



Appendix N

Monitoring Well Survey Report

General

DON TROCCHIO
REGISTERED SURVEYOR



NARRATIVE

This survey task came about MKM Engineer's, Inc. desire to accurately locate and elevate monitor well locations within the Ravenna Army Ammunition Plant, locally referred to as the Ravenna Arsenal, Portage County, Ohio.

Initial control was transferred to each site in January 2005 via static GPS observations under very cold and snowy conditions. During the survey, 63 monitor well locations were located scattered throughout the facility in 10 separate locations. There were 62 new wells and one existing within an area about 6 miles east and west by about 2.9 miles north and south.

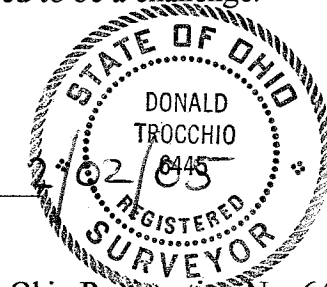
Horizontal and vertical control is based on existing monuments known as RAV 4, RAV 10 and RAV 13 established by the U.S. Army Corps of Engineers in 1997 associated with aerial photo mapping of the facility. All coordinates are referenced to the North American Datum of 1983 (NAD83), Ohio State Plane Rectangular Coordinate Grid System, North Zone, U.S. Survey Foot. The elevations are referenced to the NAVD of 1988 and are shown in feet and decimal parts thereof.

GPS data was transferred to each site using 3 Locus L1 receivers in static mode at 10 second epochs. Most occupations were about 45 minutes or longer. Depending upon well configurations and obstructions, some wells were occupied directly with a receiver unit and others were located from nearby GPS established control with Topcon Robotic APL-1A instrument and data collector. GPS adjustment files and Starnet least square adjustment files are included electronically (Adjusted Vectors.doc).

All data was plotted in AutoCad v2K and furnished to MKM Engineers, Inc. along with other electronic files. A map was prepared for each site showing the relative locations of the monitor wells along with the observed coordinates of the top of the inner casing and a nearby ground shot.

There were no major problems encountered other than the cold and deep snow cover. Access with equipment to some sites proved to be a challenge.

Don Trocchio, PS



Ohio Registration No. 6445

RAVENNA ARMY AMMUNITION PLANT RAVENNA, OHIO PORTAGE COUNTY

RVAAP-06 C-BLOCK QUARRY (FOUR MONITORING WELL LOCATIONS) SURVEY PREPARED FOR MKM ENGINEERS, INC.

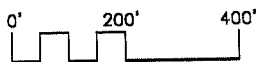
PointNo.	Northing(Y)	Easting(X)	Elev(Z)	Description	
62	559044.48	2343845.22	1175.24	CBLMW002-TIC	66
63	559403.12	2343657.08	1181.08	CBLMW001-TIC	+
64	559405.12	2343659.08	1178.50	CBLMW001-GND	
65	559046.48	2343843.22	1172.50	CBLMW002-GND	
66	559951.58	2343688.76	1174.84	CBLMW004-TIC	
67	559950.00	2343687.21	1172.08	CBLMW004-GND	
69	559697.13	2343967.67	1172.22	CBLMW003-GND	70
70	559695.52	2343970.00	1175.06	CBLMW003-TIC	+

63
+

62
+

GRID NORTH


FEBRUARY 3, 2005



SCALE IN FEET



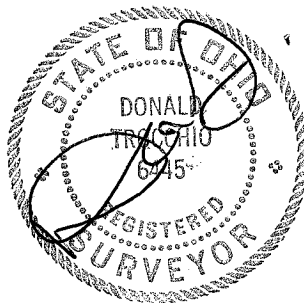
PH 330-296-2375



DON TROCCHIO

5485 McCORMICK ROAD
P.O. BOX 528
RAVENNA, OH 44266

REGISTERED SURVEYOR NO.6445



DRAWING NOTES

1. BEARINGS ARE GRID NORTH, NAD83
OHIO STATE PLANE RECTANGULAR GRID
COORDINATES, NORTH ZONE ORIGINATING
FROM RAV 4 DISC IN CONC.
N554037.682 E2348868.243 ELV(NGVD88)1105.52
2. TIC=TOP OF INSIDE CASING GND=GROUND
3. YOU MAY DOWNLOAD THE FREE UTILITY CORPSCON
AT <http://crunch.tec.army.mil/software/corpscon/corpscon.html>
TO CONVERT COORDINATES TO ANOTHER MAP PROJECTION

RAVENNA ARMY AMMUNITION PLANT RAVENNA, OHIO PORTAGE COUNTY

128
+

RVAAP-12 LOAD LINE 12 (FIVE MONITORING WELL LOCATIONS) SURVEY PREPARED FOR MKM ENGINEERS, INC.

