRATION CERTIFICATE

Applied Health Physics, Inc.		**Contact**	Todd Mobley	**PO #**	
2986 Industrial Blvd.		**Contact Phone:**	(412) 835-9555	**Calibration Date**	1/29/01
		Contact	Cindy Barto		
		Contact Phone:			
Bethel Park	PA 15102				

Instrument SN	75448	**Probe SN**	112016
Manufacturer	Ludlum	**Probe Manufacturer**	Ludlum
Model	2221	**Probe Model**	44-10w/Shielding

Scale 1 X1

Source	Reading
100	100
300	300

Scale 2 X10

Source	Reading
1000	1000
3000	3000

Scale 3 X100

Source	Reading
10000	10000
30000	30000

Scale 4 X1K

Source	Reading
100000	100000
300000	300000

Scale 5

Source	Reading

Scale 6

Source	Reading

Units for above readings: CPM

Battery Check: 5.2 **Check Source:** N/A **Technician:** C. Barto Cynthia Barto

Exposure/Dose Rate **Electronic Calibration** **Efficiency Check** **Quality Assurance:** T. Mobley

Cs-137 ☐ **Ra-226** ☑ **MP-500** ☑ **S#94932**

Alpha % 11.3, Ra-226

Beta % N/A

Gamma % N/A

Geometry to Source: Perpendicular/Electronic

Receiving comments: OK

Maintenance comments and scale adjustments: Count rate efficiency=77436CPM/mR/h Ra-226
Calibration performed with detector shielding in place.
Calibrated for lease to Earth Sciences

Temperature: 73.4

Humidity % 28

Note: If no scale adjustments are listed, readings are as found.

Calibration Due Date: 7/29/01

Notice: Applied Health Physics, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology under Nuclear Regulatory Commission License # 37-09135-01 and PA State License # PA-0228. This Calibration system conforms to the requirements of NRC regulation 10-CFR-34, 10-CFR-35, ANSI/NCSL Z540-1-1994, ANSI-STD N323A-1997 and N323-1978. This certificate is an essential record and should be maintained for inspection by the regulatory agency.

Earth Sciences Consultants, Inc.
One Triangle Lane
Export, PA 15632
(724) 733-3000

Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	2221	Source S/N:	99.2193
Instrument S/N:	75448	Source DPM:	na
Detector Model:	44-10-C	Radiation Detected:	gamma
Detector S/N:	112016	Acceptable Range: (Refer to ESC/HPM-2-1)	190836/192414 scaler
Calibration Due:	7/29/01		172463/210788 rate

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
1/30/01	2903	194269	191366	D.Baker	None
1/31/01	2802	194674	191872	D.Baker	None
2/1/01	2976	194534	191558	D.Baker	None
2/2/01	2948	193905	190957	D.Baker	None
2/3/01	2878	194705	191827	D.Baker	None
2/4/01	2987	194751	191764	D.Baker	None
2/5/01	2822	194586	191764	D.Baker	None
2/6/01	2915	194087	191172	D.Baker	None
2/7/01	2873	194270	191397	D.Baker	None
2/8/01	2847	193690	190843	D.Baker	None
2/9/01	2860	194482	191622	D.Baker	None
2/10/01	2915	194367	191452	D.Baker	None
2/11/01	2874	194327	191453	D.Baker	None
2/12/01	2861	194670	191809	D.Baker	None
2/13/01	2702	195004	192302	D.Baker	None
2/14/01	2925	194477	191552	D.Baker	None
2/15/01	2880	194426	191546	D.Baker	None
2/16/01	2931	194913	191982	D.Baker	None
2/17/01	3005	194240	191235	D.Baker	None
2/18/01	2928	195021	192093	D.Baker	None
2/19/01	3001	194305	191304	D.Baker	None
2/22/01	2960	195309	192349	D.Baker	None

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Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	2221	Source S/N:	99.2193
Instrument S/N:	75448	Source DPM:	na
Detector Model:	44-10-C	Radiation Detected:	gamma
Detector S/N:	112016	Acceptable Range: (Refer to ESC/HPM-2-1)	190836/192414 scaler
Calibration Due:	7/29/01		172463/210788 rate

