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REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT
BARABOO, WISCONSIN

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FINAL
REMEDIAL INVESTIGATION REPORT

DATA ITEM A011

US ARMY ENVIRONMENTAL CENTER
ABERDEEN PROVING GROUND, MD 21010-5401

VOLUME II OF II
TABLES AND FIGURES

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U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY
ABERDEEN PROVING GROUND, MARYLAND

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REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT
BARABOO, WISCONSIN

FINAL
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DATA ITEM A011

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TASK ORDER 1

Prepared for:

United States Army
Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

Prepared by:

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UNIFIED SOIL CLASSIFICATION SYSTEM DESCRIPTIONS

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TABLE 1-1
SUMMARY OF PREVIOUS FIELD INVESTIGATIONS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

				PROGRAM ELEMENTS		
	DATE	INVESTIGATIONS	SITES	MONITORING WELL INSTALLATIONS	SURFACE SOIL SAMPLING	SOIL BORINGS
1.	1977	U.S. AEHA	Rocket Paste Pond and Ditches	NA	Sediment and Paste Samples from Pond	Surface Water Samples from Pond
2.	1979	U.S. Army Corps of Engineers Mobile District	Existing Landfill	3 wells (S1134, S1135, S1136)	NA	NA
			Propellant Burning Ground	3 wells (S1144, S1145, S1146)	NA	NA
3.	1981	Envirodyne BAAP Contamination Survey	Distributed throughout BAAP	33 wells (S1101 through S1133)	2 sediment samples from NG Pond 2 sediment samples from Rocket Paste Ditch	NA
4.	1982	USAEHA Phase 2 Hazardous Waste Management Study	Propellant Burning Ground	NA	45 surface soil samples	NA
5.	1982	Warzyn Geological and Soils Survey and Groundwater Monitoring Program	Deterrent Burning Ground	4 wells (DBM-82-01, DBM-82-02, and DBN-82-01A,B[1])	NA	4 borings (DBB-82-01 through DBB-82-04)
			Propellant Burning Ground	20 wells: 5 sets of well nests, 3 wells per nest (PBN-82-01A,B,C through PBN-82-05A,B,C); 5 single wells (PBM-82-01 through PBM-82-05)	NA	8 borings (PBB-82-01 through PBB-82-08)
			Existing Landfill	12 wells: 4 sets of well nests, 3 wells per nest (ELN-82-01A,B,C through ELN-82-04A,B,C)	NA	6 borings (ELB-82-01 through ELB-82-06)
6.	1983	SARKO Establishment of Five Groundwater Monitoring Wells	Settling Ponds	3 wells (S-83-1147, S-83-1148, and S-83-1149)[2]	NA	NA
			Other Locations at BAAP	2 wells (S-83-1150 and S-83-1151)[2]	NA	NA

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continued

TABLE 1-1
SUMMARY OF PREVIOUS FIELD INVESTIGATIONS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

			PROGRAM ELEMENTS		
DATE	INVESTIGATIONS	SITES	MONITORING WELL INSTALLATIONS	SURFACE SOIL SAMPLING	SOIL BORINGS
7. 1984	Ayres Near-surface Soils Investigation	Final Creek and Settling Ponds Main Rocket Paste Drainage Ditch NG Pond and Overflow Pond	NA	50 surface soil samples 10 sediment samples from Main Rocket Paste Ditch 8 sediment samples	NA
8. 1984	Ayers Near-surface Soils Investigation	Ballistics Creek and Ballistics Pond	NA	5 creek sediment samples 4 pond sediment samples 2 surface soil samples	NA
9. 1984	Ayers Near-surface Soils Investigation	Oleum Plant and Pond Area	NA	8 soil/sediment samples 3 Control Pond sediment samples	NA
10. 1984	USAEHA Phase 4 Hazardous Waste Management Study	Propellant Burning Ground	NA	NA	15 soil borings to 50-foot depth; 70 subsurface soil samples
11. 1985	USAEHA Geohydrologic Study	Propellant Burning Ground	10 wells: 4 single wells (PBN-85-01A through PBN-85-04A) and 6 single wells (PBM-85-01 through PBM-85-06)	NA	NA
12. 1985	Foth & Van Dyke Soil Sampling Analysis and Evaluation of Settling Ponds Spoils Sites	Settling Ponds and Spoils Disposal Area	NA	40 samples of dredged settling pond spoils collected from spoils disposal areas	NA
13. 1985	Warzyn Subsurface Investigation at BAAP	Settling Ponds	2 wells consisting of a nested well pair (S-85-1152A,B)[3]	NA	NA
		Existing Landfill	1 well (S-85-1153)[3]	NA	NA

continued

TABLE 1-1
SUMMARY OF PREVIOUS FIELD INVESTIGATIONS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

			PROGRAM ELEMENTS		
DATE	INVESTIGATIONS	SITES	MONITORING WELL INSTALLATIONS	SURFACE SOIL SAMPLING	SOIL BORINGS
14 1986	U.S. Army Materiel Command Reactivity Testing Program	Propellant Burning Ground	NA	22 surface soil samples	NA
		Settling Ponds and Spoils Disposal Area	NA	17 surface soil samples	NA
15. 1986	USAEHA	Rocket Paste Ditch	NA	6 soil samples	NA
		Rocket Roll Ditch	NA	6 soil samples	
16. 1988	U.S. Army Engineer Waterways Experiment Station Geophysical Investigation	Existing Landfill	NA	NA	NA
		Deterrent Burning Ground	NA	NA	NA

Notes:

[1] Wells have since been renumbered as DBN-82-01B and DBN-82-01C.
[2] Wells have since been renumbered as S1147, S1148, S1149, S1150, and S1151
[3] Wells have since been renumbered as S1152A, S1152B, and S1153.
BAAP - Badger Army Ammunition Plant
NA - not applicable
USAEHA - U.S. Army Environmental Hygiene Agency
SARKO - R.F. Sarko & Associates

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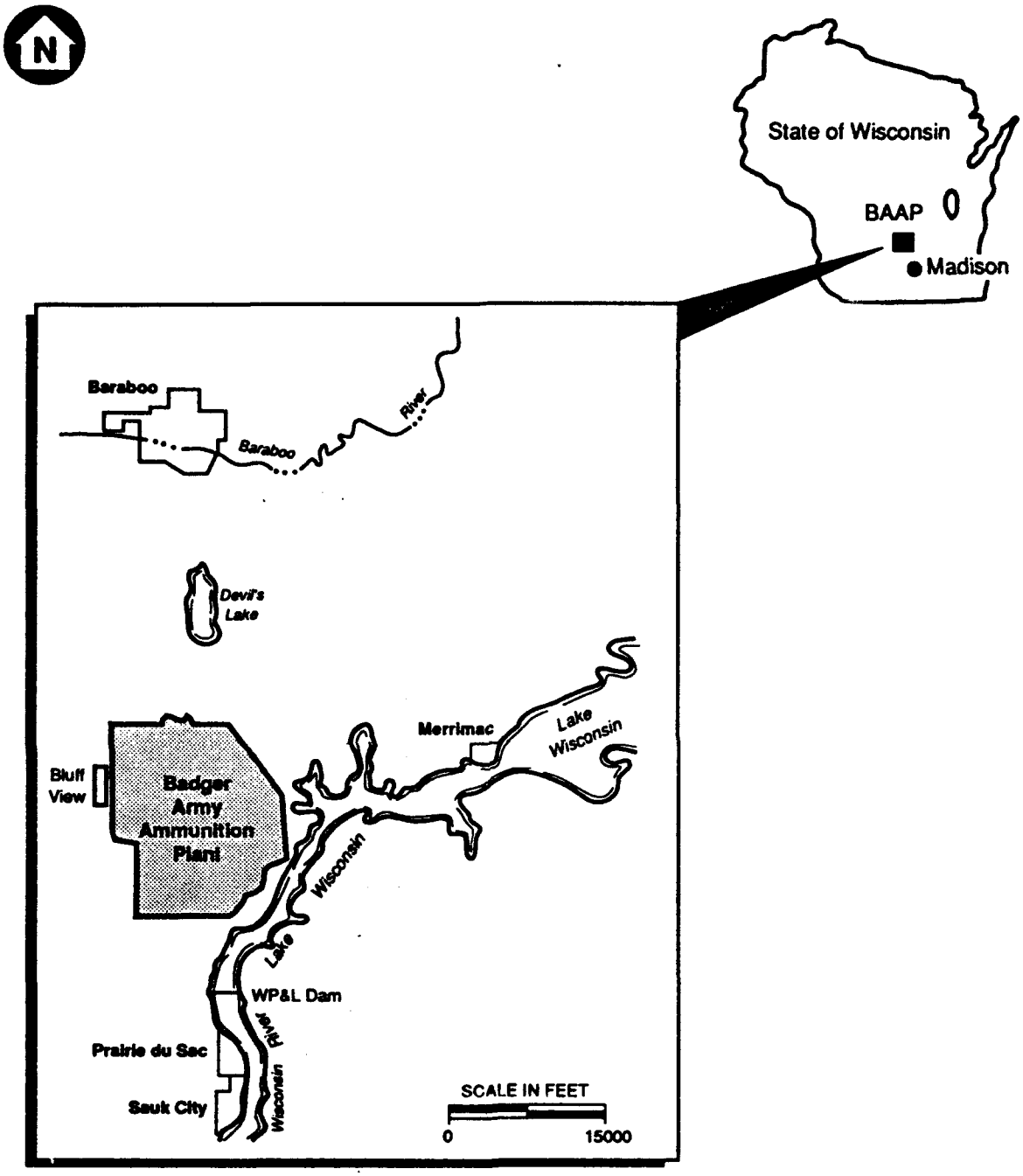


FIGURE 1-1
SITE LOCATION MAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Source: Modified from Tsai, et.al., 1988.

ABB Environmental Services, Inc.

92060280

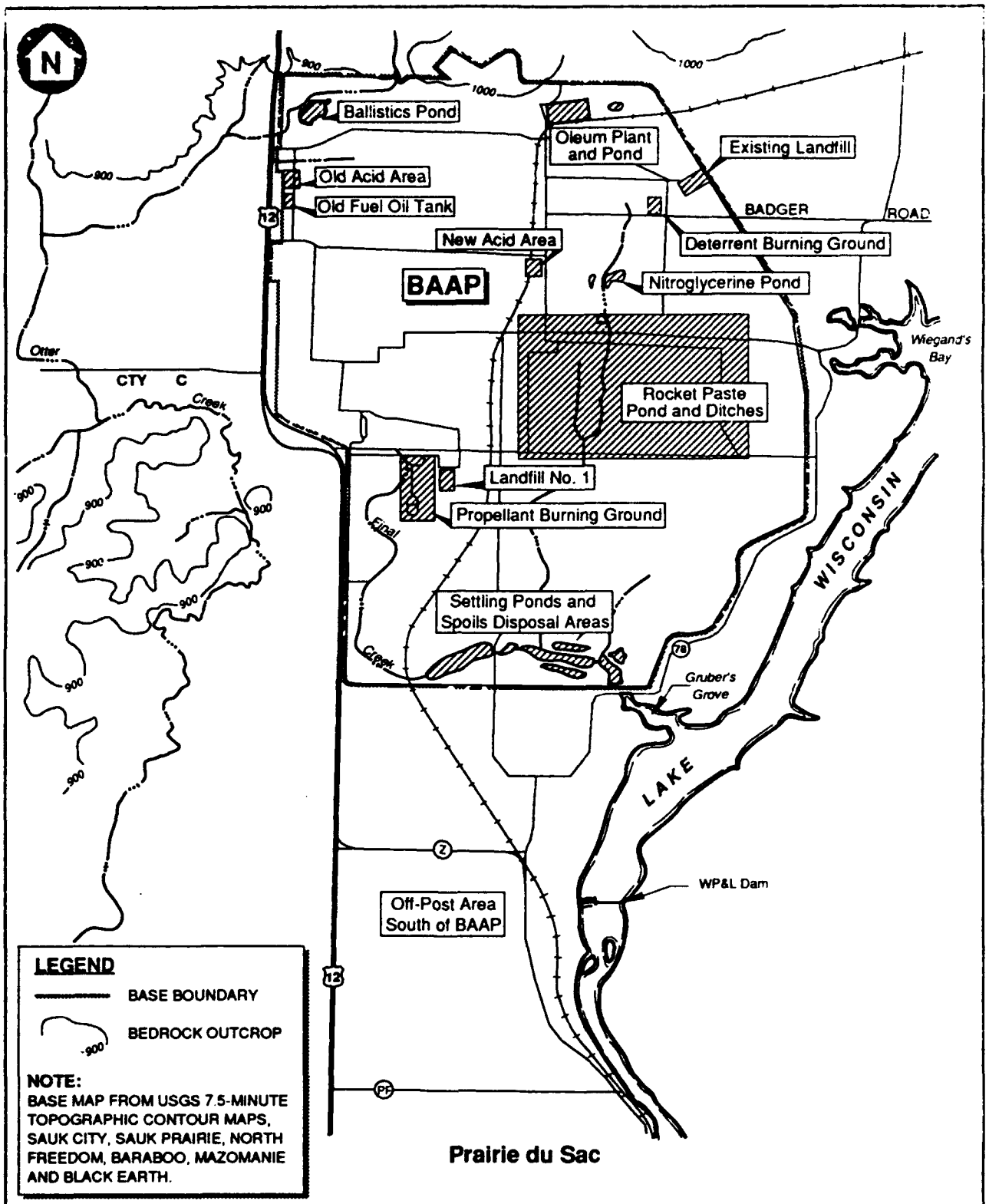
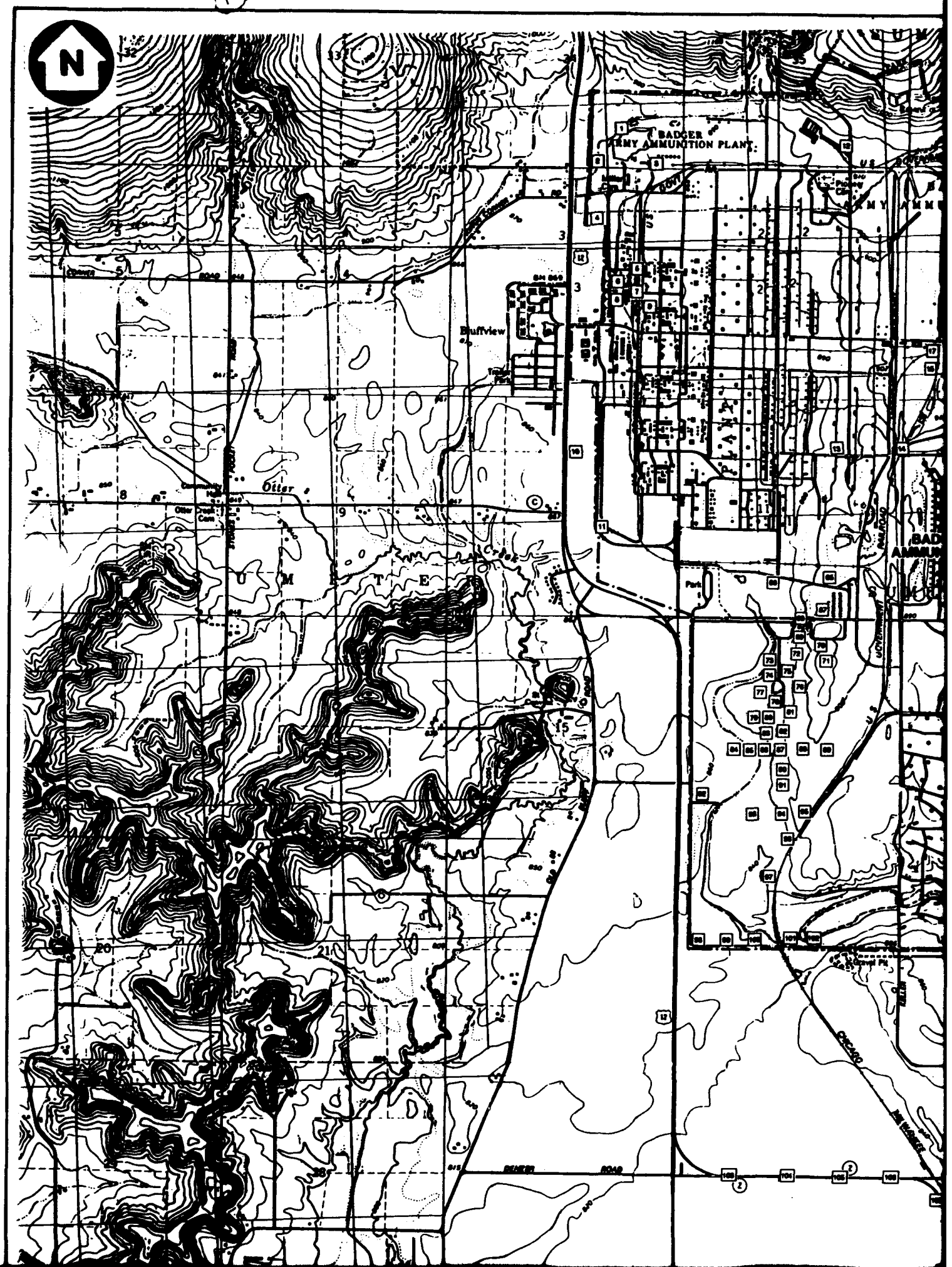
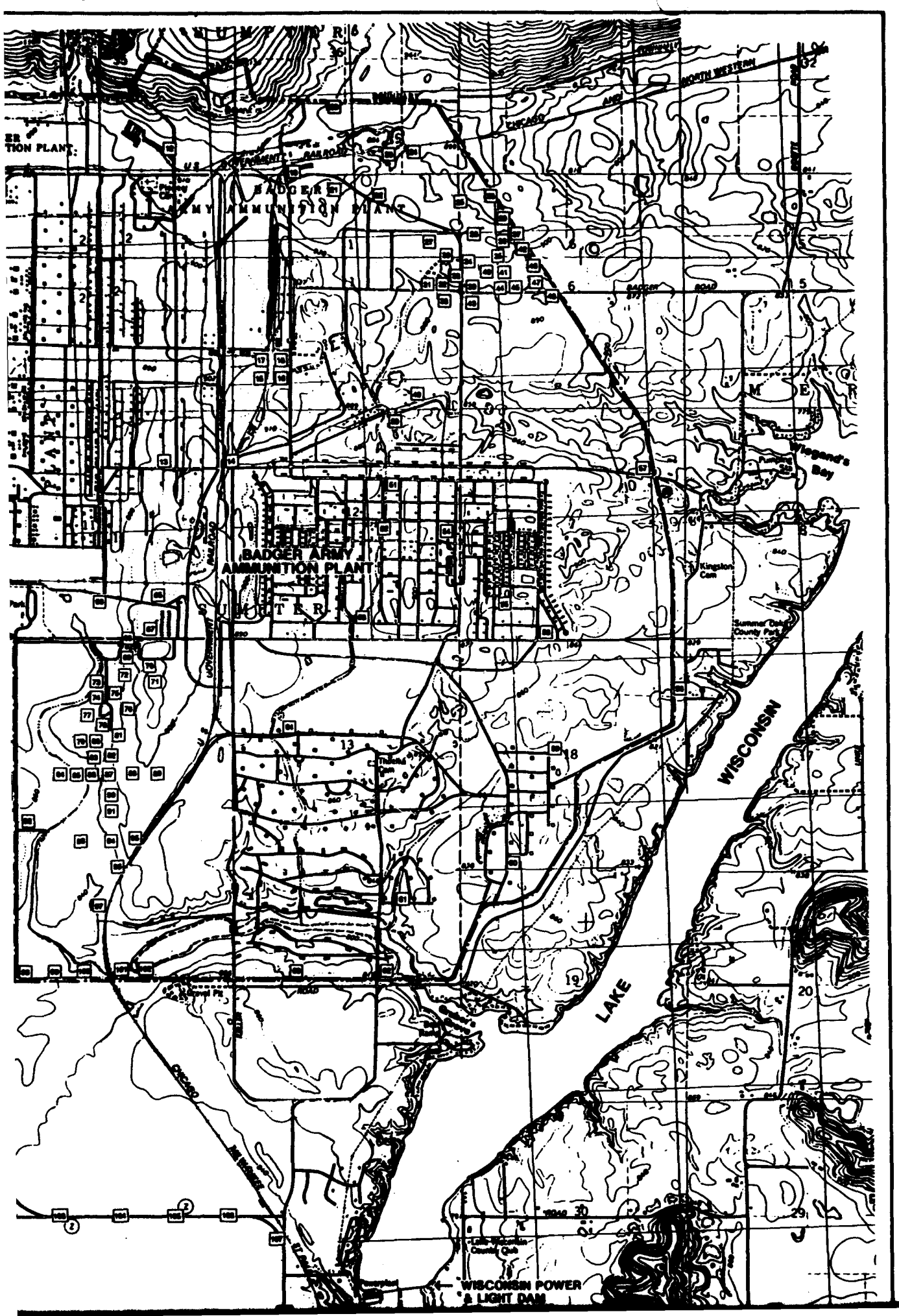


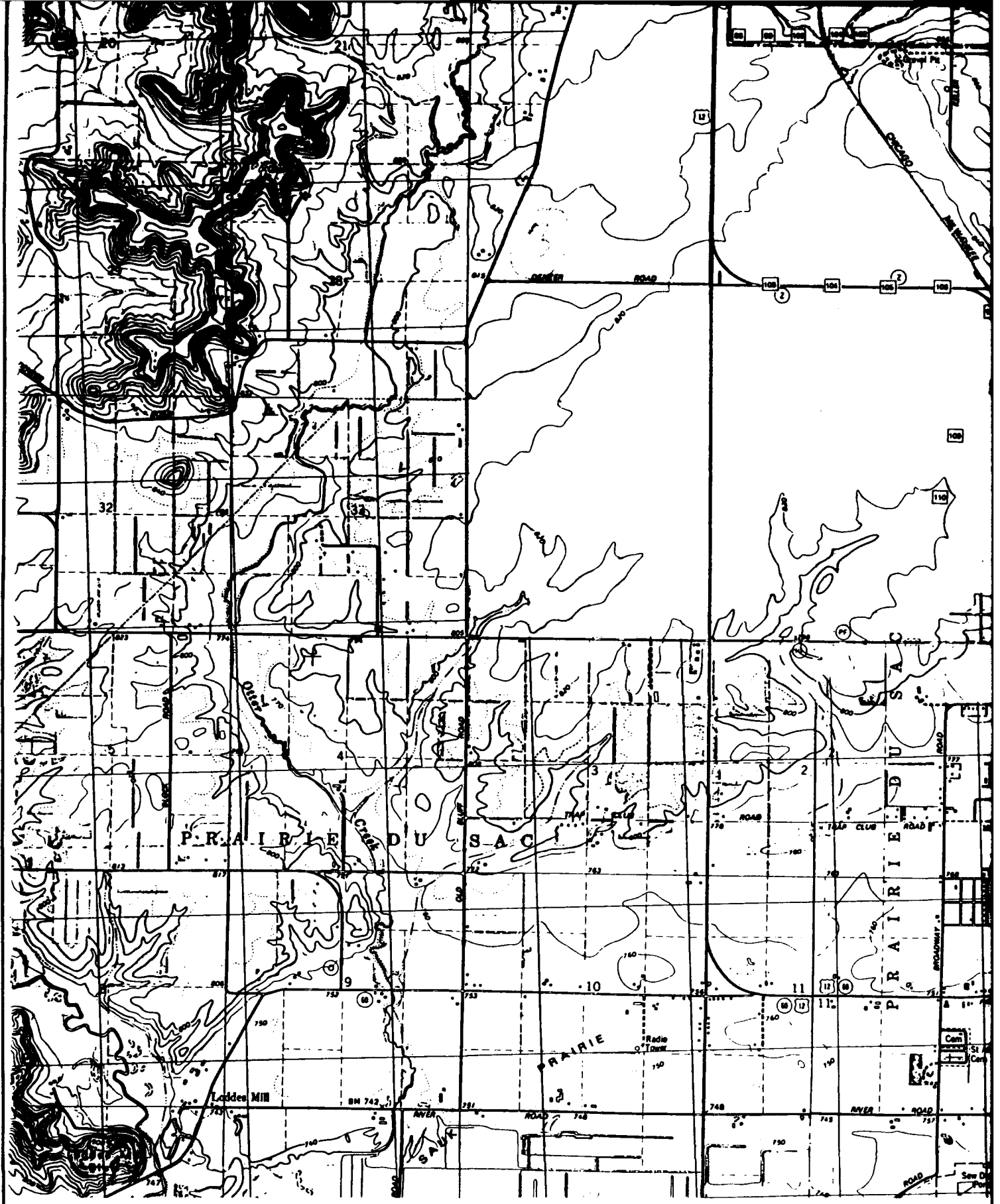
FIGURE 1-2
LOCATION OF 11 PRIORITY SITES
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

92030450


N
BADGER
ARMY AMMUNITION PLANT
Bluffview
Otter
Community Hall
Otter Creek Cem
U M E T E R
BADGER ROAD
CHICAGO
NW RAILROAD
Gravel Pit


BADGER ARMY AMMUNITION PLANT
BADGER ARMY AMMUNITION PLANT
CHICAGO AND NORTH WESTERN
Wiegand's Bay
Kingston Cem
Summer Oaks County Park
WISCONSIN
LAKE
WISCONSIN POWER & LIGHT DAM



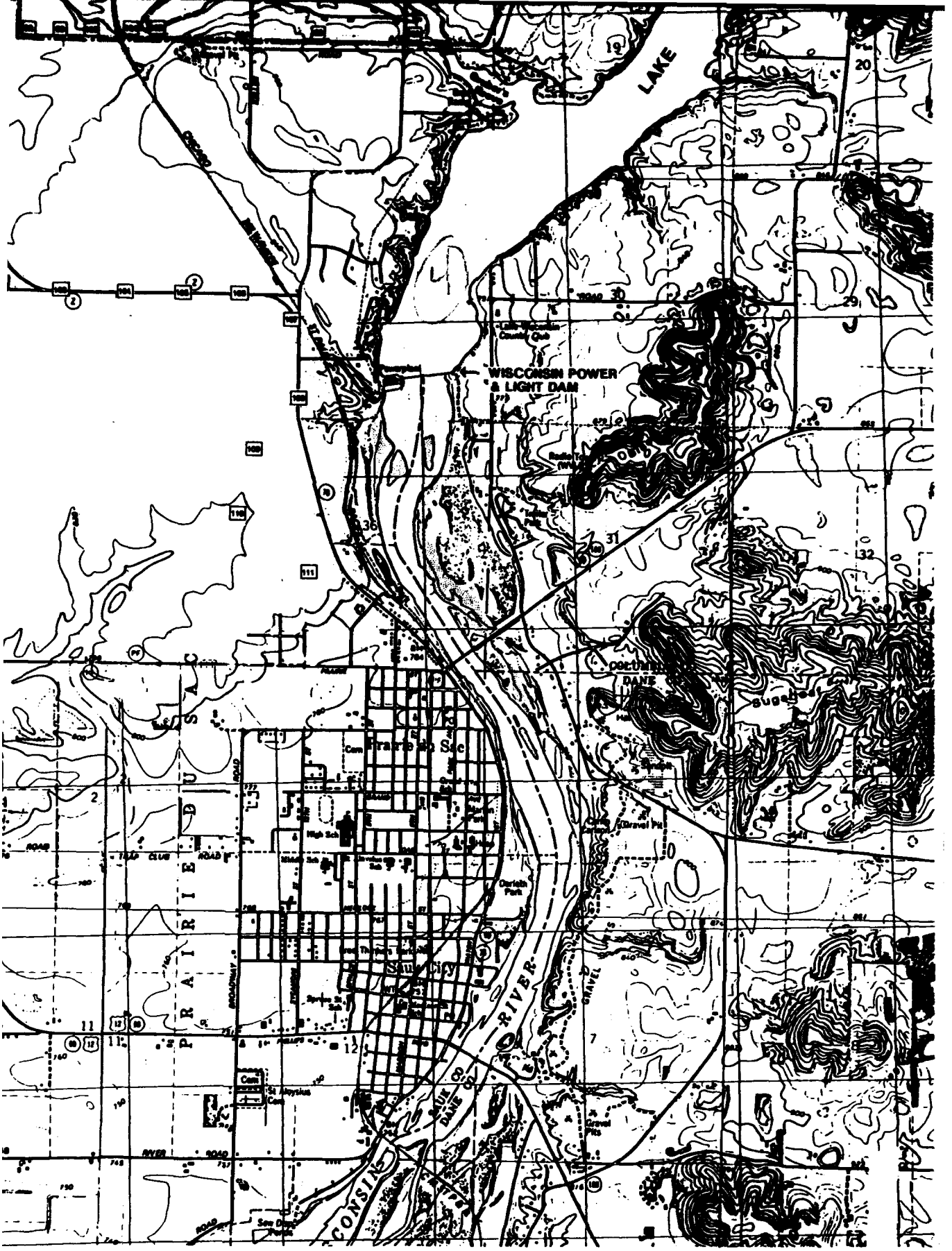
MAP CODE	WELL NO.	MAP CODE	WELL NO.	MAP CODE	WELL NO.	MAP CODE	WELL NO.	MAP CODE	WELL NO.
1	S1128	29	ELN-82-02A,B,C	55	S1120	77	PBM-82-03	97	PBN-89-12A,B
2	BGM-91-01	30	DBM-82-02	56	PRM-91-01	78	PBM-82-04	98	SPN-89-01C
3	S1127	31	DBM-89-05	57	S1121	79	S1146	98	S1133
4	BGM-91-02	32	DBN-82-01B,C	58	S1113	79	PBN-82-03A,B,C	98	S1101
5	OAM-91-01	32	S1122	58	S1114	80	S1117	99	SPN-89-02A,B,C
6	OAM-89-01	33	DBM-82-01	59	S1112	81	PBN-82-05A,B,C	99	SPN-91-02D
7	OAM-89-02	34	ELM-89-09	60	S1111	81	PBM-02-05	100	SPN-89-03B,C
8	FTM-89-01	35	S1134	61	S1110	82	PBN-82-04A,B,C	100	S1147
9	S1126	36	ELN-82-03A,B,C	62	S1107	83	PBM-85-01	100	SPN-91-03D
10	BGM-91-03	37	ELN-89-04A,B	62	S1108	84	PBM-89-05	101	S1148
11	S1123	38	DBM-89-01	62	SPN-89-05A,B	85	PBN-89-03B,C	101	SPN-89-04B,C
12	S1129	39	DBM-89-03	63	S1105	85	PBN-85-03A	101	SPN-91-04D
13	S1125	40	ELM-89-01	63	S1106	86	PBM-85-02	102	S1152A,B
14	S1150	41	ELM-89-02A,B	63	S1104	87	PBN-89-01B,C,D	102	S1149
15	NAN-91-01A	42	ELM-91-10	64	S1116	87	PBN-85-01A	102	S1102

LEGEND

75 MAP CODE DESIGNATIONS TO MONITORING WELL LO PRESENTED IN LOWER LEF

NOTE:

1. BASE MAP FROM USGS 7.5-MIN CONTOUR MAPS, SAUK CITY, S NORTH FREEDOM, BARABOO, M

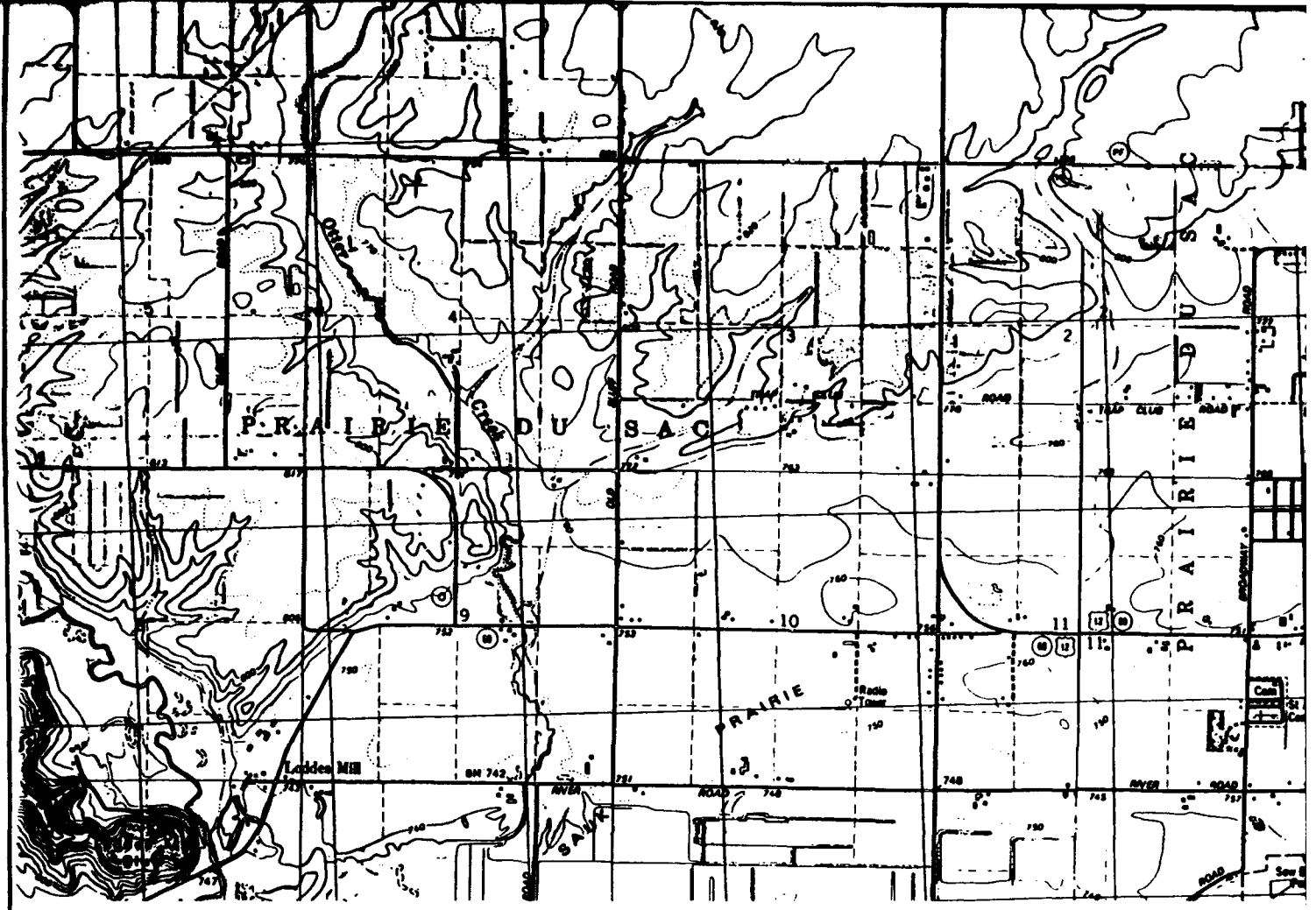


LEGEND

[75] MAP CODE DESIGNATIONS WHICH CORRELATE TO MONITORING WELL LOCATIONS ARE PRESENTED IN LOWER LEFT-HAND CORNER.

NOTE:

1. BASE MAP FROM USGS 7.5-MINUTE TOPOGRAPHIC CONTOUR MAPS, SAUK CITY, SAUK PRAIRIE, NORTH FREEDOM, BARABOO, MAZOMANIE AND BLACK EARTH.



MAP CODE	WELL NO.	MAP CODE	WELL NO.	MAP CODE	WELL NO.	MAP CODE	WELL NO.	MAP CODE	WELL NO.
1	S1128	29	ELN-82-02A,B,C	55	S1120	77	PBM-82-03	97	PBN-89-12A,B
2	BGM-91-01	30	DBM-82-02	56	PRM-91-01	78	PBM-82-04	98	SPN-89-01C
3	S1127	31	DBM-89-05	57	S1121	79	S1146	98	S1133
4	BGM-91-02	32	DBN-82-01B,C	58	S1113	79	PBN-82-03A,B,C	99	S1101
5	OAM-91-01	32	S1122	58	S1114	80	S1117	99	SPN-89-02A,B,C
6	OAM-89-01	33	DBM-82-01	59	S1112	81	PBN-82-05A,B,C	99	SPN-91-02D
7	OAM-89-02	34	ELM-89-09	60	S1111	81	PBM-02-05	100	SPN-89-03B,C
8	FTM-89-01	35	S1134	61	S1110	82	PBN-82-04A,B,C	100	S1147
9	S1126	36	ELN-82-03A,B,C	62	S1107	83	PBM-85-01	100	SPN-91-03D
10	BGM-91-03	37	ELN-89-04A,B	62	S1108	84	PBM-89-05	101	S1148
11	S1123	38	DBM-89-01	62	SPN-89-05A,B	85	PBN-89-03B,C	101	SPN-89-04B,C
12	S1129	39	DBM-89-03	63	S1105	85	PBN-85-03A	101	SPN-91-04D
13	S1125	40	ELM-89-01	63	S1106	86	PBM-85-02	102	S1152A,B
14	S1150	41	ELM-89-02A,B	63	S1104	87	PBN-89-01B,C,D	102	S1149
15	NAN-81-01A	42	ELM-91-10	64	S1116	87	PBN-85-01A	102	S1102
16	NAN-81-04B,C	42	S1135	64	S1115	87	PBM-85-03	102	S1103
17	NAN-81-02B	43	DBN-89-02A,B	65	LOM-91-02	88	PBN-89-02B,C	103	SWN-91-01B,C,D
18	NAN-81-03B,C	44	ELM-89-08	66	PBM-89-11	88	PBN-85-02A	104	SWN-91-02C,D
19	OPM-89-01	45	ELM-89-07	67	LOM-91-01	89	PBM-89-06	105	SWN-91-03B,C,D,E
20	S1131	46	S1153	68	PBM-89-09	90	PBM-85-04	106	SWN-91-04C,D
20	S1130	46	ELN-89-06B	69	PBN-89-01A,B,C	91	PBM-85-05	107	SWN-91-05B,C,D
21	OPM-89-03	47	ELM-89-03	70	LOM-89-01	92	S1109	108	PBN-91-01C
22	S1132	48	ELN-91-07A,B	71	LON-89-03A,B	93	PBM-89-07	108	PBM-90-01D
23	OPM-89-02	49	S1124	71	LON-89-02A,B	94	PBN-85-04A	109	PBM-90-02D
24	S1151	50	NPM-89-01	72	PBN-82-02A,B,C	94	PBN-89-04B,C	109	PBN-91-02B,C
25	ELN-82-01A,B,C	51	S1119	73	PBM-82-01	95	PBM-89-08	110	PBN-91-03B,C
26	ELM-89-05	52	RPM-89-02	74	S1144	96	PBM-85-06	110	PBM-90-03D
27	DBN-89-04A,B	53	S1118	75	PBM-82-02	96	PBN-91-06C,D	111	PBN-90-04A,D
28	ELN-82-04A,B,C	54	RPM-89-01	76	PBN-89-10A,B,C,D	97	PBN-91-12C,D		

LEGEND

[75] MAP CODE DESIGNATIONS TO MONITORING WELL LO PRESENTED IN LOWER LE

NOTE:

1. BASE MAP FROM USGS 7.5-MIN CONTOUR MAPS, SAUK CITY, S NORTH FREEDOM, BARABOO, M BLACK EARTH.

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6853-12/9209072T

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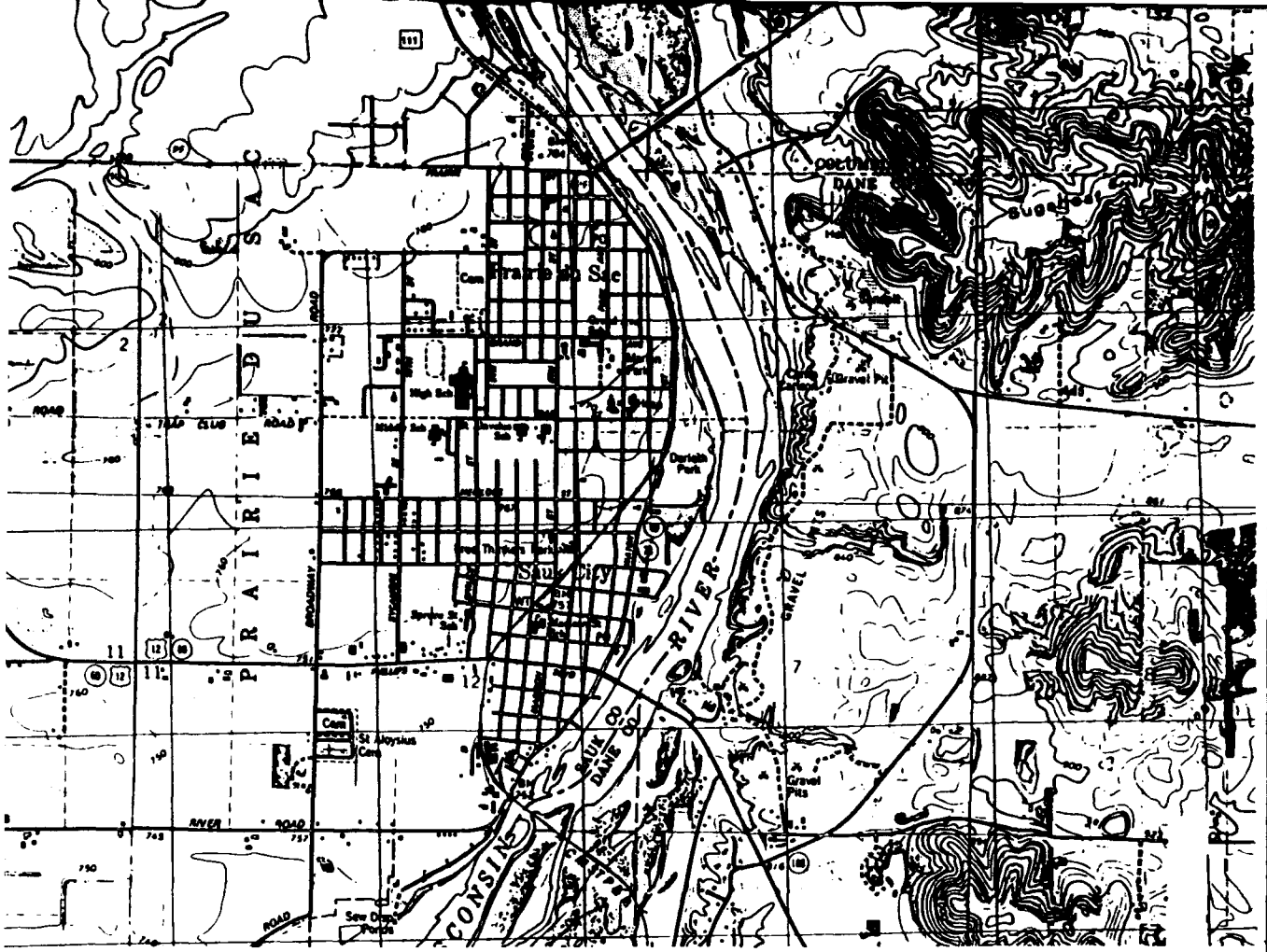

LEGEND

[75] MAP CODE DESIGNATIONS WHICH CORRELATE TO MONITORING WELL LOCATIONS ARE PRESENTED IN LOWER LEFT-HAND CORNER.

NOTE:

1. BASE MAP FROM USGS 7.5-MINUTE TOPOGRAPHIC CONTOUR MAPS, SAUK CITY, SAUK PRAIRIE, NORTH FREEDOM, BARABOO, MAZOMANIE AND BLACK EARTH.

FIGURE 1-3
MONITORING WELLS SAMPLED DURING THE REMEDIAL INVESTIGATION
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

TABLE 2-1
LOCATION AND CURRENT USE OF BAAP PRODUCTION WELLS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL	LOCATION	USE
PW-1	Approximately 600 feet southeast of administration building 200.	Potable water supply at BAAP; tested quarterly per WDNR regulations; screened in bedrock.
PW-2	Approximately 100 feet north of New Acid Area.	Process water source for BAAP; no current testing; screened in bedrock.
PW-3	Approximately 1,000 feet north of Old Acid Area.	Currently out of service; used for water levels by USGS; screened in bedrock.
PW-4	Approximately 1,200 feet northwest of the Deterrent Burning Ground and approximately 1,600 feet southeast of the Oleum Pond.	Backup to PW-2 for process water; screened in sand and gravel.
PW-5	Approximately 400 feet west of the Propellant Burning Ground.	Not currently used, but still functional; screened in bedrock.

TABLE 2-2
SUMMARY OF BORINGS/MONITORING WELLS INSTALLED -
BACKGROUND AREAS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL IDENTIFIER	DRILLING METHOD	BORING DEPTH FROM GROUND SURFACE (FT.)	ELEVATION OF BASE OF SCREEN (FT. MSL)	LENGTH OF WELL SCREEN (FT.)	LOCATION	PURPOSE
BGM-91-01	Dual-Wall Driven Casing	78.0	802.5	10	Upgradient and west of Ballistics Pond	To assess background subsurface soil and groundwater quality upgradient of BAAP
BGM-91-02	Dual-Wall Driven Casing	87.0	790.6	10	Upgradient and northwest of Old Acid Area	To assess background subsurface soil and groundwater quality upgradient of BAAP
BGM-91-03	Dual-Wall Driven Casing	100.0	761.6	10	Upgradient and south of Administration Building	To assess background subsurface soil and groundwater quality upgradient of BAAP

TABLE 2-3
BACKGROUND METALS CONCENTRATIONS IN SURFACE SOIL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

BACKGROUND METAL CONCENTRATION	SAMPLE LOCATION						REGIONAL DATA	
	BSS-90-01	BSS-90-02	BSS-90-03	BSS-90-04	BSS-90-05	Mean Concen.	CONCEN. RANGE	MEAN CONCEN.
AS	8.47	8.44	8.00	4.19	4.81	6.78	1.9 - 16.0	6.6
AG	LT 0.803	LT 0.803	LT 0.803	LT 0.803	LT 0.803		0.03 - 2.8	
AL	34300	41100	41100	21500	26100	32820	LT 700 - 50000	33000
BA	208	200	201	220	289	224	200 - 1500	675
BE	1.12	1.46	1.52	0.785	1.00	1.18	LT 1 - 15	0.55
CA	3190	3440	3570	3440	4300	3588	3500 - 5200	3400
CD	LT 1.20	LT 1.20	LT 1.20	LT 1.20	LT 1.20		0.41 - 0.51	
CO	12.6	11.8	12.1	8.37	12.8	11.5	3 - 30	11
CR	37.4	46.8	40.4	23.3	29.8	35.5	10 - 100	55
CU	14.2	20.9	18.5	7.46	9.78	14.2	7 - 100	25
FE	33700	38100	36700	18800	23200	30100	100 - 30000	14000
HG	LT 0.05	0.063	LT 0.05	0.19	LT 0.05	0.066	0.01 - 0.38	0.08
K	5260	4070	4330	2690	3670	4004	2200 - 65000	12000
MG	5720	6340	5800	3020	3850	4946	50 - 7000	2100
MN	772	647	647	810	1400	855	50 - 1500	525
NA	114	181	195	128	175	158	3000 - 10000	2500
NI	23.5	27.9	24.9	13.9	16.7	21.4	5 - 30	17
PB	10.9	10.0	LT 7.44	12.9	15.8	10.7	10 - 30	19
SB	LT 19.6	LT 19.6	LT 19.6	LT 19.6	LT 19.6		0.25 - 0.60	0.52
SE	LT 20.7	LT 20.7	LT 20.7	LT 20.7	LT 20.7		0.02 - 0.70	0.26
TL	LT 34.3	LT 34.3	LT 34.3	LT 34.3	LT 34.3		0.02 - 2.8	

continued

TABLE 2-3
BACKGROUND METALS CONCENTRATIONS IN SURFACE SOIL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

BACKGROUND METAL CONCENTRATION	SAMPLE LOCATION						REGIONAL DATA	
	BSS-90-01	BSS-90-02	BSS-90-03	BSS-90-04	BSS-90-05	Mean Concen.	CONCEN. RANGE	MEAN CONCEN.
V	75.8	90.0	91.3	45.7	56.7	71.9	LT 7 - 100	43
ZN	79.4	71.9	60.3	52.9	81.3	69.2	28 - 45	40

Notes:

1. All concentrations are in UG/G, equivalent to parts per million
2. Samples are located on Figure 2-6 and were collected on September 5 to 6, 1990.
3. Regional data based upon Shacklette & Boerngen, 1984 and Kabata-Pendias & Pendias, 1984.
4. Laboratory data summarized in Appendix K.
5. LT (less than) indicates the analyte was not detected above the certified reporting limit.
6. If an LT value was present in a range of concentrations for an analyte, the mean concentration for the analyte was calculated using one-half the LT value (or Certified Reporting Limit).

TABLE 2-4
BACKGROUND ANALYTE CONCENTRATIONS IN SUBSURFACE SOIL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

BACKGROUND ANALYTE CONCENTRATION	BGM-91-01			BGM-91-02			BGM-91-03			CONCEN. RANGE	MEAN CONCEN.
	20-22'	40-42'	60-62'	20-22'	40-42'	60-62'	20-22'	40-42'	60-62'		
AS	LT 2.50	LT 2.50	LT 2.50	LT 2.50	LT 2.50	LT 2.50	LT 2.50	LT 2.50	LT 2.50	LT 2.50	LT 2.5
AG	LT 0.803	LT 0.803	LT 0.803	LT 0.803	LT 0.803	LT 0.803	LT 0.803	LT 0.803	LT 0.803	LT 0.803	LT 0.803
AL	2060	1230	1550	923	1400	1290	2320	1330	2280	923-2320	1598
BA	7.80	3.99	4.33	LT 3.29	4.27	3.67	5.58	3.67	5.84	LT 3.29-7.8	4.53
BE	LT 0.427	LT 0.427	LT 0.427	LT 0.427	LT 0.427	LT 0.427	LT 0.427	LT 0.427	LT 0.427	LT 0.427	LT 0.427
CA	60000	13900	20600	12200	17300	22300	26200	21400	19800	13900-60000	23678
CD	LT 1.20	LT 1.20	LT 1.20	LT 1.20	LT 1.20	LT 1.20	LT 1.20	LT 1.20	LT 1.20	LT 1.20	LT 1.20
CO	LT 2.50	LT 2.50	LT 2.50	LT 2 50	LT 2.50	LT 2.50	LT 2.50	LT 2.50	LT 2.50	LT 2.50	LT 2.50
CR	3.81	3.36	3.83	1.89	3.63	2.60	10.4	4.47	3.04	1.89-10.4	4.11
CU	16.9	15.2	10.5	5.79	LT 2.84	4.77	27.5	13.1	8.48	2.84-27.5	11.52
FE	5620	3060	5650	1620	2890	3060	5080	2810	2430	1620-5650	3580
HG	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
K	375	225	284	169	314	178	270	267	302	178-375	265
MG	31900	7450	11000	5950	8780	11100	13000	10600	9660	5950-31900	12160
MN	383	68.7	87.7	48.6	82.7	77.9	119	79.4	106	48.6-383	117
NA	213	144	154	93.8	140	156	154	124	236	93.8-236	157
NI	4.22	LT 2.74	LT 2.74	LT 2.74	LT 2.74	2.82	6.19	3.90	LT 2.74	LT 2.74-6.19	2.66
PB	3.97	1.09	1.11	0.894	1.18	0.612	1.79	1.04	0.915	0.612-3.97	1.40
SB	LT 19.6	LT 19.6	LT 19.6	LT 19.6	LT 19.6	LT 19.6	LT 19.6	LT 19.6	LT 19.6	LT 19.6	LT 19.6
SE	LT 0.449	LT 0.449	LT 0.449	LT 0.449	LT 0.449	LT 0.449	LT 0.449	LT 0.449	LT 0 449	LT 0.449	LT 0.449
TL	LT 0.5	LT 0.5	LT 20	LT 0.5	LT 0.5	LT 20	LT 0.5	LT 0.5	LT 0.5	LT 0.5-LT 20	LT 4.83
V	23 0	15.0	19.0	13.0	11.0	22.0	14 0	20 0	8.60	8.6-23	16 0

W0039213T.1/5

continued

TABLE 2-4
BACKGROUND ANALYTE CONCENTRATIONS IN SUBSURFACE SOIL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

BACKGROUND ANALYTE CONCENTRATION	BGM-91-01			BGM-91-02			BGM-91-03			CONCEN. RANGE	MEAN CONCEN.
	20-22'	40-42'	60-62'	20-22'	40-42'	60-62'	20-22'	40-42'	60-62'		
ZN	10.7	9.52	9.31	3.62	4.06	3.36	19.3	7.76	4.75	3.36-19.3	8.04
TCLP METALS (μg/l)											
CD	LT 6.78	LT 6.78	LT 6.78	LT 6.78	LT 6.78	LT 6.78	LT 6.78	LT 6.78	LT 6.78	LT 6.78	LT 6.78
CR	LT 16.8	LT 16.8	LT 16.8	LT 16.8	LT 16.8	LT 16.8	LT 16.8	LT 16.8	LT 16.8	LT 16.8	LT 16.8
HG	0.103	LT 0.1	LT 0.1	LT 0.1	LT 0.1	LT 0.1	LT 0.1	LT 0.1	LT 0.1	LT 0.1-0.103	0.056
PB	LT 43.4	LT 43.4	LT 43.4	LT 43.4	LT 43.4	LT 43.4	LT 43.4	LT 43.4	LT 43.4	LT 43.4	LT 43.4
Anions											
NIT	LT 1.0	1.18	1.69	2.47	3.42	2.83	3.47	4.07	3.87	LT 1.0-4.07	2.61
SO4	LT 5.0	LT 5.0	LT 5.0	LT 5.0	LT 5.0	LT 5.0	LT 5.0	LT 5.0	LT 5.0	LT 5.0	LT 5.0
pH	9.19	10.2	8.77	9.08	9.63	9.89	9.31	9.36	9.35	8.77-10.2	9.42

Notes:

1. Concentrations are in μg/g, equivalent to parts per million
2. Samples are located on Figure 2-6 and were collected in October and November 1991.
3. Regional data based upon Shacklette & Boerngen, 1984 and Kabata-Pendias & Pendias, 1984.
4. Laboratory data summarized in Appendix K.
5. LT (less than) indicates the analyte was not detected above the certified reporting limit.
6. If an LT value was present in a range of concentrations for an analyte, the mean concentration for the analyte was calculated using one-half the LT value (or Certified Reporting Limit).

TABLE 2-5
TCLP METALS DATA SUMMARY FOR SUBSURFACE SOIL - BACKGROUND BORINGS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

		TCLP LEACHATE CONCENTRATION (µg/ℓ)				
SAMPLE LOCATION	DEPTH	CD	CR	PB	HG	NOTES
TCLP RL[1]		1,000	5,000	5,000	200	
Minimum Reporting Value		6.8	16.8	43.4	0.1	
BGM-91-01	22	LT	LT	LT	0.1	TCLP RL not exceeded
BGM-91-01	42	LT	LT	LT	LT	TCLP RL not exceeded
BGM-91-01	62	LT	LT	LT	LT	TCLP RL not exceeded
BGM-91-02	22	LT	LT	LT	LT	TCLP RL not exceeded
BGM-91-02	42	LT	LT	LT	LT	TCLP RL not exceeded
BGM-91-02	62	LT	LT	LT	LT	TCLP RL not exceeded
BGM-91-03	22	LT	LT	LT	LT	TCLP RL not exceeded
BGM-91-03	42	LT	LT	LT	LT	TCLP RL not exceeded
BGM-91-03	62	LT	LT	LT	LT	TCLP RL not exceeded

Notes:

1 TCLP Regulatory Level (RLs) exist for the following metals: AS, BA, CD, CR, SE, PB, HG, and AG. However, samples were only analyzed for CD, CR, PB, and HG. (See List of USATHAMA Chemical Codes for definitions of chemical abbreviations).
2 LT - Less than the Certified Reporting Limit; corrected for percent moisture, dilution, and percent recovery.
3 Sample locations shown on Figure 2-6.

TABLE 2-6
SUMMARY OF AVERAGE BACKGROUND GROUNDWATER QUALITY DATA-
BACKGROUND AREAS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		BGM-91-01				BGM-91-02				BGM-91-03				S1123			
Sample Type:		WELL				WELL				WELL				WELL			
UNITS:		UGL				UGL				UGL				UGL			
DATE SAMPLED:		12/06/91		04/09/92		12/07/91		04/09/92		12/07/91		04/14/92		12/05/91		04/14/92	
ROUND:		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO	
VOCs	CH2CL2	3.82	P	7.06	B	5.1	P	6.76	B	6.57		6.37	B	5.2	P	5.2	P
	CHCL3	-		-		-		-		-		0.624	P	-		-	
	TCLEE	-		-		-		-		-		0.386	P	-		-	
SVOCs	B2EHP	-		-		-		193	X	-		57.3		-		-	
Metals	AG	-		-		-		-		-		-		-		-	
	AL	-		-		-		-		-		-		-		-	
	AS	-		-		-		-		-		-		-		-	
	BA	24.7		14.6		27.5		26.6		30.5		22.8		25.3		36.2	
	BE	-		-		-		-		-		-		-		-	
	CA	61000		36000		58000		50000		74000		74000		77000		65000	
	CD	-		-		-		-		-		-		-		-	
	CR	7.31		-		6.56		-		8.24		-		6.72		-	
	CU	-		-		-		-		-		-		-		18	
	FE	56.3		-		266		57.9		46.4		-		-		40.8	
	HG	-		-		-		-		-		-		-		-	
	K	1100	T	1460	T	1280	T	1680	T	855	T	959	T	1150	T	1230	T
	MG	32000		19000		29000		26000		34000		35000		39000		34000	
	MN	-		-		-		-		-		-		-		-	
	NA	-		9900	T	-		16000	T	-		15000	T	23000	T	25000	T
	NI	-		-		-		-		-		-		-		18.1	
	PB	-		-		-		-		-		-		-		-	
	SB	-		-		-		-		-		-		-		-	
	SE	-		-		-		-		-		-		-		-	
	V	-		-		-		-		-		11.3		-		9.77	
	ZN	-		-		-		-		-		-		-		-	
Anions	NIT	2700		75.4		2800		1100		10000		9600		9100		8100	
	CL	11000		4800		27000	P	10000		13000		15000		27000	P	27000	P
	SO4	18000		19000		16000		16000		27000		29000		16000		17000	
Indicator parameter	ALK	232000		303000		188000		212000		210000		224000		252000		246000	
	HARD	282000		170000		258000		242000		312000		304000		240000		295000	
	TDS	257000		171000		243000		260000		296000		307000		348000		317000	
	pH(1)	8.2		6.5		8.2		6.5		8.4		7.7		7.9		7.7	
	Sp.Cond.(2)	539		300		522		415		605		515		570		563	

Notes and flagging codes are presented at the end of this table.

TABLE 2-6
SUMMARY OF AVERAGE BACKGROUND GROUNDWATER QUALITY DATA-
BACKGROUND AREAS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		S1129				S1130				S1131					
Sample Type:		WELL				WELL				WELL					
UNITS:		UGL				UGL				UGL					
DATE SAMPLED:		12/04/91		04/09/92		11/24/91		04/08/92		11/24/91		04/08/92		INSTALLATION	CONCENTRATION
ROUND:		ONE		TWO		ONE		TWO		ONE		TWO		AVERAGE (3)	RANGE
VOCs	CH2CL2	5.1	P	6.57	B	4.8	P	6.96	B	4.71	P	6.86	P	N/A	N/A
	CHCL3	-		-		-		-		-				N/A	N/A
	TCLEE	-		-		-		-		-		-		N/A	N/A
SVOCs	B2EHP	-		41.4	P	-		-		33.4	P	-		N/A	N/A
Metals	AG	-		-		-		-		-		-		N/A	N/A
	AL	-		-		-		-		-		-		N/A	N/A
	AS	-		-		-		-		-		-		N/A	N/A
	BA	35.4		34		27.9		14.7		32.5		22.2		27	14.6-36.2
	BE	-		-		-		-		-		-		N/A	N/A
	CA	64000		61000		26000		31000		31000		24000		52000	24000-77000
	CD	-		-		-		-		-		-		N/A	N/A
	CR	11.6		-		-		-		4.79		-		4.5	CRL-11.6
	CU	-		-		-		-		-		7.22		3.6	CRL-18
	FE	108		-		47.6		-		29.1		64.2		56	CRL-266
	HG	-		-		-		3.93		-		-		0.59	CRL-3.93
	K	702	T	1140	T	456	T	998	T	693	T	900	T	1040	456-1680
	MG	34000		32000		16000		17000		19000		13000		27000	16000-39000
	MN	-		-		-		-		-		-		N/A	N/A
	NA	22000	T	19000	T	2030	T	3300	T	2320	T	2550	T	11610	9900-25000
	NI	-		-		-		-		-		-		5.4	CRL-18.1
	PB	-		-		-		-		-		69		24	CRL-69
	SB	-		-		-		-		-		-		N/A	N/A
	SE	-		-		-		-		-		-		N/A	N/A
	V	-		-		-		-		4.88		-		7.6	CRL-11.3
	ZN	-		-		89		-		46.8		91.9		24	CRL-91.9
Anions	NIT	370		220		700		280		350		740		3300	75.4-10000
	CL	54000		46000		5600		4200		3600		6400		18000	3600-54000
	SO4	41000		38000		6200		19000		18000		6500		20000	6200-41000
Indicator parameter	ALK	232000		234000		226000		100000		125000		92000		205000	92000-303000
	HARD	310000		290000		120000		132000		144000		122000		230000	120000-312000
	TDS	401000		339000		157000		155000		209000		148000		258000	148000-401000
	pH(1)	7.7		7.7		6.5		5.2		7.0		7.0		7.3	5.2-8.4
	Sp.Cond.(2)	611		560		244		257		390		256		453	244-611

Notes and flagging codes are presented at the end of this table.

TABLE 2-6
SUMMARY OF AVERAGE BACKGROUND GROUNDWATER QUALITY DATA-
BACKGROUND AREAS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
(3)	=	Average concentrations are calculated for all analytes with one or more detected values. For analytes not detected above the CRL, averages are calculated assuming a concentration of one-half the CRL.
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
.	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits
N/A	=	Not Applicable

The CRL average concentrations were not calculated for analytes not detected above CRL or analytes outside certified range.

Appendix K contains complete analytical results.

USATHAMA chemical codes are defined in the RI Report Glossary.

TABLE 2-7
BACKGROUND SEDIMENT CONCENTRATIONS - REGIONAL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

CHEMICAL	CRYSTAL LAKE	DELAVAN LAKE	DEVIL'S LAKE	LOST LAKE	LAKE MONONA	CONCENTRATION RANGE	MEAN CONCENTRATION
AL	11400.0	2200.0	27300.0	11000.0	3800.0	2200.0 - 27300.0	13730.8
	9600.0	16800.0	26900.0	15200.0	16200.0		
		11600.0		14900.0	11600.0		
CD	3.0	0.6	6.3	1.8	0.5	0.5 - 7.8	3.4
	2.4	2.3	7.8	4.4	4.1		
		1.6		6.0	2.9		
CA	84200.0	274700.0	5600.0	2900.0	144000.0	2900.0 - 274700.0	99453.8
	70900.0	175500.0	5900.0	5600.0	150300.0		
		208100.0		5000.0	160200.0		
CR	18.0	2.0	35.0	14.0	31.0	2.0 - 159.0	36.8
	15.0	16.0	34.0	22.0	159.0		
		13.0		21.0	99.0		
CO	4.0	0.9	7.8	2.2	2.8	0.1 - 7.8	3.5
	0.1	2.8	6.8	4.1	5.2		
		2.4		3.4	3.6		
CU	142.0	12.0	36.0	9.0	29.0	9.0 - 184.0	61.2
	106.0	44.0	40.0	25.0	184.0		
		34.0		28.0	106.0		
FE	12100.0	3200.0	29700.0	11200.0	5800.0	3200.0 - 39200.0	14092.3
	10400.0	12700.0	39200.0	9200.0	16800.0		
		11100.0		8600.0	13200.0		
PB	201.0	3.0	75.0	65.0	39.0	3.0 - 201.0	78.6
	172.0	18.0	70.0	103.0	86.0		
		11.0		107.0	72.0		
MG	27900.0	11900.0	4500.0	2000.0	33700.0	2000.0 - 33700.0	13346.2
	28100.0	11000.0	4300.0	2600.0	17400.0		
		12000.0		2600.0	15500.0		
MN	280.0	280.0	1270.0	140.0	440.0	90.0 - 1270.0	496.9
	200.0	690.0	560.0	110.0	800.0		

TABLE 2-7
BACKGROUND SEDIMENT CONCENTRATIONS - REGIONAL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

CHEMICAL	CRYSTAL LAKE	DELAVAN LAKE	DEVIL'S LAKE	LOST LAKE	LAKE MONONA	CONCENTRATION RANGE	MEAN CONCENTRATION
		540.0		90.0	1060.0		
NI	8.0	1.0	37.0	8.0	4.0	1.0 - 37.0	12.7
	7.0	8.0	30.0	14.0	14.0		
		7.0		14.0	13.0		
NA	500.0	400.0	<300.0	<300.0	<300.0	<300.0 - 500.0	223.1
	500.0	<300.0	<300.0	<300.0	<300.0		
		<300.0		<300.0	<300.0		

NOTES
1. All concentrations are in ug/g, equivalent to parts per million.
2. Blank Space indicates a sample was not taken.
3. Source: WDNR 1989, Technical Bulletin 163 "Mercury Levels in Walleyes from Wisconsin Lakes of Different Water and Sediment Characteristics."

USA022.wk1

continued

TABLE 2-8
BACKGROUND SEDIMENT CONCENTRATIONS - CONTROL POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	SAMPLE		
TOTAL METALS AND INORGANICS	**CP-1**	**CP-2**	**CP-3**
PB (Lead)	7.3	12	25
NIT (Nitrogen-Nitrate)	1.0	0.11	0.12
NH3N2 (Ammonia-Nitrogen)	53	230	320
BOD (Biochemical Oxygen Demand)	<15	180	170
COD (Chemical Oxygen Demand)	<1000	23,000	25,000
pH	7.38	7.17	7.70
SO4 (Sulfate)	<20	<20	<20
TOTAL SOLIDS	93%	79%	65%

Notes:

(1) Source: Ayres, 1984
(2) All results are dry weight basis and are listed in $\mu g/g$.

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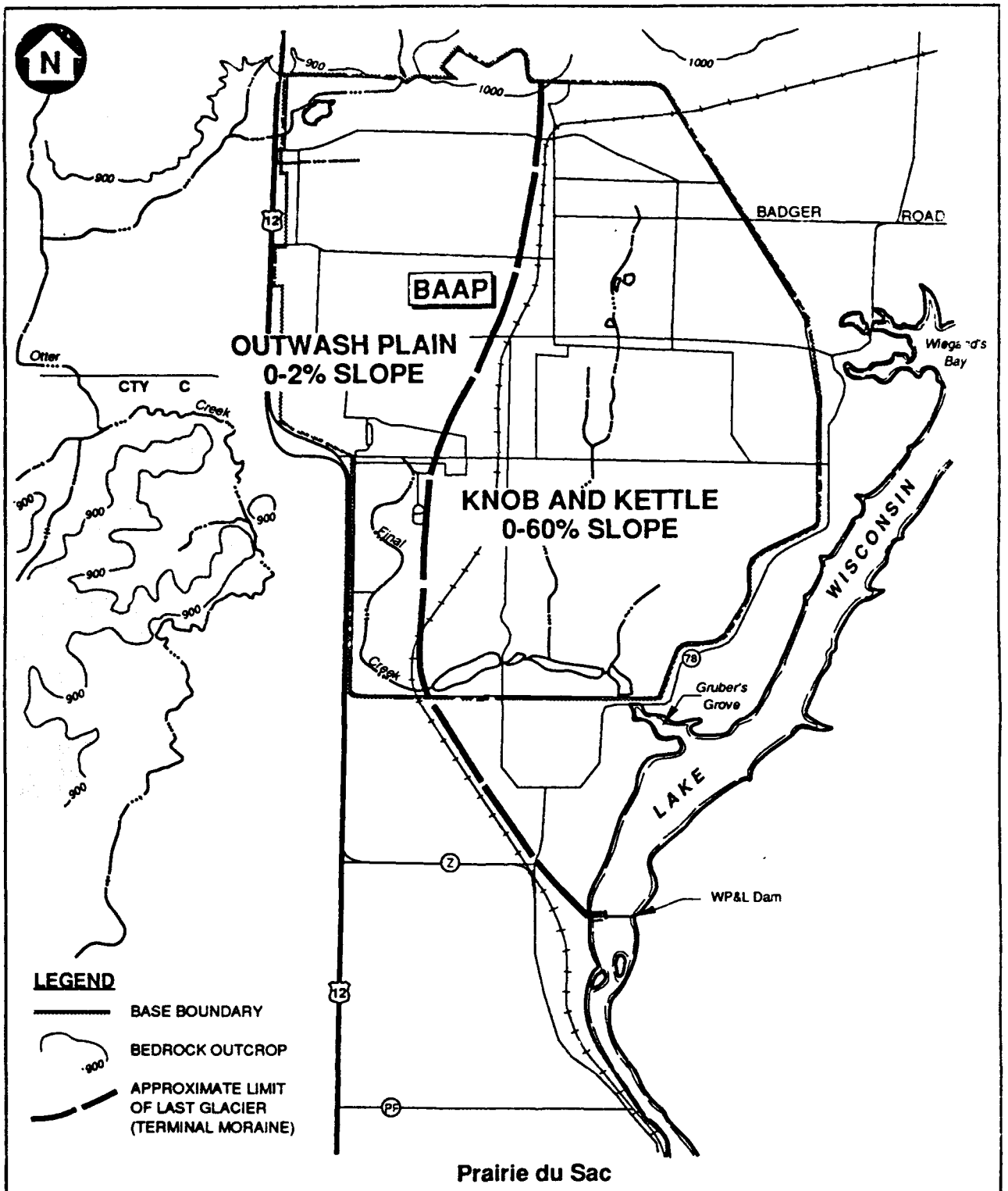
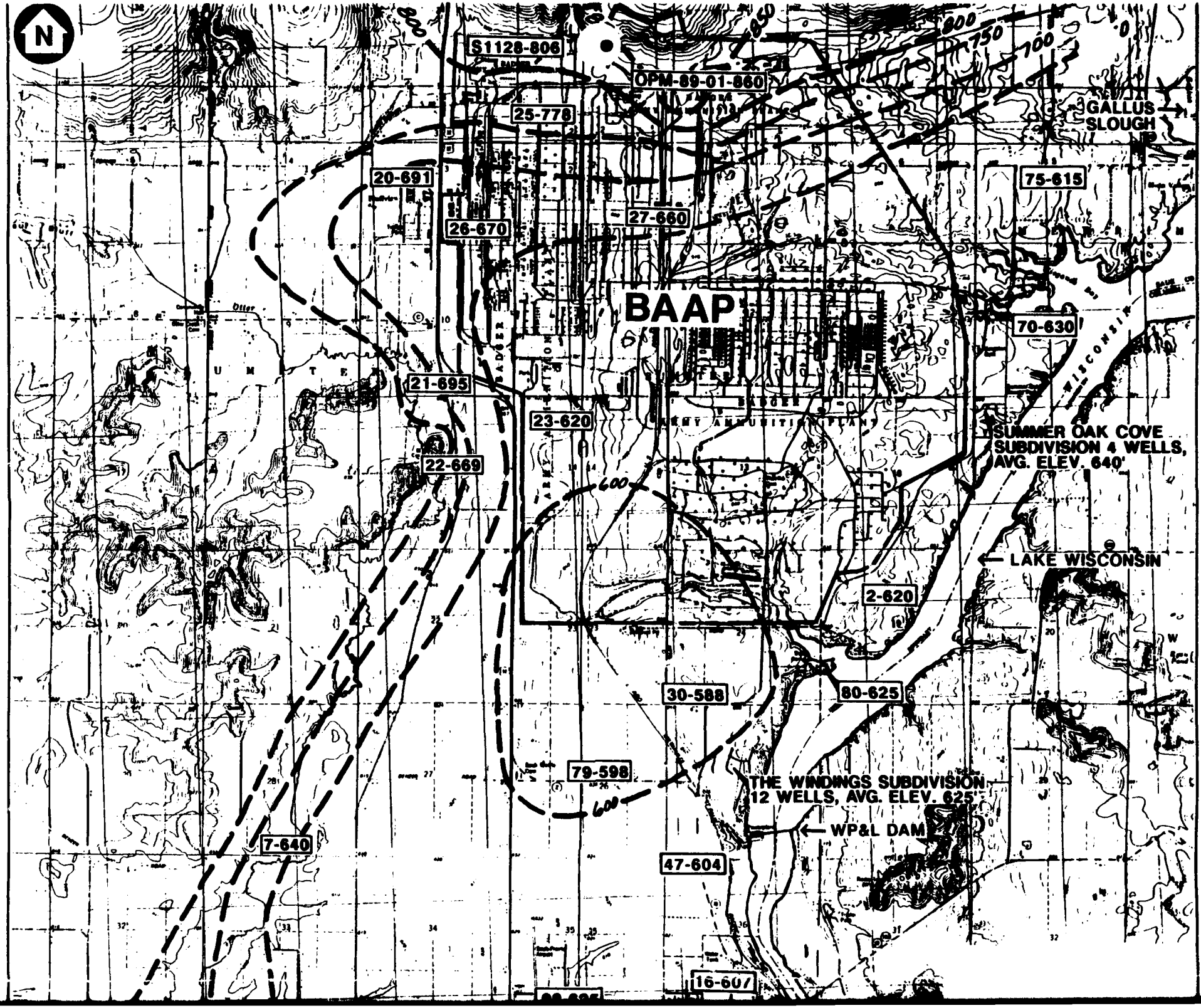


FIGURE 2-1
LOCATION OF TERMINAL MORAINE
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.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75-615
GALLUS SLOUGH
BAAP
70-630
21-695
23-620
22-669
SUMMER OAK COVE SUBDIVISION 4 WELLS, AVG. ELEV. 640'
LAKE WISCONSIN
2-620
30-588
80-625
79-598
THE WINDINGS SUBDIVISION 12 WELLS, AVG. ELEV. 625'
WP&L DAM
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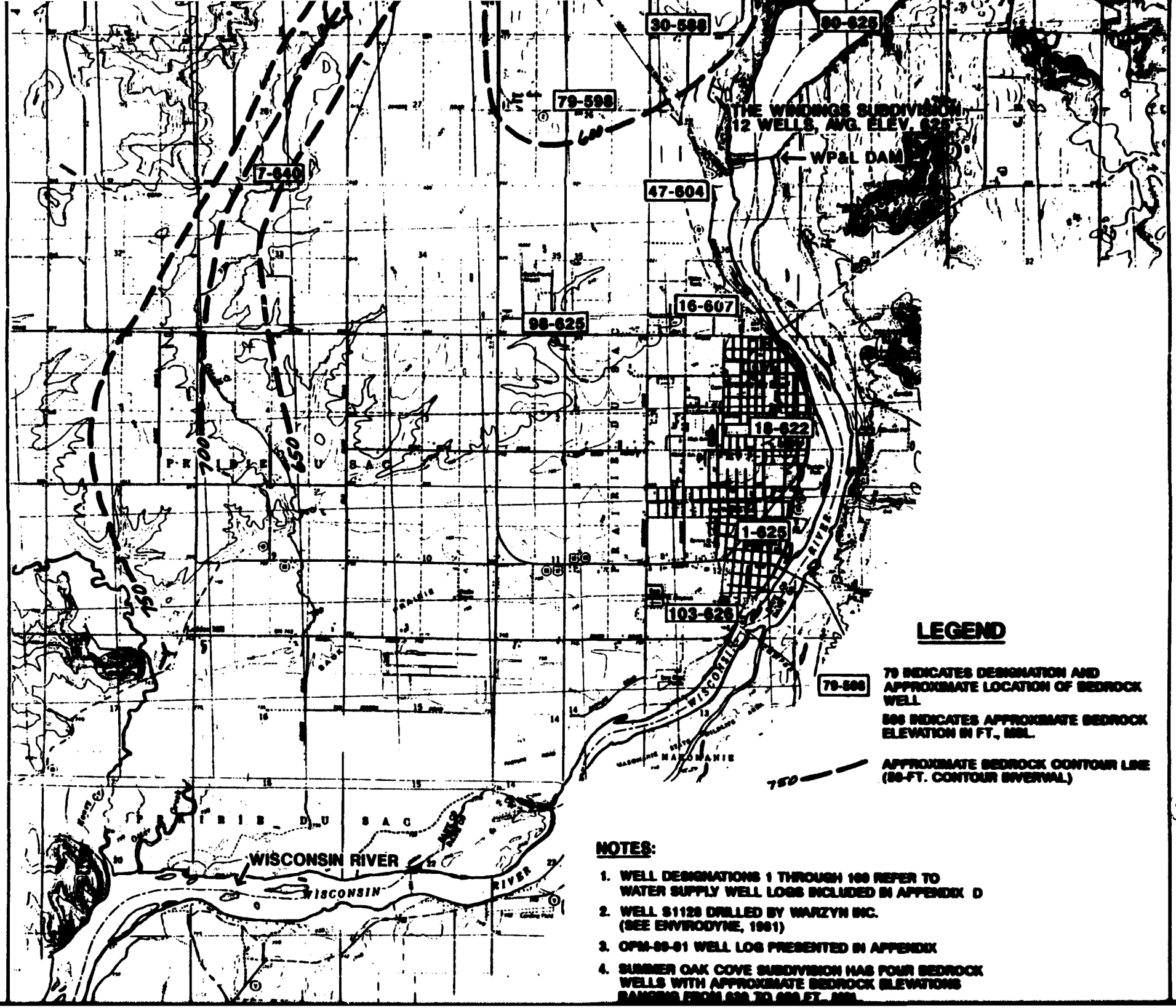
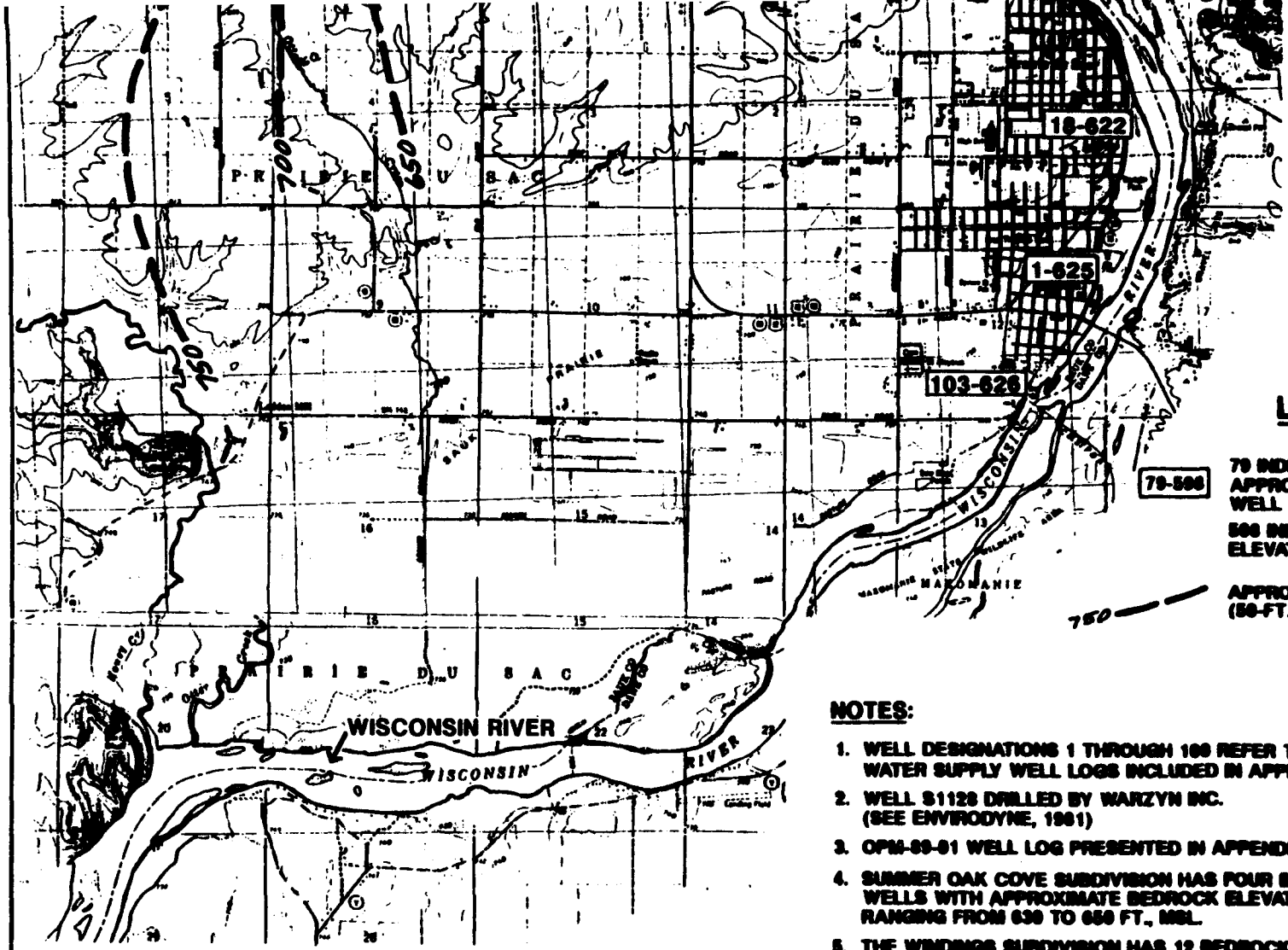
700
600
WISCONSIN


30-588
80-625
79-598
THE WINDINGS SUBDIVISION
12 WELLS, AVG. ELEV. 625
WP&L DAM
7-640
47-604
16-607
98-625
18-622
1-625
103-626
700
650
750
PRAIRIE DU SAC
WISCONSIN RIVER
WISCONSIN
RIVER
MADISONIAN
LEGEND
79-598
79 INDICATES DESIGNATION AND APPROXIMATE LOCATION OF BEDROCK WELL
598 INDICATES APPROXIMATE BEDROCK ELEVATION IN FT., MSL
750
APPROXIMATE BEDROCK CONTOUR LINE (50-FT. CONTOUR INVERVAL)
NOTES:
1. WELL DESIGNATIONS 1 THROUGH 100 REFER TO WATER SUPPLY WELL LOGS INCLUDED IN APPENDIX D
2. WELL S1128 DRILLED BY WARZYN INC. (SEE ENVIRODYNE, 1981)
3. OPM-80-01 WELL LOG PRESENTED IN APPENDIX
4. SUMMER OAK COVE SUBDIVISION HAS FOUR BEDROCK WELLS WITH APPROXIMATE BEDROCK ELEVATIONS RANGING FROM 630 TO 650 FT., MSL



LEGEND

79-596 — 79 INDICATES DESIGNATION AND APPROXIMATE LOCATION OF BEDROCK WELL

596 INDICATES APPROXIMATE BEDROCK ELEVATION IN FT., MSL.

750 — APPROXIMATE BEDROCK CONTOUR LINE (50-FT. CONTOUR INVERVAL)

NOTES:

1. WELL DESIGNATIONS 1 THROUGH 100 REFER TO WATER SUPPLY WELL LOGS INCLUDED IN APPENDIX D
2. WELL S1128 DRILLED BY WARZYN INC. (SEE ENVIRODYNE, 1981)
3. OPM-89-01 WELL LOG PRESENTED IN APPENDIX
4. SUMMER OAK COVE SUBDIVISION HAS FOUR BEDROCK WELLS WITH APPROXIMATE BEDROCK ELEVATIONS RANGING FROM 630 TO 650 FT., MSL.
5. THE WINDINGS SUBDIVISION HAS 12 BEDROCK WELLS WITH APPROXIMATE BEDROCK ELEVATIONS RANGING FROM 557 TO 665 FT., MSL.

SOURCE: USGS TOPOGRAPHIC QUADRANGLES 7.5-MINUTE SERIES; SAUK PRAIRIE, SAUK CITY, NORTH FREEDOM AND BARABOO.

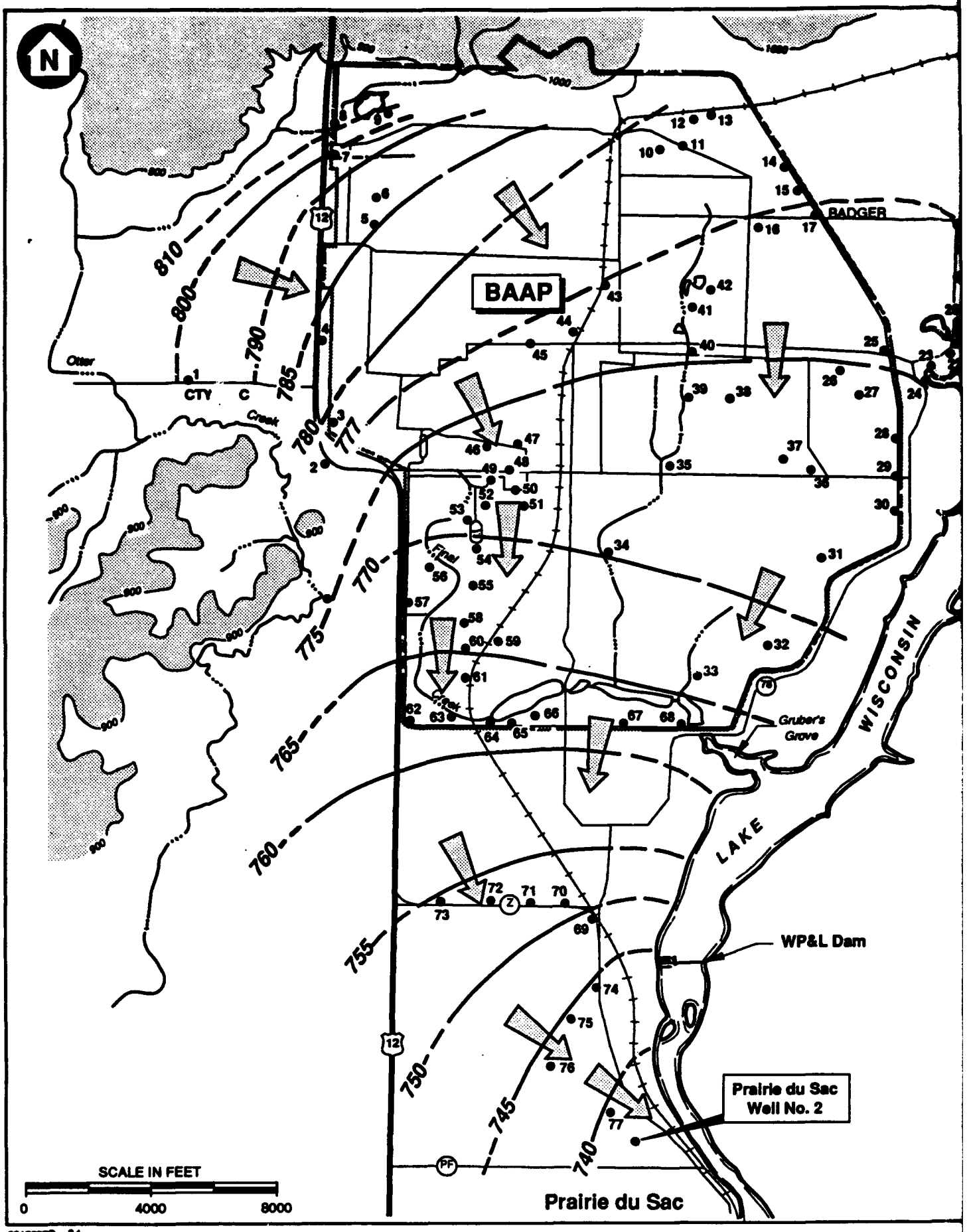
SCALE IN FEET

0 4000 8000

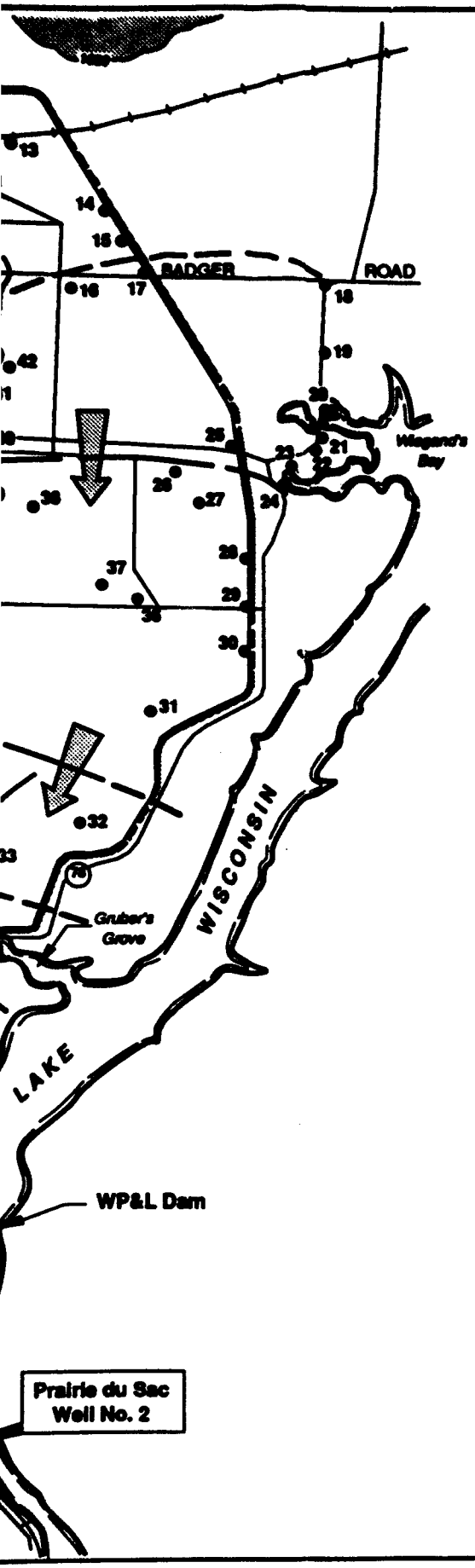
FIGURE 2-2
BEDROCK SURFACE CONTOUR PLAN
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT
ABB Environmental Services, Inc.