PointNo.	Northing(Y)	Easting(X)	Elev(Z)	Description
126	556658.89	2369432.17	984.83	LL12MW246-TIC
127	557377.17	2368751.42	980.65	LL12MW244-TIC
128	558020.51	2368545.29	981.20	LL12MW242-TIC
129	557044.55	2368370.74	980.04	LL12MW245-TIC
130	557376.32	2368190.04	980.79	LL12MW243-TIC
142	558022.51	2368543.29	978.40	LL12MW242-GND
143	557374.32	2368192.04	978.10	LL12MW243-GND
144	557380.17	2368753.42	978.10	LL12MW244-GND
145	557042.55	2368368.74	977.50	LL12MW245-GND
146	556660.89	2369434.17	982.00	LL12MW246-GND

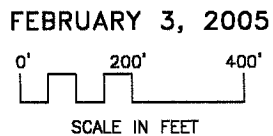
130
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127
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129
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126
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GRID NORTH

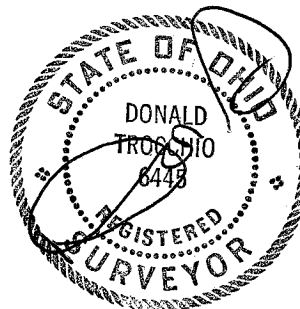


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DON TROCCHIO

5485 McCORMICK ROAD
P.O. BOX 528
RAVENNA, OH 44266

REGISTERED SURVEYOR NO.6445



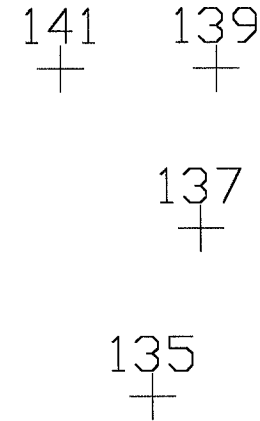
DRAWING NOTES

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COORDINATES, NORTH ZONE ORIGINATING
FROM RAV 10 DISC IN CONC.
N555004.363 E2367417.833 ELV(NGVD88)983.84
- TIC=TOP OF INSIDE CASING GND=GROUND
- YOU MAY DOWNLOAD THE FREE UTILITY CORPSCON
<http://crunch.tec.army.mil/software/corpscon/corpscon.html>
TO CONVERT COORDINATES TO ANOTHER MAP PROJECTION

RAVENNA ARMY AMMUNITION PLANT RAVENNA, OHIO PORTAGE COUNTY

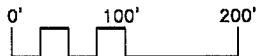
RVAAP-13 BUILDING1200 (FOUR MONITORING WELL LOCATIONS, 3NEW, 1EXISTING)
SURVEY PREPARED FOR MKM ENGINEERS, INC.

PointNo.	Northing(Y)	Easting(X)	Elev(Z)	Description
134	565540.14	2371371.62	1003.80	BKGMW010-GND
135	565540.54	2371372.86	1006.18	BKGMW010-TIC
136	565690.15	2371415.07	1003.76	B12MW011-GND
137	565687.82	2371416.15	1006.70	B12MW011-TIC
138	565824.62	2371429.64	1003.43	B12MW012-GND
139	565828.01	2371430.41	1006.32	B12MW012-TIC
140	565828.90	2371293.16	1002.72	B12MW010-GND
141	565827.43	2371292.81	1005.92	B12MW010-TIC

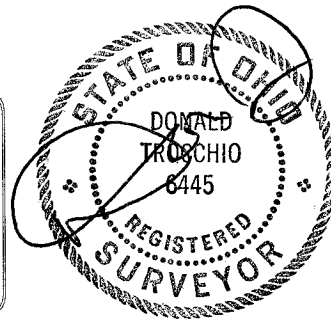
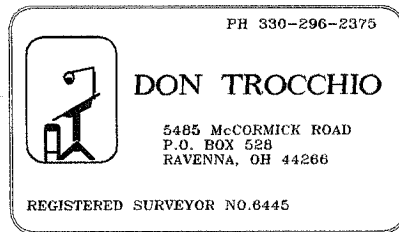