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
2/27/01	2879	194996	192117	D.Baker	None
2/28/01	2923	195007	192084	D.Baker	None
3/1/01	2945	195214	192269	D.Baker	None
3/2/01	2867	195012	192145	D.Baker	None
3/3/01	2916	194889	191973	D.Baker	None
3/4/01	2877	194799	191922	D.Baker	None
3/5/01	2883	195066	192183	D.Baker	None
3/6/01	2794	194776	191982	D.Baker	None
3/7/01	2907	194517	191610	D.Baker	None
3/8/01	2866	194677	191811	D.Baker	None
3/12/01	2837	194883	192046	D.Baker	None
3/13/01	2791	195121	192330	D.Baker	None
3/14/01	2874	194688	191814	D.Baker	None
3/15/01	2933	193999	191066	D.Baker	None
3/16/01	2864	194098	191234	D.Baker	None
3/19/01	2918	194578	191660	D.Baker	None
3/20/01	2795	194667	191872	D.Baker	None
3/26/01	2845	194321	191476	D.Baker	None
3/27/01	2955	195011	192056	D.Baker	None
3/28/01	2867	194398	191531	D.Baker	None
3/29/01	2793	194026	191233	D.Baker	None
3/30/01	2879	195002	192123	D.Baker	None

Earth Sciences Consultants, Inc.
One Triangle Lane
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Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	2221	Source S/N:	99.2193
Instrument S/N:	75448	Source DPM:	na
Detector Model:	44-10-C	Radiation Detected:	gamma
Detector S/N:	112016	Acceptable Range: (Refer to ESC/HPM-2-1)	190836/192414 scaler
Calibration Due:	7/29/01		172463/210788 rate

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
4/2/01	2899	194561	191662	D.Baker	None
4/3/01	2916	195002	192086	D.Baker	None
4/4/01	2766	194665	191899	D.Baker	None
4/5/01	2816	194667	191851	D.Baker	None
4/6/01	2907	194789	191882	D.Baker	None
4/7/01	2786	193998	191212	D.Baker	None
4/9/01	2922	193789	190867	D.Baker	None
4/20/01	2788	194567	191779	D.Baker	None
4/21/01	2806	194335	191529	D.Baker	None
5/7/01	2834	195000	192166	D.Baker	None
5/8/01	2861	194663	191802	D.Baker	None
5/9/01	2910	194882	191972	D.Baker	None
5/10/01	2799	194237	191438	D.Baker	None
5/11/01	2903	193996	191093	D.Baker	None
5/29/01	2844	194361	191517	D.Baker	None
5/30/01	2948	194227	191279	D.Baker	None

Applied Health Physics,Inc.

2986 Industrial Blvd., Bethel Park, Pa 15102 Phone: (412) 835-9555 Fax: (412) 835-9559

CALIBRATION CERTIFICATE

Applied Health Physics, Inc.		**Contact**	Todd Mobley	**PO #**	
2986 Industrial Blvd.		**Contact Phone:**	(412) 835-9555	**Calibration Date**	1/29/01
		Contact	Cindy Barto		
		Contact Phone:			
Bethel Park	PA 15102				

Instrument SN	75473	**Probe SN**	081084
Manufacturer	Ludlum	**Probe Manufacturer**	Ludlum
Model	2221	**Probe Model**	44-10

Scale 1 X1

Source	Reading
100	100
300	300

Scale 2 X10

Source	Reading
1000	1000
3000	3000

Scale 3 X100

Source	Reading
10000	10000
30000	30000

Scale 4 X1K

Source	Reading
100000	100000
300000	300000

Scale 5

Source	Reading

Scale 6

Source	Reading

Units for above readings: CPM

Battery Check: 5.2 **Check Source:** N/A **Technician:** C. Barto Cynthia Barto

Exposure/Dose Rate **Electronic Calibration** **Efficiency Check** **Quality Assurance:** T. Mobley

Cs-137 ☐ **Ra-226** ☑ **MP-500** ☑ **S#94932**

Alpha % 16.6, Ra-226

Beta % N/A

Gamma % N/A

Geometry to Source: Perpendicular/Electronic

Receiving comments: OK

Maintenance comments and scale adjustments: Count rate efficiency = 80814CPM/mR/h Ra-226
Calibration performed with detector shielding in place.
Calibrated for lease to Earth Sciences

Temperature: 73.6

Humidity % 28

Note: If no scale adjustments are listed, readings are as found.

Calibration Due Date: 7/29/01

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Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	2221	Source S/N:	99.2193
Instrument S/N:	75473	Source DPM:	na
Detector Model:	44-10	Radiation Detected:	gamma
Detector S/N:	81084	Acceptable Range: (Refer to ESC/HPM-2-1)	320054/341837 scaler
Calibration Due:	7/29/01		297851/364040 rate

Date	Background Count Rate	Gross Source Count Rate	Net Source Count Rate	Technician	Comments
2/12/01	3468	334872	331404	D.Baker	None
2/13/01	3485	339334	335849	D.Baker	None
2/14/01	3336	340069	336733	D.Baker	None
2/15/01	3558	340346	336788	D.Baker	None
2/16/01	3596	339073	335477	D.Baker	None
2/17/01	3612	330150	326538	D.Baker	None
2/18/01	3272	334987	331715	K. Brown	None
2/19/01	3671	332863	329192	K. Brown	None
2/22/01			0	D.Baker	Returned to AHP
			0		
			0		
			0		
			0		
			0		
			0		