6853-12

3


N
BAAP
BADGER
Otter
Creek
CTY C
Fine
Creek
Gruber's Grove
WISCONSIN
LAKE
WP&L Dam
Prairie du Sac Well No. 2
Prairie du Sac
810
800
790
785
780
777
775
770
765
760
755
750
745
740
SCALE IN FEET
0
4000
8000

92120070 34



MAP CODE	WELL NUMBER	GROUNDWATER ELEVATION	MAP CODE	WELL NUMBER	GROUNDWATER ELEVATION	MAP CODE	WELL NUMBER	GROUNDW ELEVAT
1	91-55P	767.7	27	NLN-92-05A	774.6	53	S1144	778.
2	91-53P	775.5	28	91-40P	774.7	54	PBN-92-04A	769.
3	S1128	778.1	29	91-39P	773.[illegible]	55	PBN-95-01A	769.
4	BGM-91-03	769.2	30	S1113	773.7	56	PBM-89-05	769.
5	S1126	765.1	31	S1112	772.1	57	S1109	765.
6	OAM-91-01	765.6	32	S1111	769.6	58	PBN-95-04A	769.
7	BGM-91-02	766.6	33	S1110	769.0	59	PBM-89-06	769.
8	BGM-91-01	814.5	34	S1115	770.8	60	PBM-95-06	765.
9	S1127	824.4	35	S1116	773.8	61	PBN-89-12A	764.
10	OPM-89-03	776.9	36	RPM-91-01	773.8	62	S1101	761.
11	S1132	777.4	37	S1120	774.2	63	S1147	762.
12	OPM-89-02	777.9	38	RPM-89-01	774.8	64	S1146	761.
13	S1151	777.9	39	RPM-89-02	774.8	65	S1102	761.
14	ELM-89-05	777.5	40	S1119	775.5	66	S1149	762.
15	S1153	777.1	41	NPM-89-01	776.1	67	S1104	762.
16	DBN-89-02A	777.0	42	S1124	776.5	68	SPN-89-05A	762.
17	ELN-91-07A	776.9	43	NAN-91-01A	777.1	69	SWN-91-03B	749.
18	91-48P	777.0	44	S1150	776.8	70	SWN-91-04C	760.
19	91-47P	776.2	45	S1125	777.0	71	SWN-91-03B	762.
20	91-46P	776.2	46	PBM-89-11	773.9	72	SWN-91-02C	760.
21	91-45P	776.5	47	LOM-91-02	773.7	73	SWN-91-01B	754.
22	91-44P	776.5	48	LOM-91-01	772.8	74	PBN-91-01C	743.
23	91-42P	776.0	49	PBM-89-09	772.2	75	PBN-91-02B	742.
24	91-43P	775.5	50	LOM-89-01	771.7	76	PBN-91-03B	742.
25	S1121	775.2	51	LON-89-03A	771.1	77	PBN-90-04B	738.
26	NLN-92-01A	775.0	52	PBN-92-02A	771.4			

LEGEND

740 — REGIONAL WATER TABLE CONTOU LINE

BEDROCK OUTCROP

DIRECTION OF GROUNDWATER FLOW

● MONITORING WELL OR PIEZOMET USED TO DETERMINE CONTOURS

NOTES:

1. BASE MAP FROM USGS 7.5-MINUTE TOPOGRAPHIC CONTOUR MAPS, SAUK CI SAUK PRAIRIE, NORTH FREEDOM, BARAB MAZOMANIE, AND BLACK EARTH.
2. WATER LEVELS MEASURED 12/15/91.
3. CONTOURS IN FEET MSL.

FIG
REGIONAL WATER TABLE CONTOU
REMEDIAL INVESTI
BADGER ARMY AMMUNITION
ABB Environmental Se

MAP CODE	WELL NUMBER	GROUNDWATER ELEVATION	MAP CODE	WELL NUMBER	GROUNDWATER ELEVATION	MAP CODE	WELL NUMBER	GROUNDWATER ELEVATION
1	91-55P	787.7	27	NLN-82-05A	774.6	53	S1144	770.6
2	91-56P	775.5	28	91-40P	774.7	54	PBN-82-04A	769.2
3	S1123	779.1	29	91-39P	773.7	55	PBN-85-01A	768.6
4	BGM-91-03	783.2	30	S1113	773.7	56	PBM-89-05	768.0
5	S1126	785.1	31	S1112	772.1	57	S1109	768.7
6	OAM-91-01	785.6	32	S1111	768.8	58	PBN-85-04A	768.6
7	BGM-91-02	788.6	33	S1110	768.0	59	PBM-89-06	768.1
8	BGM-91-01	814.5	34	S1115	770.8	60	PBM-85-06	765.3
9	S1127	824.4	35	S1116	773.8	61	PBN-89-12A	764.4
10	OPM-89-03	776.9	36	RPM-91-01	773.8	62	S1101	761.9
11	S1132	777.4	37	S1120	774.2	63	S1147	762.3
12	OPM-89-02	777.9	38	RPM-89-01	774.8	64	S1148	761.9
13	S1151	777.9	39	RPM-89-02	774.8	65	S1102	761.7
14	ELM-89-05	777.5	40	S1119	775.5	66	S1149	762.7
15	S1153	777.1	41	NPM-89-01	776.1	67	S1104	762.4
16	DBN-89-02A	777.0	42	S1124	776.5	68	SPN-89-05A	762.7
17	ELN-91-07A	776.9	43	NAN-81-01A	777.1	69	SWN-91-05B	748.3
18	91-48P	777.0	44	S1150	776.6	70	SWN-91-04C	750.9
19	91-47P	776.2	45	S1125	777.0	71	SWN-91-03B	752.3
20	91-46P	776.2	46	PBM-89-11	773.9	72	SWN-91-02C	753.8
21	91-45P	776.5	47	LOM-91-02	773.7	73	SWN-91-01B	754.8
22	91-44P	776.5	48	LOM-91-01	772.8	74	PBN-91-01C	743.0
23	91-42P	776.0	49	PBM-89-09	772.2	75	PBN-91-02B	742.9
24	91-43P	775.5	50	LOM-89-01	771.7	76	PBN-91-03B	742.1
25	S1121	775.2	51	LON-89-03A	771.1	77	PBN-89-04B	738.8
26	NLN-82-01A	775.0	52	PBN-82-02A	771.4			

LEGEND

740 — REGIONAL WATER TABLE CONTOUR LINE

BEDROCK OUTCROP

DIRECTION OF GROUNDWATER FLOW

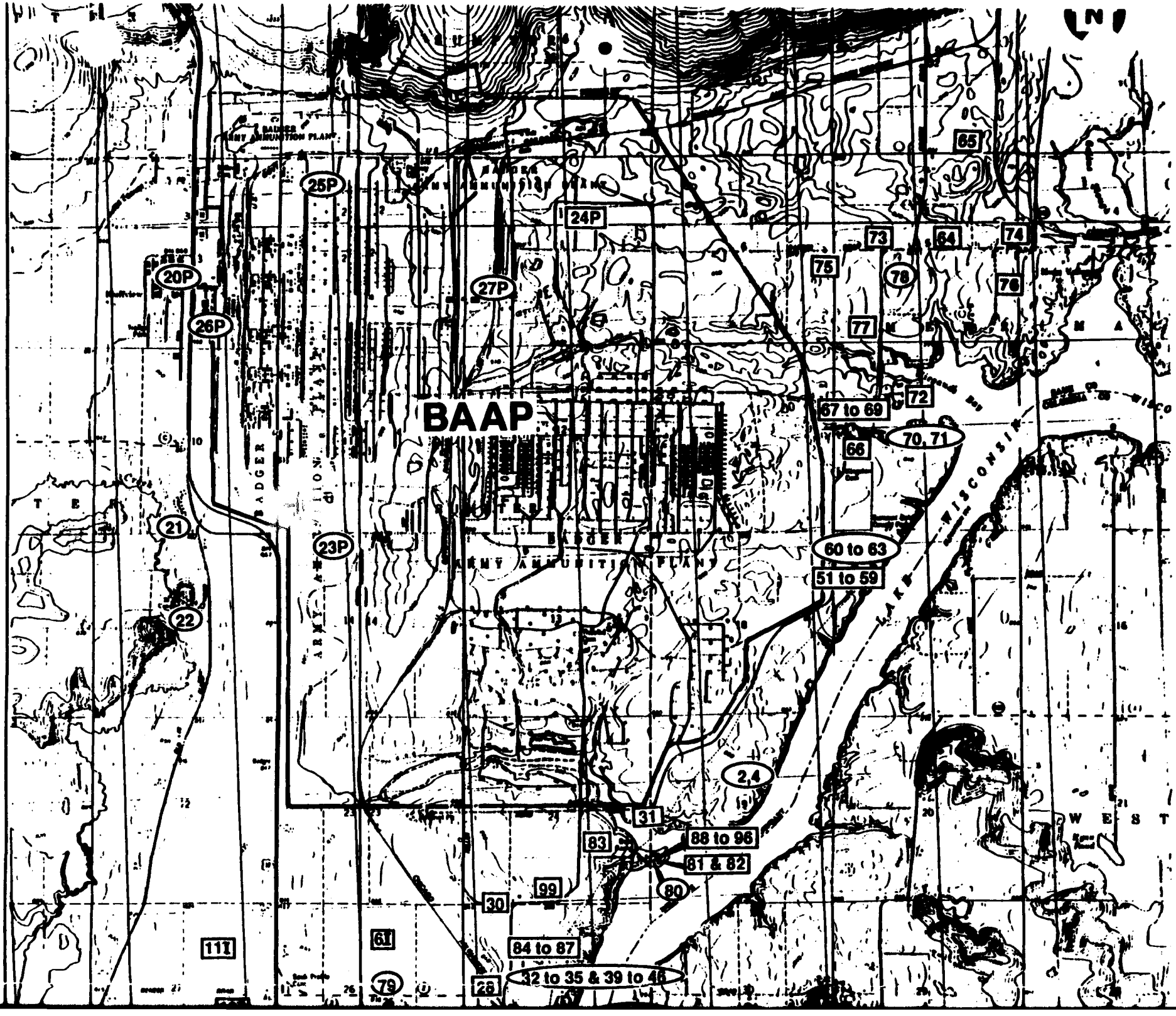
MONITORING WELL OR PIEZOMETER USED TO DETERMINE CONTOURS

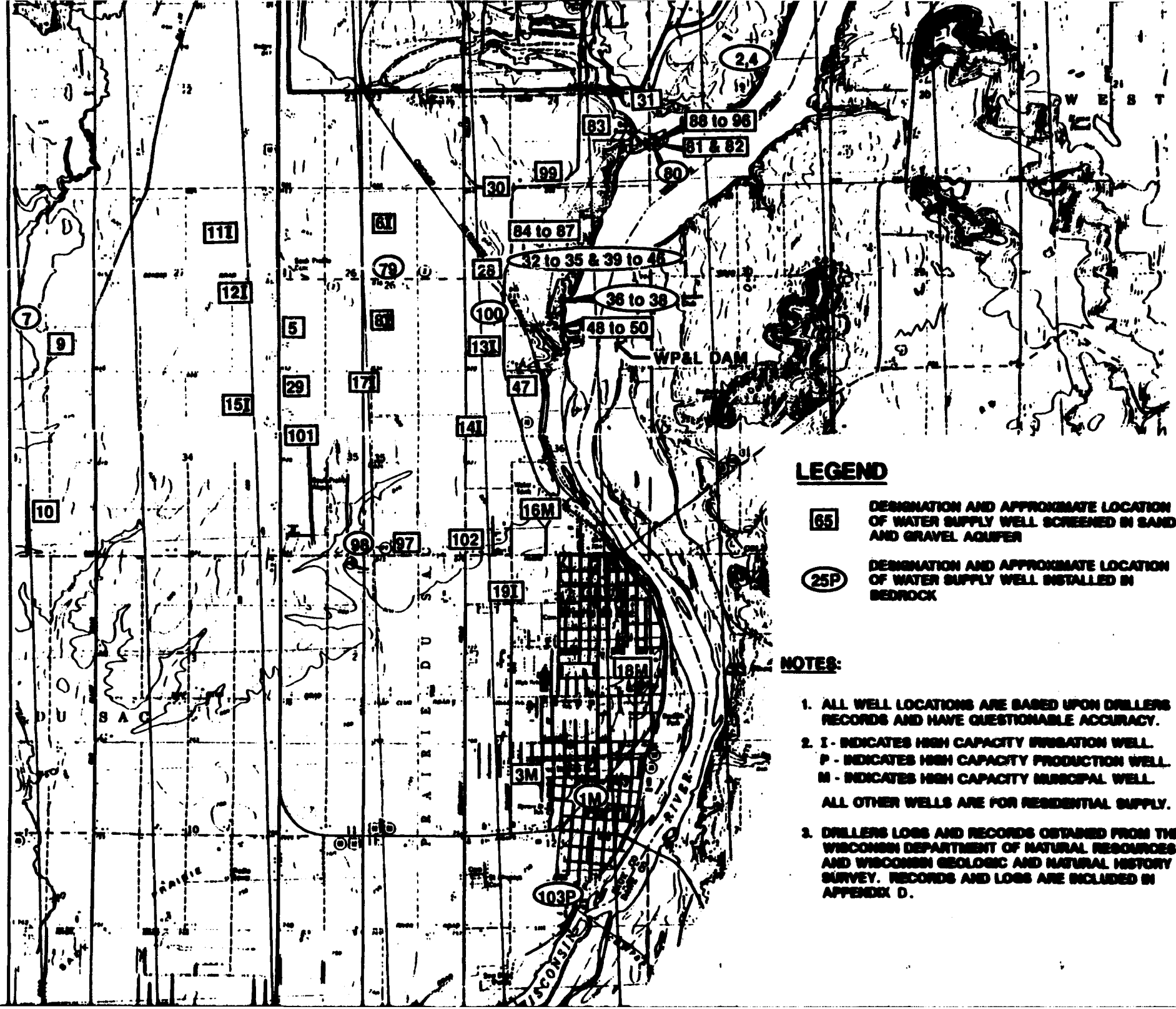
NOTES:

1. BASE MAP FROM USGS 7.5-MINUTE TOPOGRAPHIC CONTOUR MAPS, SAUK CITY, SAUK PRAIRIE, NORTH FREEDOM, BARABOO, MAZOMANIE, AND BLACK EARTH.
2. WATER LEVELS MEASURED 12/15/91.
3. CONTOURS IN FEET MSL.

FIGURE 2-3
REGIONAL WATER TABLE CONTOUR PLAN
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.


BAAP
BADGER ARMY AMMUNITION PLANT
BADGER ARMY AMMUNITION PLANT
BADGER ARMY AMMUNITION PLANT
BADGER ARMY AMMUNITION PLANT
ARMY AMMUNITION PLANT
LAKE WISCONSIN
WEST
20P
21
22
23P
24P
25P
26P
27P
2,4
31
30
28
61
65
64
66
67 to 69
70, 71
72
73
74
75
76
77
78
79
80
81 & 82
83
84 to 87
88 to 96
99
111
32 to 35 & 39 to 46
51 to 59
60 to 63

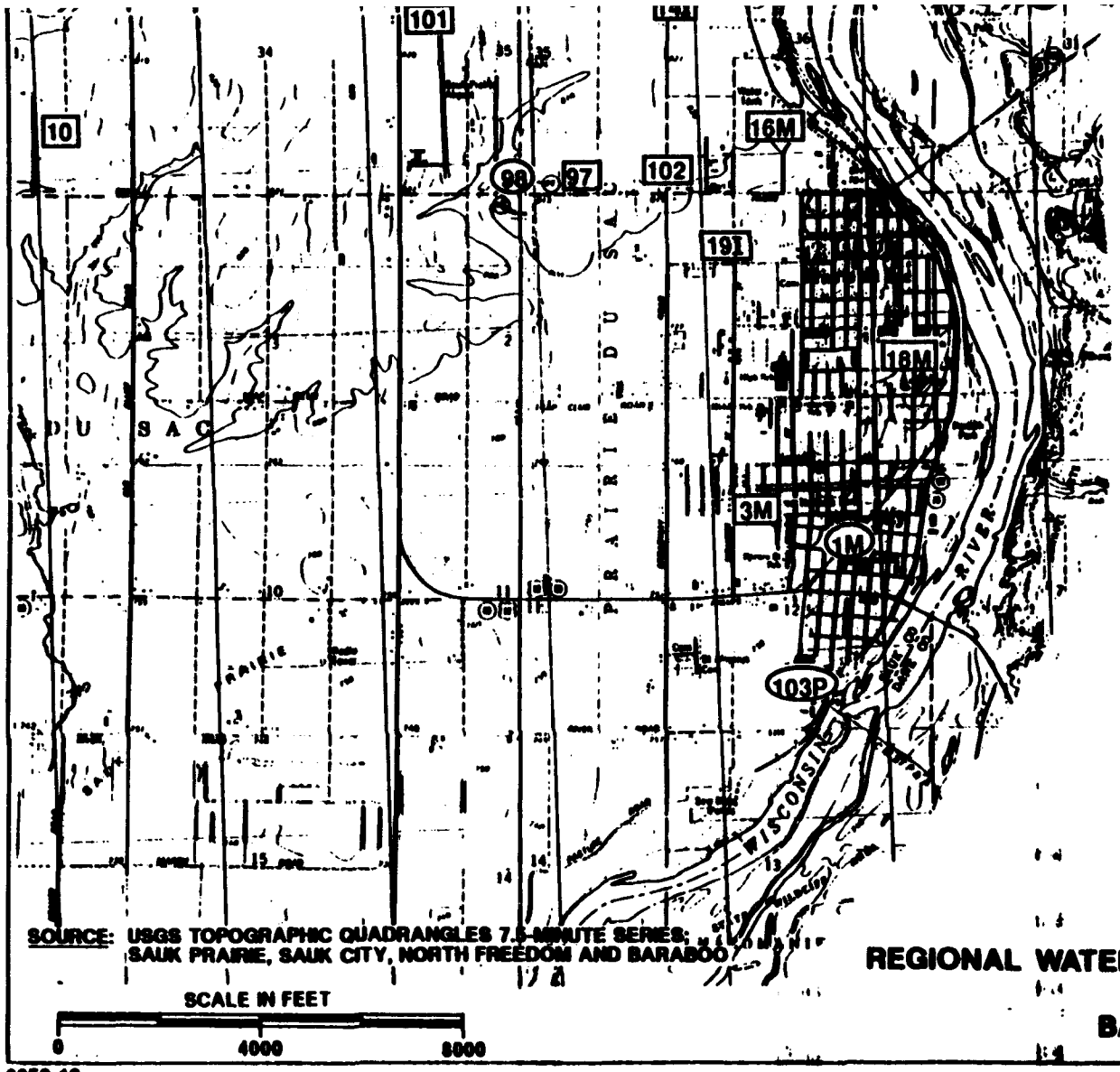


LEGEND

65	DESIGNATION AND APPROXIMATE LOCATION OF WATER SUPPLY WELL SCREENED IN SAND AND GRAVEL AQUIFER
25P	DESIGNATION AND APPROXIMATE LOCATION OF WATER SUPPLY WELL INSTALLED IN BEDROCK

NOTES:

1. ALL WELL LOCATIONS ARE BASED UPON DRILLERS RECORDS AND HAVE QUESTIONABLE ACCURACY.
2. I - INDICATES HIGH CAPACITY IRRIGATION WELL.
   P - INDICATES HIGH CAPACITY PRODUCTION WELL.
   M - INDICATES HIGH CAPACITY MUNICIPAL WELL.
   ALL OTHER WELLS ARE FOR RESIDENTIAL SUPPLY.
3. DRILLERS LOGS AND RECORDS OBTAINED FROM THE WISCONSIN DEPARTMENT OF NATURAL RESOURCES AND WISCONSIN GEOLOGIC AND NATURAL HISTORY SURVEY. RECORDS AND LOGS ARE INCLUDED IN APPENDIX D.



LEGEND

65 — DESIGNATION AND APPROXIMATE LOCATION OF WATER SUPPLY WELL SCREENED IN SAND AND GRAVEL AQUIFER

25P — DESIGNATION AND APPROXIMATE LOCATION OF WATER SUPPLY WELL INSTALLED IN BEDROCK

NOTES:

1. ALL WELL LOCATIONS ARE BASED UPON DRILLERS RECORDS AND HAVE QUESTIONABLE ACCURACY.
2. I - INDICATES HIGH CAPACITY IRRIGATION WELL.
   P - INDICATES HIGH CAPACITY PRODUCTION WELL.
   M - INDICATES HIGH CAPACITY MUNICIPAL WELL.
   ALL OTHER WELLS ARE FOR RESIDENTIAL SUPPLY.
3. DRILLERS LOGS AND RECORDS OBTAINED FROM THE WISCONSIN DEPARTMENT OF NATURAL RESOURCES AND WISCONSIN GEOLOGIC AND NATURAL HISTORY SURVEY. RECORDS AND LOGS ARE INCLUDED IN APPENDIX D.

SOURCE: USGS TOPOGRAPHIC QUADRANGLES 7.5-MINUTE SERIES: SAUK PRAIRIE, SAUK CITY, NORTH FREEDOM AND BARABOO

FIGURE 2-4
REGIONAL WATER SUPPLY AND IRRIGATION WELLS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT
ABB Environmental Services, Inc.

6853-12

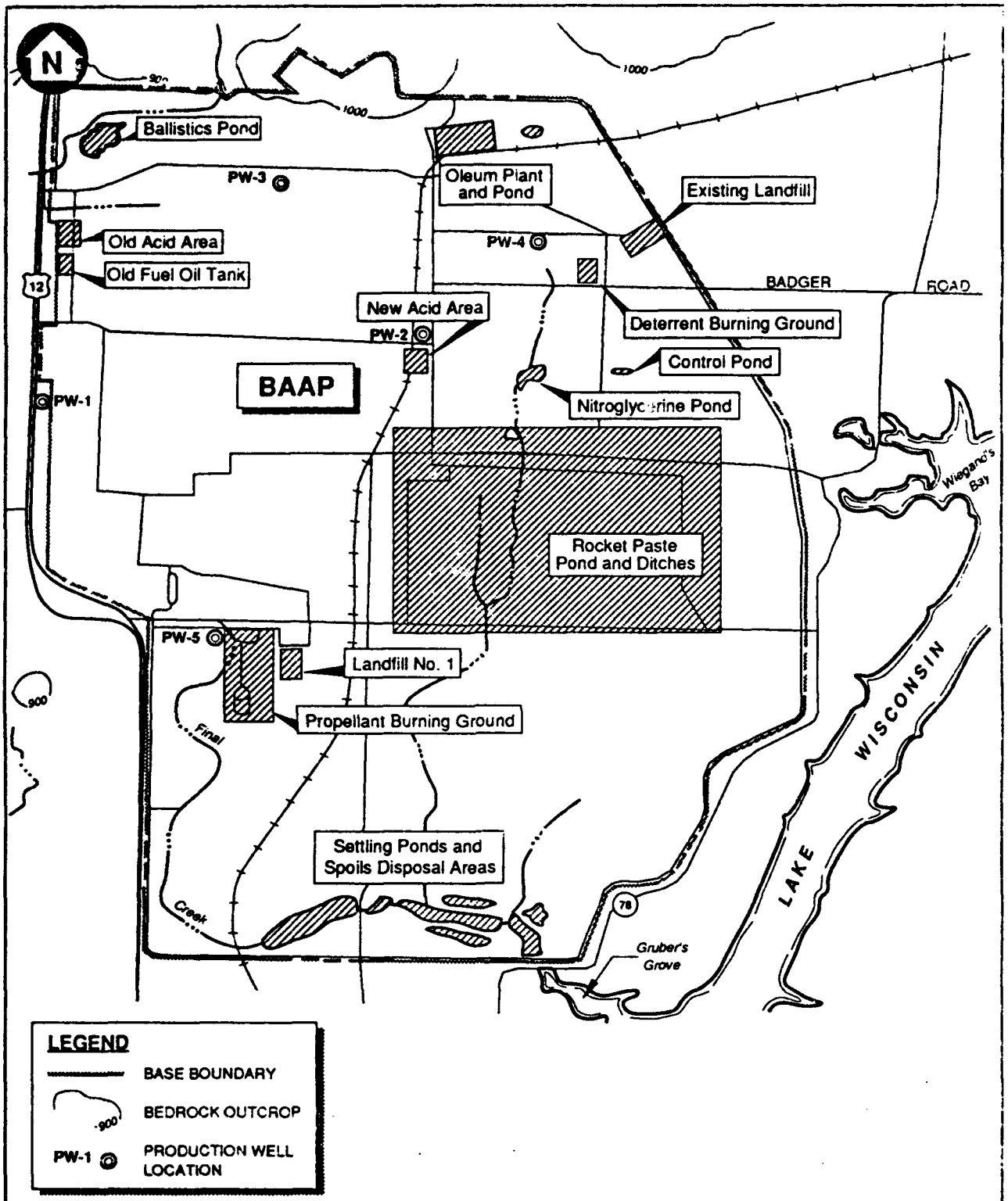
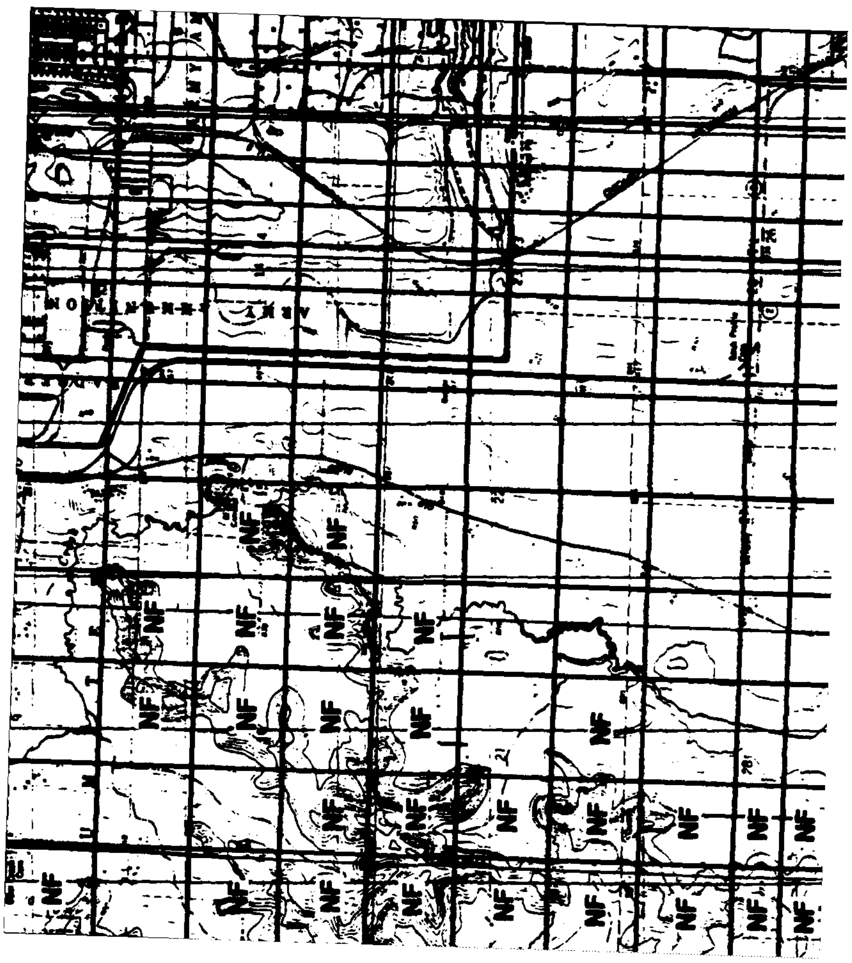
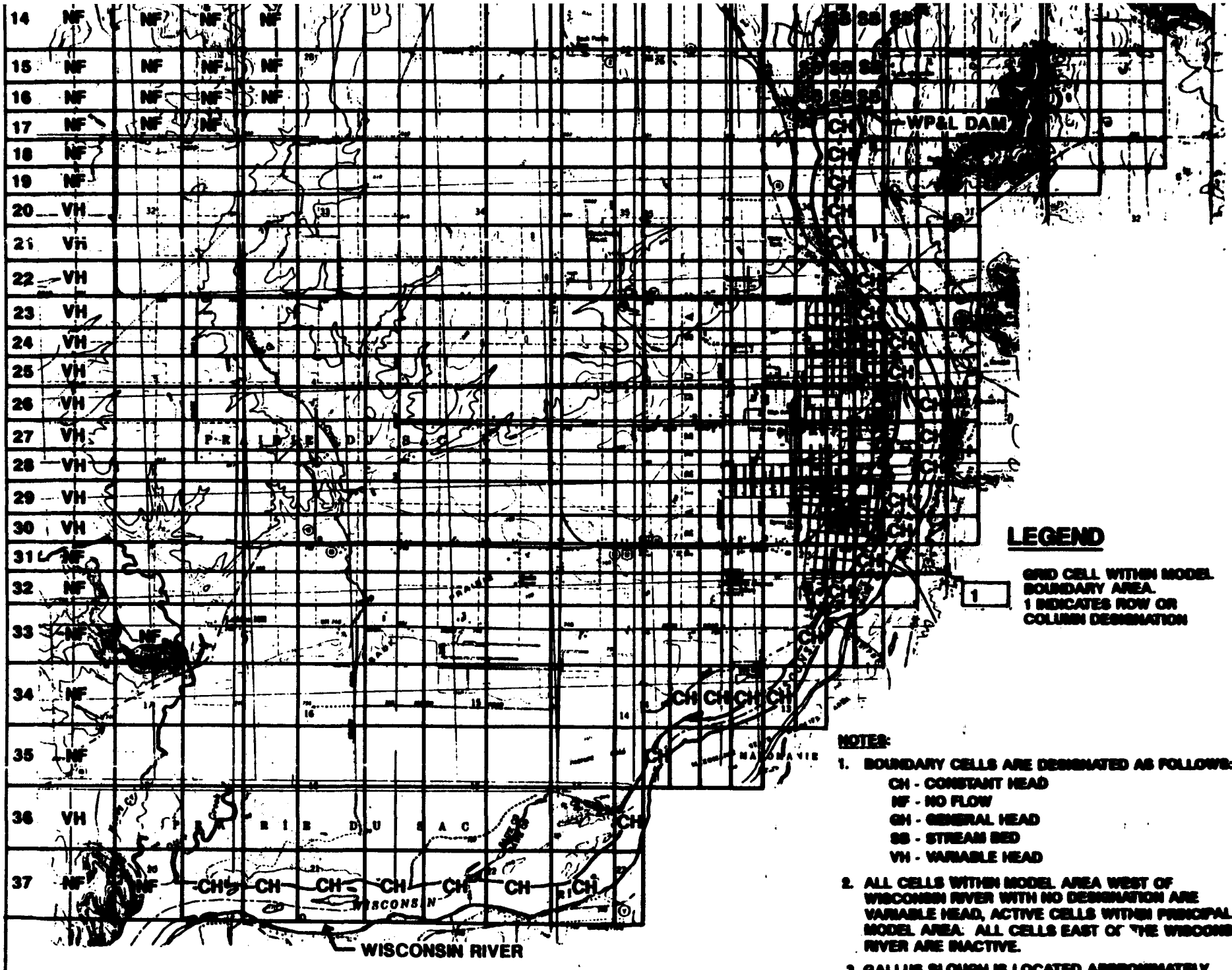


FIGURE 2-5
LOCATION OF BAAP PRODUCTION WELLS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

92080530 1 3 7


NF



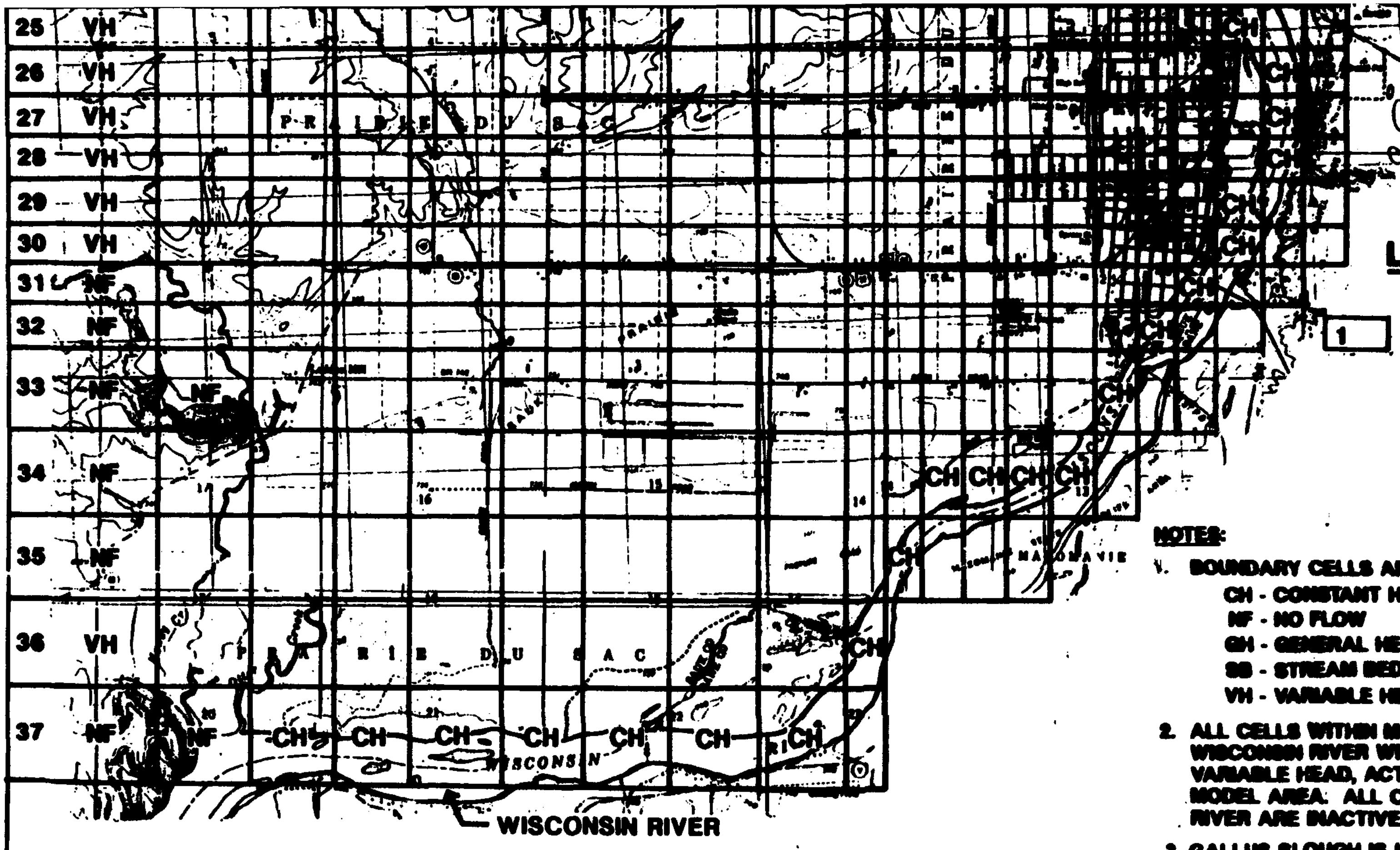
LEGEND

1 — GRID CELL WITHIN MODEL BOUNDARY AREA. 1 INDICATES ROW OR COLUMN DESIGNATION

NOTES:

1. BOUNDARY CELLS ARE DESIGNATED AS FOLLOWS:
   - CH - CONSTANT HEAD
   - NF - NO FLOW
   - GH - GENERAL HEAD
   - SB - STREAM BED
   - VH - VARIABLE HEAD
2. ALL CELLS WITHIN MODEL AREA WEST OF WISCONSIN RIVER WITH NO DESIGNATION ARE VARIABLE HEAD, ACTIVE CELLS WITHIN PRINCIPAL MODEL AREA: ALL CELLS EAST OF THE WISCONSIN RIVER ARE INACTIVE.
3. GALLUS SLOUGH IS LOCATED APPROXIMATELY 2,000 FEET EAST OF MODEL BOUNDARY.

2



LEGEND

[1] GRID CELL WITHIN MODEL BOUNDARY AREA. 1 INDICATES ROW OR COLUMN DESIGNATION

NOTES:

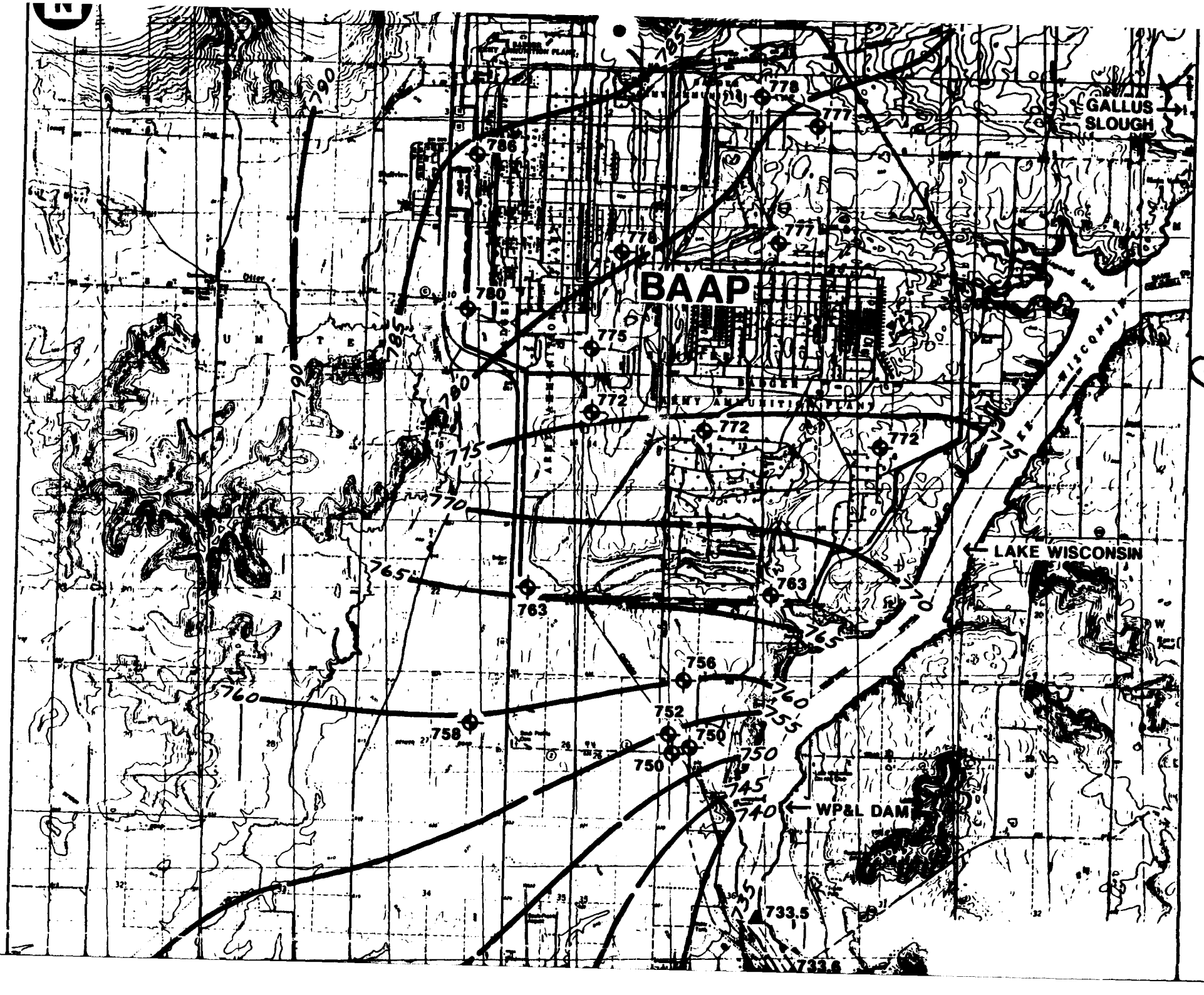
1. BOUNDARY CELLS ARE DESIGNATED AS FOLLOWS:
   - CH - CONSTANT HEAD
   - NF - NO FLOW
   - GH - GENERAL HEAD
   - SB - STREAM BED
   - VH - VARIABLE HEAD
2. ALL CELLS WITHIN MODEL AREA WEST OF WISCONSIN RIVER WITH NO DESIGNATION ARE VARIABLE HEAD, ACTIVE CELLS WITHIN PRINCIPAL MODEL AREA. ALL CELLS EAST OF THE WISCONSIN RIVER ARE INACTIVE.
3. GALLUS SLOUGH IS LOCATED APPROXIMATELY 2,800 FEET EAST OF MODEL BOUNDARY.

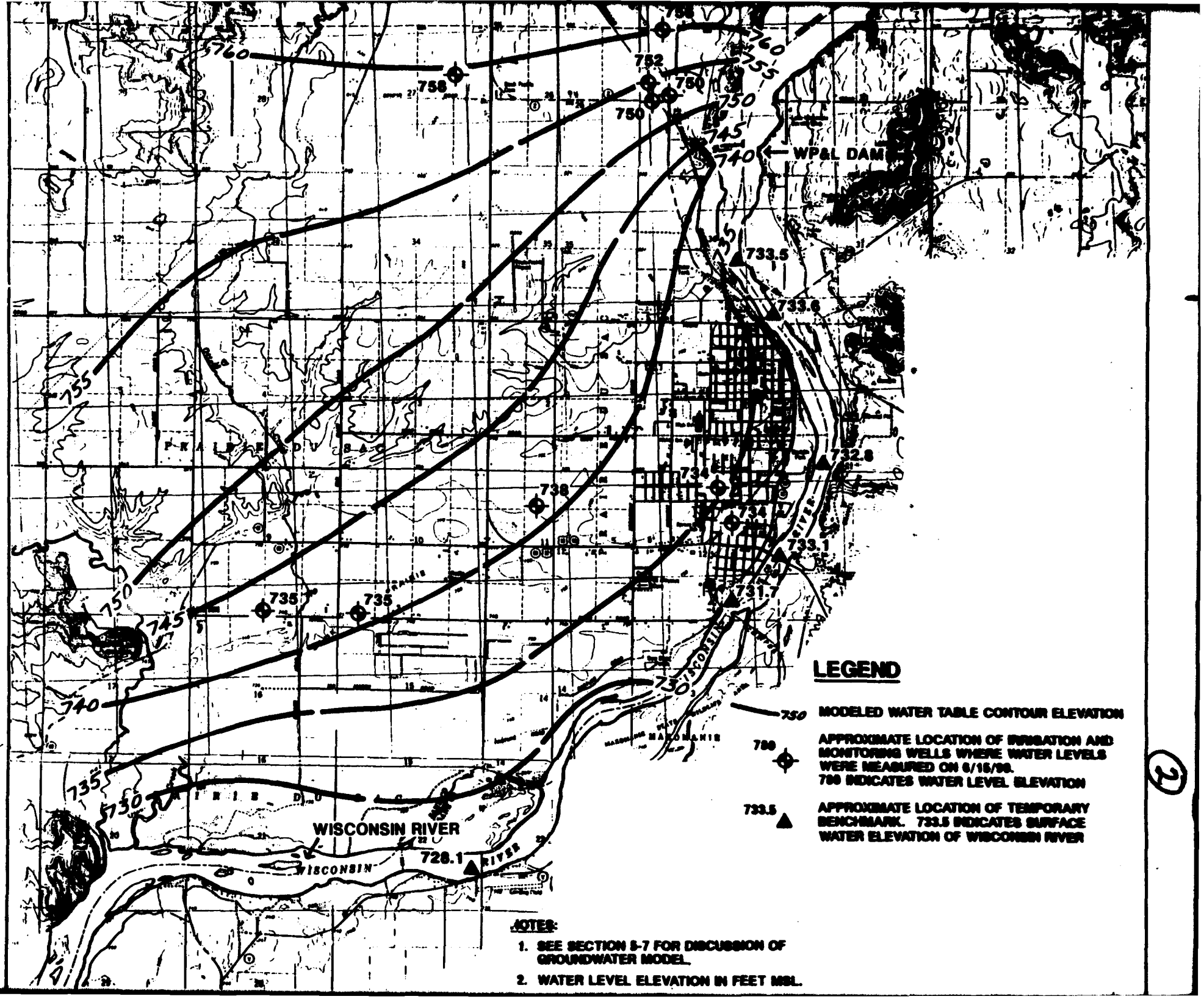
SOURCE: USGS TOPOGRAPHIC QUADRANGLES 7.5-MINUTE SERIES; SAUK PRAIRIE, SAUK CITY, NORTH FREEDOM AND BARABOO.

FIGURE 2-6
GROUNDWATER FLOW MODEL GRID
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

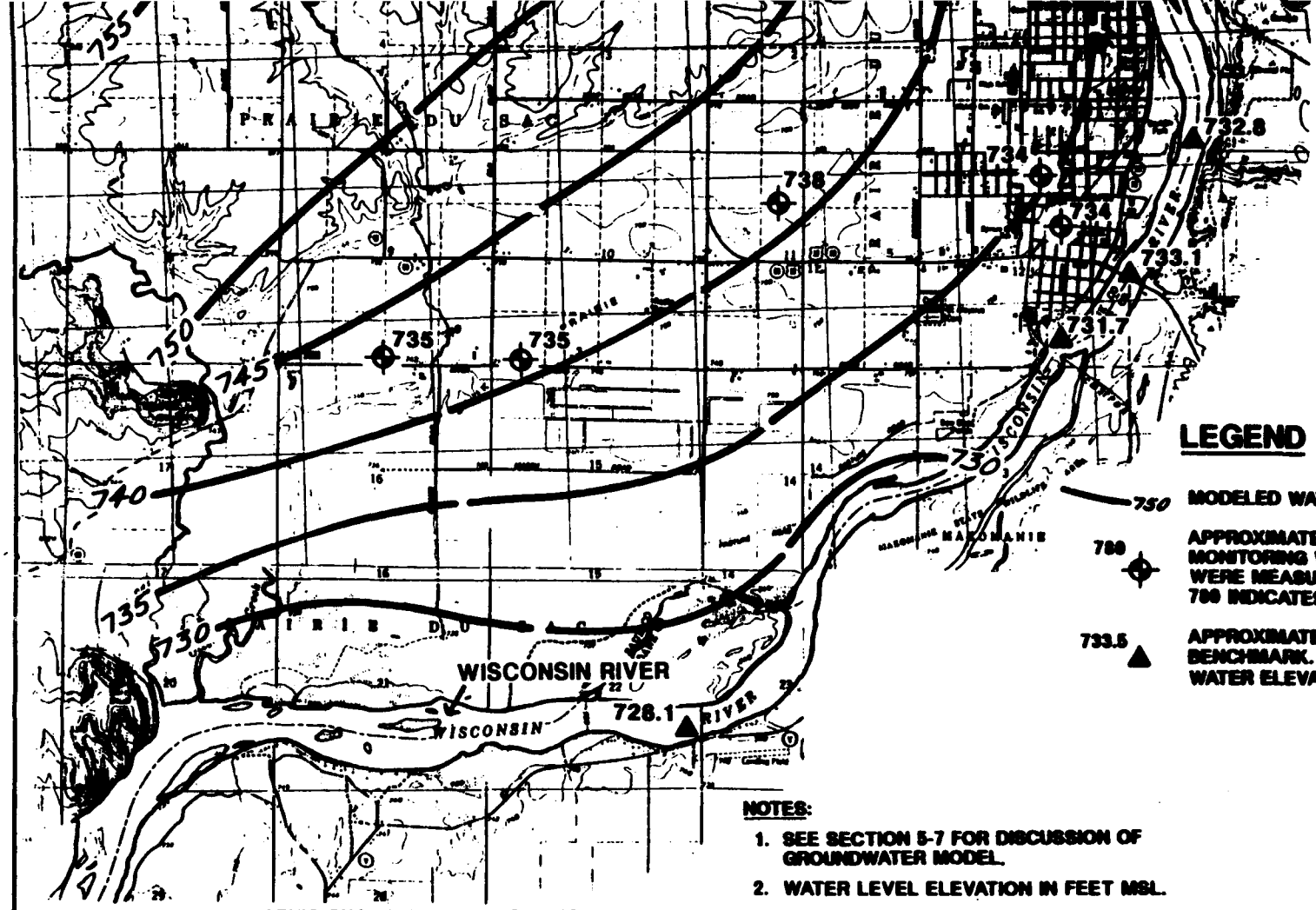
ABB Environmental Services, Inc.

6853-12


BAAP
GALLUS SLOUGH
LAKE WISCONSIN
WP&L DAM
WISCONSIN
ARMY AMMUNITION PLANT
786
778
777
780
775
772
763
756
752
750
758
733.5
790
785
780
775
770
765
760
755
750
745
740


760
755
750
745
740
735
730
758
752
750
750
745
740
WP&L DAM
733.5
733.6
732.8
734
734
733.1
731.7
738
735
735
WISCONSIN RIVER
728.1
WISCONSIN
RIVER
LEGEND
750 MODELED WATER TABLE CONTOUR ELEVATION
750 APPROXIMATE LOCATION OF IRRIGATION AND MONITORING WELLS WHERE WATER LEVELS WERE MEASURED ON 6/15/90. 750 INDICATES WATER LEVEL ELEVATION
733.5 APPROXIMATE LOCATION OF TEMPORARY BENCHMARK. 733.5 INDICATES SURFACE WATER ELEVATION OF WISCONSIN RIVER
NOTES:
1. SEE SECTION 5-7 FOR DISCUSSION OF GROUNDWATER MODEL.
2. WATER LEVEL ELEVATION IN FEET MSL.

2



LEGEND

750 — MODELED WATER TABLE CONTOUR ELEVATION

789 — APPROXIMATE LOCATION OF IRRIGATION AND MONITORING WELLS WHERE WATER LEVELS WERE MEASURED ON 6/15/90. 789 INDICATES WATER LEVEL ELEVATION

733.5 — APPROXIMATE LOCATION OF TEMPORARY BENCHMARK. 733.5 INDICATES SURFACE WATER ELEVATION OF WISCONSIN RIVER

NOTES:

1. SEE SECTION 5-7 FOR DISCUSSION OF GROUNDWATER MODEL.
2. WATER LEVEL ELEVATION IN FEET MSL.

SOURCE: USGS TOPOGRAPHIC QUADRANGLES 7.5-MINUTE SERIES; SAUK PRAIRIE, SAUK CITY, NORTH FREEDOM AND BARABOO.

SCALE IN FEET

0 4000 8000

FIGURE 2-7
MODELED WATER TABLE CONTOUR PLAN
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

6853-12

3

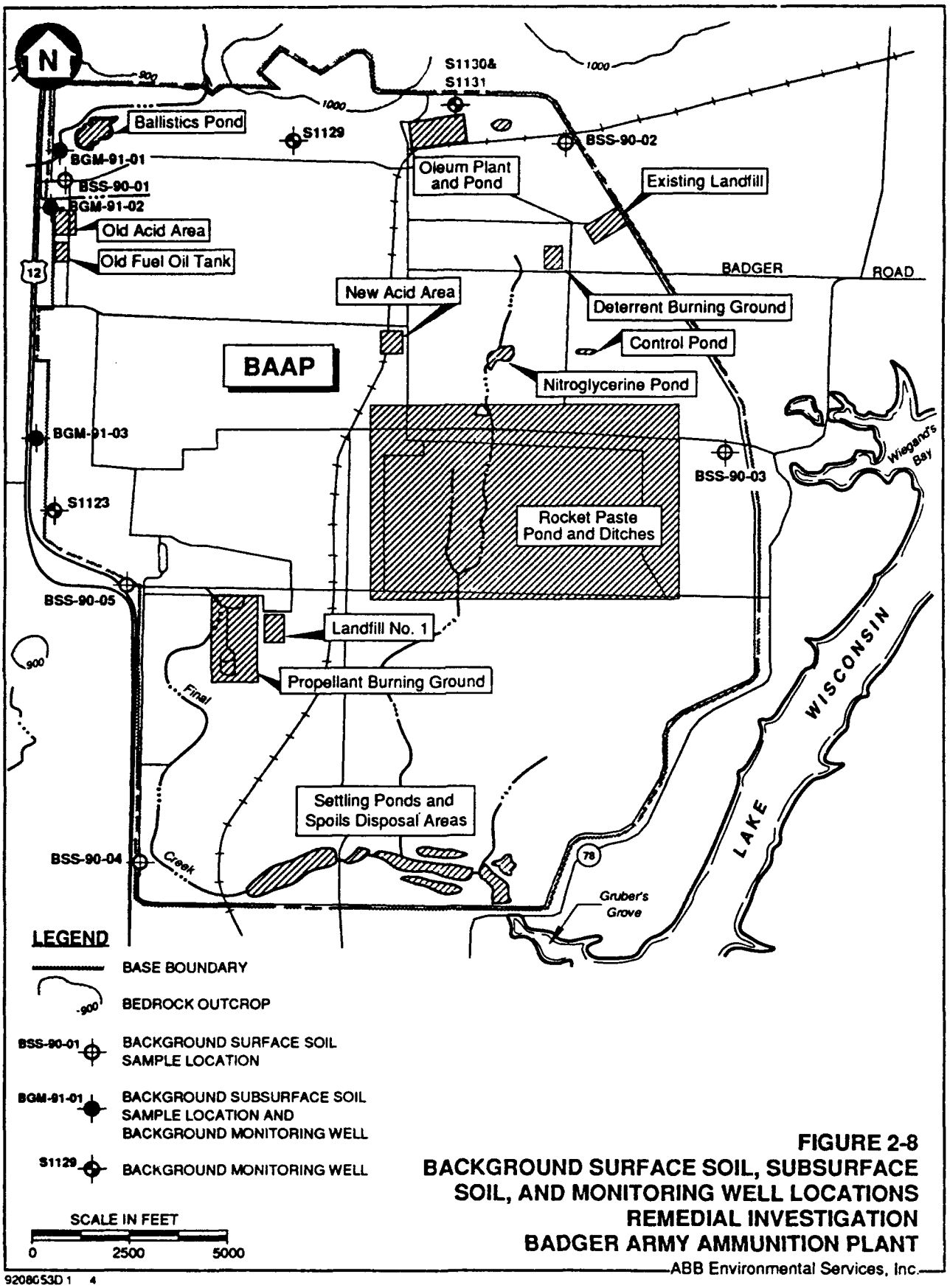
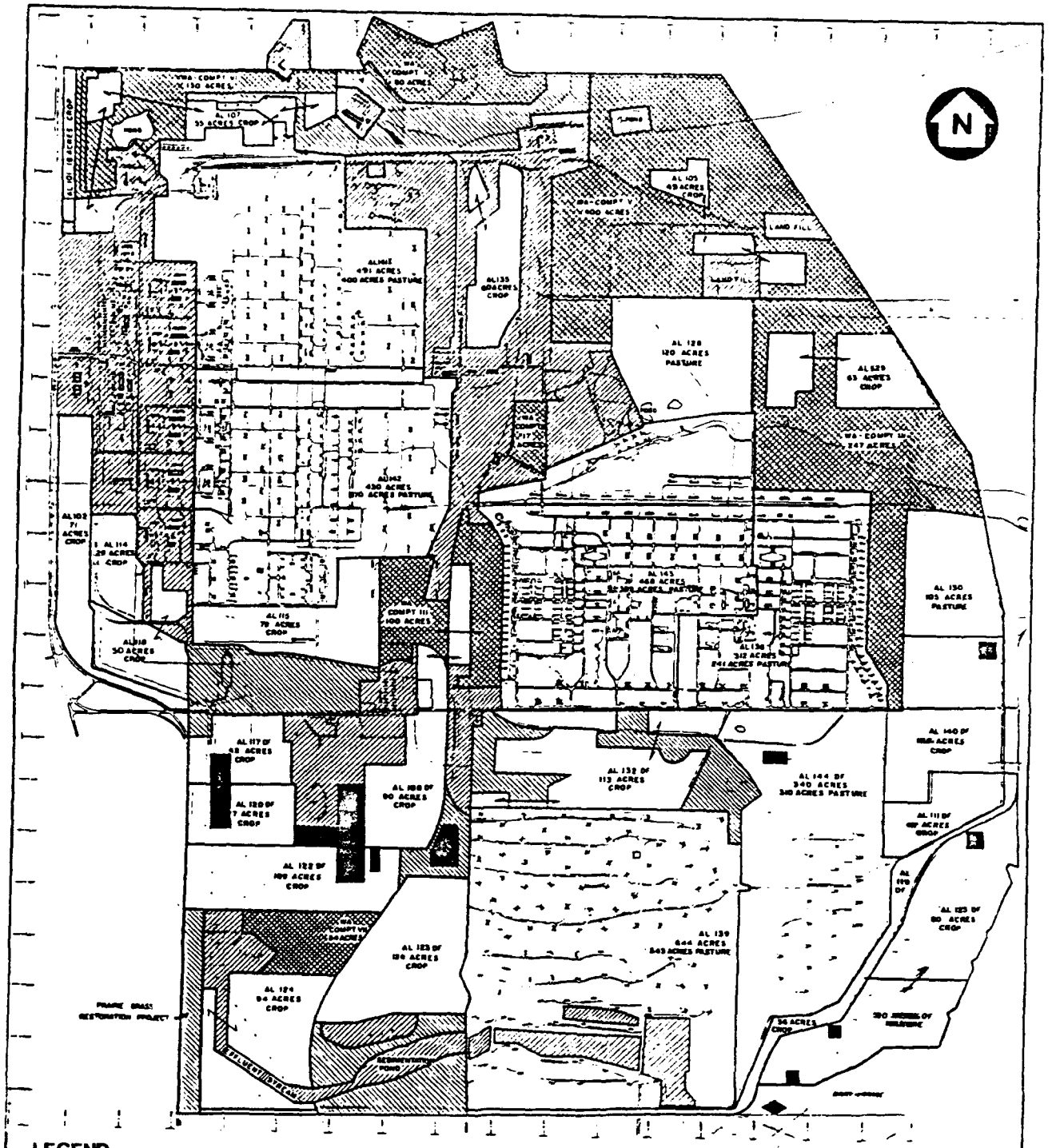


FIGURE 2-8
BACKGROUND SURFACE SOIL, SUBSURFACE SOIL, AND MONITORING WELL LOCATIONS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

9208053D 1 4



LEGEND

	U.S.D.A. RESEARCH PLOTS	
	WOODLAND AREA TRACTS	1,028 ACRES
	AGRICULTURAL LAND TRACTS	4,383 ACRES
	PLANT FACILITY TRACTS	1,642 ACRES
	WILDLIFE & OPEN AREAS	300 ACRES
	TOTAL ACRES	7,353

PLANT SITE AND LAND UTILIZATION MAP

FIGURE 2-9
LAND USE CLASSIFICATION
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

5853-12

ABB Environmental Services, Inc.

TABLE 3-1
CHECKLIST OF SWMU ENVIRONMENTAL SETTING AND FEATURES

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SWMU	WETLANDS	SURFACE WATER	SURFACE IMPOUNDMENT	LANDFILL	ABOVEGROUND STORAGE TANK
Propellant Burning Ground				X	X (propane)
Deterrent Burning Ground				X	
Existing Landfill				X	
Settling Ponds and Spoils Disposal Area	X	X	X	X	
Ballistics Pond	X	X			
Oleum Plant and Pond	X	X			
Nitroglycerine Pond	X	X			
Rocket Paste Area	X	X			
Old Acid Area					X (acids)
New Acid Area			X		X (acids)
Old Fuel Oil Tank					X (fuel)

Note:

The landfill at the Propellant Burning Ground is known as Landfill 1, and is considered a separate SWMU.

TABLE 3-2
POTENTIAL LOCATION-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE	POTENTIAL ARARS/CITATION
Propellant Burning Ground	LANDFILL Resource Conservation and Recovery Act (RCRA), Subpart N, Landfills; (40 CFR Section 264.300) WDNR, Solid Waste Management Regulations (WAC, Chapters 504-516) WDNR, Hazardous Waste Landfill Standards (WAC, Chapter 660) AIR Clean Air Act (CAA), Prevention of Significant Deterioration (PSD) Requirements; (40 CFR Part 52.21)
Deterrent Burning Ground	LANDFILL RCRA, Subpart N, Landfills; (40 CFR Section 264.300) WDNR, Solid Waste Management Regulations (WAC, Chapters 504-516) WDNR, Hazardous Waste Landfill Standards (WAC, Chapter 660) AIR Clean Air Act (CAA), Prevention of Significant Deterioration (PSD) Requirements; (40 CFR, Part 52.21)
Existing Landfill	LANDFILL RCRA, Subpart N, Landfills; (40 CFR Section 264.300) WDNR, Solid Waste Management Regulations (WAC, Chapters 504-516) WDNR, Hazardous Waste Landfill Standards (WAC, Chapter 660) AIR Clean Air Act (CAA), Prevention of Significant Deterioration (PSD) Requirements; (40 CFR, Part 52.21)

continued

TABLE 3-2
POTENTIAL LOCATION-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE	POTENTIAL ARARs/CITATION
Settling Ponds and Spoils Disposal Area	<u>WETLANDS</u> Clean Air Act (CAA), Prevention of Significant Deterioration (PSD) Requirements; (40 CFR, Part 52.21) Clean Water Act (CWA), Dredge or Fill Requirements; (Section 404), 40 CFR 230 U.S. Army Corps of Engineers Permit Program Regulations; (33 CFR Parts 320-330) Fish and Wildlife Coordination Act; (40 CFR 302(g)) National Environmental Policy Act (NEPA) - Protection of Wetlands Exec. Order No. 11990: (40 CFR Part 6) WDNR, Water Quality Standards for Wetlands (WAC, Chapter NR 103) WDNR, City and Village Shoreland-Wetland Protection Program (WAC, Chapter NR 117) WDNR, Hazardous Waste Storage, Treatment, and Disposal Facility Standards (WAC, NR 630) <u>SURFACE WATER</u> WDNR, Water Quality Standards for Wisconsin Waters (WAC, Chapter NR 102) WDNR, Water Quality Standards for Wisconsin Waters; Uses and Designated Standards (WAC, Chapter NR 104) WDNR, Shoreline Management Program (WAC, Chapter 115) WDNR, Wisconsin Statutes Annotated, Chapter 30, Dredge and Fill Requirements City of Baraboo Floodplain Zoning Code (Subchapter II) <u>LANDFILL</u> RCRA, Subpart N, Landfills; (40 CFR Section 264.300) WDNR, Solid Waste Management Regulations (WAC, Chapters 504-516) WDNR, Hazardous Waste Landfill Standards (WAC, Chapter 660)

continued

TABLE 3-2
POTENTIAL LOCATION-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE	POTENTIAL ARARS/CITATION
Ballistics Pond	WETLANDS
	Clean Water Act, Dredge or Fill Requirements; (Section 404), 40 CFR 230
	U.S. Army Corps of Engineers Permit Program Regulations; (33 CFR Parts 320-330)
	Fish and Wildlife Coordination Act; (40 CFR 302(g))
	NEPA - Protection of Wetlands Exec. Order No. 11990; (40 CFR Part 6)
	WDNR, Water Quality Standards for Wetlands (WAC, Chapter NR 103)
	WDNR, City and Village Shoreland-Wetland Protection Program (WAC, Chapter NR 117)
	WDNR, Hazardous Waste Storage, Treatment, and Disposal Facility Standards (WAC, NR 630)
	SURFACE WATER
	WDNR, Water Quality Standards for Wisconsin Waters (WAC, Chapter NR 102)
	WDNR, Water Quality Standards for Wisconsin Waters; Uses and Designated Standards (WAC, Chapter NR 104)
	WDNR, Shoreline Management Program (WAC, Chapter 115)
	WDNR, Wisconsin Statutes Annotated, Chapter 30, Dredge and Fill Requirements
	City of Baraboo Floodplain Zoning Code (Subchapter II)
	AIR
	Clean Air Act (CAA), Prevention of Significant Deterioration (PSD) Requirements; (40 CFR, Part 52.21)

continued

TABLE 3-2
POTENTIAL LOCATION-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE	POTENTIAL ARARs/CITATION
Oleum Plant and Pond	WETLANDS Clean Water Act (CWA), Dredge or Fill Requirements; (Section 404), 40 CFR 230 U.S. Army Corps of Engineers Permit Program Regulations; (33 CFR Parts 320-330) Fish and Wildlife Coordination Act; (40 CFR 302(g)) NEPA - Protection of Wetlands Executive Order Number 11990; (40 CFR Part 6) WDNR, Water Quality Standards for Wetlands (WAC, Chapter NR 103) WDNR, City and Village Shoreland-Wetland Protection Program (WAC, Chapter NR 117) WDNR, Hazardous Waste Storage, Treatment, and Disposal Facility Standards (WAC, NR 630) SURFACE WATER WDNR, Water Quality Standards for Wisconsin Waters (WAC, Chapter NR 102) WDNR, Water Quality Standards for Wisconsin Waters; Uses and Designated Standards (WAC, Chapter NR 104) WDNR, Shoreline Management Program (WAC, Chapter 115) WDNR, Wisconsin Statutes Annotated, Chapter 30, Dredge and Fill Requirements City of Baraboo Floodplain Zoning Code (Subchapter II) AIR Clean Air Act (CAA), Prevention of Significant Deterioration (PSD) Requirements; (40 CFR, Part 52.21)

continued

TABLE 3-2
POTENTIAL LOCATION-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE	POTENTIAL ARARs/CITATION
Nitroglycerine Pond	WETLANDS Clean Water Act, Dredge or Fill Requirements; (Section 404), 40 CFR 230 U.S. Army Corps of Engineers Permit Program Regulations; (33 CFR Parts 320-330) Fish and Wildlife Coordination Act; (40 CFR 302(g)) NEPA - Protection of Wetlands Exec. Order No. 11990; (40 CFR Part 6) WDNR, Water Quality Standards for Wetlands (WAC, Chapter NR 103) WDNR, City and Village Shoreland-Wetland Protection Program (WAC, Chapter NR 117) WDNR, Hazardous Waste Storage, Treatment, and Disposal Facility Standards (WAC, NR 630) SURFACE WATER WDNR, Water Quality Standards for Wisconsin Waters (WAC, Chapter NR 102) WDNR, Water Quality Standards for Wisconsin Waters; Uses and Designated Standards (WAC, Chapter NR 104) WDNR, Shoreline Management Program (WAC, Chapter 115) WDNR, Wisconsin Statutes Annotated, Chapter 30, Dredge and Fill Requirements City of Baraboo Floodplain Zoning Code (Subchapter II) AIR Clean Air Act (CAA), Prevention of Significant Deterioration (PSD) Requirements; (40 CFR, Part 52.21)

continued

TABLE 3-2
POTENTIAL LOCATION-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE	POTENTIAL ARARs/CITATION
Rocket Paste Area	WETLANDS Clean Water Act, Dredge or Fill Requirements; (Section 404), 40 CFR 230 U.S. Army Corps of Engineers Permit Program Regulations; (33 CFR Parts 320-330) Fish and Wildlife Coordination Act; (40 CFR 302(g)) NEPA - Protection of Wetlands Exec. Order No. 11990; (40 CFR Part 6) WDNR, Water Quality Standards for Wetlands (WAC, Chapter NR 103) WDNR, City and Village Shoreland-Wetland Protection Program (WAC, Chapter NR 117) WDNR, Hazardous Waste Storage, Treatment, and Disposal Facility Standards (WAC, NR 630) SURFACE WATER WDNR, Water Quality Standards for Wisconsin Waters (WAC, Chapter NR 102) WDNR, Water Quality Standards for Wisconsin Waters; Uses and Designated Standards (WAC Chapter NR 104) WDNR, Shoreline Management Program (WAC, Chapter 115) WDNR, Wisconsin Statutes Annotated, Chapter 30, Dredge and Fill Requirements City of Baraboo Floodplain Zoning Code (Subchapter II) AIR Clean Air Act (CAA), Prevention of Significant Deterioration (PSD) Requirements; (40 CFR, Part 52.21)
Old Acid Area	AIR Clean Air Act (CAA), Prevention of Significant Deterioration (PSD) Requirements; (40 CFR, Part 52.21)

continued

TABLE 3-2
POTENTIAL LOCATION-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE	POTENTIAL ARARs/CITATION
New Acid Area	SURFACE IMPOUNDMENT RCRA, Subpart K, Surface Impoundments; (40 CFR 264.220) WDNR, Solid Waste Management Regulations (WAC, Chapters 504-516)
	AIR Clean Air Act (CAA), Prevention of Significant Deterioration (PSD) Requirements; (40 CFR, Part 52.21)
Old Fuel Oil Tank	ABOVEGROUND STORAGE TANKS CWA - Oil Pollution Prevention (40 CFR Part 112) AIR Clean Air Act (CAA), Prevention of Significant Deterioration (PSD) Requirements; (40 CFR, Part 52.21)

TABLE 3-3
POTENTIAL CHEMICAL-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE MEDIA	REQUIREMENT/CITATION
GROUNDWATER	
Federal Regulatory Requirements	Safe Water Drinking Act (SDWA), Maximum Contaminant Level Goals (MCLGs); (40 CFR Part 141)
	SDWA, National Primary Drinking Water Standards, Maximum Contaminant Levels (MCLs); (40 CFR Part 141)
	RCRA, Releases from Solid Waste Management Units, Groundwater Protection Standards; (40 CFR Part 264.90-264.101, Subpart F)
State Regulatory Requirements	WDNR, Environmental Protection (WAC, Chapter NR 100)
	WDNR, Water Quality Standards for Wisconsin Waters (WAC, Chapter 102.14)
	WDNR, Water Quality Criteria for Toxic Substances (WAC, Chapter 105)
	WDNR, Procedures for Calculating Water-quality-based Effluent Limitations for Toxic and Organoleptic Substances Discharged to Surface Water (WAC, Chapter NR 106)
	WDNR, Groundwater Quality Standards (WAC, Chapter 140)
	WDNR, Pollutant Discharge Elimination System Standards for Uncategorized Point Sources (WAC, Chapter 220.20)
	WDNR, Groundwater Standards for Hazardous Waste; Groundwater and Leachate Monitoring Standards and Corrective Action Requirements (WAC, Chapter 635)
Federal Criteria, Advisories, and Guidance	Clean Water Act (CWA), Ambient Water Quality Criteria (AWQC); (40 CFR Part 131 Quality Criteria for Water, 1986)
	SDWA, National Secondary Drinking Water Standards (SMCLs); (40 CFR Part 143)
	EPA Reference Doses (RfDs)
	EPA Reference Concentrations (RfCs)
	EPA Human Health Assessment Cancer Slope Factors (CSFs)
	EPA Office of Drinking Water, Health Advisories
	EPA Health Assessment Documents, Acceptable Intake - Chronic (AIC) and Subchronic (AIS)
	EPA, Office of Water Guidance, Water-Related Fate of 129 Priority Pollutants (1979)

continued

TABLE 3-3
POTENTIAL CHEMICAL-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE MEDIA	REQUIREMENT/CITATION
SURFACE WATER	
Federal Regulatory Requirements	CWA, National Pollutant Discharge Elimination System (NPDES); (40 CFR Part 122, 125)
	CWA, Ambient Water Quality Criteria (AWQC); (40 CFR Part 131 Quality Criteria for Water, 1986)
State Regulatory Requirements	WDNR, Water Quality Standards for Wisconsin Waters (WAC, Chapter 102.14)
	WDNR, Water Quality Criteria for Toxic Substances (WAC, Chapter 105)
	WDNR, Procedures for Calculating Water-quality-based Effluent Limitations for Toxic and Organoleptic Substances Discharged to Surface Water (WAC, Chapter NR 106)
	WDNR, Pollutant Discharge Elimination System Standards for Uncategorized Point Sources (WAC, Chapter 220.20)
Discharge to Publicly Owned Treatment Works	CWA, National Pretreatment Standards; (40 CFR Part 403) Discharge to Publicly Owned Treatment Works
SOIL	Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites; [OSWER Directive #9355.4-02]
SEDIMENT	No chemical-specific ARARs identified for this media.
AIR	
Federal Regulatory Requirements	Clean Air Act (CAA), National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50)
	CAA - National Emission Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR 61)
	CAA - Hazardous Air Pollutants (HAPs) (CAA, Title III)
State Regulatory Requirements	WNDR; Wisconsin General and Portable Sources Air Pollution Control Rules; Ambient Air Quality Standards (WAC, Chapter NR 404)
	WNDR; Wisconsin Particulate and Sulfur Emissions Rules; Control of Particulate Emissions (WAC, Chapter NR 415)
	WNDR; Wisconsin Organic Compound Emissions Rules (WAC, Chapter NR 419)
	WDNR; Wisconsin Hazardous Air Pollutants Emissions Standards (WAC, Chapter NR 445)

TABLE 3-4
GROUNDWATER CHEMICAL SPECIFIC STANDARDS AND GUIDANCE

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITIONS PLANT

CHEMICAL		SAFE DRINKING WATER ACT (SDWA) (d)		CWA WATER QUALITY CRITERIA (c)				WI PUBLIC HEALTH GROUNDWATER QUALITY STANDARDS (b)			
				FOR PROTECTION OF HUMAN HEALTH		FOR PROTECTION OF AQUATIC LIFE		CURRENT STANDARDS		PROPOSED STANDARDS	
CHEMICAL CODE	CHEMICAL NAME	MCL (µg/l) (a)	MCLG (µg/l)	WATER AND FISH CONSUMPTION (µg/l)	FISH CONSUMPTION ONLY (µg/l)	FRESHWATER ACUTE/CHRONIC (µg/l)	MARINE ACUTE/CHRONIC (µg/l)	ENFORCEMENT STANDARDS (µg/l)	PAL (µg/l)	ENFORCEMENT STANDARDS (µg/l)	PAL (µg/l)
ACRYLO	acrylonitrile	-	-	0.058	0.65	7,500/2,600 (10)	-/-	-	-	-	-
AL	aluminum	50-200 (1)	-	(2)	(2)	(2)	(2)	-	-	-	-
ALK	alkalinity	-	-	-	-	- /20 ppm	-/-	-	-	-	-
AS	arsenic	50 (3)	-	0.0022	0.0175	-/-	-/-	50	5	-	
B2EHP	bis(2 ethylhexyl) phthalate	4 (4)	0	15,000	50,000	400/300 (4)	400/360 (4)	3	0.3	-	-
BA	barium	2,000	2,000	1,000	-	-/-	-/-	1,000	200	2,000	400
C2H3CL	vinyl chloride	2	0	2	525	-/-	-/-	0.2	0.0015	-	0.02
C6H6	benzene	5	0	0.66	40	5,300/- (5)	5,100/700 (5)	5	0.067	-	0.5
CA	calcium	-	-	-	-	-/-	-/-	-	-	-	
CCL4	carbon tetrachloride	5	0	0.4	6.94	35,200/- (5)	50,000/- (5)	5	0.5	-	-
CD	cadmium	5	5	10	-	3.9/1.1 (4)	43/9.3	10	1	5	0.5
CHCL3	chloroform	100 (6)	-	0.19	15.7	28,900/1,240(5)	-/-	6	0.6	-	
CL	chloride	250,000 (7)	-	-	-	860,000/230,000	-/-	250,000 (7)	125,000 (7)	-	-
CO	cobalt	-	-	-	-	-/-	-/-	-	-	-	
CR	chromium (total)	100	100	-	-	-/-	-/-	50	5	100	10
CS2	carbon disulfide	-	-	-	-	-/-	-/-	-	-	-	
12DCLE	1,2-dichloroethane	5	0	0.94	243	118,000/20,000 (5)	11,300/- (5)	5	0.05	-	0.5
DEP	diethylphthalate	-	-	350,000	1,800,000	-/-	-/-	-	-	-	
DBUP	di-n-butyl phthalate	-	-	34,000	154,000	-/-	-/-	-	-		

W0039213.T3/11

continued

TABLE 3-4
GROUNDWATER CHEMICAL SPECIFIC STANDARDS AND GUIDANCE

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITIONS PLANT

CHEMICAL		SAFE DRINKING WATER ACT (SDWA) (d)		CWA WATER QUALITY CRITERIA (c)				WI PUBLIC HEALTH GROUNDWATER QUALITY STANDARDS (b)			
				FOR PROTECTION OF HUMAN HEALTH		FOR PROTECTION OF AQUATIC LIFE		CURRENT STANDARDS		PROPOSED STANDARDS	
CHEMICAL CODE	CHEMICAL NAME	MCL (µg/l) (a)	MCLG (µg/l)	WATER AND FISH CONSUMPTION (µg/l)	FISH CONSUMPTION ONLY (µg/l)	FRESHWATER ACUTE/CHRONIC (µg/l)	MARINE ACUTE/CHRONIC (µg/l)	ENFORCEMENT STANDARDS (µg/l)	PAL (µg/l)	ENFORCEMENT STANDARDS (µg/l)	PAL (µg/l)
DNOP	di-n-octyl phthalate	-	-	-	-	-/-	-/-	-	-	-	-
24DNT	2,4-dinitrotoluene	-	-	0.11	9.1	330/230 (5)	-/-	0.05	0.005	-	-
26DNT	2,6-dinitrotoluene	-	-	-	-	-/-	-/-	0.05	0.005	-	-
FANT	fluoroanthene	-	-	42	54	3,980/- (5)	40/16 (5)	-	-	-	-
FE	iron	300 (1)	-	300	-	- / 1	-/-	300 (7)	150 (7)	-	-
HARD	hardness	-	-	-	-	-/-	-/-	-	-	-	-
HG	mercury	2	2	0.144	0.146	2.4/0.012	2.1/0.025	2	0.2	-	-
MEC6H5	toluene	1,000	1,000	14,300	424,000	17,500/- (5)	6,300/5000 (5)	343	68.6	40 (8)	20 (8)
MEK	2-butanone	-	-	-	-	-/-	-/-	460	90	-	-
MN	manganese	50 (1)	200 (4)	50	100	-/-	-/-	50 (7)	25 (7)	-	-
2MNAP	2-methylnaphthalene	-	-	-	-	-/-	-/-	-		-	-
NA	sodium	(9)	-	-	-	-/-	-/-	-	-	-	-
2NANIL	2-nitroaniline	-	-	-	-	-/-	-/-	-	-	-	-
3NANIL	3-nitroaniline	-	-	-	-	-/-	-/-	-		-	-
4NANIL	4-nitroaniline	-	-	-	-	-/-	-/-	-	-	-	-
NAP	naphthalene	-	-		-	2,300/620 (5)	2,350/-	40	8	-	-
NB	nitrobenzene	-	-	19,800	-	27,000/- (5)	6,680/- (5)	-		-	-
NG	nitroglycerine	-	-	-	-	-/-	-/-	-	-	-	-

continued

TABLE 3-4
GROUNDWATER CHEMICAL SPECIFIC STANDARDS AND GUIDANCE

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITIONS PLANT

Chemical		Safe Drinking Water Act (SDWA) (d)		CWA Water Quality Criteria (c)				WI Public Health Groundwater Quality Standards (b)			
				For Protection of Human Health		For Protection of Aquatic Life		Current Standards		Proposed Standards	
Chemical Code	Chemical Name	MCL (µg/l) (a)	MCLG (µg/l)	Water and Fish Consumption (µg/l)	Fish Consumption only (µg/l)	Freshwater Acute/Chronic (µg/l)	Marine Acute/Chronic (µg/l)	Enforcement Standards (µg/l)	PAL (µg/l)	Enforcement Standards (µg/l)	PAL (µg/l)
NI	nickel	100	100	13.4	100	1,400/160 (10)	75/8.3	-	-	-	-
NIT	nitrite/nitrate-nonspecific	10,000 (11)	10,000 (11)	-	-	-/-	-/-	10,000	2,000	-	-
NNDPA	n-nitros diphenylamine	-	-	(12)	(12)	-/-	-/-	-	-	-	
rNO2	nitrite	1,000	1,000	-	-	-/-	-/-	-	-	1000	200
NO3	nitrate	10,000	10,000	10,000	-	-/-	-/-	-	-	10,000	2,000
PB	lead	TT (3)	0	50	-	83/3.2 (10)	220/8.5	50	5	15	1.5
SE	selenium	50	50	10	-	0.02/0.005	0.3/0.071	10	1	50	10
SO4	sulfate	250,000 (1) 400/500 (4)	400/500 (4)	-	-	-/-	-/-	250,000 (7)	125,000 (7)	-	-
111TCE	1,1,1-trichloroethane	200	200	18400	1,030,000	-/-	31,200/- (5)	200	40	-	
112TCE	1,1,2-trichloroethane	5	3	0.6	41.8	-/9,400 (5)	-/-	0.6	0.06	-	-
TDS	total dissolved solids	500,000 (14)	-	-	-	-/-	-/-	-	-	-	
236TMN	2,3,6-trimethylnapthalene	-	-	-	-	-/-	-/-	-	-	-	-
TRCLE	trichloroethylene	5	0	2.7	80.7	45,000/21,000 (5)	2,000/- (5)	5	0.18		0.5

continued

TABLE 3-4
GROUNDWATER CHEMICAL SPECIFIC STANDARDS AND GUIDANCE

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITIONS PLANT

CHEMICAL		SAFE DRINKING WATER ACT (SDWA) (d)		CWA WATER QUALITY CRITERIA (c)				WI PUBLIC HEALTH GROUNDWATER QUALITY STANDARDS (b)			
				FOR PROTECTION OF HUMAN HEALTH		FOR PROTECTION OF AQUATIC LIFE		CURRENT STANDARDS		PROPOSED STANDARDS	
CHEMICAL CODE	CHEMICAL NAME	MCL (µg/l) (a)	MCLG (µg/l)	WATER AND FISH CONSUMPTION (µg/l)	FISH CONSUMPTION ONLY (µg/l)	FRESHWATER ACUTE/CHRONIC (µg/l)	MARINE ACUTE/CHRONIC (µg/l)	ENFORCEMENT STANDARDS (µg/l)	PAL (µg/l)	ENFORCEMENT STANDARDS (µg/l)	PAL (µg/l)
ZN	Zinc	5000 (1)	-	-	-	102/110 (10)	95/86 (10)	5,000 (7)	2,500 (7)	-	-

Sources:

(a) U.S. Environmental Protection Agency (EPA), 1991, "Fact Sheet: National Primary Drinking Water Standards". Office of Water, Washington, D.C. August, 1991; EPA, 1991, "Fact Sheet: National Secondary Drinking Water Standards", Office of Water, Washington, D.C., September, 1991; and EPA, 1990, "National Primary and Secondary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals, Final Rule", 57FR31776, July 17, 1992.

(b) *Wisconsin Administrative Code, Chapter NR 140.10, Table 1.*

(c) EPA, 1991, "Water Quality Criteria Summary"; Office of Science and Technology, Health and Ecological Criteria Division, Ecological Risk Assessment Branch, Human Risk Assessment Branch; Washington, D.C. May 1, 1991.

(d) EPA SDWA National Primary Drinking Water Regulations per 40 CFR 141; MCLs and MCLGs.

Notes:

(1) Secondary drinking water standards, suggested level
(2) Criteria are pH dependent. Refer to 53FR33178.
(3) MCL for arsenic currently under review.
(4) Proposed value.
(5) Insufficient data to develop criteria. Value presented is the lowest observed effect level.
(6) Standard indicated is propose value for total trihalomethanes (i.e., chloroform, dibromomethane, bromodichloromethane, and bromoform).
(7) Values are for protection of public welfare (usually aesthetic concerns) rather than for protection of public health. Public welfare standards may not be enforced as rigorously as public health standards.
(8) WDNR proposes to delete toluene from regulation as a public health water quality standard and to promulgate a public welfare water quality standard.
(9) No MCL has been set for sodium. However, a reporting level of 20,000 µg/l has been established as the reporting level. Monitoring is required and data is reported to health officials to protect individuals on restricted sodium diet.
(10) Hardness dependent criteria (100 mg/l $CaCO_3$ used).
(11) Standard indicated is for total nitrite/nitrate.
(12) Although no published criteria exist, values for NNDPA have been calculated using IRIS. Refer to Source (c).
(13) Treatment technique requirement in effect.
(14) The Preventative Action Limit for total dissolved solids (TDS) is 200,000 µg/l above an established background concentration; there is no Enforcement Standard for TDS.

Acronyms:

CWA Clean Water Act
EPA United States Environmental Protection Agency
IRIS Integrated Risk Information System
MCL Maximum Contaminant Level
MCLG Maximum Contaminant level Goal
µg/l micrograms per liter, equivalent to parts per billion
mg/l milligrams per liter, equivalent to parts per million
PAL Preventative Action Limit
SDWA Safe Water Drinking Act
TDS Total Dissolved Solids
WDNR Wisconsin Department of Natural Resources

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS COMMON TO A VARIETY OF REMEDIAL ALTERNATIVES			
OTHER RESPONSE ACTIVITIES	CITATION	REQUIREMENTS	CONSIDERATIONS
All Hazardous Waste TSD Units	RCRA, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities; (40 CFR Part 264)	Establishes minimum national standards which define the acceptable management of hazardous wastes for owners and operators of facilities which treat, store or dispose of hazardous wastes.	Should remedial actions involve management of RCRA wastes at an off-site TSDF or if a treatment facility is constructed on-site, these requirements would be applicable.
	RCRA, General Facility Standards; (40 CFR Subpart B, 264.10-264.18)	General facility requirements outline general waste analysis, security measures, inspections, and training requirements.	Should remedial actions involve management of RCRA wastes at an off-site TSDF or if a treatment facility is constructed on-site, these requirements would be applicable.
	RCRA, Preparedness and Prevention; (40 CFR Subpart C, 264.30-264.37)	This regulation outlines requirements for safety equipment and spill-control for hazardous waste facilities. Facilities must be designed, maintained, constructed, and operated to minimize the possibility of an unplanned release that could threaten human health or the environment.	Safety and communication equipment should be incorporated into all aspects of the remedial process and local authorities should be familiarized with site operations.
	RCRA, Contingency Plan and Emergency Procedures; (40 CFR Subpart D, 264.30-264.37)	This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.	These requirements are relevant and appropriate for remedial actions involving the management of hazardous waste.

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS COMMON TO A VARIETY OF REMEDIAL ALTERNATIVES			
OTHER RESPONSE ACTIVITIES	**CITATION**	**REQUIREMENTS**	**CONSIDERATIONS**
	RCRA, Releases from Solid Waste Management Units; (Subpart F, 264.90-264.109)	The scope of the regulation encompasses: groundwater protection standards; concentration limits; point of compliance; compliance period; requirements for groundwater monitoring, detection monitoring, and compliance monitoring; and the corrective action program. Provides guidelines for the remediation of solid waste management units including: establishes specific groundwater monitoring requirements, sets MCLs as level of compliance for upper aquifer, and establishes requirements of the corrective action program.	Applicable to remedial alternatives that involve the closure and post-closure of SWMUs because BAAP holds a RCRA Part B Permit.
	RCRA, Hazardous Waste Permit Program; (40 CFR Part 270)	Establishes provisions covering basic EPA permitting requirements.	RCRA permitting requirements need to be determined on a case-by-case basis, working with all involved regulatory agencies. However, any activity involving the treatment or containment of hazardous waste is subject to these permitting requirements.
Hazardous Waste Transportation	DOT Rule for Transportation of Hazardous Materials (49 CFR Parts 107, 171.1-172.558)	Outlines procedures for the packaging, labeling, manifesting, and transportation of hazardous materials.	This regulation will be applicable to any company contracted to transport hazardous wastes from the site.

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS COMMON TO A VARIETY OF REMEDIAL ALTERNATIVES			
OTHER RESPONSE ACTIVITIES	**CITATION**	**REQUIREMENTS**	**CONSIDERATIONS**
	Standards Applicable to Transporter of Hazardous Waste, RCRA Section 3003, 40 CFR 170 - 179.	Establishes the responsibility of off-site transporters of hazardous waste in the handling, transportation, and management of the waste. Requires a manifest, recordkeeping, and immediate action in the event of a discharge of hazardous waste.	This regulations will be applicable to any company contracted to transport hazardous material from the site.
Control of Air Emissions	CAA - New Source Performance Standards; 40 CFR 60	Establish emission limits for a number of different pollutants for certain classes of new stationary sources. Include limits for fluorides, sulfuric acid mist, and total reduced sulfur.	These provisions are generally not applicable to cleanup actions. However, if a facility is a new source subject to a NSPS (such as an incinerator), the requirement may be applicable. If the pollutants emitted and the technology employed is similar to the pollutant and source category regulated, the NSPS may be considered relevant and appropriate.
	WDNR, General and Portable Sources Air Pollution Control Rules; Ambient Air Quality Standards (WAC, Chapter NR 404)	Primary and secondary ambient air quality standards for sulfur oxides, suspended particulated, carbon monoxide, ozone, nitrogen dioxide, lead, and particulate matter are established in this rule. The primary air standard provides protection for the public health with a margin of safety. The secondary air standard is the level of air quality that may be necessary to protect public welfare from unknown or anticipated adverse effects.	Potential applicable requirements for off-site TSD units. Potential Relevant and appropriate requirements for on-site TSD units.

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARs COMMON TO A VARIETY OF REMEDIAL ALTERNATIVES			
OTHER RESPONSE ACTIVITIES	**CITATION**	**REQUIREMENTS**	**CONSIDERATIONS**
	WDNR, Wisconsin Particulate and Sulfur Emissions Rules, Control of Particulate Emissions (WAC, Chapter NR 415)	This rule requires that precautions be taken to prevent particulate matter from becoming airborne. Particulate emission limits for certain processes are specified, and a default value of 0.4 Lbs of particulate matter per 1,000 pounds of gas is established for any process not listed in Section 415.05. Particulate emission limits for fuel-burning equipment and incinerators are established.	Potential applicable requirements for off-site TSD units. Potential Relevant and appropriate requirements for on-site TSD units.
	WDNR, Organic Compound Emission Rules (WAC, Chapter NR 419)	The rule states that no more than 5.7 liters of any liquid volatile organic compound (VOC) waste or any liquid, semisolid, or solid material containing more than 5.7 liters of any VOC may not be disposed of in one day's time from a facility in a manner which would permit evaporation into the ambient air during ozone season. The quantity of VOCs that evaporate into the ambient air during the ozone season must not exceed 15% (by weight) or 5.7 liters in any one day, whichever is larger.	Potential applicable requirements for off-site TSD units. Potential Relevant and appropriate requirements for on-site TSD units.
	WDNR, Wisconsin Carbon, Lead, and Nitrogen Emission Rules (WAC, Chapters 426-428)	These rules establish emission rules for carbon, lead, and nitrogen.	Potential applicable requirements for off-site TSD units. Potential Relevant and appropriate requirements for on-site TSD units.

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS COMMON TO A VARIETY OF REMEDIAL ALTERNATIVES			
OTHER RESPONSE ACTIVITIES	CITATION	REQUIREMENTS	CONSIDERATIONS
	WDNR, Hazardous Air Pollutants Emissions Standards (WAC, Chapter NR 445)	Establishes acceptable emission rates for hazardous air contaminants, which are defined as contaminants for which no ambient air quality standard is set in Chapter NR 404 and which may cause or significantly contribute to mortality or a serious irreversible illness, or may pose a significant threat or public health or the environment.	Potential applicable requirements for off-site TSD units. Potential Relevant and appropriate requirements for on-site TSD units.
Excavation	CAA - NAAQS for Total Suspended Solids (40 CFR 129.105, 750).	This regulation specifies maximum primary and secondary 24-hour concentrations for particulate matter. Fugitive dust emissions from site excavation activities must be maintained below 260 $\mu g/m^3$ (primary standard).	Proper dust suppression methods must be implemented.
	CAA - NAAQS (40 CFR 50)	Provides Air Quality Standards for particulate matter and lead.	Fugitive dust emissions must be controled during construction to maintain concentrations below these levels.
	RCRA - 40 CFR 264	Requires owner/operator to control wind dispersal of particulate matter.	Same as above.