GRID NORTH

FEBRUARY 3, 2005



SCALE IN FEET



DRAWING NOTES

1. BEARINGS ARE GRID NORTH, NAD83
OHIO STATE PLANE RECTANGULAR GRID
COORDINATES, NORTH ZONE ORIGINATING
FROM RAV 13 DISC IN CONC.
N569575.016 E2368754.577 ELV(NGVD88)965.60
2. TIC=TOP OF INSIDE CASING GND=GROUND
3. YOU MAY DOWNLOAD THE FREE UTILITY CORPSCON
<http://crunch.tec.army.mil/software/corpscon/corpscon.html>
TO CONVERT COORDINATES TO ANOTHER MAP PROJECTION

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO PORTAGE COUNTY

RVAAP-19 LANDFILL NORTH OF WINKLEPECK (FOUR MONITORING WELL LOCATIONS)
SURVEY PREPARED FOR MKM ENGINEERS, INC.

PointNo.	Northing(Y)	Easting(X)	Elev(Z)	Description
68	564825.89	2358403.21	1038.00	LNWMW024-TIC
73	564827.89	2358401.21	1035.30	LNWMW024-GND
79	564658.16	2358952.24	1027.80	LNWMW026-TIC
82	565071.92	2358417.06	1029.13	LNWMW025-TIC
85	564517.41	2358628.75	1027.13	LNWMW027-TIC
87	565069.92	2358420.06	1027.20	LNWMW025-GND
90	564656.16	2358954.24	1025.00	LNWMW026-GND
91	564519.41	2358626.75	1024.40	LNWMW027-GND

82
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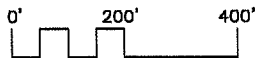
68
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79
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85
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GRID NORTH

FEBRUARY 3, 2005



SCALE IN FEET

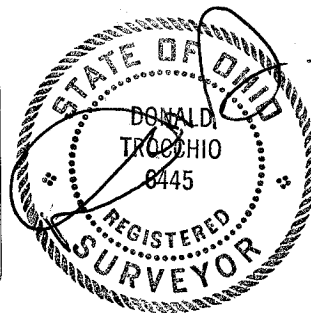


PH 330-296-2375

DON TROCCHIO

5485 McCORMICK ROAD
P.O. BOX 528
RAVENNA, OH 44266

REGISTERED SURVEYOR NO.6445



DRAWING NOTES

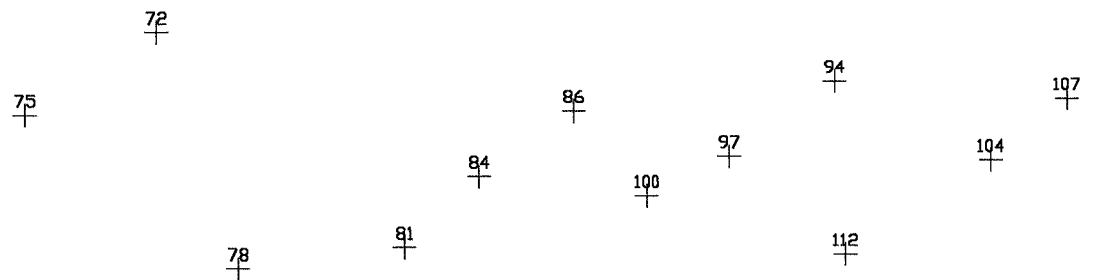
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OHIO STATE PLANE RECTANGULAR GRID
COORDINATES, NORTH ZONE ORIGINATING
FROM RAV 3 DISC IN CONC.
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2. TIC=TOP OF INSIDE CASING GND=GROUND
3. YOU MAY DOWNLOAD THE FREE UTILITY CORPSCON
<http://crunch.tec.army.mil/software/corpscon/corpscon.html>
TO CONVERT COORDINATES TO ANOTHER MAP PROJECTION

RAVENNA ARMY AMMUNITION PLANT RAVENNA, OHIO PORTAGE COUNTY

RVAAP-38 NACA TEST AREA (TWELVE MONITORING WELL LOCATIONS)

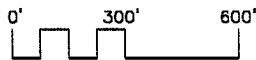
SURVEY PREPARED FOR MKM ENGINEERS, INC.