Earth Sciences Consultants, Inc.
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Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	2929
Instrument S/N:	95574
Detector Model:	43-10-1
Detector S/N:	94383
Calibration Due:	9/5/01

Source S/N:	99TH2204141
Source Amount	0.007 mCi
Radiation Detected:	alpha/beta
Acceptable Range:	3410/3561 α
(Refer to ESC/HPM-2-1)	3164/3601 β

Date	Background Count Rate Alpha (cpm)	Background Count Rate Beta (cpm)	Gross α Source Count Rate (cpm)	Gross β Source Count Rate (cpm)	Net α Source Count Rate (cpm)	Net β Source Count Rate (cpm)	Technician	Comments
1/3/01	0	49	3492	3292	3492	3243	dsb	none
1/4/01	0	56	3466	3510	3466	3454	dsb	none
1/5/01	0	43	3497	3314	3497	3271	dsb	none
1/8/01	0	59	3476	3300	3476	3241	dsb	none
1/9/01	0	46	3473	3284	3473	3238	dsb	none
1/10/01	0	47	3469	3326	3469	3279	dsb	none
1/11/01	0	61	3422	3445	3422	3384	dsb	none
1/12/01	0	51	3458	3317	3458	3266	dsb	none
1/15/01	0	53	3439	3290	3439	3237	dsb	none
1/16/01	0	56	3554	3301	3554	3245	dsb	none
1/17/01	0	49	3487	3416	3487	3367	dsb	none
1-1801	0	54	3465	3312	3465	3258	dsb	none
1/19/01	0	46	3429	3349	3429	3303	dsb	none
1/20/01	0	63	3414	3406	3414	3343	dsb	none
1/21/01	0	54	3436	3253	3436	3199	dsb	none
1/22/01	1	54	3464	3306	3463	3252	dsb	none
1/23/01	1	56	3506	3381	3505	3325	dsb	none
1/24/01	0	70	3421	3439	3421	3369	dsb	none
1/25/01	0	38	3397	3296	3397	3258	dsb	none

Earth Sciences Consultants, Inc.
One Triangle Lane
Export, PA 15632
(724) 733-3000

Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	2929
Instrument S/N:	95574
Detector Model:	43-10-1
Detector S/N:	94383
Calibration Due:	9/5/01

Source S/N:	99TH2204141	93-1256C
Source Amount	0.007 mCi	27000 DPM
Radiation Detected:	alpha	beta
Acceptable Range:	3230/3494 α	3002/3451 β
(Refer to ESC/HPM-2-1)		

Date	Background Count Rate Alpha (cpm)	Background Count Rate Beta (cpm)	Gross α Source Count Rate (cpm)	Gross β Source Count Rate (cpm)	Net α Source Count Rate (cpm)	Net β Source Count Rate (cpm)	Technician	Comments
2/1/01	1	55	3365	3332	3364	3277	D.Baker	None
2/2/01	1	44	3381	3228	3380	3184	D.Baker	None
2/3/01	0	38	3296	3242	3296	3204	D.Baker	None
2/4/01	0	46	3423	3337	3423	3291	D.Baker	None
2/5/01	1	64	3469	3106	3468	3042	D.Baker	None
2/6/01	0	55	3398	3225	3398	3170	D.Baker	None
2/7/01	0	48	3417	3167	3417	3119	D.Baker	None
2/8/01	0	43	3242	3224	3242	3181	D.Baker	None
2/9/01	0	43	3346	3336	3346	3293	D.Baker	None
2/10/01	0	40	3370	3249	3370	3209	D.Baker	None
2/11/01	0	46	3316	3243	3316	3197	D.Baker	None
2/12/01	0	65	3397	3216	3397	3151	D.Baker	None
2/13/01	0	39	3367	3276	3367	3237	D.Baker	None
2/14/01	0	54	3268	3264	3268	3210	D.Baker	None
2/15/01	1	41	3395	3227	3394	3186	D.Baker	None
2/16/01	0	71	3446	3187	3446	3116	D.Baker	None
2/17/01	0	59	3389	3272	3389	3213	D.Baker	None
2/18/01	2	54	3346	3121	3344	3067	D.Baker	None
2/19/01	1	45	3299	3208	3298	3163	D.Baker	None
2/20/01	1	58	3315	3167	3314	3109	D.Baker	None
2/21/01	1	43	3349	3199	3348	3156	D.Baker	None

Earth Sciences Consultants, Inc.
One Triangle Lane
Export, PA 15632
(724) 733-3000

Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	2929
Instrument S/N:	95574
Detector Model:	43-10-1
Detector S/N:	94383
Calibration Due:	9/5/01

