ELECTROMAGNETIC GEOPHYSICAL SURVEY

KOPPERS SOUTH CAVALCADE SITE

HOUSTON, TEXAS

FILE

FOR

KOPPERS COMPANY, INC.

PITTSBURGH, PENNSYLVANIA

PREPARED BY

MCBRIDE-RATCLIFF AND ASSOCIATES, INC

HOUSTON, TEXAS

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McBride-Ratcliff and Associates, Inc.

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ELECTROMAGNETIC GEOPHYSICAL SURVEY

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FOR

KOPPERS COMPANY, INC.

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PREPARED BY

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HOUSTON, TEXAS

McBride-Ratcliff
and Associates, Inc.
Geotechnical Consultants
7220 Langmy Houston, Texas 77040 713-460-3766

December 27, 1985

Koppers Company, Inc.
1940 Koppers Building
436 Seventh Avenue
Pittsburgh, Pennsylvania 15219

ATTENTION: Dr. James R. Campbell
Previously Operated Properties

SUBJECT: Electromagnetic Geophysical Survey
Koppers South Cavalcade Site
Houston, Texas
MRA File No. 85-317

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Presented here is the report of our electromagnetic geophysical survey at the Koppers South Cavalcade Site in Houston, Texas. This report is submitted in response to Subtask 2C of the EPA South Cavalcade Street Work Plan and was conducted in general accordance with Section 9.0 of the Koppers Field Sampling and Analytical Plan.

This electromagnetic survey included 696 data stations and substations to identify subsurface anomalies. This information will be used in designing the soil boring program for the South Cavalcade Site.

We appreciate this opportunity to be of service. Please contact us if you have any questions.

Sincerely.

McBRIDE-RATCLIFF AND ASSOCIATES, INC.

Paul C Moore /JL
Paul C. Moore
Project Geologist

J. L. Ireland, C.P.G.
Vice President

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William R. Tobin, P.E.
Project Manager

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Copies Submitted - 10

CONTENTS

	Page
SUMMARY	i
INTRODUCTION	1
FIELD SURVEY	
Site Location	1
Test Procedure	1
DATA EVALUATION	3
TEST RESULTS	
Vegetated Areas	3
Asphalt-Paved Areas	4
CONCLUSIONS	5

002196

ILLUSTRATIONS

	Figure
VICINITY MAP	1
ELECTROMAGNEIC SURVEY STATIONS	2
INTERPRETATION FLOW CHART	3
SITE SECTION MAP	4
APPARENT CONDUCTIVITY CONTOUR MAP	5
GEOPHYSICAL ANOMALIES MAP	6

APPENDICES

	Appendix
ELECTROMAGNETIC DATA	A

SUMMARY

An electromagnetic geophysical site survey was performed at the Koppers South Cavalcade Site in Houston, Texas. The objective of this survey was to delineate areas of subsurface anomalies associated with potential fill areas. The feasibility of using electromagnetic methods was evaluated in our geophysical feasibility survey report dated December 18, 1985.

The geophysical site survey included 696 electromagnetic data stations and substations. These stations were located in the field by our geologist, and were plotted on a site base map for reference.

The principal findings and conclusions of the geophysical survey are summarized as follows:

1. The survey detected electromagnetic responses in the subsurface which were interpreted as apparent conductivity anomalies at several locations at the site.

2. Apparent conductivity anomalies were evaluated for surface cultural features, underground utilities, and potential fill areas.

3. Anomalies interpreted as potential fill areas have been delineated on a site map to assist in designing the soil boring program.

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INTRODUCTION

The electromagnetic geophysical survey was conducted at the Koppers South Cavalcade Site in Houston, Texas. The site exhibits a variety of surface cover, consisting of vegetated areas, asphaltic paving and steel reinforced concrete paving.

The objective of the geophysical site survey was to delineate subsurface apparent conductivity anomalies to assist in locating soil borings.

FIELD SURVEY

Site Location

The electromagnetic geophysical survey was performed on November 22 and 25, 1985 by personnel of McBride-Ratcliff and Associates, Inc. The site is located in northern Houston, Texas and is bounded by the Houston Belt Terminal Railroad tracks to the east, Missouri Pacific Railroad tracks to the west, Cavalcade Street to the north, and Collingsworth Street to the south. The site location is shown on Figure 1.

Test Procedure

The electromagnetic profiling method was performed over approximately one-quarter of the site. As documented in our geophysical feasibility report dated December 18,1985, the electromagnetic method was not responsive in areas paved with reinforced concrete. Therefore, the entrance to Merchants Fast Motors Lines and the area at Palletized Truck Lines (See Figure 4) were not included in our site survey. The geophysical survey included unpaved areas and asphalt-paved areas. Access was also restricted by parked trucks, buildings, and heavily wooded areas.

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The electromagnetic method was conducted under the guidelines set forth in Section 4.0 of the Geonics Limited: EM 31 Operating Manual, revised June, 1984. All readings for this method were obtained using a Geonics Limited Model EM31-D Non-Contacting Terrain Conductivity Meter. The intercoil spacing of the EM31-D unit is fixed at approximately 12 ft. This spacing yields a penetration depth of approximately 19.7 feet.

Traverse lines were typically located with a 50-ft spacing and were field located by using a transit. Readings were obtained at station intervals generally of 50 ft. At several localities, substations were located in the traverse line between consecutive stations to further delineate the boundaries of anomalous areas. These substations were designated by the previous station number plus the measured distance to the next higher station number in the traverse. Several other substations were located perpendicular to the traverse line. These substations were designated by the previous station number, plus the distance from that station, and a capitol letter to indicate the compass direction taken. The location of the electromagnetic stations are shown on Figures 2A and 2B.

Two sets of readings were obtained at each station; one with the coils oriented north-south, the other with the coils oriented east-west. This procedure yields an average apparent conductivity value to compensate for lateral variations of conductivity in the underlying soil layers at each station. A listing of the field conductivity measurements is included in Appendix A.

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DATA EVALUATION

The conductivity contouring method was used to delineate areas of abnormally high to abnormally low apparent conductivity. The average apparent conductivity measurements were plotted to their corresponding stations located on a map and contours of equal apparent conductivity were drawn in relation to the stations. The resulting contour map was then used to evaluate the apparent conductivity anomalies. The anomalous areas were evaluated for buried utilities, surface cultural features, and potential fill areas. Figure 3 illustrates the interpretation flow chart used for evaluation of the electromagnetic data.

Anomalies detected in the asphalt-paved areas of the site were evaluated separately from anomalies detected in vegetated areas. This practice reduced the possibility of erroneous interpretations across differing surface coverings.

TEST RESULTS

Vegetated Areas

Three vegetated sections were evaluated as shown on Figure 4. The electromagnetic survey disclosed apparent conductivity values from negative off-scale to positive 237.5 mmhos/m. The average background range of apparent conductivity values vary from about 40 mmhos/m to 60 mmhos/m based upon values from stations in areas known to be undisturbed by previous site activities.

Figures 5A and 5B present apparent conductivity contour maps based upon average field measurements. The contoured areas of apparent conductivity values less than about 40 mmhos/m and greater than about 60 mmho/m generally indicate subsurface anomalies.

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The negative off-scale values measured in the vegetated areas are generally interpreted as highly conductive electromagnetic responses to buried metallic objects such as underground pipelines and railroad tracks. The apparent conductivity values greater than 60 mmhos/m measured south of Transcon Truck Lines are attributed to the conductive influence of a chain-link fence in proximity to Stations 96 and 96+8. The high anomalous apparent conductivity measurements at the grass covered esplanade in the Merchants Fast Motor Lines driveway are interpreted as the influence of buried utility lines.

Asphalt-Paved Areas

Two asphalt-paved areas were evaluated as shown on Figure 4. The survey disclosed apparent conductivity values ranging from negative off-scale to positive 160 mmhos/m. The average background range of apparent conductivity values for the asphalt-paved areas appear to vary from about 40 mmhos/m to about 80 mmhos/m based upon values from stations in areas known to be undisturbed by previous site activities.

Figures 5A and 5B present apparent conductivity contour maps based on average field measurements. The contoured areas of apparent conductivity values less than about 40 mmhos/m and greater than about 80 mmhos/m generally indicate subsurface anomalies.

The negative off-scale values measured in the vicinity of Transcon Truck Lines are interpreted as the electromagnetic response to buried utilities. The high anomalous apparent conductivity measurements at Station 19 are interpreted as the conductive influence of a chain-link fence in proximity to the station. The slightly anomalous

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measurements at Stations 74 and 75 are interpreted as conductive influence associated with the proximity of a chain-link fence and parked tractor trailors.

CONCLUSIONS

The electromagnetic data reflected a wide range of apparent conductivity values throughout the surveyed areas of the Koppers South Cavalcade Site. Apparent conductivity values less than 40 mmho/m or greater than 60 mmho/m in vegetated areas, and values less than 40 mmho/m or greater than 80 mmho/m in asphalt-paved areas, were interpreted as subsurface anomalies. The subsurface anomalies were evaluated for potential fill areas and are shown on Figures 6A and 6B. The negative off-scale readings encountered are interpreted as underground utilities or abandoned railroad tracks, and therefore are not included on Figures 6A and 6B.

The geophysical assessment of this site was based upon our professional evaluation of the geophysical data gathered and our experience with the geophysical properties of the geology in the area. The geophysical evaluation rendered in this report meets the standards of care of our profession. No other warranty or representation, either expressed or implied, is included or intended. The verification of measured subsurface anomalies will require direct sampling and observation of the subsurface soils and groundwater.