PointNo.	Northing(Y)	Easting(X)	Elev(Z)	Description
71	551917.92	2345782.17	1083.22	NTAMW108-GND
72	551916.22	2345781.60	1085.62	NTAMW108-TIC
74	551699.09	2345432.73	1077.65	NTAMW107-GND
75	551697.29	2345433.40	1080.30	NTAMW107-TIC
77	551291.19	2345996.99	1076.89	NTAMW109-GND
78	551293.25	2345997.72	1079.84	NTAMW109-TIC
80	551350.80	2346436.82	1080.03	NTAMW110-GND
81	551351.46	2346438.94	1082.62	NTAMW110-TIC
83	551538.99	2346640.16	1078.07	NTAMW111-GND
84	551538.60	2346638.01	1080.94	NTAMW111-TIC
86	551712.14	2346889.48	1078.33	NTAMW112-TIC
88	551708.76	2346889.01	1075.36	NTAMW112-GND
93	551793.39	2347582.94	1086.91	NTAMW115-GND
94	551791.78	2347581.16	1089.65	NTAMW115-TIC
96	551590.76	2347302.80	1075.61	NTAMW114-GND
97	551592.94	2347301.57	1078.71	NTAMW114-TIC
99	551487.86	2347081.15	1072.61	NTAMW113-GND
100	551488.52	2347082.83	1075.68	NTAMW113-TIC
103	551586.36	2347994.79	1091.67	NTAMW117-GND
104	551584.57	2347994.83	1094.54	NTAMW117-TIC
106	551749.39	2348196.78	1091.68	NTAMW116-GND
107	551748.00	2348196.39	1094.33	NTAMW116-TIC
111	551333.89	2347608.09	1078.86	NTAMW118-GND
112	551335.04	2347609.41	1081.44	NTAMW118-TIC



GRID NORTH

FEBRUARY 3, 2005



SCALE IN FEET

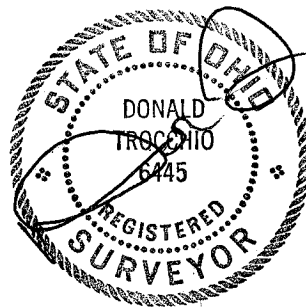


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5485 McCORMICK ROAD
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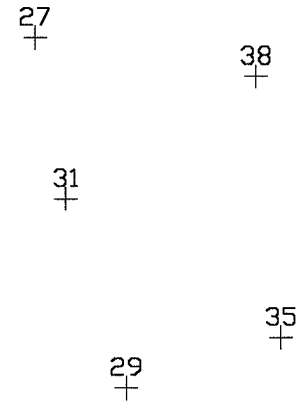
DRAWING NOTES

1. BEARINGS ARE GRID NORTH, NAD83
OHIO STATE PLANE RECTANGULAR GRID
COORDINATES, NORTH ZONE ORIGINATING
FROM RAV 4 DISC IN CONC.
N554037.682 E2348868.243 ELV(NGVD88)1105.52
2. TIC=TOP OF INSIDE CASING GND=GROUND
3. YOU MAY DOWNLOAD THE FREE UTILITY CORPSCON
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TO CONVERT COORDINATES TO ANOTHER MAP PROJECTION

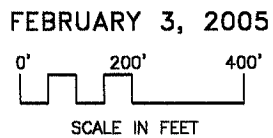
RAVENNA ARMY AMMUNITION PLANT RAVENNA, OHIO PORTAGE COUNTY

RVAAP-39 LOAD LINE 5 (SIX MONITORING WELL LOCATIONS) SURVEY PREPARED FOR MKM ENGINEERS, INC.