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS COMMON TO A VARIETY OF REMEDIAL ALTERNATIVES			
OTHER RESPONSE ACTIVITIES	**CITATION**	**REQUIREMENTS**	**CONSIDERATIONS**
	WDNR, General and Portable Sources Air Pollution Control Rules; Ambient Air Quality Standards (WAC, Chapter NR 404)	Primary and secondary ambient air quality standards for sulfur oxides, suspended particulated, carbon monoxide, ozone, nitrogen dioxide, lead, and particulate matter are established in this rule. The primary air standard provides protection for the public health with a margin of safety. The secondary air standard is the level of air quality that may be necessary to protect public welfare from unknown or anticipated adverse effects.	Same as above
	WDNR, Wisconsin Particulate and Sulfur Emissions Rules, Control of Particulate Emissions (WAC, Chapter NR 415)	This rule requires that precautions be taken to prevent particulate matter from becoming airborne. Particulate emission limits for certain processes are specified, and a default value of 0.4 Lbs of particulate matter per 1,000 pounds of gas is established for any process not listed in Section 415.05. Particulate emission limits for fuel-burning equipment and incinerators are established.	Same as above.

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS COMMON TO A VARIETY OF REMEDIAL ALTERNATIVES			
OTHER RESPONSE ACTIVITIES	**CITATION**	**REQUIREMENTS**	**CONSIDERATIONS**
	WDNR, Organic Compound Emission Rules (WAC, Chapter NR 419)	The rule states that no more than 5.7 liters of any liquid volatile organic compound (VOC) waste or any liquid, semisolid, or solid material containing more than 5.7 liters of any VOC may not be disposed of in one day's time from a facility in a manner which would permit evaporation into the ambient air during ozone season. The quantity of VOCs that evaporate into the ambient air during the ozone season must not exceed 15% (by weight) or 5.7 liters in any one day, whichever is larger.	Same as above.
	WDNR, Wisconsin Carbon, Lead, and Nitrogen Emission Rules (WAC, Chapters 426-428)	These rules establish emission rules for carbon, lead, and nitrogen. Same as above.	
	WDNR, Hazardous Air Pollutants Emissions Standards (WAC, Chapter NR 445)	Establishes acceptable emission rates for hazardous air contaminants, which are defined as contaminants for which no ambient air quality standard is set in Chapter NR 404 and which may cause or significantly contribute to mortality or a serious irreversible illness, or may pose a significant threat or public health or the environment.	Same as above.

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS COMMON TO A VARIETY OF REMEDIAL ALTERNATIVES			
OTHER RESPONSE ACTIVITIES	**CITATION**	**REQUIREMENTS**	**CONSIDERATIONS**
Land Disposal	RCRA, Land Disposal Restrictions; (40 CFR Part 268)	Land disposal of RCRA hazardous wastes without prior treatment is prohibited. Waste at specific sites must be evaluated as to whether it meets the definition of one of the specified restricted wastes and the remedial action must constitute "placement" for the land disposal restrictions to be considered applicable. For each hazardous waste, the LDRs specify that the waste must be treated either by a treatment technology or to a concentration level prior to disposal in a RCRA Subtitle C permitted facility.	Under the LDRs, treatment standards have been established for all listed wastes. If it is determined that hazardous wastes at BAAP are subject to LDRs, these requirements will be potential relevant and appropriate requirements for on-site disposal and applicable requirements for off-site disposal.
	RCRA, Identification and Listing of Hazardous Waste; (40 CFR Part 261, 261.1-261.33)	Defines those solid wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 262-265.	Applicability of RCRA regulations to wastes found at the site is dependent on the solid waste meeting one of the following criteria: a. Generated through a RCRA listed source process. b. RCRA listed waste from non-specific source. c. Characteristically hazardous due to ignitability, corrositivity, reactivity, or toxicity.

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS COMMON TO A VARIETY OF REMEDIAL ALTERNATIVES			
OTHER RESPONSE ACTIVITIES	**CITATION**	**REQUIREMENTS**	**CONSIDERATIONS**
Worker Protection	Occupational Health and Safety Act (OSHA), Health and Safety Standards; (29 CFR Part 1926)	This regulation specifies the type of safety training, equipment, and procedures to be followed during site investigation and remediation.	All phases of the remedial response project at BAAP should be executed in compliance with this regulation.
	OSHA, General Industry Standards; (29 CFR Part 1910)	Regulates worker health and safety at hazardous waste sites (i.e., specifies 8-hour time-weighted average concentration for various organics compounds). Training requirements for workers at hazardous waste operations are specified in 29 CFR Part 1910.120.	Under 40 CFR 300.38, requirements of the Act apply to all response activities under the NCP. Proper respiratory equipment will be worn if it is impossible to maintain the work atmosphere below the specified concentration. Workers performing site work are required to have completed specific training requirements.
	OSHA, Recordkeeping, Reporting, and Related Regulations; (29 CFR Part 1904)	This regulation outlines the recordkeeping and reporting requirements to be followed during on-site remedial activities.	These requirements apply to all site contractors and subcontractors, and must be followed during all site work.

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS FOR SOIL TREATMENT AND DISPOSAL TECHNOLOGIES

TECHNOLOGY	DESCRIPTION	CITATION	REQUIREMENTS	CONSIDERATIONS
Containment by Capping	Low-permeability cover is constructed over the site to provide a barrier to water infiltration and/or prevent direct contact and ingestion hazards associated with contaminated soil surfaces.	RCRA, 40 CFR 264.117(c)	Restrict post-closure use of property as necessary to prevent damage to the cover.	Because capping would not include placement of hazardous waste into another unit, this requirement is a potential applicable ARAR. Where "placement" occurs, the requirement is potentially relevant and appropriate.
		WNDR, Hazardous Waste Disposal Landfill Cap Standards; Chapter 660.15.	Specification for a final cover for hazardous waste landfills or surface impoundments which have operated without an operating license are established in this chapter.	These requirements are potential relevant and appropriate requirements for a capping system.
Excavation and Disposal in On-Site Landfill	Excavate and dispose soils which are not regulated by RCRA LDRs in a secure on-site landfill constructed for that purpose.	RCRA, Landfills; (Subpart N, 264.300-261.339)	This regulation details the design, operation, monitoring, inspection, recordkeeping, closure, and permit requirements for a RCRA landfill.	For on-site disposal, these regulations are relevant and appropriate in order ensure adequate long-term land-based management of hazardous materials. For containment oriented alternatives, the construction of caps using RCRA design and performance standards criteria may be warranted.

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS FOR SOIL TREATMENT AND DISPOSAL TECHNOLOGIES				
TECHNOLOGY	**DESCRIPTION**	**CITATION**	**REQUIREMENTS**	**CONSIDERATIONS**
		Wisconsin Hazardous Waste Landfill Standards: Landfill and Surface Impoundment Standards. (WDNR, Chapter NR 660)	This chapter establishes the requirements for initial site inspection and report, feasibility report, plan of operation, and minimum design requirements for landfills and surface impoundments.	This chapter applies to owners and operators of facilities that treat, store, or dispose of hazardous waste in landfills or surface impoundments.
		Also, see all requirements listed under "Excavation", and "All Hazardous Waste TSD Units".		
Excavation and Disposal in Off-Site Landfill	Excavate and haul soil not regulated by LDRs to a secure, existing landfill.	RCRA, Landfills; (Subpart N, 264.301)	This regulation details the design, operation, monitoring, inspection, recordkeeping, closure, and permit requirements for a RCRA landfill.	For off-site disposal, these regulations are applicable requirements for the owners or operators of a Subtitle C landfill
		Chapter NR 660; Wisconsin Hazardous Waste Landfill Standards: Landfill and Surface Impoundment Standards	This chapter establishes the requirements for initial site inspection and report, feasibility report, plan of operation, and minimum design requirements for landfills and surface impoundments.	This chapter applies to owners and operators of facilities that treat, store, or dispose of hazardous waste in landfills or surface impoundments.
		Also, see all regulations listed under "Excavation" and "Hazardous Waste Transportation".		
Excavation and Treatment by On-Site Incineration	Excavate and treat soil by a mobile incinerator which thermally destroys organics in a direct fired treatment unit.	RCRA, Incinerators; (Subpart O, 264.340-264.599)	This regulation specifies the performance standards, operating requirements and monitoring, inspection, and closure guidelines of any incinerator burning hazardous waste.	These substantive requirements established by this rule are potentially relevant and appropriate for on-site incineration of RCRA-regulated wastes.

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS FOR SOIL TREATMENT AND DISPOSAL TECHNOLOGIES

TECHNOLOGY	DESCRIPTION	CITATION	REQUIREMENTS	CONSIDERATIONS
		Chapter NR 665; Wisconsin Hazardous Waste Incinerator Standards	This chapter establishes requirements and standards for incinerators that burn hazardous wastes. Requirements for design of the incinerator are outlined in Section NR640.06.	The substantive requirements of this rule are potentially relevant and appropriate for on-site incineration of RCRA-regulated wastes.
		Also, see requirements listed under "Excavation" and "Air Emissions".		
Excavation and Treatment by Off-site Incineration	Excavate and treat soil by an incinerator which thermally destroys organics in a direct fired treatment unit.	RCRA, Incinerators; (Subpart O, 264.340-264.599)	This regulation specifies the performance standards, operating requirements and monitoring, inspection, and closure guidelines of any incinerator burning hazardous waste.	These requirements are potential applicable or relevant and appropriate requirements for off-site incineration of RCRA-regulated wastes.
		Chapter NR 665; Wisconsin Hazardous Waste Incinerator Standards	This chapter establishes requirements and standards for incinerators that burn hazardous wastes. Requirements for design of the incinerator are outlined in Section NR640.06.	The substantive requirements of this rule are potentially applicable or relevant and appropriate requirements for off-site incineration of RCRA-regulated wastes.
		See requirements listed under "Excavation", "Air Emissions", and "Hazardous Waste Transportation"		

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS FOR SOIL TREATMENT AND DISPOSAL TECHNOLOGIES				
TECHNOLOGY	**DESCRIPTION**	**CITATION**	**REQUIREMENTS**	**CONSIDERATIONS**
Excavation and Treatment by Solvent Extraction	Excavate and mix soils with a chemical solvent in a mobile batch mixer. Soil settles out and solvent and contaminant is decanted off. The contaminant is then separated from the solvent to produce an effluent stream of concentrated contaminant.	See requirements listed under "Excavation" and "Hazardous Waste Transportation"		
Excavation and Treatment by Stabilization/ Solidification	Soil is excavated and mixed with a settling agent to form a hard product in which contaminants are entrapped by the solidified mass.	See requirements listed under "Excavation" and "Hazardous Waste Transportation".		
Excavation and Treatment by Anaerobic Thermal Process	Soil is excavated and treated by a mobile unit which volatilizes/desorbs organic contaminants from the soil and condenses them into a liquid stream.	See requirements listed under "Excavation", "Hazardous Waste Transportation", and "Air Emissions".		

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS FOR SOIL TREATMENT AND DISPOSAL TECHNOLOGIES				
TECHNOLOGY	DESCRIPTION	CITATION	REQUIREMENTS	CONSIDERATIONS
Excavation and Treatment by Soil Washing	Excavate and mix soils with an aqueous-based washing solution in a series of high-energy mobile washing units. Organics and inorganics can be separated from soils with this system. Washing solution is recycled.	See requirements listed under "Excavation" and "Hazardous Waste Transportation".		
Excavation and Treatment by Soil Vitrification	Soils are excavated and heated to temperatures exceeding 2000° C. Organic and nitrate chemical components are destroyed, the remaining contaminants are immobilized into a geologically stable glass material, and the overall volume of the waste is reduced.	See requirements listed under "Excavation" and "Hazardous Waste Transportation".		

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS FOR SOIL TREATMENT AND DISPOSAL TECHNOLOGIES

TECHNOLOGY	DESCRIPTION	CITATION	REQUIREMENTS	CONSIDERATIONS
Excavation and Treatment by Biodegradation/ Composting	Soils contaminated by organics are excavated and treated with engineered (rather than naturally occurring) biological decomposition under controlled conditions.	See requirements listed under "Excavation" and "Hazardous Waste Transportation".		
Excavation and Treatment by Forced Aeration Through Soils	A soil pile in constructed on an elevated perforated base through which air is force into the pile.	RCRA, Waste Piles; (Subpart L, 264.250-264.269)	This regulation establishes procedures, operating requirements, and closure and post-closure for waste piles.	Should a remedial action involve the placement of hazardous wastes in waste piles, this regulation would be applicable. According to RCRA, waste piles used for treatment or storage of non-containerized accumulation of solid, non-flowing hazardous waste may comply with either the waste pile or landfill requirements. The temporary storage or treatment of hazardous waste on-site, therefore, should meet the requirements of one or the other subpart.
		Also, see all regulations listed under "Excavation", "Hazardous Waste Transportation", and "Air Emissions"		

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARS FOR SOIL TREATMENT AND DISPOSAL TECHNOLOGIES				
TECHNOLOGY	**DESCRIPTION**	**CITATION**	**REQUIREMENTS**	**CONSIDERATIONS**
In-Situ Vacuum Extraction	A vacuum is applied to wells at the site to extract vapor from voids in the subsurface soil. The vapor is collected and either treated or released to the atmosphere.	See requirements under "Air Emissions".		
In-Situ Stabilization/ Solidification	A settling agent is places with contaminated soil to form a monolithic product in which contaminants are entrapped by the solidified mass.	See requirements under "Air Emissions".		
In-Situ Bioventing	Air, nutrients, and moisture (as needed) are injected into a contaminated soil zone to enhance the indigenous microbe environment and increase the biodegradation rate of organic contaminants.	See requirements under "Air Emissions"		

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL ACTION-SPECIFIC ARARs FOR SOIL TREATMENT AND DISPOSAL TECHNOLOGIES

TECHNOLOGY	DESCRIPTION	CITATION	REQUIREMENTS	CONSIDERATIONS
In-Situ Biodegradation/ Composting	Soils contaminated by organics are treated in place with engineered (rather than naturally occurring) biological decomposition under controlled conditions.	See requirements under "Air Emissions".		
In-Situ Vitrification	Soils are heated in place to temperatures exceeding 2000°C. Organic and nitrate chemical components are destroyed, the remaining contaminants are immobilized into a geologically stable glass material, and the overall volume of the waste is reduced.	See requirements under "Air Emissions".		
In-Situ Forced Aeration through Soil Piles	Air is forced into an existing soil pile to enhance biodegradation of organic contaminants.	See requirements under "Air Emissions".		

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ACTION-SPECIFIC ARARS FOR WATER TREATMENT AND DISPOSAL TECHNOLOGIES				
TECHNOLOGY	**DESCRIPTION**	**CITATION**	**REQUIREMENTS**	**CONSIDERATIONS**
Containment with Slurry Wall	Emplacement of a low permeability barrier to restrict groundwater migration. Should include a cover system to reduce infiltration.	RCRA - Land Disposal Restriction (40 CFR Part 268)	See requirements under "Land Disposal Restrictions".	Excavation of soil for construction of slurry wall may trigger LDRs. Materials subject to LDRs must therefore be placed in another unit.
Collection of Water into Groundwater Extraction Wells	Installation of several strategically located pumping wells to collect contaminated groundwater for treatment.	WDNR, Wisconsin Well Construction Standards, (WAC, Chapter NR 112)	This rule establishes standards and approvals for well construction. Any withdrawal well or combination of wells withdrawing more than 70 gpm or more is subject to this rule.	Any remedial alternative considered during the FS which proposes pumping of groundwater at a rate of greater than or equal to 70 gpm will consider this rule as a possible ARAR.
Treatment with UV/ Oxidation	Oxidize organic contaminants in extracted groundwater through simultaneous application of UV light and ozone or hydrogen peroxide.	See requirements under "Air Emissions".		
Treatment with Air Stripping	Reduce concentration of volatile organics through intimate contact of extracted groundwater with air. Water descends a packed column while air forced up the column to promote mass transfer of organics from aqueous to gaseous phase.	See requirements under "Air Emissions".		

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ACTION-SPECIFIC ARARS FOR WATER TREATMENT AND DISPOSAL TECHNOLOGIES				
TECHNOLOGY	DESCRIPTION	CITATION	REQUIREMENTS	CONSIDERATIONS
Treatment with Carbon Adsorption	Reduce concentrations of aqueous or gaseous phase organics through adsorption onto granular activated carbon. May be used as a polishing strip for treatments such as air stripping to further reduce organic contaminant concentrations in groundwater or to capture organics in air stripper emissions. Process produces concentrated wastestream requiring further treatment.	See requirements under "Air Emissions".		
Treatment with Resin Adsorption	Contaminants are transferred from the dissolved state to the surface of the resin. Resin can be regenerated by removing the contaminants with solvent. Process produces a concentrated wastestream requiring further treatment.	No requirements identified.		
In Situ Biological Treatment	Introduce nutrients, oxygen, and methane into the groundwater using a matrix of extraction wells and recirculation techniques.	See requirements under "Air Emissions".		

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ACTION-SPECIFIC ARARS FOR WATER TREATMENT AND DISPOSAL TECHNOLOGIES

TECHNOLOGY	DESCRIPTION	CITATION	REQUIREMENTS	CONSIDERATIONS
Discharge into Off-Site Water Treatment Facility	Off-site disposal of extracted groundwater to a POTW. Groundwater would require transport by means of a force main and/or gravity feed sewer or by truck to the POTW.	CWA, National Pretreatment Standards; (40 CFR Part 403)	This regulation sets pretreatment standards for the introduction of pollutants from non-domestic sources into POTWs. These regulations are designed control pollutants which pass through, cause interference, or are otherwise incompatible with treatment processes at a POTW.	If treated groundwater is discharged to a POTW, the discharge must meet all discharge limitations imposed by the POTW.
		Also, see requirements listed under "Transportation".		
Discharge by Groundwater Reinjection	Groundwater is reinjected using a series of wells and pumps. Can be used to enhance plume removal and accelerate remediation.	SDWA - Underground Injection Control Regulations; (40 CFR Parts 144, 146, 147, 1000)	These regulations outline minimum program and performance standards for underground injection programs.	State regulations prohibit discharge of water by reinjection wells.
		WDNR, Wisconsin Well Construction Standards, (WAC, Chapter NR 112)	In addition to establishing standards and approvals for well construction, this regulation prohibits the use of injection wells of any sort.	Because the state requirement is an enforceable requirement and more stringent than the federal requirements, it takes precedence of the federal requirement for remedies using reinjection wells.

continued

TABLE 3-5
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ACTION-SPECIFIC ARARS FOR WATER TREATMENT AND DISPOSAL TECHNOLOGIES				
TECHNOLOGY	DESCRIPTION	CITATION	REQUIREMENTS	CONSIDERATIONS
Discharge to Surface Water	Discharge treated groundwater directly to nearby surface water body. Transport groundwater by means of force main.	Clean Water Act (CWA), National Pollutant Discharge Elimination System (NPDES); (40 CFR Part 122, 125)	This rule requires permits specifying the permissible concentration or level of contaminants in the effluent for the discharge of pollutants from any point source into waters of the U.S.	Both on- and off-site discharges to surface waters are required to meet the requirements of the NPDES, including discharge limitations, monitoring requirements, and best management practices.

Notes:

TSD = treatment, storage, or disposal
RCRA = Resource Conservation and Recovery Act
TSDF = Treatment, Storage, and Disposal Facility
DOT = Department of Transportation
EPA = U.S. Environmental Protection Agency
SWMU = Solid Waste Management Act
CAA = Clean Air Act
WDNR = Wisconsin Department of Natural Resources
NAAQS = National Ambient Air Quality Standards
LDRs = Land Disposal Restrictions

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TABLE 4-1
EXPOSURE PATHWAYS -
CURRENT AND FUTURE LAND USE

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL EXPOSED POPULATION	EXPOSURE, ROUTE, MEDIUM AND EXPOSURE POINT	PATHWAY SELECTED FOR EVALUATION?	REASON FOR SELECTION OR EXCLUSION
Grounds Maintenance Workers	Dermal contact with, incidental ingestion and inhalation of chemicals in surface soil	Yes (current and future scenario)	Potential exists for workers to be exposed to chemicals in surface soil.
Research Workers	Dermal contact with and incidental ingestion of chemicals in surface soil	No	On site infrequently and not expected to visit contaminated areas.
Hunters	Dermal contact with and incidental ingestion of chemicals in surface soil	No	Magnitude of exposure less than that of grounds maintenance worker.
	Ingestion of chemicals in deer meat	No	Tissue analysis of deer meat indicates that it is not contaminated.
Farmer	Dermal contact with, incidental ingestion, and inhalation of chemicals in surface soil	Yes (future scenario)	Although no contaminated areas are currently used for crop farming, the potential exists for some areas to be farmed in the future.
	Ingestion of chemicals in beef	No	No cattle are currently grazed on contaminated soil. Physical characteristics of contaminated areas make them unlikely future pastures.
Construction Worker	Dermal contact with, incidental ingestion of, and inhalation of chemicals in surface and subsurface soils	Yes (future scenario)	Potential exists for future land use to involve excavation for foundations or utilities.
Residents	Dermal contact with and incidental ingestion of chemicals in surface soil	Yes (future scenario)	Although it is not a realistic future use, residential scenario is selected to provide a conservative comparison to other scenarios.

TABLE 4-2
EQUATIONS USED TO ESTIMATE CHEMICAL INTAKE

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

INGESTION OF SOIL OR SEDIMENT

$$\textit{Intake (mg/kg-day)} = \frac{CS \times IR \times RAF \times CF \times FI \times EF \times ED}{BW \times AT}$$

where:

CS	=	chemical concentration in soil (mg/kg)
IR	=	ingestion rate (mg soil/day)
RAF	=	relative absorption factor (unitless)[1]
CF	=	conversion factor (10^{-6}kg/mg)
FI	=	fraction ingested from site
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time - period over which exposure is averaged (days)[2]

DERMAL CONTACT WITH SOIL OR SEDIMENT

$$\textit{Absorbed Dose (mg/kg-day)} = \frac{CS \times AF \times SA \times RAF \times CF \times EF \times ED}{BW \times AT}$$

where:

CS	=	chemical concentration in soil (mg/kg)
AF	=	soil to skin adherence factor (mg/cm^2)
SA	=	skin surface area exposed (cm^2/event)
RAF	=	relative absorption factor (unitless)[1]
CF	=	conversion factor (10^{-6} kg/mg)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time - period over which exposure is averaged (days)[2]

(continued)

TABLE 4-2
EQUATIONS USED TO ESTIMATE CHEMICAL INTAKE

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

INHALATION OF SUSPENDED PARTICULATES OR VOLATILES

$$Intake\ (mg/kg\text{-}day) = \frac{CA \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT}$$

where:

CA	=	chemical concentration in air (mg/m^3)
IhR	=	inhalation rate (m^3/hour)
RAF	=	relative absorption factor (unitless)[1]
ET	=	exposure time (hours/events)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time - period over which exposure is averaged (days)[2]

INGESTION OF SURFACE WATER

$$Intake\ (mg/kg\text{-}day) = \frac{CW \times RAF \times CR \times ET \times EF \times ED}{BW \times AT}$$

where:

CW	=	chemical concentration in water (mg/ℓ)
CR	=	contact rate (L/hour)
RAF	=	relative absorption factor (unitless)[1]
ET	=	exposure time (hours/event)
EF	=	exposure frequency (events/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time - period over which exposure is averaged (days)[2]

(continued)

TABLE 4-2
EQUATIONS USED TO ESTIMATE CHEMICAL INTAKE

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

DERMAL CONTACT WITH SURFACE WATER

$$\textit{Absorbed Dose (mg/kg-day)} = \frac{CW \times SA \times PC \times ET \times EF \times ED \times CF}{BW \times AT}$$

where:

CW	=	chemical concentration in water (mg/ℓ)
SA	=	skin surface area (cm^2/event)
PC	=	chemical specific dermal permeability constant $(cm/hr)^3$
ET	=	exposure time (hours/event)
EF	=	exposure frequency (events/year)
ED	=	exposure duration (years)
CF	=	conversion factor (1 liter/1000 cm^3)
BW	=	body weight (kg)
AT	=	averaging time - period over which exposure is averaged (days)[2]

Notes:

1 RAF - Ingestion and Inhalation: Assumed to be 100%.

RAF - Dermal: Little data exist regarding the fraction of chemicals in soil that cross the skin. In the absence of this data, the dermal pathway will not be evaluated.

2 AT: The averaging time is the pathway-specific period of exposure for noncarcinogenic effects (e.g., AT = ED x 365 days/year), and 70 year lifetime for carcinogenic effects (i.e., 70 years x 365 days/year).

3 PC: If chemical-specific PC value is not available, the permeability of water (1.5×10^{-3}) is used as a default value.

Source: USEPA, 1989b

TABLE 4-3
EXPOSURE PARAMETERS - OCCUPATIONAL/RECREATIONAL CONTACT WITH SOIL AND SEDIMENT

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

PARAMETER	MAINTENANCE WORKER	CONSTRUCTION WORKER	FARMER	OLDER CHILD (6-16)	UNITS	SOURCE
Soil Ingestion Rate (IR)	100	480	480	100	mg/day	USEPA, 1991b
Inhalation Rate (IhR)	2.5	2.5	1.7	NA	m^3/hr	USEPA, 1990
Soil Adherence Factor (AF)	1.0	1.0	1.0	1.0	mg/cm^2	USEPA, 1992a
Surface Area Exposed (SA)[1]	2,100	2,100	2,100	6,150	cm^2	USEPA, 1990
Fraction Ingested from Site (FI)	100%	100%	100%	100%		Assumption
Exposure Time (ET)	8	8	1	NA	hours/day	Assumption
Exposure Frequency (EF)[2]	24	20	24	24	days/year	USEPA, 1991b/ Assumption
Exposure Duration (ED)	25	20 days	30	11	years	USEPA, 1991b/ Assumption
Body Weight (BW)	70	70	70	40	kg	USEPA, 1989b
Averaging Time (AT)						
Cancer	70	70	70	70	years	USEPA, 1991b/ Assumption
Noncancer	25	20 days	30	11	years	

Notes:

1 2,100 cm^2 = 50th percentile value - hands and forearms
6,150 cm^2 = 50th percentile value - hands, feet, arms, and legs

2 24 days = 2 days/week for 12 weeks (summer season)
20 days = 5 workdays/week for 4 weeks

mg = milligram
hr = hour
cm^2 = square centimeter
kg = kilogram
m^3 = square meter
NA = not applicable

TABLE 4-4
EXPOSURE PARAMETERS -
FUTURE RESIDENTIAL SURFACE SOIL CONTACT

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

PARAMETER	CHILD 1-6	ADULT 7-30	UNITS	SOURCE
Soil Ingestion Rate (IR)	200	100	mg/day	USEPA, 1991b
Soil Adherence Factor (AF)	1.0	1.0	mg/cm^2	USEPA, 1992a
Surface Area Exposed (SA)[1]	3,720	2,100	cm^2	USEPA, 1990
Fraction Ingested from Site (FI)	100%	100%		Assumption
Exposure Frequency (EF)	350	350	days/year	USEPA, 1991b
Exposure Duration (ED)	6	24	years	USEPA, 1991b
Body Weight (BW)	15	70	kg	USEPA, 1989a/1991b
Averaging Time (AT)				
Cancer	70	70	years	USEPA, 1991b
Noncancer	6	24	years	USEPA, 1991b

Notes:

[1] Child: 50th percentile area - hands, feet, arms, and legs
Adult: 50th percentile area - hands and forearms

mg = milligram
cm^2 = square centimeter
kg = kilogram

TABLE 4-5
RECREATIONAL CONTACT WITH SURFACE WATER

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

PARAMETER	OLDER CHILD (6-16)	UNITS	SOURCE
Contact Rate (CR)	0.05	L/hour	USEPA, 1991b
Surface Area Exposed - Swimming (SA_s)[1]	13,000	cm^2	USEPA, 1990
Surface Area Exposed - Wading (SA_w)[2]	6,150	cm^2	USEPA, 1990
Exposure Time (ET)	2.6	hrs/day	USEPA, 1989b
Exposure Frequency (EF)[3]	24	days/year	USEPA, 1989b
Exposure Duration (ED)	11	years	Assumption
Body Weight (BW)	40	kg	USEPA, 1990
Averaging Time (AT)			
Cancer	70	years	USEPA, 1991b
Noncancer	11	years	Assumption

Notes:

[1] 50th percentile - whole body
[2] 50th percentile - hands, feet, arms, and legs
[3] 2 days/week for 12 weeks (summer season)

L = liter
cm^2 = square centimeter
kg = kilogram
hrs = hours

TABLE 4-6
ORAL DOSE-RESPONSE INFORMATION FOR NONCARCINOGENIC EFFECTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	CHRONIC ORAL RfD (mg/kg-day)	SUBCHRONIC ORAL RfD (mg/kg-day) **	STUDY TYPE	CONFIDENCE LEVEL	CRITICAL EFFECT	TEST ANIMAL	UNCERTAINTY FACTOR	SOURCE
111TCE	9E-02 W	9E-01	Oral		Hepatotoxicity	Guinea Pig	1,000	HEAST
13DNB	2E+00	4E+00	Gavage		Hyperactivity, decreased body weight	Rat	100	HEAST
24DNT	2E-03	ND ****	Feeding	High	Neurotoxicity, Heinz bodies and biliary tract hyperplasia	Dog	100 A	IRIS
26DNT	ND	ND						IRIS
2MNAP	ND *	ND *						
2NNDPA	Not Listed							
3NT	1E-02	1E-01	Gavage		Spleen Lesions	Rat	10,000	HEAST
ACET	1E-01	1E+00	Gavage	Low	Increased liver and kidney weights, nephrotoxicity	Rat	1,000 H,A,S	IRIS
AG	5E-03	5E-03	Therapeutic	Medium	Argyria	Human	2 L	IRIS
AL	ND	ND						HEAST
ANAPNE	6E-02	6E-01	Gavage	Low	Hepatotoxicity	Mouse	3,000 H,A,D	IRIS
ANAPYL	ND *	ND *						IRIS
AS	3E-04 P	3E-04	Oral-diet	Medium	Keratosis and hyperpigmentation	Human	3 H	IRIS
B2EHP	2E-02	2E-02	Oral-diet	Medium	Increased liver weight	Guinea Pig	1,000 H,A,S	IRIS
BA	7E-02	7E-02	Oral-DW	Medium	Increased blood pressure	Human	3 H	IRIS
BAANTR	ND *	ND *						IRIS
BBFANT	ND *	ND *						IRIS
BE	5E-03	5E-03	DW	Low	None observed	Rat	100 H,A	IRIS
BGHIPY	ND *	ND *						IRIS
BKFANT	ND *	ND *						IRIS
BR	Not Listed							
C6H6	P							IRIS
CCL3F	3E-01	7E-01	Gavage	Medium	Survival and histopathology	Rat	1,000 H,A,L	IRIS
CCL4	7E-04	7E-03	Gavage	Medium	Liver lesions	Rat	1,000 H,A,S	IRIS
CD (food)	1E-03	None	Oral-diet	High	Significant proteinuria	Human	10 H	IRIS
CD (water)	5E-04	None	Oral-DW	High	Significant proteinuria	Human	10 H	IRIS
CH2CL2	6E-02	6E-02	DW	Medium	Liver toxicity	Rat	100 H,A	IRIS
CHCL3	1E-02	1E-02	Oral-diet	Medium	Fatty cyst formation in liver	Dog	1,000 H,A,S	IRIS
CHRY	ND *	ND *						IRIS
CL	Not Listed							
CR III	1E+00	1E+00	Oral-diet	Low	No effects observed	Rat	100 H,A; MF=10	IRIS
CR VI	5E-03	2E-02	Oral-DW	Low	No effects reported	Rat	500 H,A,S	IRIS
CU	ND	ND						IRIS
DBAHA	ND *	ND*						IRIS
DBZFUR	Data inadequate for risk assessment							HEAST
DEP	8E-01	8E+00	Oral-diet	Low	Reduced terminal body weight	Rat	1,000 H,A,S	HEAST
DNBP	1E-01	1E+00	Oral-diet	Low	Increased mortality	Rat	1,000 H,A,S	IRIS
DNOP	2E-02 R	2E-02	Oral-diet		Elevated SGOT,SGPT,liver & kidney weight	Rat	1,000	HEAST
DPA	2.5E-02	2.5E-02	Oral-diet	Medium	Decreased body weight gain, increased liver & kidney weight	Dog	100 H,A	IRIS
DTCDD	1E-01	1E+00	Oral-diet	Low	Liver and kidney toxicity	Rat	1,000 H,A,S	IRIS

TABLE 4-6
ORAL DOSE-RESPONSE INFORMATION FOR NONCARCINOGENIC EFFECTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	CHRONIC ORAL RfD (mg/kg-day)	SUBCHRONIC ORAL RfD (mg/kg-day) **	STUDY TYPE	CONFIDENCE LEVEL	CRITICAL EFFECT	TEST ANIMAL	UNCERTAINTY FACTOR	SOURCE
FANT	4E-02	4E-01	Gavage	Medium	Increased liver weights, hematologic changes	Mouse	3,000 H,A,S	IRIS
FLRENE	4E-02	4E-01	Gavage	Low	Hematologic changes, decreased RBC	Mouse	3,000 H,A,S	IRIS
HG	3E-04 P	3E-04	Parenteral		Kidney effects	Rat	1,000	HEAST
ICDPYR	ND *	ND*						IRIS
MEC6H5	2E-01	2E+00	Gavage	Medium	Weight change in liver and kidneys	Rat	1,000 H,A,S	IRIS
MIBK	5E-02 W	5E-01	Gavage		Liver and kidney effects	Rat	1,000	HEAST
MN	1E-01	1E-01	Oral-diet	Medium	CNS effects	Human	1	IRIS
NAP	4E-02 P	4E-02	Gavage		Decreased body weight gain	Rat	10,000	HEAST
NC	Not Listed							
NG	Not Listed							IRIS
NH3	34 mg/L R	34 mg/L	DW		Taste threshold	Human	none	IRIS
NH3N2	Not Listed							
NI	2E-02	2E-02	Oral-diet	Medium	Decreased body and organ weights	Rat	100 H,A	IRIS
NIT (NO2)	1E-01	1E-01	Epidemiologic	High	Early clinical signs of methemoglobinemia	Human infant	1	IRIS
NIT (NO3)	1.6E+00	ND	Epidemiologic	High	Early clinical signs of methemoglobinemia	Human infant	1	IRIS
NNDMEA	ND	ND						IRIS
NNDNPA	ND	ND						IRIS
NNDPA	ND	ND						IRIS
PB	ND	ND						IRIS
PHANTR	ND *	ND *						HEAST
PYR	3E-02	3E-01	Gavage	Low	Kidney effects, renal tubular pathology	Mouse	3,000 H,A,S	IRIS
SE	5E-03	5E-03	Epidemiologic	Medium	Clinical selenosis	Human	3 H	IRIS
SN	6E-1	6E-1	Diet		Liver and kidney lesions	Rat	100	HEAST
SO4	Not Listed							
TCLEE	1E-02	1E-01	Gavage	Medium	Hepatotoxicity	Mouse	1,000 H,A,S	IRIS
TRCLE	P							IRIS
V	7E-03	7E-03	Oral-DW		None observed	Rat	100	HEAST
XYLEN	2E+00	4E+00	Gavage	Medium	Hyperactivity, decreased body weight	Rat	100 H,A	IRIS
ZN	2E-01	2E-01	Therapeutic		Anemia	Human	10	HEAST

ND - No data available
W - RfD withdrawn from IRIS
P - RfD pending in IRIS
N - No data in IRIS
NE - Not evaluated by IRIS
R - Under review by IRIS

*RfD for naphthalene is used as surrogate for PAHs without assigned RfD
**All subchronic values are obtained from HEAST 1992
**** - Chronic RfD used when no subchronic RfD is available

Uncertainty factor:H - variation in human sensitivity
A - animal to human extrapolation
S - extrapolation from subchronic to chronic NOAEL
L - extrapolation from LOAEL to NOAEL
N - NOEL not attained
D - Lack of supporting data
Additional uncertainty factors or modifying factors (MF) of 1 to 10 may be added to account for other uncertainties such as inadequacies in the database or the severity of the effect

SOURCES:
IRIS - Integrated Risk Information System files as of August 1992
HEAST - Health Effects Assessment Tables 1992

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TABLE 4-7
ORAL DOSE-RESPONSE INFORMATION FOR CARCINOGENIC EFFECTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Compound	Weight of Evidence	Oral Slope Factor [(mg/kg/day)(-1)]	Test Species	Study Type	Tumor Type	Source
111TCE	D					IRIS
13DMB	D					HEAST
24DNT	B2	6.8E-01 *	Rat	Diet	Liver, mammary gland	IRIS
26DNT	B2	6.8E-01 *	Rat	Diet	Liver, mammary gland	IRIS
2MNAP	NE					IRIS
2NNDPA	Not Listed					
3NT	Not Listed					
ACET	D					IRIS
AG	D					IRIS
AL	Not Listed					
ANAPNE	NE					IRIS
ANAPYL	D					IRIS
AS	A	1.8E+00 **	Human	DW	Skin tumors	IRIS
B2EHP	B2	1.4E-02	Mouse	Oral/Diet	Hepatocellular carcinoma	IRIS
BA	NE					IRIS
BAANTR	B2	ND ***				IRIS
BAPYR	B2	7.3E+00	Mouse	Diet	Forestomach	IRIS
BBFANT	B2	ND ***				IRIS
BE	B2	4.3E+00	Rat	DW	Total tumors	IRIS
BGHIPY	D					IRIS
BKFANT	B2	ND ***				IRIS
BR	Not Listed					
C6H6	A	2.9E-02	Human	Occup.	Leukemia	IRIS
CCL3F	NE					IRIS
CCL4	B2	1.3E-01	Several	Gavage	Liver	IRIS
CD	B1	NA				IRIS
CH2CL2	B2	7.5E-03	Mouse	DW	Hepatocellular	IRIS
CHCL3	B2	6.1E-03	Rat	DW	Kidney	IRIS
CHRY	B2	NA ***				IRIS
CL	Not Listed					
CR III	NE					IRIS
CR VI	A	NA				IRIS
CU	D					IRIS
DBAHA	B2	ND ***				IRIS
DBZFUR	D					IRIS
DEP	D					IRIS
DNBP	D					IRIS
DNOP	Not Listed					
DPA	ND					IRIS
ETC6H5	D					IRIS
FANT	D					IRIS

TABLE 4-7
ORAL DOSE-RESPONSE INFORMATION FOR CARCINOGENIC EFFECTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Compound	Weight of Evidence	Oral Slope Factor [(mg/kg/day)(-1)]	Test Species	Study Type	Tumor Type	Source
FLRENE	D					IRIS
HG	D					IRIS
ICDPYR	B2	ND ***				IRIS
MEC6H5	D					IRIS
MIBK	NE					IRIS
MN	D					IRIS
NAP	D					IRIS
NC	Not Listed					
NG	Not listed					
NH3	Not Listed					
NH3N2	Not Listed					
NI	NE					IRIS
NIT (NO2)	P					IRIS
NIT (NO3)	P					IRIS
NNDMEA	B2	5.1E+01	Rat	DW	Liver	IRIS
NNDNPA	B2	7.0E+00	Rat	DW	Liver	IRIS
NNDPA	B2	4.9E-03	Rat	Diet	Urinary bladder	IRIS
PB	B2	ND				IRIS
PHANTR	D					IRIS
PYR	D					IRIS
SE	D					IRIS
SN	Not Listed					
SO4	Not Listed					
TCLEE	B2	5.1E-02 W,X	Mouse	Gavage	Liver tumors	HEAST 1991
TRCLE	B2	1.1E-02 W,X	Mouse	Gavage	Liver	HEAST 1991
V	ND					IRIS
XYLEN	D					IRIS
ZN	D					IRIS

NA - Not Applicable
ND - Not Determined
NE - Not Evaluated by EPA
W - Withdrawn from IRIS
X - Withdrawn from HEAST 1992
P - IRIS input pending
R - Under review on IRIS
DW - Drinking water

*Based on IRIS for 2,4-/2,6-dinitrotoluene
**Based on unit risk of 5E-5 ug/L in drinking water
*** Slope factor for benzo(a)pyrene used as surrogate value

Weight of Evidence:
A - Human carcinogen
B - Probable human carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans)
C - Possible human carcinogen
D - Not classifiable as to human carcinogenicity
E - Evidence of lack of carcinogenicity to humans

SOURCES:
IRIS - Integrated Risk Information System files as of August 1992
HEAST - Health Effects Assessment Tables 1992 unless otherwise noted

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TABLE 4-8
INHALATION DOSE-RESPONSE INFORMATION FOR CARCINOGENIC EFFECTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Compound	Weight of Evidence	Inhalation Slope Factor* [(mg/kg/day)(-1)]	Test Species	Study Type	Tumor Type	Source
111TCE	D					IRIS
13DMB	D					HEAST
24DNT	B2	ND				IRIS
26DNT	B2	ND				IRIS
2MNAP	NE					IRIS
2NNDPA	Not Listed					
3NT	Not Listed					
ACET	D					IRIS
AG	D					IRIS
AL	Not Listed					
ANAPNE	NE					IRIS
ANAPYL	D					IRIS
AS	A	5.0E+01	Human	Inhalation	Respiratory tract	HEAST
B2EHP	B2	ND				IRIS
BA	NE					IRIS
BAANTR	B2	ND **				IRIS
BAPYR	B2	6.1E+00	Hamster	Inhalation	Respiratory Tract	HEAST
BBFANT	B2	ND **				IRIS
BE	B2	8.4E+00	Human	Occupational	Lung	HEAST
BGHIPY	D					IRIS
BR	Not Listed					
C6H6	A	2.9E-02	Human	Occupational	Leukemia	HEAST
CCL3F	NE					IRIS
CCL4	B2	5.3E-02	Several	Gavage	Liver	HEAST
CD	B1	6.1E+00	Human	Inhalation	Respiratory tract	HEAST
CH2CL2	B2	ND				IRIS
CHCL3	B2	8.1E-02	Mouse	Gavage	Liver carcinoma	HEAST
CHRY	B2	ND **				IRIS
CL	Not Listed					
CR III	NE					IRIS
CR VI	A	4.1E+01	Human	Occup.	Lung	HEAST
CU	D					IRIS
DBAHA	B2	ND **				IRIS
DBZFUR	D					IRIS
DEP	D					IRIS
DNBP	D					IRIS
DNOP	Not Listed					
DPA	ND					IRIS

TABLE 4-8
INHALATION DOSE-RESPONSE INFORMATION FOR CARCINOGENIC EFFECTS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Compound	Weight of Evidence	Inhalation Slope Factor* [(mg/kg/day)(-1)]	Test Species	Study Type	Tumor Type	Source
ETC6H5	D					IRIS
FANT	D					IRIS
FLRENE	D					IRIS
HG	D					IRIS
ICDPYR	B2	ND **				IRIS
MEC6H5	D					IRIS
MIBK	NE					IRIS
MN	D					IRIS
NAP	D					IRIS
NC	Not listed					
NG	Not listed					
NH3	Not Listed					
NH3N2	Not Listed					
NI	NE					IRIS
NIT (NO2)	P					IRIS
NIT (NO3)	P					IRIS
NNDMEA	B2	5.1E+01	Rat	Oral-DW	Liver	HEAST
NNDNPA	B2	ND				IRIS
NNDPA	B2	ND				IRIS
PB	B2	ND				IRIS
PHANTR	D					IRIS
PYR	D					IRIS
SE	D					IRIS
SN	Not Listed					
SO4	Not Listed					
TCLEE	B2	ND				HEAST 1991
TRCLE	B2	1.7E-02 WX	Mouse	Inhalation	Lung	HEAST 1991
V	NE					IRIS
XYLEN	D					IRIS
ZN	D					IRIS

NA - Not Applicable
ND - Not Determined
NE - Not Evaluated by EPA

W - Withdrawn from IRIS
X - Withdrawn from HEAST, 1992
DW - Drinking Water
** - Cancer slope factor for BAP used for carcinogenic PAHs without assigned slope factors

Sources:
IRIS - Integrated Risk Information System files as of August 1992
HEAST - Health Effects Assessment Tables 1992

Weight of Evidence:
A - Human carcinogen
B - Probable human carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans)
C - Possible human carcinogen
D - Not classifiable as to human carcinogenicity
E - Evidence of lack of carcinogenicity to humans

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TABLE 4-9

INHALATION DOSE-RESPONSE INFORMATION FOR NONCARCINOGENIC EFFECTS

REMEDIAL INVESTIGATION

BADGER ARMY AMMUNITION PLANT

COMPOUND	CHRONIC INHALATION RfC (mg/m³)	SUBCHRONIC INHALATION RfC (mg/m³)	STUDY TYPE	CONFIDENCE LEVEL	CRITICAL EFFECT	TEST ANIMAL	UNCERTAINTY FACTOR	SOURCE
111TCE	ND	ND						IRIS
13DMB	ND	ND						HEAST
24DNT	ND	ND						IRIS
26DNT	ND	ND						IRIS
2MNAP	ND	ND						IRIS
2NNDPA	Not Listed	Not Listed						
3NT	ND	ND						IRIS
ACET	ND	ND						IRIS
AG	ND	ND						IRIS
AL	Data inadequate for risk assessment							HEAST
ANAPNE	NE	NE						IRIS
ANAPYL	ND	ND						IRIS
AS	ND	ND						IRIS
B2EHP	ND	ND						IRIS
BA	ND	ND						IRIS
BAANTR	ND	ND						IRIS
BBFANT	ND	ND						IRIS
BE	ND	ND						IRIS
BGHIPY	ND	ND						IRIS
BR	Not Listed	Not Listed						
C6H6	ND	ND						IRIS
CCL3F	ND	ND						IRIS
CCL4	ND	ND						IRIS
CD	P	P						IRIS
CH2CL2	ND	ND						IRIS
CHCL3	ND	ND						IRIS
CHRY	ND	ND						IRIS
CL	Not Listed	Not Listed						
CR III	ND R	ND						IRIS
CR VI	ND R	ND						IRIS
CU	ND	ND						IRIS
DBAHA	ND	ND						IRIS
DBZFUR	ND	ND						IRIS
DEP	ND	ND						IRIS
DN8P	ND	ND						IRIS
DNOP	ND	ND						IRIS
DPA	ND	ND						IRIS
ETC6H5	ND	ND						IRIS
FANT	ND	ND						IRIS

TABLE 4-9

INHALATION DOSE-RESPONSE INFORMATION FOR NONCARCINOGENIC EFFECTS

REMEDIAL INVESTIGATION

BADGER ARMY AMMUNITION PLANT

COMPOUND	CHRONIC INHALATION RfC (mg/m³)	SUBCHRONIC INHALATION RfC (mg/m³)	STUDY TYPE	CONFIDENCE LEVEL	CRITICAL EFFECT	TEST ANIMAL	UNCERTAINTY FACTOR	SOURCE
FLRENE	ND	ND						IRIS
HG	3.00E-04 P	ND	Inhalation		Neurotoxicity	Human	30	HEAST
ICDPYR	ND	ND						
MEC6H5	4E-01 P	2E+00 P	Inhalation		CNS effects; eye and nose irritation	Human	300	HEAST
MIBK	ND	ND						IRIS
MN	ND	ND						IRIS
NAP	ND	ND						HEAST
NC	Not listed	Not listed						
NG	Not listed	Not listed						
NH3	ND	ND						IRIS
NH3N2	Not Listed	Not Listed						
NI	P	P						IRIS
NIT (NO2)	ND	ND						IRIS
NIT (NO3)	ND	ND						IRIS
NNDMEA	ND	ND						IRIS
NNDNPA	ND	ND						IRIS
NNDPA	ND	ND						IRIS
PB	ND	ND						IRIS
PHANTR	ND	ND						HEAST
PYR	ND	ND						IRIS
SE	ND	ND						IRIS
SN	ND	ND						HEAST
SO4	Not listed	Not listed						
TCLEE	ND	ND						IRIS
TRCLE	P	P						IRIS
V	ND	ND						HEAST
XYLEN	ND	ND						IRIS
ZN	ND	ND						IRIS

ND - No data available

W - RfD withdrawn from IRIS

P - RfD pending in IRIS

N - No data in IRIS

NE - Not evaluated by IRIS

R - Under review by IRIS

Sources

IRIS - Ingegrated Risk Information System files as of August 1992

HEAST - Health Effects Assessment Tables 1992

Uncertainty factors:

H - variation in human sensitivity

A - animal to human extrapolation

S - extrapolation from subchronic to chronic NOAEL

L - extrapolation from LOAEL to NOAEL

N - NOEL not attained

D - Lack of supporting data

Additional uncertainty factors or modifying factors (MF) of 1 to 10 may be added to account for other uncertainties such as inadequacies in the database or the severity of the effect

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TABLE 4-10
POTENTIAL SOURCES OF UNCERTAINTY FOR RISK ASSESSMENT

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL SOURCE OF UNCERTAINTY	DIRECTION OF EFFECT	JUSTIFICATION
Likelihood of exposure pathways.	Overestimate	Pathways may not actually occur (e.g., future resident)
Use of maximum concentration and lack of consideration of degradation of chemicals.	Overestimate	Risk estimates are based on recent chemical concentrations. Concentrations will tend to decrease with time as a result of degradation processes.
Exposure assumptions (frequency, duration, and intensity).	Overestimate	Parameters selected are conservative estimates of exposure.
Lack of dermal absorption data to quantify dermal pathway for exposure to soil.	Underestimate	Dermal risk would be added to risk from ingestion and inhalation routes.
Extrapolation of animal toxicity data to humans.	Unknown, probably overestimate	Animals and humans differ with respect to absorption, metabolism, distribution, and excretion of chemicals. The magnitude and direction of the difference will vary with each chemical. Animal studies typically involve high-dose exposures, whereas humans are exposed to low doses in the environment.
Use of linearized, multi-stage model to derive cancer slope factors.	Overestimate	Model assumes a non-threshold, linear at low dose relationship for carcinogens. Many compounds induce cancer by non-genotoxic mechanism. Model results in a 95% upper confidence limits of the cancer risk. The true risk is unlikely to be higher and may be as low as zero.
Summation of effects (cancer risks and hazard indices) from multiple substances.	Unknown	The assumption that effects are additive ignores potential synergistic and/or antagonistic effects. Assumes similarity in mechanism of action, which is not the case for many substances. Compounds may induce tumors or other toxic effects in different organs or systems.
Use of uncertainty factors in the derivation of reference doses.	Unknown	Ten-fold uncertainty factors are incorporated to account for various sources of uncertainty (animal-to-human extrapolation, protection of sensitive human populations, extrapolation from subchronic to chronic data, and use of LOAELs rather than NOAELs). Although some data seem to support the ten-fold factor, its selection is somewhat arbitrary.

TABLE 4-10
POTENTIAL SOURCES OF UNCERTAINTY FOR RISK ASSESSMENT

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

POTENTIAL SOURCE OF UNCERTAINTY	DIRECTION OF EFFECT	JUSTIFICATION
Lack of toxicity values for many compounds to quantify inhalation pathway for exposure to soil.	Underestimate	Risks from additional compounds would be added to currently quantified risks from inhalation exposure.

Notes:

LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level

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TABLE 5-1
PRIMARY ROUTES OF EXPOSURE FOR ECOLOGICAL RECEPTORS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

MEDIUM	ROUTE OF EXPOSURE	POPULATIONS EXPOSED
Surface Soil	Incidental ingestion of contaminated soil	Birds, mammals, and reptiles
	Dermal uptake	Amphibians and young, hairless mammals
Surface Water	Indirect exposures associated with the consumption of contaminated prey items	Seed-eating birds and mammals, and predatory and omnivorous mammals, birds, reptiles, and fish
	Ingestion of contaminated water	Birds, mammals, reptiles, amphibians, and fish
	Dermal contact with contaminated water	Fish, aquatic invertebrates, amphibians, and fish
Sediment	Indirect exposures associated with the consumption of contaminated prey items	Waterfowl, semi-aquatic mammals, reptiles, amphibians, and fish
	Ingestion of contaminated sediment	Fish, aquatic invertebrates
	Dermal contact with contaminated sediments	Fish, aquatic invertebrates
	Root uptake	Aquatic plants
Air	Indirect exposures associated with the consumption of contaminated prey items	Waterfowl, reptiles, amphibians, and semi-aquatic mammals
	Inhalation of volatile constituents and airborne particles	Birds, mammals, reptiles and amphibians

TABLE 5-2
SUMMARY OF EXPOSURE PATHWAYS EVALUATED IN THE AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

STUDY AREA	MEDIUM			
	SURFACE SOIL	SURFACE WATER	SEDIMENT	AIR
Propellant Burning Ground	X			*
Landfill 1	NA	NA	NA	*
Final Creek	X			*
Settling Pond I	X			*
Settling Pond II	X			*
Settling Pond III	X			*
Settling Pond IV	X			*
Spoils Disposal Area I	X			*
Spoils Disposal Area II	X			*
Spoils Disposal Area III	X			*
Spoils Disposal Area IV	X			*
Spoils Disposal Area V	X			*
Deterrent Burning Ground	X			*
Existing Landfill	X			*
Rocket Paste Area	X	X	X	*
Nitroglycerine Pond	X	X	X	*
New Acid Area	NA	NA	NA	*
Oleum Plant and Oleum Plant Pond	X	X	X	*
Ballistics Pond		X	X	*
Old Acid Area	X			*
Old Fuel Oil Tank	NA	NA	NA	*

Notes:

na = no analytical data
* = pathway not evaluated

TABLE 5-3
REFERENCE TOXICITY VALUES FOR AQUATIC RECEPTORS - SURFACE WATER[A]

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	RTV (µg/ℓ)
Surface Water	
AL	748
AS	153
BA	1,360
BE	5.3
CL	94,300
CR	9.74
CU	2.27
FE	1,000
PB	3.2
MN	100
HG	0.012
NI	66.13
NIT	5,000
SO4	1,060,000
V	200
ZN	49.59
NH3N2	2,100

Notes:

[A] Summarized from information presented in Appendix Q, Table Q-3.
µg/ℓ = micrograms per liter

TABLE 5-4
REFERENCE TOXICITY VALUES FOR AQUATIC RECEPTORS - SEDIMENT[A]

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	RTV (µg/ℓ)
Sediment	
AL	-[B]
NH3	75
CR	100
PB	50
HG	0.1
NIT	545
SO4	-
B2EHP	-
PHANTR	1,390
DEP	-
NG	-
NNDPA	-

Notes:

A Summarized from information presented in Appendix Q, Table Q-3.
B No RTVs available.

TABLE 5-5
SUMMARY OF REFERENCE TOXICITY VALUES(a) FOR TERRESTRIAL RECEPTORS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

CHEMICAL	INDICATOR SPECIES				
	Small Mammal	Small Bird	Herptile	Predatory Mammal	Predatory Bird
ACET	500	500	500	500	500
MEK	131	131	131	131	131
C6H6	10	10	10	10	10
CH2CL2	52.6	52.6	52.6	52.6	52.6
ANAPNE	350	350	350	350	350
ANAPYL	600	600	600	600	600
ANTRC	3300	3300	3300	3300	3300
B2EHP	19	19	19	19	19
BAANTR	2	2	2	2	2
BAPYR	0.002	0.002	0.002	0.002	0.002
BBFANT	40	40	40	40	40
BKFANT	72	72	72	72	72
CHRY	99	99	99	99	99
DBAHA	0.006	0.006	0.006	0.006	0.006
DNBP	600	600	600	600	600
DNOP	175	175	175	175	175
DEP	172	172	172	172	172
24DNT	40	40	40	1	40
DPA	31	31	31	25	31
NNDMEA	0.46	0.46	0.46	2.5	0.46
NNDPA	50	50	50	50	50
NNDNPA	5.1	5.1	5.1	5.1	5.1
FANT	40	40	40	40	40
FLRENE	250	250	250	250	250
ICDPYR	720	720	720	720	720
2MNAP	33	33	33	33	33
NAP	35.7	35.7	35.7	35.7	35.7
NC	9000	9000	9000	9000	9000
PHANTR	14	14	14	14	14
PYR	125	125	125	125	125
CCL3F	488	488	488	488	488
NG	31.5	31.5	31.5	3	31.5
AL	100	100	100	100	100
SB	0.35	0.35	0.35	0.35	0.35
AS	7.5	1	1	250	1
BA	1	1	1	1	1
BE	0.22	0.22	0.22	0.22	0.22
CD	0.32	7.6	7.6	0.32	7.6
CR	5.7	3.5	3.5	5.7	3.5
CU	1.21	0.2	0.2	1.21	0.2
PB	0.1	2.5	2.5	3	2.5
HG	0.12	0.007	0.007	0.1	0.007
NI	1.3	10.1	10.1	62.5	10.1
NO3	133	133	133	133	133
SE	0.004	0.06	0.06	0.004	0.06
AG	18.1	18.1	18.1	18.1	18.1
SO4	120	120	120	120	120
SN	0.1	3.5	3.5	0.1	3.5
ZN	160	160	160	160	160

(a) Ingestion toxicity data for chronic exposures by terrestrial organisms as summarized in Table N-3.

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TABLE 6-1
SUMMARY OF THE REMEDIAL INVESTIGATION FIELD PROGRAM -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITES	PROGRAM ELEMENTS			
	SOIL VAPOR SURVEY	REMOTE SENSING GEOPHYSICS	MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING*	SOIL BORINGS AND SOIL SAMPLING
Propellant Burning Ground	VOC-SST/MS, 135 collectors	--	25 new wells and 6 new piezometers; 116 samples from 25 new and 33 existing wells	9 borings, 112 analytical samples; 1 mud rotary boring, no analytical samples; 118 surface soil analytical samples
Landfill 1	--	GPR and TC	7 new wells; 14 samples from 7 new wells	2 soil borings, 10 analytical samples
Settling Ponds and Spoils Disposal Area	--	--	13 new wells; 58 samples from 13 new and 14 existing wells	1 soil boring, 6 analytical samples

Notes:

VOC-SST/MS = Volatile Organic Compounds - Surface Static Trapping/Mass Spectrometry
GPR = Ground Penetrating Radar
TC = Terrain Conductivity
* Includes 2 rounds of groundwater sampling

TABLE 6-2
SUMMARY OF BORINGS COMPLETED -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

BORING NUMBER	DEPTH OF SOIL BORING FROM GROUND SURFACE (ft)	TOTAL NUMBER OF SPLIT-SPOON SAMPLES	NUMBER OF SUBSURFACE SOIL SAMPLES FOR CHEMICAL ANALYSIS	PURPOSE
Propellant Burning Ground				
PBB-90-01[1]	102	10	10	Borings were drilled at the 1949 Pit area to provide chemical data to characterize the type and vertical distribution of contaminants in the unsaturated soils below the 1949 Pit.
PBB-90-02[1]	97	10	10	
PBB-91-01	107	21	12	Borings were drilled at the former refuse pits to provide chemical data to characterize the type and vertical distribution of contaminants in the unsaturated soils below the former refuse pits.
PBB-91-02	112	21	14	
PBB-91-03	101	22	14	
PBB-91-04	107	24	13	Borings were drilled at the location of the former waste pits to provide chemical data to characterize the type and vertical distribution of contaminants in the unsaturated soils below the former waste pits.
PBB-91-05	111	25	12	
PPB-91-06	111	21	14	
PPB-91-07	77	21	13	This boring was drilled at the Old Burn Area to provide chemical data to characterize the type and vertical distribution of contaminants in the unsaturated soils below the Old Burn Area.
PBB-89-10[2]	260	26	0	This boring was drilled in the Propellant Burning Ground adjacent to PBN-89-10 to obtain split-spoon samples at 10-foot intervals throughout the entire unconsolidated thickness.
Landfill 1				
LOB-90-01	142	10	9	These borings were drilled at Landfill 1 to determine the nature and depth of waste materials and to characterize the vertical distribution of any contaminants leached from this site.
LOB-90-02	22	5	1	

continued

TABLE 6-2
SUMMARY OF BORINGS COMPLETED -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

BORING NUMBER	DEPTH OF SOIL BORING FROM GROUND SURFACE (ft)	TOTAL NUMBER OF SPLIT-SPOON SAMPLES	NUMBER OF SUBSURFACE SOIL SAMPLES FOR CHEMICAL ANALYSIS	PURPOSE
Settling Ponds and Spoils Disposal Area				
SPB-91-01	67	10	6	This boring was drilled in the Settling Ponds and Spoils Disposal Area at Final Creek south of the wastewater treatment facility to assess whether use of the general purpose sewer and Final Creek to convey wastewater resulted in residual soil contamination in and below Final Creek.

Notes:

[1] These borings drilled in the area of the 1949 Pit using dual-wall driven casing.
[2] This boring is numbered out of sequence because it was drilled using mud rotary versus hollow-stem auger (HSA) drilling techniques and is adjacent to monitoring well cluster PBN-89-10.

ft = feet

TABLE 6-3
SUMMARY OF MONITORING WELLS AND PIEZOMETERS INSTALLED - PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE AND WELL IDENTIFIER	DRILLING METHOD	BORING DEPTH FROM GROUND SURFACE (ft.)	BOTTOM ELEVATION OF SCREENS (ft. MSL)	LENGTH OF WELL SCREEN (ft.)	LOCATION	PURPOSE
Propellant Burning Ground						
PBN-89-01 B -01 C -01 D	Dual-wall driven casing Dual-wall driven casing Dual-wall driven casing	195 210 240	711.33 676.06 635.05	5 5 5	Downgradient of Propellant Burning Ground	To provide horizontal and vertical definition to the plume.
PBN-89-02 B -02 C	Dual-wall driven casing Dual-wall driven casing	180 195	740.25 702.04	5 5	Downgradient of Propellant Burning Ground, east of PBN-85-01	To provide horizontal and vertical definition of the plume.
PBN-89-03 B -03 C	Dual-wall driven casing Dual-wall driven casing	128 160	722.80 684.87	5 5	Downgradient of Propellant Burning Ground, west of PBN-88-01	To provide horizontal and vertical definition of the plume.
PBN-89-04 B -04 C	Hollow-stem augers Dual-wall driven casing	150 190	713.23 671.70	5 5	Downgradient of Propellant Burning Ground, south of PBN-88-01	To provide horizontal and vertical definition of the plume.
PBM-89-05	Hollow-stem augers	95	757.58	20	Downgradient of Propellant Burning Ground	To provide horizontal and vertical definition of the plume.
PBM-89-06	Dual-wall driven casing	150	736.37	20	Downgradient of Propellant Burning Ground	To provide horizontal definition of the plume.
PBM-89-07	Hollow-stem augers	95	758.36	20	Downgradient of Propellant Burning Ground	To provide horizontal definition of the plume.
PBM-89-08	Hollow-stem augers	130	761.56	20	Downgradient of Propellant Burning Ground	To provide horizontal definition of the plume

continued

TABLE 6-3
SUMMARY OF MONITORING WELLS AND PIEZOMETERS INSTALLED - PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE AND WELL IDENTIFIER	DRILLING METHOD	BORING DEPTH FROM GROUND SURFACE (ft.)	BOTTOM ELEVATION OF SCREENS (ft. MSL)	LENGTH OF WELL SCREEN (ft.)	LOCATION	PURPOSE
PBM-89-09	Hollow-stem augers	125	760.48	20	Upgradient of Propellant Burning Ground	To provide horizontal definition of the plume near past unspecified activities.
PBN-89-10 A -10 B -10 C -10 D	Dual-wall driven casing Dual-wall driven casing Dual-wall driven casing Dual-wall driven casing	130 167 205 255	763.65 723.81 697.00 645.25	20 5 5 5	Downgradient of Decontamination Oven and Contaminated Waste Area	To provide horizontal and vertical definition of the plume throughout the unconsolidated thickness.
PBM-89-11	Hollow-stem augers	128	771.41	20	Upgradient of Propellant Burning Ground	To characterize water quality at the water table upgradient of the Propellant Burning Ground
PBN-89-12 A -12 B	Hollow-stem augers Dual-wall driven casing	106 140	753.66 714.04	20 5	Downgradient of Propellant Burning Ground	To provide horizontal and vertical definition of the plume.
PBN-91-06 C -06 D	Dual-wall driven casing Dual-wall driven casing	220 251	645.3 594.8	10 10	Downgradient of Propellant Burning Ground	To provide horizontal and vertical plume definition.
PBN-91-12 C -12 D	Dual-wall driven casing Dual-wall driven casing	200 231	668.8 620.2	10 10	Downgradient of Propellant Burning Ground	To provide horizontal and vertical plume definition.
PBP-91-01 B -01 C -01 D	Dual-wall driven casing Dual-wall driven casing Dual-wall driven casing	253 253 253	704.3 658.3 505.8	10 10 10	Downgradient of Propellant Burning Ground	To provide vertical gradient data downgradient from Propellant Burning Ground.
PBP-91-02 B -02 C -02 D	Dual-wall driven casing Dual-wall driven casing Dual-wall driven casing	254 254 254	707.3 657.3 595.8	10 10 10	Downgradient of Propellant Burning Ground	To provide vertical gradient data downgradient from Propellant Burning Ground.

continued

TABLE 6-3
SUMMARY OF MONITORING WELLS AND PIEZOMETERS INSTALLED - PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE AND WELL IDENTIFIER	DRILLING METHOD	BORING DEPTH FROM GROUND SURFACE (ft.)	BOTTOM ELEVATION OF SCREENS (ft. MSL)	LENGTH OF WELL SCREEN (ft.)	LOCATION	PURPOSE
Old Landfill						
LOM-89-01	Dual-wall driven casing	159	761.86	20	Upgradient of Landfill 1	To provide background water quality data upgradient of Landfill 1
LON-89-02 A -02 B	Dual-wall driven casing Dual-wall driven casing	160 200	764.59 721.13	20 5	Downgradient of Landfill 1	To provide horizontal and vertical plume definition.
LON-89-03 A -03 B	Dual-wall driven casing Dual-wall driven casing	160 200	767.14 731.99	20 5	Downgradient of Landfill 1	To provide horizontal and vertical plume definition.
LOM-91-01	Dual-wall driven casing	151	765.8	10	Upgradient of Landfill 1	To provide background water quality data upgradient of Landfill 1.
LOM-91-02	Dual-wall driven casing	148	763.9	10	Upgradient of Landfill 1	To provide background water quality data upgradient of Landfill 1.
Settling Ponds						
SPN-89-01 C	Dual-wall driven casing	135	710.04	5	Downgradient of Final Creek, prior to entrance to Settling Pond 1	In association with existing wells S1101 and S1113, provide horizontal and vertical definition of the plume downgradient of Final Creek.
SPN-89-02 A -02 B -02 C	Hollow-stem augers Hollow-stem augers Dual-wall driven casing	74 105 140	751.67 823.53 691.60	20 5 5	Downgradient of Final Creek, prior to entrance to Settling Pond 1	To provide horizontal and vertical definition of the plume downgradient.
SPN-89-03 B -03 C	Hollow-stem augers Dual-wall driven casing	100 150	723.09 689.25	5 5	Downgradient of Final Creek, prior to entrance to Settling Pond 1	In association with existing well S1147, provide horizontal and vertical definition of the plume downgradient of the Final Creek.

continued

TABLE 6-3
SUMMARY OF MONITORING WELLS AND PIEZOMETERS INSTALLED -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE AND WELL IDENTIFIER	DRILLING METHOD	BORING DEPTH FROM GROUND SURFACE (ft.)	BOTTOM ELEVATION OF SCREENS (ft. MSL)	LENGTH OF WELL SCREEN (ft.)	LOCATION	PURPOSE
SPN-89-04 B -04 C	Hollow-stem augers Hollow-stem augers	77 130	730.21 697.17	5 5	Downgradient of Final Creek and Settling Pond 1	In association with existing well S1148, provide horizontal and vertical definition of the plume downgradient of Final Creek.
SPN-89-05 A -05 B	Hollow-stem augers Dual-wall driven casing	60 89	754.25 716.02	20 5	Downgradient of Settling Ponds 2 and 3 and upgradient of Graf well	To provide horizontal and vertical definition of the plume downgradient of Settling Ponds 3 and 4 and upgradient of the Graf well.
SPN-91-02 D	Dual-wall driven casing	190	638.8	10	Downgradient of Final Creek and prior to entrance to Settling Pond 1	In association with existing nest SPN-89-02A,B,C, provide horizontal and vertical definition of the plume downgradient of Final Creek.
SPN-91-03 D	Dual-wall driven casing	202	616.2	10	Downgradient of Final Creek and prior to entrance to Settling Pond 1	In association with existing wells S1147, SPN-89-03B, C to provide horizontal and vertical definition of the plume downgradient of Final Creek.
SPN-91-04 D	Dual-wall driven casing	212	594.8	10	Downgradient of Final Creek and Settling Pond 1	In association with existing wells S1148, SPN-89-04B, C to provide horizontal and vertical definition of the plume downgradient of Final Creek.

TABLE 6-4
SUMMARY OF MONITORING WELLS LOGGED WITH BOREHOLE GEOPHYSICS -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE/WELL NO.	BORING DEPTH FROM TOP OF PVC RISER (feet)	APPROXIMATE DEPTH TO WATER FROM TOP OF PVC RISER (feet)	DATE LOGGED	DATE INSTALLED	DRILLING METHOD
1. PBN-89-12B	142	89	5/12/89	4/15/89	Dual-wall driven casing
2. PBN-89-04C	183	90	5/12/89	4/16/89	Dual-wall driven casing
3. PBN-89-03C	162	87	5/12/89	3/9/89	Dual-wall driven casing
4. PBN-89-01D	241	102	5/12/89	1/20/89	Dual-wall driven casing
5. PBN-89-02C	195	126	5/12/89	3/19/89	Dual-wall driven casing
6. PBN-89-10D	240	111	5/12/89	3/7/89	Dual-wall driven casing
7. PBN-89-11	114	107	5/13/89	3/7/89	Hollow-stem augers
8. PBN-82-03C	117	75	5/13/89	3/15/82	Mud rotary
9. PBN-82-05C	134	105	5/13/89	3/11/82	Mud rotary
10. PBN-82-01C	141	108	5/13/89	3/10/82	Mud rotary
11. PBN-89-09	124	107	5/13/89	3/1/89	Hollow-stem augers
12. LON-89-02B	201	147	5/13/89	2/18/89	Dual-wall driven casing
13. LOM-89-01	158	142	5/13/89	2/17/89	Dual-wall driven casing
14. SPN-89-01C	121	65	5/15/89	3/29/89	Dual-wall driven casing
15. SPN-89-02C	132	57	5/15/89	4/14/89	Dual-wall driven casing
16. SPN-89-03C	131	52	5/15/89	4/13/89	Dual-wall driven casing
17. SPN-89-04C	107	38	5/15/89	3/30/89	Hollow-stem augers
18. SPN-89-05B	89	40	5/15/89	3/30/89	Dual-wall driven casing

Notes:

PVC = polyvinyl chloride

TABLE 6-5
AQUIFER PUMPING TEST - SUMMARY OF DRAWDOWN AND RECOVERY ANALYSES
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL/ PIEZOMETER	BOULTON DELAYED YIELD DRAWDOWN ANALYSES (1)			JACOB DRAWDOWN ANALYSES (2)			RESIDUAL DRAWDOWN ANALYSES	
	TRANSMISSIVITY (GPD/FT)	HYDRAULIC CONDUCTIVITY (CM/SEC)	STORATIVITY	TRANSMISSIVITY (GPD/FT)	HYDRAULIC CONDUCTIVITY (CM/SEC)	STORATIVITY	TRANSMISSIVITY (GPD/FT)	HYDRAULIC CONDUCTIVITY (CM/SEC)
PBP-91-01B	-	-	-	223,000	6.03E-02	0.07	239,000	6.46E-02
PBP-91-01C	214,000	5.78E-02	0.16	285,000	7.70E-02	0.08	236,000	6.38E-02
PBP-91-01D	235,000	6.35E-02	0.17	311,490	8.42E-02	0.11	257,000	6.95E-02
PBP-91-02B	261,000	7.05E-02	0.04	-	-	-	252,000	6.81E-02
PBP-91-02C	224,000	6.05E-02	0.07	-	-	-	258,000	6.97E-02
PBP-91-02D	314,000	8.49E-02	0.06	-	-	-	313,000	8.46E-02
PBN-91-06C	205,000	5.54E-02	0.14	-	-	-	240,000	6.49E-02
PBN-91-06D	196,000	5.30E-02	0.13	-	-	-	249,000	6.73E-02
Average:	233,000	6.29×10^{-2}	0.11	273,000	7.38E-02	0.09	255,500	6.91E-02

(1) Boulton Delayed Yield Method not applicable for PBP-91-01B data.

(2) Jacob Drawdown Analyses not applicable for the more distant wells PBP-91-02 and PBN-91-06.

TABLE 6-6
WELLS INCLUDED IN GROUNDWATER SAMPLING PROGRAM -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITES	NEW WELLS	EXISTING WELLS
Propellant Burning Ground	PBN-89-01B,C,D PBN-89-02B,C PBN-89-03B,C PBN-89-04B,C PBM-89-05 PBM-89-06 PBM-89-07 PBM-89-08 PBM-89-09 PBM-89-10A,B,C,D PBM-89-11 PBN-89-12A,B PBN-91-06C,D PBN-91-12C,D	PBN-82-01A,B,C PBN-82-02A,B,C PBN-82-03A,B,C PBN-82-04A,B,C PBM-82-05A,B,C PBM-82-01 PBM-82-02 PBM-82-03 PBM-82-04 PBM-82-05 S1109 S1117 S1146 PBM-85-01 PBM-85-02 PBM-85-03 PBM-85-04 PBM-85-05 PBM-85-06 PBN-85-01A PBN-85-02A PBN-85-03A PBN-85-04A
Subtotal	25	33
Landfill 1	LOM-89-01 LON-89-02A,B LON-89-03A,B LOM-91-01 LOM-91-02	
Subtotal	7	0
Settling Ponds and Spoils Disposal Area	SPN-89-01C SPN-89-02A,B,C SPN-89-03B,C SPN-89-04B,C SPN-89-05A,B SPN-91-02D SPN-91-03D SPN-91-04D	S1101 S1102 S1103 S1104 S1105 S1106 S1107 S1108 S1133 S1147 S1148 S1149 S1152A,B

continued

TABLE 6-6
WELLS INCLUDED IN GROUNDWATER SAMPLING PROGRAM -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITES	NEW WELLS	EXISTING WELLS
Subtotal	13	14
TOTAL WELLS	45	47

Notes:

A,B,C,D - Shallowest to deepest: A indicates shallowest well; D indicates deepest well in a well nest.

TABLE 6-7
CHEMICAL ANALYSES PERFORMED ON SURFACE SOIL AND SEDIMENT SAMPLES –
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS														OTHER			ORGANICS				
	TOTAL METALS								TCLP METALS				ANIONS									
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	CD	CR	HG	PB	NIT	SO4	NH3N2	TOC	pH	VOC	SNVA	NG	NAM	DNT
PROPELLANT BURNING GROUND																						
Burning Pads																						
PBS-91-01	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-02	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-03	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-04	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-05	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-06	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-07	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-08	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-09	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-10	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	1	—	—	1
PBS-91-11	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-12	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-13	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-14	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-15	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-16	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-17	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-18	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-19	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-20	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	1
PBS-91-21	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-22	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-23	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-24	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-25	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-26	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-27	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-28	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-29	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-30	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	1
PBS-91-31	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-32	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-33	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-34	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-35	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-36	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-37	1	—	—	—	—	—	—	—	—	—		—	—	—	—	—	—	1	—	—	—	1

TABLE 6-7
CHEMICAL ANALYSES PERFORMED ON SURFACE SOIL AND SEDIMENT SAMPLES –
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS														OTHER			ORGANICS				
	TOTAL METALS								TCLP METALS				ANIONS									
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	CD	CR	HG	PB	NIT	SO4	NH3N2	TOC	pH	VOC	BN/A	NG	NAM	DNT
PBS-01-38	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-39	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-01-40	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	1
PBS-01-49	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
Contam.Waste Area																						
PBS-01-41	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-42	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-43	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-01-44	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-01-45	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-01-46	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-47	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-48	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	1	—	—	1
Race Track/Burning Plates																						
PBS-01-50	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-51	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-52	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-01-53	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-54	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-55	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	1	—	—	1
PBS-01-56	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-57	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-58	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-01-59	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-60	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-61	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-01-62	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-63	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-64	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-65	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	1	—	—	1
PBS-01-66	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-01-67	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-68	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-69	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-01-70	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-71	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-01-72	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1

TABLE 6-7
CHEMICAL ANALYSES PERFORMED ON SURFACE SOIL AND SEDIMENT SAMPLES –
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS														OTHER			ORGANICS				
	TOTAL METALS								TCLP METALS				ANIONS									
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	CD	CR	HG	PB	NIT	SO4	NH3N2	TOC	pH	VOC	BN/A	NG	NAM	DNT
PBS-91-73	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-74	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-75	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	1	—	—	1
PBS-91-76	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-77	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-78	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-79	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-80	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-81	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-82	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-83	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-84	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-85	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	1	—	—	1
PBS-91-86	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-87	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-88	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-89	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-90	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-91	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-92	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-93	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-94	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-95	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	1	—	—	1
PBS-91-96	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-97	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-98	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-99	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-100	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-101	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-102	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-103	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-104	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-105	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	1	—	—	1
PBS-91-106	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-107	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-108	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-109	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-110	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-111	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	1

TABLE 6-7
CHEMICAL ANALYSES PERFORMED ON SURFACE SOIL AND SEDIMENT SAMPLES –
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS														OTHER			ORGANICS				
	TOTAL METALS								TCLP METALS				ANIONS									
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	CD	CR	HG	PB	NIT	SO4	NH3N2	TOC	pH	VOC	BN/A	NG	NAM	DNT
PBS-91-112	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-113	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-114	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBS-91-115	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	—	—	—	1
PBS-91-116	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	1	—	—	1
PBS-91-117	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	1	—	—	1
PBS-91-118	1	—	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—	1	1	—	—	1
TOTALS	118	0	0	0	0	0	0	0	45	45	45	45	0	0	0	0	0	118	15	0	0	118

NOTES:
PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, PB, HG, NI, SB, SE, TL, ZN)
TAL = Toxic Analyte List (23) (AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)
VOC = volatile organic compounds by GC/MS
GC/MS = Gas Chromatography/Mass Spectrometry
BN/A = base-neutral and acid-extractable organics by GC/MS
NAM = nitrosamines by GC
DNT = 2,4- and 2,6-dinitrotoluene by HPLC
HPLC = High Performance Liquid Chromatrography

TABLE 6-8
CHEMICAL ANALYSES PERFORMED ON SUBSURFACE SOIL SAMPLES -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS																OTHER			ORGANICS				
	METALS									TCLP METALS					ANIONS									
SAMPLE LOCATION	PP	TAL	CD	CR	CU	HG	FE	NI	PB	ZN	CD	CR	HG	PB	NIT	SO4	TOC	pH	TPHC	VOC	BN/A	NG	NAM	DNT
PROPELLANT BURNING GROUND																								
PBB-91-01	12	—	—	—	—	—	—	—	—	—	2	2	2	2	12	12	—	—	—	12	1	—	1	12
PBB-91-02	14	—	—	—	—	—	—	—	—	—	2	2	2	2	14	14	—	—	—	14	1	—	1	14
PBB-91-03	14	—	—	—	—	—	—	—	—	—	2	2	2	2	14	14	—	—	—	14	2	—	1	14
PBB-91-04	13	—	—	—	—	—	—	—	—	—	4	4	4	4	13	13	—	—	—	15	1	—	1	13
PBB-91-05	12	—	—	—	—	—	—	—	—	—	2	2	2	2	12	12	—	—	—	13	2	—	1	12
PBB-91-06	14	—	—	—	—	—	—	—	—	—	8	8	8	8	14	14	—	—	—	15	2	—	2	14
PBB-91-07	13	—	—	—	—	—	—	—	—	—	7	7	7	7	13	13	—	—	—	13	1	—	1	13
PBB-90-01(1)	—	1	—	—	9	—	—	—	9	9	—	—	—	—	—	—	—	—	—	10	1	—	—	9
PBB-90-02(1)	—	1	—	—	9	—	—	—	9	9	—	—	—	—	—	—	—	—	—	10	—	—	—	9
PBT-90-01(2)	—	—	—	—	2	—	—	—	2	2	—	—	—	—	—	—	—	—	—	2	—	—	—	2
PBT-90-02(2)	—	—	—	—	1	—	—	—	1	1	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBT-90-03(2)	—	—	—	—	3	—	—	—	3	3	—	—	—	—	—	—	—	—	—	3	—	—	—	3
PBT-90-04(2)	—	—	—	—	1	—	—	—	1	1	—	—	—	—	—	—	—	—	—	1	—	—	—	1
PBT-90-05(2)	—	—	—	—	2	—	—	—	2	2	—	—	—	—	—	—	—	—	—	2	—	—	—	2
PBT-90-06(2)	—	—	—	—	2	—	—	—	2	2	—	—	—	—	—	—	—	—	—	2	—	—	—	2
PBT-90-07(2)	—	—	—	—	2	—	—	—	2	2	—	—	—	—	—	—	—	—	—	2	—	—	—	2
PBT-90-08(2)	—	—	—	—	3	—	—	—	3	3	—	—	—	—	—	—	—	—	—	3	—	—	—	3
LANDFILL 1																								
LOB-90-01(1)	—	1	—	—	8	—	—	—	8	8	—	—	—	—	—	—	—	—	—	9	1	—	—	8
LOB-90-02(2)	—	—	—	—	1	—	—	—	1	1	—	—	—	—	—	—	—	—	—	1	—	—	—	1
FINAL CREEK																								
SPB-91-01	—	6	—	—	—	—	—	—	—	—	—	—	—	—	6	6	—	6	—	6	6	—	6	6
TOTALS	92	9	0	0	43	0	0	0	43	43	27	27	27	27	96	96	0	6	0	148	18	0	14	141

NOTES:

BN/A = base-neutral and acid-extractable organics by GC/MS
DNT = 2,4- and 2,6-dinitrotoluene by HPLC
GC/MS = Gas Chromatography/Mass Spectrometry
HPLC = High Performance Liquid Chromatrography
NAM = nitrosamines by GC
PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, PB, HG, NI, SB, SE, TL, ZN)
TAL = Toxic Analyte List (23) (AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)
VOC = volatile organic compounds by GC/MS
(1) Only one sample was analyzed for a full suite of VOCs; the remaining samples were analyzed for CCL4, TCLEE, and TRCLE only
(2) Analyzed for CCL4, TCLEE, and TRCLE only

TABLE 6-9
CHEMICAL ANALYSES PERFORMED ON GROUNDWATER SAMPLES -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS																	ORGANICS					TPH
	METALS									ANIONS			OTHER										
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	NI	NIT	CL	SO4	HARD	ALK	TDS	TOC	NH3N2	VOC	BN/A	NG	NAM	DNT	
PROPELLANT BURNING GROUND																							
PBM-82-01	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBM-82-02	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBM-82-03	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBM-82-04	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBM-82-05	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBM-85-01	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBM-85-02	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBM-85-03	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBM-85-04	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBM-85-05	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBM-85-06	—	—	—	—	—	—	—	—	—	1	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-82-01 A	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-82-01 B	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-82-01 C	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-82-02 A	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-82-02 B	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-82-02 C	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-82-03 A	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-82-03 B	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-82-03 C	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-82-04 A	—	—	—	—	—	—	—	—	—	1	1	1	—	1	1	—	—	B	—	—	2	B	—
PBN-82-04 B	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-82-04 C	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-82-05 A	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-82-05 B	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-82-05 C	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-85-01 A	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-85-02 A	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-85-03 A	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-85-04 A	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-89-01 B	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-89-01 C	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-89-01 D	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-89-02 B	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-89-02 C	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-89-03 B	—	—	—	—	—	—	—	—	—	B	B	B	B	P	B	—	—	B	—	—	B	B	—

TABLE 6-9
CHEMICAL ANALYSES PERFORMED ON GROUNDWATER SAMPLES –
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS																	ORGANICS					TPH
	METALS									ANIONS			OTHER										
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	NI	NIT	CL	SO4	HARD	ALK	TDS	TOC	NH3N2	VOC	BN/A	NG	NAM	DNT	
PBN-89-03 C	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-89-04 B	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-89-04 C	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBM-89-05	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBM-89-06	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBM-89-07	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBM-89-08	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBM-89-09	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-89-10 A	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-89-10 B	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-89-10 C	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-89-10 D	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-89-11	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-89-12 A	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-89-12 B	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	—	—	B	B	—
PBN-91-06 C	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-91-06 D	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-91-12 C	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
PBN-91-12 D	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
LOM-89-01	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
LON-89-02 A	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
LON-89-02 B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
LON-89-03 A	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
LON-89-03 B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
LOM-91-01	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
LOM-91-02	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
S1109	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
S1117	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
S1145	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
S1146*	—	—	—	—	—	—	—	—	—	2	2	2	2	2	2	—	—	B	B	—	B	B	—
SETTLING PONDS AND SPOILS DISPOSAL AREA																							
SPN-89-01 C	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
SPN-89-02 A	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
SPN-89-02 B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
SPN-89-02 C	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
SPN-89-03 B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
SPN-89-03 C	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—

TABLE 6-9
CHEMICAL ANALYSES PERFORMED ON GROUNDWATER SAMPLES -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS																	ORGANICS					TPH
	METALS									ANIONS			OTHER										
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	NI	NIT	CL	SO4	HARD	ALK	TDS	TOC	NH3N2	VOC	BN/A	NG	NAM	DNT	
SPN-89-04 B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
SPN-89-04 C	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
SPN-89-05 A	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
SPN-89-05 B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
SPN-91-02 D	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
SPN-91-03 D	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
SPN-91-04 D	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
S1101 *	—	—	—	—	—	—	—	—	—	1	1	1	—	—	—	—	—	B	—	—	—	1	—
S1102	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
S1103	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
S1104	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
S1105	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
S1106	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
S1107	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
S1108	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
S1133	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
S1147	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
S1148	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
S1149	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
S1152A	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
S1152B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
TOTALS	0	68	0	0	46	46	46	46	0	182	183	183	181	182	182	0	0	186	124	52	181	183	0

NOTES:

BN/A = base-neutral and acid-extractable organics by GC/MS

DNT = 2,4- and 2,6-dinitrotoluene by HPLC

GC/MS = Gas Chromatography/Mass Spectrometry
HPLC = High Performance Liquid Chromatrography

NAM = nitrosamines by GC

PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, PB, HG, NI, SB, SE, TL, ZN)

TAL = Toxic Analyte List (23) (AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)

VOC = volatile organic compounds by GC/MS

* = Well did not contain adequate water for sampling.

B = Analyzed in both Rounds (One and Two).

1 = Analyzed in Round One only.

2 = Analyzed in Round Two only.

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TABLE 6-10
VERTICAL GROUNDWATER GRADIENTS -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS
AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL NEST	WATER LEVEL DIFFERENCE (FT.)/SCREEN SEPARATION (FT.)	VERTICAL GRADIENT (FT/FT)	COMMENT[1] (WATER LEVEL DIFFERENCE)
PBN-82-01A and B	0.02/19	0.0011u[3]	Insignificant[2]
PBN-82-01B and C	0.02/9	0.001u[4]	Insignificant
PBN-82-02A and B	0.12/17	0.007u	
PBN-82-02B and C	0.06/9	0.007d	
PBN-82-03A and B	0.01/16	0.0006u	Insignificant
PBN-82-03B and C	0.01/9	0.001d	Insignificant
PBN-82-04A and B	0.08/16	0.005u	Small
PBN-82-04B and C	0.0/10	0.0	None
PBN-82-05A and B[5]	0.09/15	0.006d	
PBN-82-05B and C	0.05/10	0.005u	Small
PBN-85-01A and PBN-89-01B	0.29/48	0.006d	
PBN-89-01B and C	0.11/32	0.0034u	
PBN-89-01C and D	0.01/43	0.0002u	Insignificant
PBN-85-02A and PBN-89-02B	1.31/28	0.047d	Substantial
PBN-89-02B and C	0.27/33	0.008u	
PBN-85-03A and PBN-89-03B	0.67/36	0.019d	
PBN-89-03B and C	0.68/35	0.019u	
PBN-85-04A and PBN-89-04B	0.34/37	0.009d	
PBN-89-04B and C	0.53/37	0.01u	
PBN-89-10A and B	0.06/46	0.001d	Small
PBN-89-10B and C	0.34/29	0.01u	
PBN-89-10C and D	0.26/48	0.005d	
PBN-89-12A and B	0.10/44	0.002d	Small
PBN-89-12B and PBN-91-12C	0.06/45	0.001	Small
PBN-91-12C and PBN-91-12D	0.05/45	0.001	Insignificant

:ontinued

TABLE 6-10
VERTICAL GROUNDWATER GRADIENTS -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS
AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL NEST	WATER LEVEL DIFFERENCE (FT.)/SCREEN SEPARATION (FT.)	VERTICAL GRADIENT (FT/FT)	COMMENT[1] (WATER LEVEL DIFFERENCE)
PBM-85-06 and PBN-91-06C	0.09/111	0.0008	Small
PBN-91-06C and PBN-91-06D	0.02/53	0.0004	Insignificant
S1101 and S1133	0.04/37	0.001u	Insignificant
S1133 and SPN-89-01C	0.05/24	0.002d	Small
SPN-89-02A and B	0.0/36	0.0	None
SPN-89-02B and C	0.01/30	0.0003d	Insignificant
SPN-89-02C and SPN-91-02D	0.0/53	0.0	None
S1147 and SPN-89-03B	0.10/33	0.003d	Small
SPN-89-03B and C	0.02/34	0.0006u	Insignificant
SPN-89-03C and SPN-91-03D	0.12/63	0.0019	
S1148 and SPN-89-04B	0.07/30	0.002d	Small
SPN-89-04B and C	0.04/32	0.001u	Insignificant
SPN-89-04C and SPN-91-04D	0.02/100	0.0002d	Insignificant
S1152A and B	0.0/22	0.0	None
S1152B and S1103	0.24/51	0.005u	

continued

TABLE 6-10
VERTICAL GROUNDWATER GRADIENTS -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS
AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL NEST	WATER LEVEL DIFFERENCE (FT.)/SCREEN SEPARATION (FT.)	VERTICAL GRADIENT (FT/FT)	COMMENT[1] (WATER LEVEL DIFFERENCE)
S1104 and S1105	0.02/23	0.0009u	Insignificant
S1105 and S1106	0.06/26	0.0023d	Small
SPN-89-05A and B	0.09/43	0.002d	Small

Notes:

1 Water levels measured on December 15, 1991.

2 Insignificant gradient was concluded if the water level difference was less than the probable measurement accuracy considering the variance expec: from two measurements.