Source S/N:	99TH2204141	93-1256C
Source Amount	0.007 mCi	27000 DPM
Radiation Detected:	alpha	beta
Acceptable Range:	3230/3494 α	3002/3451 β
(Refer to ESC/HPM-2-1)		

Date	Background Count Rate Alpha (cpm)	Background Count Rate Beta (cpm)	Gross α Source Count Rate (cpm)	Gross β Source Count Rate (cpm)	Net α Source Count Rate (cpm)	Net β Source Count Rate (cpm)	Technician	Comments
2/27/01	0	59	3412	3249	3412	3190	D.Baker	None
2/28/01	0	60	3356		3356	3189	D.Baker	None
3/1/01	0	62	3453	3207	3453	3145	D.Baker	None
3/2/01	0	70	3405	3245	3405	3175	D.Baker	None
3/3/01	0	55	3347	3282	3347	3227	D.Baker	None
3/4/01	0	58	3309	3224	3309	3166	D.Baker	None
3/5/01	0	39	3402	3273	3402	3234	D.Baker	None
3/6/01	0	41	3345	3255	3345	3214	D.Baker	None
3/7/01	1	42	3299	3267	3298	3225	D.Baker	None
3/8/01	1	57	3347	3246	3346	3189	D.Baker	None
3/12/01	0	39	3349	3219	3349	3180	D.Baker	None
3/13/01	0	49	3289	3267	3289	3218	D.Baker	None
3/14/01	0	66	3346	3291	3346	3225	D.Baker	None
3/15/01	0	51	3328	3267	3328	3216	D.Baker	None
3/16/01	1	44	3319	3219	3318	3175	D.Baker	None
3/19/01	0	50	3409	3261	3409	3211	D.Baker	None
3/20/01	1	70	3411	3233	3410	3163	D.Baker	None
3/26/01	0	68	3387	3217	3387	3149	D.Baker	None
3/27/01	0	56	3367	3259	3367	3203	D.Baker	None
3/28/01	0	54	3359	3267	3359	3213	D.Baker	None
3/29/01	0	62	3407	3246	3407	3184	D.Baker	None
3/30/01	0	43	3402	3212	3402	3169	D.Baker	None

Earth Sciences Consultants, Inc.
One Triangle Lane
Export, PA 15632
(724) 733-3000

Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	2929
Instrument S/N:	95574
Detector Model:	43-10-1
Detector S/N:	94383
Calibration Due:	9/5/01

Source S/N:	99TH2204141	93-1256C
Source Amount	0.007 mCi	27000 DPM
Radiation Detected:	alpha	beta
Acceptable Range:	3230/3494 α	3002/3451 β
(Refer to ESC/HPM-2-1)		

Date	Background Count Rate Alpha (cpm)	Background Count Rate Beta (cpm)	Gross α Source Count Rate (cpm)	Gross β Source Count Rate (cpm)	Net α Source Count Rate (cpm)	Net β Source Count Rate (cpm)	Technician	Comments
4/2/01	0	60	3411	3090	3411	3030	D.Baker	None
4/3/01	0	59	3389	3156	3389	3097	D.Baker	None
4/4/01	0	49	3376	3249	3376	3200	D.Baker	None
4/5/01	0	39	3299	3316	3299	3277	D.Baker	None
4/6/01	0	67	3349	3249	3349	3182	D.Baker	None
4/7/01	0	55	3367	3155	3367	3100	D.Baker	None
4/9/01	0	48	3408	3197	3408	3149	D.Baker	None
4/20/01	0	44	3367	3259	3367	3215	D.Baker	None
4/21/01	1	59	3364	3316	3363	3257	D.Baker	None
5/7/01	1	56	3288	3364	3287	3308	D.Baker	None
5/8/01	0	42	3346	3397	3346	3355	D.Baker	None
5/9/01	0	47	3329	3400	3329	3353	D.Baker	None
5/10/01	0	48	3250	3456	3250	3408	D.Baker	None
5/11/01	0	52	3276	3319	3276	3267	D.Baker	None
5/29/01	1	46	3319	3225	3318	3179	D.Baker	None
5/30/01	0	60	3250	3197	3250	3137	D.Baker	None

GTS Instrument Services
2045 Route 286
Pittsburgh, PA 15239-2839
724/733-1900 Fax: 724/327-8189

CALIBRATION CERTIFICATE

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION

RENTAL EQUIPMENT

Customer Name: GTS INSTRUMENT SERVICES
Customer Address: 2045 Rt. 286
Pittsburgh, PA 15239

Customer P.O.#
Work Order #

INSTRUMENT INFORMATION

Instrument Manufacturer: Ludlum
Model: 2224 Serial Number: 116240 (315)
External Probe(s): Serial #:
Calibration Method: Pulser s/n 120935