PointNo.	Northing(Y)	Easting(X)	Elev(Z)	Description
27	554604.01	2354571.52	1128.68	LL5MW002-TIC
28	554152.73	2354422.02	1129.42	LL5MW005-TIC
29	553984.82	2354730.78	1128.00	LL5MW006-TIC
31	554319.25	2354625.07	1127.92	LL5MW001-TIC
35	554073.73	2355006.44	1125.81	LL5MW004-TIC
38	554535.41	2354964.47	1127.70	LL5MW003-TIC
49	554321.25	2354627.07	1125.00	LL5MW001-GND
50	554606.00	2354573.52	1125.80	LL5MW002-GND
51	554533.41	2354962.47	1124.70	LL5MW003-GND
52	554071.73	2355008.44	1122.90	LL5MW004-GND
53	554154.73	2354424.02	1126.50	LL5MW005-GND
54	553981.82	2354730.00	1125.10	LL5MW006-GND



GRID NORTH



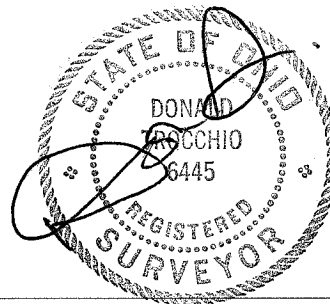
PH 330-296-2375



DON TROCCHIO

5485 McCORMICK ROAD
P.O. BOX 528
RAVENNA, OH 44266

REGISTERED SURVEYOR NO.6445



DRAWING NOTES

1. BEARINGS ARE GRID NORTH, NAD83 OHIO STATE PLANE RECTANGULAR GRID COORDINATES, NORTH ZONE ORIGINATING FROM RAV 4 DISC IN CONC.
N554037.682 E2348868.243 ELV(NGVD88)1105.52
2. TIC=TOP OF INSIDE CASING GND=GROUND
3. YOU MAY DOWNLOAD THE FREE UTILITY CORPSCON <http://crunch.tec.army.mil/software/corpscon/corpscon.html> TO CONVERT COORDINATES TO ANOTHER MAP PROJECTION

RAVENNA ARMY AMMUNITION PLANT RAVENNA, OHIO PORTAGE COUNTY

RVAAP-40 LOAD LINE 7 (SIX MONITORING WELL LOCATIONS)

SURVEY PREPARED FOR MKM ENGINEERS, INC.

PointNo.	Northing(Y)	Easting(X)	Elev(Z)	Description
6	555581.80	2351741.47	1135.87	LL7MW005-TIC
7	555581.14	2352035.20	1126.32	LL7MW004-TIC
9	555126.55	2351918.23	1129.55	LL7MW002-TIC
21	555579.52	2351740.29	1133.30	LL7MW005-GND
22	555583.15	2352036.23	1123.30	LL7MW004-GND
23	555124.46	2351916.51	1126.70	LL7MW002-GND
39	554925.77	2352192.91	1129.64	LL7MW001-TIC
40	555990.59	2351879.92	1123.56	LL7MW006-TIC
41	554927.57	2352190.31	1126.90	LL7MW001-GND
42	555992.59	2351881.62	1120.70	LL7MW006-GND
55	555414.33	2352349.51	1118.23	LL7MW003-GND
56	555417.04	2352351.04	1120.84	LL7MW003-TIC

40
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6
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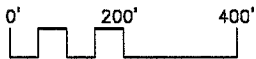
56
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9
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39
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GRID NORTH

FEBRUARY 3, 2005



SCALE IN FEET

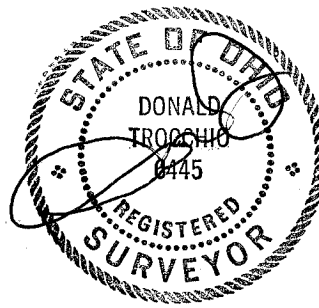


PH 330-296-2375

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RAVENNA, OH 44266

REGISTERED SURVEYOR NO.6445



DRAWING NOTES

1. BEARINGS ARE GRID NORTH, NAD83
OHIO STATE PLANE RECTANGULAR GRID
COORDINATES, NORTH ZONE ORIGINATING
FROM RAV 4 DISC IN CONC.
N554037.682 E2348868.243 ELV(NGVD88)1105.52
2. TIC=TOP OF INSIDE CASING GND=GROUND
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RAVENNA ARMY AMMUNITION PLANT RAVENNA, OHIO PORTAGE COUNTY

RVAAP-41 LOAD LINE 8 (SIX MONITORING WELL LOCATIONS)
SURVEY PREPARED FOR MKM ENGINEERS, INC.