3 u = upward gradient

4 d = downward gradient

5 April 7, 1992 water levels

ft/ft = feet per foot

TABLE 6-11
HORIZONTAL GROUNDWATER GRADIENTS -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS
AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL NEST	HORIZONTAL GRADIENT (FT/FT)[1]	COMMENT
PBM-89-11 LON-89-03A	0.0014	Northern Propellant Burning Ground; southeasterly flow vector
PBM-82-01 PBN-82-04A	0.0015	At Propellant Burning Ground; southeasterly flow vector
PBN-82-03A PBM-89-07	0.0013	South of Propellant Burning Ground; southerly flow vector
PBM-85-06 S1148	0.0014	Propellant Burning Ground and Settling Ponds and Spoils Disposal Area; southerly flow vector
PBN-89-10B PBN-89-01B	0.0014	Propellant Burning Ground; deep gravel/cobble zone; southerly flow vector
PBN-89-01B PBN-89-04B	0.0012	Propellant Burning Ground; deep gravel/cobble zone; southerly flow vector
PBN-89-04B PBN-89-12B	0.0015	Propellant Burning Ground; deep gravel/cobble zone; southerly flow vector

Notes:

[1] Water levels measured on December 15, 1991.

ft/ft = feet per foot

TABLE 6-12
FIELD HYDRAULIC CONDUCTIVITY TEST RESULTS -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL DESIGNATION	MAXIMUM WATER LEVEL DEPRESSION (FEET)	HYDRAULIC CONDUCTIVITY (CM/SEC)	GEOLOGIC CONDITIONS
PBM-89-11	1.5	$4x10^{-2}$	Fine to medium sand (SP)
PBN-82-03B	3.4	$1x10^{-3}$	Medium-fine sand (SP-SM)
PBN-82-03C	9.0	$7x10^{-4}$	Medium-fine sand (SP-SM)
PBN-89-01B	3.7	$3x10^{-2}$	Gravel with sand and cobbles (GP)
PBN-89-01C	10.9	$3x10^{-2}$	Fine to medium sand (SP-SW)
PBN-89-01D	4.3	$5x10^{-2}$	Medium-fine sand with trace gravel (SW)
PBN-89-02B	11.0	$1x10^{-2}$	Fine to medium sand (SP)
PBN-89-02C	12.1	$2x10^{-2}$	Fine to medium sand (SP)
PBN-89-03B	8.7	$1x10^{-2}$	Sand with trace gravel (SP)
PBN-89-03C	8.7	$4x10^{-2}$	Sand with trace gravel (SP)
PBN-89-04C	5.8	$2x10^{-2}$	Fine sand (SP-SW)
PBN-89-10B	1.5	$2x10^{-1}$	Gravel with sand (GW-SP)
PBN-89-10C	8.5	$2x10^{-2}$	Medium-fine sand, little gravel (SP-SW)
PBN-89-10D	10.7	$5x10^{-2}$	Fine to coarse sand with gravel and cobbles (SP-GP)
PBN-91-06C	7.3	$1.6x10^{-2}$	Medium to coarse sand, some gravel (SW)
PBN-91-12C	4.8	$8x10^{-3}$	Medium to coarse sand with little fine sand and little gravel (SW)

continued

TABLE 6-12
FIELD HYDRAULIC CONDUCTIVITY TEST RESULTS -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL DESIGNATION	MAXIMUM WATER LEVEL DEPRESSION (FEET)	HYDRAULIC CONDUCTIVITY (CM/SEC)	GEOLOGIC CONDITIONS
PBN-91-12D	10.3	$3x10^{-2}$	Medium to coarse sand, some gravel, little fine sand (SW)
LON-89-02B	5.0	$4x10^{-2}$	Gravel and cobbles (GP-GW)
LON-89-03B	2.0	$1x10^{-1}$	medium sand and fine gravel (SP-GP)
SPN-89-01C	8.4	$4x10^{-2}$	Fine sand (SP) over gravel (GP)
SPN-89-02B	9.3	$1x10^{-2}$	Fine to medium sand (SP)
SPN-89-02C	9.3	$3x10^{-2}$	Medium to coarse and (SP)
SPN-89-03B	8.4	$4x10^{-2}$	Fine sand over gravel (SP-GW)
SPN-89-04B	8.5	$2x10^{-2}$	Fine sand and some gravel (SP-GW)
SPN-89-04C	10.5	$2x10^{-2}$	Fine sand trace gravel (SP)
S1103	3.4	$8x10^{-3}$	Medium-fine sand with some gravel (SP, SP-SM)

continued

TABLE 5-12
FIELD HYDRAULIC CONDUCTIVITY TEST RESULTS -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL DESIGNATION	MAXIMUM WATER LEVEL DEPRESSION (FEET)	HYDRAULIC CONDUCTIVITY (CM/SEC)	GEOLOGIC CONDITIONS
S1106	9.8	$7x10^{-3}$	Medium-fine sand, little gravel (SP, SP-SM)
S1107	8.6	$3x10^{-3}$	Medium-fine sand, little gravel (SP, SP-SM)
S1114	7.5	2x10-2	Medium-fine sand, little gravel (SP, SP-SM)

Notes:

Field data and calculations are presented in Appendix I. Hydraulic conductivities calculated using HVORSLEV method.

Hydraulic Conductivity Tests completed during March and November 1989, and November and December 1991.

Values of hydraulic conductivities represent an averaged value of multiple tests performed on each well.

cm/sec = centimeters per second

Water level recovery at this well impacted by inertial effects resulting in water level recovery above static water level. Hydraulic conductivity measurements may be greater than calculated at this well.

TABLE 6-13
SUMMARY OF SURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBS-91-01	PBS-91-02	PBS-91-03	PBS-91-04	PBS-91-05	PBS-91-06	PBS-91-07	PBS-91-08	PBS-91-09	PBS-91-10
Sample Type:		BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/22/91	09/22/91	09/22/91	09/22/91	09/22/91	09/22/91	09/22/91	09/22/91	09/22/91	09/22/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VOCs	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	0.200	-	-	2.640
	CCL3F	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	-
SVOCs	2MNAP	-									-
	24DNT	-	9.880	-	-	3.160	-	-	-	-	40.000
	26DNT	-	-	-	-	-	-	-	-	-	3.410
	ANAPNE	-									-
	ANAPYL	-									-
	ANTRC	-									-
	B2EHP	-									6.200 GT
	BAANTR	-									-
	BAPYR	-									-
	BBFANT	-									-
	BGHIPY	-									-
	BKFANT	-									-
	CHRY	-									-
	DBAHA	-									-
	DBZFUR	-									-
	DEP	-									6.200 GT
	DNBP	-									-
	FANT	-									-
	FLRENE	-									-
	ICDPYR	-									-
	NNDPA	-									30.800
	PHANTR	-									0.110
	PYR	-									-
Metals	AG	-	-	-	-	-	-	-	-	-	2.020
	AS	3.990	3.550	4.450	6.120	-	-	-	-	3.440	4.780
	BE	1.010	0.725	0.930	0.903	0.787	0.494	0.634	0.603	0.955	-
	CD	-	-	-	-	-	-	-	-	-	-
	CR	24.400	21.200	23.800	34.200	18.400	12.000	23.100	23.200	25.000	49.800
	CU	27.900	28.300	18.300	115.000	38.800	55.000	99.600	97.700	24.800	1090.000
	HG	-	-	-	0.189	-	-	0.094	0.066	-	0.922
	NI	16.000	15.500	18.100	22.400	14.100	11.200	16.700	15.500	15.200	33.500
	PB	230.000	450.000	140.000	1200.000	730.000	1100.000	2000.000	2800.000	160.000	2700.000
	SB	-	-	-	-	-	-	-	-	-	-
	SE	-	-	-	-	-	-	-	-	-	-
	TL	-	-	-	-	-	-	-	-	-	-
	ZN	78.000	108.000	62.500	286.000	146.000	271.000	192.000	342.000	66.500	1040.000

Notes and flagging codes are presented at the end of this table.

TABLE 6-13
SUMMARY OF SURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBS-91-11	PBS-91-12	PBS-91-13	PBS-91-14	PBS-91-15	PBS-91-16	PBS-91-17	PBS-91-18	PBS-91-19	PBS-91-20
Sample Type:		BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/22/91	09/22/91	09/22/91	09/22/91	09/22/91	09/23/91	09/23/91	09/23/91	09/23/91	09/23/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VOCs	ACET	-	-	-	-	-		0.006 S			
	C6H6	-	0.199	0.420	-	-	-	-	-	-	-
	CCL3F	-	-	-	-	-	-		-	-	-
	MEK	-	-	-	-	-					
SVOCs	2MNAP										-
	24DNT	-	-	3.060	-	-	10.700	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	ANAPNE										-
	ANAPYL										-
	ANTRC										-
	B2EHP										-
	BAANTR										-
	BAPYR										-
	BBFANT										-
	BGHIPY										-
	BKFANT										-
	CHRY										-
	DBAHA										-
	DBZFUR										-
	DEP										-
	DNBP										2.060
	FANT										-
	FLRENE										-
	ICDPYR										-
	NNDPA										-
	PHANTR										-
	PYR										-
Metals	AG	-	-	-	-	-	-	-	-	-	-
	AS	2.880	-	-	-	3.560	4.140	-	3.250	-	3.630
	BE	0.796	0.975	0.559	0.768	0.942	0.652	0.531	0.960	0.830	0.949
	CD	-	-	-	-	-	-	-	-	-	-
	CR	28.000	26.400	19.300	19.700	23.500	31.000	13.200	22.100	21.500	26.000
	CU	93.400	25.900	138.000	27.400	19.400	142.000	119.000	15.800	32.500	20.700
	HG	0.058	-	0.093	-	-	0.161	-	0.199	-	-
	NI	22.500	16.700	16.300	14.700	15.000	23.600	12.700	13.700	15.200	17.900
	PB	790.000	220.000	1900.000	300.000	170.000	2800.000	3300.000	17.000	670.000	39.000
	SB	-	-	-	-	-	-	-	-	-	-
	SE	-	-	-	-	-	-	-	-	-	-
	TL	-	-	-	-	-	-	-	-	-	-
	ZN	225.000	102.000	290.000	69.700	70.900	337.000	202.000	71.200	111.000	78.200

Notes and flagging codes are presented at the end of this table.

TABLE 6-13
SUMMARY OF SURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBS-91-21	PBS-91-22	PBS-91-23	PBS-91-24	PBS-91-25	PBS-91-26	PBS-91-27	PBS-91-28	PBS-91-29	PBS-91-30
Sample Type:		BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/23/91	09/23/91	09/23/91	09/23/91	09/23/91	09/23/91	09/23/91	09/23/91	09/23/91	09/24/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VOCs	ACET										
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL3F	0.003 S	0.003 S	-	-	-	-	-	-	-	-
	MEK						0.010 S	0.007 S	0.006 S	0.007 S	0.010 S
SVOCs	2MNAP										-
	24DNT	-	-	-	-	3.890	53.300	51.600	-	8.760	-
	26DNT	-	-	-	-	-	4.250	-	-	-	-
	ANAPNE										-
	ANAPYL										-
	ANTRC										-
	B2EHP										-
	BAANTR										-
	BAPYR										-
	BBFANT										-
	BGHIPY										-
	BKFANT										-
	CHRY										-
	DBAHA										-
	DBZFUR										-
	DEP										0.886
	DNBP										6.350
	FANT										-
	FLRENE										-
	ICDPYR										-
	NNDPA										1.220
	PHANTR										-
	PYR										-
Metals	AG	-	-	-	-	-	-	-	-	-	-
	AS	-	3.370	-	4.770	4.570	4.900	3.200	4.820	4.290	3.740
	BE	0.978	1.000	1.030	0.780	0.861	0.731	0.690	0.856	0.840	0.857
	CD	-	-	-	-	-	-	-	-	-	-
	CR	25.400	27.000	24.000	19.100	25.000	27.700	14.700	18.200	17.500	18.200
	CU	29.800	19.900	20.700	21.500	38.900	94.000	759.000	34.200	65.200	17.200
	HG	0.070	0.156	0.465	-	0.082	0.173	0.096	0.061	0.334	-
	NI	14.800	15.400	14.700	14.100	17.800	24.500	12.100	12.500	16.000	13.800
	PB	68.000	25.000	21.000	380.000	2300.000	1800.000	580.000	120.000	290.000	120.000
	SB	-	-	-	-	-	-	-	-	-	-
	SE	-	-	-	-	0.624	-	-	-	-	-
	TL	-	-	-	-	-	-	-	-	-	-
	ZN	111.000	85.700	75.700	74.900	166.000	421.000	207.000	81.800	123.000	71.600

Notes and flagging codes are presented at the end of this table.

TABLE 6-13
SUMMARY OF SURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBS-91-31	PBS-91-32	PBS-91-33	PBS-91-34	PBS-91-35	PBS-91-36	PBS-91-37	PBS-91-38	PBS-91-39	PBS-91-40
Sample Type:		BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/24/91	09/24/91	09/24/91	09/24/91	09/24/91	09/24/91	09/24/91	09/24/91	09/24/91	09/24/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VOCs	ACET		-	-	-	-	-	-	-	-	-
	C6H6	-	0.426	0.527	0.749	0.754	-	-	-	-	-
	CCL3F	-	-	-	-	-	-	-	-	-	-
	MEK		-	-	-	-	-	-	-	-	-
SVOCs	2MNAP										-
	24DNT	-	14.300	5.610	8.460	-	-	-	4.660	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	ANAPNE										-
	ANAPYL										-
	ANTRC										-
	B2EHP										-
	BAANTR										-
	BAPYR										-
	BBFANT										-
	BGHIPY										-
	BKFANT										-
	CHRY										-
	DBAHA										-
	DBZFUR										-
	DEP										0.568
	DNBP										2.500
	FANT										-
	FLRENE										-
	ICDPYR										-
	NNDPA										-
	PHANTR										-
	PYR										-
Metals	AG	-	-	-	-	-	-	-	25.800	-	-
	AS	5.210	5.190	4.440	4.260	4.870	4.420	4.780	6.820	4.420	5.330
	BE	0.850	-	0.684	0.707	0.784	0.840	0.652	-	0.737	0.810
	CD	-	-	-	-	-	-	-	3.080	-	-
	CR	29.400	60.500	33.000	20.900	19.400	25.100	30.900	24.500	19.400	24.700
	CU	81.600	985.000	91.400	90.600	52.000	37.300	57.300	344.000	21.600	24.500
	HG	0.205	0.328	0.115	0.103	0.081	0.102	0.122	0.125	-	-
	NI	17.300	38.100	14.600	15.200	17.000	18.000	31.800	20.300	14.000	15.300
	PB	1400.000	1100.000	1100.000	870.000	1100.000	1100.000	3300.000	3000.000	260.000	250.000
	SB	-	-	-	-	-	-	-	404.000	-	-
	SE	-	-	-	-	-	-	-	-	-	-
	TL	-	-	-	-	-	-	-	-	-	-
	ZN	174.000	655.000	254.000	171.000	1160.000	154.000	285.000	2700.000	80.700	154.000

Notes and flagging codes are presented at the end of this table.

TABLE 6-13
SUMMARY OF SURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBS-91-41	PBS-91-42	PBS-91-43	PBS-91-44	PBS-91-45	PBS-91-46	PBS-91-47	PBS-91-48	PBS-91-49	PBS-91-50
Sample Type:		BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/01/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91	09/24/91	09/24/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VOCs	ACET									-	-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL3F	-	-	-	-	-	-	-	-	-	-
	MEK									-	-
SVOCs	2MNAP								0.122		
	24DNT	4.220	-	25.800	-	-	-	-	2.770	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	ANAPNE								-		
	ANAPYL								-		
	ANTRC								-		
	B2EHP								-		
	BAANTR								-		
	BAPYR								-		
	BBFANT								-		
	BGHIPY								-		
	BKFANT								-		
	CHRY								-		
	DBAHA								-		
	DBZFUR								-		
	DEP								0.794		
	DNBP								3.280		
	FANT								0.145		
	FLRENE								-		
	ICDPYR								-		
	NNDPA								1.310		
	PHANTR								0.249		
	PYR								-		
Metals	AG	-	-	-	-	-	-	-	-	-	-
	AS	24.700	8.310	64.000	3.490	4.680	11.000	4.650	5.600	5.300	3.570
	BE	-	-	-	-	-	-	-	-	0.818	0.761
	CD	4.480	1.700	-	-	-	-	-	-	-	-
	CR	60.100	26.200	55.100	10.500	18.100	40.500	27.400	51.600	25.500	19.300
	CU	2700.000	472.000	222.000	42.300	98.700	60.400	150.000	161.000	40.500	10.400
	HG	0.258	0.072	7.700	-	-	0.061	-	0.430	-	-
	NI	20.800	17.600	13.500	9.070	18.300	19.100	30.700	27.300	18.100	13.300
	PB	1100.000	330.000	2100.000	200.000	130.000	120.000	930.000	1000.000	930.000	15.000
	SB	-	-	-	-	-	-	-	-	-	-
	SE	1.110	-	2.030	-	-	0.618	-	-	-	-
	TL	1.190	-	2.280	-	-	-	-	-	-	-
	ZN	5200.000	700.000	219.000	132.000	554.000	340.000	817.000	1500.000	444.000	62.200

Notes and flagging codes are presented at the end of this table.

TABLE 6-13
SUMMARY OF SURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBS-91-51	PBS-91-52	PBS-91-53	PBS-91-54	PBS-91-55	PBS-91-56	PBS-91-57	PBS-91-58	PBS-91-59	PBS-91-60
Sample Type:		BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/24/91	09/24/91	09/24/91	09/24/91	09/24/91	09/24/91	09/24/91	09/24/91	09/24/91	09/24/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VOCs	ACET	-	-	-	-	-	-	-	-	-	
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL3F	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	
SVOCs	2MNAP					-					
	24DNT	-	-	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	ANAPNE					-					
	ANAPYL					-					
	ANTRC					-					
	B2EHP					-					
	BAANTR					-					
	BAPYR					-					
	BBFANT					-					
	BGHIPY					-					
	BKFANT					-					
	CHRY					-					
	DBAHA					-					
	DBZFUR					-					
	DEP					-					
	DNBP					-					
	FANT					-					
	FLRENE					-					
	ICDPYR					-					
	NNDPA					-					
	PHANTR					-					
	PYR					-					
Metals	AG	-	-	-	-	-	-	-	-	-	-
	AS	4.700	3.980	4.110	4.660	3.950	4.500	4.440	4.310	5.760	4.800
	BE	0.857	0.722	0.778	0.814	0.830	0.739	0.717	0.843	0.913	0.847
	CD	-	-	-	-	-	-	-	-	-	-
	CR	23.000	22.300	25.100	24.700	20.800	21.300	21.700	26.800	28.000	26.800
	CU	9.570	15.100	12.000	14.400	11.600	-	9.860	14.800	16.500	16.400
	HG	-	-	-	-	-	-	-	-	-	-
	NI	17.400	14.000	16.100	16.300	15.300	13.700	13.900	15.200	19.000	18.000
	PB	17.500	44.000	24.000	23.000	17.000	34.000	29.000	56.000	48.000	39.000
	SB	-	-	-	-	-	-	-	-	-	-
	SE	-	-	-	-	-	-	-	-	-	-
	TL	-	-	-	-	-	-	-	-	-	-
	ZN	54.200	64.300	61.900	58.300	60.100	61.100	47.400	73.100	65.100	67.000

Notes and flagging codes are presented at the end of this table.

TABLE 6-13
SUMMARY OF SURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBS-91-61	PBS-91-62	PBS-91-63	PBS-91-64	PBS-91-65	PBS-91-66	PBS-91-67	PBS-91-68	PBS-91-69	PBS-91-70
Sample Type:		BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/24/91	09/24/91	09/24/91	09/24/91	09/24/91	09/25/91	09/25/91	09/25/91	09/25/91	09/25/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VOCs	ACET										
	C6H6		-	-	-	-	-	-	-	-	-
	CCL3F	-	-	-	-	-	-	-	-	-	-
	MEK				0.006 S						
SVOCS	2MNAP					-					
	24DNT	-	-	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	ANAPNE					-					
	ANAPYL					-					
	ANTRC					-					
	B2EHP					-					
	BAANTR					-					
	BAPYR					-					
	BBFANT					-					
	BGHIPY					-					
	BKFANT					-					
	CHRY					-					
	DBAHA					-					
	DBZFUR					-					
	DEP					-					
	DNBP					-					
	FANT					-					
	FLRENE					-					
	ICDPYR					-					
	NNDPA					-					
	PHANTR					-					
	PYR					-					
Metals	AG	-	-	-	-	-	-	-	-	-	-
	AS	4.170	3.450	-	3.840	4.720	4.350	3.820	4.580	-	3.250
	BE	0.735	0.886	-	-	0.835	0.781	0.832	0.522	0.507	0.807
	CD	-	-	-	-	-	-	-	-	-	-
	CR	22.200	29.300	9.720	18.200	26.300	25.300	23.800	11.300	18.600	25.200
	CU	10.200	15.100	21.200	35.500	13.900	13.000	15.100	19.000	55.200	12.100
	HG	-	-	-	-	-	-	-	-	-	-
	NI	12.400	16.800	6.910	11.600	17.800	16.200	15.100	6.570	17.200	14.500
	PB	14.000	22.000	45.000	150.000	14.000	22.000	36.000	36.000	330.000	17.000
	SB	-	-	-	-	-	-	-	-	-	-
	SE	-	-	-	-	-	-	-	-	-	-
	TL	-	-	-	-	-	-	-	-	-	-
	ZN	46.500	73.100	39.100	61.300	55.400	50.500	75.900	27.000	74.900	65.100

Notes and flagging codes are presented at the end of this table.

TABLE 6-13
SUMMARY OF SURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBS-91-71	PBS-91-72	PBS-91-73	PBS-91-74	PBS-91-75	PBS-91-76	PBS-91-77	PBS-91-78	PBS-91-79	PBS-91-80
Sample Type:		BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/25/91	09/25/91	09/25/91	09/30/91	09/30/91	09/30/91	09/30/91	09/30/91	09/30/91	09/30/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VOCs	ACET										-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL3F	-	-	-	-	-	-	-	0.004 S	0.005 S	-
	MEK		0.006 S								-
SVOCs	2MNAP					0.452					
	24DNT	-	-	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	ANAPNE					-					
	ANAPYL					-					
	ANTRC					-					
	B2EHP					-					
	BAANTR					0.204					
	BAPYR					-					
	BBFANT					-					
	BGHIPY					-					
	BKFANT					-					
	CHRY					3.680					
	DBAHA					-					
	DBZFUR					-					
	DEP					4.010					
	DNBP					-					
	FANT					0.200					
	FLRENE					-					
	ICDPYR					-					
	NNDPA					-					
	PHANTR					1.320					
	PYR					0.168					
Metals	AG	-	-	-	-	-	-	-	-	-	-
	AS	-	-	-	-	4.770	2.960	3.660	4.080	3.470	3.660
	BE	0.826	0.718	0.842	-	0.887	0.637	0.810	0.882	0.850	0.851
	CD	-	-	-	-	-	-	-	-	-	-
	CR	23.600	22.400	26.200	11.300	19.500	18.900	23.900	25.000	21.500	24.700
	CU	16.300	30.100	15.000	29.300	20.300	24.400	15.400	15.000	17.200	18.100
	HG	-	-	-	-	-	-	-	-	-	-
	NI	13.900	18.200	16.500	15.100	19.200	20.700	18.200	16.300	19.500	17.900
	PB	27.000	310.000	32.000	55.000	33.000	24.000	20.000	58.000	16.000	55.000
	SB	-	-	-	-	-	-	-	-	-	-
	SE	-	-	-	-	-	-	-	-	-	-
	TL	-	-	-	-	-	-	-	-	-	-
	ZN	64.100	71.400	76.300	48.900	60.500	40.700	81.100	70.900	60.400	85.000

Notes and flagging codes are presented at the end of this table.

TABLE 6-13
SUMMARY OF SURFACE SOIL CHEMICAL DATA -
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBS-91-81	PBS-91-82	PBS-91-83	PBS-91-84	PBS-91-85	PBS-91-86	PBS-91-87	PBS-91-88	PBS-91-89	PBS-91-90
Sample Type:		BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/30/91	09/30/91	09/30/91	09/30/91	09/30/91	09/30/91	09/30/91	09/30/91	09/30/91	09/30/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VOCs	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL3F	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	-
SVOCs	2MNAP					-					
	24DNT	-	-	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	ANAPNE					-					
	ANAPYL					-					
	ANTRC					-					
	B2EHP					-					
	BAANTR					-					
	BAPYR					-					
	BBFANT					-					
	BGHIPY					-					
	BKFANT					-					
	CHRY					-					
	DBAHA					-					
	DBZFUR					-					
	DEP					-					
	DNBP					-					
	FANT					-					
	FLRENE					-					
	ICDPYR					-					
	NNDPA					-					
	PHANTR					-					
	PYR					-					
Metals	AG	-	-	-	-	-	-	-	-	2.380	-
	AS	-	7.700	3.340	-	3.150	-	3.890	-	3.570	-
	BE	-	0.640	0.861	0.829	0.578	-	1.510	0.893	0.[illegible]3	-
	CD	-	-	-	-	-	-	-	-	-	-
	CR	7.150	23.900	23.100	23.600	19.500	15.800	15.300	22.400	23.400	14.900
	CU	20.200	29.100	13.700	27.700	13.300	19.400	39.000	14.200	17.200	25.600
	HG	-	-	-	-	-	-	-	-	-	-
	NI	7.220	21.800	14.800	16.600	14.400	12.400	20.300	17.100	17.700	12.300
	PB	86.000	640.000	23.000	260.000	34.000	150.000	18.000	24.000	110.000	76.000
	SB	-	-	-	-	-	-	-	-	-	-
	SE	-	-	-	-	-	-	0.629	-	-	-
	TL	-	-	-	-	-	-	-	-	-	-
	ZN	27.100	101.000	72.900	84.700	35.000	46.500	48.400	61.200	73.800	45.000

Notes and flagging codes are presented at the end of this table.

TABLE 6-13
SUMMARY OF SURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBS-91-91	PBS-91-92	PBS-91-93	PBS-91-94	PBS-91-95	PBS-91-96	PBS-91-97	PBS-91-98	PBS-91-99	PBS-91-100
Sample Type:		BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/30/91	09/30/91	09/30/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
VOCs	ACET	-	-	-	-	-	-	-	-	-	
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL3F	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	
SVOCs	2MNAP					-					
	24DNT	-	-	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	ANAPNE					-					
	ANAPYL					-					
	ANTRC					-					
	B2EHP					-					
	BAANTR					-					
	BAPYR					-					
	BBFANT					-					
	BGHIPY					-					
	BKFANT					-					
	CHRY					-					
	DBAHA					-					
	DBZFUR					-					
	DEP					6.200 GT					
	DNBP					-					
	FANT					-					
	FLRENE					-					
	ICDPYR					-					
	NNDPA					-					
	PHANTR					-					
	PYR					-					
Metals	AG	-	-	-	-	-	-	-	-	-	-
	AS	15.600	-	-	3.930	9.450	3.590	5.160	5.850	3.120	5.860
	BE	-	1.570	2.290	0.853	0.920	-	0.648	0.673	-	-
	CD	-	-	-	-	-	-	-	-	-	-
	CR	21.800	21.100	48.100	23.800	29.700	25.200	26.500	29.100	20.900	23.100
	CU	25.500	13.500	28.200	20.200	25.000	13.600	13.600	15.500	14.000	13.300
	HG	-	-	-	-	-	-	-	-	-	-
	NI	23.400	11.700	21.700	12.800	21.800	19.000	23.600	22.400	16.700	16.800
	PB	1200.000	20.000	41.000	120.000	240.000	62.000	49.000	83.000	15.000	52.000
	SB	-	-	-	-	-	-	-	-	-	-
	SE	-	-	-	-	-	0.731	0.603	0.606	-	-
	TL	-	-	-	-	-	-	-	-	-	-
	ZN	106.000	79.500	168.000	77.400	93.200	70.900	60.400	64.600	58.800	64.100

Notes and flagging codes are presented at the end of this table.

TABLE 6-13
SUMMARY OF SURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBS-91-101	PBS-91-102	PBS-91-103	PBS-91-104	PBS-91-105	PBS-91-106	PBS-91-107	PBS-91-108	PBS-91-109	PBS-91-110
Sample Type:		BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/01/91	10/01/91	10/01/91	10/01/91	10/01/91	10/01/91	09/22/91	09/22/91	09/23/91	09/23/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.000	3.000
VOCs	ACET							-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL3F	-	-	-	-	-	-	-	-	-	-
	MEK							-	-	-	-
SVOCs	2MNAP					-					
	24DNT	-	-	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	ANAPNE					-					
	ANAPYL					-					
	ANTRC					-					
	B2EHP					-					
	BAANTR					-					
	BAPYR					-					
	BBFANT					-					
	BGHIPY					-					
	BKFANT					-					
	CHRY					-					
	DBAHA					-					
	DBZFUR					-					
	DEP					6.200 GT					
	DNBP					-					
	FANT					-					
	FLRENE					-					
	ICDPYR					-					
	NNDPA					-					
	PHANTR					-					
	PYR					-					
Metals	AG	-	-	-	-	-	-	-	-	-	-
	AS	3.450	3.460	4.750	24.700	-	3.360	3.660	3.810	3.530	3.580
	BE	-	-	-	-	-	-	0.870	1.110	0.917	0.960
	CD	-	-	-	-	-	-	-	-	-	-
	CR	25.300	23.100	26.200	89.800	22.100	21.600	27.400	30.000	22.100	26.900
	CU	10.900	12.900	11.800	217.000	12.900	12.100	13.100	16.400	21.600	23.300
	HG	-	-	-	3.300	-	-	-	0.090	0.160	-
	NI	17.600	15.400	19.000	63.900	16.000	16.600	16.300	17.400	14.500	15.600
	PB	15.000	23.000	34.000	130.000	12.000	19.000	19.000	24.000	8.600	13.000
	SB	-	-	-	-	-	-	-	-	-	-
	SE	-	-	0.591	-	-	0.581	-	-	-	-
	TL	-	-	-	-	-	-	-	-	-	-
	ZN	73.400	66.900	59.400	188.000	75.600	66.600	54.100	79.800	72.400	66.000

Notes and flagging codes are presented at the end of this table.

TABLE 6-13
SUMMARY OF SURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBS-91-111	PBS-91-112	PBS-91-113	PBS-91-114	PBS-91-115	PBS-91-116	PBS-91-117	PBS-91-118
Sample Type:		BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR	BUGR
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/23/91	09/23/91	09/23/91	09/23/91	09/23/91	10/01/91	10/01/91	10/03/91
DEPTH:		3.500	3.000	3.000	3.000	3.000	3.000	3.000	3.000
VOCs	ACET	-							
	C6H6	-	-	-	-	-	-	-	-
	CCL3F	-	-	-	-	-	-	-	-
	MEK	-							
SVOCs	2MNAP	-					-	1.650	-
	24DNT	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-
	ANAPNE	-					-	16.900	-
	ANAPYL	-					-	1.040	-
	ANTRC	-					-	12.400	-
	B2EHP	-					-	-	-
	BAANTR	-					-	8.900	-
	BAPYR	-					-	3.550	-
	BBFANT	-					-	3.910	-
	BGHIPY	-					-	2.570	-
	BKFANT	-					-	3.360	-
	CHRY	-					-	8.280	-
	DBAHA	-					-	0.661	-
	DBZFUR	-					-	5.800	-
	DEP	-					-	6.200 GT	6.200 GT
	DNBP	-					-	-	-
	FANT	-					-	6.200 GT	-
	FLRENE	-					-	18.400	-
	ICDPYR	-					-	4.520	-
	NNDPA	-					-	-	-
	PHANTR	-					-	12.000 GT	-
	PYR	-					-	6.200 GT	-
Metals	AG	-	-	-	-	-	-	-	-
	AS	3.390	4.040	5.110	3.100	4.080	6.570	15.400	8.600
	BE	0.986	1.260	1.460	0.935	1.200	0.624	-	0.632
	CD	-	-	-	-	-	-	-	-
	CR	25.100	36.500	40.400	23.800	28.100	30.700	33.500	23.400
	CU	14.500	16.800	21.900	11.200	24.900	18.200	40.000	27.500
	HG	0.071	0.079	-	-	-	-	0.060	-
	NI	15.700	18.400	21.200	13.700	19.000	23.600	25.500	16.200
	PB	65.000	16.000	15.000	15.000	840.000	20.000	1200.000	1500.000
	SB	-	-	-	-	-	-	-	-
	SE	-	-	-	0.585	-	-	-	-
	TL	-	-	-	-	-	-	-	-
	ZN	73.600	60.600	71.000	64.300	73.400	55.600	169.000	81.100

Notes and flagging codes are presented at the end of this table.

TABLE 6-13
SUMMARY OF SURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS AND DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

Appendix K contains complete analytical results.

USATHAMA chemical codes are defined in the RI Report Glossary.

TABLE 6-14
SUMMARY OF TCLP METALS DATA FOR SURFACE SOIL -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	TCLP LEACHATE CONCENTRATION (µg/ℓ)				
SAMPLE LOCATION	CD	CR	PB	HG	NOTES
TCLP RL[1]	1,000	5,000	5,000	200	
Minimum Reporting Value	6.8	16.8	43.4	0.1	
PBS-91-03	LT[2]	LT	LT	LT	TCLP RL not exceeded
PBS-91-06	LT	LT	7,790	LT	TCLP RL exceeded for PB
PBS-91-10	31.2	18.9	100,000	LT	TCLP RL exceeded for PB
PBS-91-12	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-15	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-16	LT	LT	6,050	LT	TCLP RL exceeded for PB
PBS-91-18	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-21	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-23	--	--	--	LT	TCLP RL not exceeded
PBS-91-24	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-27	LT	LT	8,310	LT	TCLP RL exceeded for PB
PBS-91-29	LT	LT	1,140	LT	TCLP RL not exceeded
PBS-91-33	LT	LT	2,070	LT	TCLP RL not exceeded
PBS-91-34	LT	LT	1,620	LT	TCLP RL not exceeded
PBS-91-36	LT	LT	910	LT	TCLP RL not exceeded
PBS-91-39	LT	LT	LT	LT	TCLP RL not exceeded
Contaminated Waste Area					
PBS-91-43	LT	LT	315	LT	TCLP RL not exceeded
PBS-91-44	LT	LT	604	LT	TCLP RL not exceeded
PBS-91-45	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-48	LT	LT	28,000	LT	TCLP RL exceeded for PB
PBS-91-49	LT	LT	5,730	LT	TCLP RL exceeded for PB
PBS-91-52	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-55	LT	LT	LT	LT	TCLP RL not exceeded

continued

TABLE 6-14
SUMMARY OF TCLP METALS DATA FOR SURFACE SOIL -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	TCLP LEACHATE CONCENTRATION (μg/ℓ)				
SAMPLE LOCATION	CD	CR	PB	HG	NOTES
PBS-91-58	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-61	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-65	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-66	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-69	LT	LT	1,130	LT	TCLP RL not exceeded
PBS-91-72	LT	LT	209	LT	TCLP RL not exceeded
PBS-91-75	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-79	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-82	LT	LT	928	LT	TCLP RL not exceeded
PBS-91-85	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-88	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-91	LT	LT	246	LT	TCLP RL not exceeded
PBS-91-95	LT	LT	122	LT	TCLP RL not exceeded
PBS-91-96	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-99	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-102	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-105	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-109	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-112	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-115	LT	LT	546	LT	TCLP RL not exceeded
PBS-91-116	LT	LT	LT	LT	TCLP RL not exceeded
PBS-91-118	LT	LT	397	LT	TCLP RL not exceeded

Notes:

1 TCLP Regulatory Level (RLs) exist for the following metals: AS, BA, CD, CR, SE, PB, HG, and AG. However, these results were reported only for CD, CR, PB, and HG. (See List of USATHAMA Chemical Codes for definitions of chemical abbreviations).

2 LT - Less than the Minimum Reporting Value; corrected for percent moisture, dilution, and percent recovery.

TABLE 6-15
SUMMARY OF SURFACE SOIL CHEMICAL DATA -
SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	Final Creek Samples								Settling Pond 1 Samples						
Location	FC-1	FC-2	FC-3	FC-4	FC-5	FC-6	FC-7	FC-8	FPI-1	FPI-2	FPI-3	FPI-4	FPI-5	FPI-6	FPI-7
AL	890	14000	5700	12000	2700	1100	10000	3000	21000	18000	1400	27000	10000	14000	23000
FE															
PB	8.6	14	40	12	3.6	12	27	12	14	31	ND	30	170	15	13
K	34	680	460	920	230	26	790	210	750	720	69	1100	760	900	1100
NA	23	84	140	180	170	18	100	74	83	63	17	82	190	110	130
SN	50	49	41	41	25	47	63	ND	26	43	40	57	46	40	38
ZN															
BR															
CL															
NIT	1.6	8.4	11	2.2	1.9	2.4	6.5	4.1	2.5	6.5	0.54	1.1	12	3.1	1.4
NH3	24	187	140	81	56	44	1800	93	600	740	75	380	580	300	100
SO4	107	260	28	ND	ND	ND	33	ND	ND	ND	ND	82	2500	ND	ND
CH2CL2															
2,4-DNT	0.2	0.17	6	ND	1.9	ND	2.1	ND	ND	1.9	ND	ND	0.03	ND	ND
2,6-DNT	5.4	2.04	40	ND	25	1.6	22	ND	ND	18	ND	ND	9.1	0.4	ND
B2EHP															
DEP	ND	ND	0.11	ND	ND	ND	0.13	ND	ND	ND	ND	ND	ND	ND	ND
DNBP	3.6	3.2	26	ND	ND	1.7	7.9	ND	ND	11	0.67	ND	ND	ND	0.1
DNOP															
DPA	0.93	0.48	15	ND	4.7	0.22	3.5	ND	ND	3.3	ND	ND	10	0.25	ND
2NDPA	ND	ND	2	ND	0.57	ND	0.77	ND	ND	0.97	ND	ND	ND	ND	ND
NC	100	440	740	ND	ND	ND	ND	ND	ND	780	ND	180	60000	ND	ND
NG															
pH	7.74	7.79	7.78	7.9	7.55	7.9	6.42	8.03	6.9	6.78	6.88	5.13	5.39	5.32	5.66
COD	1300	35000	103000	20000	11000	6900	69000	24000	56000	60000	2400	76000	150000	51000	38000
TOC															

TABLE 6-15
SUMMARY OF SURFACE SOIL CHEMICAL DATA -
SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	Settling Pond 1 Samples (continued)											Settling Pond 2 Samples			
Location	FPI-8	FPI-9	FPI-10	FPI-11	FPI-12	FPI-13	FPI-14	S1201	S1202	S1203	S1204	FPII-1	FPII-2	FPII-3	S1205
AL	12000	2300	11000	14000	21000	10000	9200		9750	10800	14500	40000	12000	24000	
FE															
PB	51	5.1	79	10	13	14	11		100	45	180	190	95	250	
K	510	160	340	420	500	380	210					600	370	430	
NA	120	32	150	89	53	21	56					120	73	72	
SN	36	28	42	29	27	33	27		0.45	2.8	1.2	53	22	31	
ZN															
BR															
CL															
NIT	13	0.86	6.8	0.83	0.49	0.2	0.26	ND			ND	14	14	43	
NH3	230	55	150	190	260	73	53					840	260	470	
SO4	150	ND	2000	ND	ND	ND	ND	1300	344	661	58	64	ND	ND	
CH2CL2															
2,4-DNT	94	ND	2	ND	ND	ND	ND			172		ND	ND	ND	7.6
2,6-DNT	14	ND	26	ND	0.16	ND	ND					ND	ND	ND	
B2EHP															
DEP	ND	ND	ND	ND	ND	ND	ND			460		ND	ND	ND	135
DNBP	7.8	ND	14	1.4	ND	ND	ND			ND		0.74	ND	ND	ND
DNOP															
DPA	ND	ND	5	ND	0.24	ND	1.3					ND	1.5	ND	
2NDPA	0.78	ND	0.72	ND	ND	ND	ND					ND	ND	ND	
NC	1050	ND	360	ND	ND	ND		60000			336	ND	260	280	
NG															
pH	6.6	5.85	7.61	6.54	4.85	6.23	7.08					7.73	7.85	7.19	
COD	77000	6900	45000	5100	28000	4100	1900					150000	63000	160000	
TOC															

TABLE 6-15
SUMMARY OF SURFACE SOIL CHEMICAL DATA -
SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	Settling Pond 3 Samples											
Location	FPIII-1	FPIII-2	FPIII-3	FPIII-4	FPIII-5	FPIII-6	FPIII-7	FPIII-8	FPIII-9	FPIII-10	FPIII-11	FPIII-12
AL	12000	5500	8800	13000	3100	22000	4400	29000	17000	7600	5800	2900
FE												
PB	11	6.8	8.5	30	6.7	24	11	34	14	20	8.1	8.3
K	470	180	450	1100	190	900	240	860	830	350	150	140
NA	77	19	66	130	2	160	67	120	160	51	140	20
SN	24	50	57	26	30	32	23	46	32	38	36	40
ZN												
BR												
CL												
NIT	2.6	0.69	1.1	4.1	0.78	4.9	0.91	4	0.39	0.86	0.59	1.4
NH3	170	22	28	160	30	50	21	520	89	37	29	50
SO4	ND	30	ND	ND	ND	ND	ND	36	ND	ND	ND	ND
CH2CL2												
2,4-DNT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-DNT	ND	ND	ND	ND	ND	ND	ND	1.5	ND	ND	ND	ND
B2EHP												
DEP	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DNBP	ND	17.4	ND	[illegible]	4.9	ND	ND	8	ND	ND	ND	2.5
DNOP												
DPA	ND	ND	ND	ND	ND	ND	ND	2.8	ND	ND	ND	2
2NDPA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	190
NG												
pH	7.48	6.45	7.37	7.28	7.32	7.4	7.65	7.53	7.15	7.55	7.79	7.73
COD	23000	11000	17000	92000	11000	35000	9000	56000	16000	12000	6800	890
TOC												

TABLE 6-15
SUMMARY OF SURFACE SOIL CHEMICAL DATA -
SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	Settling Pond 3 Samples (continued)				Settling Pond 4 Samples										
Location	FPIII-13	FPIII-14	FPIII-15	S1206	FPIV-1	FPIV-2	FPIV-3	FPIV-4	FPIV-5	FPIV-6	FPIV-7	FPIV-8	FPIV-9	FPIV-10	S1207
AL	16000	34000	13000	1750	23000	17000	21000	34000	23000	18000	60000	12000	24000	1300	19000
FE															
PB	23	18	32	20	15	21	22	21	100	20	300	22	100	8.4	165
K	1300	610	640		1100	1200	1500	1300	870	1200	1500	460	1900	25	
NA	150	1.1	120		460	270	120	170	130	190	400	44	180	ND	
SN	62	72	40	3.9	26	43	57	77	57	54	69	45	64	37	1.1
ZN															
BR															
CL															
NIT	0.49	1.2	3.2	ND	1.1	0.8	0.82	0.67	4.9	1.1	10	1.8	8.1	1.1	ND
NH3	270	463	88		310	170	130	330	870	520	960	810	520	29	
SO4	ND	ND	ND	15.2	ND	ND	ND	ND	400	ND	170	ND	ND	ND	183
CH2CL2															
2,4-DNT	ND	ND	ND	0.057	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-DNT	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
B2EHP															
DEP	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DNBP	ND	ND	2.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DNOP															
DPA	ND	0.24	2.2		ND	ND	ND	ND	ND	ND	ND	ND	0.36	ND	
2NDPA	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
NC	ND	ND	50	17	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	1038
NG															
pH	7.2	7.32	7.44		7.34	7.23	7.28	7.52	7.96	7.39	7.65	7.58	7.63	7.66	
COD	62000	32000	20000		30000	51000	ND	26000	71000	82000	260000	36000	97000	4000	
TOC															

TABLE 6-15
SUMMARY OF SURFACE SOIL CHEMICAL DATA -
SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	Spoils Disposal Site 1					Spoils Disposal Site 2					Spoils Disposal Site 3				
Location	SD1-1	SD1-2	SD1-3	SD1-4	SD1-5	SD2-1	SD2-2	SD2-3	SD2-4	SD2-5	SD3-1	SD3-2	SD3-3	SD3-4	SD3-5
AL	12487	14220	37395	44258	31282	4547	37583	49398	19841	25918	10844	7123	14963	26530	18207
FE	4162	10902	35401	29418	16535	17231	15534	17348	18674	15950	10623	5224	14746	15918	14566
PB	42	119	349	75	210	239	326	370	373	299	44	24	43	34	58
K	283	561	55	1660	1229	445	566	469	560	437	443	332	577	1327	121
NA	150	90	92	199	94	235	125	123	215	130	146	95	182	139	165
SN	3.27	3.5	3.46	3.68	2.54	1.04	2.6	4.04	2.54	3.68	2.24	1.33	1.36	5.8	1.28
ZN	129	128	170	212	63	148	220	307	326	748	84	119	243	96	126
BR		12		12			4								
CL	15	13	19	14	15	16	21	19	23	16	12	11	11	11	11
NIT	8	9	16	8	16	8	10	10	10	8	13	13	11	9	9
NH3															
SO4	33	50	146	80	126	97	93	130	80	85	29	31	36	75	30
CH2CL2		0.034	0.08	0.01				0.017	0.012	0.024		0.025			
2,4-DNT	9.8		0.51		12		0.54	1.3	0.84	0.48	0.47		1.1		
2,6-DNT					1										
B2EHP					0.35										
DEP															
DNBP	51	0.82	5.4	2.2	34	0.98	3.1	5.8	5.2	3.2	1.6	0.26	4		0.69
DNOP	8.6														
DPA	24		2.1	0.34	20	0.24	1.5	3.2	1.8	0.79	0.25		1.1		
2NDPA															
NC	11000	6000	9200	8700	10000	6100	5900	7800	8000	5800	2200	550	1400	450	2000
NG	19														
pH	8.3	8.4	8.3	8.4	8.3	8.3	7.6	8.3	8.2	8.2	8.1	7.8	8.1	7.6	7.8
COD	12000	23000	32000	22000	43000	48000	46000	40000	44000	46000	18000	22000	19000	33000	15000
TOC	4100	70000	64000	63000	56000	48000	58000	98000	69000	66000	10000	13000	17000	13000	19000

TABLE 6-15
SUMMARY OF SURFACE SOIL CHEMICAL DATA -
SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	Spoils Disposal Site 3 (continued)					Spoils Disposal Site 4									
Location	SD3-6	SD3-7	SD3-8	SD3-9	SD3-10	SD4-1	SD4-2	SD4-3	SD4-4	SD4-5	SD4-6	SD4-7	SD4-8	SD4-9	SD4-10
AL	13849	11452	11277	11131	15459	11511	20197	17810	16500	17086	12059	18270	20865	18919	20612
FE	14714	11685	13365	12912	15696	13512	16684	15204	16117	15915	13915	16864	19894	18201	17945
PB	43	50	42	67	48	35	22	43	27	47	23	117	24	120	24
K	1298	473	543	445	642	415	650	1195	1535	1250	455	539	1456	1317	1819
NA	286	194	167	129	247	115	255	248	130	112	121	98	175	104	223
SN	1.58	1.16	2.01	1.74	1.38	0.91	0.65	1.64	1.21	1.11	0.8	1.28	0.63	1.31	1.21
ZN	95	139	251	129	186	100	97	130	192	89	204	108	175	144	175
BR															
CL	13	10	13	10	17		10	11	13	10	10	10	11	11	10
NIT	22	9	12	9	10	4	12	8	8	7	5	9	8	7	11
NH3															
SO4	33	51	37	31	70	30	30	27	24	26	30	44	26	139	22
CH2CL2						0.031			0.016			0.01		0.038	
2,4-DNT	0.83	0.24	0.63						0.7						
2,6-DNT															
B2EHP									0.32						
DEP															
DNBP	3.6	1.9	2.8	1.2	0.78				4.4	0.32		0.51		0.75	
DNOP					0.42					0.22	0.63			0.37	
DPA	2.2	0.46	0.79						1.1						
2NDPA															
NC	3200	2400	3800	2900	2000	110		1600	660	230	65	1800	33	3000	140
NG															
pH	7.8	8	8	8.3	8	7.7	6.1	8.2	7.4	7.7	7	7.9	5.6	8.2	7.1
COD	17000	34000	35000	22000	22000	9200	17000	20000	15000	16000	9200	20000	11000	28000	24000
TOC	16000	20000	16000	16000	14000	12000	9100	16000	20000	18000	4600	25000	6100	38000	18000

TABLE 6-15
SUMMARY OF SURFACE SOIL CHEMICAL DATA -
SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	Spoils Disposal Site 5													
Location	SD5-1	SD5-2	SD5-3	SD5-4	SD5-5	SD5-6	SD5-7	SD5-8	SD5-9	SD5-10	COUNT	MIN	MAX	AVG
AL	19436	16567	14776	18354	14759	13075	10138		3684	10282	93	890	60000	16273.16
FE	16518	14329	17731	18922	15935	17067	12522		10591	10990	39	4162	35401	15627.18
PB	73	45	23	102	41	24			23	35	90	3.6	373	68.60
K	1336	685	1250	1230	1124	527	531		111	356	89	25	1900	700.91
NA	214	130	68	159	123	117	188	216	189	64	89	1.1	460	136.02
SN	1.23	1.64	1.43	0.78	0.63	0.93	1.71	0.73	1.28	1.94	93	0.45	77	23.12
ZN	112	121	155	239	306	151	121		101	103	39	63	748	172.87
BR							16				4	4	16	11.00
CL	10	13	13		13	13	18	15	13	14	38	10	23	13.37
NIT	12	12	18	9	11	15	9	14	7	15	90	0.2	43	7.08
NH3											50	21	1800	289.14
SO4	25	33	28	25	31	38	29	23	24	24	58	22	2500	179.78
CH2CL2							0.014	0.026	0.01		14	0.01	0.08	0.02
2,4-DNT											25	0.03	172	12.80
2,6-DNT											14	0.16	40	11.87
B2EHP											2	0.32	0.35	0.34
DEP											5	0.11	460	127.85
DNBP			2.8	6.5		0.82	0.34	1.7	0.33	1.1	47	0.1	51	5.57
DNOP			0.2								6	0.2	8.6	1.74
DPA			0.91	2.4		0.22					37	0.22	24	3.18
2NDPA											6	0.57	2	0.97
NC	320	270	1800	11000			250	4800	530	1700	53	33	60000	4784.19
NG											1	19	19	19.00
pH	7.7	8.4	7.2	7.4	6.1	5.8	7.9	7.3	8.2	8.2	90	4.85	8.4	7.39
COD	18000	28000	18000	28000	24000	15000	7100	13000	13000	11000	89	890	260000	36435.84
TOC	15000	7100	11000	58000	16000	15000	13000	32000	13000	19000	40	4100	98000	27900.00

SOURCES:

Ayres Associates, 1984.(FC-,FP1-,FP2-,FP3-,FP4-)

Envirodyne Engineers, Inc., 1981.(S1201,S1202,S1203)

Foth & Van Dyke, 1985.(SD1-,SD2-,SD3-,SD4-,SD5-)

NOTES:

All concentrations are in milligrams per kilogram (mg/kg), equivalent to micrograms per gram (ug/g)

' ' - Not tested.

ND - Concentration not detected above instrument Certified Reporting Limit

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBB-90-01	PBB-90-01	PBB-90-01	PBB-90-01	PBB-90-01	PBB-90-01	PBB-90-01	PBB-90-01	PBB-90-01	PBB-90-01
Sample Type:		BORE	PORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		08/22/90	08/22/90	08/22/90	08/22/90	08/22/90	08/22/90	08/22/90	08/22/90	08/22/90	08/22/90
DEPTH:		0.000	5.000	10.000	15.000	20.000	25.000	45.000	70.000	85.000	100.000
VOCs	111TCE				-						
	12DCE				-						
	13DMB				-						
	4E2MHX										
	ACET				-						
	C6H6				-						
	CCL4	-	-	-	-	-	-	-	-	-	-
	CH2CL2				-						
	ETC6H5				-						
	MEC6H5				-						
	MEK				-						
	MIBK				-						
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	-	-	-	-	-	-	-	-
	TXYLEN										
	XYLEN				-						
SVOCs	2MNAP				-						
	24DNT	-	-	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	35DNA				-						
	ANAPYL				-						
	B2EHP				-						
	BAANTR				-						
	BBFANT				-						
	BGHIPY				-						
	BKFANT				-						
	CHRY				-						
	DNBP				-						
	FANT				-						
	NAP				-						
	NBUETH										
	NNDPA				-						
	PHANTR				-						
	PYR				-						
Metals	AG				-						
	AL				3234.706						
	AS				-						
	BA				12.644						
	BE				-						
	CA				40785.414						
	CD				-						
	CO				3.752						
	CR				5.528						
	CU	17.137	10.858	16.547	10.601	5.378	3.940	-	16.985	-	8.444
	FE				7435.939						
	HG				-						
	K				285.424						
	MG				22398.287						
	MN				216.649						
	NA				379.441						
	NI				4.732						
	PB	22.484	-	-	-	-	-	-	-	-	-
	SE				-						
	TL				-						
	V				15.014						
	ZN	74.922	14.579	15.167	90.051	5.479	4.273	3.073	10.072	-	16.642
Anions	NIT										
	SO4										
Indicator parameter	pH(1)										

Notes and flagging codes are presented at the end of this table.

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBB-90-02	PBB-90-02	PBB-90-02	PBB-90-02	PBB-90-02	PBB-90-02	PBB-90-02	PBB-90-02	PBB-90-02	PBB-90-02
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		08/23/90	08/23/90	08/23/90	08/23/90	08/23/90	08/23/90	08/23/90	08/23/90	08/23/90	08/23/90
DEPTH:		0.000	5.000	10.000	15.000	20.000	25.000	45.000	65.000	85.000	95.000
VOCs	111TCE			-							
	12DCE			-							
	13DMB			-							
	4E2MHX										
	ACET			-							
	C6H6			-							
	CCL4	-	-	-	-	-	-	-	-	-	-
	CH2CL2			-							
	ETC6H5			-							
	MEC6H5			-							
	MEK			-							
	MIPK			-							
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	-	-	-	-	-	-	-	-
	TXYLEN										
	XYLEN			-							
SVOCs	2MNAP										
	24DNT	-	-		-	-	-	-	-	-	-
	26DNT	-	-		-	-	-	-	-	-	-
	35DNA										
	ANAPYL										
	B2EHP										
	BAANTR										
	BBFANT										
	BGHIPY										
	BKFANT										
	CHRY										
	DNBP										
	FANT										
	NAP										
	NBUETH										
	NNDPA										
	PHANTR										
	PYR										
Metals	AG			-							
	AL			2082.747							
	AS			15.354							
	BA			16.532							
	BE			-							
	CA			104249.930							
	CD			-							
	CO			4.199							
	CR			6.686							
	CU	12.954	4.483	28.768	4.161	5.929	4.987	4.122	9.156	3.527	4.886
	FE			11556.239							
	HG			-							
	K			510.007							
	MG			59777.063							
	MN			280.985							
	NA			222.867							
	NI			7.254							
	PB	19.218	-	-	-	-	-	-	-	-	-
	SE			-							
	TL			-							
	V			27.618							
	ZN	81.355	4.400	10.650	6.284	6.152	5.050	4.594	7.282	3.132	7.476
Anions	NIT										
	SO4										
Indicator parameter	pH(1)										

tes and flagging codes are presented at the end of this table

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBB-91-01	PBB-91-01	PBB-91-01	PBB-91-01	PBB-91-01	PBB-91-01	PBB-91-01	PBB-91-01	PBB-91-01	PBB-91-01
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/11/91	10/11/91	10/11/91	10/11/91	10/11/91	10/11/91	10/11/91	10/11/91	10/11/91	10/11/91
DEPTH:		8.000	12.000	16.000	18.000	22.000	31.000	41.000	51.000	61.000	71.000
VOCS	111TCE	0.002 S	-	-	-	-	-	-	-	-	-
	12DCE	-	-	-	-	-	-	-	-	-	-
	13DMB										
	4E2MHX										
	ACET	-	0.002 S	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	0.001 S	-	-
	CCL4	-	-	-	-	-	-	-	-	-	-
	CH2CL2	-	-	-	-	-	-	-	-	-	-
	ETC6H5	-	-	-	-	-	-	-	-	-	-
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	-	0.003 S	0.003 S	-	0.003 S	0.003 S	0.003 S	0.003 S	0.003 S	0.004 S
	MIBK	-	-	-	-	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	-	-	-	-	-	-	-	-
	TXYLEN	-	-	-	-	-	-	-	-	-	-
	XYLEN										
SVOCS	2MNAP				-						
	24DNT	165.000	-	-	-	-	-	-	-	-	-
	26DNT	5.960	-	-	-	-	-	-	-	-	-
	35DNA				-						
	ANAPYL				-						
	B2EHP				-						
	BAANTR				-						
	BBFANT				-						
	BGHIPY				-						
	BKFA				-						
	CHRY				-						
	DNBP				-						
	FANT				-						
	NAP				-						
	NBUETH										
	NNDPA				-	-					
	PHANTR				-						
	PYR				-						
Metals	AG	1.050	0.976	1.230	0.866	-	-	-	-	-	-
	AL										
	AS	29.500	-	-	-	-	-	-	-	-	-
	BA										
	BE	1.270	0.497	0.565	-	-	-	-	-	-	-
	CA										
	CD	1.660	-	-	-	-	-	-	-	-	-
	CO										
	CR	63.300	9.330	14.700	9.370	5.510	2.800	2.390	10.800	3.050	3.090
	CU	31.900	22.300	53.300	23.900	11.300	-	-	-	5.300	5.470
	FE										
	HG	-	-	-	-	-	-	-	-	-	0.054
	K										
	MG										
	MN										
	NA										
	NI	27.900	9.880	30.300	12.400	6.320	-	-	3.430	3.370	-
	PB	130.000	1.750	2.030	1.410	1.600	2.040	1.320	1.230	1.340	1.210
	SE	-	-	-	-	-	-	-	-	-	-
	TL	-	-	-	-	-	-	-	-	-	-
	V										
	ZN	132.000	14.500	28.800	15.100	9.720	2.960	-	2.770	5.250	5.250
Anions	NIT	12.100	3.710	2.420	2.340	1.910	2.170	1.090	1.350	1.210	1.540
	SO4	109.000	9.050	14.400	13.900	16.200	6.93	-	-	-	-
Indicator parameter	pH(I)										

Notes and flagging codes are presented at the end of this table.

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBB-91-01	PBB-91-01	PBB-91-02	PBB-91-02	PBB-91-02	PBB-91-02	PBB-91-02	PBB-91-02	PBB-91-02	PBB-91-02
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/11/91	10/11/91	10/11/91	10/11/91	10/11/91	10/11/91	10/11/91	10/11/91	10/11/91	10/11/91
DEPTH:		91.000	105.000	1.000	4.000	12.000	18.000	20.000	22.000	27.000	32.000
VOCs	111TCE	-	0.001 S		-	-	-	-	-	-	-
	12DCE	-	-		-	10.000 GT	-	-	-	-	-
	13DMB				-	-	-	-	-	-	-
	4E2MHX										
	ACET	-	-		-	-	-	-	-	-	-
	C6H6	-	-		-	9.090	-	-	-	-	-
	CCL4	-	0.001 S		-	-	-	-	-	-	-
	CH2CL2	-	-		-	-	-	-	-	-	-
	ETC6H5	-	-		-	-	-	-	-	-	-
	MEC6H5	-	-		-	1.040	-	-	-	-	-
	MEK	-	-		-	-	-	-	-	-	-
	MIBK	-	-		-	-	-	-	-	-	-
	TCLEE	-	-		-	0.334	-	-	-	-	-
	TRCLE	-	0.001 S		-	10.000 GT	-	-	-	-	-
	TXYLEN	-	-								
	XYLEN				-	-	-	-	-	-	-
SVOCs	2MNAP								-		
	24DNT	-	-		58.900	-	-	-	-	-	-
	26DNT	-	-		-	-	-	-	-	-	-
	35DNA								-		
	ANAPYL								-		
	B2EHP								-		
	BAANTR								-		
	BBFANT								-		
	BGHIPY								-		
	BKFANT								-		
	CHRY								-		
	DNBP								-		
	FANT								-		
	NAP								-		
	NBUETH										
	NNDPA							-	-		
	PHANTR								-		
	PYR								-		
Metals	AG	-	-	-		-	-	-	-	-	-
	AL										
	AS	-	-		5.470	18.800	3.400	2.840	4.180	-	-
	BA										
	BE	-	-	0.997		-	-	-	-	-	-
	CA										
	CD	-	-	-		-	-	-	-	-	-
	CO										
	CR	2.680	6.600	28.600		39.300	10.500	9.070	10.100	3.380	4.780
	CU	-	6.410	243.000		183.000	30.200	25.500	29.700	5.640	4.630
	FE										
	HG	-	-		-	-	-	-	-	-	-
	K										
	MG										
	MN										
	NA										
	NI	-	3.590	22.400		23.200	10.500	3.570	14.100	3.160	2.870
	PB	0.581	1.080		21.000	400.000	41.000	1.370	2.390	1.410	1.320
	SE	-	-		-	-	-	-	-	-	-
	TL	-	-		-	-	-	-	-	-	-
	V										
	ZN	6.120	5.830	63.800		273.000	42.000	22.200	32.000	6.470	4.640
Anions	NIT	1.130	1.280		16.200	1.800	2.620	2.830	1.760	1.890	1.330
	SO4	-	7.800		61.500	280.000	28.300	41.600	14.000	14.600	9.590
Indicator parameter	pH(I)										

*s and flagging codes are presented at the end of this table.

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBB-91-02	PBB-91-02	PBB-91-02	PBB-91-02	PBB-91-02	PBB-91-02	PBB-91-02	PBB-91-03	PBB-91-03	PBB-91-03
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/11/91	10/12/91	10/12/91	10/12/91	10/12/91	10/12/91	10/12/91	10/12/91	10/12/91	10/12/91
DEPTH:		52.000	62.000	72.000	82.000	92.000	102.000	112.000	4.000	6.000	12.000
VOCs	111TCE	-	-	-	-	-	-	-	-	-	-
	12DCE	-	-	-	-	-	-	-	-	-	-
	13DMB	-	-	-	-	-	-	-			
	4E2MHX										
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	0.005 S	0.001 S
	CCL4	-	-	-	-	-	-	-	-	-	-
	CH2CL2	-	-	-	-	-	-	-	-	-	-
	ETC6H5	-	-	-	-	-	-	-	-	-	-
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	0.005 S	0.005 S	0.003 S
	MIBK	-	-	-	-	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	-	-	-	-	-	-	-	-
	TXYLEN								-	-	-
	XYLEN	-	-	-	-	-	-	-			
SVOCs	2MNAP										
	24DNT	-	-	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	35DNA										
	ANAPYL										
	B2EHP										
	BAANTR										
	BBFANT										
	BGHIPY										
	BKFANT										
	CHRY										
	DNBP										
	FANT										
	NAP										
	NBUETH										
	NNDPA										
	PHANTR										
	PYR										
Metals	AG	-	-	-	-	-	-	-	-	-	-
	AL										
	AS	-	-	-	-	-	-	-	5.500	7.240	-
	BA										
	BE	-	-	-	-	-	-	-	0.654	0.781	-
	CA										
	CD	-	-	-	-	-	-	-	-	-	-
	CO										
	CR	2.350	7.120	5.830	17.300	4.410	4.830	5.760	25.200	27.000	7.250
	CU	-	3.620	8.140	12.300	11.100	5.920	7.450	17.500	14.900	32.900
	FE										
	HG	-	-	0.067	-	-	-	-	-	-	-
	K										
	MG										
	MN										
	NA										
	NI	-	-	5.860	4.710	3.300	3.770	4.560	16.500	18.900	10.400
	PB	1.310	1.210	2.050	1.920	1.620	1.010	1.220	67.000	17.000	4.530
	SE	-	-	-	-	-	-	-	0.762	-	-
	TL	-	-	-	-	-	-	-	-	-	-
	V										
	ZN	2.670	3.320	10.100	15.600	7.480	5.790	28.800	67.400	58.100	17.900
Anions	NIT	-	-	-	-	-	-	-	35.000	13.400	1.310
	SO4	-	-	-	-	-	-	6.270	41.900	12.700	-
Indicator parameter	pH(1)										

Notes and flagging codes are presented at the end of this table.

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBB-91-03	PBB-91-03	PBB-91-03	PBB-91-03	PBB-91-03	PBB-91-03	PBB-91-03	PBB-91-03	PBB-91-03	PBB-91-03
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/12/91	10/12/91	10/12/91	10/12/91	10/12/91	10/12/91	10/12/91	10/12/91	10/12/91	10/12/91
DEPTH:		16.000	18.000	22.000	30.000	41.000	51.000	61.000	71.000	81.000	91.000
VOCs	111TCE	-	-	-	-	-	-	-	-	-	-
	12DCE	-	-	-	-	-	-	-	-	-	-
	13DMB										
	4E2MHX										
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	0.001 S	-	-	-	-	-	-	-	-	-
	CCL4	-	-	-	-	-	-	-	-	-	-
	CH2CL2	-	-	-	-	-	-	-	-	-	-
	ETC6H5	-	-	-	-	-	-	-	-	-	-
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	0.003 S	0.003 S	-	0.002 S	0.002 S	0.003 S	-	0.003 S	-	0.003 S
	MIBK	-	-	-	-	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	-	-	-	-	-	-	-	-
	TXYLEN	-	-	-	-	-	-	-	-	-	-
	XYLEN										
SVOCs	2MNAP					-					-
	24DNT	-	-	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	35DNA					-					-
	ANAPYL					-					-
	B2EHP					-					-
	BAANTR					-					-
	BBFANT					-					-
	BGHIPY					-					-
	BKFANT					-					-
	CHRY					-					-
	DNBP					-					-
	FANT					-					-
	NAP	-									-
	NBUETH										
	NNDPA	-	-								-
	PHANTR					-					-
	PYR					-					-
Metals	AG	-	-	-	-	-	-	-	-	-	-
	AL										
	AS	-	-	-	-	-	-	-	-	-	3.310
	BA										
	BE	-	-	-	-	-	-	-	0.478	-	-
	CA										
	CD	-	-	-	-		-	-	-	-	-
	CO										
	CR	3.340	2.530	3.460	2.920	2.340	2.760	2.910	7.460	5.390	4.460
	CU	7.420	-	-	-	-	-	-	15.300	15.200	-
	FE										
	HG	-	-	-	-	-	-	-	-	-	-
	K										
	MG										
	MN										
	NA										
	NI	4.960	3.020	-	3.230	-	-	-	10.400	10.100	3.950
	PB	2.610	1.320	1.450	1.140	1.430	0.935	1.750	1.410	2.720	2.390
	SE	-	-	-	-	-	-	-	-	-	-
	TL	-	-	-	-	-	-	-	-	-	-
	V										
	ZN	5.230	3.130	2.820	-	-	-	-	17.800		-
Anions	NIT	-	-	1.100	1.180	1.270	-	-	-	1.360	-
	SO4	-	-	-	-	-	-	-	-	-	-
Indicator parameter	pH(I)										

otes and flagging codes are presented at the end of this table.

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBB-91-03	PBB-91-04	PBB-91-04	PBB-91-04	PBB-91-04	PBB-91-04	PBB-91-04	PBB-91-04	PBB-91-04	PBB-91-04
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/12/91	10/13/91	10/13/91	10/13/91	10/13/91	10/13/91	10/13/91	10/13/91	10/13/91	10/13/91
DEPTH:		101.000	8.000	12.000	18.000	22.000	26.000	28.000	32.000	42.000	52.000
VOCS	111TCE	-	-	-	-	-	-	-	-	-	-
	12DCE	-	-	-	-	-	-	-	-	-	-
	13DMB		-	-	-	-	-	-	-	-	-
	4E2MHX										
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	0.001 S	-	-	-	-	-	-	-	-	-
	CCL4	-	-	-	-	-	-	-	-	-	-
	CH2CL2	-	-	-	-	-	-	-	-	-	-
	ETC6H5	-	-	-	-	-	-	-	-	-	-
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	0.003 S	-	-	-	-	-	-	-	-	-
	MIBK	-	-	-	-	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	-	-	-	-	-	-	-	-
	TXYLEN	-									
	XYLEN		-	-	-	-	-	-	-	-	-
SVOCs	2MNAP										
	24DNT	-	-	-	-	-			76.000	-	66.500
	26DNT	-	-	-	-	-			-	-	10.500
	35DNA										
	ANAPYL										
	B2EHP										
	BAANTR										
	BBFANT										
	BGHIPY										
	BKFANT										
	CHRY										
	DNBP										
	FANT										
	NAP										
	NBUETH										
	NNDPA										
	PHANTR										
	PYR										
Metals	AG	-	-	-	-	-			-	-	-
	AL										
	AS	-	-	-	-	-			-	-	-
	BA										
	BE	-	-	-	-	-			-	-	-
	CA										
	CD	-	-	-	-	-			-	-	-
	CO										
	CR	5.490	8.740	7.130	2.840	3.600			3.120	2.890	2.640
	CU	-	36.500	18.200	6.090	9.930			4.270	-	4.150
	FE										
	HG	-	-	-	-	-			-	-	-
	K										
	MG										
	MN										
	NA										
	NI	3.830	12.500	5.920	-	5.370			-	-	-
	PB	1.260	1.550	1.680	2.830	2.370			2.080	2.360	1.360
	SE	-	-	-	-	-			-	-	-
	TL	-	-	-	-	-			-	-	-
	V										
	ZN	-	20.400	17.500	6.530	8.540			6.270	3.960	4.380
Anions	NIT	1.700	2.650	1.940	3.840	6.530			12.500	3.430	6.230
	SO4	-	-	-	-	-			28.000	100.000	50.500
Indicator parameter	pH(1)										

Notes and flagging codes are presented at the end of this table.

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBB-91-04	PBB-91-04	PBB-91-04	PBB-91-04	PBB-91-04	PBB-91-04	PBB-91-05	PBB-91-05	PBB-91-05	PBB-91-05
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/13/91	10/14/91	10/14/91	10/14/91	10/14/91	10/14/91	10/14/91	10/14/91	10/14/91	10/14/91
DEPTH:		62.000	72.000	82.000	92.000	102.000	107.000	6.000	14.000	26.000	28.000
VOCs	111TCE	-	-	-	-	-	-	-	-	-	-
	12DCE	-	-	-	-	-	-	-	-	-	-
	13DMB	-	-	-	-	-	-	-	-	0.849	-
	4E2MHX										
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	0.139	-
	CCL4	-	-	-	-	-	-	-	-	-	-
	CH2CL2	-	-	-	-	-	-	-	-	-	-
	ETC6H5	-	-	-	-	-	-	-	-	0.204	-
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	-
	MIBK	-	-	-	-	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	0.547	0.621	-	-	-	-	-	-	0.253	-
	TXYLEN										
	XYLEN	-	-	-	-	-	-	-	-	0.992	-
SVOCs	2MNAP		-						-		
	24DNT	1400.000	1500.000	-	-	-	-	-	-	3500.000	2500.000
	26DNT	-	6.200 GT	-	-	-	-	-	-	-	-
	35DNA		-						-		
	ANAPYL		-						-		
	B2EHP		4.710						-		
	BAANTR		-						-		
	BBFANT		-						-		
	BGHIPY		-						-		
	BKFANT		-						-		
	CHRY		-						-		
	DNBP		6.200 GT						-		
	FANT		-						-		
	NAP		-						-		
	NBUETH										
	NNDPA		230.000						-		
	PHANTR		-						-		
	PYR		-						-		
Metals	AG	-	-	-	-	-	-	-	-	-	-
	AL										
	AS	-	-	-	-	-	-	-	-	-	-
	BA										
	BE	-	-	-	-	-	-	0.562	0.547	-	-
	CA										
	CD	-	-	-	-	-	-	-	-	-	-
	CO										
	CR	2.360	2.050	5.000	3.170	8.400	5.320	5.640	21.600	2.520	12.900
	CU	-	-	8.470	-	11.100	9.800	8.270	7.550	4.050	4.010
	FE										
	HG	-	-	-	-	-	-	-	-	-	-
	K										
	MG										
	MN										
	NA										
	NI	-	-	4.170	-	4.660	4.790	6.490	13.200	4.080	5.510
	PB	1.140	1.240	1.580	0.958	1.730	2.720	6.670	2.040	3.440	4.070
	SE	-	-	-	-	-	-	-	-	-	-
	TL	-	-	-	-	-	-	-	-	-	-
	V										
	ZN	2.690	-	10.700	-	37.000	8.950	3.950	6.230	5.420	8.230
Anions	NIT	6.150	5.420	2.620	4.310	2.500	5.620	1.730	1.820	11.400	10.400
	SO4	22.300	36.000	98.000	23.400	10.600	21.300	8.550	-	-	-
Indicator parameter	pH(1)										

es and flagging codes are presented at the end of this table.

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBB-91-05	PBB-91-05	PBB-91-05	PBB-91-05	PBB-91-05	PBB-91-05	PBB-91-05	PBB-91-05	PBB-91-05	PBB-91-06
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/14/91	10/14/91	10/14/91	10/14/91	10/14/91	10/14/91	10/14/91	10/14/91	10/14/91	10/13/91
DEPTH		32.000	41.000	51.000	61.000	71.000	73.000	81.000	101.000	111.000	6.000
VOCs	111TCE	-	-	-	-	-	-	-	-	-	-
	12DCE	-	-	-	-	-	-	-	-	-	-
	13DMB	0.434	-	-	-	-	-	-	-	-	
	4E2MHX										
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL4	-	-	-	-	-	-	-	-	-	-
	CH2CL2	-	-	-	-	-	-	-	-	-	-
	ETC6H5	-	-	-	-	-	-	-	-	-	-
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	-
	MIBK	-	-	-	-	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	-	-	-	-	-	-	-	0.003 S
	TXYLEN										-
	XYLEN	-	-	-	-	-	-	-	-	-	
SVOCs	2MNAP					-					
	24DNT	3100.000	-	-	-	5.520	5.550		-	-	-
	26DNT	-	-	-	-	1.480	-		-	-	-
	35DNA					5.470					
	ANAPYL					-					
	B2EHP					-					
	BAANTR					-					
	BBFANT					-					
	BGHIPY					-					
	BKFANT					-					
	CHRY					-					
	DNBP					-					
	FANT					-					
	NAP					-					
	NBUETH										
	NNDPA					0.769	0.113				
	PHANTR					-					
	PYR					-					
Metals	AG	-	-	-	-	-	-		-	-	-
	AL										
	AS	-	-	-	-	-	-		-	-	4.550
	BA										
	BE	-	-	-	-	-	-		-	-	0.594
	CA										
	CD	-	-	-	-	-	-		-	-	-
	CO										
	CR	2.480	3.170	3.470	2.430	1.880	14.100		3.340	3.210	19.300
	CU	-	-	5.650	-	-	-		-	-	11.500
	FE										
	HG	-	-	-	-	-	-		-	-	-
	K										
	MG										
	MN										
	NA										
	NI	3.890	5.240	-	-	-	5.510		-	-	15.000
	PB	2.080	2.050	1.060	1.120	0.987	1.300		0.683	-	9.200
	SE	-	-	-	-	-	-		-	-	-
	TL	-	-	-	-	-	-		-	-	-
	V										
	ZN	-	-	6.740	4.640	-	-		-	2.920	43.300
Anions	NIT	9.560	11.300	9.430	3.900	3.230	3.220		2.010	3.190	3.800
	SO4	5.890	14.000	23.100	36.000	36.400	33.600		-	21.100	-
Indicator parameter	pH(1)										

Notes and flagging codes are presented at the end of this table.

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBB-91-06	PBB-91-06	PBB-91-06	PBB-91-06	PBB-91-06	PBB-91-06	PBB-91-06	PBB-91-06	PBB-91-06	PBB-91-06
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/13/91	10/13/91	10/13/91	10/13/91	10/13/91	10/13/91	10/13/91	10/13/91	10/13/91	10/13/91
DEPTH:		12.000	14.000	16.000	20.000	22.000	26.000	31.000	41.000	51.000	61.000
VOCs	111TCE	-	-	-	-	-	-	-	-	-	-
	12DCE	-	-	-	-	-	-	-	-	-	-
	13DMB										
	4E2MHX	8.360 S									
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	37.200 S	864.000 S	441.000 S	114.000 S	179.000 S	114.000 S	51.900 S	166.000 S	86.600 S	51.600 S
	CCL4	-	-	-	-	-	-	-	-	-	-
	CH2CL2	0.825 S	-	-	0.887 S	-	-	-	0.883 S	0.969 S	-
	ETC6H5	-	1.540 S	-	-	-	-	-	0.273 S	0.289 S	-
	MEC6H5	5.570 S	14.400 S	4.010 S	0.845 S	1.100 S	0.686 S	0.560 S	1.640 S	1.150 S	0.619 S
	MEK	2.670 S	-	4.560 S	-	3.360 S	3.860 S	3.730 S	3.790 S	3.510 S	2.680 S
	MIBK	4.990 S	-	-	-	-	-	-	-	-	-
	TCLEE	1.140 S	-	-	-	-	-	-	-	-	-
	TRCLE	22.100 S	39.400 S	20.600 S	5.910 S	13.200 S	6.860 S	4.150 S	17.900 S	15.500 S	9.910 S
	TXYLEN	39.500 S	11.500 S	5.510 S	0.971 S	0.380 S	0.322 S	0.353 S	1.770 S	1.710 S	1.610 S
	XYLEN										
SVOCs	2MNAP	18.200									
	24DNT	73000.000	69000.000	280000.000	21000.000		56000.000	8200.000	5700.000	4700.000	8500.000
	26DNT	6.200 GT	-	-	-		-	-	1000.000	1000.000	830.000
	35DNA	-									
	ANAPYL	-									
	B2EHP	6.200 GT									
	BAANTR	-									
	BBFANT	-									
	BGHIPY	-									
	BKFANT	-									
	CHRY	-									
	DNBP	6.200 GT									
	FANT	-									
	NAP	6.200 GT									
	NBUETH								5.050 S	5.980 S	
	NNDPA	12.000 GT									
	PHANTR	-									
	PYR	-									
Metals	AG	-	-	-	-		-	-	-	-	-
	AL										
	AS	-	-	-	-		2.870	-	-	-	-
	BA										
	BE	-	-	-	-		-	-	-	-	-
	CA										
	CD	-	-	-	-		-	-	-	-	-
	CO										
	CR	8.900	4.630	4.560	3.840		5.580	5.650	2.440	2.670	2.240
	CU	106.000	19.600	9.650	13.200		7.060	6.250	4.760	-	-
	FE										
	HG	-	-	-	-		-	-	-	-	-
	K										
	MG										
	MN										
	NA										
	NI	6.070	4.270	-	-		-	-	-	-	-
	PB	110.000	32.000	18.000	1.140		11.000	1.090	1.260	2.020	1.080
	SE	1.770	-	-	-		-	-	-	-	-
	TL	-	-	-	-		-	-	-	-	-
	V										
	ZN	70.100	53.200	18.100	11.300		9.980	6.930	5.260	-	-
Anions	NIT	4.460	4.180	3.910	3.750		3.110	4.110	4.760	7.770	7.090
	SO4	88.600	29.900	94.300	23.100		16.800	19.100	29.900	32.800	20.100
Indicator parameter	pH(1)										

Notes and flagging codes are presented at the end of this table.

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBB-91-06	PBB-91-06	PBB-91-06	PBB-91-06	PBB-91-06	PBB-91-07	PBB-91-07	PBB-91-07	PBB-91-07	PBB-91-07
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/13/91	10/13/91	10/13/91	10/13/91	10/13/91	10/12/91	10/12/91	10/12/91	10/12/91	10/12/91
DEPTH:		71.000	91.000	101.000	111.000	141.000	6.000	8.000	10.000	12.000	16.000
VOCs	111TCE	-	-	-	-		-	-	-	-	-
	12DCE	-	-	-	-		-	-	-	-	-
	13DMB						-	-	-	-	-
	4E2MHX										
	ACET	-	-	-	-		-	-	-	-	-
	C6H6	24.500 S	0.001 S	-	0.004 S		-	-	-	-	-
	CCL4	-	-	-	-		-	-	-	-	-
	CH2CL2	-	-	-	-		-	-	-	-	-
	ETC6H5	-	-	-	-		-	-	-	-	-
	MEC6H5	0.307 S	-	-	-		-	-	-	-	-
	MEK	2.860 S	-	-	-		-	-	-	-	-
	MIBK	-	-	-	-		-	-	-	-	-
	TCLEE	-	-	-	-		-	-	-	-	-
	TRCLE	5.110 S	-	-	0.001 S		-	-	-	-	-
	TXYLEN	1.080 S	-	-	-						
	XYLEN						-	-	-	-	-
SVOCs	2MNAP		-		-					-	
	24DNT	1900.000	57.900	-	-		-	-	-	-	-
	26DNT	160.000	11.900	-	-		-	-	-	-	-
	35DNA		-		-					-	
	ANAPYL		-		-					-	
	B2EHP		-		-					-	
	BAANTR		-		-					-	
	BBFANT		-		-					-	
	BGHIPY		-		-					-	
	BKFANT		-		-					-	
	CHRY		-		-					-	
	DNBP		6.200 GT		-					-	
	FANT		-		-					-	
	NAP		-		-					-	
	NBUETH										
	NNDPA		14.100		-					-	
	PHANTR		-		-					-	
	PYR		-		-					-	
Metals	AG	-	-	-	-		-	-	-	-	-
	AL										
	AS	-	-	-	-		-	-	-	-	-
	BA										
	BE	-	-	-	-		-	0.547	-	-	-
	CA										
	CD	-	-	-	-		-	-	-	-	-
	CO										
	CR	2.200	5.760	2.030	4.200		10.900	26.000	5.810	4.310	-
	CU	-	12.300	-	18.300		10.600	50.700	28.300	17.900	-
	FE										
	HG	-	-	-		-	-	-	-	-	-
	K										
	MG										
	MN										
	NA										
	NI	-	4.000	-	4.420		9.860	20.700	10.500	7.860	5.980
	PB	1.080	1.800	0.548	1.040		4.820	2.550	3.400	2.340	1.910
	SE	-	-	-	-		-	-	-	-	-
	TL	-	-	-	-		-	-	-	-	-
	V										
	ZN	-	6.240	-	11.600		14.100	61.200	15.300	10.000	-
Anions	NIT	5.160	2.720	1.860	1.030		1.360	1.560	1.160	1.420	1.330
	SO4	70.600	22.900	7.260	-		150.000	60.200	41.600	31.600	49.300
Indicator parameter	pH(1)										

Notes and flagging codes are presented at the end of this table.

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBB-91-07	PBB-91-07	PBB-91-07	PBB-91-07	PBB-91-07	PBB-91-07	PBB-91-07	PBB-91-07	PBT-90-01	PBT-90-01
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	PIT	PIT
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/12/91	10/12/91	10/12/91	10/12/91	10/13/91	10/13/91	10/13/91	10/13/91	09/05/90	09/05/90
DEPTH:		20.000	26.000	32.000	42.000	52.000	62.000	72.000	76.000	1.000	12.000
VOCs	111TCE	-	-	-	-	-	-	-	-		
	12DCE	-	-	-	-	-	-	-	-		
	13DMB	-	-	-	-	-	-	-	-		
	4E2MHX										
	ACET	-	-	-	-	-	-	-	-		
	C6H6	-	-	-	-	-	-	-	-		
	CCL4	-	-	-	-	-	-	-	-	-	-
	CH2CL2	-	-	-	-	-	-	-	-		
	ETC6H5	-	-	-	-	-	-	-	-		
	MEC6H5	-	-	-	-	-	-	-	-		
	MEK	-	-	-	-	-	-	-	-		
	MIBK	-	-	-	-	-	-	-	-		
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	-	-	-	-	-	-	-	-
	TXYLEN										
	XYLEN	-	-	-	-	-	-	-	-		
SVOCs	2MNAP										
	24DNT	-	-	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	35DNA										
	ANAPYL										
	B2EHP										
	BAANTR										
	BBFANT										
	BGHIPY										
	BKFANT										
	CHRY										
	DNBP										
	FANT										
	NAP										
	NBUETH										
	NNDPA										
	PHANTR										
	PYR										
Metals	AG	-	-	-	-	-	-	-	-		
	AL										
	AS	-	-	-	-	-	-	-	-		
	BA										
	BE	-	-	-	-	-	-	-	-		
	CA										
	CD	-	-	-	-	-	-	-	-		
	CO										
	CR	8.810	2.370	2.810	2.470	2.400	1.920	2.480	4.150		
	CU	13.800	4.340	15.400	-	-	-	-	4.910	5945.474	13.769
	FE										
	HG	-	-	-	-	-	-	-	-		
	K										
	MG										
	MN										
	NA										
	NI	12.000	4.750	4.280	-	-	-	-	4.600		
	PB	2.220	2.930	1.990	1.130	2.010	1.160	1.090	4.060	147.882	12.411
	SE	-	-	-	-	-	-	-	-		
	TL	-	-	-	-	-	-	-	-		
	V										
	ZN	7.490	4.800	4.240	-	3.280	-	-	-	232.830	8.840
Anions	NIT	2.380	1.790	2.490	4.500	1.970	2.150	2.300	2.310		
	SO4	140.000	91.400	79.700	100.000	110.000	110.000	170.000	97.700		
Indicator parameter	pH(1)										

'otes and flagging codes are presented at the end of this table.

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBT-90-02	PBT-90-03	PBT-90-03	PBT-90-03	PBT-90-04	PBT-90-05	PBT-90-05	PBT-90-06	PBT-90-06	PBT-90-07
Sample Type:		PIT	PIT	PIT	PIT	PIT	PIT	PIT	PIT	PIT	PIT
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/05/90	09/05/90	09/05/90	09/05/90	09/05/90	09/05/90	09/05/90	09/06/90	09/06/90	09/06/90
DEPTH:		3.000	5.000	10.000	12.000	4.000	3.000	8.000	4.000	9.000	3.000
VOCs	111TCE										
	12DCE										
	13DMB										
	4E2MHX										
	ACET										
	C6H6										
	CCL4	-	-	-	-	-	-	-	-	-	0.390
	CH2CL2										
	ETC6H5										
	MEC6H5										
	MEK										
	MIBK										
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	-	-	-	-	-	-	-	-
	TXYLEN										
	XYLEN										
SVOCs	2MNAP										
	24DNT	-	-	-	-	-	-	12.282	-	6.127	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	35DNA										
	ANAPYL										
	B2EHP										
	BAANTR										
	BBFANT										
	BGHIPY										
	BKFANT										
	CHRY										
	DNBP										
	FANT										
	NAP										
	NBUETH										
	NNDPA										
	PHANTR										
	PYR										
Metals	AG										
	AL										
	AS										
	BA										
	BE										
	CA										
	CD										
	CO										
	CR										
	CU	114.998	71.180	197.322	97.551	402.665	327.190	131.348	85.392	106.953	28.767
	FE										
	HG										
	K										
	MG										
	MN										
	NA										
	NI										
	PB	407.265	350.374	514.730	112.933	5371.520	749.805	265.231	153.511	628.610	92.437
	SE										
	TL										
	V										
	ZN	1253.935	260.218	1452.920	116.525	2984.426	1017.916	653.906	480.750	1212.498	206.562
Anions	NIT										
	SO4										
Indicator parameter	pH(1)										

Notes and flagging codes are presented at the end of this table.

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PTB-90-07	PBT-90-08	PBT-90-08	PBT-90-08	LOB-90-01	LOB-90-01	LOB-90-01	LOB-90-01	LOB-90-01	LOB-90-01
Sample Type:		PIT	PIT	PIT	PIT	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/06/90	09/06/90	09/06/90	09/06/90	08/21/90	08/21/90	08/21/90	08/21/90	08/21/90	08/21/90
DEPTH:		4.000	3.000	5.000	7.000	0.000	5.000	10.000	15.000	20.000	25.000
VOCs	111TCE							-			
	12DCE							-			
	13DMB							-			
	4E2MHX										
	ACET							-			
	C6H6							-			
	CCL4	-	-	0.645	-	-	-	-	-	-	-
	CH2CL2							-			
	ETC6H5							-			
	MEC6H5							-			
	MEK							-			
	MIBK							-			
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	-	-	-	-	-	-	-	-
	TXYLEN										
	XYLEN							-			
SVOCs	2MNAP							-			
	24DNT	-	-	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	35DNA							-			
	ANAPYL							-			
	B2EHP							-			
	BAANTR							-			
	BBFANT							-			
	BGHIPY							-			
	BKFANT							-			
	CHRY							-			
	DNBP							-			
	FANT							-			
	NAP							-			
	NBUETH										
	NNDPA							-			
	PHANTR							-			
	PYR							-			
Metals	AG							-			
	AL							30495.701			
	AS							36.880			
	BA							241.121			
	BE							0.559			
	CA							31202.166			
	CD							2.689			
	CO							11.437			
	CR							114.412			
	CU	22.834	-	12.361	71.696	110.899	488.008	837.106	15.609	118.876	116.329
	FE							45145.602			
	HG							0.059			
	K							1336.502			
	MG							27876.725			
	MN							854.897			
	NA							948.819			
	NI							95.355			
	PB	18.027	10.944	153.023	8.558	62.851	873.744	1343.194	-	-	-
	SE							-			
	TL							-			
	V							55.698			
	ZN	134.809	10.912	138.026	349.359	450.891	1342.148	1695.162	15.924	35.092	56.560
Anions	NIT										
	SO4										
Indicator parameter	pH(1)										

Notes and flagging codes are presented at the end of this table.