INSTRUMENT CALIBRATION INFORMATION

	Instrument Range	Calibration Standard Value	Instrument Response Before Calib.	Instrument Response After Calib.	Comment
1	X1	100 CPM		100 CPM	All Calibrations Btn. + & - 10%
2		200		200	
3		400		400	Battery: OK
4					
	X10	1K		1K	Mechanical Zero: OK
		2K		2K	
		4K		4K	BETA: Threshold = 4.5mV
7					Window = 41.6mV
8					Background = 158.5
9	X100	10K		10K	
10		20K		20K	Audio: OK
11		40K		40K	
12					ALPHA: Threshold = 128mV
13	X1000	100K		100K	Background = 2
14		200K		200K	
15		400K		400K	
16					
17	SCALER	400		402	
18		4K		4,024	
19		40K		40,224	
20		400K		402,308	
21					
22					
23					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all of the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated by: James Christopher (Signed)
Calibration Date: 04-18-00
Next Calibration Due: 04-18-01

I certify that the above information is correct:
Administrative Coordinator — 04-18-00 Date

Earth Sciences Consultants, Inc.
One triangle Lane
Export, PA 15632

Form HPM-1-2-2
Gas Decay Log

Effective Date: September 2000
Revision: 0

Date	Inst. S/N	Cal Due Date	Alpha BKG	Beta BKG	Alpha Source DPM	Beta Source DPM	Time Out	Source Count Alpha	Source Count Beta	Alpha Eff % Out	Beta Eff % Out	Time In	Source Count Alpha	Source Count Beta	Alpha Eff % In	Beta Eff % In	Comments
10/2/00	116240	4/18/01	3	220	15540	27000	10:10	1795	3914	11.5%	13.7%	N/A	0	0	0.0%	-0.8%	Not Used
10/3/00	116240	4/18/01	1	220	15540	27000	13:30	1992	3864	12.8%	13.5%	16:10	1859	4009	12.0%	14.0%	Not Used
10/4/00	116240	4/18/01	1	220	15540	27000	10:15	1864	3864	12.0%	13.5%	N/A	0	0	0.0%	-0.8%	Not Used
10/5/00	116240	4/18/01	2	220	15540	27000	7:00	1880	3879	12.1%	13.6%	N/A	0	0	0.0%	-0.8%	Not Used
10/6/00	116240	4/18/01	1	220	15540	27000	7:15	1963	3904	12.6%	13.6%	N/A	0	0	0.0%	-0.8%	Not Used
10/7/00	116240	4/18/01	1	220	15540	27000	7:10	1799	3900	11.6%	13.6%	N/A	0	0	0.0%	-0.8%	Not Used
10/9/00	116240	4/18/01	2	220	15540	27000	7:10	1908	3866	12.3%	13.5%	N/A	0	0	0.0%	-0.8%	Not Used
10/10/00	116240	4/18/01	1	220	15540	27000	7:10	1896	3799	12.2%	13.3%	N/A	0	0	0.0%	-0.8%	Not Used
10/11/00	116240	4/18/01	1	220	15540	27000	7:15	1878	3864	12.1%	13.5%	N/A	0	0	0.0%	-0.8%	Not Used
10/12/00	116240	4/18/01	1	220	15540	27000	7:10	1955	3944	12.6%	13.8%	N/A	0	0	0.0%	-0.8%	Not Used
10/13/00	116240	4/18/01	2	220	15540	27000	7:00	1964	3822	12.6%	13.3%	N/A	0	0	0.0%	-0.8%	Not Used
10/14/00	116240	4/18/01	1	220	15540	27000	7:00	1892	3865	12.2%	13.5%	N/A	0	0	0.0%	-0.8%	Not Used
10/16/00	116240	4/18/01	1	220	15540	27000	7:15	1909	3905	12.3%	13.6%	N/A	0	0	0.0%	-0.8%	Not Used
10/17/00	116240	4/18/01	1	220	15540	27000	7:30	1924	3799	12.4%	13.3%	N/A	0	0	0.0%	-0.8%	Not Used
10/18/00	116240	4/18/01	2	220	15540	27000	6:45	1889	3845	12.1%	13.4%	N/A	0	0	0.0%	-0.8%	Not Used
10/19/00	116240	4/18/01	1	220	15540	27000	7:00	1964	3571	12.6%	12.4%	N/A	0	0	0.0%	-0.8%	Not Used
10/20/00	116240	4/18/01	2	220	15540	27000	8:00	1864	3644	12.0%	12.7%	N/A	0	0	0.0%	-0.8%	Not Used
10/23/00	116240	4/18/01	1	220	15540	27000	8:00	1921	3789	12.4%	13.2%	N/A	0	0	0.0%	-0.8%	Not Used