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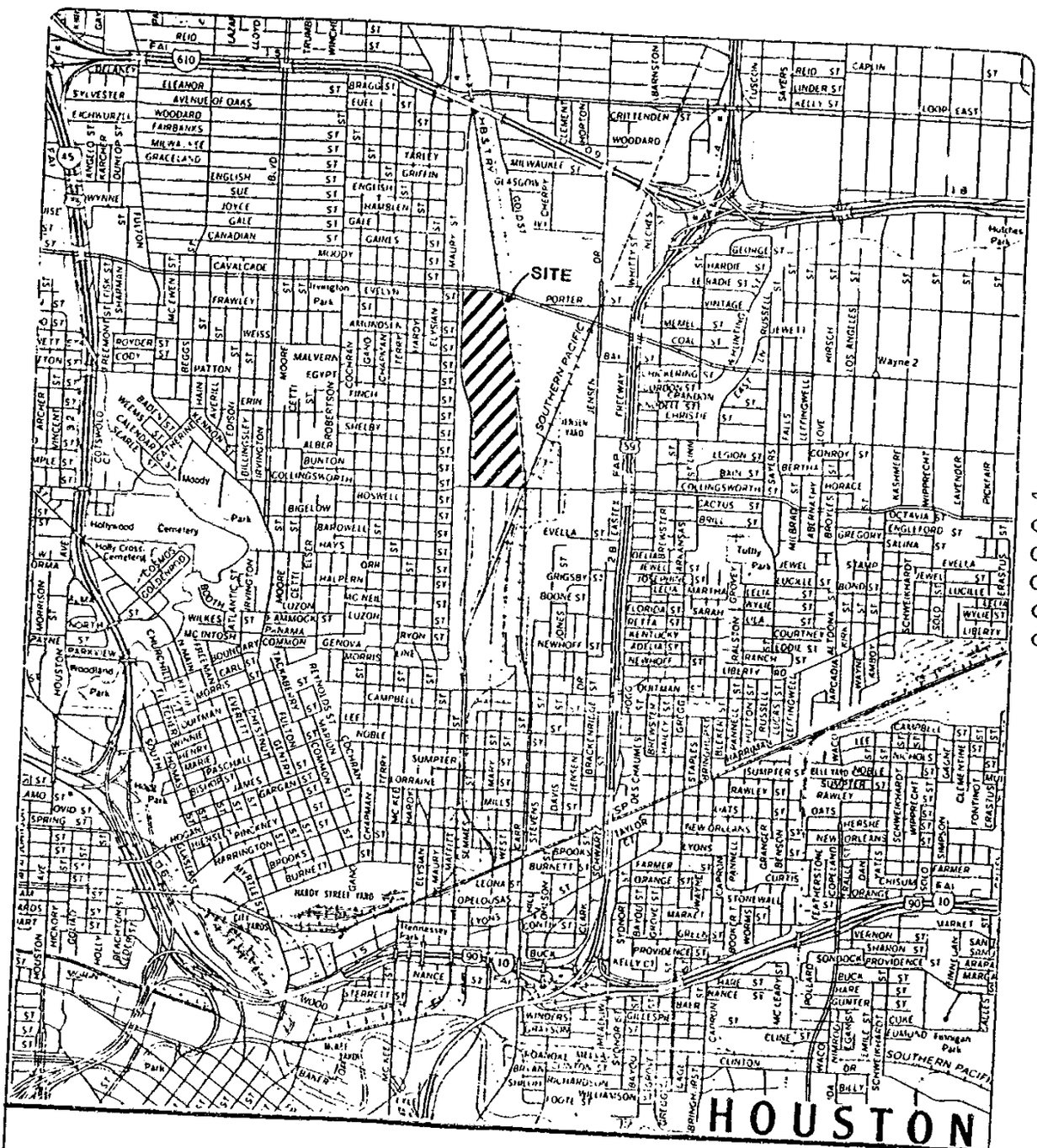

VICINITY MAP
KOPPERS SOUTH CAVALCADE SITE
HOUSTON, TEXAS

N

SCALE-MI.

0 0.25 0.5 1

FIGURE 1
FILE: 85-317

McBride-Ratcliff and Associates, Inc.

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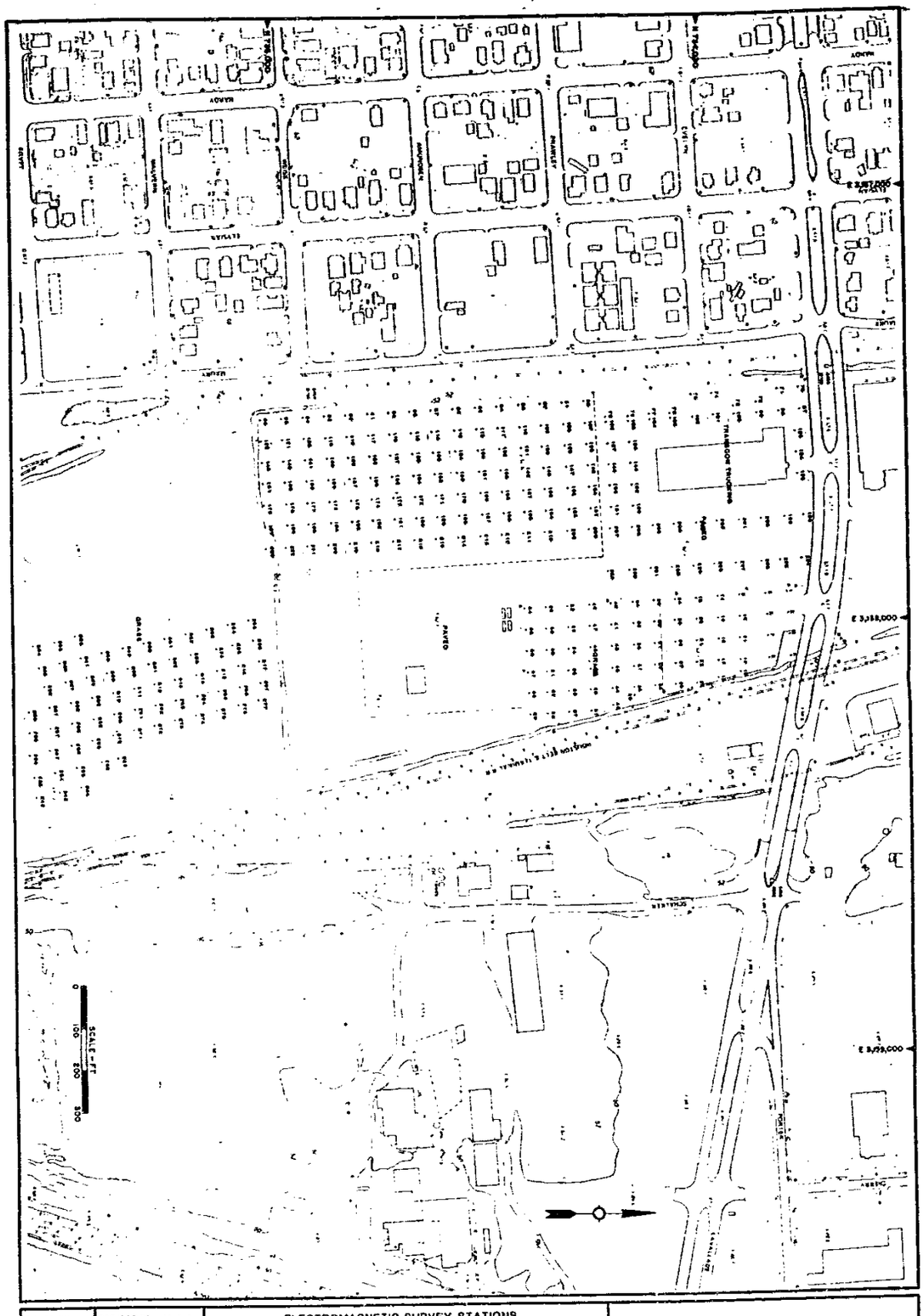

FIGURE NO	PROJECT NO 85-317	ELECTROMAGNETIC SURVEY STATIONS SUBTASK 2C SOUTH CAVALCADE SITE KOPPERS COMPANY, INC.	McBride-Ratcliff and Associates, Inc. Geotechnical Consultants Houston, Texas
2A	DATE 12/9/85		
	ENGINEER WT		
	DRAWN BY DLO		