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		LOB-90-01	LOB-90-01	LOB-90-01	LOB-90-02	SPB-91-01	SPB-91-01	SPB-91-01	SPB-91-01	SPB-91-01	SPB-91-01
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		08/21/90	08/21/90	08/21/90	08/21/90	10/14/91	10/14/91	10/14/91	10/14/91	10/14/91	10/14/91
DEPTH:		67.000	86.000	140.000	0.000	2.000	7.000	12.000	22.000	62.000	67.000
VOCs	111TCE					-	-	-	-	-	-
	12DCE					-	-	-	-	-	-
	13DMB										
	4E2MHX										
	ACET					-	-	-	-	-	-
	C6H6					-	-	-	-	-	0.001 S
	CCL4	-	-	-	-	-	-	-	-	-	-
	CH2CL2					-	-	-	-	-	-
	ETC6H5					-	-	-	-	-	-
	MEC6H5					-	-	-	-	-	-
	MEK					-	-	-	-	-	0.004 S
	MIBK					-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	-	-	-	-	-	-	-	-
	TXYLEN					-	-	-	-	-	-
	XYLEN										
SVOCs	2MNAP					-	-	-	-	-	-
	24DNT	-	-	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	35DNA					-	-	-	-	-	-
	ANAPYL					0.166	-	-	-	-	-
	B2EHP					1.020	-	-	-	-	-
	BAANTR					0.185	-	-	-	-	-
	BBFANT					0.723	-	-	-	-	-
	BGHIPY					0.618	-	-	-	-	-
	BKFANT					0.635	-	-	-	-	-
	CHRY					0.264	-	-	-	-	-
	DNBP					-	-	-	-	-	-
	FANT					0.407	-	-	-	-	-
	NAP					-	-	-	-	-	-
	NBUETH										
	NNDPA					-	-	-	-	-	-
	PHANTR					0.173	-	-	-	-	-
	PYR					0.487	-	-	-	-	-
Metals	AG					-	-	-	-	-	-
	AL					21600.000	8050.000	2710.000	2510.000	1360.000	1300.000
	AS					4.140	-	-	-	-	-
	BA					183.000	114.000	51.300	27.200	-	-
	BE					0.813	-	-	-	-	-
	CA					6060.000	2130.000	1180.000	1090.000	3500.000	10200.000
	CD					-	-	-	-	-	-
	CO					8.480	[illegible]00	3.330	-	-	-
	CR					23.900	[illegible]	7.430	6.060	2.980	3.690
	CU	15.257	4.465	4.691	103.108	13.100		4.870	5.890	-	8.330
	FE					23300.000	[illegible]00	7180.000	6830.000	2610.000	4850.000
	HG					0.505	-	-	-	-	-
	K					2340.000	707.000	485.000	322.000	220.000	227.000
	MG					3570.000	1310.000	1050.000	1170.000	1970.000	5560.000
	MN					798.000	1300.000	1090.000	499.000	33.300	67.400
	NA					79.300	-	90.400	132.000	79.900	99.600
	NI					15.900	7.220	5.940	6.890	-	3.270
	PB	-	-	-	73.211	18.000	10.000	2.150	2.770	1.030	1.490
	SE					-	-	-	-	-	-
	TL					2.140	16.500	17.000	0.156	-	-
	V					62.000	46.000	14.000	16.000	4.550	19.000
	ZN	10.128	5.983	3.110	108.713	67.000	28.000	15.000	10.300	3.680	7.340
Anions	NIT					3.530	3.460	3.760	2.770	1.990	2.330
	SO4					18.200	12.800	35.800	-	-	9.640
Indicator parameter	pH(1)					9.960	8.310	7.460	8.050	9.900	9.950

Notes and flagging codes are presented at the end of this table.

TABLE 6-16
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Resul s based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

Appendix K contains complete analytical results.

USATHAMA chemical codes are defined in the RI Report Glossary.

TABLE 6-17
SUMMARY OF TCLP METALS DATA FOR SUBSURFACE SOIL -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

		TCLP LEACHATE CONCENTRATION (µg/ℓ)				
SAMPLE LOCATION	DEPTH	CD	CR	PB	HG	NOTES
TCLP RL[1]		1,000	5,000	5,000	200	
Minimum Reporting Value		6.8	16.8	43.4	0.1	
PBB-91-01	16	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-01	105	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-02	27	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-02	102	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-03	4	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-03	101	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-04	18	LT	LT	122	LT	TCLP RL not exceeded
PBB-91-04	72	LT	LT	95.2	LT	TCLP RL not exceeded
PBB-91-04	102	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-04	107	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-05	73	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-05	111	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-06	6	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-06	12	9.5	LT	1,460	LT	TCLP RL not exceeded
PBB-91-06	14	10.1	LT	167	LT	TCLP RL not exceeded
PBB-91-06	20	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-06	31	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-06	41	LT	22.8	LT	LT	TCLP RL not exceeded
PBB-91-06	61	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-06	91	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-07	6	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-07	8	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-07	10	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-07	12	LT	LT	LT	LT	TCLP RL not exceeded

continued

TABLE 6-17
SUMMARY OF TCLP METALS DATA FOR SUBSURFACE SOIL -
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

		TCLP LEACHATE CONCENTRATION ($\mu g/\ell$)				
SAMPLE LOCATION	DEPTH	CD	CR	PB	HG	NOTES
PBB-91-07	20	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-07	32	LT	LT	LT	LT	TCLP RL not exceeded
PBB-91-07	62	LT	LT	LT	LT	TCLP RL not exceeded

Notes:

1 TCLP Regulatory Level (RLs) exist for the following metals: AS, BA, CD, CR, SE, PB, HG, and AG. However, these results were reported only for CD, CR, PB, and HG. (See List of USATHAMA Chemical Codes for definitions of chemical abbreviations).

2 LT - Less than the Minimum Reporting Value; corrected for percent moisture, dilution, and percent recovery.

TABLE 6-18
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA FROM PREVIOUS PROGRAMS - SETTLING PONDS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	SAMPLE IDENTIFICATION AND DEPTH																			
	Settling Pond 1		Settling Pond 1			Settling Pond 1			Settling Pond 1			Settling Pond 2			Settling Pond 3			Settling Pond 4		
	S1201		S1202			S1203			S1204			S1205			S1206			S1207		
ANALYTE	0ft.	15ft.	0ft.	3ft.	15ft.	0ft.	3ft.	16ft.	0ft.	5ft.	19ft.	0ft.	0.6ft.	15ft.	0ft.	0.6ft.	15ft.	0ft.	0.6ft.	15ft.
24DNT		0.109		681	LT 0.0089	172	17.1	0.27		0.719	0.024	0.04	7.57	LT 0.0089	0.057	2.61	LT 0.0089		LT 0.0089	LT 0.0089
AL			9750			10700			14500			3750			1750			19000		
DBP		LT 3.0		LT 3.0	LT 3.0	LT 3.0	LT 3.0	LT 3.0		LT 3.0	LT 3.0	LT 3.0	LT 2.8	LT 3.0	LT 3.0	LT 3.0	LT 3.0		LT 3.0	LT 3.0
DEP		LT 4.0		1340	LT 4.0	460	106	11			LT 4.0	LT 4.0	135	LT 4.0	LT 4.0	44	LT 4.0		LT 4.0	LT 4.0
NC	59900								336						0.17			1030		
NO2	7.15								LT 7.15			LT 7.15			LT 7.15			3.4		
NO3	0.889								LT 0.889			LT 0.889			LT 0.889			LT 0.889		
PB			100			45			180			30			20			165		
SN			0.45			2.8			1.2			4.7			3.9			1.1		
SO4	1370		344			661			58.2			20.2			15.1			183		

SOURCE: USATHAMA IRDMIS

NOTES:
1) LT - Less Than
2) All units are ug/g
3) Blank spaces indicate that the sample was not analyzed for the analyte.
4) Sample depths are likely incorrect; the Envirodyne Report indicates that two samples were taken from each boring: approximately null to 15 ft., and 15 ft. to 30 ft.
5) This table represents all available data contained in the IRDMIS for Site ID's S1201 through S1207.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBM-82-01		PBM-82-02		PBM-82-03		PBM-82-04		PBM-82-05	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		11/25/91	04/10/92	11/23/91	04/10/92	11/25/91	04/11/92	11/24/91	04/11/92	11/23/91	04/11/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	111TCE	-	-	-	-	28.5 P	-	20.9	58.2	47.2	30.7
	11DCE	-	-	-	-	-	-	-	-	-	-
	11DCLE	-	-	-	-	-	-	-	-	-	-
	13DMB	-	-	-	-	-	-	-	-	-	-
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL4	27.5 P	3.63	9.8	12.7	20.6	9.02	46.1	68.6	50	42.2
	CH2CL2	6.27	7.16 B	3.82 P	7.35 B	5.69	7.35 B	4.22 P	6.57 B	3.92 P	7.45 B
	CHCL3	-	-	3.22	2.11	1.01	-	4.83	4.63	4.12	4.43
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	21.2	0.786	61.6	63.7	11.7	10.2	42.5	38.2	51	30.8
SVOCs	26DNT	-	-	-	-	-	-	-	-	-	-
	2BUXEL										
	2E1HXL										
	B2EHP	-	-	-	-	31.5 P	-	-	30 P	-	-
	BBZP	-	-	-	-	-	-	-	-	-	-
	NNDPA	-	-	-	-	-	-	-	-	-	-
Metals	BA										
	BE										
	CA										
	CD	-	-								
	CR	6.84	-								
	CU										
	FE										
	HG	-	2.83								
	K										
	MG										
	MN										
	NA										
	PB	-	-								
	V										
	ZN										
Anions	NIT	5000	4200	4200	5700	3600	3800	3000	2400	3600	3500
	NO3										
	CL	24000	25000 X	25000 P	25000 P	27000 X	26000 P	26000 X	24000 P	26000 P	26000 P
	SO4	33000	33000	50000	51000	38000	39000	67000	66000	61000	61000
Indicator parameter	ALK	300000	299000	298000	298000	300000	266000	322000	295000	320000	356000
	HARD	352000	342000	384000	326000	354000	370000	404000	384000	410000	408000
	TDS	395000	393000	401000	411000	432000	383000	488000	428000	425000	424000
	pH(1)	7.4	6.5	7.4	6.2	7.6	6.1	7.8	6.5	7.4	6.5
	Sp.Cond.(2)	488	574	593	602	498	554	600	595	626	612

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBM-85-01		PBM-85-02		PBM-85-03		PBM-85-04		PBM-85-05	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		11/21/91	04/25/92	11/10/91	04/14/92	11/21/91	04/14/92	11/08/91	04/14/92	11/08/91	04/12/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	111TCE	17.6	20.9	2.74 P	9.88	13.2	15.4	12.1	18.7	-	-
	11DCE	-	-	-	-	-	-	-	-	-	-
	11DCLE	-	-	-	-	-	-	-	-	-	-
	13DMB	-	-	-	-	-	-	-	-	-	-
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL4	51	69.6	30	62.7	66	73.5	37	51	9.9	8.92
	CH2CL2	3.73 P	6.08 B	4.41 P	6.27 B	4.02 P	5.78 B	3.92 P	5.49 B	3.92 P	6.76 B
	CHCL3	4.63	5.33	12.1	22.1	7.44	7.44	4.73	4.93	1.31	-
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	35	44.6	7.4	18	66	74.3	24	36.1	31	2.65
SVOCs	26DNT	-	-	-	-	-	1.28	-	-	-	-
	2BUXEL										
	2E1HXL										
	B2EHP					-	-				
	BBZP					-	-				
	NNDPA	-	-	-	-	25	24	-	-	-	-
Metals	BA										
	BE										
	CA										
	CD										
	CR										
	CU										
	FE										
	HG										
	K										
	MG										
	MN										
	NA										
	PB										
	V										
	ZN										
Anions	NIT	4500	5400	1800	1400	6300	6000	10000	10000	19000	18000
	NO3										
	CL	27000 P	27000 P	31000 P	36000	31000 P	32000 P	24000 P	25000 P	19000	23000
	SO4	70000	66000		53000	61000	58000	79000	55000		36000
Indicator parameter	ALK	315000	300000	301000	316000	337000	342000	293000	314000	280000	296000
	HARD	408000	420000	382000	400000	446000	443000	392000	420000	408000	446000
	TDS	476000	495000	447000	391000	487000	467000	479000	451000	475000	463000
	pH(1)	7.6	7.1	7.6	6.5	7.5	6.5	7.7	6.5	7.3	6.0
	Sp.Cond.(2)	702	657	701	701	737	766	754	732	783	778

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBM-85-06		PBM-89-05		PBM-89-06		PBM-89-07		PBM-89-08	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		11/06/91	04/14/92	11/09/91	04/14/92	11/11/91	04/24/92	11/07/91	04/23/92	11/06/91	04/12/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	111TCE	-	-	-	-	-	-	-	-	-	-
	11DCE	-	-	-	-	-	-	-	-	-	-
	11DCLE	-	-	-	-	-	-	-	-	-	-
	13DMB	-	-	-	-	-	-	-	-	-	-
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL4	-	-	22	16.7	52	64.7	-	-	8.2	21.6
	CH2CL2	3.92 P	6.37 B	3.73 P	5.98 B	4.41 P	7.25 B	4.12 P	7.16 B	4.41 P	-
	CHCL3	-	-	-	-	0.986	1.51	-	-	0.996	2.21
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	-	-	24	7.75	-	-	40	12.7
SVOCs	26DNT	-	-	-	-	-	-	-	-	-	-
	2BUXEL										
	2E1HXL										
	B2EHP										
	BBZP										
	NNDPA	-	-	-	-	-	-	-	-	-	-
Metals	BA										
	BE										
	CA										
	CD										
	CR										
	CU										
	FE										
	HG										
	K										
	MG										
	MN										
	NA										
	PB										
	V										
	ZN										
Anions	NIT		750	14000	16000	10000	13000	12000	14000		5500
	NO3	2200								8600	
	CL	10000	3700	23000	26000 X	38000	35000	17000	20000	17000	13000
	SO4	22000	30000	69000	92000	43000	38000		28000	42000	39000
Indicator parameter	ALK	248000	276000	258000	282000	316000	438000	252000	250000	296000	324000
	HARD	276000	297000	398000	406000	446000	446000	326000	341000	356000	358000
	TDS	387000	284000	493000	476000	509000	469000	469000	391000	467000	371000
	pH(1)	7.2	3.0	7.6	6.5	7.5	7.2	7.8	7.6	7.2	6.0
	Sp.Cond.(2)	527	485	704	780	711	373	604	516	652	623

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBM-89-09		PBM-89-11		PBN-82-01A		PBN-82-01B		PBN-82-01C	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		11/23/91	04/22/92	11/06/91	04/22/92	12/04/91	04/09/92	11/25/91	04/09/92	11/08/91	04/09/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	111TCE	-	-	-	-	-	-	-	-	-	-
	11DCE	-	-	-	-	-	-	-	-	-	-
	11DCLE	-	-	-	-	-	-	-	-	-	-
	13DMB	-	-	-	-	-	-	-	-	-	-
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL4	-	-	-	-	9.8	12.7	-	-	3.8	-
	CH2CL2	4.22 P	4.71 P	4.12 P	8.04 B	3.53 P	5.88 B	6.37	5.78 B	4.02 P	6.27 B
	CHCL3	2.62	2.41	-	0.513 P	1.21	-	-	3.22	3.12	-
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	0.436 P	-	-
	TRCLE	2.02	0.902	-	-	25.5	57.3	-	0.637	20	0.764
SVOCs	26DNT	-	-	-	-	-	-	-	-	-	-
	2BUXEL										
	2E1HXL										
	B2EHP										
	BBZP										
	NNDPA	-	-	-	-	-	-	-	-	-	-
Metals	BA										
	BE										
	CA										
	CD			-	-	-	-				
	CR			-	-	46.6	-				
	CU										
	FE										
	HG			-	-	-	-				
	K										
	MG										
	MN										
	NA										
	PB			10.5	-	-	-				
	V										
	ZN										
Anions	NIT	6000	5300	6000	5600	4900	4300	6300	6600	4400	5300
	NO3										
	CL	26000 P	29000 P	10000	9100	32000 P	35000	31000 P	36000	32000 P	36000
	SO4	30000	32000		21000	28000	30000	33000	34000		41000
Indicator parameter	ALK	258000	306000	294000	330000	242000	308000	285000	292000	265000	274000
	HARD	354000	340000	314000	314000	386000	340000	368000	352000	332000	342000
	TDS	396000	356000	436000	349000	352000	413000	413000	396000	459000	407000
	pH(1)	7.4	7.7	7.3	7.6	7.3	6.9	7.5	7.3	7.5	7.5
	Sp.Cond.(2)	536	611	637	581	667	679	506	655	639	646

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBN-82-02A		PBN-82-02B		PBN-82-02C		PBN-82-03A		PBN-82-03B	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		12/04/91	04/08/92	12/05/91	04/08/92	12/05/91	04/08/92	11/22/91	04/09/92	11/24/91	04/09/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	111TCE	-	-	-	-	-	-	-	6.37	-	-
	11DCE	-	-	-	-	-	-	-	-	-	-
	11DCLE	-	-	-	-	-	-	-	-	-	-
	13DMB	-	-	-	-	-	-	-	-	-	-
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL4	11.8	14.7	17.6	13.7	2.35 P	-	45	53.9	11.8	16.7
	CH2CL2	5.39	6.86 B	4.31 P	5.88 B	4.12 P	5.98 B	3.92 P	5.49 B	4.41 P	5.1 P
	CHCL3	3.92	-	3.62	0.694 P	4.53	3.92	4.12	5.63	1.31	1.11
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TCLE	84.9	99.8	117	98.7	9.98	4.56	5.4	5.52	7.9	6.79
SVOCs	26DNT	-	-	-	-	-	-	-	-	-	-
	2BUXEL										
	2E1HXL										
	B2EHP	-	35 P	-	52.5 P	-	-	-	-	65.3	-
	BBZP	-	-	-	-	-	-	-	-	-	-
	NNDPA	-	-	-	-	-	-	-	-	-	-
Metals	BA										
	BE										
	CA										
	CD	-	-								
	CR	13.7	-								
	CU										
	FE										
	HG	-	-								
	K										
	MG										
	MN										
	NA										
	PB	-	-								
	V										
	ZN										
Anions	NIT	6400	5700	6300	6800	6200	5800	2200	3000	2700	3300
	NO3										
	CL	30000 P	27000 P	30000 P	33000	31000 P	32000 P	18000	17000	21000	23000
	SO4	32000	33000	30000	32000	38000	39000	28000	27000	30000	29000
Indicator parameter	ALK	310000	315000	312000	335000	244000	232000	287000	297000	292000	301000
	HARD	432000	394000	384000	386000	344000	364000	334000	320000	334000	336000
	TDS	429000	441000	456000	445000	416000	395000	324000	3[illegible]000	407000	348000
	pH(1)	7.4	6.0	7.4	6.5	7.5	6.5	7.4	7.5	7.7	7.3
	Sp.Cond.(2)	817	631	617	627	524	569	538	607	517	611

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBN-82-03C		PBN-82-04A		PBN-82-04B		PBN-82-04C		PBN-82-05A	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		11/24/91	04/09/92	12/07/91	04/26/92	11/22/91	04/26/92	11/22/91	04/26/92	12/05/91	04/13/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	111TCE	-	-	-	5.6	-	-	-	-	43.9	49.4
	11DCE	-	-	-	-	-	-	-	-	-	-
	11DCLE	-	-	-	-	-	-	-	-	-	-
	13DMB	-	-	-	-	-	-	-	-	-	-
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	1.76 P	-	-	-
	CCL4	2.55 P	2.94 P	30.4	42.2	2.0 P	2.75 P	2.4 P	2.75 P	73.5	92.2
	CH2CL2	4.02 P	6.08 B	5.69	6.57 B	4.12 P	6.18 B	3.82 P	6.08 B	5.39	6.67 B
	CHCL3	1.01	0.483 P	1.61	4.63	4.73	4.73	4.23	5.03	5.03	5.23
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	-	1.91	15.9	13.8	4.1	4.88	4.7	5.2	64.8	63.7
SVOCs	26DNT	-	-	-	-	-	-	-	-	0.839 P	-
	2BUXEL										
	2E1HXL										
	B2EHP	-	28.0 P			-	79.6	-	28.7 P	-	105
	BBZP	-	-			-	-	-	-	-	16.0 S
	NNDPA	-	-		-	-	-	-	-	18.3	20
Metals	BA										
	BE										
	CA										
	CD										
	CR										
	CU										
	FE										
	HG										
	K										
	MG										
	MN										
	NA										
	PB										
	V										
	ZN										
Anions	NIT	3600	3800	5600		4000	4600	4300	4200	7900	8500
	NO3										
	CL	35000	37000	26000 P.		37000	36000	36000	37000	24000 X	24000 P
	SO4	42000	43000	52000		42000	42000	41000	42000	60000	51000
Indicator parameter	ALK	314000	325000	314000	**	280000	282000	283000	286000	332000	358000
	HARD	400000	382000			370000	368000	362000	380000	396000	422000
	TDS	449000	408000	365000		373000	407000	388000	401000	520000	465000
	pH(1)	7.7	7.3	7.8		7.6	7.2	7.5	7.2	8.1	6.0
	Sp.Cond.(2)	627	709	*		608	592	604	588	804	717

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBN-82-05B		PBN-82-05C		PBN-85-01A		PBN-85-02A		PBN-85-03A	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		12/05/91	04/13/92	12/06/91	04/13/92	11/10/91	04/24/92	11/21/91	04/23/92	11/13/91	04/25/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	111TCE	-	-	-	-	16.5	19.8	-	3.62 P	59.3	-
	11DCE	-	-	-	-	-	-	-	-	-	-
	11DCLE	-	-	-	-	1.4	-	-	-	-	-
	13DMB	-	-	-	-	-	-	-	-	-	-
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL4	7.75	11.8	5.78	3.33 P	30	39.2	78	108	61	72.5
	CH2CL2	5.59	5.49 B	3.14 P	6.08 B	4.9 P	7.75 B	4.22 P	7.65 B	4.12 P	7.75 B
	CHCL3	4.02	5.03	4.63	2.72	83.5	7.85	1.91	2.82	3.02	4.33
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	53.1	73.2	32.9	20.2	28	36.1	17	31.8	20	2.76
SVOCs	26DNT	1.1 P	1.46	-	-	-	-	-	-	-	-
	2BUXEL										
	2E1HXL										
	B2EHP	47.8 P	43 P	-	74.8						
	BBZP	-	-	-	-						
	NNDPA	4.52	8.03	2.25	2.46	-	-	0.955	-	-	-
Metals	BA										
	BE										
	CA										
	CD					-	-	-	-		
	CR					11	-	10.7	-		
	CU										
	FE										
	HG					-	-	-	-		
	K										
	MG										
	MN										
	NA										
	PB					11.2	-	-	-		
	V										
	ZN										
Anions	NIT	6400	5500	5700	5600	3000	5100	12000	16000	10000	14000
	NO3										
	CL	37000	38000	35000	37000	29000 P	31000 P	26000 X	25000 P	20000	21000
	SO4	140000	130000	69000	84000	68000	54000	37000	36000	32000	31000
Indicator parameter	ALK	276000	328000	254000	304000	302000	308000	326000	268000	270000	278000
	HARD	394000	500000	384000	426000	380000	400000	444000	458000	348000	370000
	TDS	517000	569000	481000	473000	453000	433000	452000	484000	392000	392000
	pH(1)	7.6	6.0	7.4	6.0	7.5	7.3	7.6	7.5	7.5	7.4
	Sp.Cond.(2)	984	800	733	696	714	349	729	588	602	560

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBN-85-04A		PBN-89-01B		PBN-89-01C		PBN-89-01D		PBN-89-02B	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		11/08/91	04/12/92	11/10/91	04/24/92	11/12/91	04/24/92	12/08/91	04/24/92	11/21/91	04/23/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	111TCE	-	-	-	-	59.3	3.73 P	-	-	-	-
	11DCE	-	0.655 P	-	-	-	-	-	-	-	-
	11DCLE	-	-	-	-	-	-	-	-	-	-
	13DMB	-	2.9 S	-	-	-	-	2.6 S	-	-	-
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL4	6.2	12.7	6.4	7.75	15	7.35	-	1.86 P	30	14.7
	CH2CL2	3.73 P	3.14 P	4.51 P	6.76 B	4.9 P	6.96 B	5.2 P	7.94 B	4.22 P	8.33 B
	CHCL3	1.31	2.11	35.2	3.22	4.43	5.33	5.73	4.63	3.72	2.82
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	-
	TCLEE	-	1.78	-	-	-	-	-	-	-	-
	TRCLE	61	11.7	92	14.9	28	44.6	0.488 P	2.12	22	11.7
SVOCs	26DNT	-	-	-	-	-	-	-	-	-	-
	2BUXEL										
	2E1HXL										
	B2EHP										
	BBZP										
	NNDPA	-	2.93	-	-	-	3.6	-	-	-	-
Metals	BA										
	BE										
	CA										
	CD	-	-	-	-	-	-	-	-		
	CR	9.73	-	-	-	8.14	-	6.32	-		
	CU										
	FE										
	HG	-	-	-	-	-	-	-	-		
	K										
	MG										
	MN										
	NA										
	PB	11.1	-	6.83	-	-	-	-	-		
	V										
	ZN										
Anions	NIT	11000 X	14000	4300	5000	4800	5300	6700	5000	8100	7600
	NO3										
	CL	24000	24000	33000	38000	33000	37000	26000 P	26000 P	27000 X	25000 P
	SO4		51000	59000	130000	78000	75000	37000	39000	47000	49000
Indicator parameter	ALK	299000	330000	277000	296000	296000	286000	350000	296000	320000	277000
	HARD	396000	416000	392000	386000	414000	436000	296000	357000	410000	400000
	TDS	513000	424000	423000	408000	488000	404000	348000	381000	40000	447000
	pH(1)	7.2	6.0	7.1	7.2	7.5	7.2	8.4	7.5	7.7	7.5
	Sp.Cond.(2)	726	713	701	339	672	357	688	320	682	550

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBN-89-02C		PBN-89-03B		PBN-89-03C		PBN-89-04B		PBN-89-04B	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		11/21/91	04/23/92	11/09/91	04/25/92	11/07/91	04/25/92	09/26/90	10/24/90	11/08/91	04/12/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	I	II	ONE	TWO
VOCs	111TCE	-	-	-	-	-	-			2.85 P	2.41 P
	11DCE	-	-	-	-	-	-	-	-	-	-
	11DCLE	-	-	-	-	-	-		-	-	-
	13DMB	-	-	-	-	-	-			-	-
	ACET	-	-	-	-	-	-			-	-
	C6H6	-	-	-	-	-	-			-	-
	CCL4	12	13.7	21	29.4	-	-	13.0	19.1	35	29.4
	CH2CL2	4.22 P	7.45 B	4.41 P	6.67 B	4.22 P	6.37 B			3.92 P	5.0 P
	CHCL3	2.52	1.81	1.61	1.61	-	-	2.31	2.66	6.04	5.13
	MEC6H5	-	-	-	-	-	-			-	-
	MEK	-	-	-	-	-	-			-	-
	TCLEE	-	-	-	-	-	-			-	-
	TRCLE	11	11.7	2	1.91	-	0.488 P	19.2	28.4	51	45.6
SVOCs	26DNT	-	-	-	-	-	-			1.39	0.976 P
	2BUXEL										
	2E1HXL										
	B2EHP										
	BBZP										
	NNDPA	-	-	-	-	-	-			-	11.8
Metals	BA										
	BE										
	CA										
	CD									-	-
	CR									11	-
	CU										
	FE										
	HG									-	-
	K										
	MG										
	MN										
	NA										
	PB									7.23	-
	V										
	ZN										
Anions	NIT	7000	7400	4300	4800	2700	3700			5900	6200
	NO3										
	CL	25000 P	25000 P	26000 P	27000 P	39000	41000			26000 P	30000 P
	SO4	45000	48000	47000	44000		48000			67000	57000
Indicator parameter	ALK	312000	286000	300000	324000	298000	342000			326000	240000
	HARD	396000	396000	374000	396000	412000	436000			408000	428000
	TDS	417000	424000	419000	423000	556000	453000			529000	448000
	pH(1)	7.5	7.2	7.2	7.3	7.4	7.2	7.3	7.5	7.4	6.0
	Sp.Cond.(2)	659	537	652	603	752	667	655	573	757	740

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBN-89-04C		PBN-89-04C		PBN-89-10A		PBN-89-10B		PBN-89-10C	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		09/26/90	10/24/90	11/09/91	04/13/92	12/05/91	04/10/92	12/06/91	04/26/92	12/13/91	04/26/92
ROUND:		I	II	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	111TCE			2.52 P	2.31 P	-	-	-	-	-	-
	11DCE	-	-	-	-	-	-	-	-	-	-
	11DCLE		-	-	-	-	-	-	-	-	-
	13DMB			-	-	-	-	-	-	-	-
	ACET			-	-	-	-	-	-	-	-
	C6H6			-	-	-	-	-	-	-	-
	CCL4	20.5	58.6	36	27.5	22.5	30.4	-	2.45 P	-	-
	CH2CL2			4.31 P	6.37 B	-	7.75 B	4.12 P	6.76 B	3.53 P	6.96 B
	CHCL3	3.24	6.89	6.64	5.03	2.82	1.81	3.22	2.52	1.21	3.12
	MEC6H5			-	-	-	-	-	-	-	-
	MEK			-	-	-	-	-	-	-	-
	TCLEE			-	-	-	-	-	-	-	-
	TRCLE	28.5	67.4	49	41.4	79.6	97.7	2.34	0.626	1.17	-
SVOCs	26DNT			-	-	-	-	-	-	-	-
	2BUXEL									5.0 S	
	2E1HXL									60 S	
	B2EHP					28.7 P	-	57.3	-	119	382
	BBZP					-	-	-	-	-	-
	NNDPA			-	10	-	-	-	-	-	-
Metals	BA										
	BE										
	CA										
	CD			-	-	-	-	-	-	-	-
	CR			8.61	-	7.73	-	8.32	-	9.79	-
	CU										
	FE										
	HG			-	-	-	4.31	-	-	-	-
	K										
	MG										
	MN										
	NA										
	PB			5.9	-	-	-	-	-	-	-
	V										
	ZN										
Anions	NIT			5800	4900	5100	4900	1700	5200	8100	5200
	NO3										
	CL			24000 P	27000 P	32000 P	32000 P	27000 P	26000 P	29000 P	26000 P
	SO4			68000	58000	26000	27000	42000	45000	41000	43000
Indicator parameter	ALK			316000	342000	328000	356000	250000	256000	254000	276000
	HARD			406000	428000	380000	444000	364000	354000	328000	348000
	TDS			455000	452000	447000	449000	420000	409000	576000	393000
	pH(1)	7.4	7.5	6.7	6.0	7.2	6.5	7.5	7.2	7.3	7.2
	Sp.Cond.(2)	772	573	698	688	633	672	639	565	423	562

Notes and flagging codes are presented at the end of this table.

TABLE 6 - 19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBN-89-10D		PBN-89-12A		PBN-89-12B		PBN-91-06C		PBN-91-	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		11/12/91	04/29/92	11/05/91	04/29/92	11/05/91	04/28/92	12/06/91	04/29/92	12/06/91	04/29/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	111TCE	-	-	-	-	-	-	-	-	-	-
	11DCE	-	-	-	-	-	-	-	-	-	-
	11DCLE	-	-	-	-	-	-	-	-	-	-
	13DMB	-	-	-	-	-	-	-	-	-	-
	ACET	-	-	-	-	-	17 S	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL4	-	-	-	-	26	30.4	-	-	-	-
	CH2CL2	4.22 P	6.96 B	4.31 P	8.24 B	3.92 P	7.25 B	3.92 P	6.67 B	4.12 P	6.76 B
	CHCL3	-	-	-	-	4.73	4.33	-	-	-	-
	MEC6H5	-	-	-	-	4.81 P	7.41 P	-	-	-	-
	MEK	-	-	-	-	-	-	37 S	-	120 S	42 S
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	0.91	1.8	-	-	18	25.5	0.998	-	-	-
SVOCs	26DNT	-	-	-	-	-	-	-	-	-	-
	2BUXEL										
	2E1HXL										
	B2EHP	-	-					-	-	43.8 P	94.6
	BBZP	-	-					-	-	-	-
	NNDPA	-	-	-	-	-	3.25	-	-	-	-
Metals	BA										
	BE										
	CA										
	CD	-	-	-	-	-	-	-	-	-	-
	CR	9.02	-	10.2	-	10.1	-	8.27	-	12.4	-
	CU										
	FE										
	HG	-	-	-	-	-	-	-	-	-	-
	K										
	MG										
	MN										
	NA										
	PB	-	-	6.69	-	-	-	-	-	-	-
	V										
	ZN										
Anions	NIT	-	1000	13000	11000	5700	6500	140	-	-	-
	NO3										
	CL	6700	7600	21000	21000	24000	25000 X	7700	7500	6800	7000
	SO4	99000	95000	20000	20000	60000	58000 X	91000	99000	100000	100000
Indicator parameter	ALK	269000	270000	292000	296000	299000	320000	280000	304000	256000	280000
	HARD	364000	356000	376000	396000	390000	420000	380000	398000	344000	380000
	TDS	431000	391000	529000	428000	513000	403000	441000	407000	433000	389000
	pH(1)	7.5	7.6	7.2	7.5	7.4	7.6	8.0	7.8	8.1	7.7
	Sp.Cond.(2)	562	548	723	593	719	606	706	627	701	625

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBN-91-12C		PBN-91-12D		LOM-89-01		LOM-91-01	
Sample Type:		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL	
DATE SAMPLED:		12/04/91	04/28/92	12/04/91	04/29/92	11/23/91	04/10/92	11/07/91	04/22/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	111TCE	-	-	-	-	-	-	-	-
	11DCE	-	-	-	-	-	-	-	-
	11DCLE	-	-	-	-	-	-	-	-
	13DMB	-	-	-	-	-	-	-	-
	ACET	-	-	12.0 S	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-
	CCL4	34.3	19.6	-	5.59	10.8	35.3	2.2 P	2.94 P
	CH2CL2	5.1 P	7.25 B	4.51 P	6.86 B	4.22 P	7.75 B	3.92 P	5.1 P
	CHCL3	7.24	3.02	1.81	1.61	1.01	0.956	1.41	0.503 P
	MEC6H5	-	-	-	-	-	-	-	-
	MEK	-	-	40 S	32 S	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-
	TRCLE	24.4	9.45	0.881	1.91	12.7	62.6	-	-
SVOCs	26DNT	-	-	-	-	-	-	-	-
	2BUXEL								
	2E1HXL								
	B2EHP	28.0 P	41.4 P	74.8	-	-	78	45.5 P	61
	BBZP	-	-	-	-	-	-	-	-
	NNDPA	2.19	1.53	-	-	-	-	-	-
Metals	BA					61	41.9 X	68	37.5
	BE					-	-	-	-
	CA					91000	90000	85000	90000
	CD	-	-	-	-	-	-	-	-
	CR	24.0	-	38.8	-	9.99	-	11.1	-
	CU					5.18	-	5.22	4.58
	FE					74.8	25.8	37	-
	HG	-	-	-	-	-	-	-	-
	K					1380 T	2650 T	1270 T	1480 T
	MG					50000	47000	48000	45000
	MN					-	-	12.6	-
	NA					-	22000 T	-	12000 T
	PB	-	-	-	-	-	-	-	-
	V					-	-	-	15.4
	ZN					87.6	-	-	-
Anions	NIT	5800	5600	3300	1900	5700	5200	4900	4900
	NO3								
	CL	21000	24000	10000	12000	45000	52000	23000	24000
	SO4	53000	61000 X	77000	82000	36000	35000		47000
Indicator parameter	ALK	354000	310000	256000	326000	303000	312000	289000	296000
	HARD	408000	416000	366000	414000	396000	406000	370000	367000
	TDS	421000	404000	455000	436000	477000	429000	491000	405000
	pH(1)	7.8	7.4	7.9	7.4	7.2	6.5	7.7	7.5
	Sp.Cond.(2)	638	592	660	595	645	659	646	635

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		LOM-91-02		LON-89-02A		LON-89-02B		LON-89-03A		LON-89-03B	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		12/13/91	04/22/92	12/07/91	04/22/92	12/07/91	04/22/92	12/07/91	04/22/92	12/07/91	04/22/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	111TCE	-	-	-	-	-	-	-	-	-	-
	11DCE	-	-	-	-	-	-	-	-	-	-
	11DCLE	-	-	-	-	-	-	-	-	-	-
	13DMB	2.7 S	-	-	-	-	-	-	-	-	-
	ACET	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CCL4	-	-	24.5	25.5	2.25 P	2.16 P	24.5	19.6	2.06 P	-
	CH2CL2	4.12 P	6.08 B	5.29	5.98 B	5.0 P	5.39 B	5.1 P	5.69 B	5.1 P	7.35 B
	CHCL3	0.543 P	0.956	1.51	1.11	-	2.11	1.31	0.503 P	-	0.755 P
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	MEK	12 S	-	-	-	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	53.1	34	3.61	-	28.7	17	2.44	-
SVOCs	26DNT	-	-	-	-	-	-	-	-	-	-
	2BUXEL										
	2E1HXL					11 S				10 S	
	B2EHP	159	100	-	-	175	92	-	-	191 P	217
	BBZP	-	-	-	-	-	-	-	-	-	-
	NNDPA	-	-	-	-	-	-	-	-	-	-
Metals	BA	43	37.3	63	72	37.8	39.9 X	53	44.9 X	49	63
	BE	-	-	-	0.36	-	-	-	-	-	-
	CA	85000	84000	97000	93000	96000	98000	91000	93000	120000 X	110000
	CD	2.8	-	-	-	-	-	-	-	-	-
	CR	8.23	-	6.62	-	8.48	-	8.8	-	8.36	-
	CU	-	4.86	-	-	-	-	-	-	-	65.03
	FE	33.8	-	44.8	-	32.6	-	-	-	27	-
	HG	-	-	-	-	-	-	-	-	-	-
	K	1160 T	1190 T	1440 T	1350 T	1170 T	1450 T	1280 T	1540 T	1320 T	1640 T
	MG	48000	43000	55000 X	50000	54000	50000	46000	47000	50000 GT	57000 X
	MN	-	-	-	-	-	-	-	-	-	-
	NA	-	16000 T	23000 T	19000 T	-	14000 T	-	25000 T	-	16000 T
	PB	-	-	5.54	-	-	-	-	-	-	-
	V	-	12.1	-	-	-	15.6	-	15.6	-	18.5
	ZN	-	-	-	-	-	-	-	-	-	-
Anions	NIT	7200	5800	7100	5700	16000	13000	8500	6900	21000	18000
	NO3										
	CL	23000 P	25000 P	73000	56000	25000 P	27000 P	42000	42000	25000 X	27000 X
	SO4	52000	58000 X	85000	69000	76000	77000	45000	47000	86000	88000
Indicator parameter	ALK	294000	288000	254000	319000	280000	319000	302000	481000	222000	290000
	HARD	398000	382000	480000	446000	430000	442000	358000	441000	462000	468000
	TDS	439000	413000	552000	496000	503000	473000	455000	460000	535000	436000
	pH(1)	7.4	7.6	7.4	7.1	7.5	7.2	7.5	7.2	7.5	7.6
	Sp.Cond.(2)	475	652	596	715	516	682	504	670	560	814

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		SPN-89-01C		SPN-89-02A		SPN-89-02B		SPN-89-02C		SPN-89-03B	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		12/10/91	04/23/92	11/19/91	04/29/92	11/19/91	04/28/92	11/19/91	04/28/92	09/26/90	10/24/90
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	I	II
VOCs	13DMB	3.6 S	-	-	-	-	-	-	-		
	ACET	-	-	-	-	-	-	-	-		
	CCL4	-	-	-	-	4.5	21.6	29	23.5	32.6	46.3
	CH2CL2	4.41 P	7.55 B	3.92 P	6.37 B	4.61 P	7.35 B	4.22 P	7.45 B		
	CHCL3	0.755 P	0.966	-	-	0.996	1.01	2.01	1.61	2.64	3.6
	MEK	-	-	-	-	-	-	-	-		
	TRCLE	-	-	-	-	-	-	-	-	5.71	4.07
SVOCs	2BUXEL										
	2E1HXL										
	B2EHP	30.3 P	-	-	-	43.8 P	-	-	49 P		
Metals	BA	32.5	33.6	89	70	34.2	33.1	37.1	32.5		
	BE	-	-	-	0.582	-	0.357	-	-		
	CA	77000	85000	130000	120000 X	82000	84000	79000	58000		
	CD	-	-	-	-	-	-	-	-		
	CR	7.63	-	11.8	-	7.77	-	7.33	-		
	CU	4.99	10.1	23.1	20	-	5.52	-	7.6		
	FE	27.9	26.6	29.5	-	41.9	-	37	27.8		
	K	992 T	1470 T	1570 T	2690 T	755 T	1650 T	761 T	21000 T		
	MG	38000	39000	48000	40000	48000	44000	45000	38000		
	MN	-	-	-	-	-	-	-	-		
	NA	-	16000 T	-	94000 T	-	11000 T	-	24000 T		
	NI	-	9.28	9.35	-	-	-	-	-		
	PB	-	-	-	-	-	13.6	-	7.02		
	V	-	19.1	-	-	-	-	-	-		
	ZN	-	-	-	-	-	-	-	-		
Anions	NIT	15000	9200	8300	10000	8100	9900	7700	9600		
	CL	21000	24000	74000	76000	15000	19000	18000	19000		
	SO4	41000	42000	62000	62000	41000	43000	43000	42000		
Indicator parameter	ALK	262000	247000	397000	364000	296000	292000	298000	300000		
	HARD	308000	362000	508000	520000	366000	378000	382000	276000		
	TDS	411000	375000	621000	589000	395000	409000	397000	400000		
	pH(1)	7.5	7.6	7.2	7.3	7.8	7.6	7.8	7.4	7.5	7.7
	Sp.Cond.(2)	641	621	1002	961	644	568	656	569	657	515

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		SPN-89-03B		SPN-89-03C		SPN-89-03C		SPN-89-04B		SPN-89-04C	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		12/10/91	04/27/92	09/26/90	10/24/90	11/20/91	04/27/92	11/20/91	04/27/92	12/13/91	04/27/92
ROUND:		ONE	TWO	I	II	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	13DMB	-	-			-	-	-	-	-	-
	ACET	65 S	-			-	-	-	-	-	-
	CCL4	46.1	71.6	167	155	97	89.2	24	8.43	16.7	16.7
	CH2CL2	5.2 P	7.35 B			3.53 P	7.45 B	3.92 P	6.96 B	3.53 P	6.76 B
	CHCL3	5.13	6.04	13.3	9.78	7.85	8.25	3.52	1.91	2.82	3.82
	MEK	-	-			-	-	-	-	-	-
	TRCLE	1.59	2.44	2.22	1.96	0.95	0.892	4.7	2.44	2.23	2.12
SVOCs	2BUXEL									7.7 S	
	2E1HXL										
	B2EHP	223	51			-	66.9	-	175	-	-
Metals	BA	30.8	31.4			39	40.4 X	51	44 X	36.6	41.6 X
	BE	-	0.376			-	-	-	-	-	-
	CA	79000	77000			84000	78000	98000	81000	89000	89000
	CD	-	-			-	-	-	-	-	-
	CR	8.94	-			13	-	13	-	7.61	-
	CU	-	-			-	-	-	8.64	-	-
	FE	-	-			-	28.2	-	-	42.5	-
	K	799 T	1480 T			920 T	1500 T	980 T	2160 T	877 T	1550 T
	MG	43000	41000			47000	42000	52000	41000	49000	48000
	MN	-	-			-	-	-	-	-	-
	NA	-	10000 T			4600 T	9200 T	5200 T	23000 T	-	19000 T
	NI	-	-			-	-	-	-	-	-
	PB	-	10.1			8.17	-	8.8	-	-	-
	V	-	-			-	-	-	-	-	-
	ZN	-	-			-	-	-	29	-	-
Anions	NIT	7500	6300			6600	8000	7900	5600	12000	9000
	CL	15000	17000			18000	19000	20000	36000	20000	21000
	SO4	50000	50000			53000	57000 X	47000	48000	52000	58000 X
Indicator parameter	ALK	266000	230000			292000	260000	336000	298000	352000	320000
	HARD	347000	368000			374000	384000	430000	386000	374000	426000
	TDS	395000	304000			415000	411000	455000	440000	403000	461000
	pH(1)	7.5	7.3	7.5	7.6	7.4	7.4	7.2	7.4	7.5	7.4
	Sp.Cond.(2)	631	557	686	531	643	600	706	632	605	625

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		SPN-89-05A		SPN-89-05B		SPN-91-02D		SPN-91-03D		SPN-91-04D	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		11/23/91	04/24/92	11/23/91	04/24/92	12/13/91	04/29/92	12/10/91	04/29/92	12/13/91	04/29/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	13DMB	-	-	-	-	-	-	-	-	-	-
	ACET	-	-	-	-	-	-	-	-	-	-
	CCL4	-	-	-	-	-	3.14 P	11.8	28.4	-	-
	CH2CL2	4.22 P	6.76 B	4.51 P	7.55 B	3.33 P	7.16 B	5.0 P	6.67 B	3.33 P	6.96 B
	CHCL3	-	-	1.01	-	-	2.92	1.31	2.52	-	-
	MEK	-	-	-	-	-	-	6.9 S	-	12 S	-
	TRCLE	-	-	-	-	-	-	-	0.584	-	0.775
SVOCs	2BUXEL										
	2E1HXL					20 S					
	B2EHP	-	-	-	-	97.1	81.2	175 X	87.6	92.4	35 P
Metals	BA	39.5 X	33	33.8	36.9	32.3	24.4	25.4	29.9	77	98
	BE	-	-	-	-	-	0.374	-	0.397	-	-
	CA	92000	78000	76000	81000	-	77000	84000	89000	70000	68000
	CD	-	-	-	-	-	-	-	-	-	-
	CR	9.66	-	10.3	-	7.28	-	7.54	-	5.2	-
	CU	4.87	-	5.88	-	-	-	-	6.78	-	-
	FE	-	-	-	-	28.8	-	30.5	-	25.5	34.4
	K	1000 T	1170 T	1320 T	1600 T	811 T	1980 T	956 T	2040 T	769 T	2000 T
	MG	25000	23000	32000	34000	-	41000	43000	42000	35000	34000
	MN	1000	700	-	-	-	-	-	-	590	570
	NA	-	14000 T	3000 T	6900 T	3110 T	13000 T	-	11000 T	2610 T	12000 T
	NI	10.3	-	-	-	-	-	-	-	-	-
	PB	-	-	-	-	-	10.6	-	-	-	-
	V	-	-	-	-	-	-	-	-	-	-
	ZN	162	-	238 X	-	-	-	-	-	-	-
Anions	NIT	560	1300	3400	4600	5400	4600	6500	5200	1100	-
	CL	12000	11000	10000	12000	9700	11000	11000	14000	6600	7600
	SO4	38000	39000	29000	30000	42000	44000	68000	70000	51000	53000 X
Indicator parameter	ALK	267000	264000	260000	242000	256000	276000	268000	296000	278000	262000
	HARD	310000	298000	314000	318000	300000	356000	376000	400000	282000	320000
	TDS	345000	319000	327000	348000	369000	376000	425000	445000	472000	347000
	pH(1)	7.4	7.5	7.5	7.5	7.6	7.8	7.6	7.4	7.6	7.3
	Sp.Cond.(2)	494	490	456	535	389	584	664	578	445	466

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		S1101		S1102		S1103		S1104		S1105	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		12/11/91	04/25/92	12/12/91	04/24/92	11/20/91	04/21/92	12/13/91	04/23/92	12/13/91	04/23/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	13DMB	-	-	-	-	-	-	-	-	-	-
	ACET	-	-	-	-	-	-	-	-	-	-
	CCL4	-	-	-	-	8.9	4.51	-	-	-	-
	CH2CL2	5.0 P	5.88 B	4.41 P	6.18 B	4.41 P	6.27 B	4.71 P	7.65 B	4.12 P	7.75 B
	CHCL3	-	-	-	1.21	-	-	-	-	-	-
	MEK	8.0 S	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	-	-	-	0.329 P	-	-	-	-
SVOCs	2BUXEL							6.0 S			
	2EHIXL										
	B2EHP			-	-	-	40 P	-	-	-	111
Metals	BA			35.3	36.7	41.2 X	34.6	33	30.9	56	120
	BE			-	0.453	-	-	-	-	-	-
	CA			100000	97000	99000	84000	81000	71000	85000	96000
	CD			-	-	-	-	3.61	-	-	-
	CR			10.1	-	12.9	-	9.91	-	6.55	-
	CU			4.89	-	5.82	4.92	-	-	-	-
	FE			66.9	-	25.8	45.7	-	-	-	-
	K			1280 T	1470 T	890 T	960 T	793 T	836 T	1470 T	1180 T
	MG			25000	24000	53000	40000	31000	27000	26000	31000
	MN			-	-	-	-	-	-	24	-
	NA			19000 T	27000 T	-	23000 T	2090 T	2420 T	2870 T	15000 T
	NI			-	-	-	-	-	-	-	-
	PB			-	-	-	-	-	-	-	-
	V			-	-	5.01	11.5	-	-	-	-
	ZN			-	-	320	-	-	-	-	-
Anions	NIT	5100		6700	6300	7100	5600	4200	2300	5100	2300
	CL	140000		27000 P	27000 P	26000 X	27000 P	2400 P	2700 P	4800	5600
	SO4	21000		46000	49000	52000	53000 X	28000	26000	33000	39000
Indicator parameter	ALK			320000	320000	304000	309000	278000	300000	288000	300000
	HARD			380000	387000	380000	392000	334000	326000	340000	342000
	TDS			347000	451000	419000	427000	373000	345000	371000	335000
	pH(1)	7.3	7.3	7.3	6.8	7.2	7.3	7.4	7.4	7.3	7.4
	Sp.Cond.(2)	916	538	622	696	672	592	500	541	516	592

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		S1106		S1107		S1108		S1109		S1117	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		12/13/91	04/23/92	12/13/91	04/25/92	12/13/91	04/23/92	12/12/91	04/22/92	11/24/91	04/11/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
vOCs	111TCE									3.29 P	2.41
	13DMB	-	-	-	-	-	-			-	-
	ACET	-	-	-	-	-	-			-	-
	CCL4	-	-	-	-	-	-			13.7	16.7
	CH2CL2	4.22 P	7.16 B	3.24 P	7.25 B	4.61 P	67.75 B	4.31 P	7.65 B	4.61 P	5.78
	CHCL3	-	0.915	3.62	-	-	-	-	-	2.52	2.31
	MEK	-	-	-	-	-	-			-	-
	TRCLE	-	-	-	-	-	-			11.7	10.6
SVOCs	2BUXEL										
	2E1HXL										
	B2EHP	-	31.5 P	31.5 P	-	-	-	-	-	28.0 P	-
Metals	BA	27	33.1	48	43.6 X	72	130	46	53		
	BE	-	-	-	0.408	-	0.348				
	CA	60000	71000	75000	78000	82000	83000	86000	90000		
	CD	-	-	-	-	-	-			-	-
	CR	7.36	-	6.23	-	4.93	-	7.8	-	9.16	-
	CU	-	-	-	-	-	-	-	6.91		
	FE	-	-	34.7	-	504	448	33.4	-		
	K	793 T	1030 T	600 T	836 T	546 T	1310 T	672 T	1040 T		
	MG	29000	34000	31000	31000	12000	13000	47000	45000		
	MN	-	-	-	-	1700	1700				
	NA	3280 T	12000 T	-	24000 T	-	21000 T	-	11000 T		
	NI	-	-	-	-	-	-	-	-		
	PB	-	-	-	-	-	12	-	-	-	-
	V	-	-	-	-	-	-	-	19.0		
	ZN	-	-	-	-	-	-	-	-		
Anions	NIT	4800	4900	2900	1800	-	-	21000	18000	3800	3200
	CL	14000	15000	32000 P	41000	29000 P	25000 P	21000 P	25000 X	38000	39000
	SO4	37000	28000	13000	11000	62000	60000 X	26000	26000	52000	53000
Indicator parameter	ALK	205000	220000	260000	310000	178000	186000	312000	273000	306000	316000
	HARD	296000	296000	292000	304000	214000	276000	380000	395000	392000	288000
	TDS	321000	315000	343000	348000	379000	336000	415000	400000	444000	400000
	pH(1)	7.6	7.8	7.3	7.5	7.1	7.1	7.3	7.4	7.7	6.0
	Sp.Cond.(2)	447	507	389	581	314	396	474	628	622	605

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		S1133		S1146	S1147		S1148		S1149	
Sample Type:		WELL		WELL	WELL		WELL		WELL	
UNITS:		UGL		UGL	UGL		UGL		UGL	
DATE SAMPLED:		12/10/91	04/23/92	04/12/92	11/20/91	04/26/92	12/13/91	04/24/92	12/13/91	04/25/92
ROUND:		ONE	TWO	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	13DMB	-	-	-	-	-	-	-	-	-
	ACET	-	-	-	-	-	-	-	-	-
	CCL4	-	-	35.3	-	-	-	-	-	-
	CH2CL2	4.61 P	8.14 B	3.53 P	4.22 P	6.08 B	3.73 P	7.35 B	3.63 P	5.78 B
	CHCL3	0.634 P	0.775 P	3.72	-	0.503 P	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-
	TRCLE	-	-	4.99	-	-	-	-	-	-
SVOCs	2BUXEL								8.0 S	
	2E1HXL									
	B2EHP	-	-	49.4 P	-	-	-	-	-	-
Metals	BA	31.4	33.8		24.1	30.4	61	97	35	35.3
	BE	-	-		-	-	-	-	-	-
	CA	74000	87000		67000	65000	89000	84000	82000	72000
	CD	3.43	-		-	-	-	-	-	-
	CR	6.4	-		8.11	-	8.03	-	5.35	-
	CU	-	6.91		7.68	-	7.28	6.24	6.47	6.37
	FE	27.8	-		33.1	-	61.6	29.2	-	38
	K	895 T	1340 T		1170 T	2060 T	1570 T	1960 T	1080 T	1440 T
	MG	34000	41000		35000	34000	40000	37000	38000	34000
	MN	-	-		-	-	-	-	-	-
	NA	-	14000 T		22000 T	78000 T	-	80000 T	16000 T	24000 T
	NI	-	-		-	-	-	-	-	-
	PB	-	-		8.49	-	-	-	-	11.8
	V	-	16.6		-	-	-	-	-	-
	ZN	-	-		-	-	-	-	-	-
Anions	NIT	11000 X	9200	3800	6200	3800	6200	3000	4800	3800
	CL	20000	24000	18000	27000 P	69000	75000	58000	38000	625000 P
	SO4	637000	39000	27000	37000	43000	48000	41000	46000	37000
Indicator parameter	ALK	259000	290000	298000	258000	238000	322000	318000	224000	264000
	HARD	311000	356000	324000	302000	312000	341000	360000	290000	322000
	TDS	385000	411000	325000	377000	413000	477000	437000	485000	389000
	pH(1)	7.5	7.6	6.0	7.2	7.6	7.2	7.4	7.6	7.7
	Sp.Cond.(2)	643	620	512	604	648	699	753	544	589

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		S1152A		S1152B	
Sample Type:		WELL		WELL	
UNITS:		UGL		UGL	
DATE SAMPLED:		12/11/91	4/25/92	12/11/91	04/25/92
ROUND:		ONE	TWO	ONE	TWO
VOCs	13DMB	2.4 S	-	-	-
	ACET	-	-	-	-
	CCL4	-	-	-	2.55 P
	CH2CL2	4.51 P	5.98 B	4.41 P	6.27 B
	CHCL3	-	-	-	-
	MEK	-	-	-	-
	TRCLE	-	-	-	-
SVOCs	2BUXEL				
	2E1HXL				
	B2EHP	28 P	-	-	40.3 P
Metals	BA	75	79	54	86
	BE	-	0.54	-	0.373
	CA	120000 X	110000	110000	98000
	CD	-	-	-	-
	CR	7.19	-	7.39	-
	CU	8.32	-	7.51	7.14
	FE	127	155	53.4	27.1
	K	1250 T	1370 T	1350 T	1630 T
	MG	35000	32000	28000	27000
	MN	11.2	-	-	-
	NA	-	17000 T	18000 T	24000 T
	NI	-	-	-	-
	PB	-	-	7.45	-
	V	-	-		-
	ZN	1900	182	250	66.8
Anions	NIT	8400	6100	8700	6800
	CL	26000 P	25000 P	31000 P	30000 P
	SO4	51000	53000	47000	49000
Indicator parameter	ALK	328000	320000	283000	334000
	HARD	440000	388000	370000	358000
	TDS	487000	479000	445000	441000
	pH(1)	8.3	7.4	8.0	7.6
	Sp.Cond.(2)	798	704	741	675

Notes and flagging codes are presented at the end of this table.

TABLE 6-19
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PROPELLANT BURNING GROUND/ LANDFILL 1/ SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

*	=	Meter not functioning
**	=	Purged dry
(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

Appendix K contains complete analytical results.

USATHAMA chemical codes are defined in the RI Report Glossary

TABLE 6-20
CHEMICAL AND PHYSICAL PROPERTIES OF MAJOR ORGANIC CONTAMINANTS - PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREAS[A]

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

CHEMICALS	CAS#	MOLECULAR WEIGHT (g/mole)	DENSITY (g/mℓ)	WATER SOLUBILITY (mg/ℓ)	VAPOR PRESSURE (mmHg)	HENRY'S LAW CONSTANT (atm-m^3/mole)	K_{oc}[b] (mℓ/g)	K_{ow}[c] (mℓ/mℓ)
Volatile Organic Compounds								
C6H6	71-43-2	78	0.8786	1.75×10^3	95.2	5.58×10^{-3}	83	132
CCL4	56-23-5	154	1.594	7.57×10^2	90	2.41×10^{-2}	110	437
CHCL3	67-66-3	119	1.483	8.2×10^3	150.5	2.88×10^{-3}	44	91
111TCE	71-55-6	133	1.32	1.50×10^3	123	1.44×10^{-2}	152	316
TRCLE	79-01-6	132	1.45	1.10×10^3	57.9	9.10×10^{-3}	126	240
XYLEN	1330-20-7	106		1.98×10^2	10	7.04×10^{-3}	240	1.82×10^3
(ortho)	95-47-6	106	0.88	1.75×10^2	10			8.91×10^2
(meta)	108-38-3	106	0.864	1.30×10^2	10			1.82×10^3
(para)	106-42-3	106	0.86	1.98×10^2	10			1.41×10^3
Semivolatile Organic Compounds								
24DNT	121-14-2	182	1.32 (CRC)	2.40×10^2	5.10×10^{-3}	5.09×10^{-8}	45/250 (HO)	1.29×10^5 100
26DNT	606-20-2	182	1.28 (CRC)	1.80×10^2	1.80×10^{-2}	3.27×10^{-8}	92	100
NNDPA	86-30-6	198	1.23 (CRC)	1.13×10^2	$6.3E\times10^{-4}$	1.4×10^{-8}	650 (ADL)	1.35×10^3 (ADL)

Notes:

[A] All data from the Risk Assessment Guidance for Superfund (USEPA, 1989a) unless otherwise noted: ADL = Arthur D. Little, 1985; CRC = CRC Handbook of Chemistry and Physics (Weast, 1980-81); and HO = Ho, 1988.

[B] K_{oc} = partition coefficient between the organic chemical and carbon.

[C] K_{ow} = partition coefficient of the chemical between octanol and water.

See the List of USATHAMA Chemical Codes in the Glossary for definitions of chemical abbreviations.

TABLE 6-21
COMPOUNDS OF POTENTIAL CONCERN -
PROPELLANT BURNING GROUND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND OF POTENTIAL CONCERN	EXPOSURE POINT CONCENTRATION	
	SURFACE SOIL[1] (µg/g)	SUBSURFACE SOIL[2] (µg/g)
24DNT	10.7	58.9
26DNT	1	2
2MNAP	0.452	18.2
ANAPNE	-	16.9
ANAPLY	-	1.04
ANTRC	-	12.4
AS	9.45	18.8
B2EHP	6.2	6.2
BAANTR	0.204	8.9
BAPYR	-	3.55
BBFANT	-	3.91
BGHIPY	-	2.57
BKFANT	-	3.36
C6H6	0.42	9.09
CHRY	3.68	8.28
CR	49.8	40.4
CU	344	327.19
DBAHA	-	0.661
DBZFUR	-	5.8
DEP	6.2	6.2
DNBP	6.35	6.2
FANT	0.2	6.2
FLRENE	-	18.4
HG	0.334	-
ICDPYR	-	4.52
MEC6H5	-	14.4
NAP	-	6.2
NI	27.3	-
NIT	-	35
NNDPA	30.8	12
PB	2700	1200
PHANTR	1.32	12

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continued

TABLE 6-21
COMPOUNDS OF POTENTIAL CONCERN -
PROPELLANT BURNING GROUND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND OF POTENTIAL CONCERN	EXPOSURE POINT CONCENTRATION	
	SURFACE SOIL[1] (µg/g)	SUBSURFACE SOIL[2] (µg/g)
PYR	0.168	6.2
SE	0.618	1.77
SO4	-	280
TRCLE	-	0.23
TXLEN	-	39.5
ZN	1040	1253.94

Notes:

-- = Not identified as a compound of potential concern.
Exposure point concentrations is the 95th percentile concentration.
µg/g = micrograms per gram; equivalent to parts per million (ppm).

1 Assessment of surface soil contamination was performed using samples PBS-91-01 through PBS-91-108. In addition, the upper portions of samples PBS-91-109 through PBS-91-114 were used to assess contamination of surface soil by 24DNT, 26DNT, C6H6, and CCL3F.

2 Assessment of subsurface soil contamination from 0 to 12 feet was performed using data from the following borings, test pits, and surface soil samples: LOB-90-01, LOB-90-02, PBB-90-01, PBB-90-02, PBT-90-01 through PBT-90-08, PBB-91-01 through PBB-91-07, and the deeper samples from PBS-91-109 through PBS-91-118.

TABLE 6-22
SUMMARY OF RISK ESTIMATES -
PROPELLANT BURNING GROUND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

EXPOSURE SCENARIO	EXPOSURE ROUTE	CANCER RISK	HAZARD INDEX
Current and Future Grounds Maintenance Worker	Soil Ingestion	$2x10^{-6}$	0.005
	Inhalation of particulates and vapors	$2x10^{-8}$	0.0000002
	Total for Grounds Maintenance Worker	$2x10^{-6}$	0.005
Future Residential	Soil Ingestion	$8x10^{-5}$	0.8
Future Farmer	Soil Ingestion	$1x10^{-5}$	0.02
	Inhalation of Particulates and Volatiles	$7x10^{-5}$	0.03
	Total for Farmer	$8x10^{-5}$	0.05
Future Construction Worker	Soil Ingestion	$2x10^{-6}$	0.8
	Inhalation of Particulates and Volatiles	$1x10^{-7}$	0.00007
	Total for Construction Worker	$2x10^{-6}$	0.8

TABLE 6-23
COMPOUNDS OF POTENTIAL CONCERN - SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	EXPOSURE POINT CONCENTRATION* - (µg/g)														
	FINAL CREEK OUTFLOW		FINAL CREEK	SETTLING POND 1		SETTLING POND 2		SETTLING POND 3		SETTLING POND 4	SPOILS DISPOSAL AREA 1	SPOILS DISPOSAL AREA 2	SPOILS DISPOSAL AREA 3	SPOILS DISPOSAL AREA 4	SPOILS DISPOSAL AREA 5
COMPOUND OF CONCERN	SUR.[1]	SUB.[2]	SUR.[3]	SUR.[4]	SUB.[5]	SUR.[6]	SUB.[7]	SUR.[8]	SUB.[9]	SUR.[10]	SUR.[11]	SUR.[12]	SUR.[13]	SUR.[14]	SUR.[15]
24DNT	--	--	6	172	17.1	7.6	0.04	2.6	0.057	--	12	1.3	1.1	0.7	--
26DNT	--	--	40	26	--	--	--	1.5	--	--	1	--	--	--	--
2NNDPA	--	--	2	0.97	--	--	--	--	--	--	--	--	--	--	--
AL	--	--	--	--	--	--	--	--	--	60,000	--	--	--	--	--
ANAPYL	0.166	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B2EHP	1.02	--	--	--	--	--	--	--	--	--	0.35	--	--	0.32	--
BAANTR	0.185	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BBFANT	0.723	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BGHIPY	0.618	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BKFANT	0.635	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BR	--	--	--	--	--	--	--	--	--	--	12	4	--	--	16
CH2CL2	--	--	--	--	--	--	--	--	--	--	0.034	0.024	0.025	0.038	0.026
CHRY	0.264	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CL	--	--	--	--	--	--	--	--	--	--	19	23	17	13	18
DEP	--	--	0.13	460	1,340	135	--	44	--	--	--	--	--	--	--
DNOP	--	--	26	14	--	0.74	--	17.4	--	--	51	5.8	4	4.4	6.5

continued

TABLE 6-23
COMPOUNDS OF POTENTIAL CONCERN - SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	EXPOSURE POINT CONCENTRATION* - (µg/g)														
	FINAL CREEK OUTFLOW		FINAL CREEK	SETTLING POND 1		SETTLING POND 2		SETTLING POND 3		SETTLING POND 4	SPOILS DISPOSAL AREA 1	SPOILS DISPOSAL AREA 2	SPOILS DISPOSAL AREA 3	SPOILS DISPOSAL AREA 4	SPOILS DISPOSAL AREA 5
COMPOUND OF CONCERN	SUR.[1]	SUB.[2]	SUR.[3]	SUR.[4]	SUB.[5]	SUR.[6]	SUB.[7]	SUR.[8]	SUB.[9]	SUR.[10]	SUR.[11]	SUR.[12]	SUR.[13]	SUR.[14]	SUR.[15]
DNDP	--	--	--	--	--	--	--	--	--	--	8.6	--	--	0.63	0.2
DPA	--	--	15	10	--	1.5	--	2.8	--	--	24	3.2	2.2	1.1	2.4
FANT	0.407	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HG	0.505	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NC	--	--	740	60,000	--	280	--	190	0.17	1,038	11,000	8,000	3,800	3,000	11,000
NG	--	--	--	--	--	--	--	--	--	--	19	--	--	--	--
NH3	--	--	1,800	740	--	840	--	520	--	960	--	--	--	--	--
NIT	3.53	3.76	11	13	--	43	--	4.9	--	10	16	10	22	12	18
PB	--	--	40	180	--	250	--	--	--	300	349	373	67	120	102
PHANTR	0.173	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PYR	0.487	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SN	--	--	63	57	--	53	4.7	72	3.9	77	3.68	4.04	5.8	1.64	1.94
SO4	18.2	35.8	260	2,500	--	64	20.2	36	15.2	400	146	130	75	139	38

continued

TABLE 6-23
COMPOUNDS OF POTENTIAL CONCERN - SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	EXPOSURE POINT CONCENTRATION* - (μg/g)														
	FINAL CREEK OUTFLOW		FINAL CREEK	SETTLING POND 1		SETTLING POND 2		SETTLING POND 3		SETTLING POND 4	SPOILS DISPOSAL AREA 1	SPOILS DISPOSAL AREA 2	SPOILS DISPOSAL AREA 3	SPOILS DISPOSAL AREA 4	SPOILS DISPOSAL AREA 5
COMPOUND OF CONCERN	SUR.[1]	SUB.[2]	SUR.[3]	SUR.[4]	SUB.[5]	SUR.[6]	SUB.[7]	SUR.[8]	SUB.[9]	SUR.[10]	SUR.[11]	SUR.[12]	SUR.[13]	SUR.[14]	SUR.[15]
ZN	--	--	--	--	--	--	--	--	--	--	212	748	251	204	306

Notes:

* Exposure point concentration is the maximum concentration detected
Subsurface data available only for Final Creek Outflow, Settling Pond 1, Settling Pond 2, and Settling Pond 3.
-- = not identified as compound of potential concern
μg/g = micrograms per gram; equivalent to parts per million (ppm)
Sur. = Surface
Sub. = Subsurface

1 Assessment of surface soil contamination (0 to 2 feet) was performed using data from boring SPB-91-01.
2 Assessment of subsurface soil contamination (2 to 12 feet) was performed using data from boring SPB-91-01.
3 Assessment of surface soil contamination (0 to 2 feet) was performed using data from samples FC-1 through FC-8.
4 Assessment of surface soil contamination (0 to 2 feet) was performed using data from samples FPI-1 through FPI-14, and S1201 through S1204.
5 Assessment of subsurface soil contamination (2 to 16 feet) was performed using data from samples S1201 through S1204.
6 Assessment of surface soil contamination (0 to 2 feet) was performed using data from samples FPII-1 through FPII-3 and S1205.
7 Assessment of subsurface soil contamination (2 to 16 feet) was performed using data from sample S1205.
8 Assessment of surface soil contamination (0 to 2 feet) was performed using data from samples FPIII-1 through FPIII-15 and S1206.
9 Assessment of subsurface soil contamination (2 to 16 feet) was performed using data from boring S1206.
10 Assessment of surface soil contamination (0 to 2 feet) was performed using samples FPIV-1 through FPIV-10 and S1207.
11 Assessment of surface soil contamination (0 to 2 feet) was performed using samples SD1-1 through SD1-5.
12 Assessment of surface soil contamination (0 to 2 feet) was performed using samples SD2-1 through SD2-5.
13 Assessment of surface soil contamination (0 to 2 feet) was performed using samples from SD3-1 through SD3-10.
14 Assessment of surface soil contamination (0 to 2 feet) was performed using samples from SD4-1 through SD4-10.
15 Assessment of surface soil contamination (0 to 2 feet) was performed using samples from SD5-1 through SD5-10.

TABLE 6-24
SUMMARY OF RISK ESTIMATES -
SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

EXPOSURE SCENARIO	EXPOSURE ROUTE	CANCER RISK	HAZARD INDEX
Final Creek Outflow			
Current and Future Grounds Maintenance Worker	Soil Ingestion	$4x10^{-7}$	0.0002
	Inhalation of Particulates and Vapors	$2x10^{-11}$	0.0000004
	Total Grounds Maintenance Worker	$4x10^{-7}$	0.0002
Future Residential	Soil Ingestion	$2x10^{-5}$	0.03
Future Construction Worker	Soil Ingestion	$7x10^{-8}$	0.01
	Inhalation of Particulates and Volatiles	$4x10^{-10}$	0.0009
	Total Construction Worker	$7x10^{-8}$	0.06
Final Creek			
Current and Future Grounds Maintenance Worker	Soil Ingestion	$1x10^{-6}$	0.0004
	Inhalation of Particulates and Vapors	ND	ND
	Total Grounds Maintenance Worker	$1x10^{-6}$	0.0004
Future Residential	Soil Ingestion	$5x10^{-5}$	0.06
Settling Pond 1			
Current and Future Grounds Maintenance Worker	Soil Ingestion	$5x10^{-6}$	0.008
	Inhalation of Particulates and Vapors	ND	ND
	Total Grounds Maintenance Worker	$5x10^{-6}$	0.008
Future Residential	Soil Ingestion	$2x10^{-4}$	1.0
Future Construction Worker	Soil Ingestion	$7x10^{-7}$	0.006
	Inhalation of Particulates and Volatiles	ND	ND
	Total Construction Worker	$7x10^{-7}$	0.006

continued

TABLE 6-24
SUMMARY OF RISK ESTIMATES -
SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

EXPOSURE SCENARIO	EXPOSURE ROUTE	CANCER RISK	HAZARD INDEX
Settling Pond 2			
Current and Future Grounds Maintenance Worker	Soil Ingestion	$2x10^{-7}$	0.0004
	Inhalation of Particulates and Vapors	ND	ND
	Total Grounds Maintenance Worker	$2x10^{-7}$	0.0004
Future Residential	Soil Ingestion	$8x10^{-6}$	0.06
Future Construction Worker	Soil Ingestion	$3x10^{-8}$	0.004
	Inhalation of Particulates and Volatiles	ND	ND
	Total Construction Worker	$3x10^{-8}$	0.004
Settling Pond 3			
Current and Future Grounds Maintenance Worker	Soil Ingestion	$9x10^{-8}$	0.0002
	Inhalation of Particulates and Vapors	ND	ND
	Total Grounds Maintenance Worker	$9x10^{-8}$	0.0002
Future Residential	Soil Ingestion	$4x10^{-6}$	0.03
Future Construction Worker	Soil Ingestion	$1x10^{-8}$	0.002
	Inhalation of Particulates and Volatiles	ND	ND
	Total Construction Worker	$1x10^{-8}$	0.002
Settling Pond 4			
Current and Future Grounds Maintenance Worker	Soil Ingestion	ND	0.00002
	Inhalation of Particulates and Vapors	ND	ND
	Total Grounds Maintenance Worker	ND	0.00002
Future Residential	Soil Ingestion	ND	0.003

continued

TABLE 6-24
SUMMARY OF RISK ESTIMATES -
SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

EXPOSURE SCENARIO	EXPOSURE ROUTE	CANCER RISK	HAZARD INDEX
Spoils Disposal Area 1			
Current and Future Grounds Maintenance Worker	Soil Ingestion	$3x10^{-7}$	0.0009
	Inhalation of Particulates and Vapors	ND	ND
	Total Grounds Maintenance Worker	$3x10^{-7}$	0.0009
Future Residential	Soil Ingestion	$1x10^{-5}$	0.1
Spoils Disposal Area 2			
Current and Future Grounds Maintenance Worker	Soil Ingestion	$3x10^{-8}$	0.0004
	Inhalation of Particulates and Vapors	ND	ND
	Total Grounds Maintenance Worker	$3x10^{-8}$	0.0004
Future Residential	Soil Ingestion	$1x10^{-6}$	0.06
Spoils Disposal Area 3			
Current and Future Grounds Maintenance Worker	Soil Ingestion	$3x10^{-8}$	0.0002
	Inhalation of Particulates and Vapors	ND	ND
	Total Grounds Maintenance Worker	$3x10^{-8}$	0.0002
Future Residential	Soil Ingestion	$1x10^{-6}$	0.03
Spoils Disposal Area 4			
Current and Future Grounds Maintenance Worker	Soil Ingestion	$2x10^{-8}$	0.0002
	Inhalation of Particulates and Vapors	ND	ND
	Total Grounds Maintenance Worker	$2x10^{-8}$	0.0002
Future Residential	Soil Ingestion	$8x10^{-7}$	0.02

continued

TABLE 6-24
SUMMARY OF RISK ESTIMATES -
SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

EXPOSURE SCENARIO	EXPOSURE ROUTE	CANCER RISK	HAZARD INDEX
Spoils Disposal Area 5			
Current and Future Grounds Maintenance Worker	Soil Ingestion	$7x10^{-12}$	0.0002
	Inhalation of Particulates and Vapors	ND	ND
	Total Grounds Maintenance Worker	$7x10^{-12}$	0.0002
Future Residential	Soil Ingestion	$3x10^{-10}$	0.03

Notes:

ND = Not determined - no toxicity values available for compounds of potential concern.

TABLE 6-25
COMPARISON OF GROUNDWATER TO STANDARDS
UNITS: $\mu g/\ell$
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND OF POTENTIAL CONCERN	FREQUENCY OF DETECTION	MAXIMUM DETECTED CONCENTRATION	MINIMUM DETECTED CONCENTRATION	SDWA (1)		WI GROUNDWATER STANDARDS (2)		CALCULATED CONCENTRATION (3)
				MCL	MCLG	ES	PAL	
111TCE	14:94	59.3	2.52	200	200	200	40	-
26DNT	6:188	1.46	0.839	-	-	0.05	0.005	-
BA	70:70	130	24.1	2,000	2,000	1,000(c)	200(c)	-
BE	11:70	0.582	0.348	-	-	-	-	0.02
CCL4	123:197	108	1.86	5	0	5	0.5	-
CD	3:120	3.61	2.8	5	5	10(d)	1(d)	-
CHCL3	132:197	83.5	0.483	-	-	6	0.6	-
CL	187:187	140,000	2,400	250,000(a)	-	-	-	-
CR	57:120	46.6	4.93	100	100	50(e)	5(e)	-
CU	29:70	23.1	4.58	TT	1,300	-	-	-
HG	2:120	4.31	2.83	2	2	2	0.2	-
MN	9:70	1,700	11.2	50(a)	-	50(f)	25(f)	-
NA	48:70	94,000	2,090	20,000(b)	-	-	-	-
NIT	178:185	21,000	140	10,000	10,000	10,000	2,000	-
NNDPA	16:186	25	0.955	-	-	-	-	20
PB	18:120	13.6	5.54	TT	0	50(g)	5(g)	-
SO4	179:179	637,000	1.5	250,000(a)	-	250,000(f)	125,000(f)	-
TRCLE	124:197	117	0.329	5	0	5	0.18	-

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continued

TABLE 6-25
COMPARISON OF GROUNDWATER TO STANDARDS
UNITS: μg/ℓ
PROPELLANT BURNING GROUND/LANDFILL 1/SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND OF POTENTIAL CONCERN	FREQUENCY OF DETECTION	MAXIMUM DETECTED CONCENTRATION	MINIMUM DETECTED CONCENTRATION	SDWA (1)		WI GROUNDWATER STANDARDS (2)		CALCULATED CONCENTRATION (3)
				MCL	MCLG	ES	PAL	
V	10:70	19.1	5.01	-	-	-	-	260
ZN	11:70	1,900	29	-	-	5,000(f)	2,500(f)	7,300

Sources:

(1) U.S. Environmental Protection Agency (EPA), 1991, "Fact Sheet: National Primary Drinking Water Standards." Office of Water, Washington, D.C., August 1991; EPA, 1991, "Fact Sheet: National Secondary Drinking Water Standards," Office of Water, Washington, D.C., September 1991; and EPA, 1990, "National Primary and Secondary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals, Final Rule Rule," 57FR31776, July 17, 1992 (see Subsection 3.6 for details).
(2) Wisconsin Administrative Code, Chapter NR 140.10, Table 1 (see Subsection 3.6 for details).
(3) Calculated to be protective at risk of 10^{-6} or HI of 1 (see Subsection 4.5 for details).

Notes:
(a) Secondary drinking water standard, suggested level.
(b) Reporting level. Monitoring is required and data is reported to health officials to protect individuals on restricted sodium diet.
(c) WI proposing change to ES = 2,000 μg/ℓ and PAL = 400 μg/ℓ
(d) WI proposing change to ES = 5 μg/ℓ and PAL = 0.5 μg/ℓ
(e) WI proposing change to ES = 100 μg/ℓ and PAL = 10 μg/ℓ
(f) Values are for protection of public welfare (usually aesthetic concerns) rather than for protection of public health
(g) WI proposing change to ES = 15 μg/ℓ and PAL = 1.5 μg/ℓ

μg/ℓ = micrograms per liter
SDWA = Safe Drinking Water Act
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
WI = Wisconsin
ES = Enforcement Standard
PAL = Preventive Action Limit
TT = Treatment technique requirement in effect
Copper action level - 1,300 μg/ℓ
Lead action level - 15 μg/ℓ

TABLE 6-26
ECOLOGICAL CONTAMINANTS OF CONCERN[A] - PROPELLANT BURNING GROUND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil[C]		
24DNT	16:114	10.7
2MNAP	2:13	0.452
AS	83:108	9.45
B2EHP	1:13	6.2
BAANTR	1:13	0.204
C6H6	8:114	0.42
CHRY	1:13	3.68
CR	108:108	49.8
CU	108:108	344
DEP	7:13	6.2
DNBP	4:13	6.35
FANT	2:13	0.2
HG	31:108	0.334
NI	108:108	27.3
NNDPA	3:13	30.8
PB	108:108	2,700
PHANTR	3:13	1.32
PYR	1:13	0.168
SE	10:108	0.618
ZN	108:108	1,040

Notes:

[A] Constituents selected based on criteria presented in Table Q-5 and discussed in Section 5.0.

[B] 95th percentile or maximum; units in $\mu g/g$

[C] Assessment of surface soil contamination was performed using samples PBS-91-01 through PBS-91-108. In addition, the upper portions of samples PBS-91-109 through PBS-91-114 were used to assess contamination of surface soil by 24DNT, 26DNT, C6H6, and CCL3F.

TABLE 6-27
ECOLOGICAL CONTAMINANTS OF CONCERN[A] -
FINAL CREEK AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil[C]		
PB	8:8	40
SN	7:8	63
NIT	8:8	11
NH3	8:8	1,800
SO4	4:8	260
24DNT	5:8	6
26DNT	6:8	40
DEP	2:8	0.13
DNBP	5:8	26
DPA	6:8	15
2NNDPA	3:8	2
NC	3:8	740

Notes:

[A] Constituents selected based on criteria presented in Table Q-6 and discussed in Section 5.0.

[B] 95th percentile or maximum; units in $\mu g/g$.

[C] Assessment of surface soil contamination (0 to 2 feet) was performed using data from samples FC-1 through FC-8.

TABLE 6-28
ECOLOGICAL CONTAMINANTS OF CONCERN[A] -
SETTLING POND 1

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil[C]		
PB	16:17	180
SN	17:17	57
NIT	14:16	13
NH3	14:14	740
SO4	8:18	2,500
24DNT	5:15	172
26DNT	6:14	26
DEP	1:15	460
BP	6:15	14
DPA	6:14	10
2NNDPA	3:14	0.97
NC	7:15	60,000

Notes:

[A] Constituents selected based on criteria presented in Table Q-7 and discussed in Section 5.0.

[B] 95th percentile or maximum; units in $\mu g/g$.

[C] Assessment of surface soil contamination (0 to 2 feet) was performed using data from samples FPI-1 through FPI-14, and S1201 through S1204.

TABLE 6-29
ECOLOGICAL CONTAMINANTS OF CONCERN[A] -
SETTLING POND 2

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil[C]		
PB	3:3	250
SN	3:3	53
NIT	3:3	43
NH3	3:3	840
SO4	1:3	64
24DNT	1:4	7.6
26DNT	1:4	135
DEP	1:4	0.74
DNBP	1:3	1.5
DPA	1:3	1.5
NC	2:3	280

Notes:

[A] Constituents selected based on criteria presented in Table Q-8 and discussed in Section 5.0.

[B] 95th percentile or maximum; units in $\mu g/g$.

[C] Assessment of surface soil contamination (0 to 2 feet) was performed using data from samples FPII-1 through FPII-3 and S1205.

TABLE 6-30
ECOLOGICAL CONTAMINANTS OF CONCERN[A] -
SETTLING POND 3

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil[C]		
PB	15:15	34
SN	15:15	72
NIT	15:15	4.9
NH3	15:15	520
SO4	2:15	36
24DNT	1:16	2.6
26DNT	1:15	1.5
DEP	1:16	44
DNBP	5:16	17.4
DPA	4:15	2.8
NC	2:15	190

Notes:

[A] *Constituents selected based on criteria presented in Table Q-9 and discussed in Section 5.0.*

[B] 95th percentile or maximum; units in $\mu g/g$.

[C] Assessment of surface soil contamination (0 to 2 feet) was performed using data from samples FPIII-1 through FPIII-15 and S1206.

TABLE 6-31
ECOLOGICAL CONTAMINANTS OF CONCERN[A] -
SETTLING POND 4

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil[C]		
AL	11:11	60,000
PB	11:11	300
SN	11:11	77
NIT	10:11	10
NH3	10:10	960
SO4	3:11	400
DPA	1:10	0.36
NC	2:11	1,038

Notes:

[A] Constituents selected based on criteria presented in Table Q-10 and discussed in Section 5.0.

[B] 95th percentile or maximum; units in $\mu g/g$.

[C] Assessment of surface soil contamination (0 to 2 feet) was performed using samples FPIV-1 through FPIV-10 and S1207.

TABLE 6-32
ECOLOGICAL CONTAMINANTS OF CONCERN[A] - SPOILS DISPOSAL AREA 1

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil[C]		
PB	5:5	249
SN	5:5	3.68
ZN	5:5	212
BR	2:2	12
CL	5:5	19
NIT	5:5	16
SO4	5:5	146
CH2CL2	3:3	0.01
24DNT	3:3	12
26DNT	1:1	1
B2EHP	1:1	0.35
DNBP	5:5	51
DNOP	1:1	8.6
DPA	4:4	24
NC	5:5	11,000
NG	1:1	19

Notes:

[A] Constituents selected based on criteria presented in Table Q-11 and discussed in Section 5.0.

[B] 95th percentile or maximum; units in µg/g.

[C] Assessment of surface soil contamination (0 to 2 feet) was performed using samples SD1-1 through SD1-5.

TABLE 6-33
ECOLOGICAL CONTAMINANTS OF CONCERN[A] -
SPOILS DISPOSAL AREA 2

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil[C]		
PB	5:5	373
SN	5:5	4.04
ZN	5:5	748
BR	1:1	4
CL	5:5	23
NIT	5:5	10
SO4	5:5	130
CH2CL2	3:3	.012
24DNT	4:4	1.3
DNBP	5:5	5.8
DPA	5:5	3.2
NC	5:5	8,000

Notes:

[A] Constituents selected based on criteria presented in Table Q-12 and discussed in Section 5.0.

[B] 95th percentile or maximum; units in $\mu g/g$.

[C] Assessment of surface soil contamination (0 to 2 feet) was performed using samples SD2-1 through SD2-5.

TABLE 6-34
ECOLOGICAL CONTAMINANTS OF CONCERN[A] -
SPOILS DISPOSAL AREA 3

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil[C]		
PB	10:10	67
SN	10:10	5.8
ZN	10:10	251
CL	10:10	17
NIT	10:10	22
SO4	10:10	75
CH2CL2	1:1	0.025
24DNT	5:5	1.1
DNBP	9:9	4
DPA	5:5	2.2
NC	10:10	3,800

Notes:

[A] Constituents selected based on criteria presented in Table Q-13 and discussed in Section 5.0.

[B] 95th percentile or maximum; units in $\mu g/g$.

[C] Assessment of surface soil contamination (0 to 2 feet) was performed using samples from SD3-1 through SD3-10.

TABLE 6-35
ECOLOGICAL CONTAMINANTS OF CONCERN[A] -
SPOILS DISPOSAL AREA 4

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil[C]		
PB	10:10	120
SN	10:10	1.64
ZN	10:10	204
CL	9:9	13
NIT	10:10	12
SO4	10:10	139
CH2CL2	4:4	0.01
24DNT	1:1	0.7
B2EHP	1:1	0.32
DNBP	4:4	4.4
DNOP	3:3	0.63
DPA	1:1	1.1
NC	9:9	3,000

Notes:

[A] Constituents selected based on criteria presented in Table Q-14 and discussed in Section 5.0.

[B] 95th percentile or maximum; units in $\mu g/g$.

[C] Assessment of surface soil contamination (0 to 2 feet) was performed using samples from SD4-1 through SD4-10.

TABLE 6-36
ECOLOGICAL CONTAMINANTS OF CONCERN[A] - SPOILS DISPOSAL AREA 5

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil[C]		
PB	8:8	102
SN	10:10	1.94
ZN	9:9	306
BR	1:1	16
CL	9:9	18
NIT	10:10	18
SO4	10:10	38
CH2CL2	3:3	0.01
DNBP	7:7	6.5
DNOP	1:1	0.2
DPA	3:3	2.4
NC	8:8	11,000

Notes:

[A] Constituents selected based on criteria presented in Table Q-15 and discussed in Section 5.0.

[B] 95th percentile or maximum; units in $\mu g/g$.

[C] Assessment of surface soil contamination (0 to 2 feet) was performed using samples from SD5-1 through SD5-10.

TABLE 6-37
SUMMARY OF RISK EVALUATION FOR TERRESTRIAL RECEPTORS - PROPELLANT BURNING GROUND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	HAZARD INDICES[A]	
RECEPTOR	ACUTE RISK[B]	CHRONIC RISK[C]
Short-tailed shrew	5.5E+03	1.1E+05
Eastern meadowlark	2.8E+02	2.0E+03
Garter snake	3.8E+02	6.3E+03
Red fox	2.2E+01	3.7E+01
Red-tailed hawk	2.5E+02	2.4E+02

Notes:

[A] Sum of the individual Hazard Quotients for each surface soil contaminant of concern; each HQ calculated by dividing the estimated exposure dosage by the Reference Toxicity Value (RTV). Hazard Quotients are presented in Appendix R, Tables R-31 and R-32 for acute and chronic exposures, respectively.

[B] Based on comparison to acute RTVs.

[C] Based on comparison to chronic RTVs.

TABLE 6-38
SUMMARY OF RISK EVALUATION FOR TERRESTRIAL RECEPTORS -
SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	HAZARD INDICES[A]	
RECEPTOR	ACUTE RISK[B]	CHRONIC RISK[C]
Final Creek Area		
Short-tailed shrew	8.0E+01	2.6E+03
Eastern meadowlark	2.0E+00	2.8E+00
Garter snake	3.9E+00	5.1E+01
Red fox	5.1E-1	2.2E-1
Red-tailed hawk	5.5E-01	2.4E-02
Settling Pond 1 Area		
Short-tailed shrew	3.5E+02	7.8E+03
Eastern meadowlark	8.3E+00	2.4E+01
Garter snake	1.7E+01	3.9E+02
Red fox	2.3E+00	3.8E+00
Red-tailed hawk	2.0E+00	7.5E-01
Settling Pond 2 Area		
Short-tailed shrew	4.7E+02	1.0E+04
Eastern meadowlark	1.1E+01	3.2E+01
Garter snake	2.4E+01	5.1E+-01
Red fox	6.6E-01	8.5E-01
Red-tailed hawk	1.9E+00	2.6E-01
Settling Pond 3 Area		
Short-tailed shrew	6.8E+01	2.5E+03
Eastern meadowlark	1.7E+00	6.4E+00
Garter snake	3.4E+00	1.3E+02
Red fox	2.0E-01	3.5E+00
Red-tailed hawk	5.5E-01	2.7E-01
Settling Pond 4 Area		
Short-tailed shrew	6.7E+02	1.4E+04
Eastern meadowlark	2.0E+01	1.0E+02
Garter snake	3.3E+01	6.8E+02
Red fox	3.5E+00	5.6E+00
Red-tailed hawk	1.1E+01	4.6E+00
Spoils Disposal Site 1 Area		
Short-tailed shrew	6.6E+02	1.3E+04
Eastern meadowlark	1.5E+01	4.3E+01
Garter snake	3.3E+-1	6.63+02
Red fox	1.7E+00	2.5E-01
Red-tailed hawk	5.5E+00	3.3E-01
Spoils Disposal 2 Area		
Short-tailed shrew	7.2E+02	1.4E+04
Eastern meadowlark	1.7E+01	3.4E+01
Garter snake	3.6E+01	4.9E+02

continued

TABLE 6-38
SUMMARY OF RISK EVALUATION FOR TERRESTRIAL RECEPTORS -
SETTLING PONDS AND SPOILS DISPOSAL AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	HAZARD INDICES[A]	
RECEPTOR	ACUTE RISK[B]	CHRONIC RISK[C]
Red fox	3.1E+00	2.3E-01
Red-tailed hawk	1.1E+01	3.5E-01
Spoils Disposal 3 Area		
Short-tailed shrew	1.3E+2	2.6E+03
Eastern meadowlark	3.3E+00	5.7E+00
Garter snake	6.7E+00	7.9E+01
Red fox	8.7E-01	7.2E-02
Red-tailed hawk	3.2E+00	7.7E-02
Spoils Disposal 4 Area		
Short-tailed shrew	2.3E+02	4.6E+03
Eastern meadowlark	5.5E+00	1.5E+01
Garter snake	1.2E+01	2.3E+02
Red fox	1.1E+00	1.2E-01
Red-tailed hawk	3.8E+00	1.7E-01
Spoils Disposal 5 Area		
Short-tailed shrew	2.0E+02	3.9E+03
Eastern meadowlark	4.9E+00	1.4E+01
Garter snake	1.0E+01	1.9E+02
Red fox	1.4E+00	1.4E-01
Red-tailed hawk	5.2E+00	2.1E-01

Notes:

[A] Sum of the individual Hazard Quotients for each surface soil contaminant of concern; each HQ calculated by dividing the estimated exposure dosage by the Reference Toxicity Value (RTV). Hazard Quotients are presented in Appendix R, Tables R-33 through R-52.