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PointNo.	Northing(Y)	Easting(X)	Elev(Z)	Description
13	551808.38	2351263.66	1112.73	LL8MW004-GND
14	551807.58	2351261.83	1115.75	LL8MW004-TIC
19	551521.77	2351750.66	1112.51	LL8MW005-GND
20	551522.48	2351748.32	1115.73	LL8MW005-TIC
25	551294.68	2351483.72	1114.33	LL8MW006-GND
26	551296.77	2351483.58	1117.15	LL8MW006-TIC
30	552607.06	2351666.10	1121.46	LL8MW001-TIC
32	552608.92	2351664.36	1118.69	LL8MW001-GND
33	552230.97	2351360.48	1116.30	LL8MW003-GND
34	552231.14	2351359.25	1119.05	LL8MW003-TIC
36	552408.18	2351010.33	1124.51	LL8MW002-TIC
37	552409.85	2351009.30	1121.67	LL8MW002-GND

36
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34
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14
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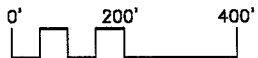
20
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DRAWING NOTES

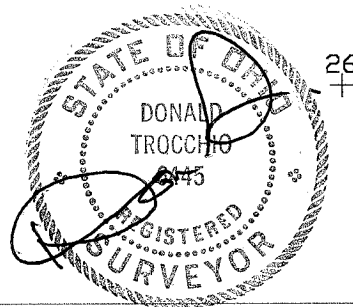
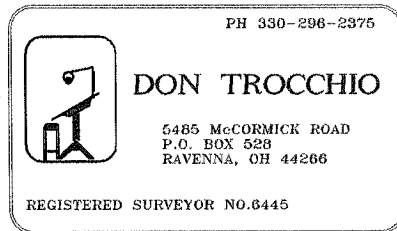
1. BEARINGS ARE GRID NORTH, NAD83
OHIO STATE PLANE RECTANGULAR GRID
COORDINATES, NORTH ZONE ORIGINATING
FROM RAV 4 DISC IN CONC.
N554037.682 E2348868.243 ELV(NGVD88)1105.52
2. TIC=TOP OF INSIDE CASING GND=GROUND
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TO CONVERT COORDINATES TO ANOTHER MAP PROJECTION

GRID NORTH

FEBRUARY 3, 2005



SCALE IN FEET



26
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RAVENNA ARMY AMMUNITION PLANT RAVENNA, OHIO PORTAGE COUNTY

RVAAP-43 LOAD LINE 10 (SIX MONITORING WELL LOCATIONS) SURVEY PREPARED FOR MKM ENGINEERS, INC.

PointNo.	Northing(Y)	Easting(X)	Elev(Z)	Description
11	554995.25	2355654.80	1123.83	LL10MW006-TIC
12	555816.25	2355272.22	1132.77	LL10MW001-TIC
16	555380.53	2355943.55	1125.67	LL10MW005-TIC
17	555494.71	2355389.92	1130.28	LL10MW003-TIC
18	555523.36	2355710.51	1127.13	LL10MW002-TIC
24	555236.59	2355438.20	1122.39	LL10MW004-TIC
43	555818.25	2355272.22	1130.00	LL10MW001-GND
44	555525.36	2355712.51	1124.40	LL10MW002-GND
45	555496.71	2355387.92	1127.40	LL10MW003-GND
46	555234.59	2355440.20	1119.60	LL10MW004-GND
47	555382.53	2355941.55	1122.90	LL10MW005-GND
48	554997.25	2355656.80	1121.20	LL10MW006-GND

12
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17
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18
+