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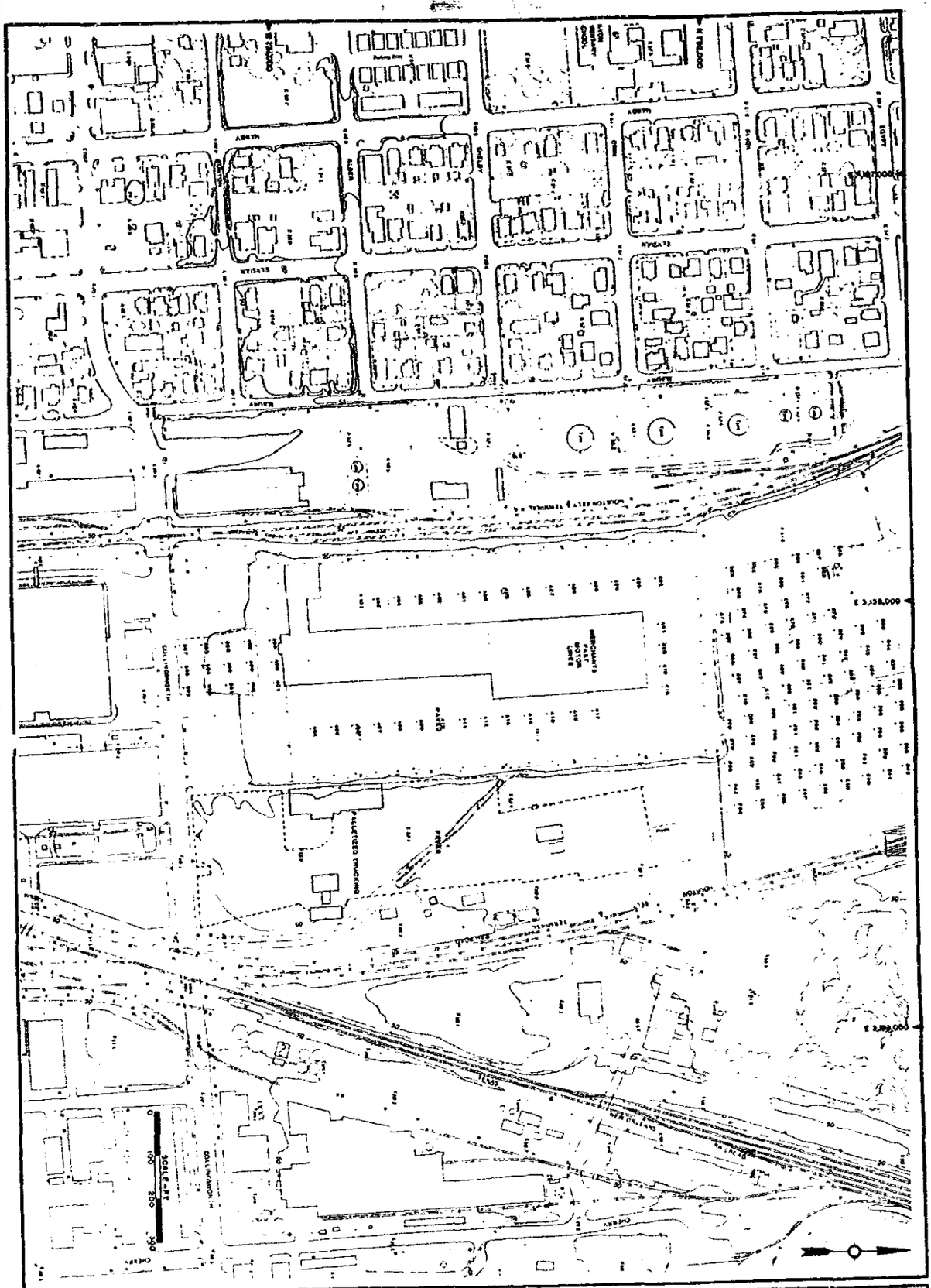

FIGURE NO.	PROJECT NO. 85-317	ELECTROMAGNETIC SURVEY STATIONS	McBride-Ratcliff and Associates, Inc.
2B	DATE 12/8/85	SUBTASK 2C	Geotechnical Consultants
	ENGINEER: WT	SOUTH CAVALCADE SITE	Houston, Texas
	DRAWN BY DLO	KOPPERS COMPANY, INC.	

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INTERPRETATION FLOW CHART

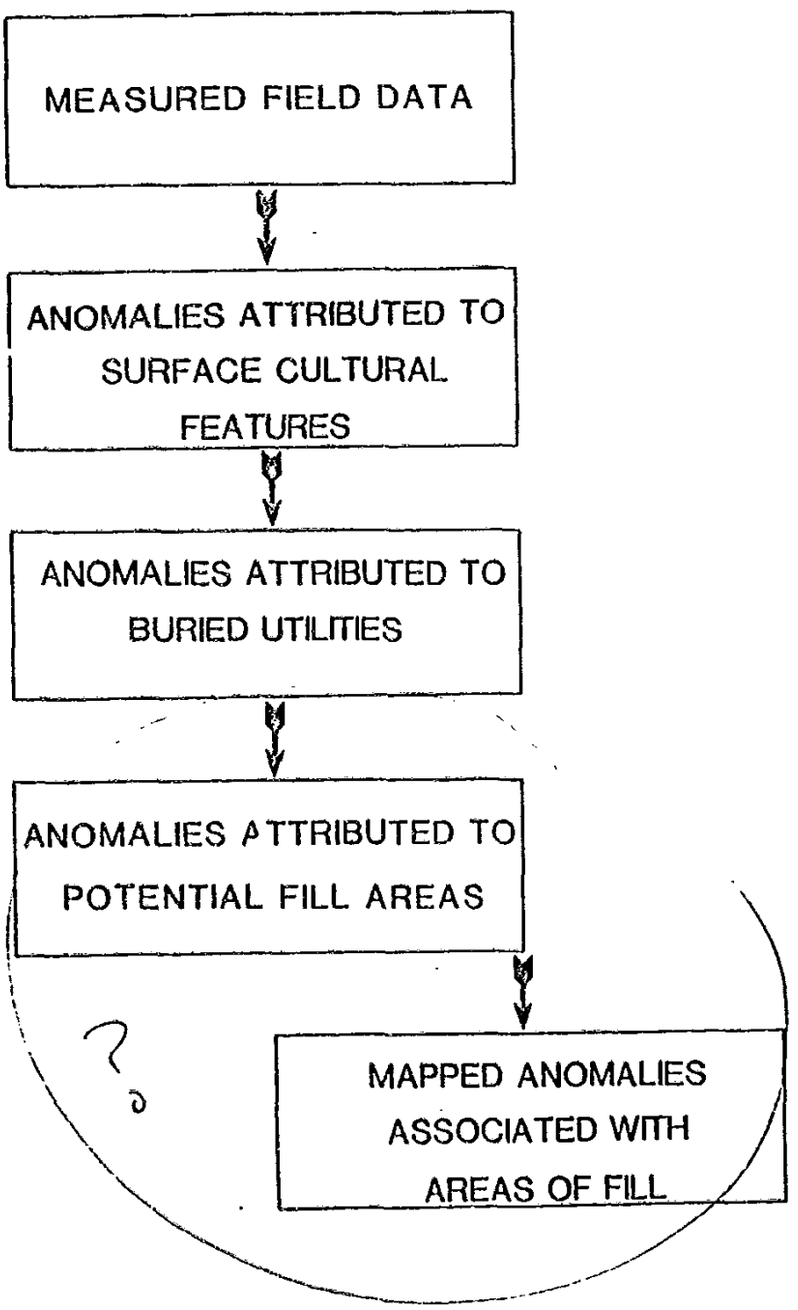

FIGURE NO. 3

JOB NO. 85-317

McBride-Ratcliff and Associates, Inc.

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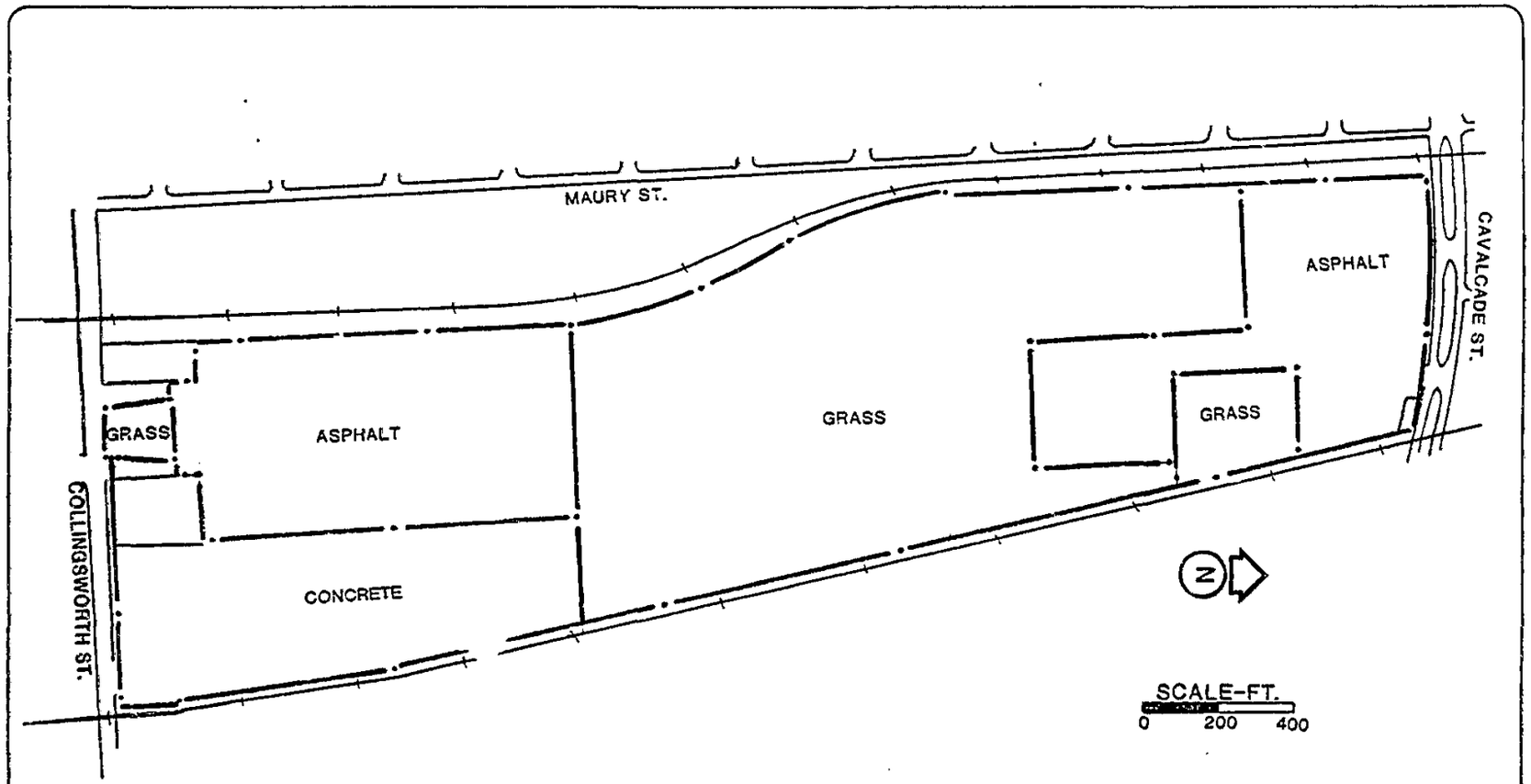

SITE SECTION MAP

LEGEND

—·—·— SECTION BOUNDARY

FIGURE NO. 4

JOB NO. 85-317

McBride-Ratcliff and Associates, Inc.