[B] Based on comaprison to acute RTVs.

[C] Based on comparison to chronic RTVs.

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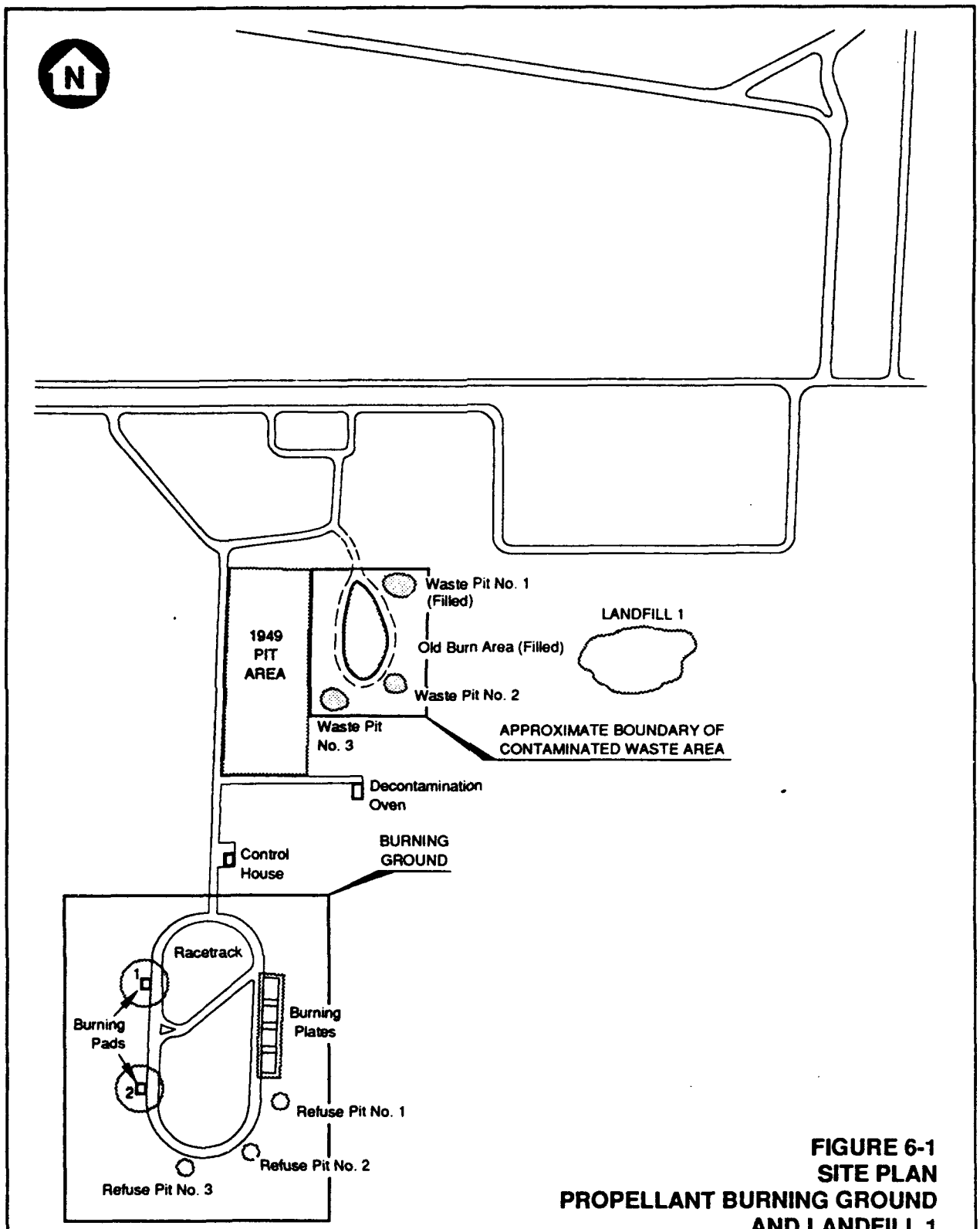

Source: Modified from Tsai, et.al., 1988.

FIGURE 6-1
SITE PLAN
PROPELLANT BURNING GROUND
AND LANDFILL 1
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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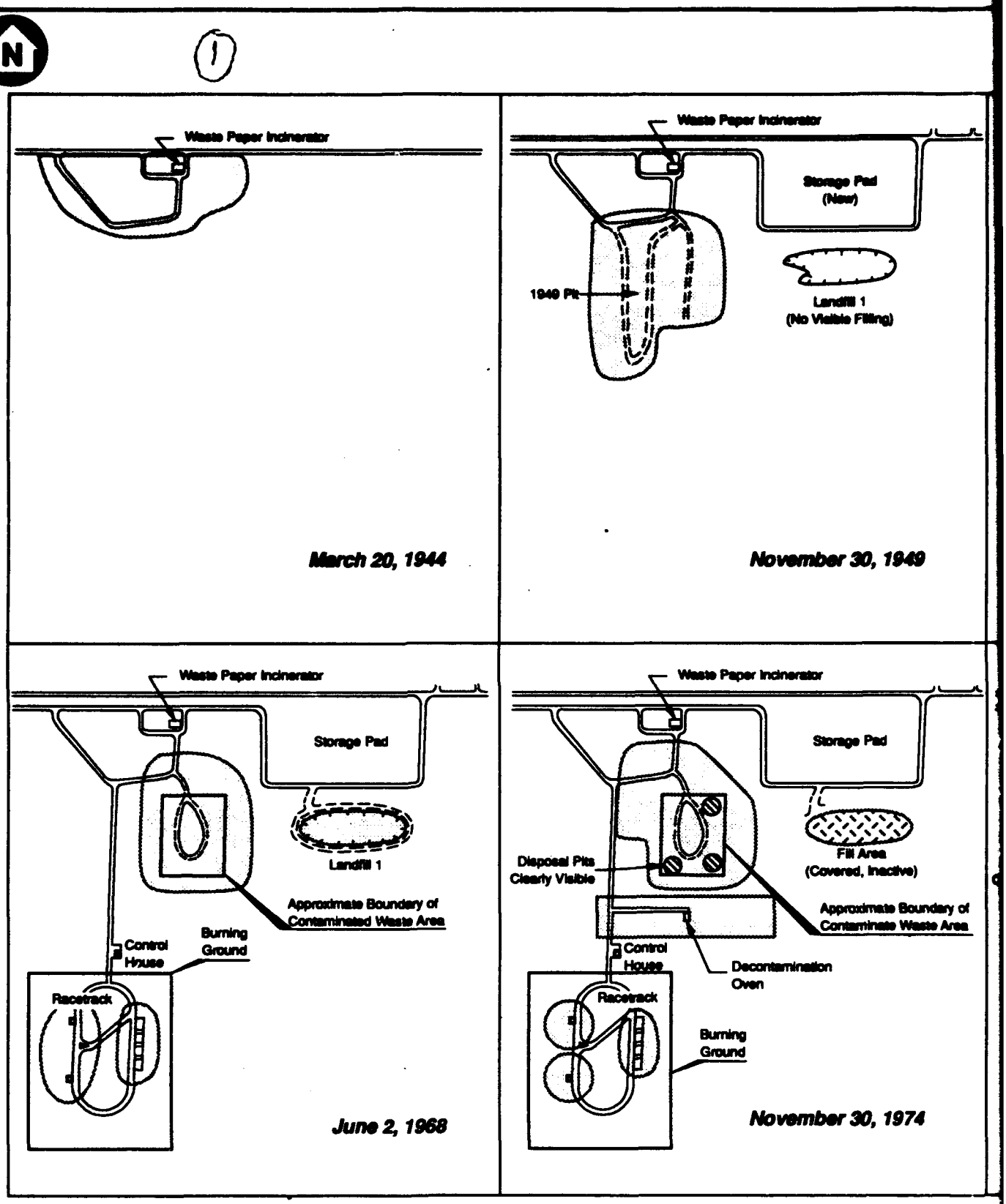
N
1
Waste Paper Incinerator
March 20, 1944
Waste Paper Incinerator
Storage Pad
(New)
1949 Pit
Landfill 1
(No Visible Filling)
November 30, 1949
Waste Paper Incinerator
Storage Pad
Landfill 1
Approximate Boundary of
Contaminated Waste Area
Control
House
Burning
Ground
Racetrack
June 2, 1968
Waste Paper Incinerator
Storage Pad
Fill Area
(Covered, Inactive)
Disposal Pits
Clearly Visible
Approximate Boundary of
Contaminate Waste Area
Control
House
Decontamination
Oven
Racetrack
Burning
Ground
November 30, 1974
LEGEND
TOP EDGE OF SLOPE
ACTIVE AREA
ACCESS ROAD

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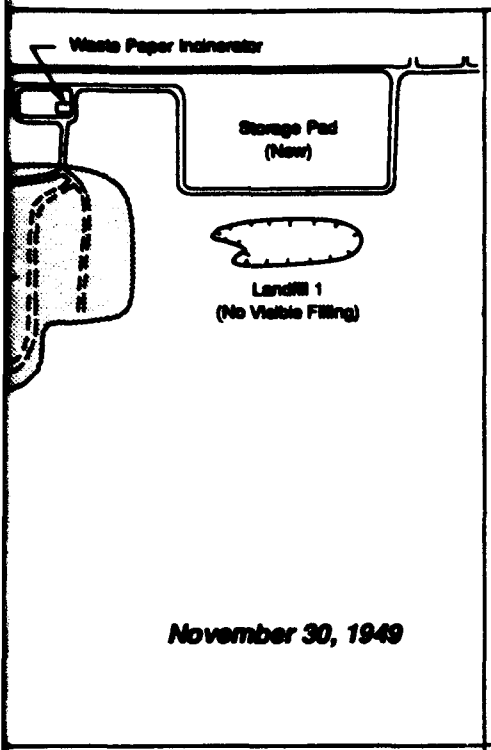

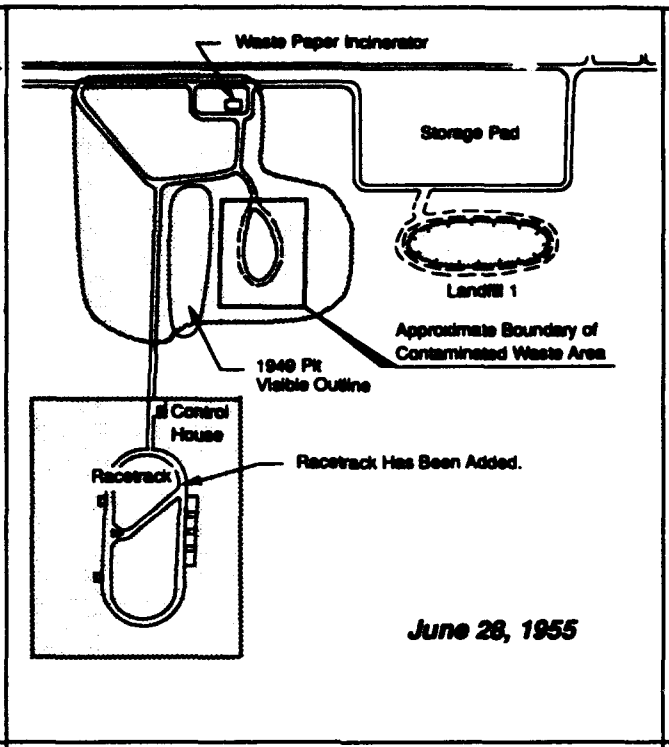

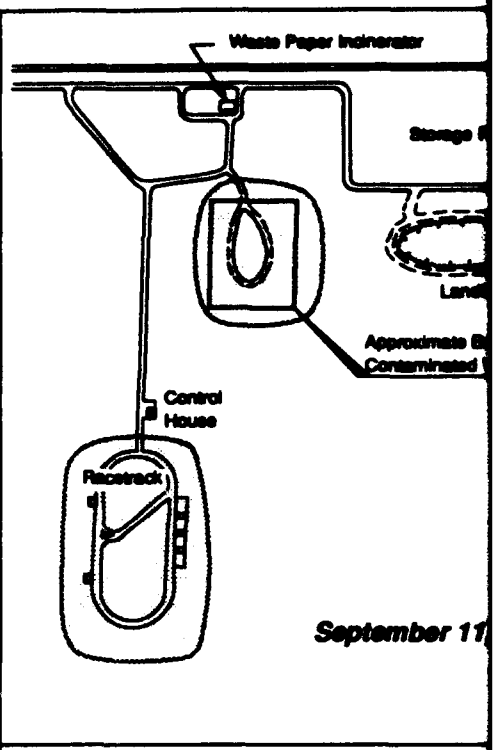

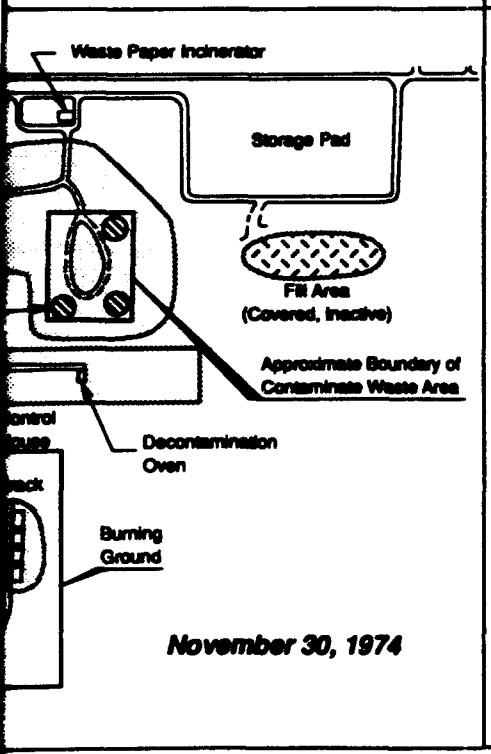

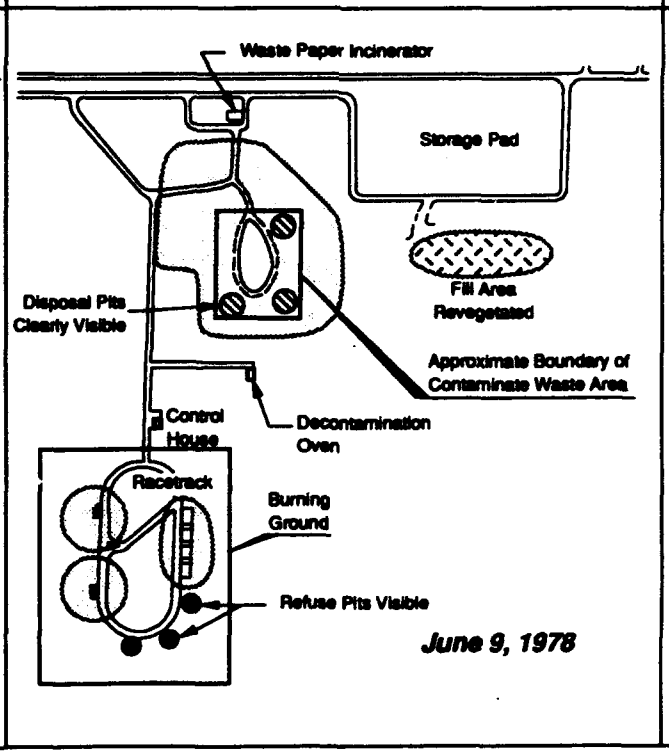

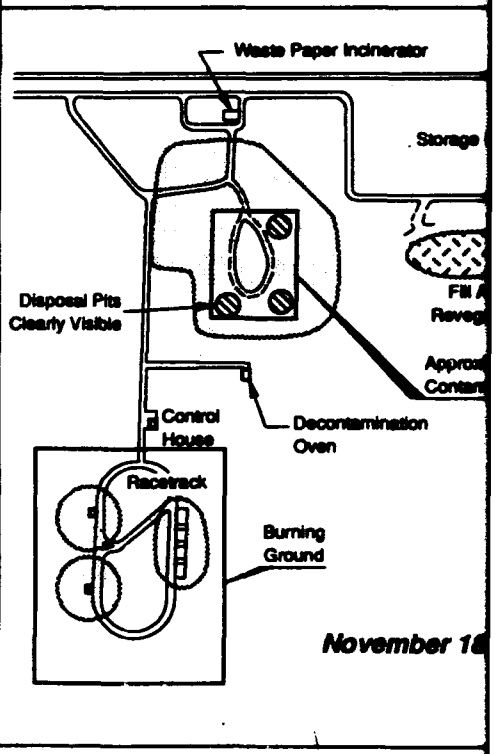

CHRONOLOGICAL EVOLUTION OF THE PROPELLANT BURNING
REMEDIAL INVE
BADGER ARMY AMMUNITI

ABB Environmental

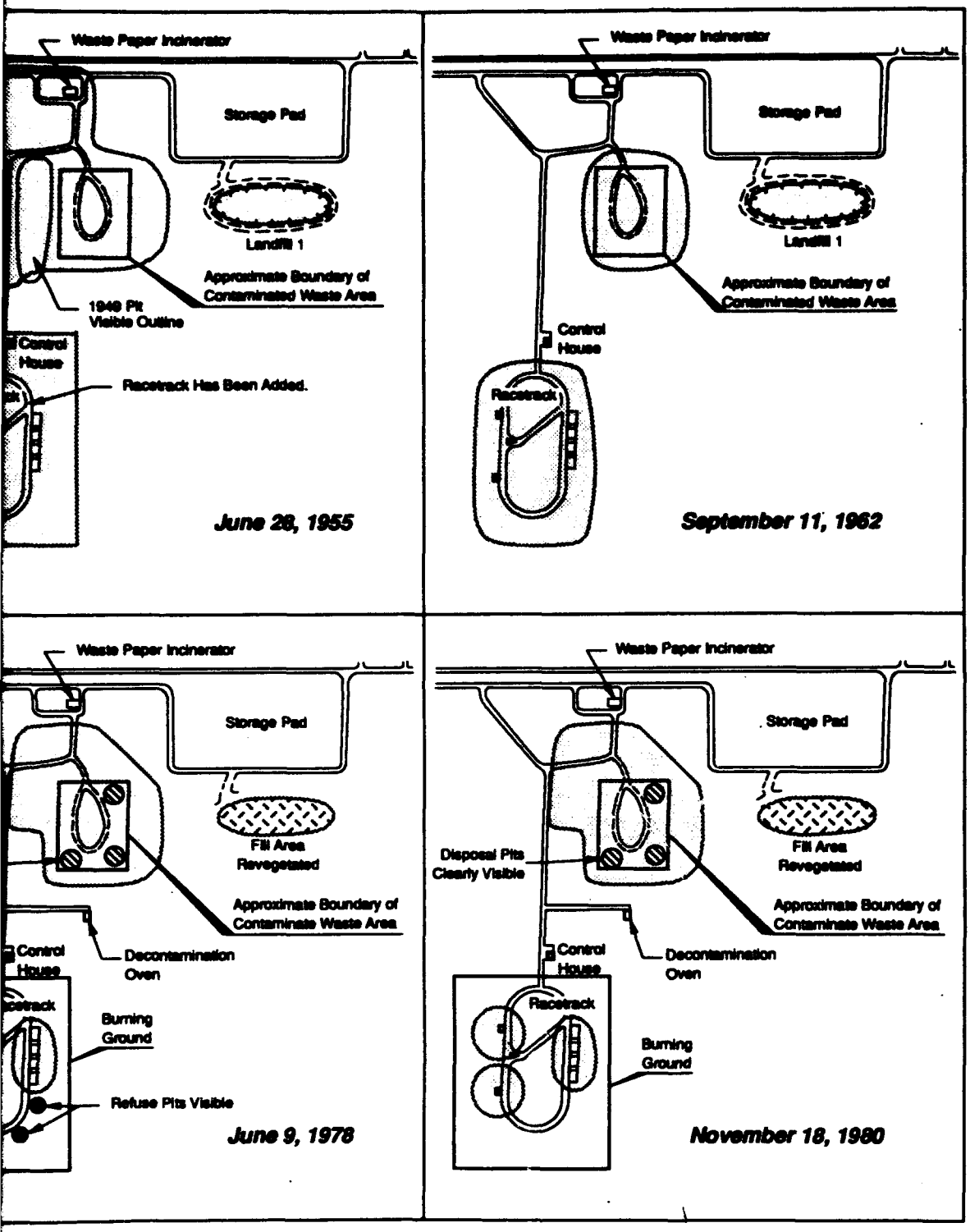

FIGURE 6-2
CHRONOLOGICAL EVOLUTION OF THE PROPELLANT BURNING GROUND
REMEDIAL INVESTIGATON
BADGER ARMY AMMUNITION PLANT

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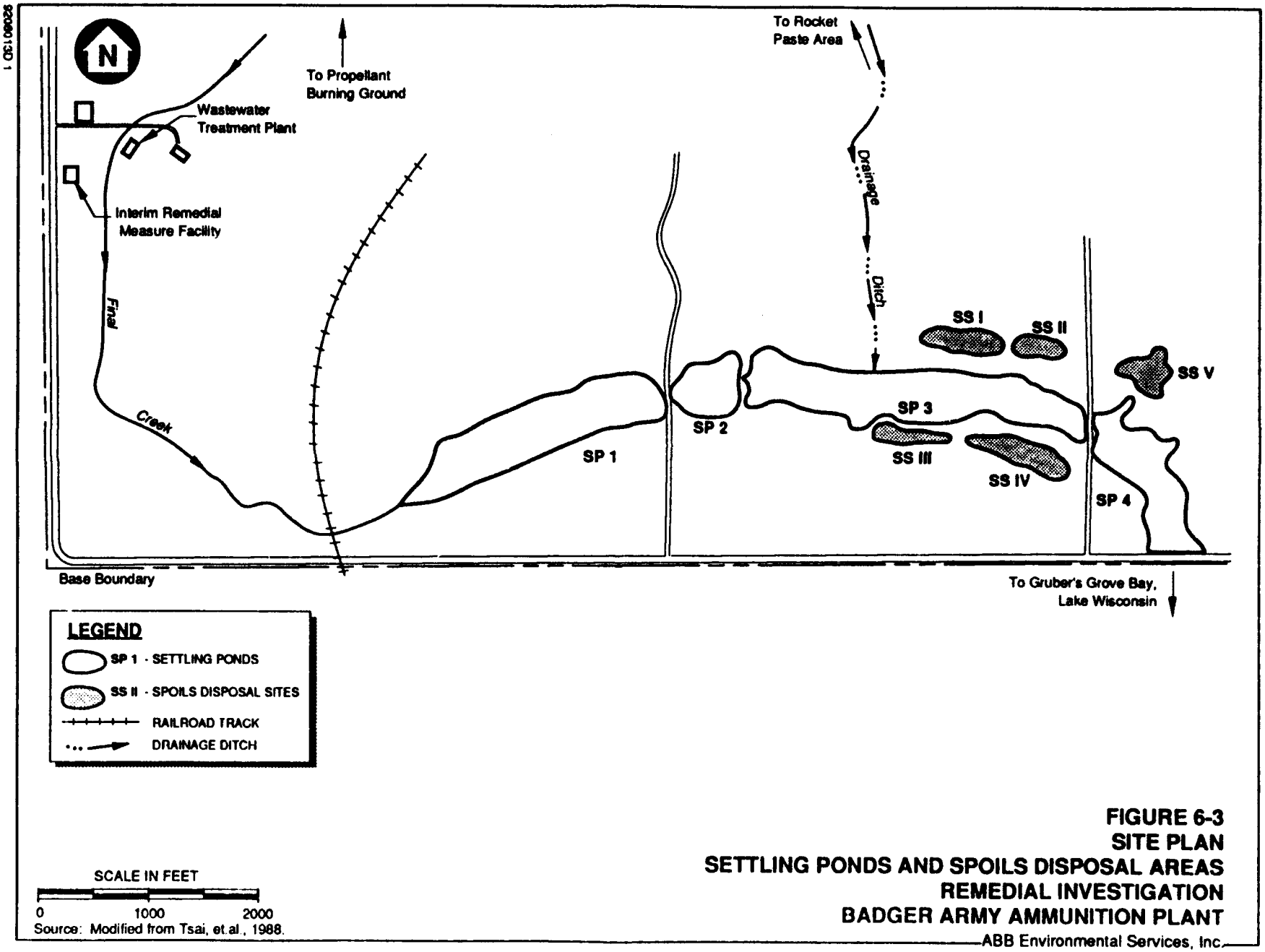

Source: Modified from Tsai, et.al., 1988.

FIGURE 6-3
SITE PLAN
SETTLING PONDS AND SPOILS DISPOSAL AREAS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

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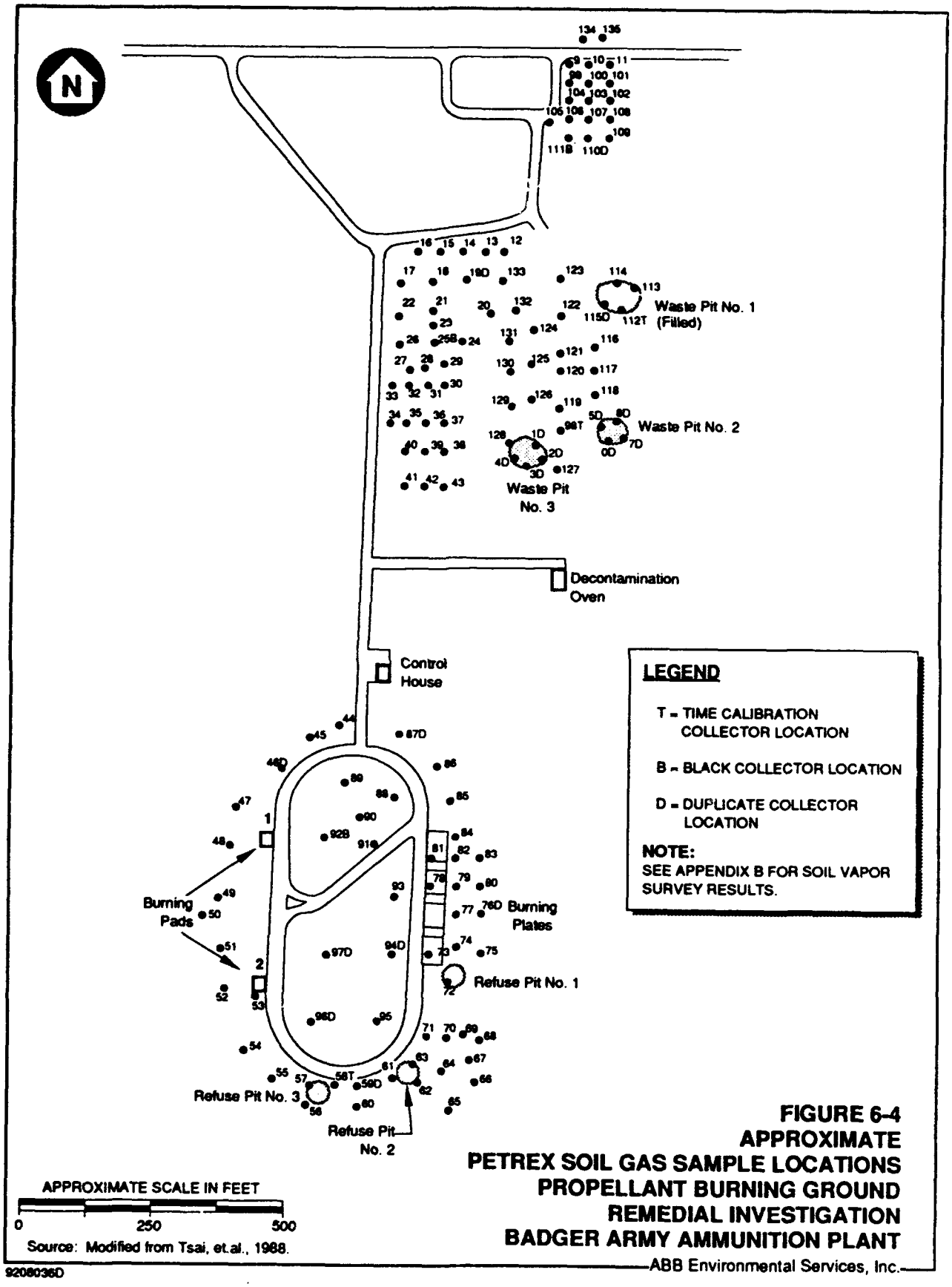

FIGURE 6-4
APPROXIMATE
PETREX SOIL GAS SAMPLE LOCATIONS
PROPELLANT BURNING GROUND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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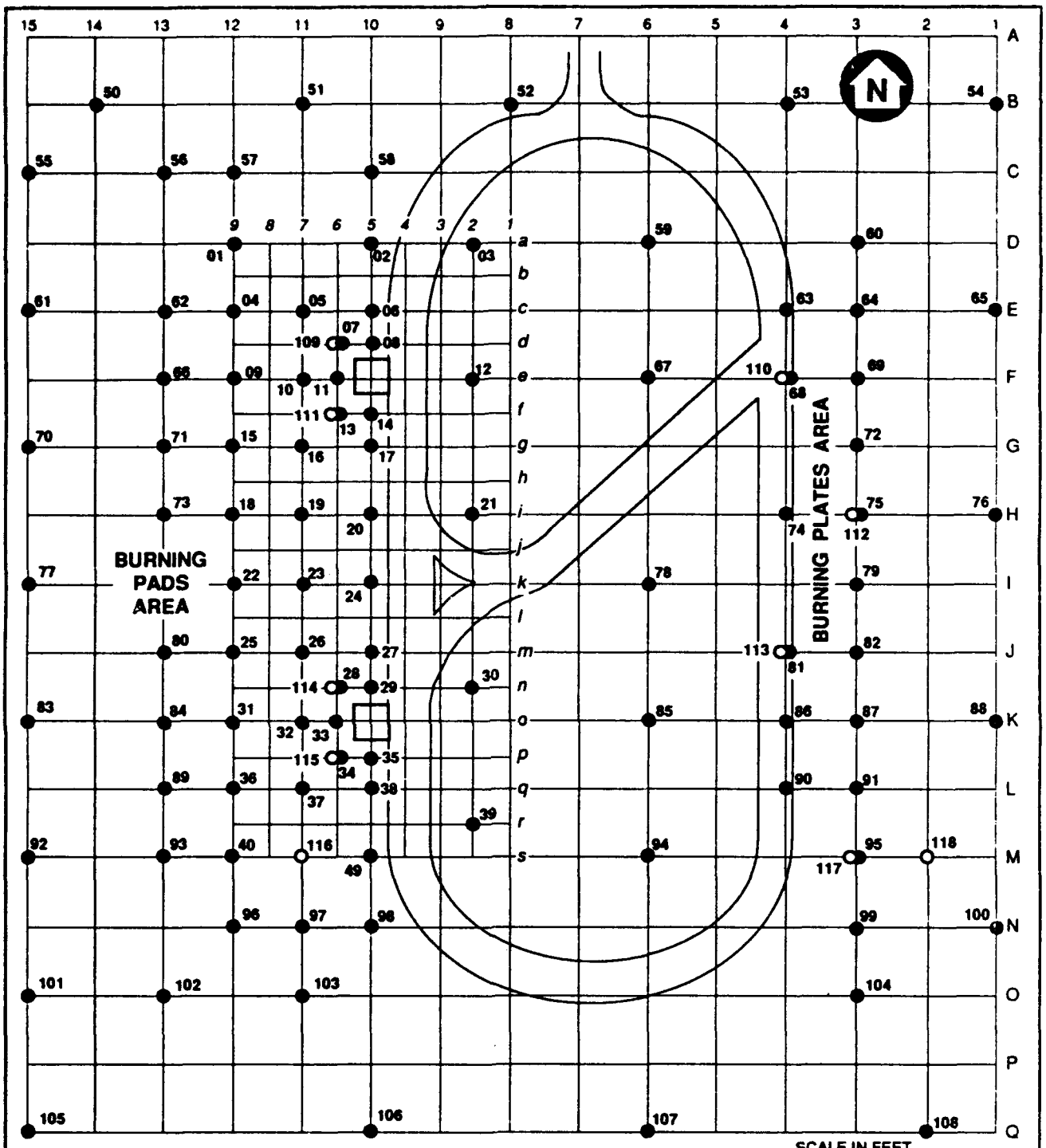


LEGEND

01 ● SURFACE SOIL SAMPLE LOCATION (PBS-91-01)

109 ○ SUBSURFACE SOIL SAMPLE LOCATION (PBS-91-109)

□ APPROXIMATE SIZE OF CONCRETE BURNING PADS

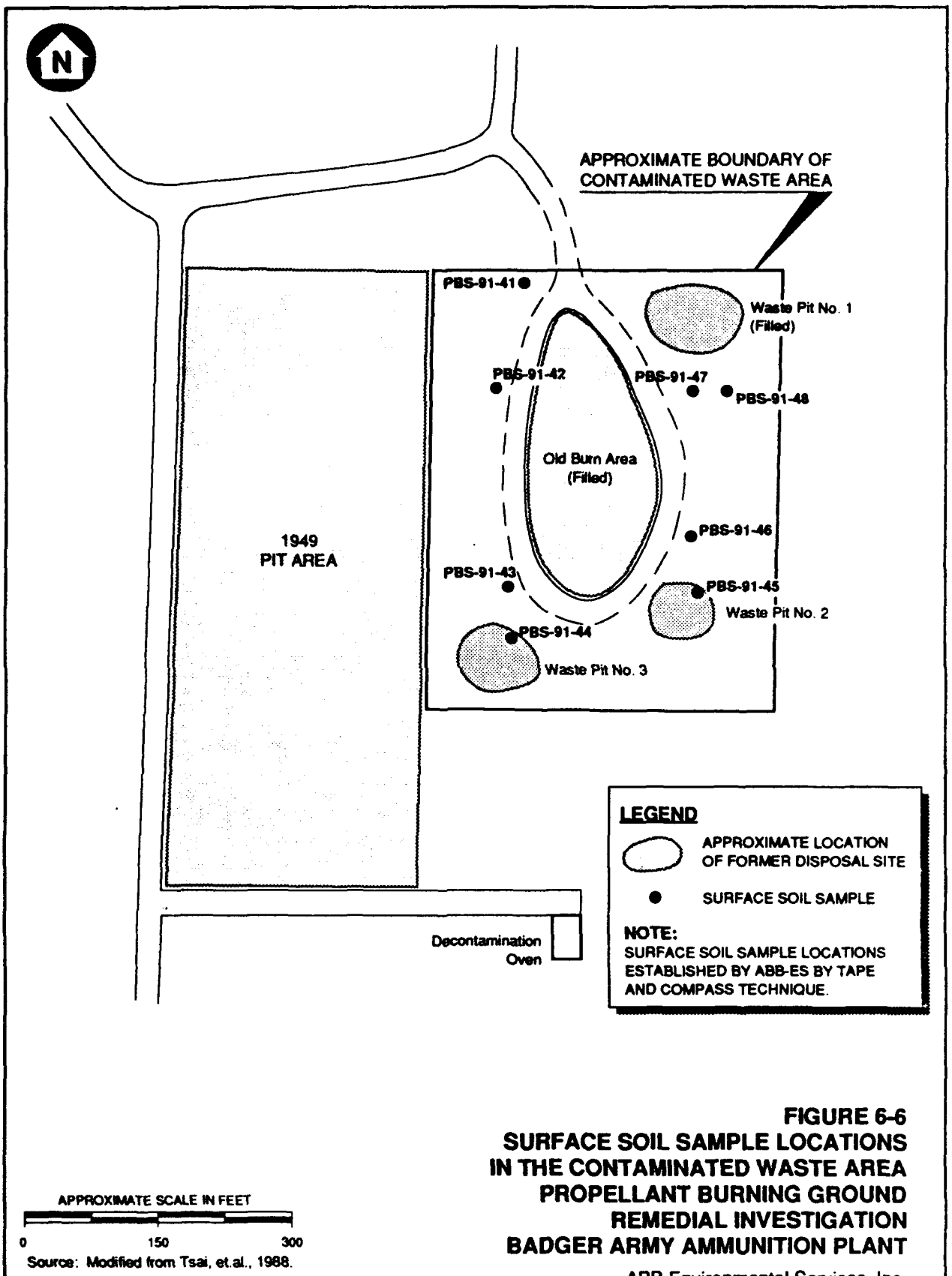
NOTE: SAMPLE LOCATIONS 41 THROUGH 48 ARE LOCATED OFF THE GRID IN THE CONTAMINATED WASTE AREA (FIGURE 6-6).

SOURCE: MODIFIED FROM FIGURE 4-12 OF TSAI ET AL., 1988.

FIGURE 6-5
SURFACE SOIL SAMPLE LOCATIONS AT THE RACETRACK PROPELLANT BURNING GROUND REMEDIAL INVESTIGATION BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

9208064D 2345



Source: Modified from Tsai, et.al., 1988.

FIGURE 6-6
SURFACE SOIL SAMPLE LOCATIONS IN THE CONTAMINATED WASTE AREA PROPELLANT BURNING GROUND REMEDIAL INVESTIGATION BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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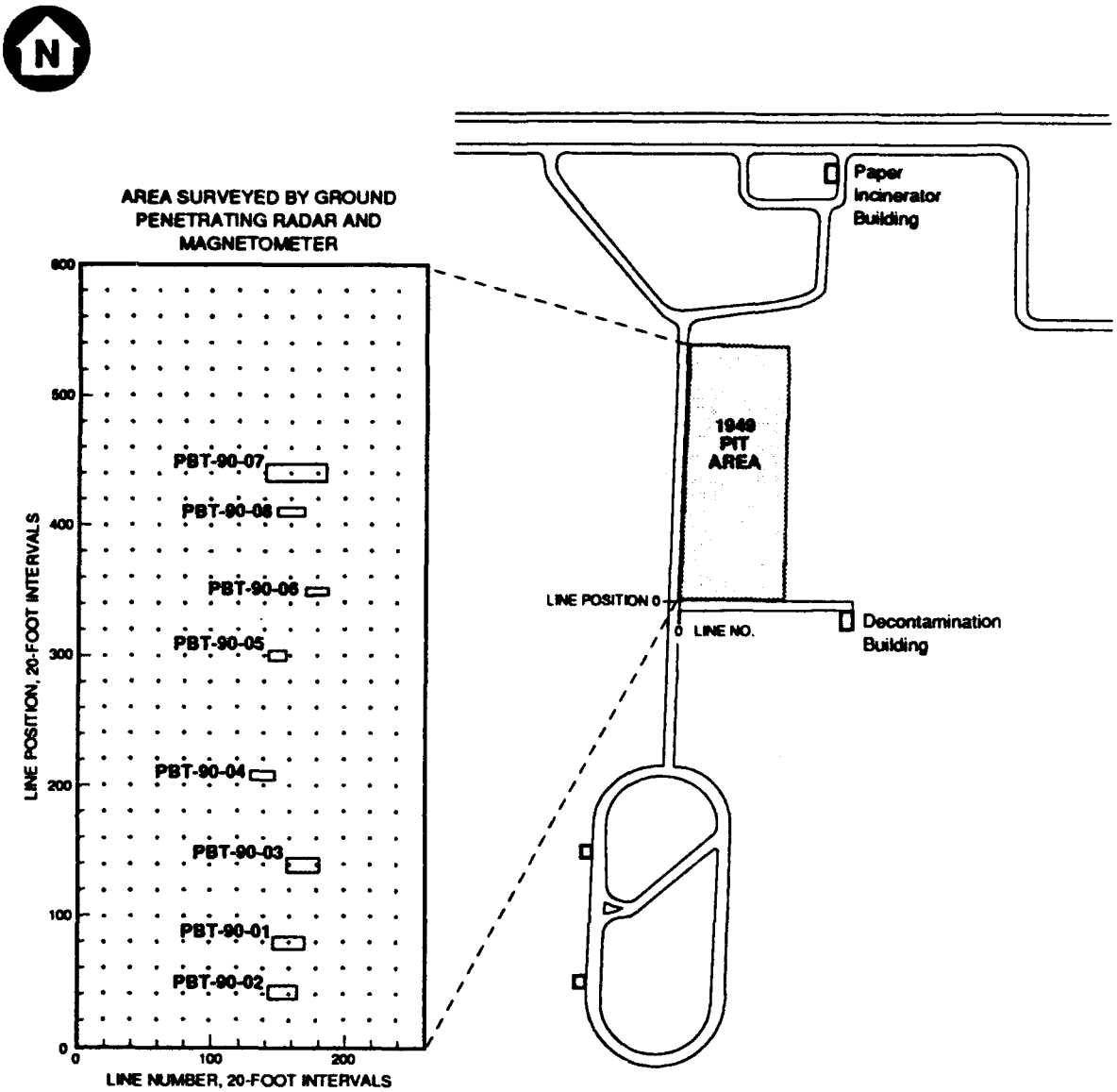

LEGEND

GRID POINTS

PBT-90-01 TEST PIT LOCATION AND DESIGNATION

APPROXIMATE SCALE IN FEET

0 250 500

FIGURE 6-7
GEOPHYSICAL SURVEY AREA
1949 PIT AREA
PROPELLANT BURNING GROUND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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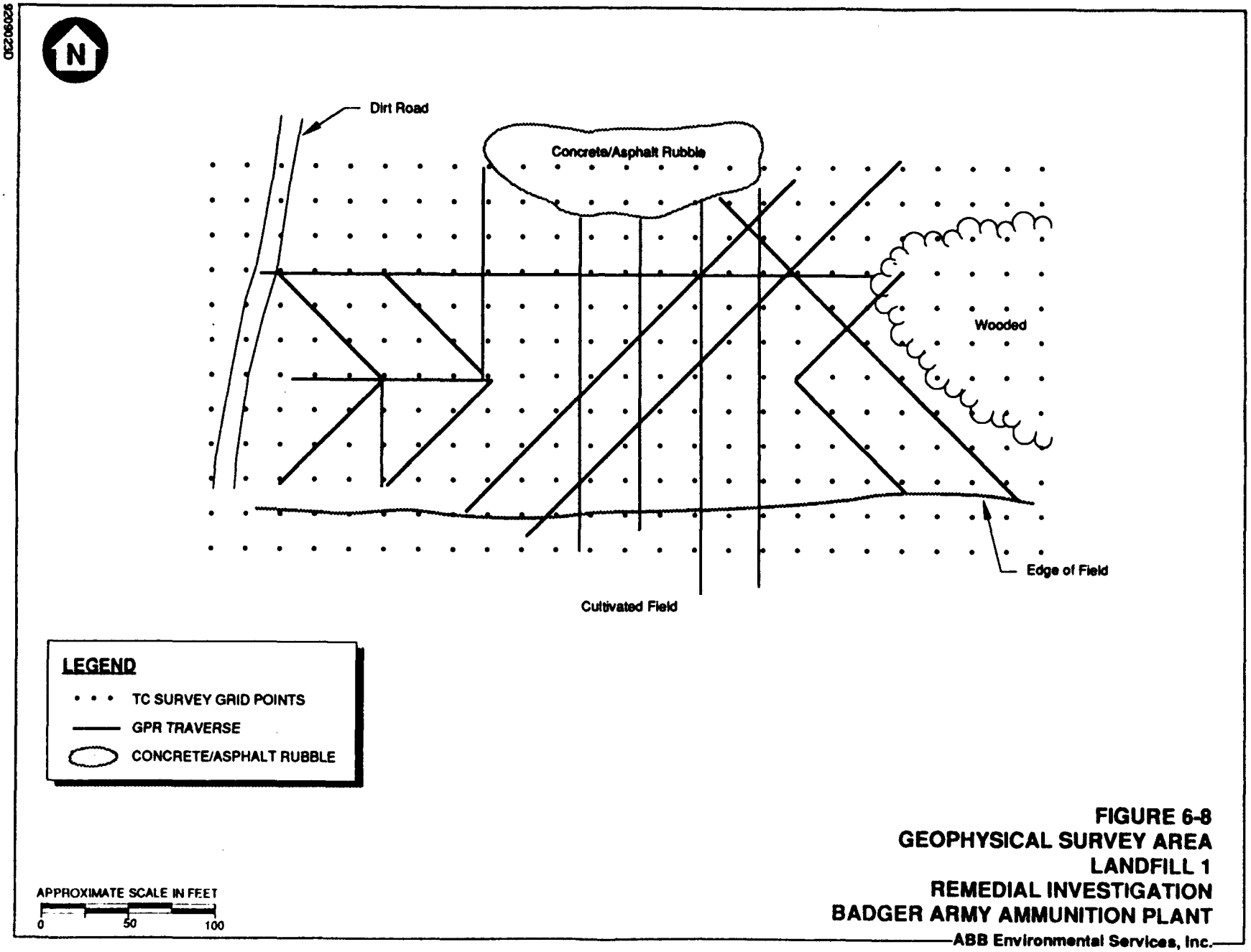
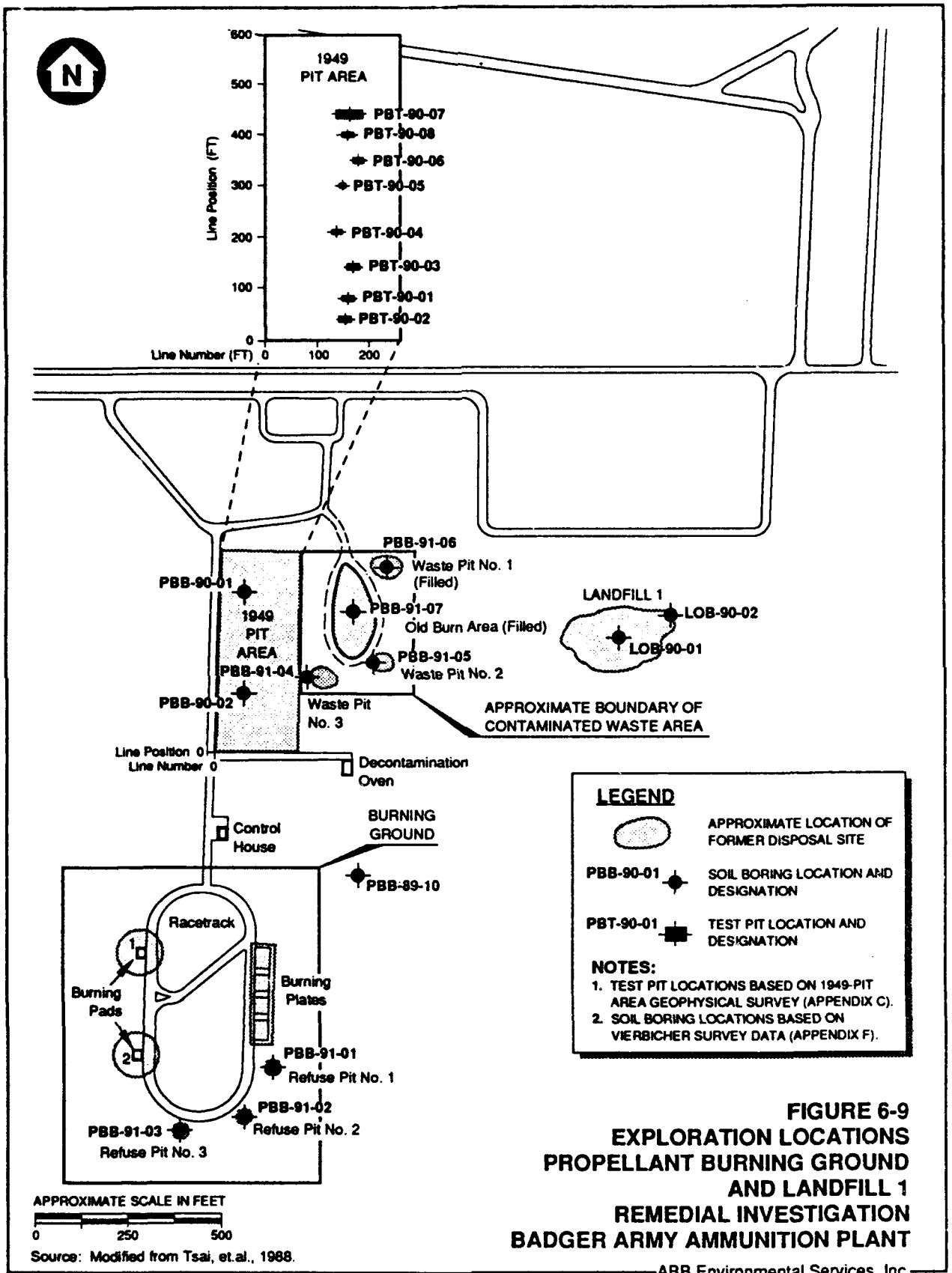


FIGURE 6-8
GEOPHYSICAL SURVEY AREA
LANDFILL 1
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT
ABB Environmental Services, Inc.

92090230

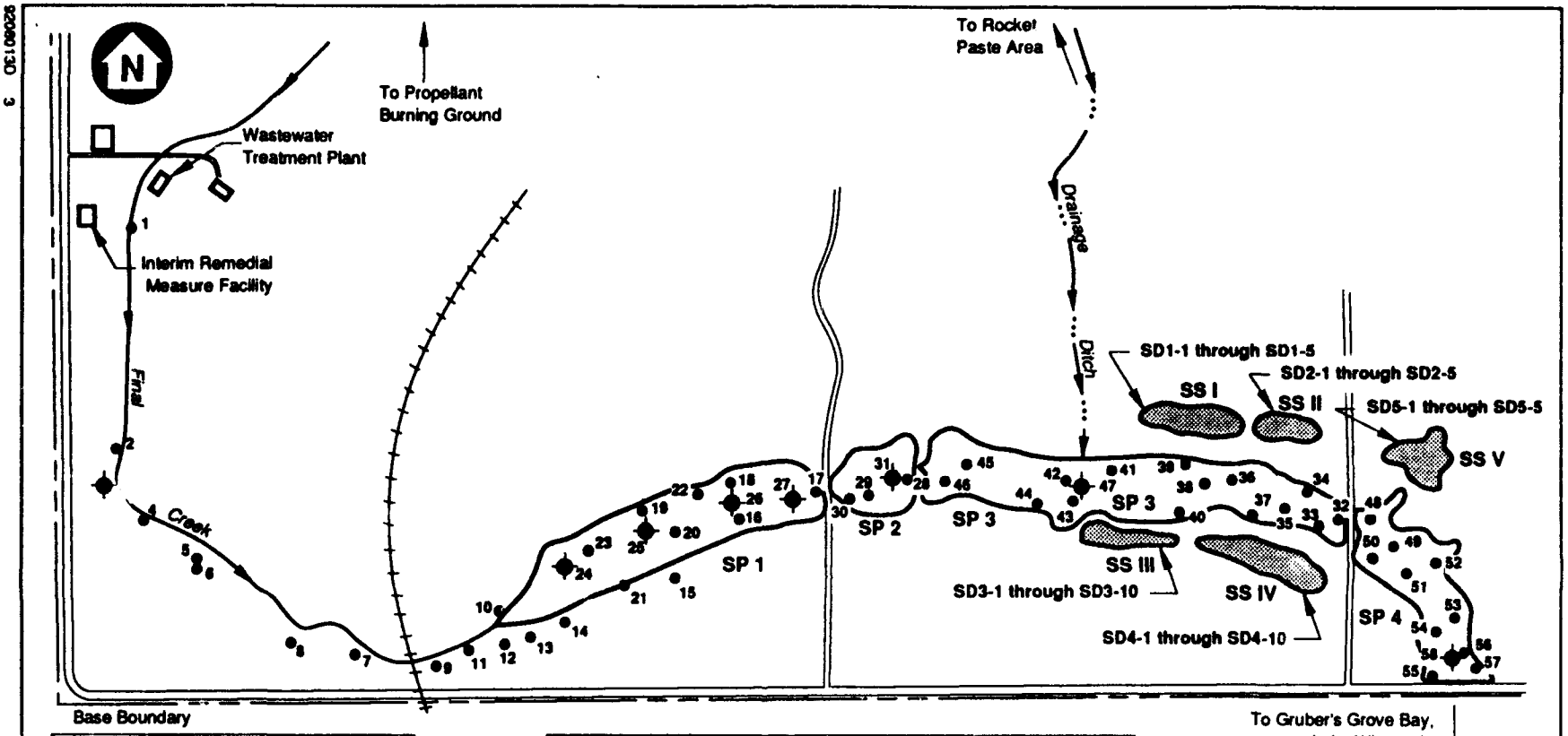


Source: Modified from Tsai, et.al., 1988.

FIGURE 6-9
EXPLORATION LOCATIONS
PROPELLANT BURNING GROUND
AND LANDFILL 1
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

9208002D1 3



LEGEND

- SP 1 - SETTLING PONDS
- SS II - SPOILS DISPOSAL SITES
- RAILROAD TRACK
- DRAINAGE DITCH
- SOIL BORING LOCATION
- SURFACE SOIL OR SEDIMENT SAMPLE LOCATION

Map Code	Well No.	Map Code	Well No.	Map Code	Well No.	Map Code	Well No.	Map Code	Well No.
1	FC-1	13	FPI-1	25	S1202	37	FPIII-6	48	FPIV-1
2	FC-2	14	FPI-2	26	S1203	38	FPIII-7	49	FPIV-2
3	SPB-91-01	15	FPI-3	27	S1204	39	FPIII-8	50	FPIV-3
4	FC-3	16	FPI-4	28	FPII-1	40	FPIII-9	51	FPIV-4
5	FC-4	17	FPI-5	29	FPII-2	41	FPIII-10	52	FPIV-5
6	FC-5	18	FPI-6	30	FPII-3	42	FPIII-11	53	FPIV-6
7	FC-6	19	FPI-7	31	S1205	43	FPIII-12	54	FPIV-7
8	FC-7	20	FPI-8	32	FPIII-1	44	FPIII-13	55	FPIV-8
9	FC-8	21	FPI-12	33	FPIII-2	45	FPIII-14	56	FPIV-9
10	FC-9	22	FPI-13	34	FPIII-3	46	FPIII-15	57	FPIV-10
11	FC-10	23	FPI-14	35	FPIII-4	47	S1206	58	S1207
12	FC-11	24	S1201	36	FPIII-5				

SCALE IN FEET

0 1000 2000

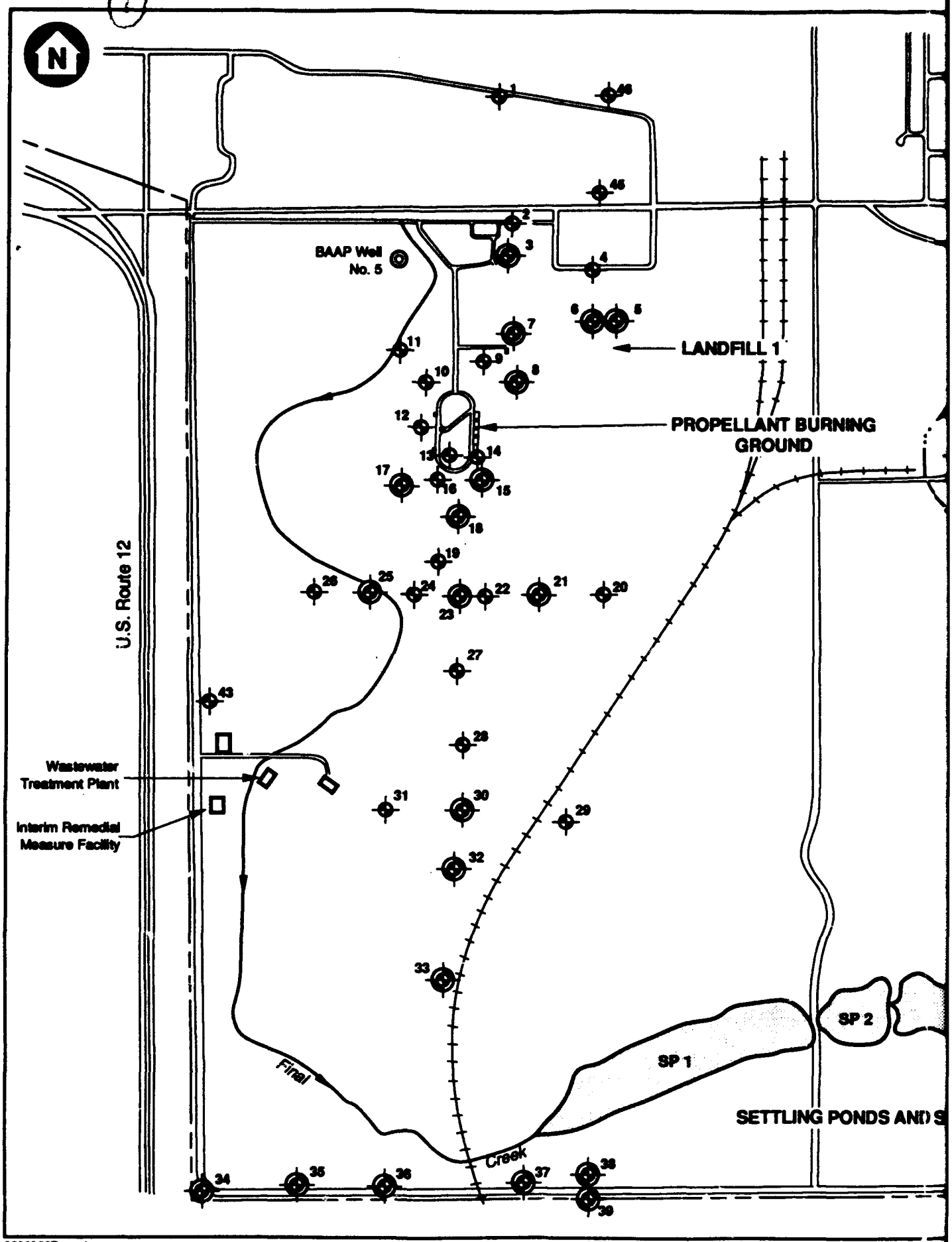
Source: Modified from Tsai, et.al., 1988.

NOTE:

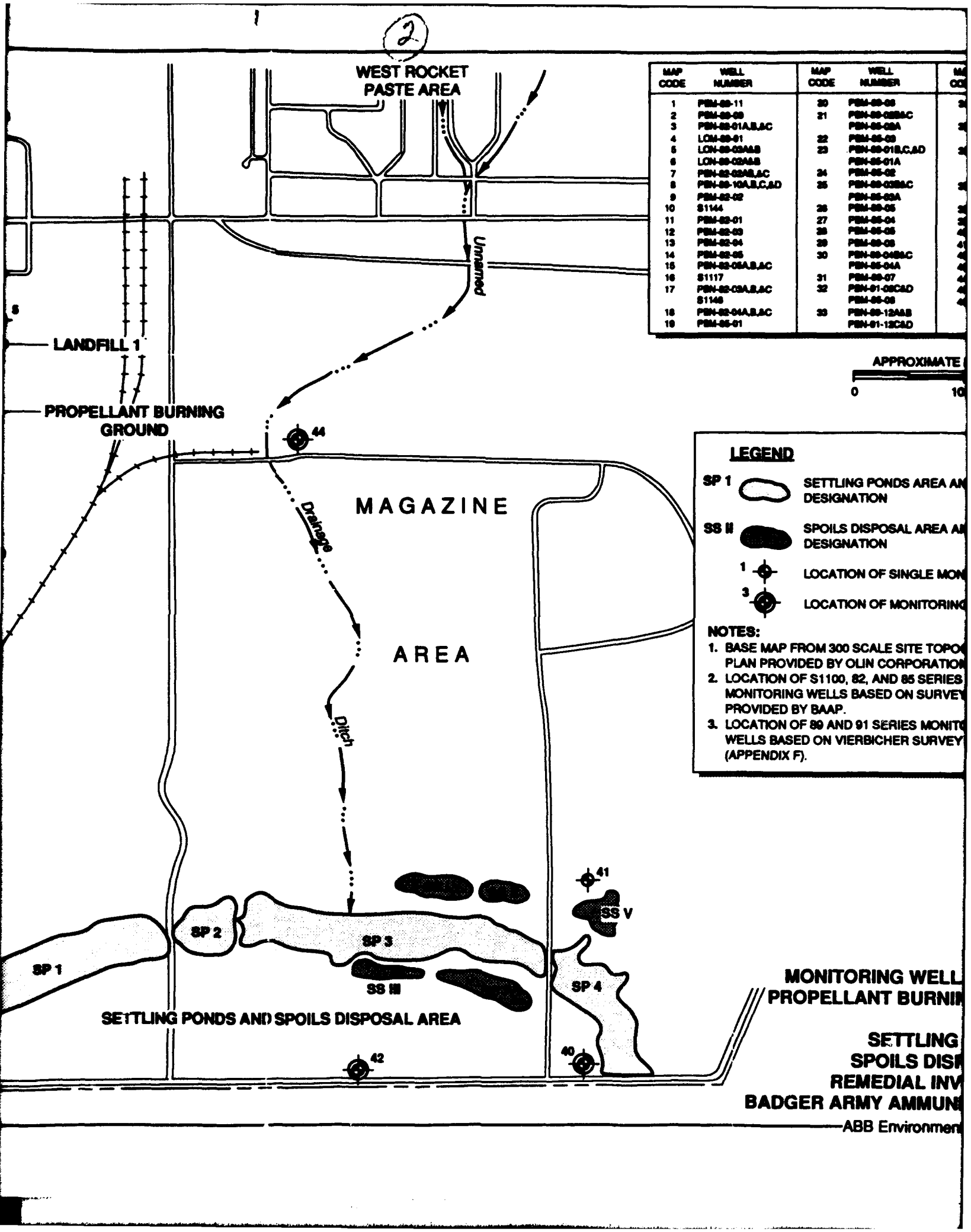
1. SURFACE SOIL AND SOIL BORING LOCATIONS ARE APPROXIMATED (AYERS, 1984, ENVIRONDYNE, 1981)

FIGURE 6-10
EXPLORATION LOCATIONS
SETTLING PONDS AND SPOILS DISPOSAL AREAS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

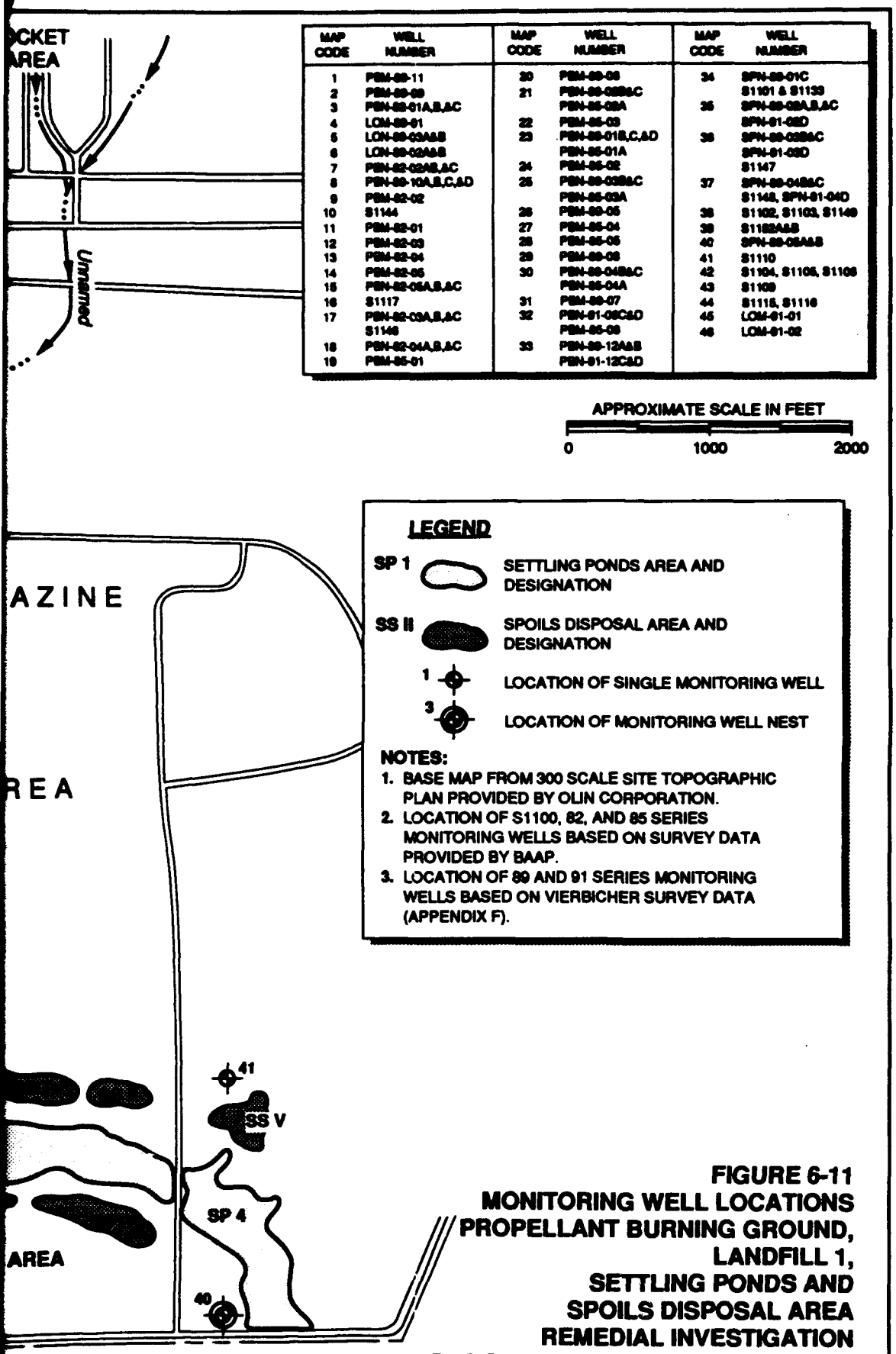
ABB Environmental Services, Inc.


N
BAAP Well No. 5
LANDFILL 1
PROPELLANT BURNING GROUND
U.S. Route 12
Wastewater Treatment Plant
Interim Remedial Measure Facility
SP 1
SP 2
SETTLING PONDS AND S
Final
Creek

9208080D de



MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER
1	PSM-89-11	20	PSM-89-06
2	PSM-89-09	21	PSM-89-08B&C
3	PSN-89-01A,B,&C		PSM-85-08A
4	LON-89-01	22	PSM-85-09
5	LON-89-03A&B	23	PSN-89-01B,C,&D
6	LON-89-02A&B		PSM-85-01A
7	PSN-82-02A&B,&C	24	PSM-85-02
8	PSN-89-10A,B,C,&D	25	PSN-89-03B&C
9	PSM-82-02		PSM-85-03A
10	S1144	26	PSM-89-05
11	PSM-82-01	27	PSM-85-04
12	PSM-82-03	28	PSM-85-05
13	PSM-82-04	29	PSM-89-08
14	PSM-82-05	30	PSN-89-04B&C
15	PSN-82-06A,B,&C		PSM-85-04A
16	S1117	31	PSM-89-07
17	PSN-82-03A,B,&C	32	PSN-91-08C&D
	S1146		PSM-85-08
18	PSN-82-04A,B,&C	33	PSN-89-12A&B
19	PSM-85-01		PSN-91-12C&D



MAP CODE	WELL NUMBER
1	PBM-89-11
2	PBM-89-09
3	PBN-89-01A,B,&C
4	LOM-89-01
5	LON-89-03A&B
6	LON-89-02A&B
7	PBN-89-02A&B,&C
8	PBN-89-10A,B,C,&D
9	PBM-82-02
10	S1144
11	PBM-82-01
12	PBM-82-03
13	PBM-82-04
14	PBM-82-05
15	PBN-82-05A,B,&C
16	S1117
17	PBN-82-03A,B,&C S1146
18	PBN-82-04A,B,&C
19	PBM-85-01
20	PBM-89-08
21	PBN-89-08B&C PBN-85-08A
22	PBM-85-03
23	PBN-89-01B,C,&D PBN-85-01A
24	PBM-85-02
25	PBN-89-03B&C PBN-85-03A
26	PBM-89-05
27	PBM-85-04
28	PBM-85-05
29	PBM-89-06
30	PBN-89-04B&C PBN-85-04A
31	PBM-89-07
32	PBN-91-09C&D PBM-85-09
33	PBN-89-12A&B PBN-91-12C&D
34	SPN-89-01C S1101 & S1139
35	SPN-89-03A,B,&C SPN-91-03D
36	SPN-89-03B&C SPN-91-03D S1147
37	SPN-89-04B&C S1148, SPN-91-04D
38	S1102, S1103, S1149
39	S1102A&B
40	SPN-89-05A&B
41	S1110
42	S1104, S1105, S1106
43	S1109
44	S1115, S1116
45	LOM-91-01
46	LOM-91-02

FIGURE 6-11
MONITORING WELL LOCATIONS
PROPELLANT BURNING GROUND,
LANDFILL 1,
SETTLING PONDS AND
SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

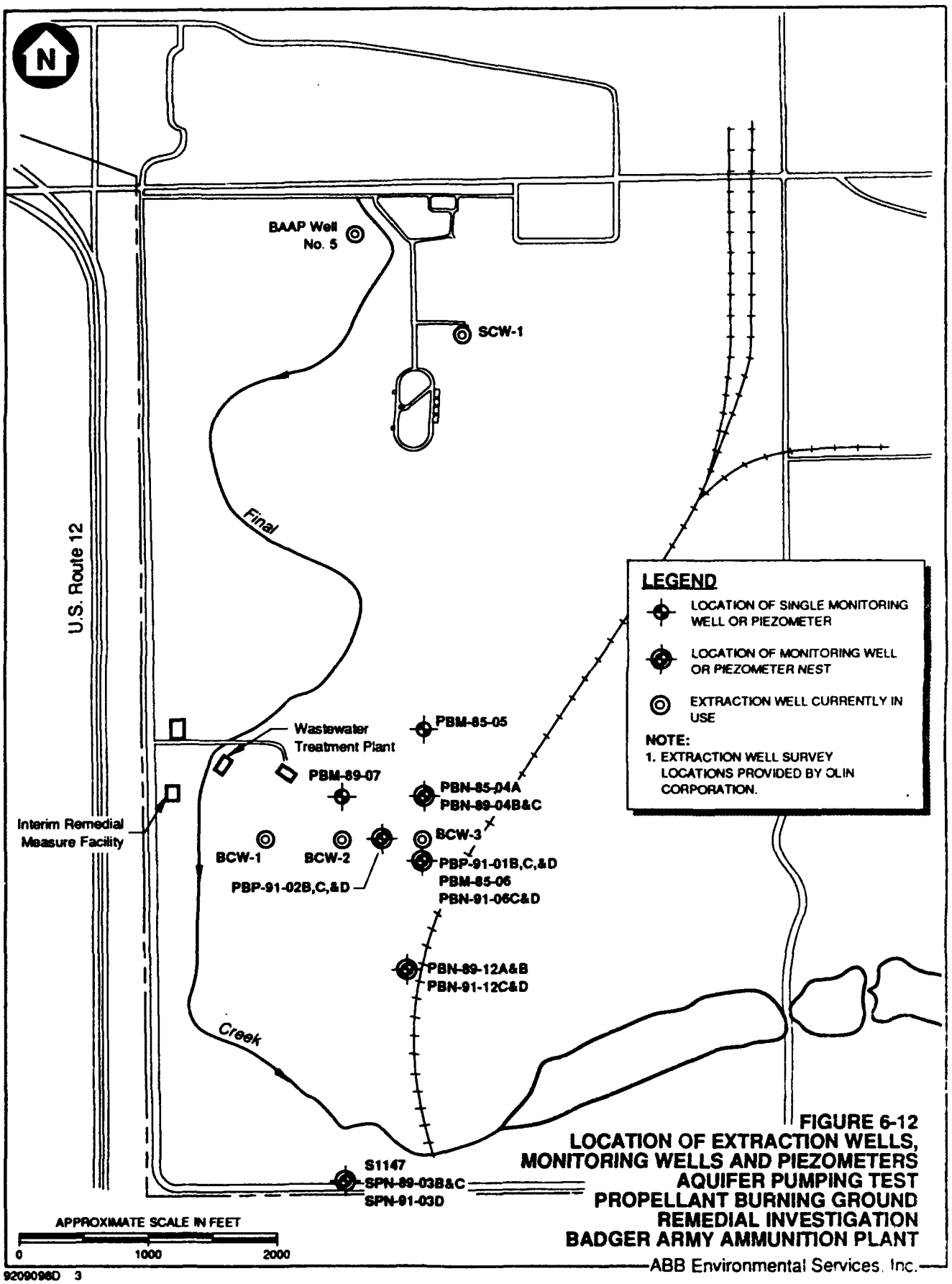
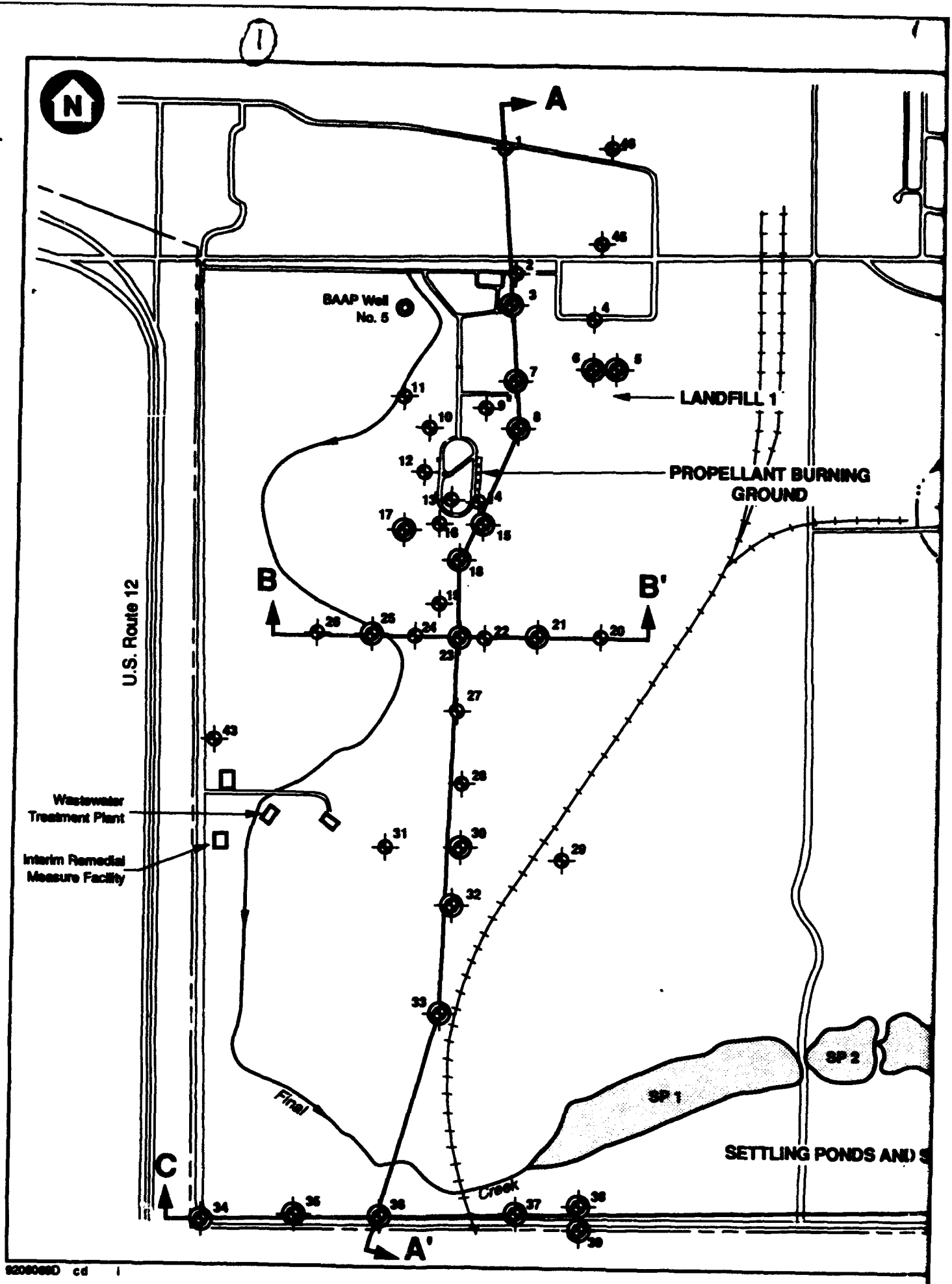


FIGURE 6-12
LOCATION OF EXTRACTION WELLS, MONITORING WELLS AND PIEZOMETERS AQUIFER PUMPING TEST PROPELLANT BURNING GROUND REMEDIAL INVESTIGATION BADGER ARMY AMMUNITION PLANT

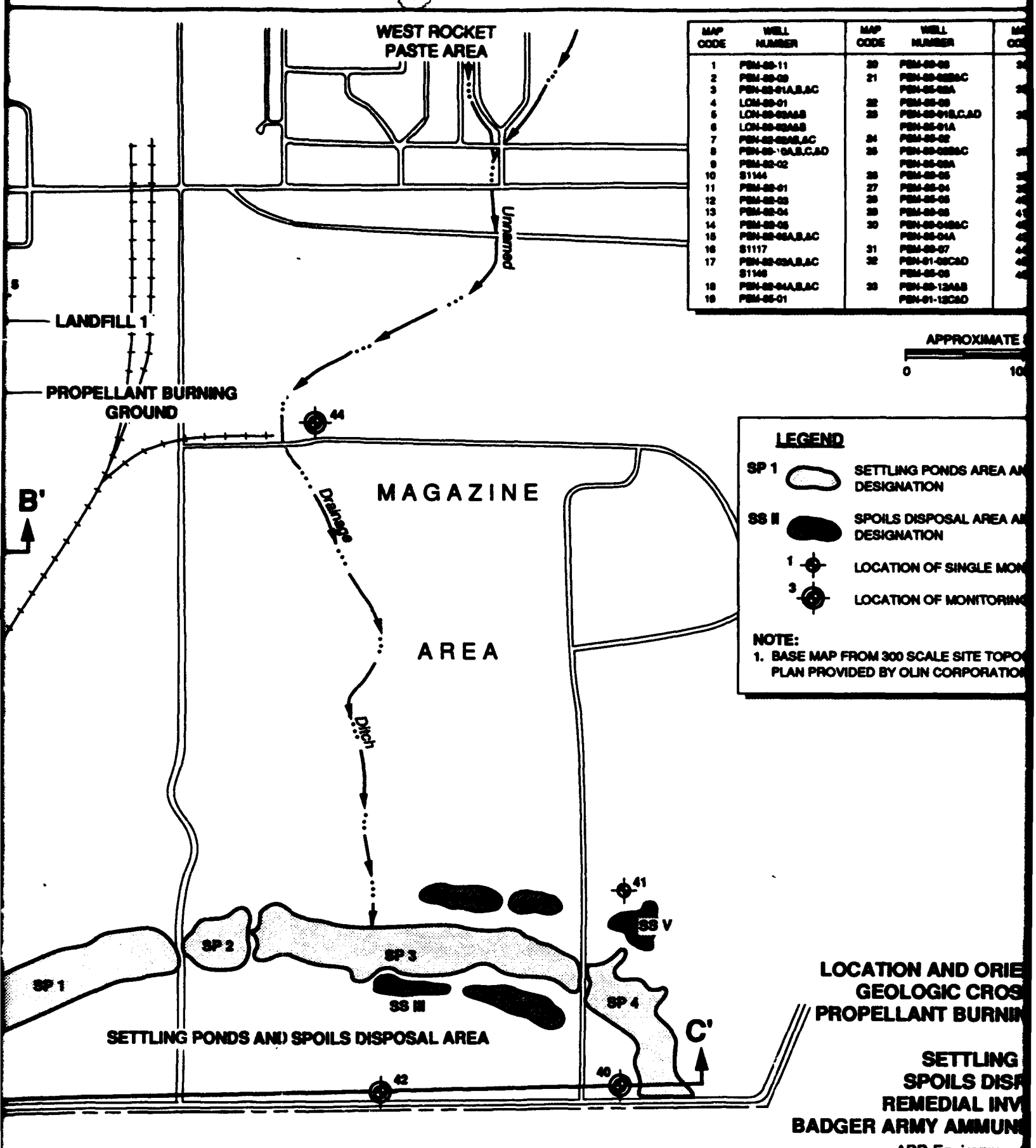
ABB Environmental Services, Inc.

9209096D 3

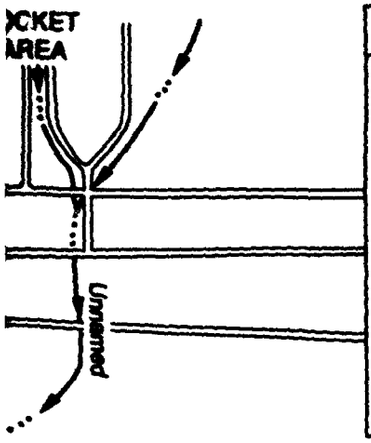


9200080D cd i

(2)



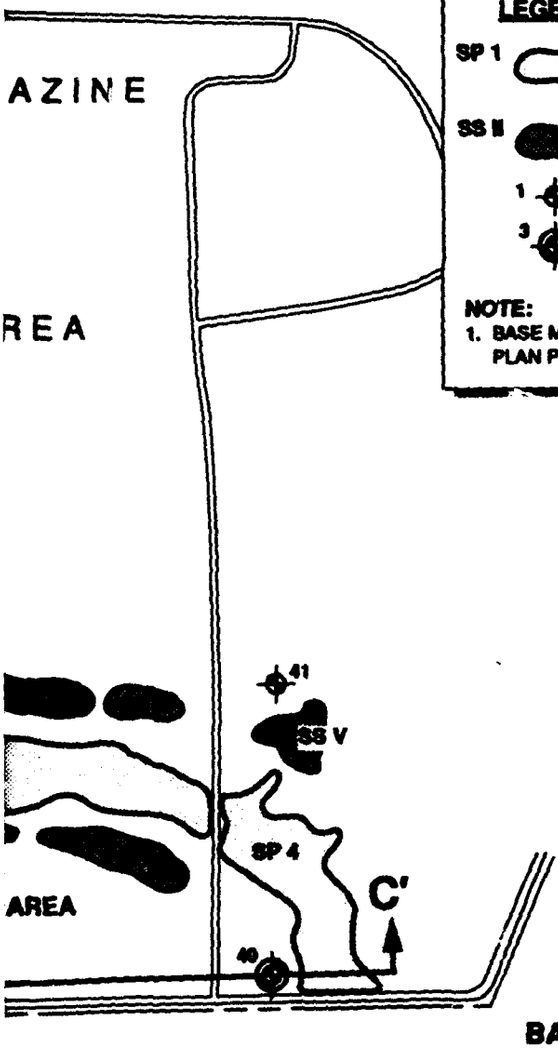
MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER
1	PBM-89-11	20	PBM-89-08
2	PBM-89-09	21	PBM-89-02B&C
3	PBM-89-01A,B,&C		PBM-85-08A
4	LOM-89-01	22	PBM-85-09
5	LOM-89-03A&B	23	PBM-89-01B,C,&D
6	LOM-89-03A&B		PBM-85-01A
7	PBM-89-02A&B,&C	24	PBM-89-02
8	PBM-89-10A,B,C,&D	25	PBM-89-02B&C
9	PBM-89-02		PBM-85-08A
10	S1144	26	PBM-89-05
11	PBM-89-01	27	PBM-85-04
12	PBM-89-03	28	PBM-85-05
13	PBM-89-04	29	PBM-89-06
14	PBM-89-05	30	PBM-89-04B&C
15	PBM-89-06A,B,&C		PBM-85-04A
16	S1117	31	PBM-89-07
17	PBM-89-03A,B,&C	32	PBM-91-09C&D
	S1146		PBM-85-09
18	PBM-89-04A,B,&C	33	PBM-89-12A&B
19	PBM-85-01		PBM-91-13C&D



MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER
1	PBM-88-11	20	PBM-88-06	34	SPN-88-01C
2	PBM-88-09	21	PBM-88-08B&C		S1101 & S1139
3	PBM-88-01A,B,&C		PBM-88-08A	35	SPN-88-08A,B,&C
4	LOM-89-01	22	PBM-88-08		SPN-91-08D
5	LOM-89-08A&B	23	PBM-89-01B,C,&D	36	SPN-89-03B&C
6	LOM-89-08A&B		PBM-88-01A		SPN-91-08D
7	PBM-88-08A,B,&C	24	PBM-88-02		S1147
8	PBM-89-10A,B,C,&D	25	PBM-89-03B&C	37	SPN-89-04B&C
9	PBM-88-02		PBM-88-03A		S1148, SPN-91-04D
10	S1144	26	PBM-88-05	38	S1102, S1105, S1149
11	PBM-88-01	27	PBM-88-04	39	S1108A&B
12	PBM-88-03	28	PBM-88-05	40	SPN-89-05A&B
13	PBM-88-04	29	PBM-88-09	41	S1110
14	PBM-88-05	30	PBM-89-04B&C	42	S1104, S1106, S1108
15	PBM-88-08A,B,&C		PBM-88-04A	43	S1109
16	S1117	31	PBM-88-07	44	S1115, S1116
17	PBM-88-03A,B,&C	32	PBM-91-08C&D	45	LOM-91-01
	S1146		PBM-88-08	46	LOM-91-02
18	PBM-88-04A,B,&C	33	PBM-89-12A&B		
19	PBM-88-01		PBM-91-12C&D		

APPROXIMATE SCALE IN FEET

0 1000 2000



LEGEND

SP 1 — SETTLING PONDS AREA AND DESIGNATION

SS II — SPOILS DISPOSAL AREA AND DESIGNATION

1 — LOCATION OF SINGLE MONITORING WELL

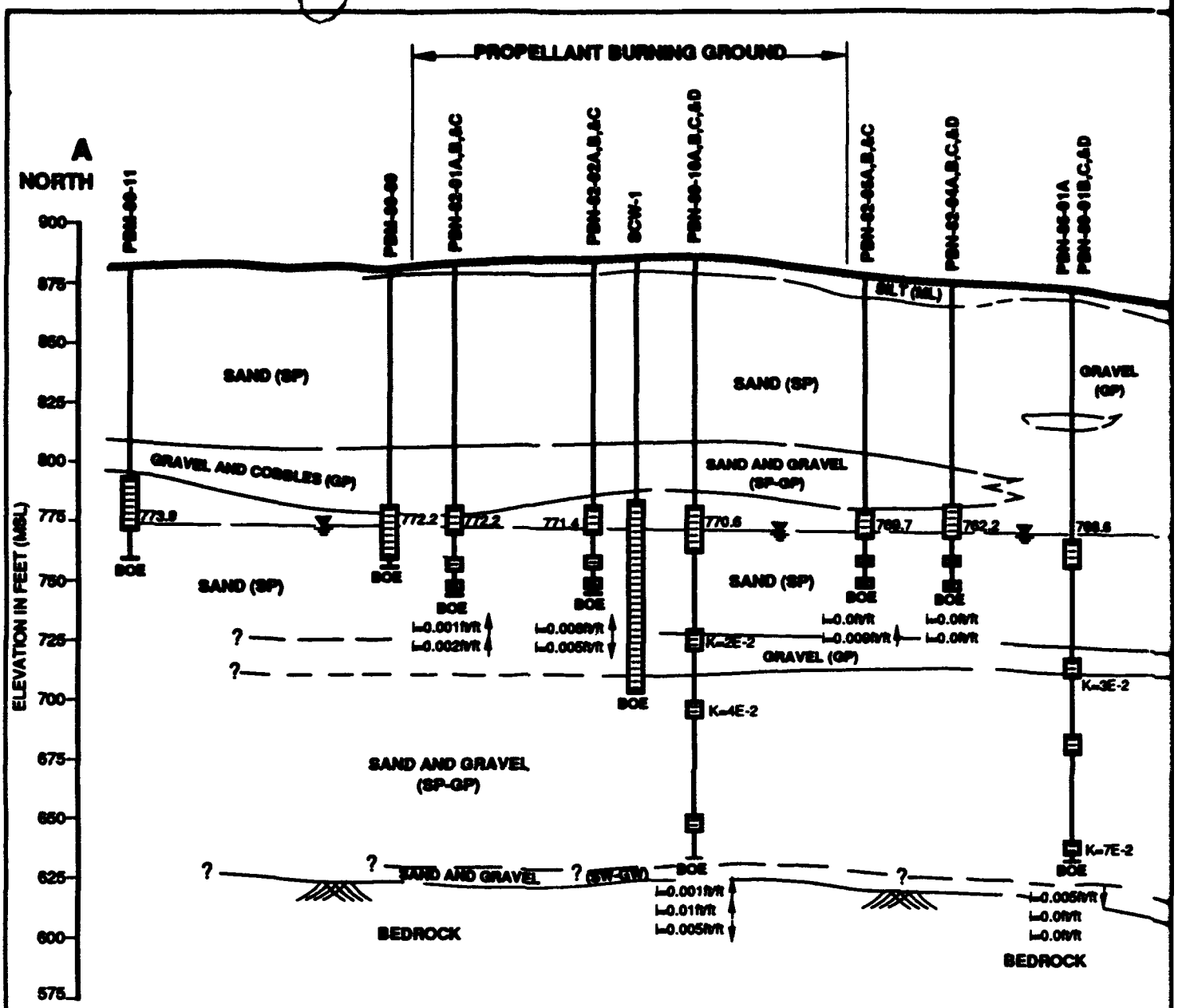
3 — LOCATION OF MONITORING WELL NEST

NOTE:

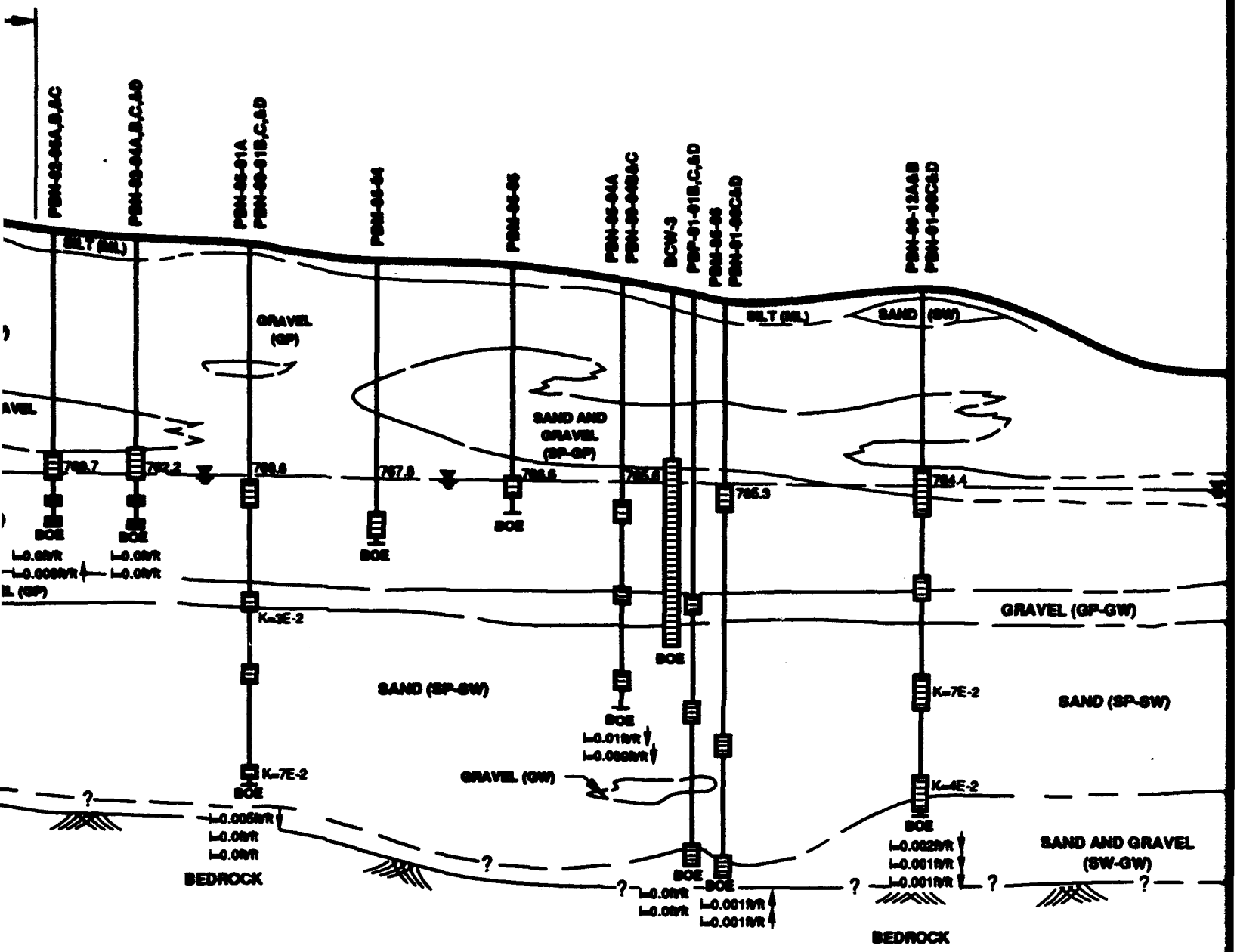
1. BASE MAP FROM 300 SCALE SITE TOPOGRAPHIC PLAN PROVIDED BY OLIN CORPORATION.