Earth Sciences Consultants, Inc.
One triangle Lane
Export, PA 15632

Form HPM-1-2-2
Gas Decay Log

Effective Date: September 2000
Revision: 0

Date	Inst. S/N	Cal Due Date	Alpha BKG	Beta BKG	Alpha Source DPM	Beta Source DPM	Time Out	Source Count Alpha	Source Count Beta	Alpha Eff % Out	Beta Eff % Out	Time In	Source Count Alpha	Source Count Beta	Alpha Eff % In	Beta Eff % In	Comments
11/2/00	116240	4/18/00	1	220	15540	27000	N/A	1896	3725	12.2%	13.0%	N/A	0	0	0.0%	-0.8%	Not Used
11/3/00	116240	4/18/00	1	220	15540	27000	N/A	1924	3802	12.4%	13.3%	N/A	0	0	0.0%	-0.8%	Not Used
11/6/00	116240	4/18/00	1	220	15540	27000	N/A	1920	3799	12.3%	13.3%	N/A	0	0	0.0%	-0.8%	Not Used
11/7/00	116240	4/18/00	1	220	15540	27000	N/A	1897	3689	12.2%	12.8%	N/A	0	0	0.0%	-0.8%	Not Used
11/8/00	116240	4/18/00	2	220	15540	27000	N/A	1877	3698	12.1%	12.9%	N/A	0	0	0.0%	-0.8%	Not Used
11/9/00	116240	4/18/00	1	220	15540	27000	N/A	1896	3807	12.2%	13.3%	N/A	0	0	0.0%	-0.8%	Not Used
11/10/00	116240	4/18/00	3	220	15540	27000	N/A	1915	3800	12.3%	13.3%	N/A	0	0	0.0%	-0.8%	Not Used
11/13/00	116240	4/18/00	1	220	15540	27000	N/A	1849	3821	11.9%	13.3%	N/A	0	0	0.0%	-0.8%	Not Used
11/14/00	116240	4/18/00	1	220	15540	27000	N/A	1897	3727	12.2%	13.0%	N/A	0	0	0.0%	-0.8%	Not Used
11/15/00	116240	4/18/00	2	220	15540	27000	N/A	1902	3845	12.2%	13.4%	N/A	0	0	0.0%	-0.8%	Not Used
11/16/00	116240	4/18/00	1	220	15540	27000	N/A	1916	3699	12.3%	12.9%	N/A	0	0	0.0%	-0.8%	Not Used
11/17/00	116240	4/18/00	3	220	15540	27000	N/A	1907	3815	12.3%	13.3%	N/A	0	0	0.0%	-0.8%	Not Used
11/18/00	116240	4/18/00	2	220	15540	27000	N/A	1877	3756	12.1%	13.1%	N/A	0	0	0.0%	-0.8%	Not Used
11/20/00	116240	4/18/00	1	220	15540	27000	N/A	1846	3796	11.9%	13.2%	N/A	0	0	0.0%	-0.8%	Not Used
11/21/00	116240	4/18/00	1	220	15540	27000	N/A	1907	3801	12.3%	13.3%	N/A	0	0	0.0%	-0.8%	Not Used

Earth Sciences Consultants, Inc.
One triangle Lane
Export, PA 15632

Form HPM-1-2-2
Gas Decay Log

Effective Date: September 2000
Revision: 0

Date	Inst. S/N	Cal Due Date	Alpha BKG	Beta BKG	Alpha Source DPM	Beta Source DPM	Time Out	Source Count Alpha	Source Count Beta	Alpha Eff % Out	Beta Eff % Out	Time In	Source Count Alpha	Source Count Beta	Alpha Eff % In	Beta Eff % In	Comments
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used
	116240	4/18/00			15540	27000	N/A			0.0%	0.0%	N/A	0	0	0.0%	0.0%	Not Used

Earth Sciences Consultants, Inc.
One triangle Lane
Export, PA 15632

Form HPM-1-2-2
Gas Decay Log

Effective Date: September 2000
Revision: 0

Date	Inst. S/N	Cal Due Date	Alpha BKG	Beta BKG	Alpha Source DPM	Beta Source DPM	Time Out	Source Count Alpha	Source Count Beta	Alpha Eff % Out	Beta Eff % Out	Time In	Source Count Alpha	Source Count Beta	Alpha Eff % In	Beta Eff % In	Comments
2/20/01	116240	4/18/00	2	212	15540	27000	9:30	1958	3849	12.6%	13.5%	11:00	1982	3684	12.7%	12.9%	None
2/20/01	116240	4/18/00	2	214	15540	27000	12:30	1967	3902	12.6%	13.7%	2:49	1874	3789	12.0%	13.2%	
2/20/01	116240	4/18/00	2	212	15540	27000	4:30	1989	3866	12.8%	13.5%	5:00	1896	3724	12.2%	13.0%	
2/21/01	116240	4/18/00	3	249	15540	27000	8:45	1928	3888	12.4%	13.5%		0	0	0.0%	-0.9%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	