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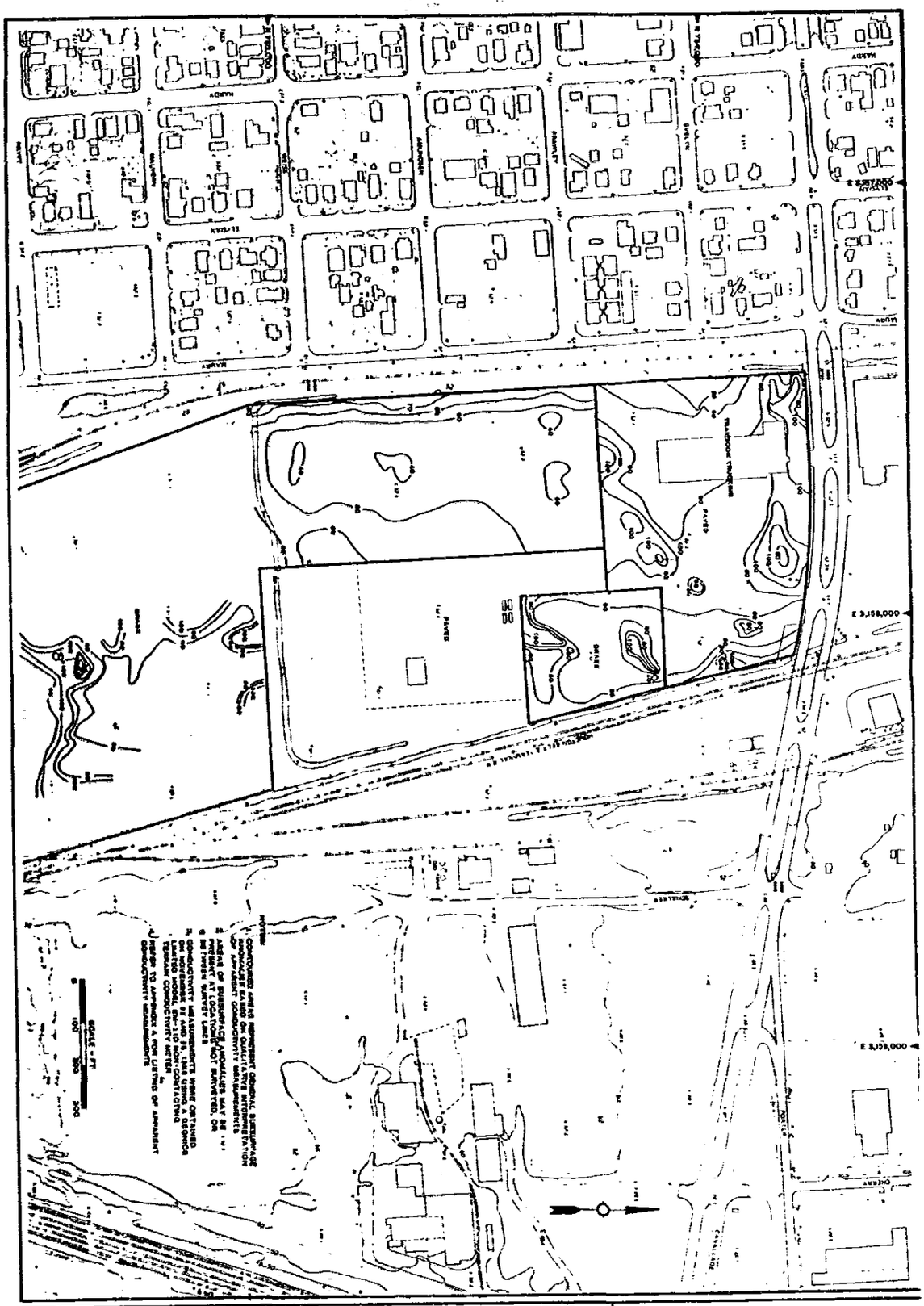

FIGURE NO	PROJECT NO 88-317	APPARENT CONDUCTIVITY CONTOUR MAP	McBride-Ratcliff and Associates, Inc.
5A	DATE: 12/12/88	SUBTASK 2C	Geotechnical Consultants
	ENGINEER: WRT	SOUTH CAVALCADE SITE	Houston, Texas
	DRAWN BY: DLQ	KOPPERS COMPANY, INC.	

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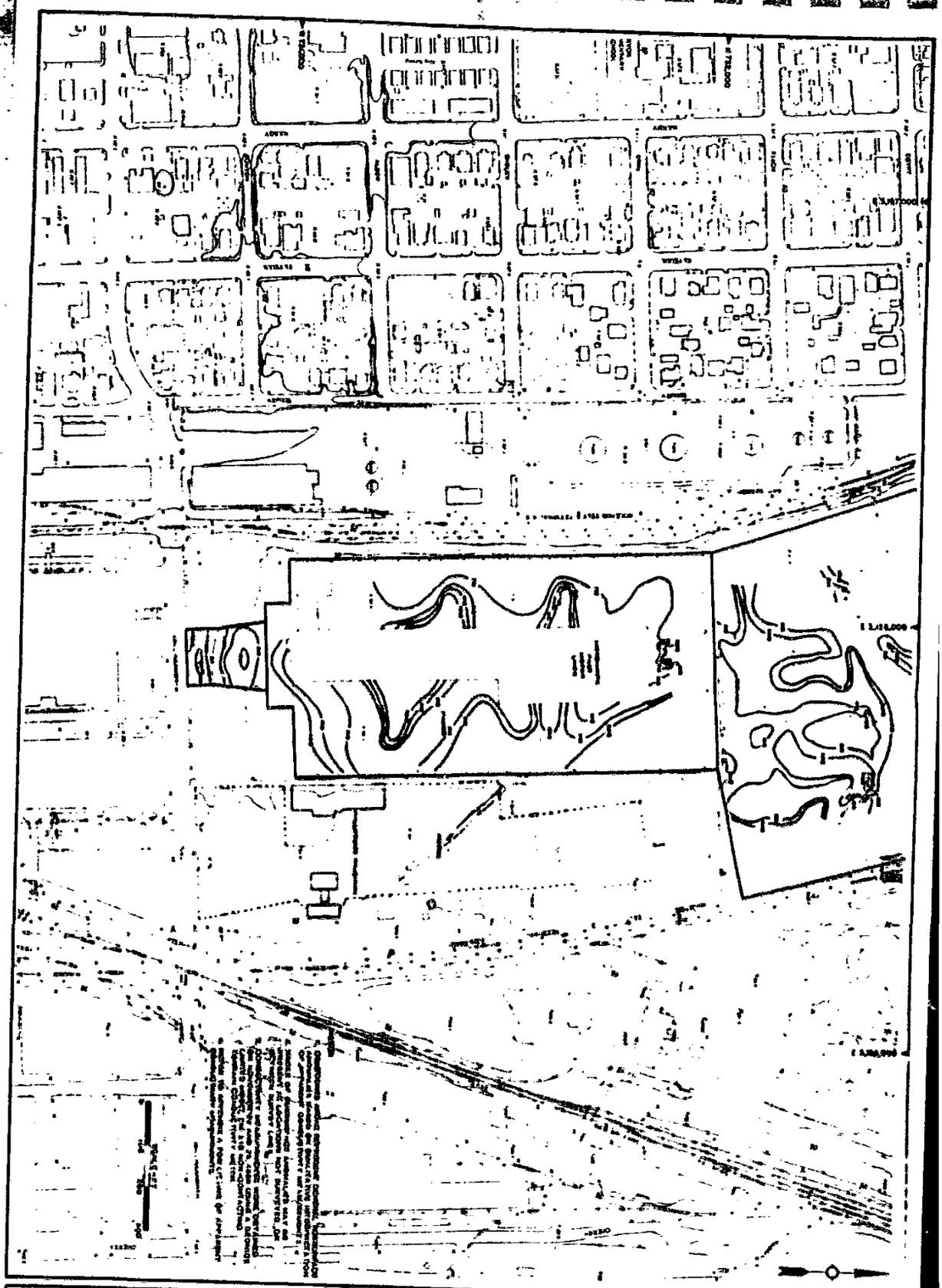

FIGURE NO.	PROJECT NO.	APPARENT CONDUCTIVITY CONTOUR MAP	McBride-Ratcliff and Associates, Inc.
5B	DATE	SUBTASK 2C	Geotechnical Consultants
	ENGINEER	SOUTH CAVALCADE SITE	Houston, Texas
	DRAWN BY	KOPPERS COMPANY, INC.	