FIGURE 6-13
LOCATION AND ORIENTATION OF GEOLOGIC CROSS SECTIONS PROPELLANT BURNING GROUND, LANDFILL 1, SETTLING PONDS AND SPOILS DISPOSAL AREA REMEDIAL INVESTIGATION BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.


PROPELLANT BURNING GROUND
A
NORTH
ELEVATION IN FEET (MSL)
900
875
850
825
800
775
750
725
700
675
650
625
600
575
PBN-89-11
PBN-89-09
PBN-89-01A,B,&C
PBN-89-02A,B,&C
SCW-1
PBN-89-10A,B,C,&D
PBN-89-04A,B,&C
PBN-89-04A,B,C,&D
PBN-89-01A
PBN-89-01B,C,&D
SILT (ML)
SAND (SP)
GRAVEL (GP)
GRAVEL AND COBBLES (GP)
SAND AND GRAVEL (SP-GP)
773.9
772.2
772.2
771.4
770.6
769.7
769.2
768.6
BOE
I=0.001ft/ft
I=0.002ft/ft
I=0.006ft/ft
I=0.005ft/ft
K=2E-2
K=4E-2
K=3E-2
K=7E-2
I=0.01ft/ft
I=0.0ft/ft
I=0.006ft/ft
I=0.005ft/ft
SAND AND GRAVEL (SW-GW)
BEDROCK
LEGEND
PBN-89-10 A,B,C,&D
WELL DESIGNATION; SUFFIXES REFER TO WATER TABLE WELL (A) AND PIEZOMETER (B,C,&D)
GROUND SURFACE
SAND (SP)
SOILS DESCRIPTION AND USCS CLASSIFICATION
773.9
WATER TABLE ELEVATION
SCREENED INTERVAL
K=5E-3
IN-FIELD PERMEABILITY TEST RESULTS IN cm/sec
BOE
BOTTOM OF EXPLORATION
I=0.001ft/ft
GROUNDWATER VERTICAL GRADIENT (ARROW INDICATES DIRECTION OF VERTICAL GRADIENT)
SCALE IN FEET
0
400
800
VERTICAL EXAGGERATON 1:10

(2)



REFER TO WATER
TER (B,C,&D)

CLASSIFICATION

RESULTS IN cm/sec

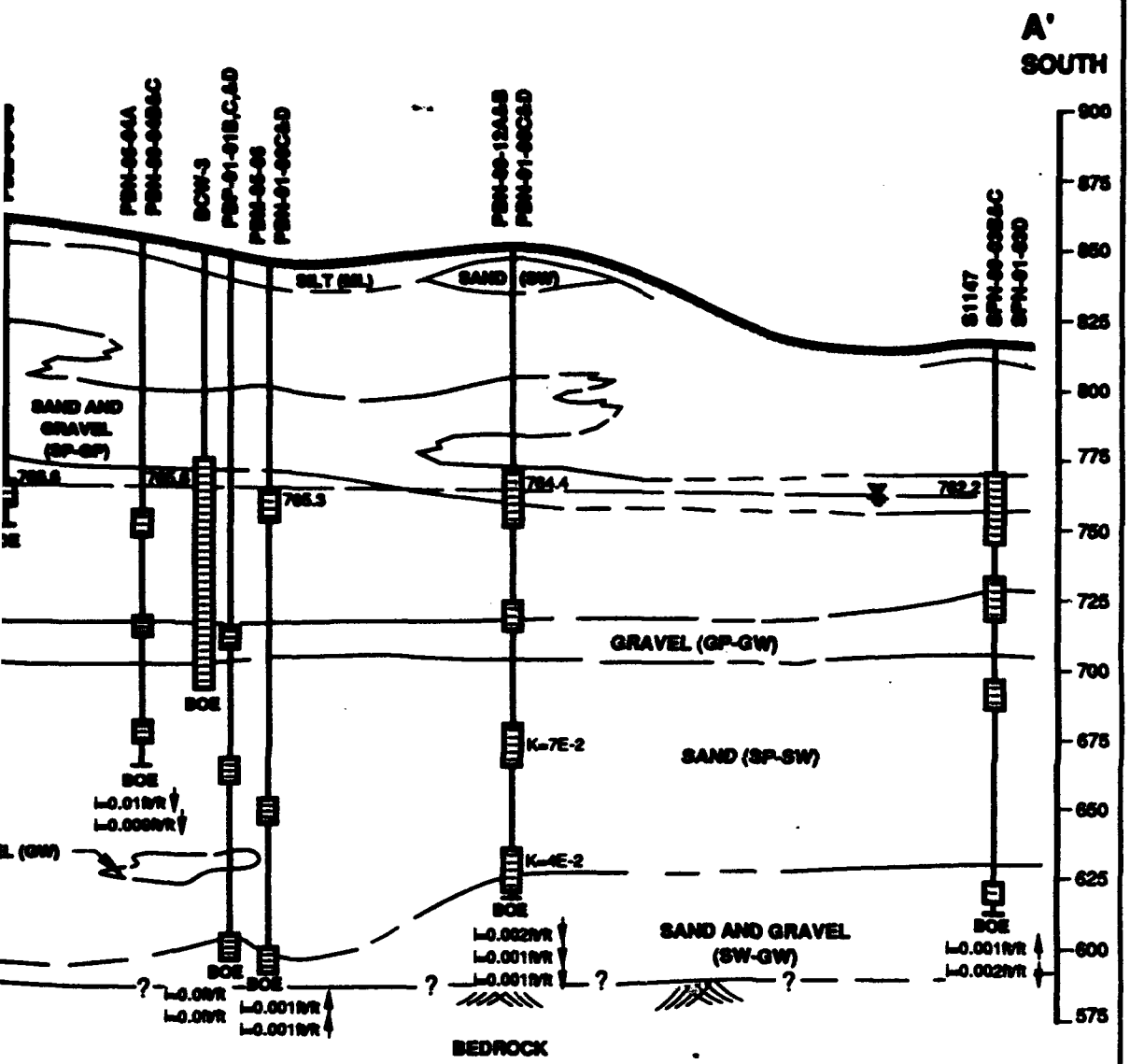
ADIENT (ARROW
ITICAL GRADIENT)

NOTES:

1. SEE FIGURE 2-2 FOR LOCATION AND ORIENTATION OF PROFILE.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. ON MULTIPLE WELL NESTS, GRADIENTS ARE LISTED IN ORDER OF SHALLOW TO DEEP WELLS; i.e., A TO B, B TO C AND C TO D.
4. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91 ARE LISTED.
5. BEDROCK SURFACE ELEVATION ESTIMATED FROM PBS-89-10 AND PRODUCTION WELL NO. 5.
6. BEDROCK SURFACE ELEVATION ESTIMATED FROM PBN-89-12D (LOCATED ADJACENT TO PBN-89-10), SPN-91-04D (LOCATED APPROXIMATELY 1200 FEET EAST OF SPN-91-03D), AND PRODUCTION WELL NO. 5 (LOCATED APPROXIMATELY 1000 FEET NORTH OF PBN-89-10).
7. PBP-91-0-2B,C,&D IS USED ONLY FOR GEOLOGIC INFORMATION AND AQUIFER ANALYSIS. IT IS NOT A MONITORING WELL CLUSTER.

GEOLOGIC CROSS S
PROPELLANT BURNI
SETTLING
SPOILS DIS
REMEDIAL INV
BADGER ARMY AMMUN

ABB Environmen

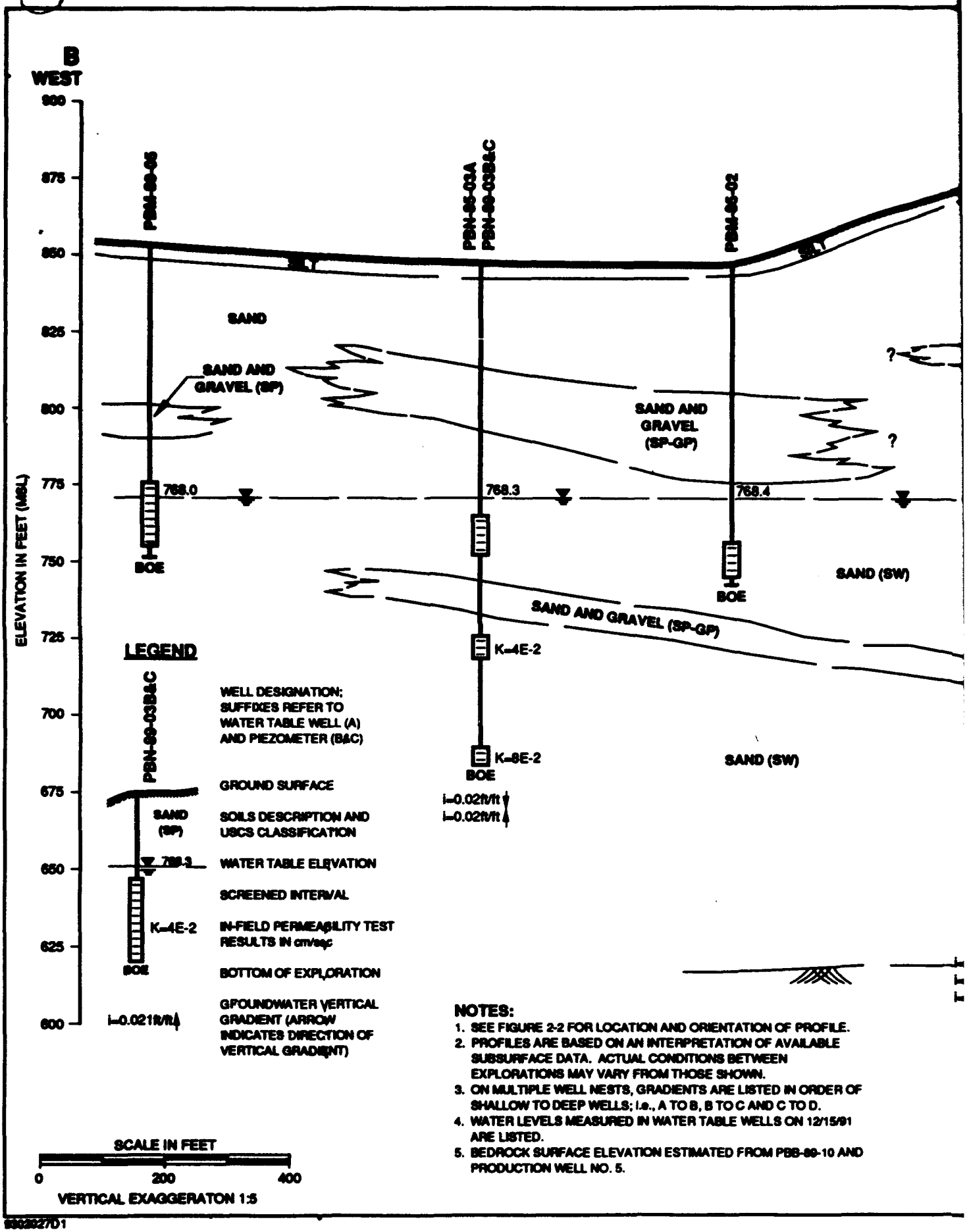


OCATION AND ORIENTATION OF PROFILE.
ON AN INTERPRETATION OF AVAILABLE SUBSURFACE
TIONS BETWEEN EXPLORATIONS MAY VARY FROM

STS, GRADIENTS ARE LISTED IN ORDER OF SHALLOW
TO B, B TO C AND C TO D.
RED IN WATER TABLE WELLS ON 12/15/91 ARE LISTED.
EVATION ESTIMATED FROM PBB-89-10 AND
). 5.
EVATION ESTIMATED FROM PBN-89-12D (LOCATED
6), SPN-91-04D (LOCATED APPROXIMATELY 1200 FEET
AND PRODUCTION WELL NO. 5 (LOCATED
FEET NORTH OF PBN-89-10).
ED ONLY FOR GEOLOGIC INFORMATION AND AQUIFER
MONITORING WELL CLUSTER.

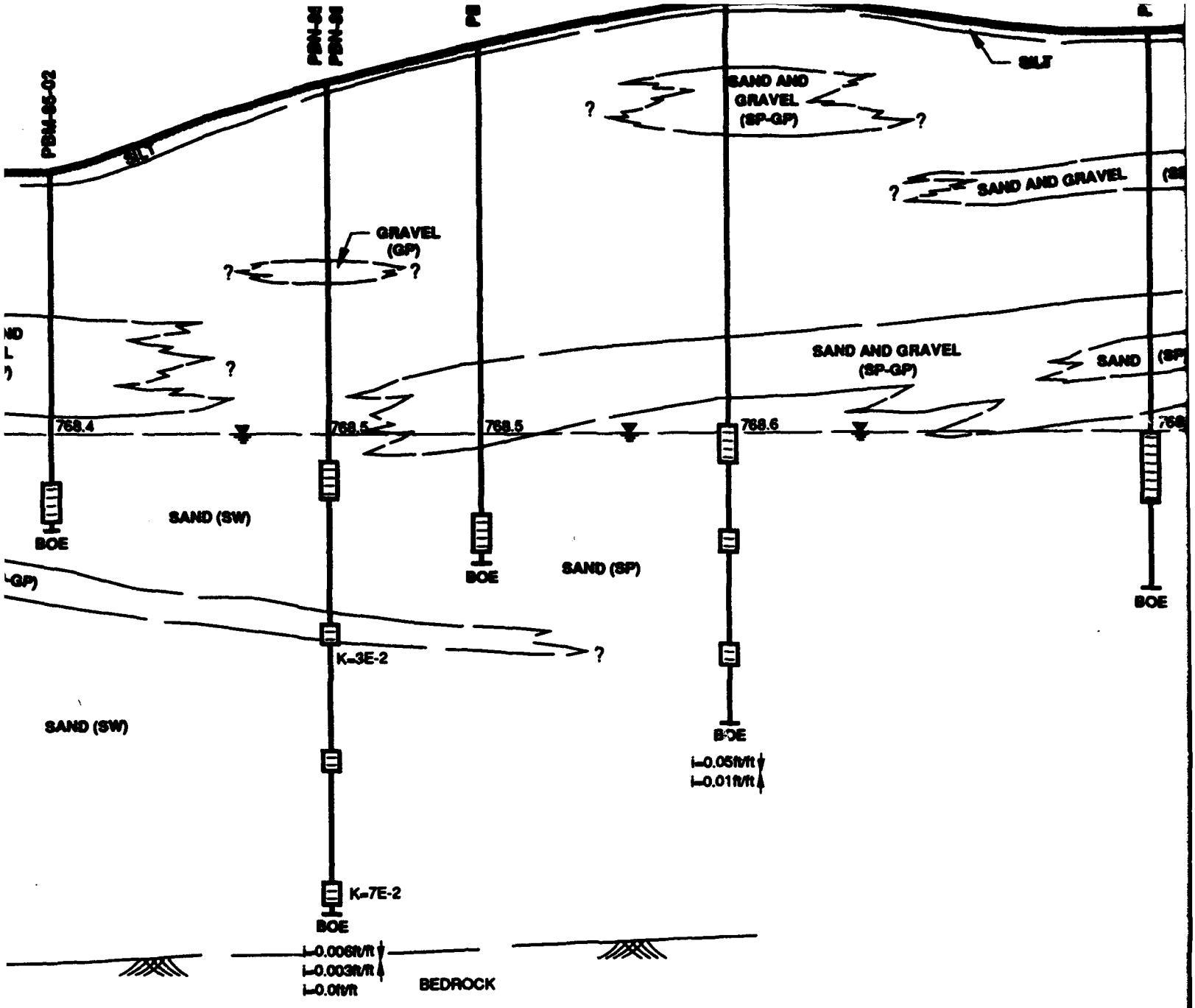
FIGURE 6-14
GEOLOGIC CROSS SECTION A-A'
PROPELLANT BURNING GROUND,
SETTLING POINDS AND
SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



NOTES:

1. SEE FIGURE 2-2 FOR LOCATION AND ORIENTATION OF PROFILE.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. ON MULTIPLE WELL NESTS, GRADIENTS ARE LISTED IN ORDER OF SHALLOW TO DEEP WELLS; *i.e.*, A TO B, B TO C AND C TO D.
4. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91 ARE LISTED.
5. BEDROCK SURFACE ELEVATION ESTIMATED FROM PBB-89-10 AND PRODUCTION WELL NO. 5.



ORIENTATION OF PROFILE.
RETATION OF AVAILABLE
TIONS BETWEEN
OSE SHOWN.
ITS ARE LISTED IN ORDER OF
B, B TO C AND C TO D.
R TABLE WELLS ON 12/15/91

IMATED FROM PBB-89-10 AND

GEOLOGIC CROSS SE
PROPELLANT BURNIN
SETTLING PONDS AND SPOILS DISP
REMEDIAL INVE
BADGER ARMY AMMUNIT

ABB Environmenta

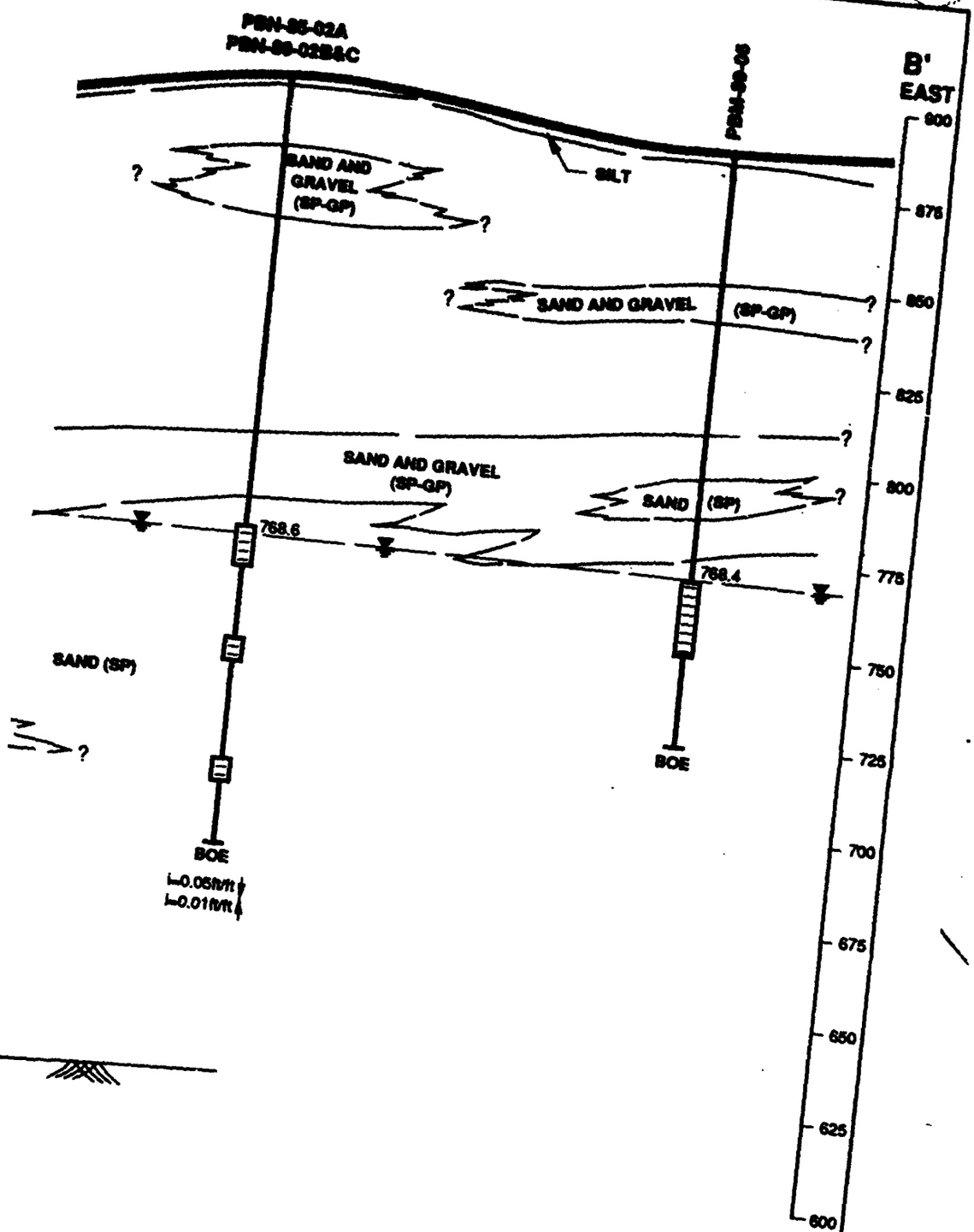
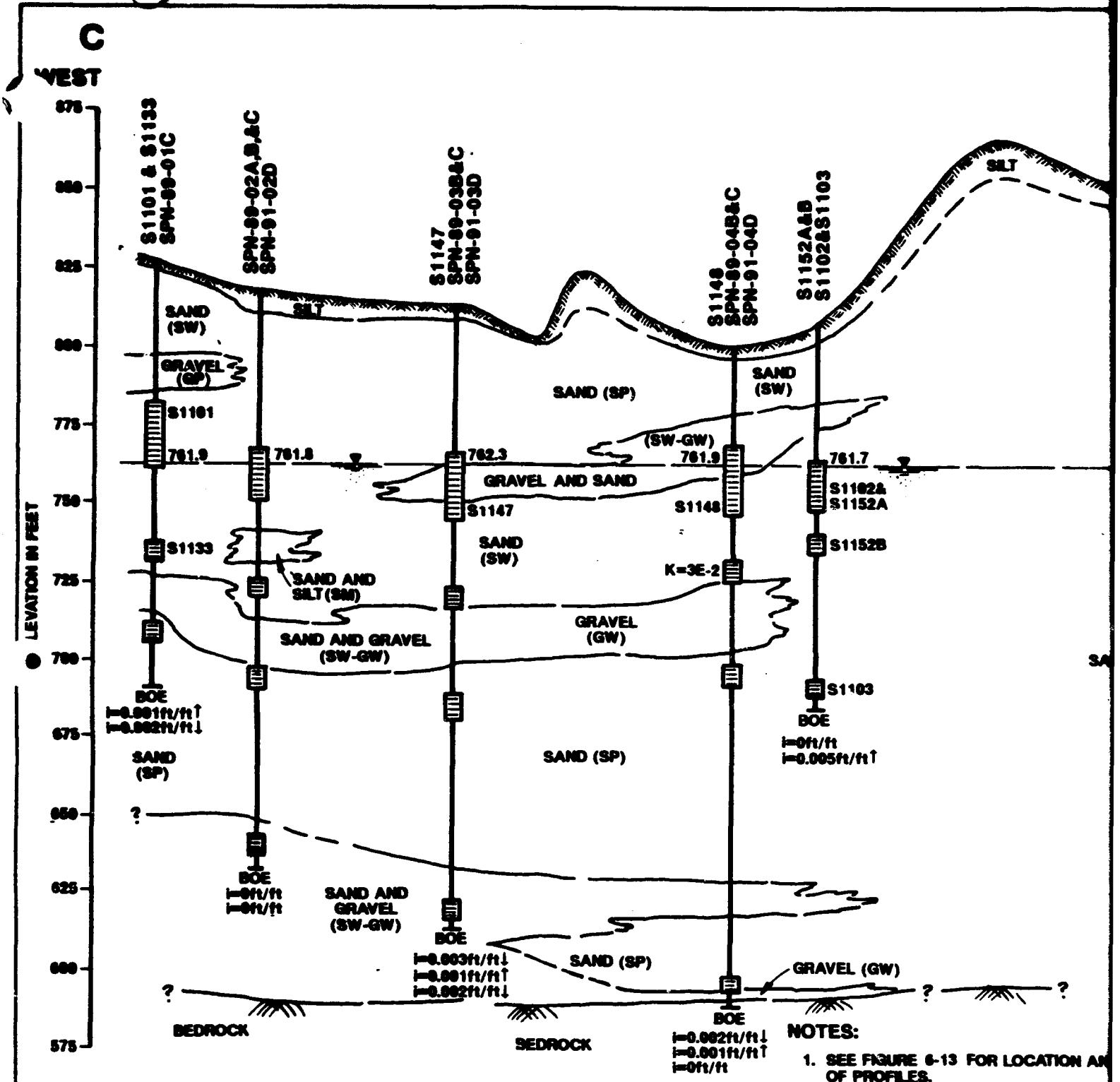


FIGURE 6-15
GEOLOGIC CROSS SECTION B-B'
PROPELLANT BURNING GROUND,
SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT
ABB Environmental Services, Inc.



NOTES:

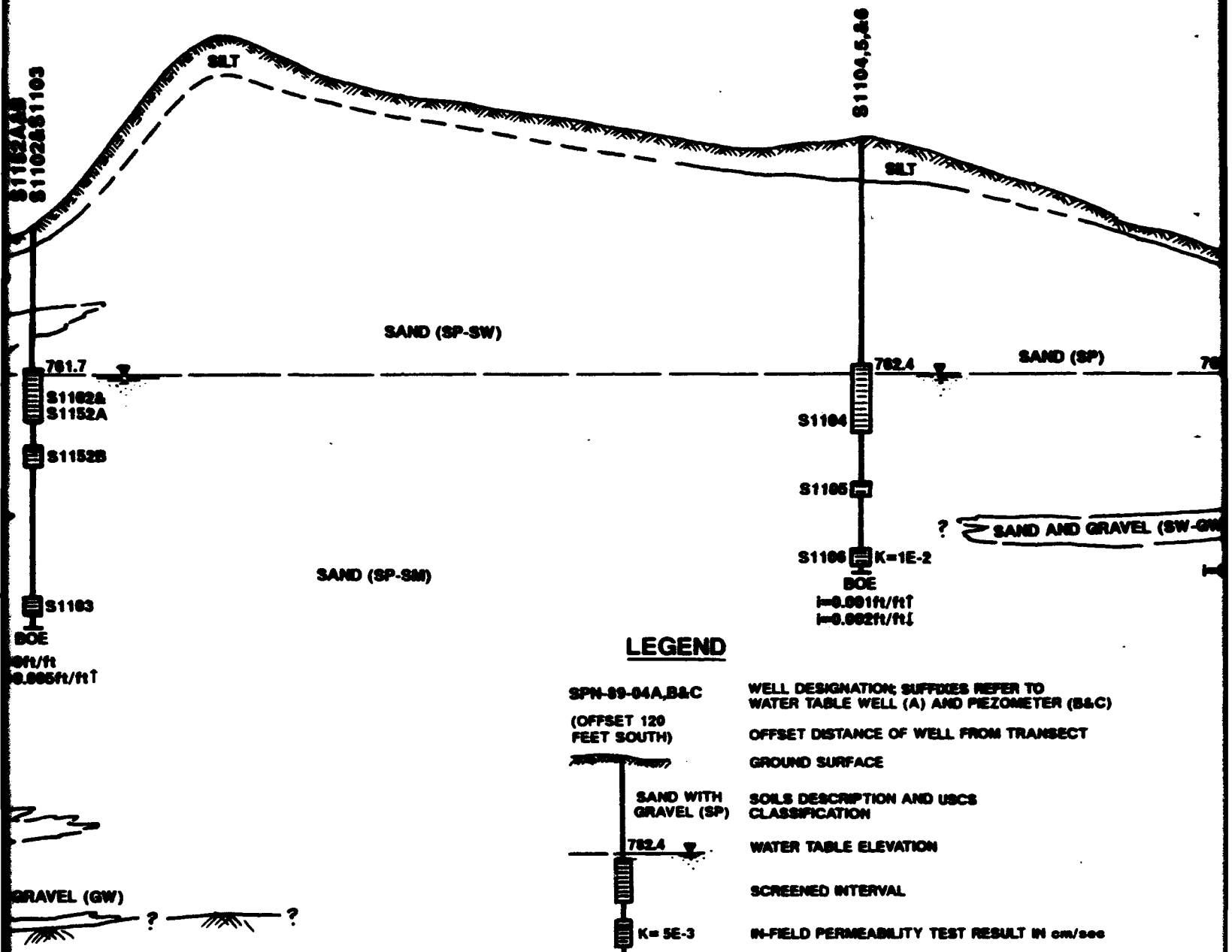
1. SEE FIGURE 6-13 FOR LOCATION AN OF PROFILES.
2. PROFILES ARE BASED ON AN INTER AVAILABLE SUBSURFACE DATA. AC BETWEEN EXPLORATIONS MAY VAR
3. ON MULTIPLE WELL NESTS, GRADIE ORDER OF SHALLOW TO DEEP WEL C TO D.
4. WATER LEVELS MEASURED IN WATE 12/15/91 ARE LISTED.
5. BEDROCK SURFACE ELEVATION EST SPN-91-04D.

SCALE IN FEET

0 500 1000

VERTICAL EXAGGERATION 1:15

6853-12 /92021511



LEGEND

SPN-89-04A,B&C	WELL DESIGNATION; SUFFIXES REFER TO WATER TABLE WELL (A) AND PIEZOMETER (B&C)
(OFFSET 120 FEET SOUTH)	OFFSET DISTANCE OF WELL FROM TRANSECT
	GROUND SURFACE
SAND WITH GRAVEL (SP)	SOILS DESCRIPTION AND USCS CLASSIFICATION
762.4	WATER TABLE ELEVATION
	SCREENED INTERVAL
K= 5E-3	IN-FIELD PERMEABILITY TEST RESULT IN cm/sec
BOE	BOTTOM OF EXPLORATION
i=0.05 ft/ft↓	GROUNDWATER VERTICAL GRADIENT

NOTES:

1. SEE FIGURE 6-13 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. ON MULTIPLE WELL NESTS, GRADIENTS ARE LISTED IN ORDER OF SHALLOW TO DEEP WELLS, i.e., A TO B, B TO C, C TO D.
4. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91 ARE LISTED.
5. BEDROCK SURFACE ELEVATION ESTIMATED FROM SPN-91-04D.

FIGURE 6
GEOLOGIC CROSS SECTION (
PROPELLANT BURNING GROU
SETTLING PONDS AND SPOILS DISPOSAL A
REMEDIAL INVESTIGAT
BADGER ARMY AMMUNITION PL

ABB Environmental Services

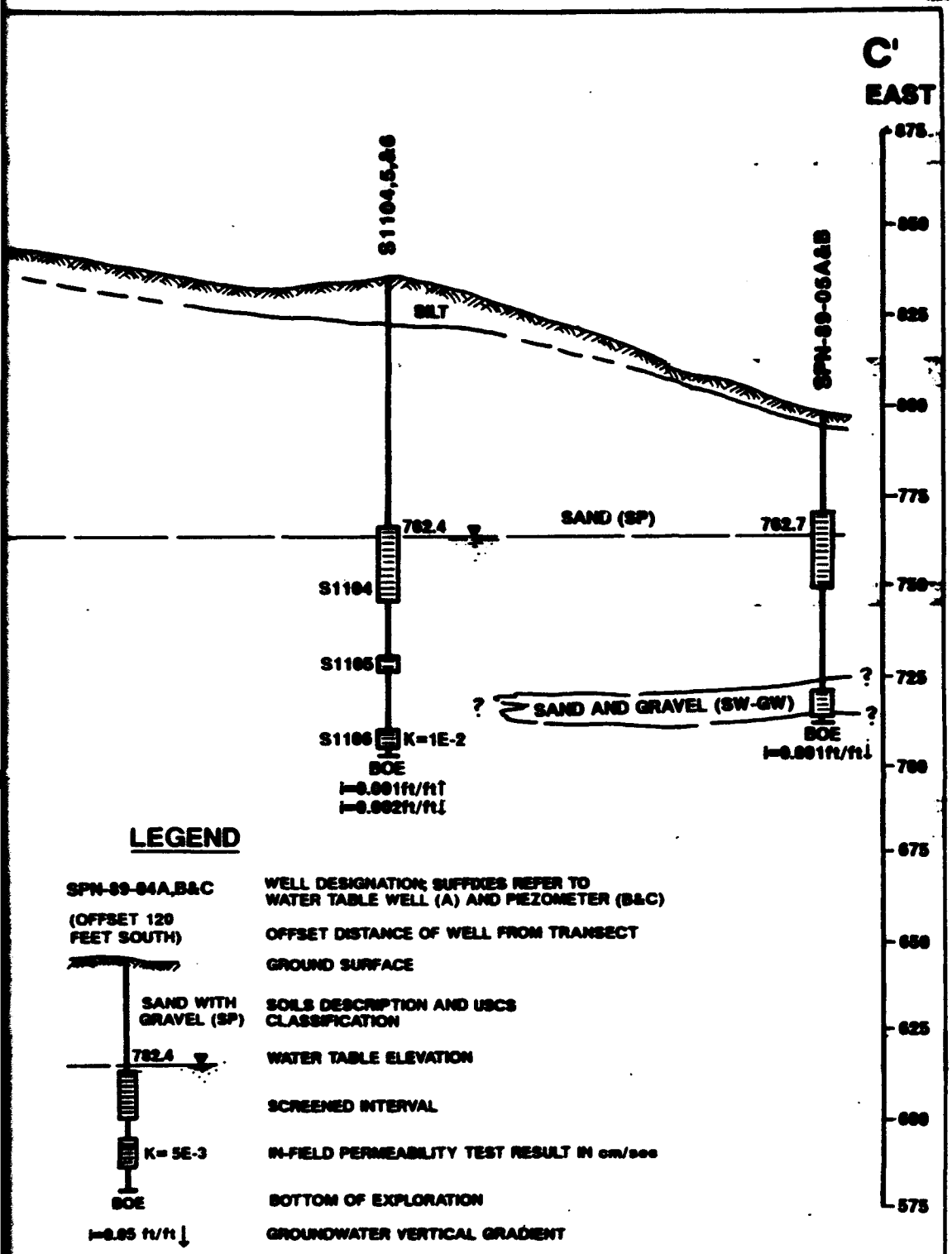
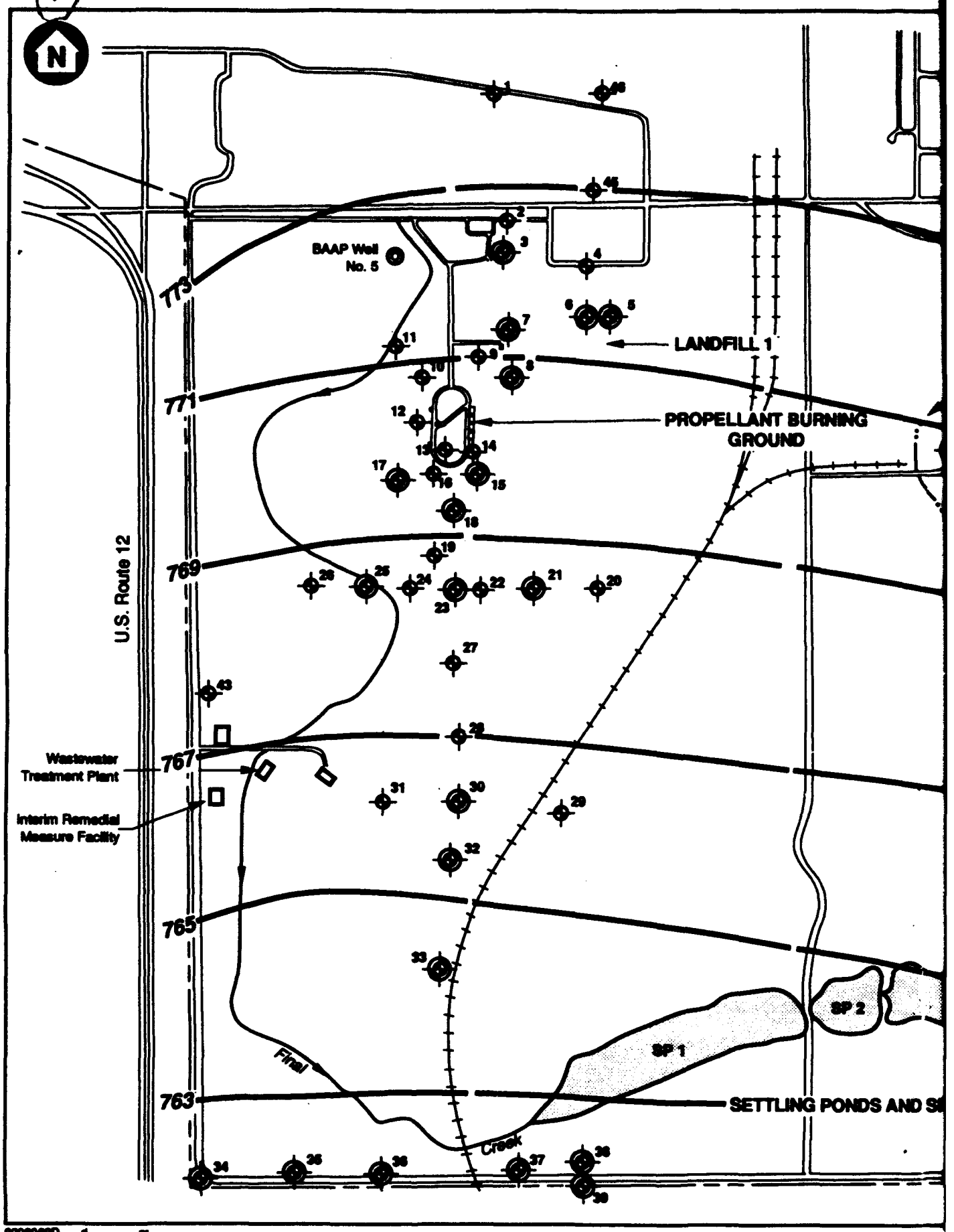


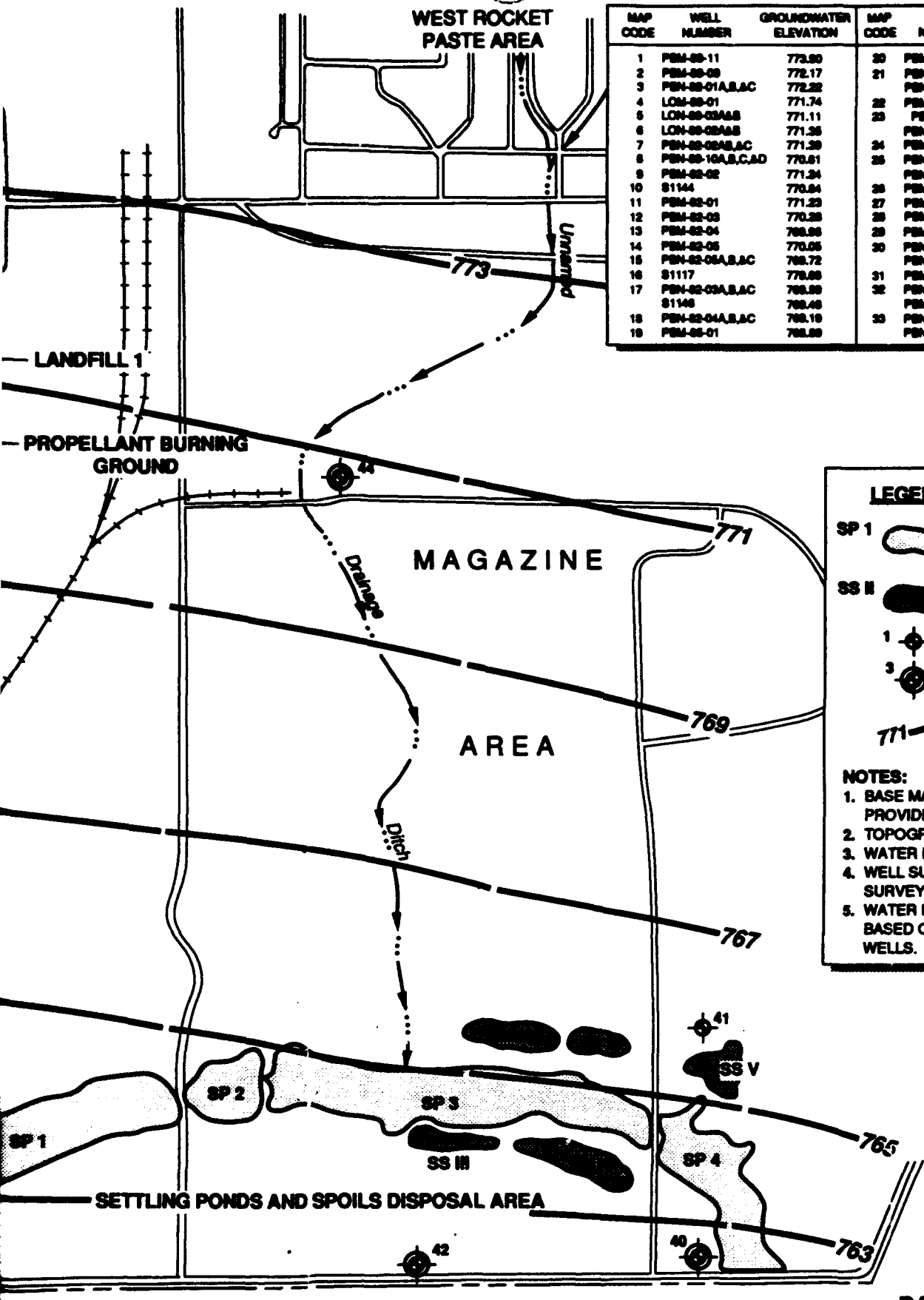
FIGURE 6-16
GEOLOGIC CROSS SECTION C-C'
PROPELLANT BURNING GROUND,
SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.


N
BAAP Well No. 5
LANDFILL 1
PROPELLANT BURNING GROUND
U.S. Route 12
Wastewater Treatment Plant
Interim Remedial Measure Facility
SP 1
SP 2
SETTLING PONDS AND SI
Final Creek
773
771
769
767
765
763

92080080 d m

(2)



MAP CODE	WELL NUMBER	GROUNDWATER ELEVATION
1	PSM-89-11	773.90
2	PSM-89-09	772.17
3	PSN-89-01A,B,AC	772.22
4	LOM-89-01	771.74
5	LON-89-03A&B	771.11
6	LON-89-02A&B	771.35
7	PSN-89-02A&B,AC	771.39
8	PSN-89-10A,B,C,AD	770.61
9	PSM-89-02	771.24
10	S1144	770.84
11	PSM-89-01	771.23
12	PSM-89-03	770.28
13	PSM-89-04	769.86
14	PSM-89-05	770.05
15	PSN-89-05A,B,AC	769.72
16	S1117	770.69
17	PSN-89-03A,B,AC	769.89
	S1146	769.46
18	PSN-89-04A,B,AC	769.19
19	PSM-89-01	769.89

MAP CODE	WELL NUMBER	GROUNDWATER ELEVATION
20	PSM-89-08	768.39
21	PSN-89-08B&C	
	PSN-89-08A	768.89
22	PSM-89-09	768.45
23	PSN-89-01B,C,AD	
	PSN-89-01A	768.60
24	PSM-89-02	768.35
25	PSN-89-09B&C	
	PSN-89-09A	768.28
26	PSM-89-06	768.09
27	PSM-89-04	767.76
28	PSM-89-05	768.08
29	PSM-89-03	768.10
30	PSN-89-04B&C	
	PSN-89-04A	768.61
31	PSM-89-07	768.49
32	PSN-91-09C&D	
	PSM-89-08	768.39
33	PSN-89-12A&B	764.43
	PSN-91-12C&D	

MAP CODE	WELL NUMBER
34	SPN-89-0
	S1161 & S
35	SPN-89-0
	SPN-91-0
36	SPN-89-0
	SPN-91-0
	S1147
37	SPN-89-0
	S1148, SP
38	S1162, S1
39	S1163A&B
40	SPN-89-0
41	S1110
42	S1104, S1
43	S1109
44	S1115, S1
45	LOM-91-01
46	LOM-91-0

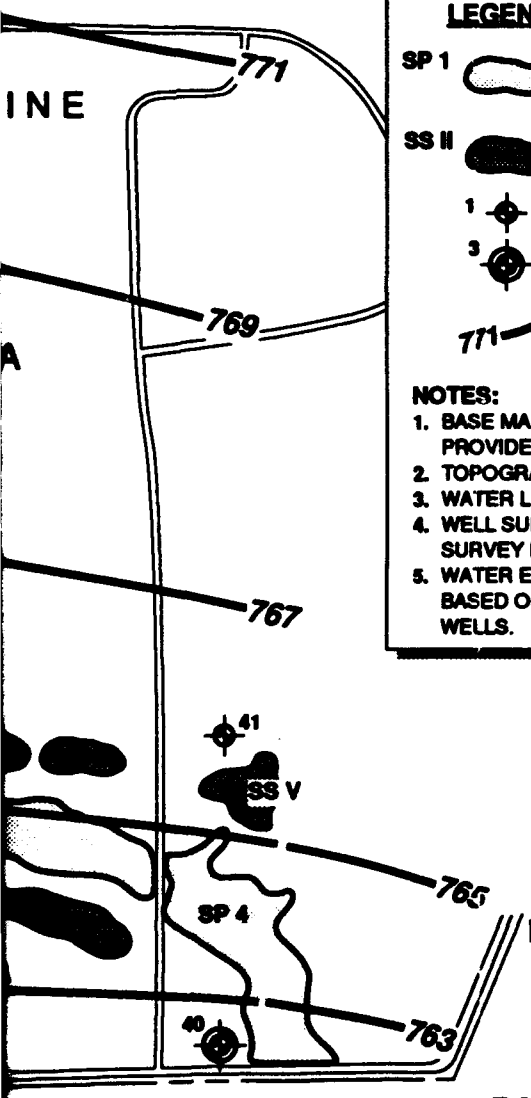
FI
INTE
WATER TABLE CONT
PROPELLANT BURNING
LA
SETTLING PO
SPOILS DISPO
REMEDIAL INVES
BADGER ARMY AMMUNITI

ABB Environmental

MAP CODE	WELL NUMBER	GROUNDWATER ELEVATION	MAP CODE	WELL NUMBER	GROUNDWATER ELEVATION	MAP CODE	WELL NUMBER	GROUNDWATER ELEVATION
1	PBM-89-11	773.89	20	PBM-89-08	768.39	34	SPN-89-01C	
2	PBM-89-09	772.17	21	PBN-89-03B&C			S1101 & S1139	761.87
3	PBN-89-01A,B,&C	772.22		PBN-89-03A	768.88	35	SPN-89-03A,B,&C	761.82
4	LOM-89-01	771.74	22	PBM-89-03	768.46		SPN-91-03D	
5	LON-89-03A&B	771.11	23	PBN-89-01B,C,&D		36	SPN-89-03B&C	
6	LON-89-03A&B	771.35		PBN-89-01A	768.60		SPN-91-03D	
7	PBN-89-03A&B,&C	771.39	24	PBM-89-02	768.36		S1147	762.28
8	PBN-89-10A,B,C,&D	770.61	25	PBN-89-03B&C		37	SPN-89-04B&C	761.87
9	PBM-89-02	771.24		PBN-89-03A	768.28		S1148, SPN-91-04D	
10	S1144	770.84	26	PBM-89-05	768.03	38	S1102, S1103, S1149	761.88
11	PBM-89-01	771.23	27	PBM-89-04	767.78	39	S1102A&B	761.85
12	PBM-89-03	770.28	28	PBM-89-05	768.68	40	SPN-89-05A&B	762.67
13	PBM-89-04	768.88	29	PBM-89-06	768.10	41	S1110	768.03
14	PBM-89-05	770.05	30	PBN-89-04B&C		42	S1104, S1105, S1106	762.39
15	PBN-89-05A,B,&C	768.72		PBN-89-04A	768.61	43	S1109	768.74
16	S1117	778.88	31	PBM-89-07	762.49	44	S1115, S1116	770.81
17	PBN-89-03A,B,&C	768.89	32	PBN-91-06C&D		45	LOM-91-01	772.82
	S1146	768.48		PBM-89-06	765.33	46	LOM-91-02	773.89
18	PBN-89-04A,B,&C	768.19	33	PBN-89-12A&B	764.43			
19	PBM-89-01	768.89		PBN-91-12C&D				

APPROXIMATE SCALE IN FEET

0 1000 2000



LEGEND

SP 1 — SETTLING PONDS AREA AND DESIGNATION

SS II — SPOILS DISPOSAL AREA AND DESIGNATION

1 — LOCATION OF SINGLE MONITORING WELL

3 — LOCATION OF MONITORING WELL NEST

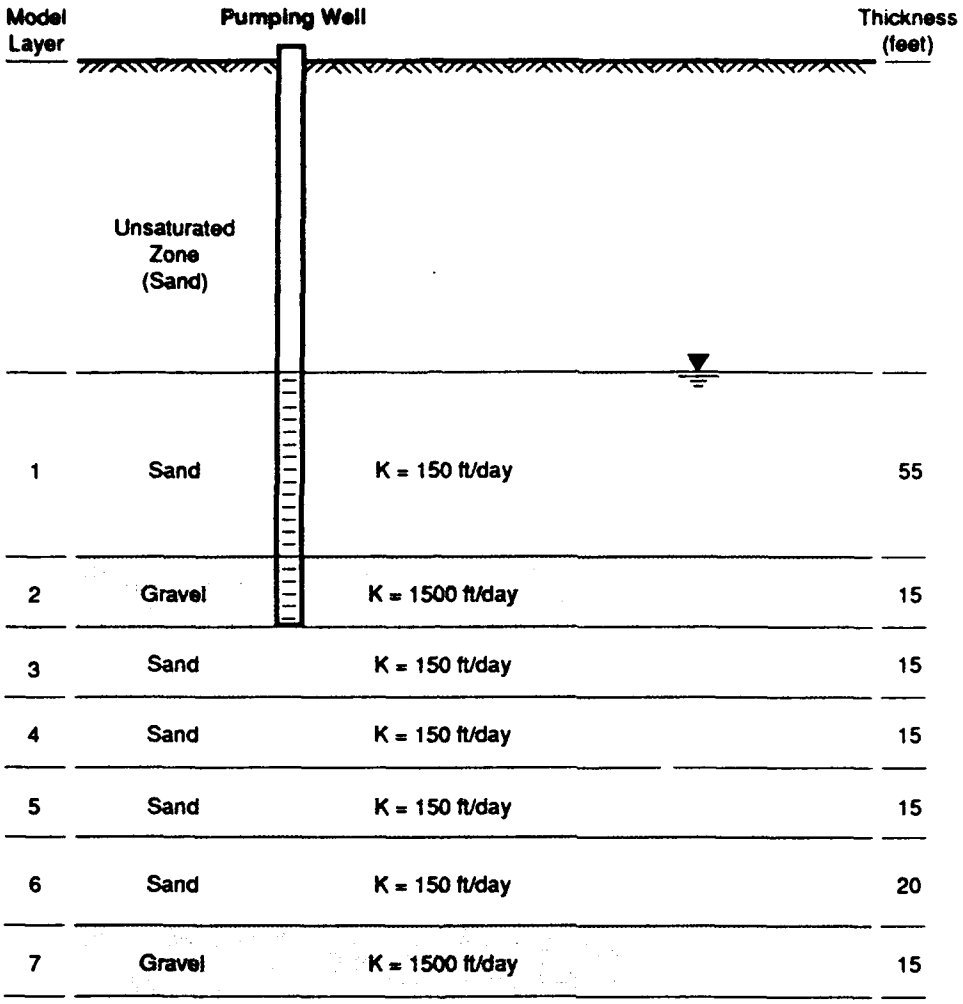
771 — CONTOUR LINE INDICATING APPROXIMATE WATER TABLE ELEVATION

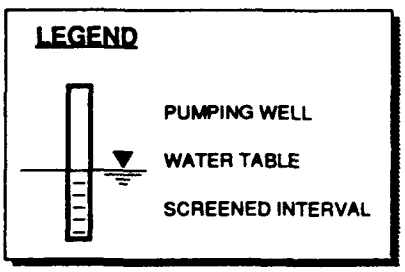
NOTES:

1. BASE MAP FROM 300-SCALE SITE TOPOGRAPHIC PLAN PROVIDED BY OLIN CORPORATION.
2. TOPOGRAPHIC CONTOUR INTERVAL 2 FEET.
3. WATER LEVELS MEASURED ON 12/15/91.
4. WELL SURVEY BASED ON U.S. COASTAL AND GEODETIC SURVEY DATUM. SURVEY BY VIERBICHER ASSOC. (1989).
5. WATER ELEVATION CONTOURS ARE INTERPOLATED BASED ON WATER TABLE AND/OR B SERIES MONITORING WELLS.

FIGURE 6-17
INTERPRETIVE
WATER TABLE CONTOUR PLAN
PROPELLANT BURNING GROUND,
LANDFILL 1,
SETTLING PONDS AND
SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



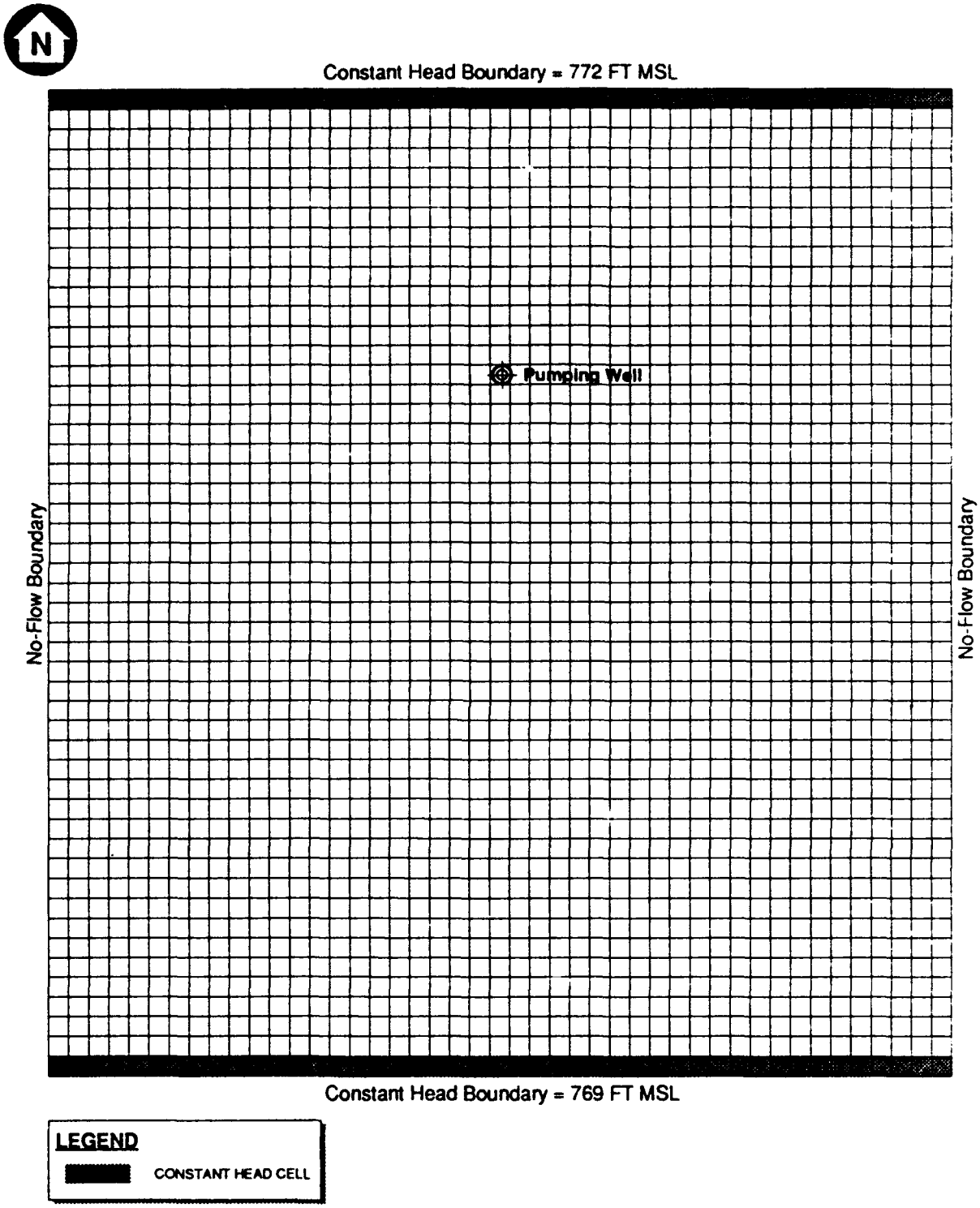


NOT TO SCALE

FIGURE 6-18
BOX MODEL LAYERS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

92090470 1



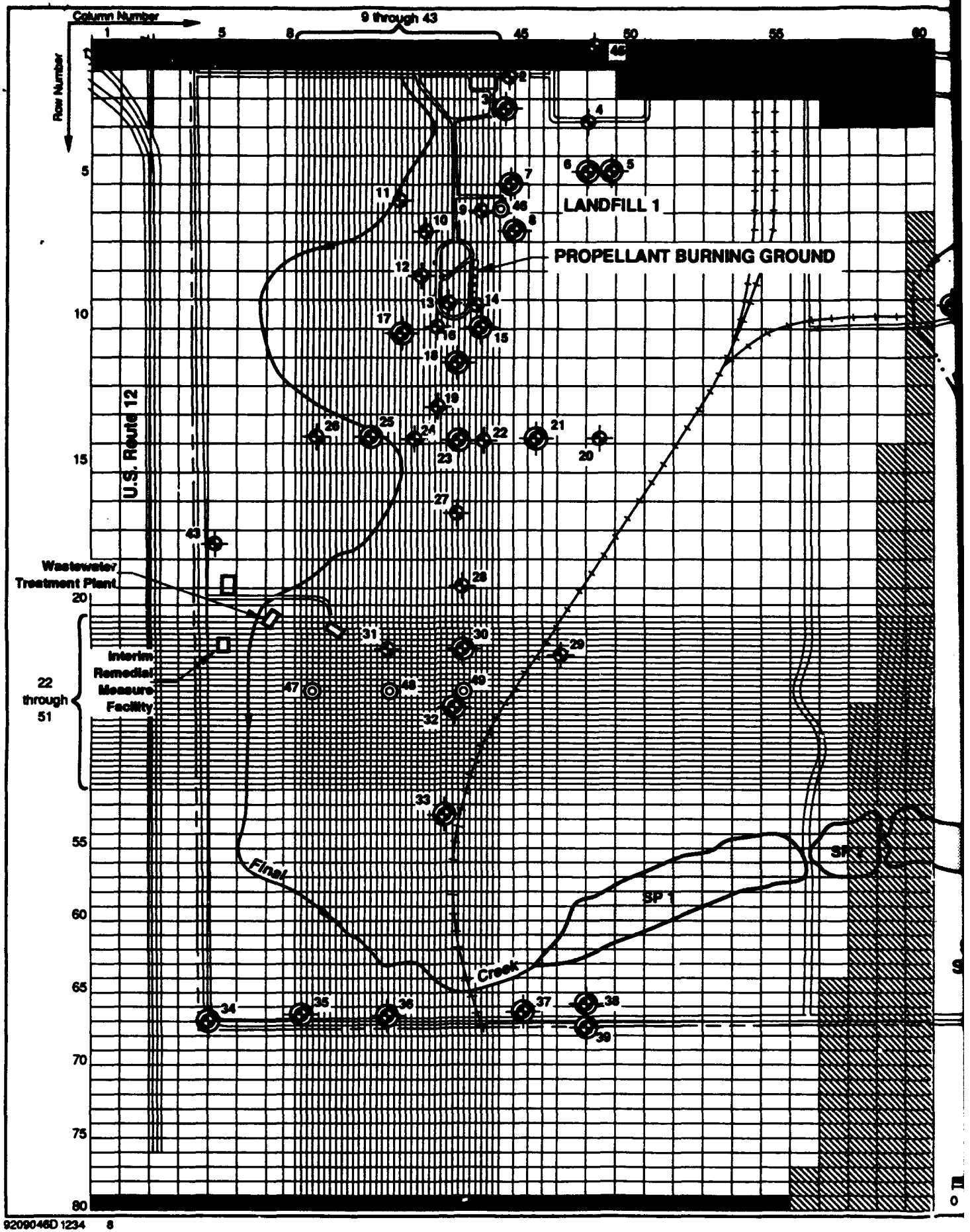
SCALE IN FEET

0 500 1000

FIGURE 6-19
BOX MODEL GRID
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

9209045D 1


Column Number
Row Number
9 through 43
LANDFILL 1
PROPELLANT BURNING GROUND
U.S. Route 12
Wastewater Treatment Plant
Interim Remedial Measure Facility
22 through 51
Final
Creek
SP 1

(2)

MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER	MAP CODE	[illegible]
2	PBM-88-09	21	PBM-88-02B&C	34	SPN
3	PBM-88-01A,B,&C		PBM-88-08A		S11
4	LCM-88-01	22	PBM-88-03	35	SPN
5	LCM-88-08A&B	23	PBM-88-01B,C,&D		SPN
6	LCM-88-08A&B		PBM-88-01A	36	SPN
7	PBM-88-08A&B,&C	24	PBM-88-02		SPN
8	PBM-88-10A,B,C,&D	25	PBM-88-03B&C		S11
9	PBM-88-02		PBM-88-08A	37	SPN
10	S1144	26	PBM-88-05		S11
11	PBM-88-01	27	PBM-88-04	38	S11
12	PBM-88-08	28	PBM-91-05	39	S11
13	PBM-88-04	29	PBM-88-06	40	SPN
14	PBM-88-05	30	PBM-88-04B&C	41	S11
15	PBM-88-05A,B,&C		PBM-88-04A	42	S11
16	S1117	31	PBM-88-07	43	S11
17	PBM-88-03A,B,&C	32	PBM-91-08C&D	44	S11
	S1146		PBM-88-06	45	LCM
18	PBM-88-04A,B,&C	33	PBM-88-12A&B	46	BCM
19	PBM-88-01		PBM-91-12C&D	47	BCM
20	PBM-88-08			48	BCM
				49	BCM

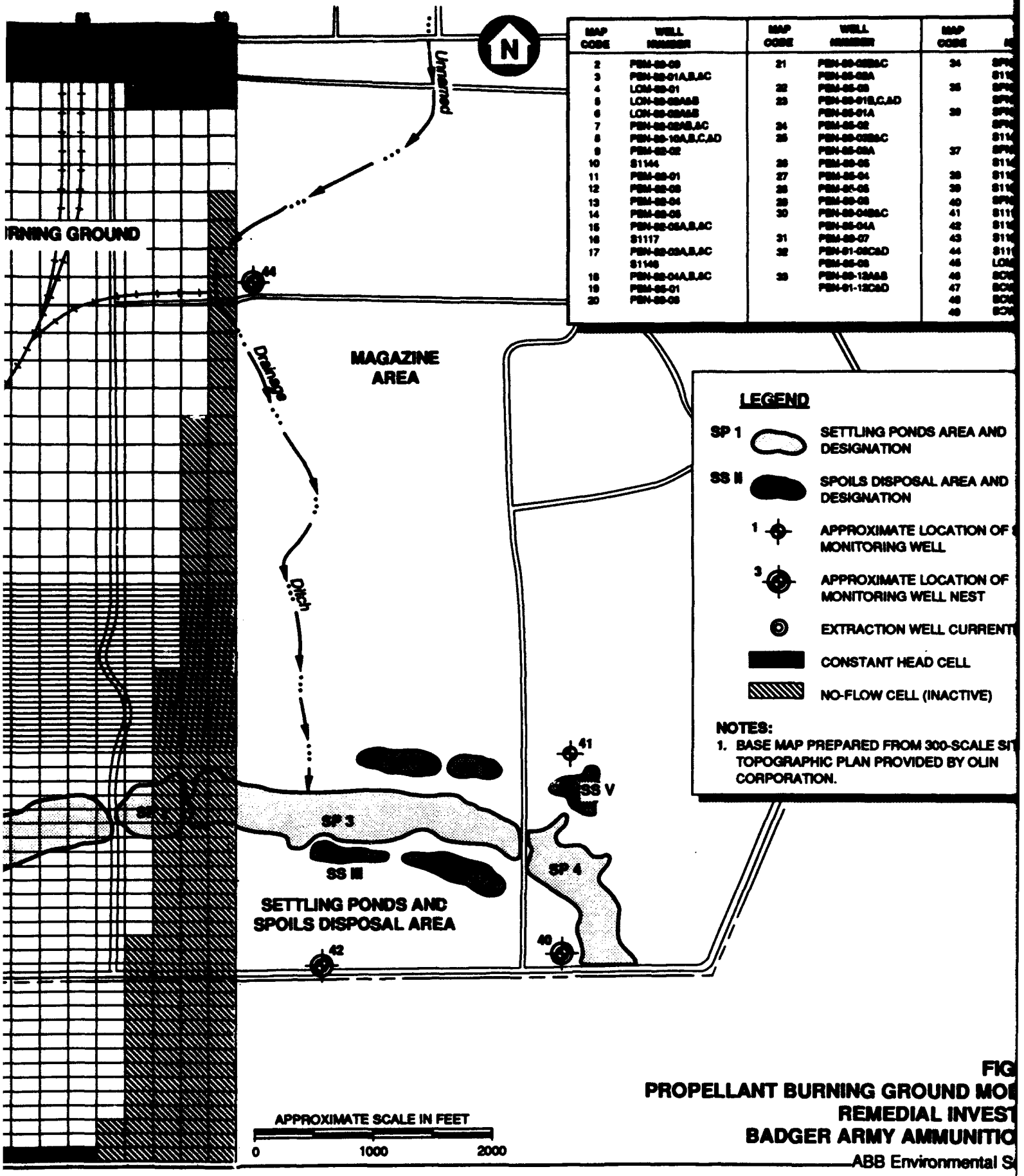
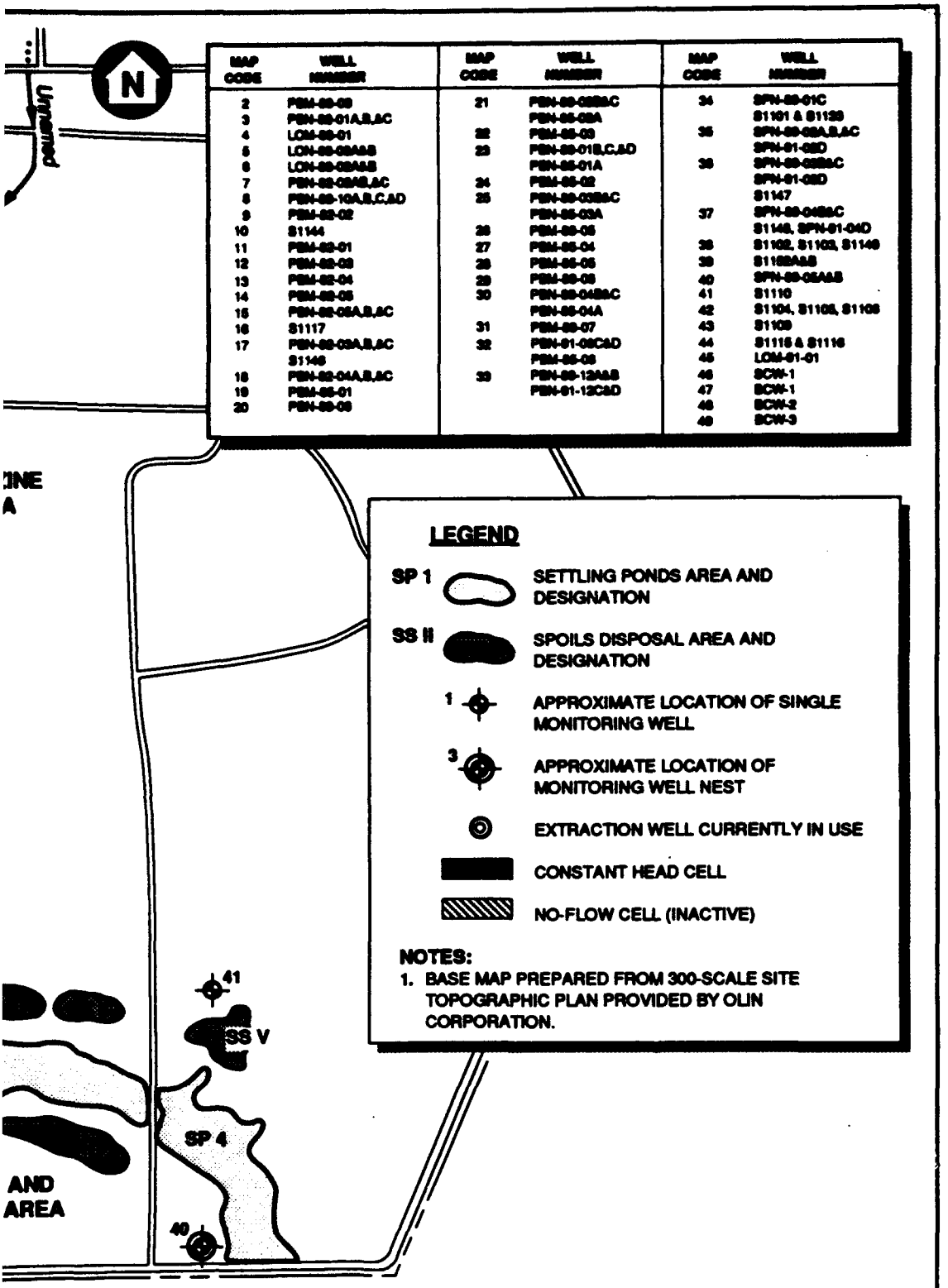
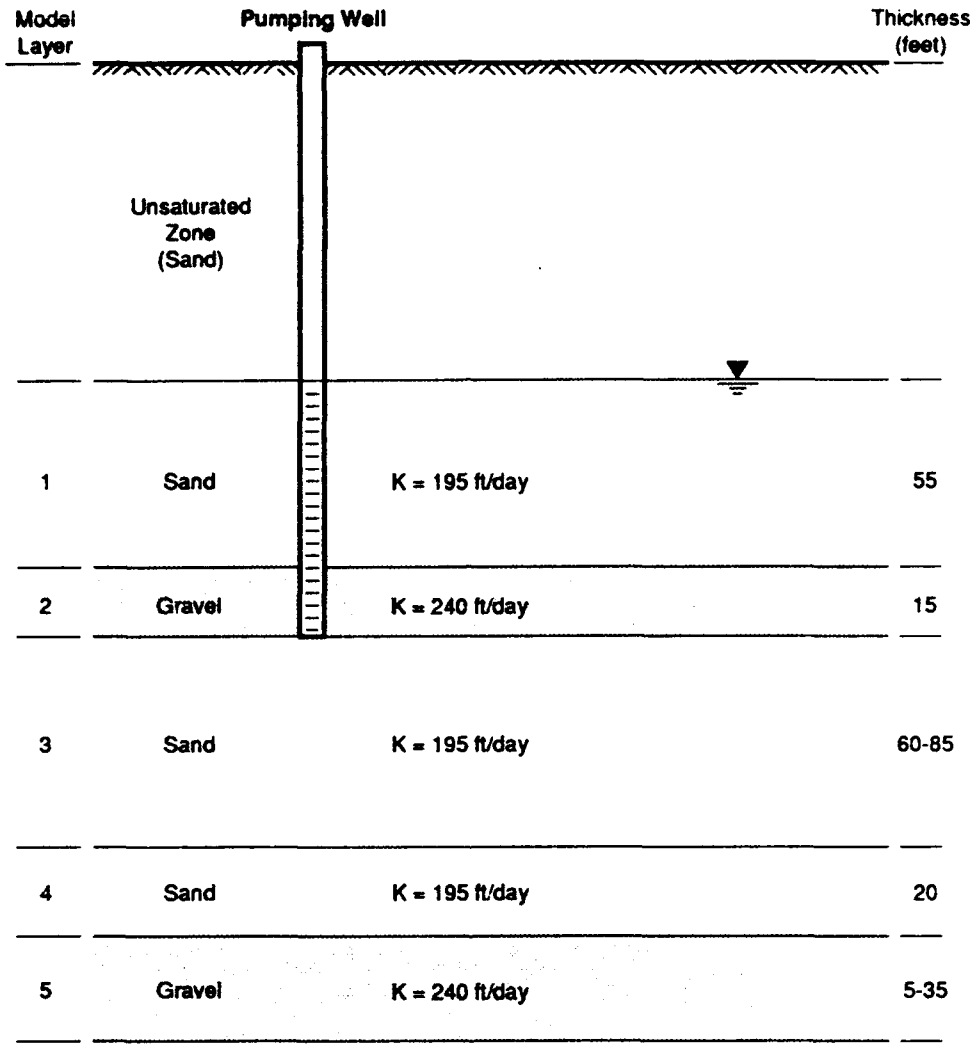


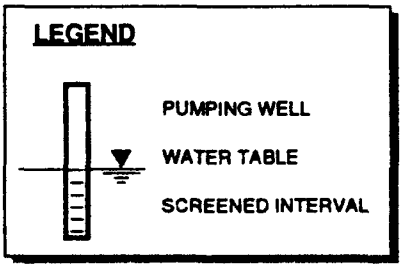
FIG
PROPELLANT BURNING GROUND MO
REMEDIAL INVEST
BADGER ARMY AMMUNITIO
ABB Environmental S



MAP CODE	WELL NUMBER
2	PBM-89-09
3	PBN-89-01A,B,&C
4	LOM-89-01
5	LON-89-03A&B
6	LON-89-02A&B
7	PBN-89-03A,B,&C
8	PBN-89-10A,B,C,&D
9	PBM-89-02
10	S1144
11	PBM-89-01
12	PBM-89-03
13	PBM-89-04
14	PBM-89-05
15	PBN-89-05A,B,&C
16	S1117
17	PBN-89-09A,B,&C S1146
18	PBN-89-04A,B,&C
19	PBM-89-01
20	PBN-89-06
21	PBN-89-02B&C PBN-89-02A
22	PBM-89-03
23	PBN-89-01B,C,&D PBN-89-01A
24	PBM-89-02
25	PBN-89-03B&C PBN-89-03A
26	PBM-89-06
27	PBM-89-04
28	PBM-89-05
29	PBM-89-08
30	PBN-89-04B&C PBN-89-04A
31	PBM-89-07
32	PBN-91-09C&D PBM-89-08
33	PBN-89-12A&B PBN-91-12C&D
34	SPN-89-01C S1101 & S1139
35	SPN-89-09A,B,&C SPN-91-09D
36	SPN-89-02B&C SPN-91-02D S1147
37	SPN-89-04B&C S1148, SPN-91-04D
38	S1102, S1103, S1149
39	S1102A&B
40	SPN-89-05A&B
41	S1110
42	S1104, S1105, S1106
43	S1109
44	S1115 & S1116
45	LOM-91-01
46	SCW-1
47	SCW-1
48	SCW-2
49	SCW-3

FIGURE 6-20
PROPELLANT BURNING GROUND MODEL GRID
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT
ABB Environmental Services, Inc.



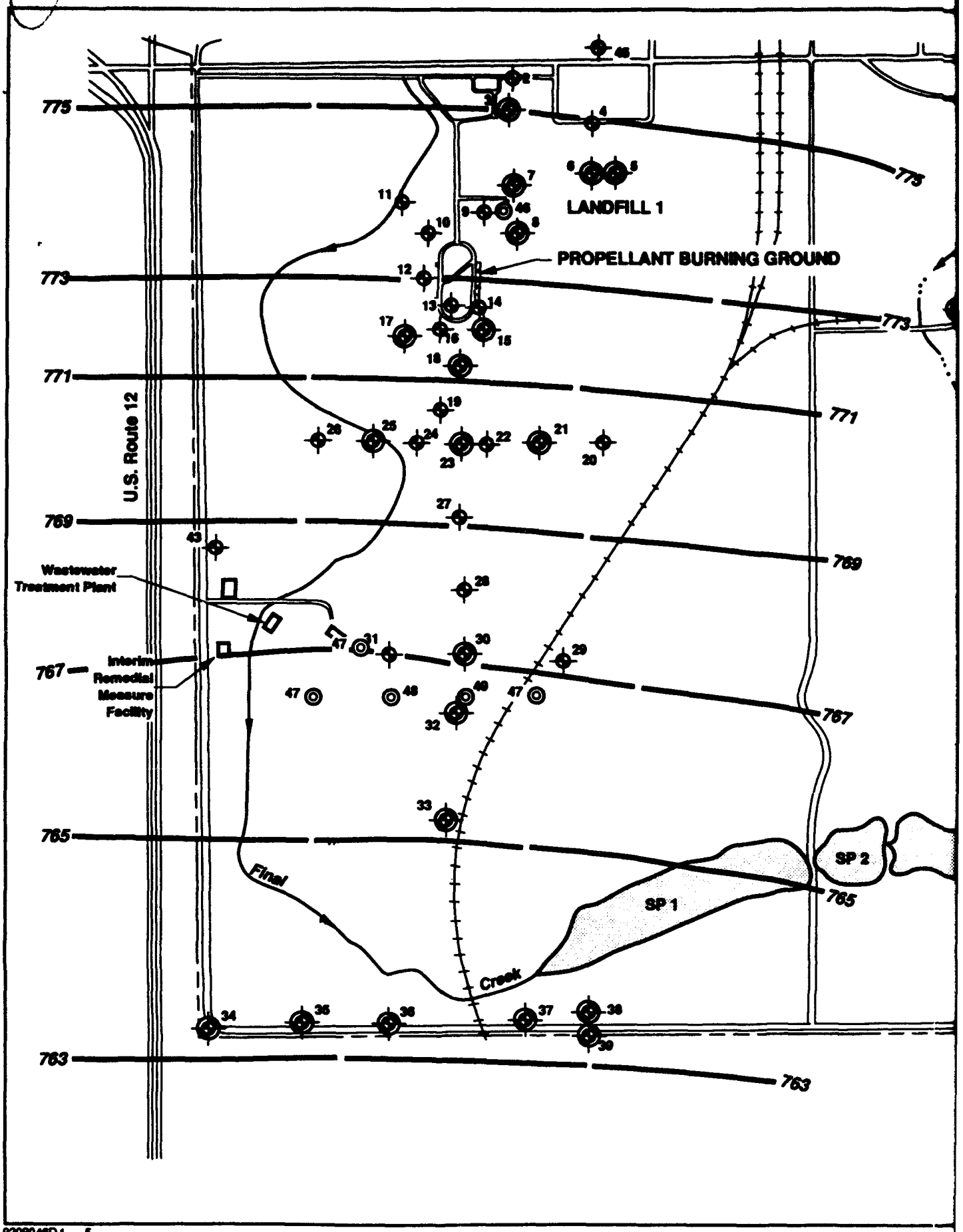


NOT TO SCALE

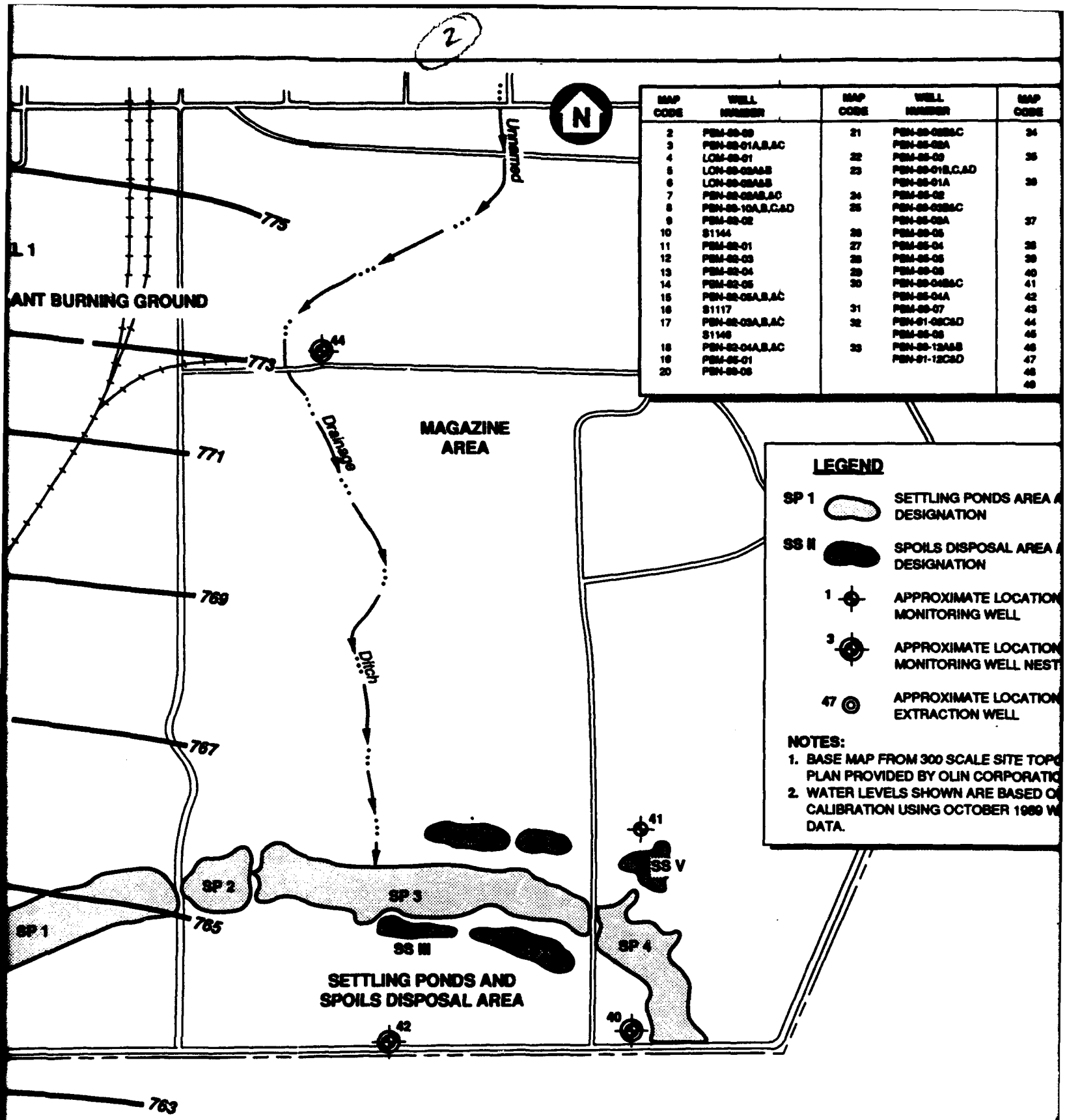
FIGURE 6-21
PROPELLANT BURNING GROUND
MODEL LAYERS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

9209048D1


LANDFILL 1
PROPELLANT BURNING GROUND
U.S. Route 12
Wastewater Treatment Plant
Interim Remedial Measure Facility
Final Creek
SP 1
SP 2
775
773
771
769
767
765
763

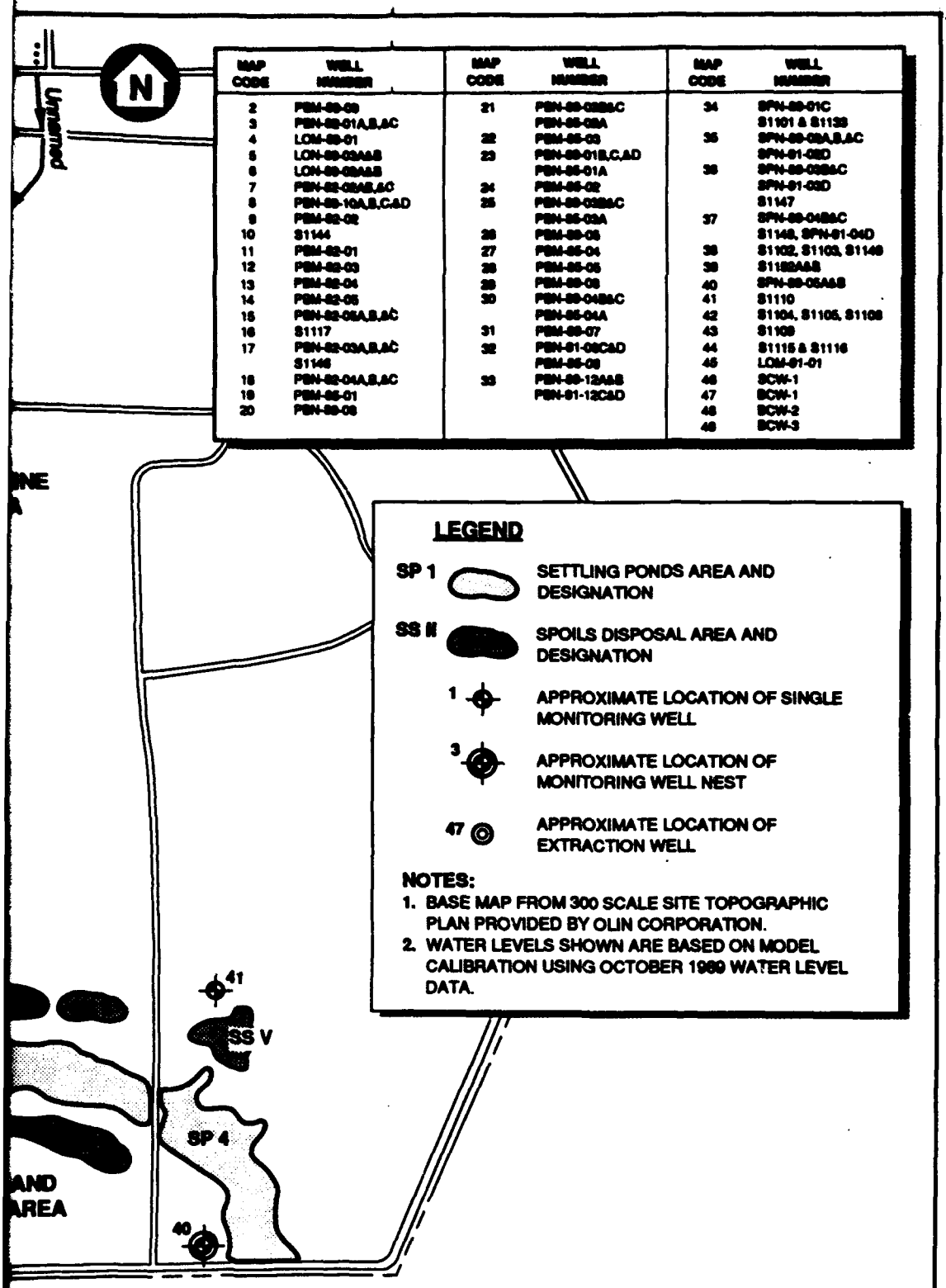
9209046D1 5



MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER	MAP CODE
2	PSM-89-09	21	PSM-89-02BAC	34
3	PSM-89-01A,B,AC		PSM-85-03A	
4	LOM-89-01	22	PSM-85-09	35
5	LON-89-03AAB	23	PSM-89-01B,C,AD	
6	LON-89-03AAB		PSM-85-01A	36
7	PSM-89-03AB,AC	24	PSM-85-02	
8	PSM-89-10A,B,C,AD	25	PSM-89-03BAC	
9	PSM-89-02		PSM-85-03A	37
10	S1144	26	PSM-89-05	
11	PSM-82-01	27	PSM-85-04	38
12	PSM-82-03	28	PSM-85-05	39
13	PSM-82-04	29	PSM-89-08	40
14	PSM-82-05	30	PSM-89-04BAC	41
15	PSM-89-05A,B,AC		PSM-85-04A	42
16	S1117	31	PSM-89-07	43
17	PSM-89-03A,B,AC	32	PSM-91-08C&D	44
	S1146		PSM-85-08	45
18	PSM-82-04A,B,AC	33	PSM-89-12AAB	46
19	PSM-85-01		PSM-91-12C&D	47
20	PSM-89-06			48
				49

MODELED WATER TABLE CON
PROPELLANT BURNING GRO
REMEDIAL INV
BADGER ARMY AMMUNI

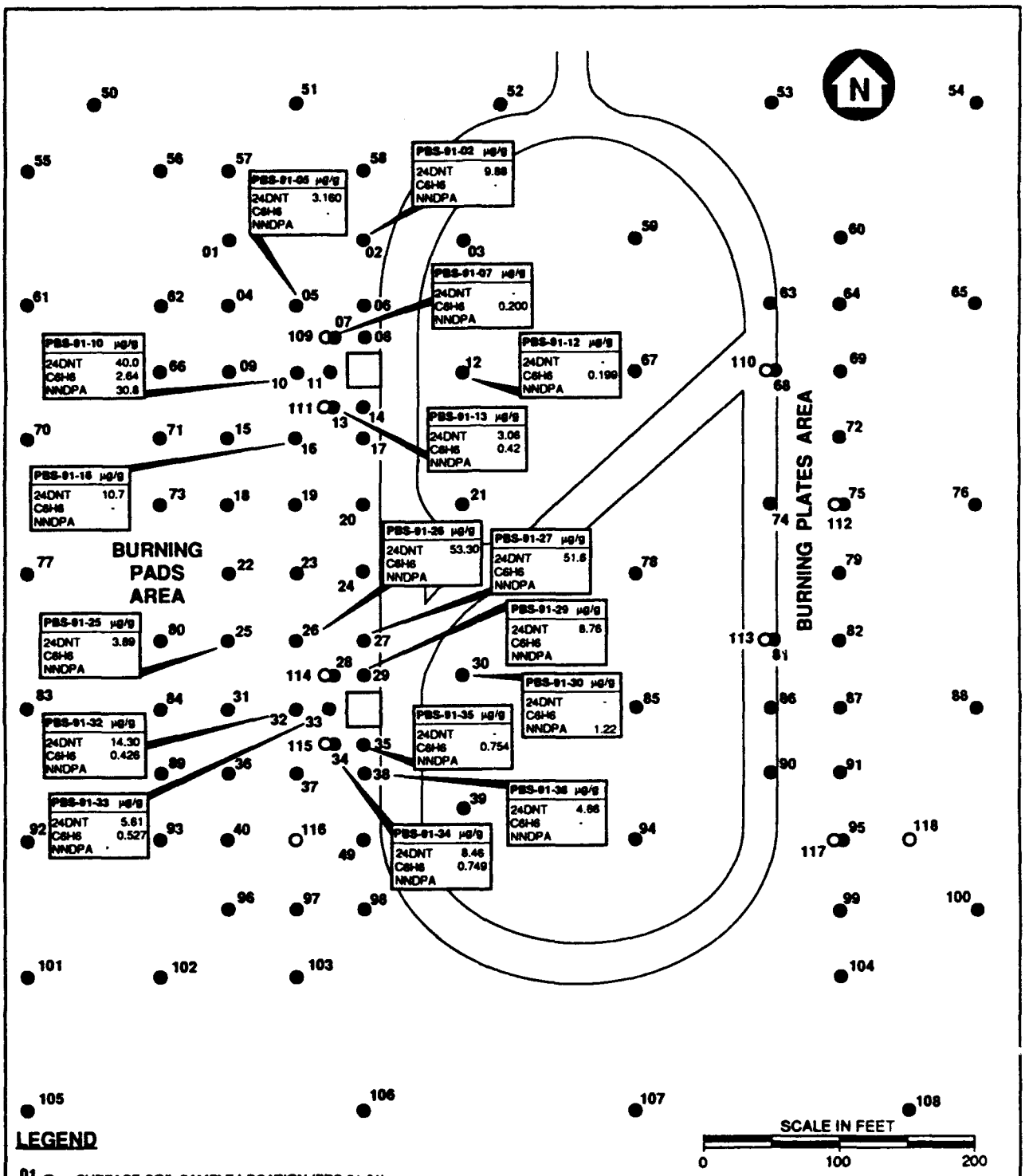
ABB Environment



MAP CODE	WELL NUMBER
2	PBM-89-09
3	PBN-89-01A,B,&C
4	LOM-89-01
5	LON-89-03A&B
6	LON-89-02A&B
7	PBN-89-09A,B,&C
8	PBN-89-10A,B,C&D
9	PBM-89-02
10	S1144
11	PBM-89-01
12	PBM-89-03
13	PBM-89-04
14	PBM-89-05
15	PBN-89-05A,B,&C
16	S1117
17	PBN-89-03A,B,&C
	S1146
18	PBN-89-04A,B,&C
19	PBM-89-01
20	PBN-89-06
21	PBN-89-09B&C
	PBN-89-09A
22	PBM-89-03
23	PBN-89-01B,C,&D
	PBN-89-01A
24	PBM-89-02
25	PBN-89-09B&C
	PBN-89-09A
26	PBM-89-06
27	PBM-89-04
28	PBM-89-05
29	PBM-89-08
30	PBN-89-04B&C
	PBN-89-04A
31	PBM-89-07
32	PBN-91-09C&D
	PBM-89-08
33	PBN-89-12A&B
	PBN-91-12C&D
34	SPN-89-01C
	S1101 & S1139
35	SPN-89-09A,B,&C
	SPN-91-09D
36	SPN-89-09B&C
	SPN-91-09D
	S1147
37	SPN-89-04B&C
	S1148, SPN-91-04D
38	S1102, S1103, S1149
39	S1150A&B
40	SPN-89-05A&B
41	S1110
42	S1104, S1105, S1108
43	S1109
44	S1115 & S1116
45	LOM-91-01
46	BCW-1
47	BCW-1
48	BCW-2
49	BCW-3

FIGURE 6-22
MODELED WATER TABLE CONTOUR PLAN
PROPELLANT BURNING GROUND MODEL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



LEGEND

01 ● SURFACE SOIL SAMPLE LOCATION (PBS-91-01)

109 ○ SUBSURFACE SOIL SAMPLE LOCATION (PBS-91-109)

▭ APPROXIMATE SIZE OF CONCRETE BURNING PADS

- = NON-DETECT

BLANK = NO ANALYSIS PERFORMED

NOTE: SAMPLE LOCATIONS 41 THROUGH 48 ARE LOCATED OFF THE GRID IN THE CONTAMINATED WASTE AREA (FIGURE 6-6).