Earth Sciences Consultants, Inc.
One triangle Lane
Export, PA 15632

Form HPM-1-2-2
Gas Decay Log

Effective Date: September 2000
Revision: 0

Date	Inst. S/N	Cal Due Date	Alpha BKG	Beta BKG	Alpha Source DPM	Beta Source DPM	Time Out	Source Count Alpha	Source Count Beta	Alpha Eff % Out	Beta Eff % Out	Time In	Source Count Alpha	Source Count Beta	Alpha Eff % In	Beta Eff % In	Comments
	116240	4/18/00			15540	27000				0.0%	0.0%				0.0%	0.0%	None
	116240	4/18/00			15540	27000				0.0%	0.0%				0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%				0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	
	116240	4/18/00			15540	27000				0.0%	0.0%		0	0	0.0%	0.0%	

GTS Instrument Services
2045 Route 286
Pittsburgh, PA 15239-2839
724/733-1900 Fax: 724/327-8189

CALIBRATION CERTIFICATE

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION

Customer Name: Earth Science Consultants
Customer Address: 1 Triangle Lane
Export, PA 15632

Customer P.O.#
Work Order # I-00-08-209

INSTRUMENT INFORMATION

Instrument Manufacturer Ludlum
Model 2929 Serial Number 95574
External Probe(s) 43-10-1 Serial # 094383

Calibration Method ^{99}Tc Pulser s/n 101500
^{230}Th s/n 11623

INSTRUMENT CALIBRATION INFORMATION

	Instrument Range	Calibration Standard Value	Instrument Response Before Calib.	Instrument Response After Calib.	Comment
1	BETA				All Calibrations Btn. + & - 10%
2	0.1 MIN	40K CPM	4,000 CPM	4,000	
3					HV Mechanical Zero: OK
4	1	40K	40,095	40,095	Audio: OK
5					
6	10	40K	401,262	401,262	BETA:
7					Input Sensitivity: 4.5mV
8	ALPHA				Window = 50mV
9	0.1 MIN	40K	4,000	4,000	^{99}TRc Efficiency = 15.4%
10					
11	1	40K	40,100	40,100	ALPHA
12					Input Sensitivity = 180mV
13	10	40K	401,092	401,092	^{230}Th Efficiency = 22.8%
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all of the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated by: (Signed)
Calibration Date: 09-05-00
Next Calibration Due: 09-05-01

I certify that the above information is correct:
Administrative Coordinator
09-05-00
Date

Earth Sciences Consultants, Inc.
One Triangle Lane
Export, PA 15632
(724) 733-3000

Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	2929
Instrument S/N:	95574
Detector Model:	43-10-1
Detector S/N:	94383
Calibration Due:	9/5/01

Source S/N:	99TH2204141
Source Amount	0.007 mCi
Radiation Detected:	alpha/beta
Acceptable Range:	2598/2325 α
(Refer to ESC/HPM-2-1)	479/402 β

Date	Background Count Rate Alpha (cpm)	Background Count Rate Beta (cpm)	Gross α Source Count Rate (cpm)	Gross β Source Count Rate (cpm)	Net α Source Count Rate (cpm)	Net β Source Count Rate (cpm)	Technician	Comments
10/2/00	1	61	2459	486	2458	425	D.Baker	none
10/3/00	2	64	2494	490	2492	426	D.Baker	none
10/4/00	1	69	2484	499	2483	430	D.Baker	none
10/5/00	1	55	2508	503	2507	448	D.Baker	none
10/6/00	1	58	2547	510	2546	452	D.Baker	none
10/7/00	2	59	2406	487	2404	428	D.Baker	none
10/9/00	3	60	2419	488	2416	428	D.Baker	none
10/10/00	2	54	2505	456	2503	402	D.Baker	none
10/11/00	1	57	2499	489	2498	432	D.Baker	none
10/12/00	2	65	2451	519	2449	454	D.Baker	none
10/13/00	1	60	2513	476	2512	416	D.Baker	none
10/14/00	1	61	2469	485	2468	424	D.Baker	none
10/16/00	2	57	2497	476	2495	419	D.Baker	none
10/17/00	2	55	2379	459	2377	404	D.Baker	none
10/18/00	2	63	2511	501	2509	438	D.Baker	none
10/19/00	1	64	2489	511	2488	447	D.Baker	none
10/20/00	2	59	2499	500	2497	441	D.Baker	none
10/23/00	3	54	2489	476	2486	422	D.Baker	none