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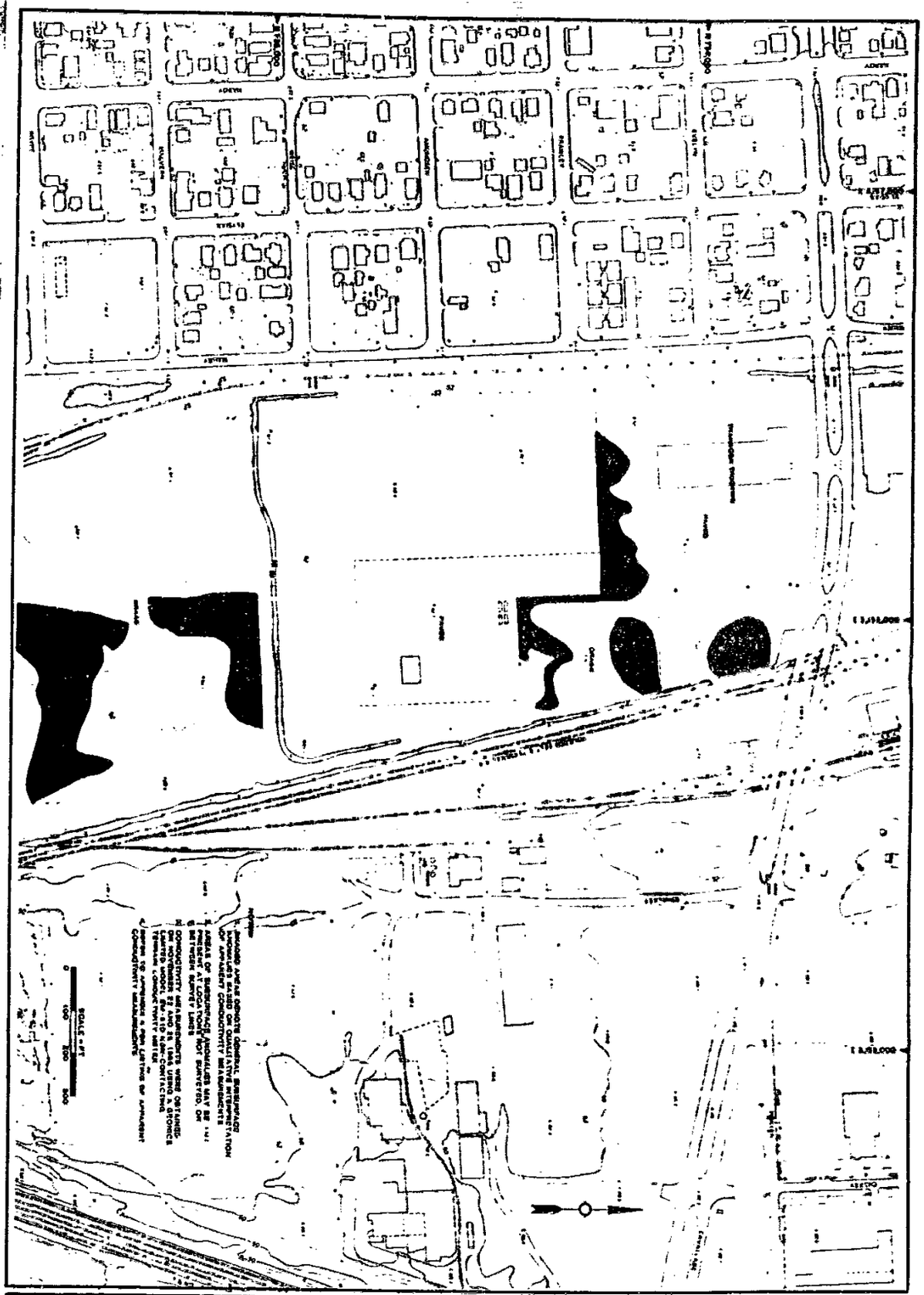

FIGURE NO.	PROJECT NO 88-317	GEOPHYSICAL ANOMALIES MAP BASED ON CONDUCTIVITY DATA	McBride-Ratcliff and Associates, Inc.
6A	DATE 12/10/88	SUBTASK 2C	Geotechnical Consultants
	ENGINEER WT	SOUTH CAVALCADE SITE	Houston, Texas
	DRAWN BY DLG	KOPPERS COMPANY, INC.	

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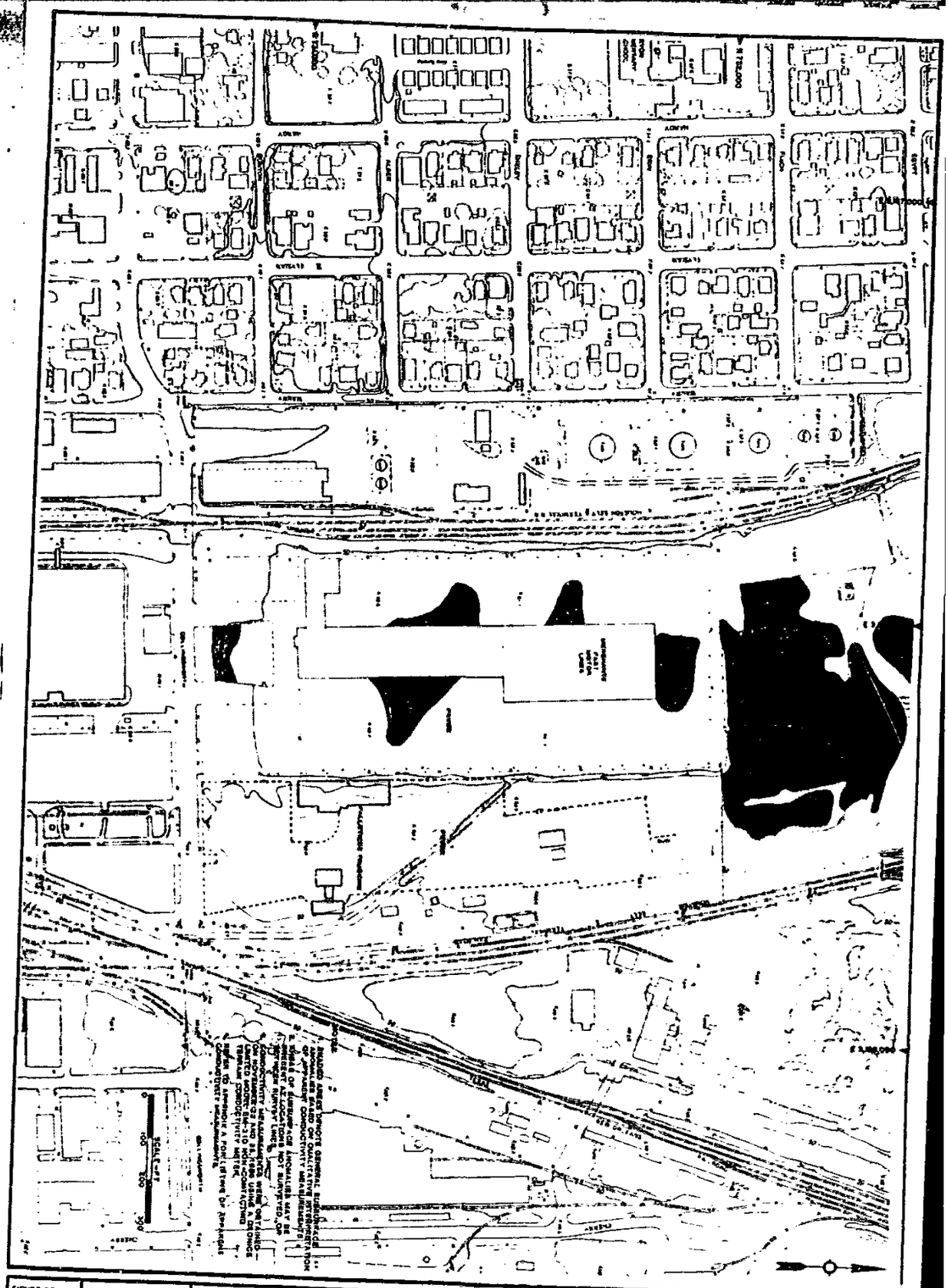

FIGURE NO.:	PROJECT NO 89-317	GEOPHYSICAL ANOMALIES MAP BASED ON CONDUCTIVITY DATA	McBride-Ratcliff and Associates, Inc.
6B	DATE 12/19/89	SUBTASK 2C	Geotechnical Consultants
	ENGINEER WT	SOUTH CAVALCADE SITE	Houston, Texas
	DRAWN BY: DLQ	KOPPERS COMPANY, INC.	

002212

APPENDIX A

ELECTROMAGNETIC DATA

002213

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Asphalt Paving and Moist Soil JOB NO. : 85-317

STATION INTERVAL : 50 ft. TABLE NO. : 1 DATE : November 22, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
1	122	1	130	126	Next to Fence; 10'
2	57	2	56	56.5	
3	53	3	55	54.5	
4	80	4	110	95	
5	105	5	90	97.5	
5+38	70	5+38	74	72	12' from a car
7	54	7	53	53.5	
8	66	8	73	65	20' west of power pole
9+20	72	9+20	73	72.5	
10+35	86	10+35	86	86	10' south of fence
11	65	11	66	65.5	
12+12	92	12+12	200	96	13' south of fence
13	115	13	110	112.5	12' from fence corner
14+23	63	14+23	66	64.5	
15	60	15	58	59	
17	71	17	105	88	8' east of a car
17+14	58	17+14	58	58	
18	93	18	100	96.5	
19	165	19	160	162.5	
19+20	70	19+20	70	70	
20	64	20	62	63	
21	53	21	36	44.5	5' west of drain
15+35	52	15+35	51	51.5	
22	54	22	54	54	
22+30	60	24+30	60	60	
24+15	67	24+15	68	67.5	
25	60	25	60	60	
26	50	26	48	50	
27	48	27	48	48	
27+35	53	27+35	54	53.5	

McBride-Ratcliff and Associates, Inc.