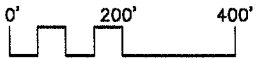
16
+

24
+

11
+

GRID NORTH

FEBRUARY 3, 2005



SCALE IN FEET

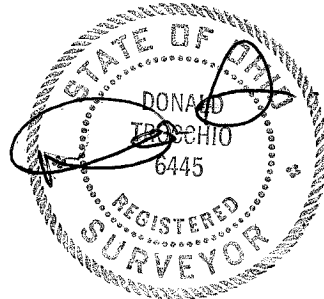


PH 330-296-2375

DON TROCCHIO

5485 McCORMICK ROAD
P.O. BOX 528
RAVENNA, OH 44266

REGISTERED SURVEYOR NO.6445



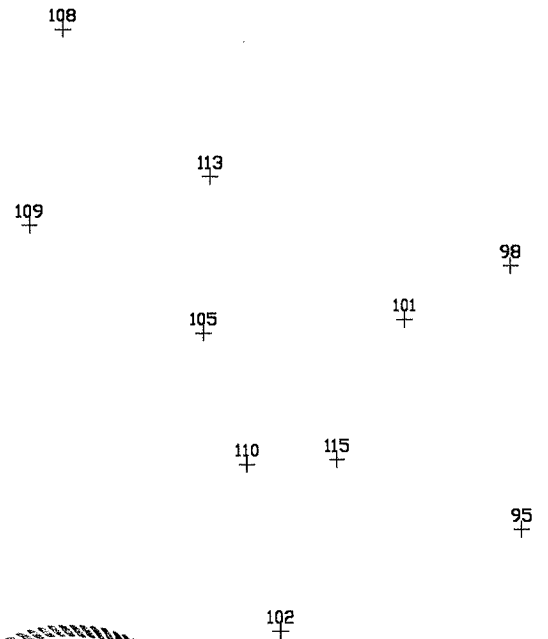
DRAWING NOTES

1. BEARINGS ARE GRID NORTH, NAD83
OHIO STATE PLANE RECTANGULAR GRID
COORDINATES, NORTH ZONE ORIGINATING
FROM RAV 4 DISC IN CONC.
N554037.682 E2348868.243 ELV(NGVD88)1105.52
2. TIC=TOP OF INSIDE CASING GND=GROUND
3. YOU MAY DOWNLOAD THE FREE UTILITY CORPSCON
<http://crunch.tec.army.mil/software/corpscon/corpscon.html>
TO CONVERT COORDINATES TO ANOTHER MAP PROJECTION

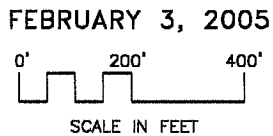
RAVENNA ARMY AMMUNITION PLANT RAVENNA, OHIO PORTAGE COUNTY

RVAAP-50 ATLAS SCRAP YARD (TEN MONITORING WELL LOCATIONS) SURVEY PREPARED FOR MKM ENGINEERS, INC.

PointNo.	Northing(Y)	Easting(X)	Elev(Z)	Description
95	557087.66	2367475.07	978.85	ASYMW008-TIC
98	557783.01	2367448.16	979.80	ASYMW005-TIC
101	557640.81	2367166.04	979.66	ASYMW004-TIC
102	556818.08	2366834.49	984.16	ASYMW007-TIC
105	557603.68	2366631.94	982.70	ASYMW009-TIC
108	558404.04	2366260.85	981.13	ASYMW001-TIC
109	557887.86	2366170.86	985.24	ASYMW002-TIC
110	557257.72	2366746.73	983.01	ASYMW006-TIC
113	558015.94	2366651.49	982.21	ASYMW003-TIC
115	557270.61	2366985.37	981.05	ASYMW010-TIC
116	558406.04	2366262.85	978.40	ASYMW001-GND
117	557889.86	2366168.86	982.00	ASYMW002-GND
118	558013.94	2366653.49	979.70	ASYMW003-GND
119	557642.81	2367164.04	977.10	ASYMW004-GND
120	557785.01	2367446.16	977.60	ASYMW005-GND
121	557255.72	2366748.73	980.20	ASYMW006-GND
122	556820.08	2366836.49	981.40	ASYMW007-GND
123	557085.66	2367473.07	976.20	ASYMW008-GND
124	557605.68	2366633.94	979.90	ASYMW009-GND
125	557272.61	2366983.37	978.20	ASYMW010-GND



GRID NORTH



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DRAWING NOTES

1. BEARINGS ARE GRID NORTH, NAD83
OHIO STATE PLANE RECTANGULAR GRID
COORDINATES, NORTH ZONE ORIGINATING
FROM RAV 10 DISC IN CONC.
N555004.363 E2367417.833 ELV(NGVD88)983.84
2. TIC=TOP OF INSIDE CASING GND=GROUND
3. YOU MAY DOWNLOAD THE FREE UTILITY CORPSCON
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Appendix O

Surface Water Field Sampling Forms

C-Block Quarry

Building 1200

Landfill North of Winklepeck Burning Grounds

Pistol Range

Load Line 5

Load Line 7

Load Line 8

Load Line 10

Buildings F-15/F-16

Atlas Scrap Yard