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Form HPM-1-2-1
Source/Background Log

Effective Date: September 2000
Revision: 0

Instrument Model:	2929
Instrument S/N:	95574
Detector Model:	43-10-1
Detector S/N:	94383
Calibration Due:	9/5/01

Source S/N:	99TH2204141
Source Amount	0.007 mCi
Radiation Detected:	alpha/beta
Acceptable Range:	2598/2325 α
(Refer to ESC/HPM-2-1)	479/402 β

Date	Background Count Rate Alpha (cpm)	Background Count Rate Beta (cpm)	Gross α Source Count Rate (cpm)	Gross β Source Count Rate (cpm)	Net α Source Count Rate (cpm)	Net β Source Count Rate (cpm)	Technician	Comments
11/2/00	1	54	2435	474	2434	420	D.Baker	none
11/3/00	1	67	2418	518	2417	451	D.Baker	none
11/6/00	2	51	2466	473	2464	422	D.Baker	none
11/7/00	3	54	2464	501	2461	447	D.Baker	none
11/8/00	2	61	2369	490	2367	429	D.Baker	none
11/9/00	1	51	2380	456	2379	405	D.Baker	none
11/10/00	2	55	2416	476	2414	421	D.Baker	none
11/13/00	2	62	2350	489	2348	427	D.Baker	none
11/14/00	3	54	2409	483	2406	429	D.Baker	none
11/15/00	1	57	2424	490	2423	433	D.Baker	none
11/16/00	1	60	2505	500	2504	440	D.Baker	none
11/17/00	3	61	2406	502	2403	441	D.Baker	none
11/18/00	2	57	2407	489	2405	432	D.Baker	none
11/20/00	1	53	2348	470	2347	417	D.Baker	none
11/21/00	1	54	2499	476	2498	422	D.Baker	none

Ludlum Model 2929 Daily Use Log

Instrument Model:	2929		Source S/N:	99TH2204141 / 93-1256C	
Instrument S/N:	95574		Source Amount	15540 / 27000	
Detector Model:	43-10-1		Radiation Detected:	alpha/beta	
Detector S/N:	094383		Acceptable Range:	Net Alpha: 3410-3561	
Calibration Due:	9/5/01		(Refer to ESC/HPM-2-1)	Net Beta: 3164-3601	

Date	Background Count Rate Alpha (cpm)	Background Count Rate Beta (cpm)	Gross α Source Count Rate (cpm)	Gross β Source Count Rate (cpm)	Net α Source Count Rate (cpm)	Net β Source Count Rate (cpm)	Technician	Comments
11/27/00	0	47	3411	3282	3411	3235	T.Brautigam	Source Holder in
11/28/00	0	55	3531	3295	3531	3240	T.Brautigam	Source Holder in
11/29/00	0	46	3535	3345	3535	3299	T.Brautigam	Source Holder in
11/30/00	0	46	3456	3295	3456	3249	T.Brautigam	Source Holder in
12/1/00	0	48	3370	3291	3370	3243	T.Brautigam	Source Holder in
12/4/00	0	45	3425	3259	3425	3214	T.Brautigam	Source Holder in
12/5/00	0	46	3337	3264	3337	3218	T.Brautigam	Source Holder in
12/6/00	0	51	3474	3231	3474	3180	T.Brautigam	Source Holder in
12/7/00	1	46	3526	3329	3525	3283	T.Brautigam	Source Holder in
12/8/00	0	53	3430	3255	3430	3202	T.Brautigam	Source Holder in
12/9/00	0	51	3487	3370	3487	3319	T.Brautigam	Source Holder in
12/11/00	0	51	3479	3305	3479	3254	T.Brautigam	Source Holder in
12/12/01	0	65	3548	3311	3548	3246	T.Brautigam	Source Holder in
12/13/01	0	62	3480	3289	3480	3227	T.Brautigam	Source Holder in
12/14/01	0	54	3482	3287	3482	3233	T.Brautigam	Source Holder in
12/15/01	1	63	3499	3304	3498	3241	T.Brautigam	Source Holder in
12/16/01	0	46	3509	3306	3509	3260	T.Brautigam	Source Holder in
12/17/01	1	58	3522	3311	3521	3253	T.Brautigam	Source Holder in
12/18/01	0	55	3534	3322	3534	3267	T.Brautigam	Source Holder in
12/19/01	1	61	3456	3366	3455	3305	T.Brautigam	Source Holder in

Ludlum Model 2929 Daily Use Log

12/20/01	0	55	3499	3402	3499	3347	T.Brautigam	Source Holder in
12/21/01	0	63	3509	3346	3509	3283	T.Brautigam	Source Holder in
12/22/01	0	62	3466	3376	3466	3314	T.Brautigam	Source Holder in