002214

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Moist

JOB NO. : 85-317

STATION INTERVAL : 50 ft TABLE NO. : 2 DATE : November 22,1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
29+15	68	29+15	70	69	
30	54	30	54	54	
31	50	31	50	50	
32	52	32	53	52.5	
32+15	60	32+15	62	61	
32+37	93	32+37	110	101.5	
32+46	26	32+46	72	49	
33	11	33	48	29.5	18' NE of light pole
34+13	65	34+13	67	66	
35	56	35	56	56	
35+22	63	35+22	63	63	
35+39	76	35+39	78	77	
36	92	36	120	106	
36+10	Neg. def.	36+10	33	Neg	
36+20	Neg. def.	36+20	100	Neg	
36+38	110	36+38	100	105	
37	72	37	71	71.5	
37+10	64	37+10	60	62	
37+25	55	37+25	55	55	
38	50	38	50	50	
39	73	39	74	73.5	
40+15	60	40+15	66	63	
41	59	41	58	58.5	
42	52	42	52	52	
43	50	43	48	49	
43+45	47	43+45	46	46.5	
44	49	44	50	49.5	
44+35	62	44+35	63	62.5	
46+12	64	46+12	65	64.5	
46+29	50	46+29	50	50	

McBride-Ratcliff and Associates, Inc.

002215

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Moist

JOB NO. : 85-317

STATION INTERVAL : 50 ft. TABLE NO. : 3

DATE November 22, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
47	42	47	43	42.5	
47+30	52	47+30	50	51	
48	55	48	55	55	
49	45	49	44	44.5	
50	48	50	50	49	
50+39	55	50+39	59	57	
52+11	59	52+11	60	59.5	
52+30	47	52+30	48	47.5	
53	46	53	48	47	
53+40	48	53+40	48	48	
54	60	54	60	60	
54+7	70	54+7	70	70	
54+15	75	54+15	57	66	
54+20	56	54+20	34	45	
54+34	82	54+34	62	72	
55	56	55	58	57	
55+20	53	55+20	45	49	
56	44	56	43	43.5	
56+39	54	56+39	54	54	
58+12	56	58+12	56	56	
58+35	45	58+35	45	45	
59	48	59	48	48	
59+13	60	59+13	60	60	
59+18	72	59+18	78	75	
59+23	105	59+23	110	107.5	
59+35	115	59+35	60	87.5	
59+38	12	59+38	Neg. Def.	Neg.	
59+46	72	59+46	24	48	
60	142	60	110	126	
60+12	76	60+12	76	76	

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002216

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Moist soil and asphalt paving **JOB NO. :** 85-317

STATION INTERVAL : 50 ft. **TABLE NO. :** 4 **DATE :** November 22, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
60+20	56	60+20	56	56	
61	47	61	47	47	
62	46	62	46	46	
63	64	63	63	63.5	
62+30	50	62+30	50	50	
64+10	94	64+10	96	95	
64+45	120	64+45	125	122.5	
65	130	65	105	117.5	
65+04	Neg. Def.	65+04	Neg. Def.	Neg.	
65+11	135	65+11	110	122.5	
65+24	185	65+24	165	175	
65+35	90	65+35	100	95	
66	88	66	85	86.5	
66+10	58	66+10	54	56	
66+20	74	66+20	74	74	
66+29	54	66+29	56	55	
66+32	29	66+32	27	28	
66+40	48	66+40	55	51.5	
67	68	67	68	68	
68	66	68	64	65	
69	72	69	70	71	
70+10	125	70+10	120	122.5	
70+26	80	70+26	8	44	
71	74	71	74	74	
71+15	80	71+15	82	81	
71+20	54	71+20	70	62	20' east of light pole
72	56	72	56	56	27' east of Sta. 72
73	64	73	64	64	32' east of Sta. 73
74	84	74	89	86.5	
75	85	75	90	87.5	

McBride-Ratcliff and Associates, Inc.

002217

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Asphalt paving and moist soil **JOB NO. :** 85-317

STATION INTERVAL : 50 ft. **TABLE NO. :** 5 **DATE :** November 22, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
76	68	76	69	68.5	40' east of Sta. 76
77	62	77	62	62	38' east of Sta. 77
78	58	78	58	58	40' east of Sta. 78
79	58	79	56	57	38' east of Sta. 79
80	62	80	66	64	
81	59	81	60	59.5	
82	60	82	60	60	
83	60	83	61	60.5	
84	60	84	62	61	
85	62	85	62	62	
86	64	86	64	64	
86+15	68	86+15	67	67.5	
86+30	70	86+30	69	69.5	
87	72	87	72	72	
88	71	88	72	71.5	
88+30	75	88+30	73	74	
90	71	90	72	71.5	
90+18	67	90+18	66	66.5	
91	66	91	68	67	
91+32	61	91+32	62	61.5	
92	64	92	64	64	
93	66	93	66	66	
94	66	94	63	64.5	
95	68	95	65	66.5	
95+20	70	95+20	68	69	
95+27	74	95+27	73	73.5	
96	78	96	78	78	12' north of ditch
96+8	88	96+8	88	88	
96+8E	68	96+8E	69	68.5	11' east of 96+8
97+18	95	97+18	91	93	

McBride-Ratcliff and Associates, Inc.

002218

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Asphalt paving and moist soil **JOB NO. :** 85-317

STATION INTERVAL : 50 ft. **TABLE NO. :** 6 **DATE :** November 22, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
97+20	100	97+20	104	102	
97+25	80	97+25	98	89	
97+33	18	97+33	41	29.5	
97+37	57	97+37	88	72.5	
98	150	98	160	155	
98+8	Neg	98+8	29	Neg.	
98+18	29	98+18	146	87.5	
98+20	110	98+20	110	110	
98+25	86	98+25	82	84	
98+31	64	98+31	60	62	
99	52	99	50	51	
100	50	100	50	50	
100+25	45	100+25	62	53.5	
101	67	101	66	66.5	
101+21	72	101+21	85	78.5	
101+27	38	101+27	62	50	
101+33	56	101+33	84	70	
101+38	79	101+38	86	87.5	
102	74	102	73	73.5	
103	68	103	68	68	
103+15	66	103+15	65	65.5	
104	58	104	58	58	
105	54	105	50	52	
106	50	106	48	49	
107	46	107	42	44	
108	42	108	40	41	
109	40	109	39	39.5	
110	45	110	43	44	
111	44	111	42	43	
112	43	112	40	41.5	

McBride-Ratcliff and Associates, Inc.

002219

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Asphalt paving and moist soil **JOB NO. :** 85-317

STATION INTERVAL : 50 ft. **TABLE NO. :** 7 **DATE :** November 22, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
113	44	113	42	43	
114	46	114	42	44	
115	47	115	44	45.5	
116	46	116	42	44	
117	46	117	45	45.5	
118	45	118	45	45	
119	44	119	44	44	
120	42	120	42	42	
121	49	121	48	48.5	
121+8	47	121+8	48	47.5	
122	54	122	55	54.5	
123	130	123	120	125	
124	121	124	128	124.5	
125	70	125	142	106	
126	56	126	55	55.5	
126+35	70	126+35	64	67	
127	25	127	100	62.5	
128	45	128	46	45.5	
129	43	129	44	43.5	
130	44	130	44	44	
131	43	131	44	43.5	
132	45	132	45	45	
133	42	132	42	42	
134	45	134	45	45	
135	43	135	44	43.5	
136	42	136	43	42.5	
137	44	137	44	44	
138	42	138	42	42	
139	48	139	48	48	
140	50	140	49	49.5	

McBride-Ratcliff and Associates, Inc.

002220

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Asphalt paving and moist soil **JOB NO. :** 85-317

STATION INTERVAL : 50 ft. **TABLE NO. :** 8 **DATE :** November 22, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
141	40	141	40	40	
142	44	142	44	44	
143	58	143	60	59	
144	62	144	62	62	
145	105	145	105	105	10' south and 15' east of Sta. 145
146	47	146	47	47	
147	48	147	48	48	
149	42	149	42	42	
150	42	150	42	42	
151	41	151	42	41.5	
152	42	152	43	42.5	
153	45	153	45	45	
154	40	154	40	40	
154+39	36	154+39	41	38.5	
155	44	155	43	43.5	
155+15	39	155+15	40	39.5	
156	45	156	45	45	
157	47	157	46	46.5	
158	44	158	45	44.5	
159	42	159	40	41	
159+13	40	159+13	40	40	
160	46	160	48	47	
161	56	161	56	56	
162	57	162	58	57.5	
163+15	70	163+15	70	70	
164	48	164	48	48	
165	46	165	46	46	
166	50	166	50	50	
167	46	167	44	45	
168	42	168	44	43	

McBride-Ratcliff and Associates, Inc.

002221

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Asphalt paving and moist soil **JOB NO. :** 85-317

STATION INTERVAL : 50 ft. **TABLE NO. :** 9 **DATE :** November 22, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
169	42	169	42	42	
170	48	170	48	48	
171	44	171	45	44.5	
172	44	172	43	43.5	
172+38	40	172+38	45	42.5	
173	42	173	43	42.5	
174	44	174	44	44	
175	44	175	44	44	
176	48	176	49	48.5	
177	44	177	44	44	
178	49	178	49	49	
178+28	52	178+28	52	52	
179	55	179	55	55	
180	61	180	62	61.5	
181	96	181	86	91	17' west and 10' south of Sta. 181
182	49	182	49	49	
183	46	183	46	46	
184	48	184	48	48	
185	45	185	45	45	
186	44	186	44	44	
187	52	187	52	52	
188	56	188	56	56	
189	51	189	50	50.5	
190	48	190	48	48	
191	48	191	48	48	
192	52	192	52	52	
193	56	193	56	56	
194	53	194	54	53.5	
195	51	195	50	50.5	
195+32	50	195+32	52	51	

McBride-Ratcliff and Associates, Inc.

002222

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Asphalt paving and moist soil **JOB NO. :** 85-317

STATION INTERVAL : 50 ft. **TABLE NO. :** 10 **DATE :** November 22, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
196	56	196	57	56.5	
197	60	197	58	59	
198+28	80	198+28	84	82	
199	87	199	85	86	
199+10	122	199+10	132	127	
199+17	Neg.	199+17	47	Neg.	
199+25	82	199+25	152	117	
200	76	200	74	75	
201	72	201	72	72	
202	70	202	70	70	
203	62	203	61	61.5	
204	59	204	58	58.5	
205	26	205	62	44	
205+20	72	205+20	73	72.5	
205+35	90	205+35	90	90	Buried electrical line 20' south
205+41	110	205+41	115	112.5	Buried electrical line 14' south
206	160	206	160	160	Buried electrical line 10' south
206+10	Varies	206+10	Neg.	Neg.	Over electrical line
207		207			Covered by a trailer
208	46	208	44	45	
209	40	209	42	41	
210	41	210	40	40.5	
211	42	211	44	43	
212	55	212	54	54.5	
213	55	213	55	55	
214	55	214	55	55	
215	54	215	54	54	
216	54	216	52	53.5	
217	51	217	52	51.5	
218	55	218	54	54.5	

McBride-Ratcliff and Associates, Inc.

002223

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Asphalt paving and moist soil JOB NO. : 85-317

STATION INTERVAL : 50 ft. TABLE NO. : 11 DATE : November 22, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
219	52	219	52	52	
219+32	48	219+32	47	47.5	
220	49	220	48	48.5	
221	46	221	46	46	
222	57	222	57	57	
222+38	68	222+38	62	65	
223	64	223	65	64.5	
224+12	Neg.	214+12	119	Neg.	
224+26	96	224+16	90	93	
225	70	225	71	70.5	
225+25	92	225+25	93	92.5	
225+38	140	225+38	140	140	
225+43	74	225+43	188	131	
226	Neg.	226	32	Neg.	
226+14	132	226+14	170	151	
226+17	109	226+17	108	108.5	
227	79	227	80	79.5	
228	76	228	78	77	
229	79	229	80	79.5	
230	80	230	82	81	
230+25	107	230+25	111	109	
230+30	74	230+30	112	93	
230+35	34	230+35	94	64	
230+43	80	220+43	120	100	
231	108	231	108	108	
232	76	232	80	78	
232+40	79	232+40	82	80.5	
233	94	233	97	95.5	
234+16	100	234+16	105	102.5	

McBride-Ratcliff and Associates, Inc.

002224

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Asphalt paving **JOB NO. :** 85-317

STATION INTERVAL : 50 ft. **TABLE NO. :** 12 **DATE :** November 22,1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
235	72	235	72	72	
235+25	80	235+25	80	80	
236	76	236	74	75	
237	82	237	76	79	
237+10	98	237+10	99	98.5	
237+38	230	237+38	38	134	
238	34	238	Neg.	Neg.	
238+8	160	238+8	93	126.5	
239	82	239	83	82.5	
239+38	60	239+38	61	60.5	
240	76	240	74	75	
240+7	90	240+7	97	93.5	
240+11	20	240+11	100	60	
240+18	1	240+18	75	38.5	Needle fluctuating
240+28	88	240+28	58	73	
241	96	241	29	62.5	
241+9	115	241+9	60	87.5	
241+45	74	241+45	68	71	
242	90	242	82	86	
242+11	110	242+11	102	106	
242+30	170	242+30	170	170	
242+32	Neg.	242+32	105	Neg.	
242+44	78	242+44	250	164	
243	200	243	195	197.5	
243+10	142	243+10	135	138.5	
243+39	99	243+39	94	96.5	
244	98	244	98	98	
245+12	74	245+12	74	74	
246	69	246	69	69	

McBride-Ratcliff and Associates, Inc.

002225

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Asphalt paving and moist soil **JOB NO. :** 85-317

STATION INTERVAL : 50 ft. **TABLE NO. :** 13 **DATE :** November 22, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
247	72	247	70	71	
248	75	248	73	74	
249	70	249	72	71	
250	70	250	68	69	
250+28	75	250+28	46	60.5	
250+37	Neg.	250+37	Neg.	Neg.	
250+40	34	250+40	75	54.5	
251	120	251	120	120	
251+18	68	251+18	115	91.5	
251+25	6	251+25	93	49.5	
251+30	50	251+30	120	85	
251+37	101	251+37	100	100.5	
252	72	252	72	72	
251+20	70	252+20	70	70	
253	65	253	64	64.5	
253+20	78	253+20	78	78	
253+29	70	253+29	160	115	
253+45	Neg	253+45	79	Neg	
254	95	254	140	117.5	
254+20	72	254+20	74	73	
255	65	255	65	65	
256	63	256	64	63.5	
257	63	257	65	64	
378	89	378	91	90	
378+15	98	378+15	108	103	
378+20	50	378+20	88	69	
378+29	60	378+29	100	80	
379	78	379	76	77	
380	72	380	74	73	

McBride-Ratcliff and Associates, Inc.

002226

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Moist Soil **JOB NO. :** 85-317

STATION INTERVAL : 50 ft. **TABLE NO. :** 14 **DATE :** November 22, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
381	76	381	77	76.5	
382	66	382	66	66	
383	71	383	89	80	
383+11	115	383+11	115	115	
383+28	84	383+28	85	84.5	
384	80	384	80	80	
384+40	72	384+40	70	71	
385	68	385	84	76	
386	68	386	69	68.5	
387	72	387	72	72	
387+20	99	387+20	96	97.5	
387+34	160	387+34	210	185	
387+38	21	387+38	225	123	
387+42	Neg.	387+42	94	Neg.	
388	120	388	160	140	

McBride-Ratcliff and Associates, Inc.

002227

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Moist Soil

JOB NO. : 85-317

STATION INTERVAL : 50 ft. TABLE NO. : 15

DATE : November 25, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
258-12	98	258+12	98	98	
258+38	110	258+38	89	99.5	
259	88	259	82	85	
259+38	110	259+38	70	90	
260	160	260	34	97	
260+28	115	260+28	37	76	
261	120	261	90	105	
261+25	295	261+25	180	237.5	
262	230	262	145	187.5	
262+28	145	262+28	Neg.	Neg.	
262+40	230	262+40	Neg.	Neg.	
263	78	263	Neg.	Neg.	
263+8	120	263+8	Neg.	Neg.	
263+35	165	263+35	94	129.5	
264	125	264	97	111	
264+27	73	264+27	110	91.5	
264+38	36	264+38	110	73	
265	84	265	80	82	
266	73	266	73	73	
267	77	267	77	77	
267+25	130	267+25	120	125	Over standing water
267+35	Neg.	267+35	67	Neg	Next to trees and standing water
267+40	80	267+40	140	110	
268	86	268	76	81	
268+15	60	268+15	60	60	
269	58	269	60	59	
270	54	270	55	54.5	
271	50	271	48	49	
271+44	57	271+44	56	56.5	
272	48	272	52	50	

McBride-Ratcliff and Associates, Inc.

002228

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Moist Soil

STATION INTERVAL : 50 ft. TABLE NO. : 16

JOB NO. : 85-317

DATE : November 25, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
273	55	273	53	54	
273+26	46	273+26	48	47	
274	51	274	49	50	
275	54	275	55	54.5	
276	58	276	58	58	
276+15	94	276+15	92	93	
276+25	135	276+25	170	152.5	
276+30	Neg	276+30	90	Neg.	
277	100	277	96	98	
278	61	278	160	110.5	
279	91	279	92	91.5	
279+14	79	279+14	87	83	
280	96	280	97	96.5	
281	110	281	110	110	
281+22	99	281+22	99	99	
282	84	282	84	84	
283	66	283	64	65	
284	68	284	67	67.5	
285	72	285	74	73	
286	74	286	72	73	
287	70	287	70	70	
287+13	76	287+13	75	75.5	
287+30	105	287+30	140	122.5	
287+38	Neg.	287+38	81	Neg.	
288	112	288	122	117	
289	61	289	61	61	
290	54	290	56	55	
291	56	291	58	57	
292	58	292	57	57.5	
293	54	293	52	53	

McBride-Ratcliff and Associates, Inc.

002229

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Moist

JOB NO. : 85-317

STATION INTERVAL : 50 ft. TABLE NO. : 17

DATE : November 25, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
294	54	294	54	54	
295	54	295	54	54	
296	56	296	58	57	
296+15	61	296+15	59	60	
296+30	42	285+30	64	53	
297	68	297	28	48	
298	84	298	85	84.5	
299	86	299	87	86.5	
300	71	300	75	73	
300+19	86	30+19	90	88	
301	98	301	98	98	
302	80	302	80	80	
303	70	303	71	70.5	
304	68	304	65	66.5	
304+21	90	304+21	87	88.5	
304+30	27	304+30	50	38.5	
304+39	140	304+39	170	155	
305	Neg	305	102	Neg.	
305+8	105	305+8	135	120	
306	73	306	73	73	
307	79	307	84	81.5	
307+25	92	307+25	94	83	
307+35	165	307+35	190	177.5	
307+45	Neg.	307+45	71	Neg.	
308	42	308	132	87	
308+25	67	308+25	64	65.5	
309	56	309	55	55.5	
310	54	310	53	53.5	
311	62	311	62	62	
312	56	312	54	55	

McBride-Ratcliff and Associates, Inc.

002230

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Moist Soil JOB NO. : 85-317

STATION INTERVAL : 50 ft. TABLE NO. : 18 DATE November 25, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
313	52	313	54	53	
314	55	314	54	54.5	
315	56	315	57	56.5	
315+30	51	315+30	49	50	
316	55	316	55	55	
317	59	317	59	59	
318	101	318	101	101	South edge at ditch
319	101	319	100	100.5	
320	120	320	121	120.5	
321	100	321	100	100	
322	195	322	130	162.5	Next to pile
323	270	323	225	247.5	
323+7	265	323+7	140	202.5	In ditch
323+12	140	323+12	26	83	
323+18	39	323+18	Neg.	Neg.	
323+25	102	323+25	Neg.	Neg.	
323+30	185	323+30	37	111	
324	137	324	155	146	
324+15	120	324+15	82	101	
325	63	325	68	65.5	
326	62	326	68	65	
326+21	74	326+21	73	73.5	
326+43	105	326+43	138	121.5	
327	Neg.	327	84	Neg.	
327+12	44	327+12	Neg.	Neg.	
327+20	85	327+20	Neg.	Neg.	
327+30	32	327+30	56	44	
328	82	328	84	83	
328+10	93	328+10	90	91.5	
328+46	115	328+46	64	89.5	

McBride-Ratcliff and Associates, Inc.

002231

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Moist soil

JOB NO. : 85-317

STATION INTERVAL : 50 ft. TABLE NO. : 19

DATE : November 25, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
329	86	329	17	51.5	
329+17	38	329+17	62	50	
329+28	75	329+28	74	74.5	
330	56	330	58	57	
331	60	331	60	60	
332	56	332	56	56	
333	55	333	55	55	
334	50	334	53	51.5	
334+12	55	334+12	56	55.5	
334+40	76	334+40	78	77	
335	106	335	107	106.5	
335+30	105	335+30	Neg.	Neg.	
335+45	250	335+45	Neg.	Neg.	
336	150	336	Neg.	Neg.	
337	93	337	94	93.5	South edge of ditch
338	105	338	101	103	
339	96	339	97	96.5	
340	83	340	83	83	
340+12	97	340+12	99	98	
341	93	341	94	93.5	
341+22	74	341+22	69	71.5	
342	66	342	65	65.5	
343	94	343	103	98.5	On new gravel road over ditch
343+5	30	343+5	83	56.5	
343+15	84	343+15	115	99.5	
343+18	64	343+18	64	64	
344	65	344	66	65.5	
345	110	345	115	112.5	
345+33	47	345+33	Neg.	Neg.	
345+40	68	345+40	7	37.5	

McBride-Ratcliff and Associates, Inc.

002232

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Moist soil

JOB NO. : 85_317

STATION INTERVAL : 50 ft. TABLE NO. : 20

DATE November 25, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
346	30	346	98	64	
346+4	Neg.	396+4	50	Neg.	
346+7	34	346+7	158	96	
346+12	Neg.	346+12	11	Neg.	
346+28	40	346+28	320	180	
346+43	Neg.	346+43	118	Neg.	
347	Neg.	347	54	Neg.	
347+10E	34	347+10E	115	74.5	10 ft. east of Sta. 347
347+10W	54	347+10W	65	59.5	5 ft. west of Sta. 347
347+7	94	374+7	101	97.5	
347+30	68	347+30	67	67.5	
348	69	348	70	69.5	In wooded area
348+10	100	348+10	96	98	In wooded area
348+30	Neg.	348+30	121	Neg.	
348+38	58	348+38	165	111.5	
349	90	349	83	86.5	
349+15	66	349+15	66	66	
350	66	350	66	66	
351	68	351	68	68	
351+20	88	351+20	95	91.5	
351+38	115	351+38	121	118	
352	170	352	130	150	
352+20	Neg.	352+20	Neg.	Neg.	
352+33	110	352+33	Neg.	Neg.	
353	160	353	135	147.5	
353+30	78	353+30	76	77	
354	62	354	64	63	
355	53	355	54	53.5	
356	86	356	90	88	
357	150	357	160	155	

McBride-Ratcliff and Associates, Inc.

002233

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Moist soil **JOB NO. :** 85-317

STATION INTERVAL : 50 ft. **TABLE NO. :** 21 **DATE :** November 25, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
357+40	108	357+40	108	108	
358	93	358	96	94.5	
358+7	91	358+7	90	90.5	
359	79	359	80	79.5	
360	76	360	76	76	
361	84	361	86	85	
361+30	120	361+30	109	114.5	In road
362		362			In fence enclosure
363	87	363	87	87	
364	62	364	64	63	
365	62	365	63	62.5	
366	63	366	62	62.5	
367	121	367	125	123	
368	115	368	115	115	
368+20	195	368+20	200	197.5	
368+32	Neg.	368+32	68	Neg.	
368+40	110	368+40	195	152.5	
369	150	369	145	147.5	
370	185	370	190	187.5	
370+10	230	370+10	74	152	
370+20	130	370+20	Neg.	Neg.	
370+25	23	370+25	Neg.	Neg.	
370+34	96	370+34	Neg.	Neg.	
370+40	190	370+40	118	154	
371	180	371	140	160	
371+34	83	371+34	82	82.5	
372	76	372	74	75	
373	94	373	97	95.5	
374	84	374	87	85.5	
375	82	375	84	83	

McBride-Ratcliff and Associates, Inc.

002234

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Moist soil

JOB NO. : 85-317

STATION INTERVAL : 50 ft.

TABLE NO. : 22

DATE : November 25, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
376	72	376	72	72	
377	69	377	68	68.5	
389+5	96	389+5	95	95.5	
389+30	86	389+30	76	81	
390	110	390	200	155	
390+10	Neg.	390+10	95	Neg.	
390+20	145	390+20	140	142.5	
390+29	93	390+29	95	94	
391	72	391	74	73	
391+38	70	391+38	69	69.5	
392	90	392	88	89	
393	96	393	97	96.5	
393+11	80	393+11	77	78.5	
393+25	6	393+25	77	41.5	
393+46	150	393+46	175	162.5	
394	65	394	190	127.5	
394+4	Neg.	394+4	56	Neg.	
394+10	91	394+10	190	140.5	
394+32	74	394+32	74	74	
395	77	395	80	78.5	
395+31	60	395+31	55	57.5	
396	72	396	70	71	
397	115	397	115	115	
397+25	88	397+25	100	94	
398	18	398	185	101.5	
398+4	Neg.	398+4	73	Neg.	
398+10	68	398+10	205	136.5	
398+33	115	398+33	120	117.5	
399	86	399	93	89.5	
400	74	400	75	74.5	

McBride-Ratcliff and Associates, Inc.

002235

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Asphalt paving

JOB NO. : 85-317

STATION INTERVAL : 50 ft. TABLE NO. : 23

DATE : November 25, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
401	100	401	100	100	
402	92	402	91	91.5	
403	150	403	150	150	
404	92	404	90	91	
405	87	405	88	87.5	
406	74	406	73	73.5	
407	76	407	76	76	
407+35	105	407+35	97	101	
407+42	46	407+42	155	100.5	
408	Neg	408	68	Neg.	
408+2	19	408+2	150	84.5	
408+15	93	408+15	90	91.5	
409	77	409	76	76.5	
410	76	410	75	75.5	
411	90	411	90	90	
412	98	412	99	98.5	
413	80	413	82	81	
414	78	414	66	72	
414+35	59	414+35	70	64.5	
414+43	97	414+43	110	103.5	
415	112	415	115	113.5	
415+20	33	415+20	170	101.5	
416	87	416	87	87	
417	86	417	88	87	
417+40	98	417+40	94	96	
418	101	418	108	104.5	
419	88	419	88	88	
420	93	420	93	93	
420+5	100	420+5	101	100.5	
420+17	86	420+17	80	83	

McBride-Ratcliff and Associates, Inc.

002236

CONDUCTIVITY PROFILE DATA

KOPPERS SOUTH CAVALCADE SITE

SOIL CONDITION : Asphalt Paving

JOB NO. : 85-317

STATION INTERVAL : 50 ft. TABLE NO. : 24

DATE : November 25, 1985

STATION NUMBER N-S	READING mmho/m (R)	STATION NUMBER E-W	READING mmho/m (R)	AVG. VALUE	REMARKS
420+40	89	420+40	96	92.5	
421	31	421	100	65.5	
422	71	422	72	71.5	
423	77	423	76	76.5	
424	68	424	69	68.5	
425	73	425	73	73	
426	73	426	75	74	
426+8	100	426+8	96	98	
426+20	121	426+20	170	145.5	
426+22	Neg.	426+22	140	Neg.	
426+32	135	426+32	176	155.5	
426+44	96	426+44	92	94	
427	84	427	78	81	
427+31	70	427+31	64	67	
428	66	428	57	61.5	
429	69	429	62	65.5	
430	75	430	65	70	
431	86	431	78	82	
431+32	110	431+32	90	100	
431+44	Neg.	431+44	110	Neg.	
432	35	432	160	97.5	
432+5	115	432+5	100	107.5	
432+25	80	432+25	68	74	
433	76	433	62	69	
434	80	434	65	72.5	
435	71	435	69	70	

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002237