SOURCE: MODIFIED FROM FIGURE 4-12 OF TSAI ET AL., 1988.

FIGURE 6-23
DISTRIBUTION OF 24DNT, C6H6 AND NNDPA IN SURFACE SOILS AT THE RACETRACK PROPELLANT BURNING GROUND REMEDIAL INVESTIGATION BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

9208064D 34 7

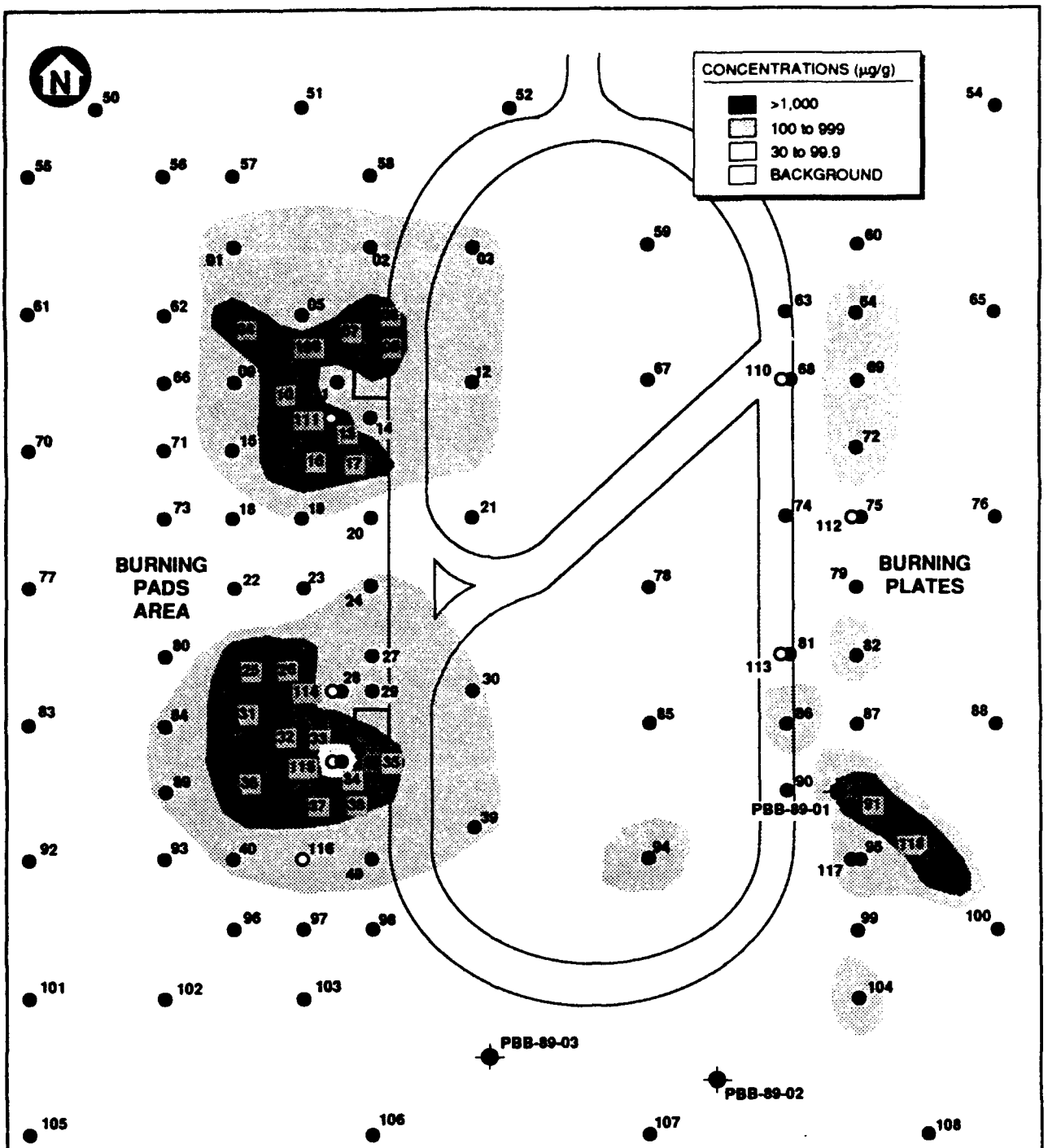


FIGURE 6-24
INTERPRETIVE PB DISTRIBUTION IN SURFACE SOILS AT THE RACETRACK AREA PROPELLANT BURNING GROUND REMEDIAL INVESTIGATION BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

92070790 1

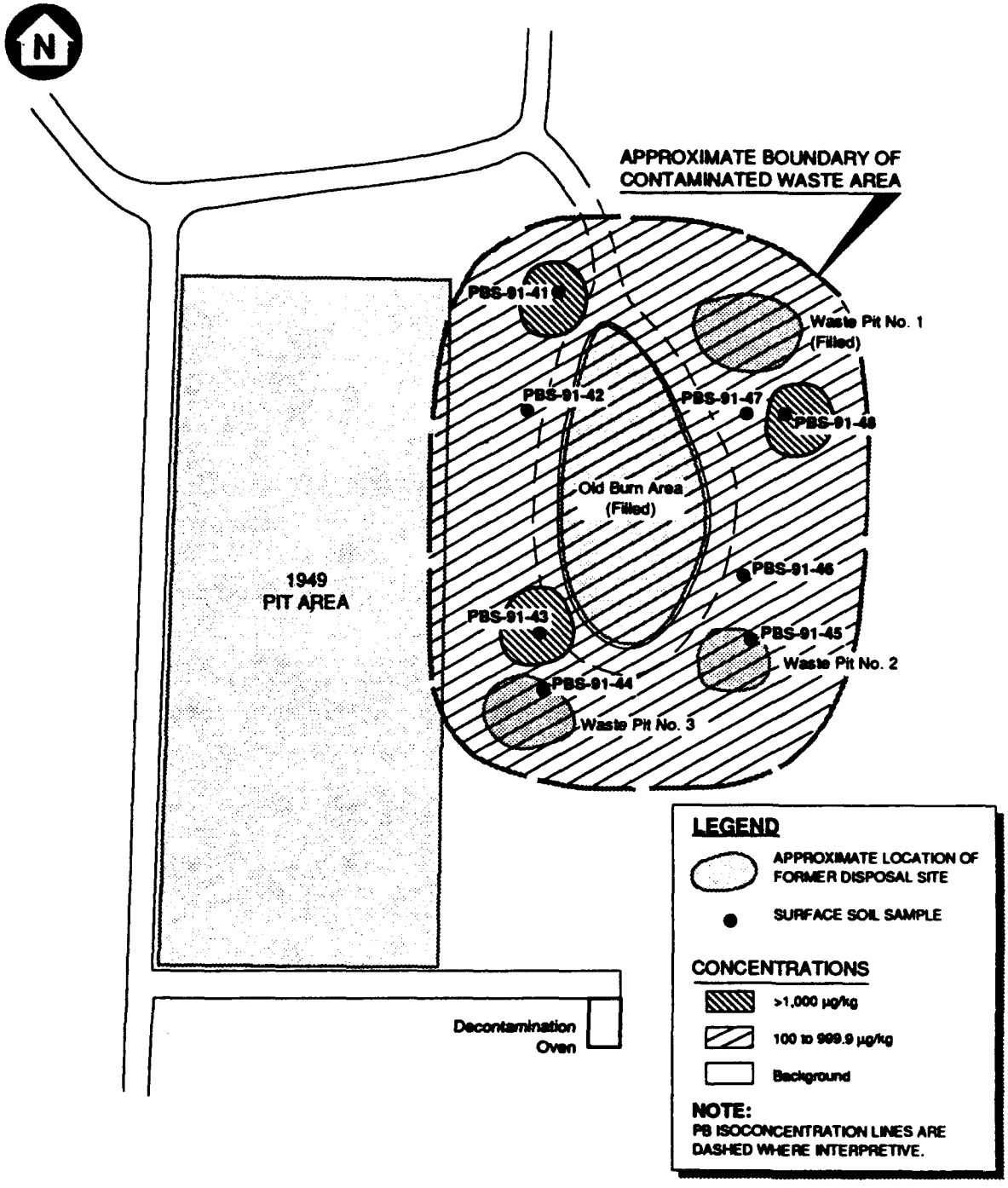


FIGURE 6-25
INTERPRETIVE PB DISTRIBUTION IN SURFACE SOILS AT THE CONTAMINATED WASTE AREA PROPELLANT BURNING GROUND REMEDIAL INVESTIGATION BADGER ARMY AMMUNITION PLANT

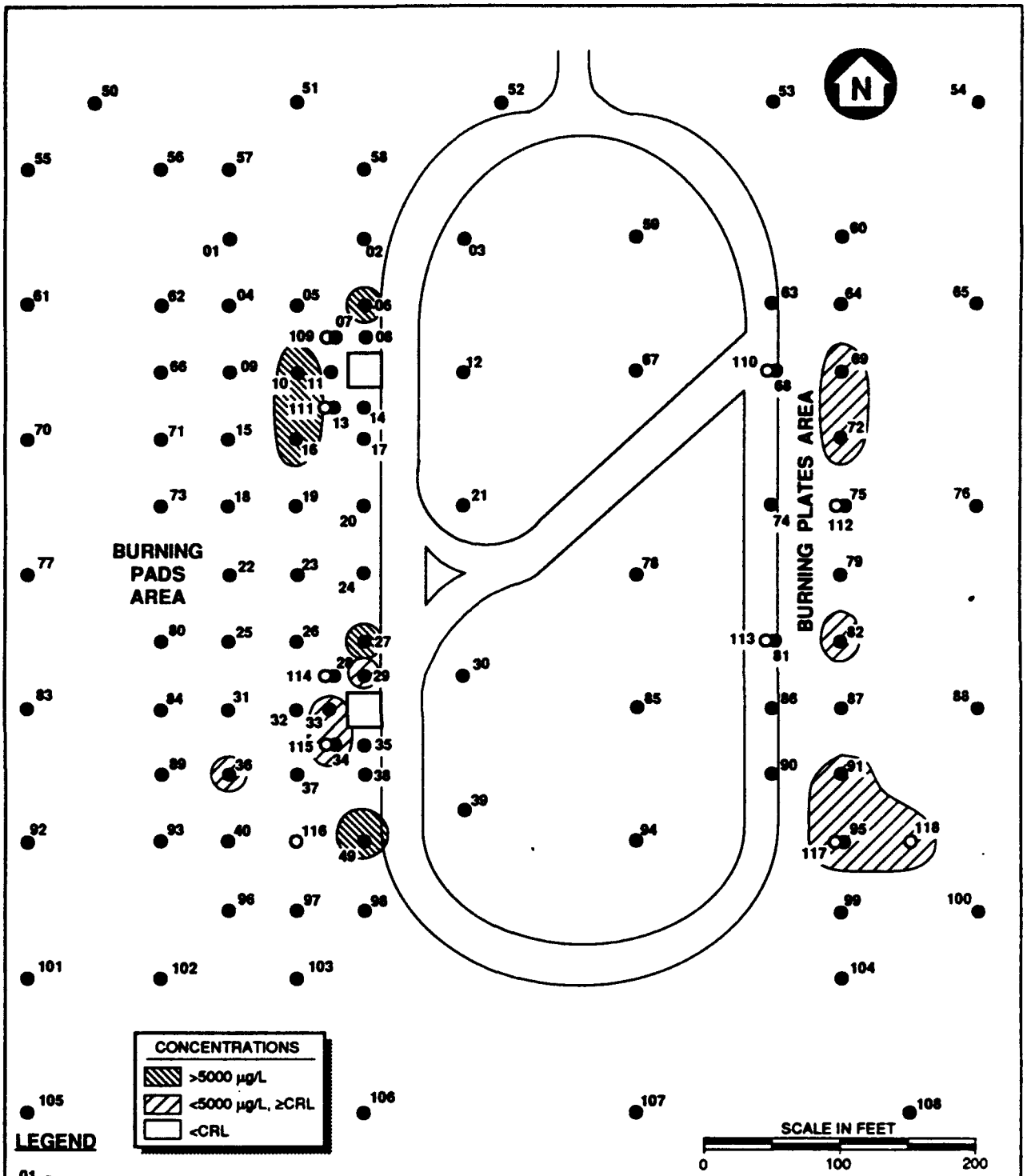
APPROXIMATE SCALE IN FEET

0 150 300

Source: Modified from Tsai, et.al., 1988.

92080550 2

ABB Environmental Services, Inc.



LEGEND

01 ● SURFACE SOIL SAMPLE LOCATION (PBS-91-01)

109 ○ SUBSURFACE SOIL SAMPLE LOCATION (PBS-91-109)

▭ APPROXIMATE SIZE OF CONCRETE BURNING PADS

CRL - CERTIFIED REPORTING LIMIT

NOTE: SAMPLE LOCATIONS 41 THROUGH 48 ARE LOCATED OFF THE GRID IN THE CONTAMINATED WASTE AREA (FIGURE 6-5).

SOURCE: MODIFIED FROM FIGURE 4-12 OF TSAI ET AL., 1988.

FIGURE 6-26
INTERPRETIVE TCLP PB DISTRIBUTION IN SURFACE SOILS AT THE RACETRACK AREA PROPELLANT BURNING GROUND REMEDIAL INVESTIGATION BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

9208064D1 34 6

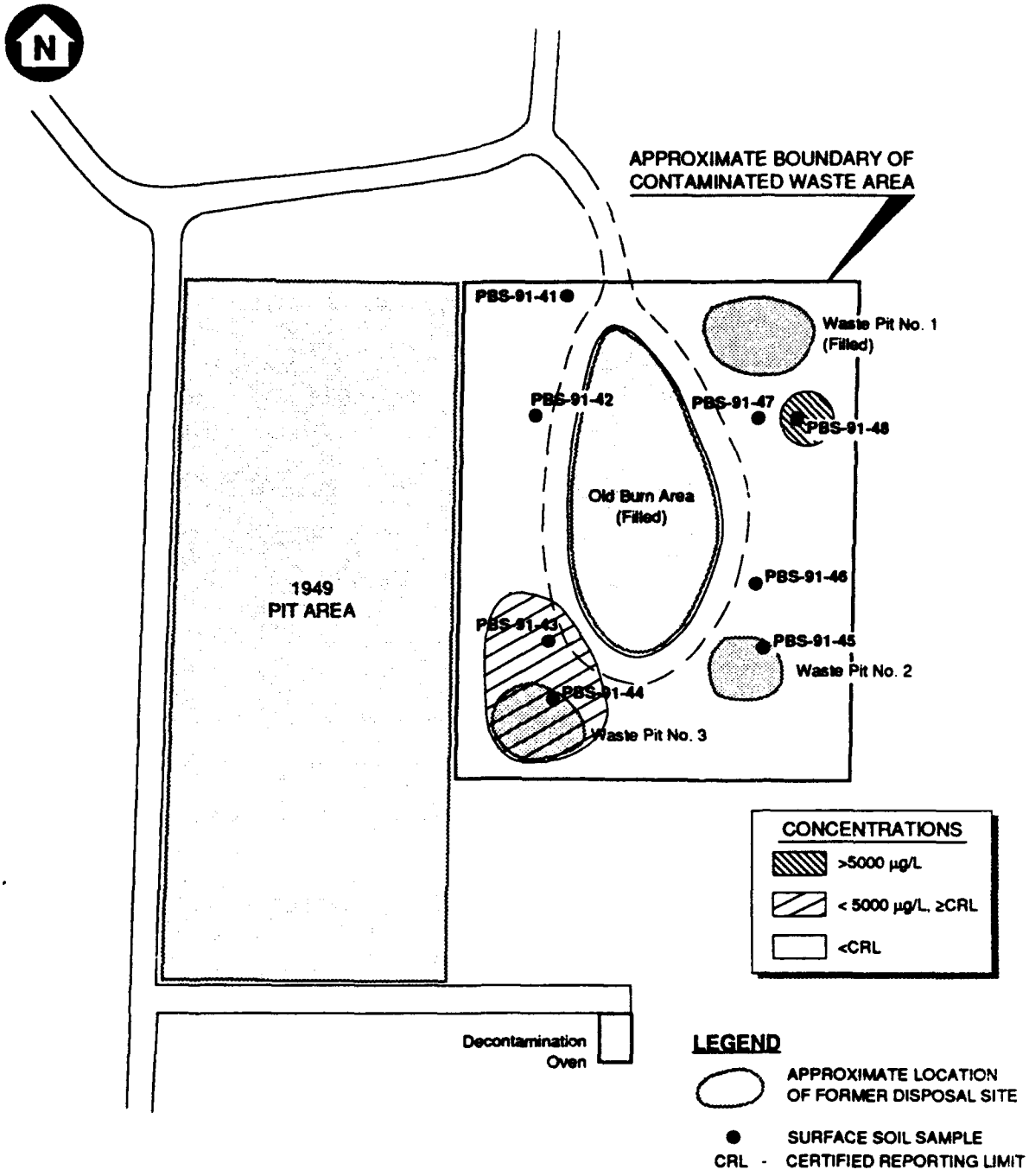


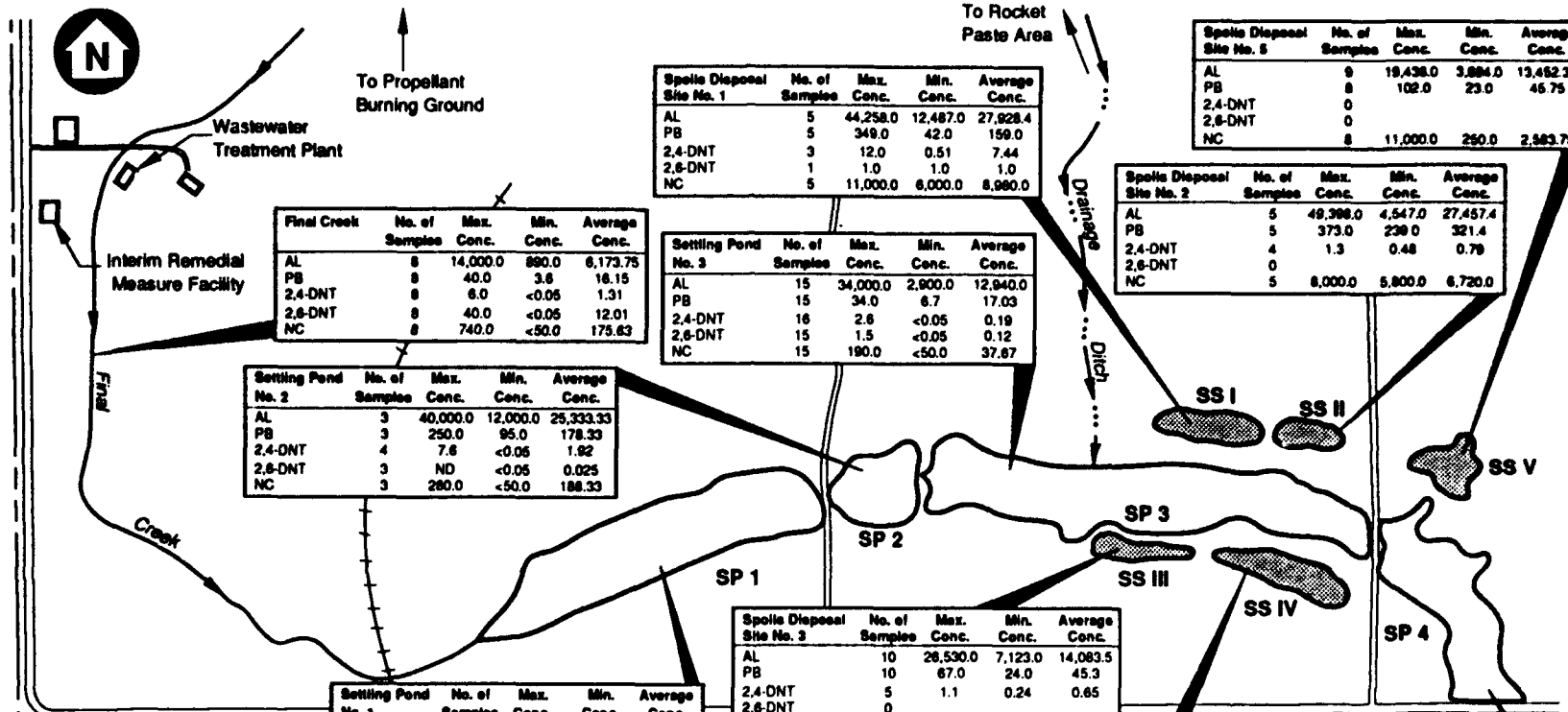
FIGURE 6-27
INTERPRETIVE TCLP PB DISTRIBUTION IN SURFACE SOILS IN THE CONTAMINATED WASTE AREA
PROPELLANT BURNING GROUND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

APPROXIMATE SCALE IN FEET
0 150 300

Source: Modified from Tsai, et.al., 1988.

ABB Environmental Services, Inc.

9208055D 4



Final Creek	No. of Samples	Max. Conc.	Min. Conc.	Average Conc.
AL	8	14,000.0	890.0	6,173.75
PB	8	40.0	3.6	16.15
2,4-DNT	8	6.0	<0.05	1.31
2,6-DNT	8	40.0	<0.05	12.01
NC	8	740.0	<50.0	175.63

Settling Pond No. 2	No. of Samples	Max. Conc.	Min. Conc.	Average Conc.
AL	3	40,000.0	12,000.0	25,333.33
PB	3	250.0	95.0	178.33
2,4-DNT	4	7.6	<0.05	1.92
2,6-DNT	3	ND	<0.05	0.025
NC	3	280.0	<50.0	188.33

Settling Pond No. 1	No. of Samples	Max. Conc.	Min. Conc.	Average Conc.
AL	17	27,000.0	1,400.0	13,487.65
PB	17	180.0	<3.0	46.04
2,4-DNT	15	172.0	<0.05	18.01
2,6-DNT	14	26.0	<0.05	4.85
NC	15	60,000.0	<50.0	8,193.73

Spoils Disposal Site No. 1	No. of Samples	Max. Conc.	Min. Conc.	Average Conc.
AL	5	44,258.0	12,487.0	27,928.4
PB	5	349.0	42.0	159.0
2,4-DNT	3	12.0	0.51	7.44
2,6-DNT	1	1.0	1.0	1.0
NC	5	11,000.0	6,000.0	8,980.0

Settling Pond No. 3	No. of Samples	Max. Conc.	Min. Conc.	Average Conc.
AL	15	34,000.0	2,900.0	12,940.0
PB	15	34.0	6.7	17.03
2,4-DNT	16	2.6	<0.05	0.19
2,6-DNT	15	1.5	<0.05	0.12
NC	15	190.0	<50.0	37.67

Spoils Disposal Site No. 3	No. of Samples	Max. Conc.	Min. Conc.	Average Conc.
AL	10	26,530.0	7,123.0	14,083.5
PB	10	67.0	24.0	45.3
2,4-DNT	5	1.1	0.24	0.65
2,6-DNT	0			
NC	10	3,800.0	450.0	2,090.0

Spoils Disposal Site No. 4	No. of Samples	Max. Conc.	Min. Conc.	Average Conc.
AL	10	20,865.0	11,511.0	17,382.9
PB	10	120.0	22.0	48.2
2,4-DNT	1	0.7	0.7	0.7
2,6-DNT	0			
NC	9	3,000.0	33.0	848.67

Spoils Disposal Site No. 5	No. of Samples	Max. Conc.	Min. Conc.	Average Conc.
AL	9	19,436.0	3,884.0	13,452.33
PB	8	102.0	23.0	45.75
2,4-DNT	0			
2,6-DNT	0			
NC	8	11,000.0	250.0	2,583.75

Spoils Disposal Site No. 2	No. of Samples	Max. Conc.	Min. Conc.	Average Conc.
AL	5	49,398.0	4,547.0	27,457.4
PB	5	373.0	230.0	321.4
2,4-DNT	4	1.3	0.48	0.79
2,6-DNT	0			
NC	5	8,000.0	5,800.0	6,720.0

Settling Pond No. 4	No. of Samples	Max. Conc.	Min. Conc.	Average Conc.
AL	11	60,000.0	1,300.0	22,936.36
PB	11	300.0	8.4	72.22
2,4-DNT	10	<0.05	<0.05	0
2,6-DNT	10	<0.05	<0.05	0
NC	11	1,038.0	<50.0	119.36

LEGEND

- SP 1 - SETTLING PONDS
- SS II - SPOILS DISPOSAL SITES
- RAILROAD TRACK
- DRAINAGE DITCH

NOTES:

1. ALL RESULTS REPORTED IN PART PER MILLION (*mg/kg or µg/g*)
2. ND = NON-DETECT
3. AVERAGE CONCENTRATIONS WERE CALCULATED BY SUMMING ALL CONCENTRATIONS, AND DIVIDING BY THE NUMBER OF SAMPLES. WHERE ND AND LESS THAN (<) VALUES WERE PRESENT, ONE HALF THE SAMPLE DETECTION LIMIT WAS USED AS THE CONCENTRATION AND INCLUDED IN THE SUMMATION.
4. NUMBER OF SAMPLES = 0; INDICATES NO SAMPLES WERE ANALYZED FOR THAT ANALYTE.
5. DATA PRESENTED AND USED IN COMPUTING AVERAGE CONCENTRATIONS WAS PRODUCED BY MORE THAN ONE LABORATORY. THEREFORE SAMPLE DETECTION LIMITS MAY VARY.

SCALE IN FEET

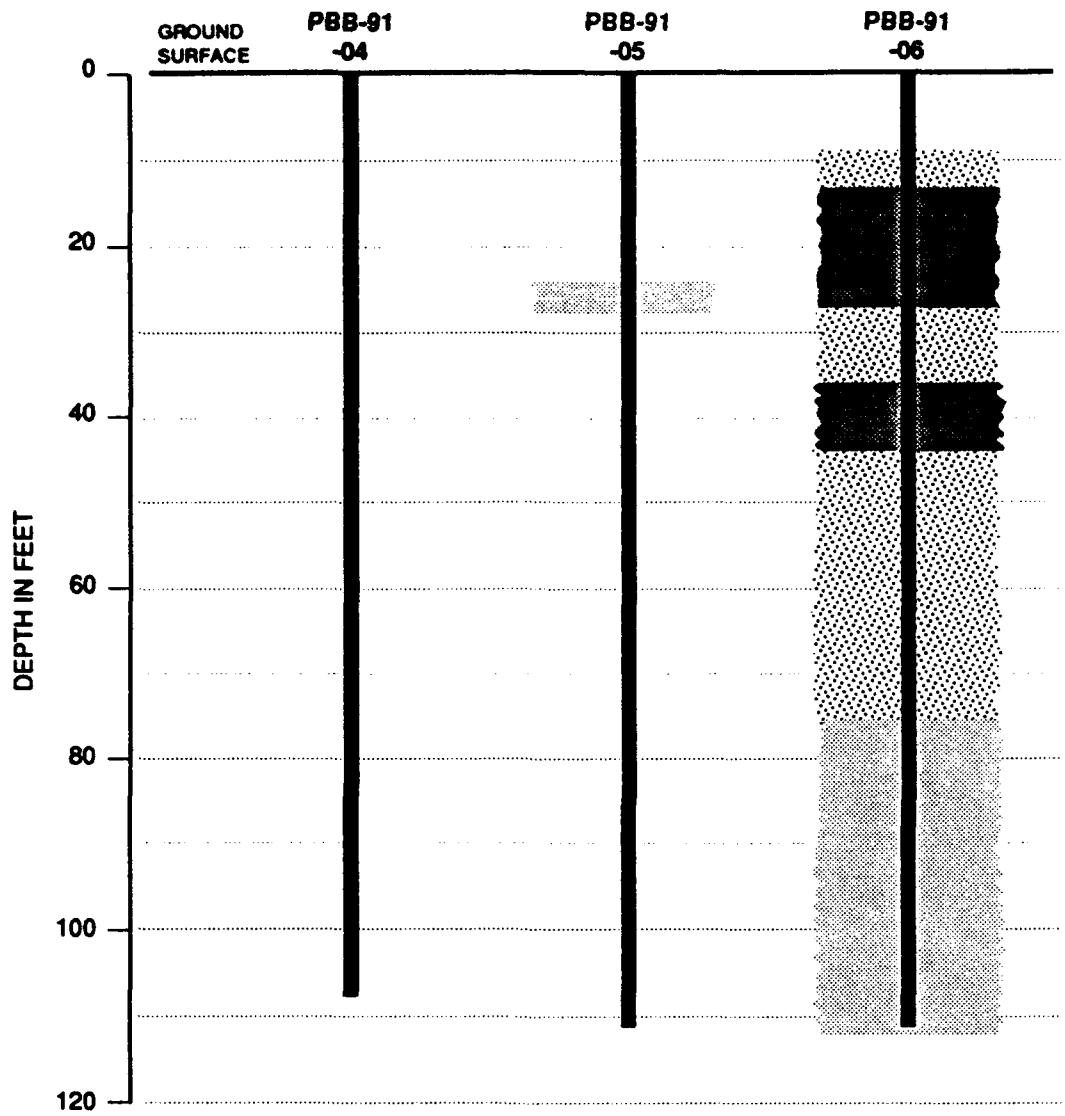
0 1000 2000

Source: Modified from Tsai, et.al., 1988.

FIGURE 6-28
SUMMARY OF SELECTED INORGANIC AND SVOC DATA FOR SURFACE SOILS SETTLING PONDS AND SPOILS DISPOSAL AREAS REMEDIAL INVESTIGATION BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

92090130 2



C6H6 CONCENTRATION

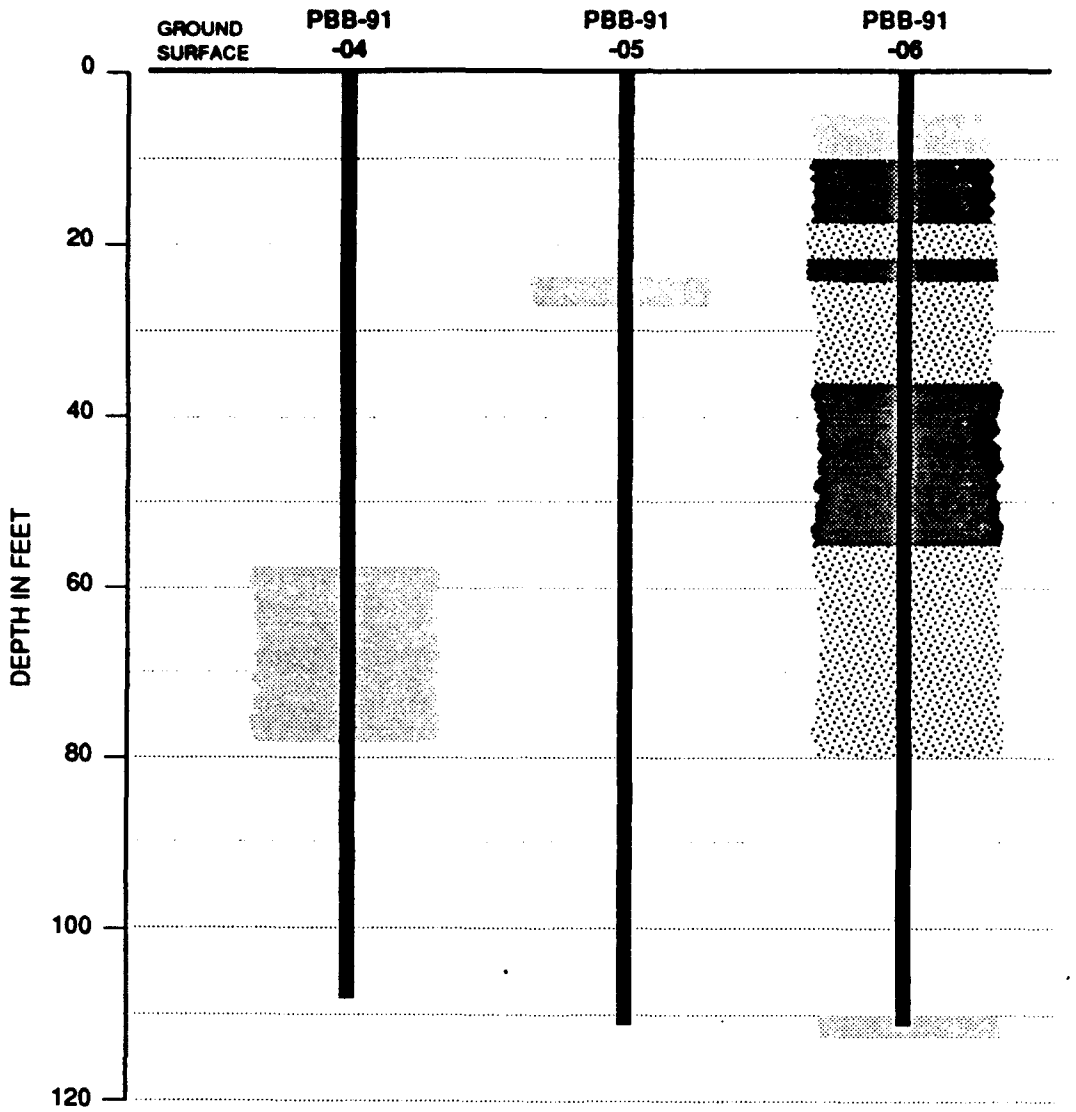
- > 100 ppm
- 1.0 to 100 ppm
- ND to 1.0 ppm

NOTE:
1. SEE TABLE 6-16 AND APPENDIX K FOR CHEMICAL DATA SUMMARY.

FIGURE 6-29
INTERPRETIVE C6H6 CONCENTRATIONS IN SUBSURFACE SOILS
PROPELLANT BURNING GROUND WASTE PITS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

92080430 1

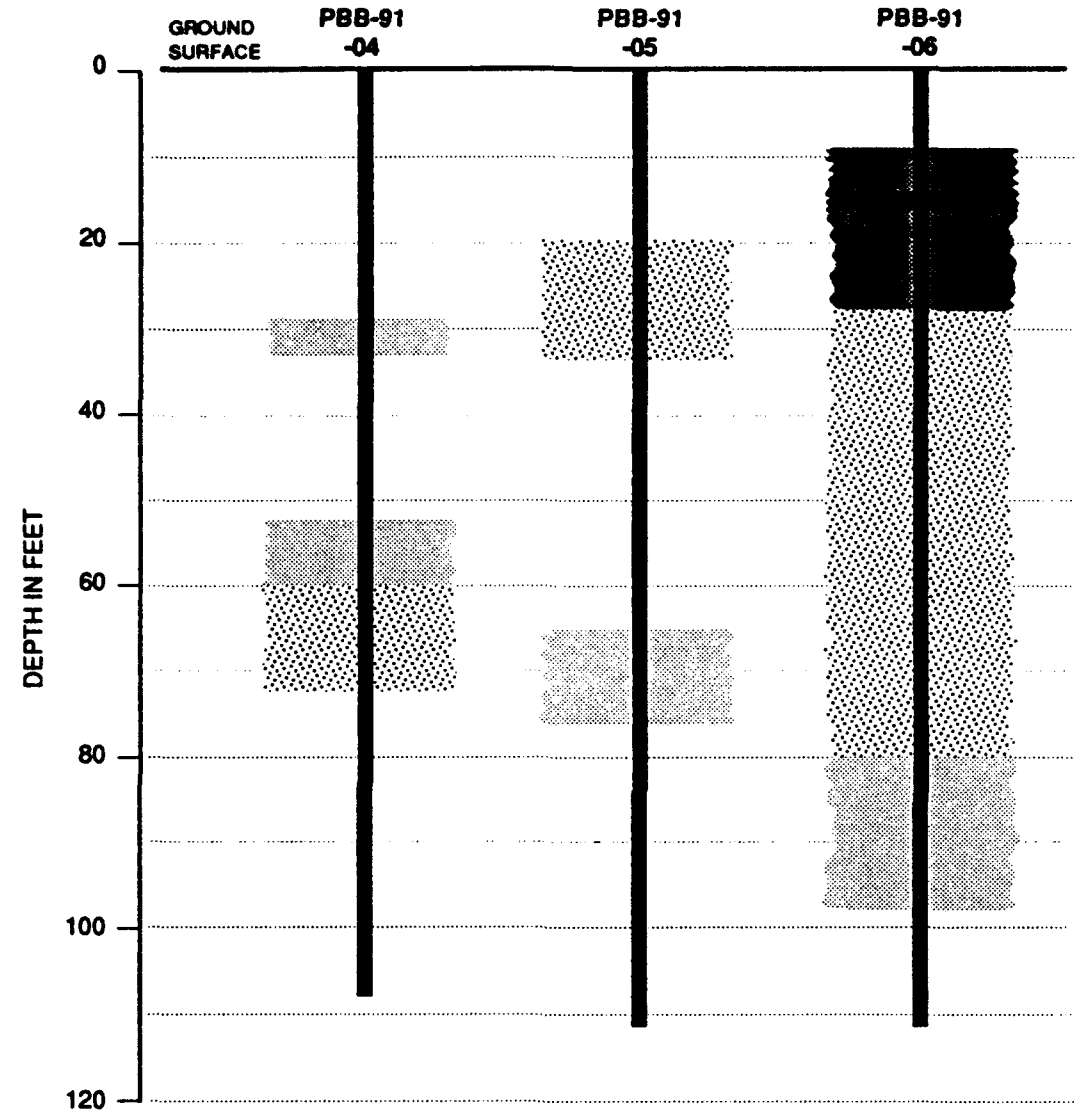


TRCLE CONCENTRATION

- > 10 ppm
- 1.0 to 10 ppm
- ND to 1.0 ppm

NOTE:
1. SEE TABLE 6-16 AND APPENDIX K FOR CHEMICAL DATA SUMMARY.

FIGURE 6-30
INTERPRETIVE TRCLE CONCENTRATIONS IN SUBSURFACE SOILS
PROPELLANT BURNING GROUND WASTE PITS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT



TOTAL DNTs CONCENTRATION

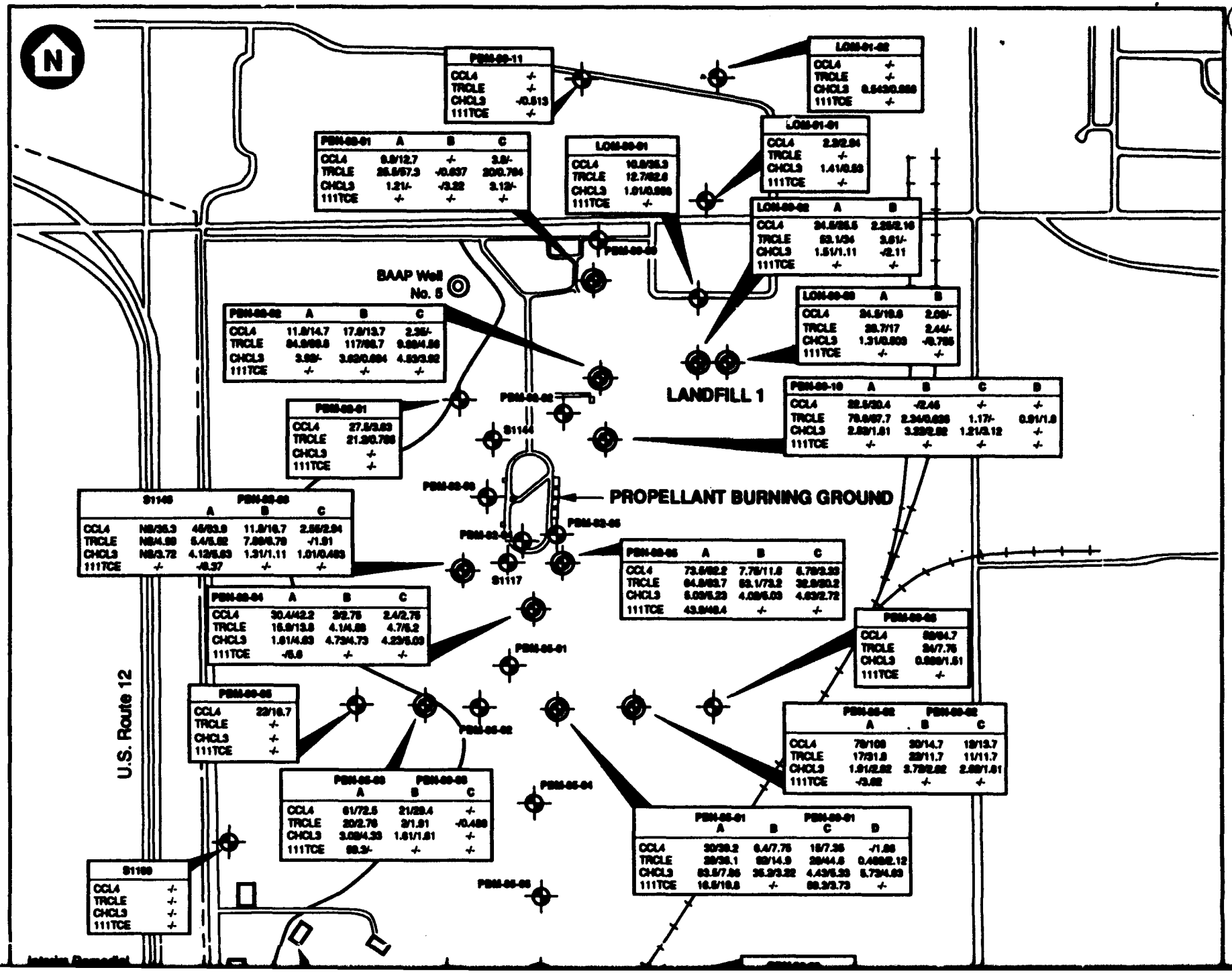
- > 100,000 ppm
- 10,000 to 100,000 ppm
- 1,000 to 10,000 ppm
- ND to 1,000 ppm

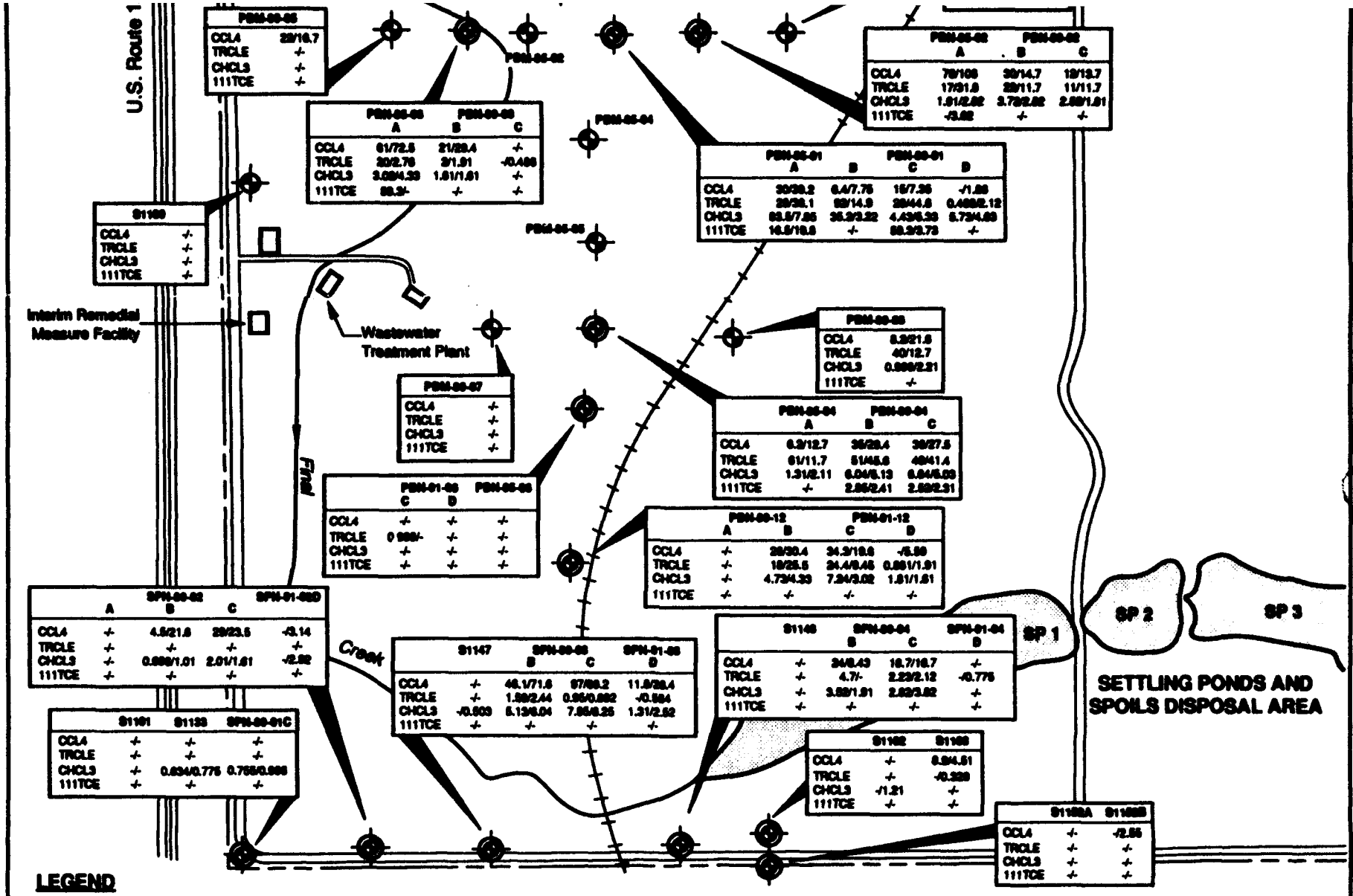
NOTE:
1. SEE TABLE 6-16 AND APPENDIX K FOR CHEMICAL DATA SUMMARY.

FIGURE 6-31
INTERPRETIVE TOTAL DNT CONCENTRATIONS IN SUBSURFACE SOILS
PROPELLANT BURNING GROUND WASTE PITS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

92080430 3


N
BAAP Well No. 5
LANDFILL 1
PROPELLANT BURNING GROUND
U.S. Route 12
S1144
S1117
S1160
PBM-00-11
CCL4 +
TRCLE +
CHCL3 -/0.513
111TCE +
LOM-01-02
CCL4 +
TRCLE +
CHCL3 0.543/0.550
111TCE +
LOM-01-01
CCL4 2.3/2.54
TRCLE +
CHCL3 1.41/0.58
111TCE +
PBM-00-01 A B C
CCL4 9.8/12.7 + 3.8/-
TRCLE 25.5/57.3 -/0.637 20/0.784
CHCL3 1.21/- -/3.22 3.13/-
111TCE + + +
LOM-00-01
CCL4 16.8/35.3
TRCLE 12.7/62.6
CHCL3 1.01/0.559
111TCE +
LOM-00-02 A B
CCL4 24.5/25.5 2.25/2.16
TRCLE 53.1/34 3.61/-
CHCL3 1.51/1.11 -/2.11
111TCE + +
LOM-00-03 A B
CCL4 34.5/19.5 2.09/-
TRCLE 28.7/17 2.44/-
CHCL3 1.31/0.609 -/0.755
111TCE + +
PBM-00-02 A B C
CCL4 11.8/14.7 17.8/13.7 2.35/-
TRCLE 84.9/68.8 117/68.7 9.99/4.56
CHCL3 3.98/- 3.62/0.694 4.53/3.02
111TCE + + +
PBM-00-01
CCL4 27.5/3.03
TRCLE 21.3/0.766
CHCL3 +
111TCE +
PBM-00-10 A B C D
CCL4 22.5/20.4 -/2.46 + +
TRCLE 70.6/67.7 2.34/0.626 1.17/- 0.91/1.8
CHCL3 2.53/1.61 3.23/2.52 1.21/3.12 +
111TCE + + + +
S1148 PBM-00-03 A B C
CCL4 NB/35.3 45/53.8 11.8/16.7 2.55/2.94
TRCLE NB/4.99 5.4/5.02 7.89/6.76 -/1.91
CHCL3 NB/3.72 4.12/5.63 1.31/1.11 1.01/0.483
111TCE + -/8.37 + +
PBM-00-05 A B C
CCL4 73.5/62.2 7.76/11.8 6.78/3.33
TRCLE 64.8/69.7 53.1/73.2 32.8/50.2
CHCL3 5.03/5.23 4.02/5.03 4.63/2.72
111TCE 43.9/48.4 + +
PBM-00-04 A B C
CCL4 30.4/42.2 3/2.76 2.4/2.76
TRCLE 16.9/13.8 4.1/4.89 4.7/5.2
CHCL3 1.61/4.63 4.73/4.73 4.23/5.03
111TCE -/5.6 + +
PBM-00-03
CCL4 59/54.7
TRCLE 24/7.76
CHCL3 0.599/1.51
111TCE +
PBM-00-05
CCL4 22/10.7
TRCLE +
CHCL3 +
111TCE +
PBM-00-02 A B C
CCL4 78/109 30/14.7 19/13.7
TRCLE 17/31.8 22/11.7 11/11.7
CHCL3 1.91/2.52 2.73/2.02 2.59/1.61
111TCE -/3.62 + +
PBM-00-03 A B PBM-00-03 C
CCL4 61/72.5 21/29.4 +
TRCLE 20/2.76 3/1.91 -/0.489
CHCL3 3.03/4.33 1.61/1.61 +
111TCE 69.3/- + +
PBM-00-01 A B PBM-00-01 C D
CCL4 30/39.2 6.4/7.76 16/7.35 -/1.86
TRCLE 28/36.1 92/14.9 28/44.6 0.469/2.12
CHCL3 63.5/7.86 35.2/3.22 4.43/5.33 5.73/4.03
111TCE 16.5/19.8 + 69.3/3.73 +
PBM-00-02 A B PBM-00-02 C
CCL4 +
TRCLE +
CHCL3 +
111TCE +



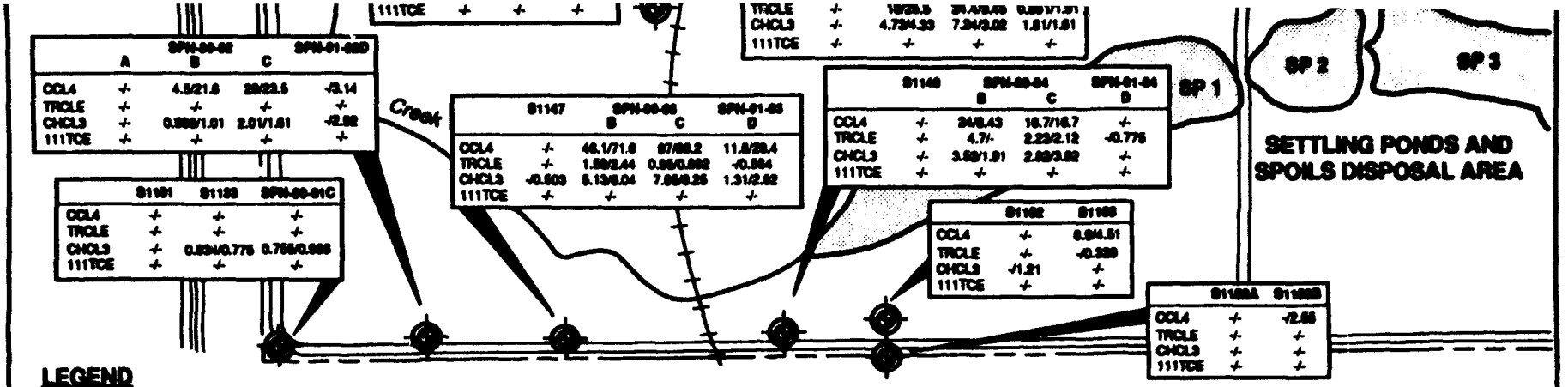
LEGEND

- SP 1 — SPOILS DISPOSAL AREA AND DESIGNATION
- FINAL CREEK
- RAILROAD TRACK
- LOCATION OF SINGLE MONITORING WELL
- LOCATION OF MONITORING WELL NEST

LOW-00-02 A B — SAMPLE LOCATION
CCL4 + 2.7/3.2 — COMPOUND CONCENTRATION IN SAMPLE (µg/L) FROM ROUND ONE OF SAMPLING (NOV/DEC 1991)
COMPOUND CONCENTRATION IN SAMPLE (µg/L)

NOTES:

1. GROUNDWATER DATA PRESENTED IS PRIMARILY FROM MONITORING WELL NESTS TO BETTER DETERMINE VERTICAL DISTRIBUTION OF CHEMICAL CONCENTRATIONS.
2. CCL4 = CARBON TETRACHLORIDE
   TRCLE = TRICHLOROETHENE
   CHCL3 = CHLOROFORM
   111TCE = 1,1,1-TRICHLOROETHANE
3. ALL ANALYTICAL RESULTS REPORTED IN MICROGRAMS PER LITER (µg/L).
4. BASE MAP PREPARED FROM 300 SCALE TOPOGRAPHIC PLAN PROVIDED BY OLIN CORPORATION.



LEGEND

- SP 1 — SPOILS DISPOSAL AREA AND DESIGNATION
- FINAL CREEK
- RAILROAD TRACK
- LOCATION OF SINGLE MONITORING WELL
- LOCATION OF MONITORING WELL NEST

LOW-00-02 (A, B)
CCL4 + 2.7/3.2

- SAMPLE LOCATION
- COMPOUND CONCENTRATION IN SAMPLE (µg/L) FROM ROUND ONE OF SAMPLING (NOV/DEC 1991)
- COMPOUND CONCENTRATION IN SAMPLE (µg/L) FROM ROUND TWO OF SAMPLING (APR/MAY 1992)
- COMPOUND OF CONCERN
- \- = LESS THAN CERTIFIED REPORTING LIMIT (CRL)

APPROXIMATE SCALE IN FEET

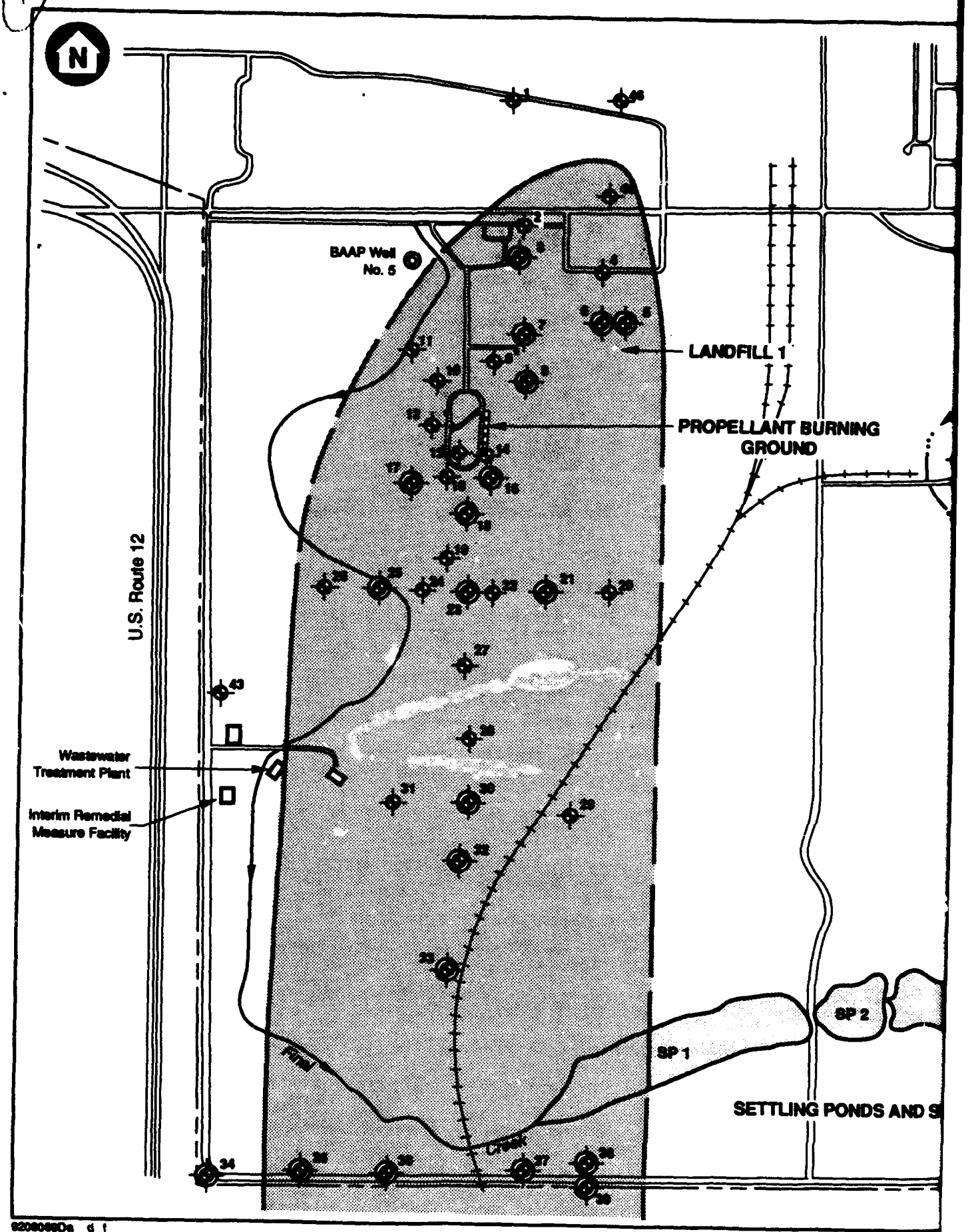
0 1000 2000

NOTES:

1. GROUNDWATER DATA PRESENTED IS PRIMARILY FROM MONITORING WELL NESTS TO BETTER DETERMINE VERTICAL DISTRIBUTION OF CHEMICAL CONCENTRATIONS.
2. CCL4 = CARBON TETRACHLORIDE
   TRCLE = TRICHLOROETHENE
   CHCL3 = CHLOROFORM
   111TCE = 1,1,1-TRICHLOROETHANE
3. ALL ANALYTICAL RESULTS REPORTED IN MICROGRAMS PER LITER (µg/L).
4. BASE MAP PREPARED FROM 300 SCALE TOPOGRAPHIC PLAN PROVIDED BY OLIN CORPORATION.

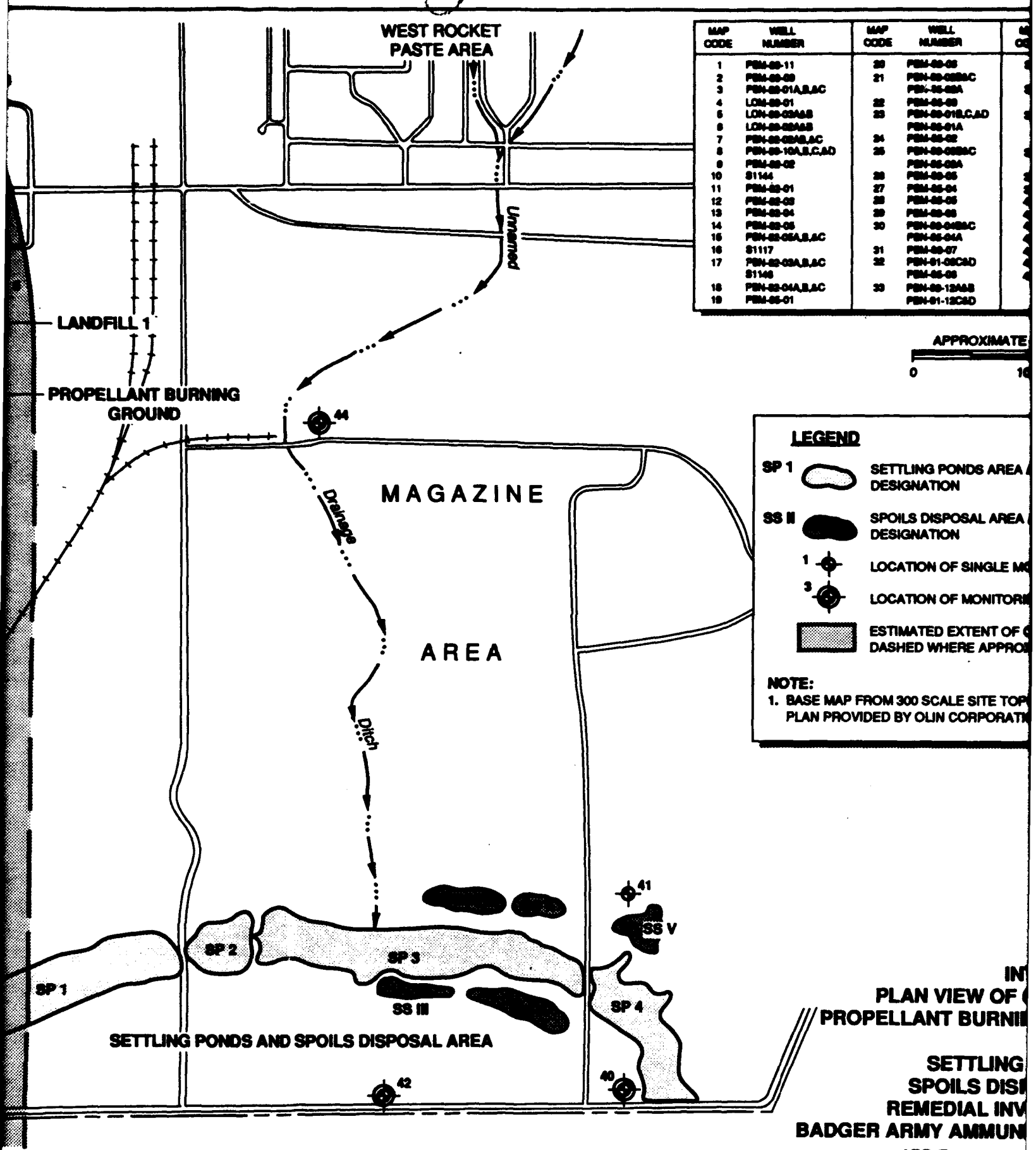
FIGURE 6-32
SUMMARY OF SELECTED VOC GROUNDWATER DATA
PROPELLANT BURNING GROUND AND LANDFILL 1
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT
ABB Environmental Services, Inc.

92080020

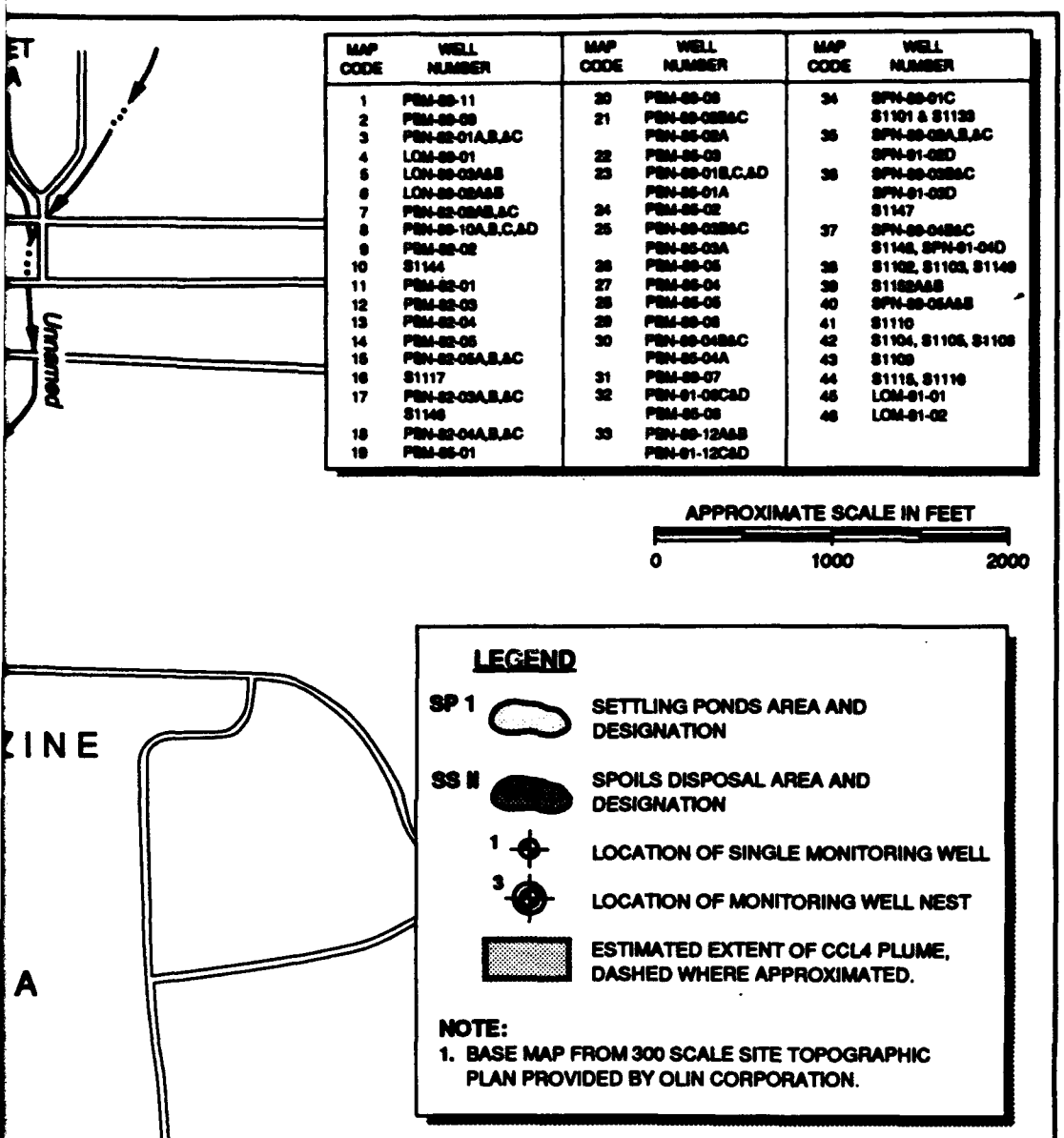


9208088Da d f

(2)



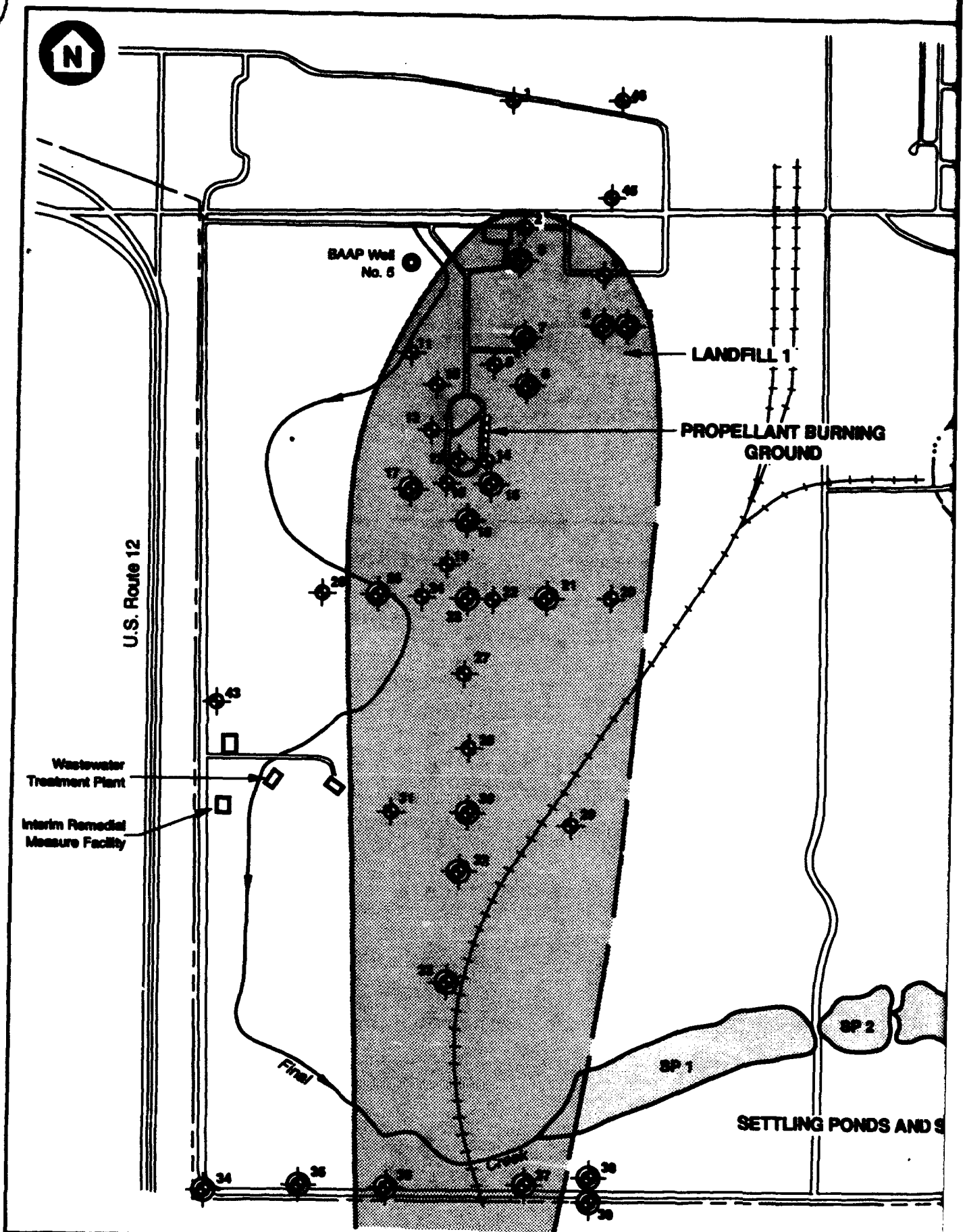
MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER
1	PSM-89-11	20	PSM-89-05
2	PSM-89-09	21	PSN-89-05B&C
3	PSN-89-01A,B,&C		PSN-89-05A
4	LCM-89-01	22	PSM-89-09
5	LCN-89-03A&B	23	PSN-89-01B,C,&D
6	LCN-89-03A&B		PSN-89-01A
7	PSN-89-03A&B,&C	24	PSM-89-02
8	PSN-89-10A,B,C,&D	25	PSN-89-03B&C
9	PSM-89-02		PSN-89-03A
10	S1144	26	PSM-89-05
11	PSM-89-01	27	PSM-89-04
12	PSM-89-03	28	PSM-89-05
13	PSM-89-04	29	PSM-89-06
14	PSM-89-05	30	PSN-89-04B&C
15	PSN-89-05A,B,&C		PSN-89-04A
16	S1117	31	PSM-89-07
17	PSN-89-03A,B,&C	32	PSN-91-08C&D
	S1146		PSM-89-08
18	PSN-89-04A,B,&C	33	PSN-89-12A&B
19	PSM-89-01		PSN-91-12C&D



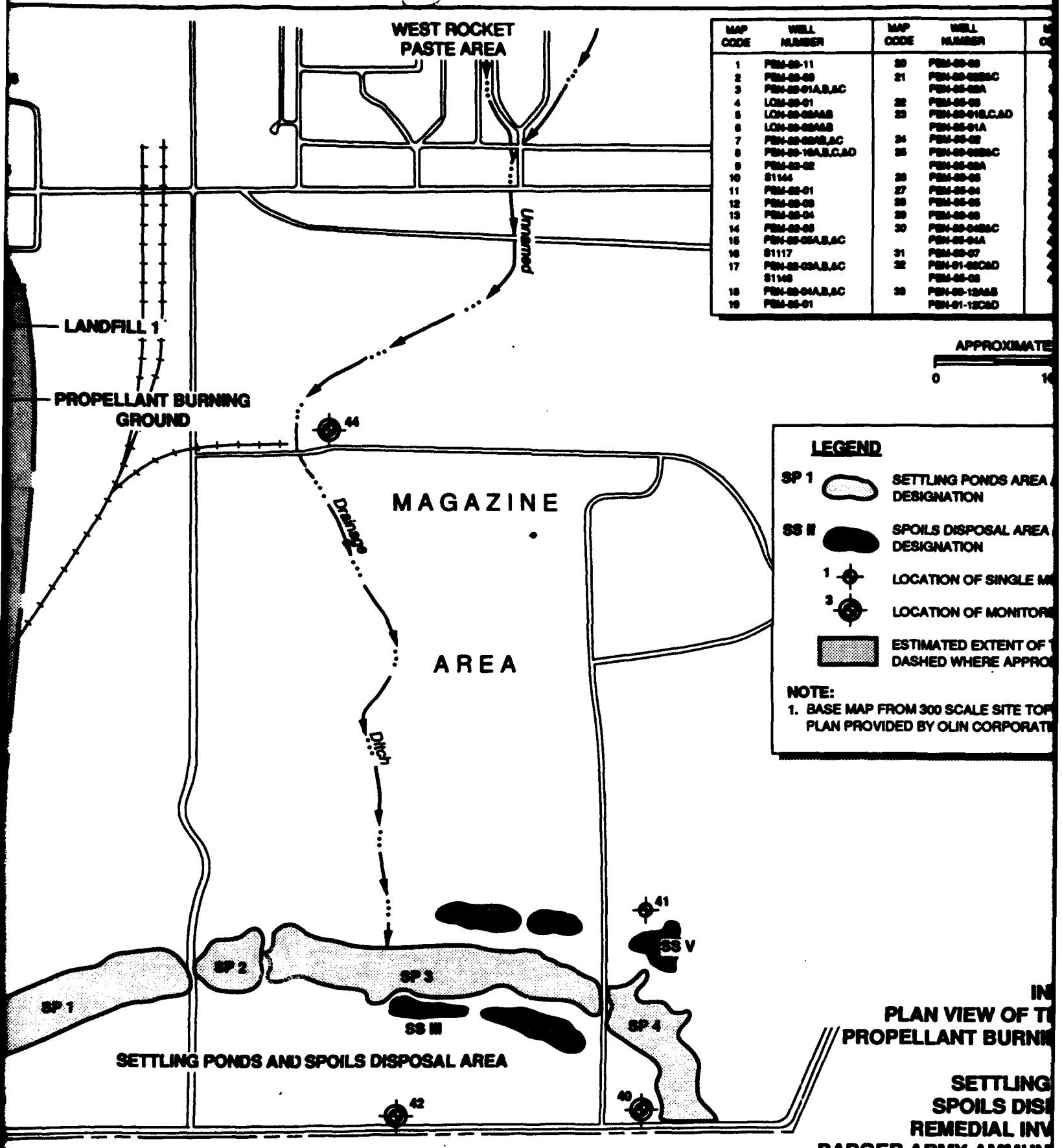
MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER
1	PBM-89-11	20	PBM-89-09	34	SPN-89-01C
2	PBM-89-09	21	PBN-89-03BaC		S1101 & S1139
3	PBN-92-01A,B,&C		PBN-95-03A	35	SPN-89-03A,B,&C
4	LOM-89-01	22	PBM-95-09		SPN-91-03D
5	LON-89-03A&B	23	PBN-89-01B,C,&D	36	SPN-89-03BaC
6	LON-89-03A&B		PBN-95-01A		SPN-91-03D
7	PBN-92-03A,B,&C	24	PBM-95-02		S1147
8	PBN-89-10A,B,C,&D	25	PBN-89-03BaC	37	SPN-89-04BaC
9	PBM-92-02		PBN-95-03A		S1148, SPN-91-04D
10	S1144	26	PBM-89-05	38	S1102, S1103, S1149
11	PBM-92-01	27	PBM-95-04	39	S1102A&B
12	PBM-92-03	28	PBM-95-05	40	SPN-89-05A&B
13	PBM-92-04	29	PBM-89-06	41	S1110
14	PBM-92-05	30	PBN-89-04BaC	42	S1104, S1105, S1106
15	PBN-92-05A,B,&C		PBN-95-04A	43	S1109
16	S1117	31	PBM-89-07	44	S1115, S1116
17	PBN-92-03A,B,&C	32	PBN-91-06CaD	45	LOM-91-01
	S1146		PBM-95-08	46	LOM-91-02
18	PBN-92-04A,B,&C	33	PBN-89-12A&B		
19	PBM-95-01		PBN-91-12CaD		

FIGURE 6-33
INTERPRETIVE
PLAN VIEW OF CCL4 PLUME
PROPELLANT BURNING GROUND,
LANDFILL 1,
SETTLING PONDS AND
SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.


N
BAAP Well No. 5
LANDFILL 1
PROPELLANT BURNING GROUND
U.S. Route 12
Wastewater Treatment Plant
Interim Remedial Measure Facility
SP 1
SP 2
SETTLING PONDS AND S
Final
Creek

(2)

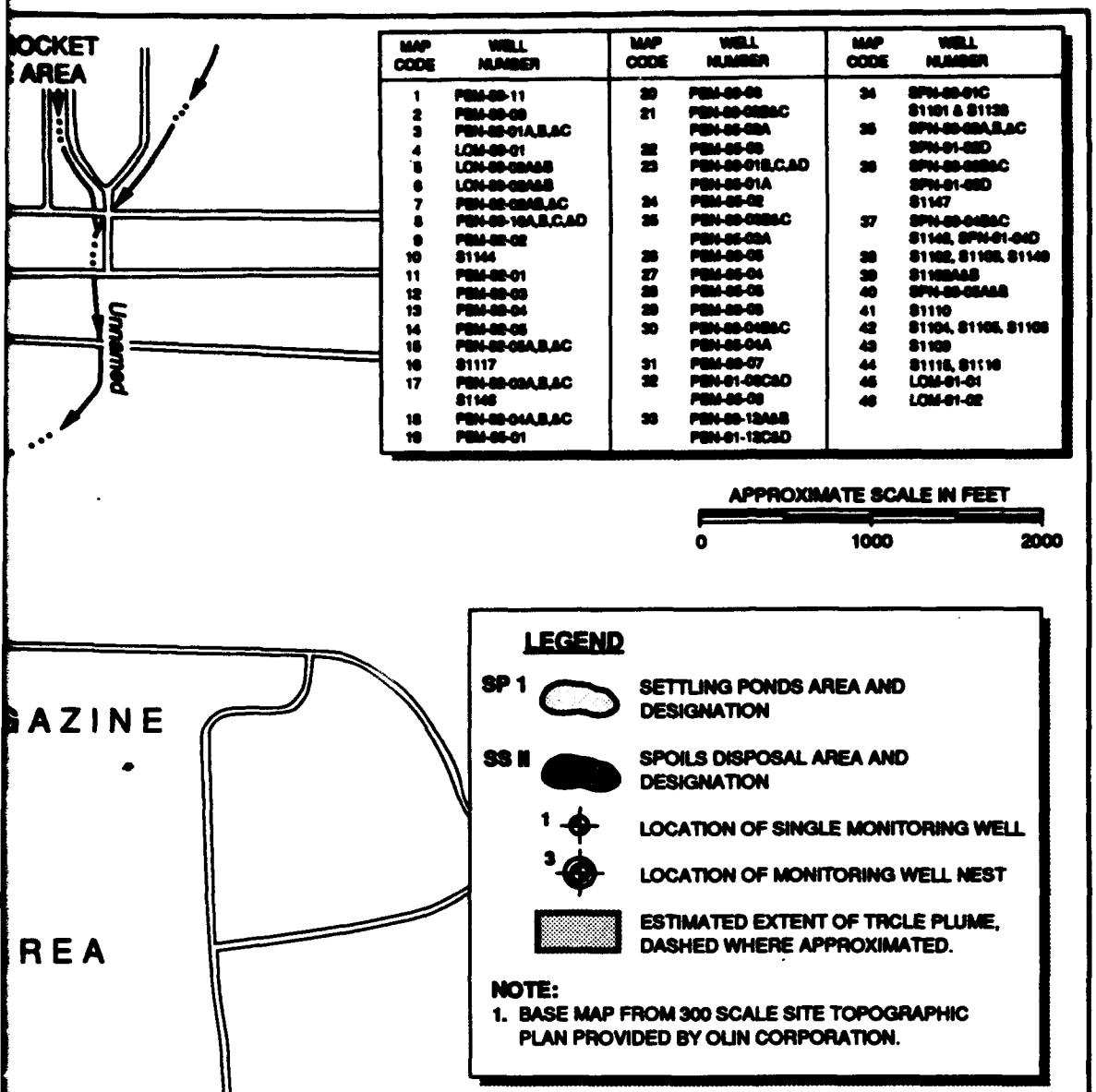


MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER
1	PBM-89-11	20	PBM-89-08
2	PBM-89-09	21	PBM-89-08B&C
3	PBM-89-01A,B,&C		PBM-89-08A
4	LOM-89-01	22	PBM-89-09
5	LOM-89-08A&B	23	PBM-89-01B,C,&D
6	LOM-89-08A&B		PBM-89-01A
7	PBM-89-08A,B,&C	24	PBM-89-02
8	PBM-89-10A,B,C,&D	25	PBM-89-08B&C
9	PBM-89-02		PBM-89-08A
10	S1144	26	PBM-89-05
11	PBM-89-01	27	PBM-89-04
12	PBM-89-03	28	PBM-89-05
13	PBM-89-04	29	PBM-89-06
14	PBM-89-05	30	PBM-89-04B&C
15	PBM-89-05A,B,&C		PBM-89-04A
16	S1117	31	PBM-89-07
17	PBM-89-03A,B,&C	32	PBM-91-08C&D
	S1146		PBM-89-08
18	PBM-89-04A,B,&C	33	PBM-89-12A&B
19	PBM-89-01		PBM-91-12C&D

IN
PLAN VIEW OF T
PROPELLANT BURNI

SETTLING
SPOILS DIS
REMEDIAL INV
BADGER ARMY AMMUN

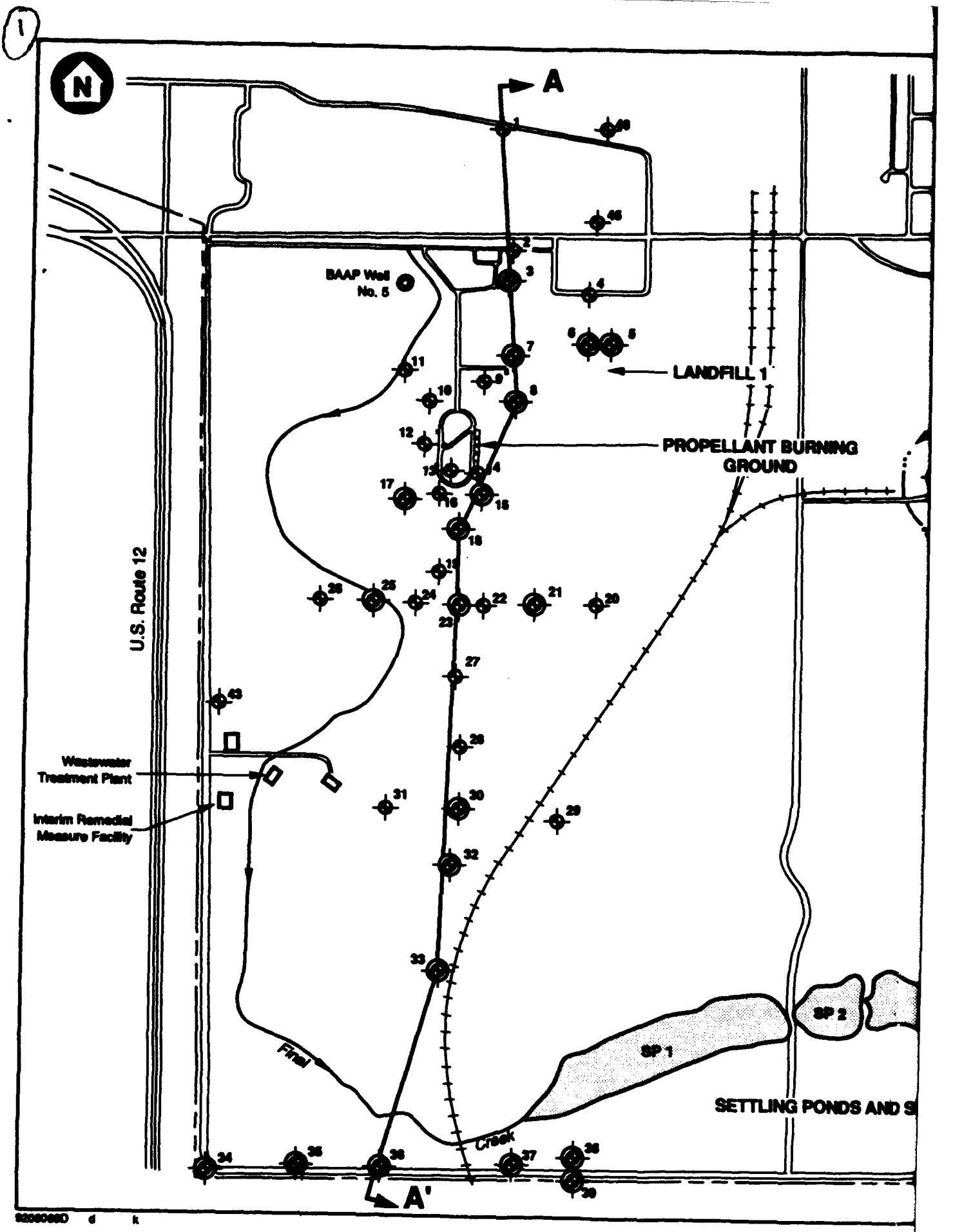
ABB Environmen

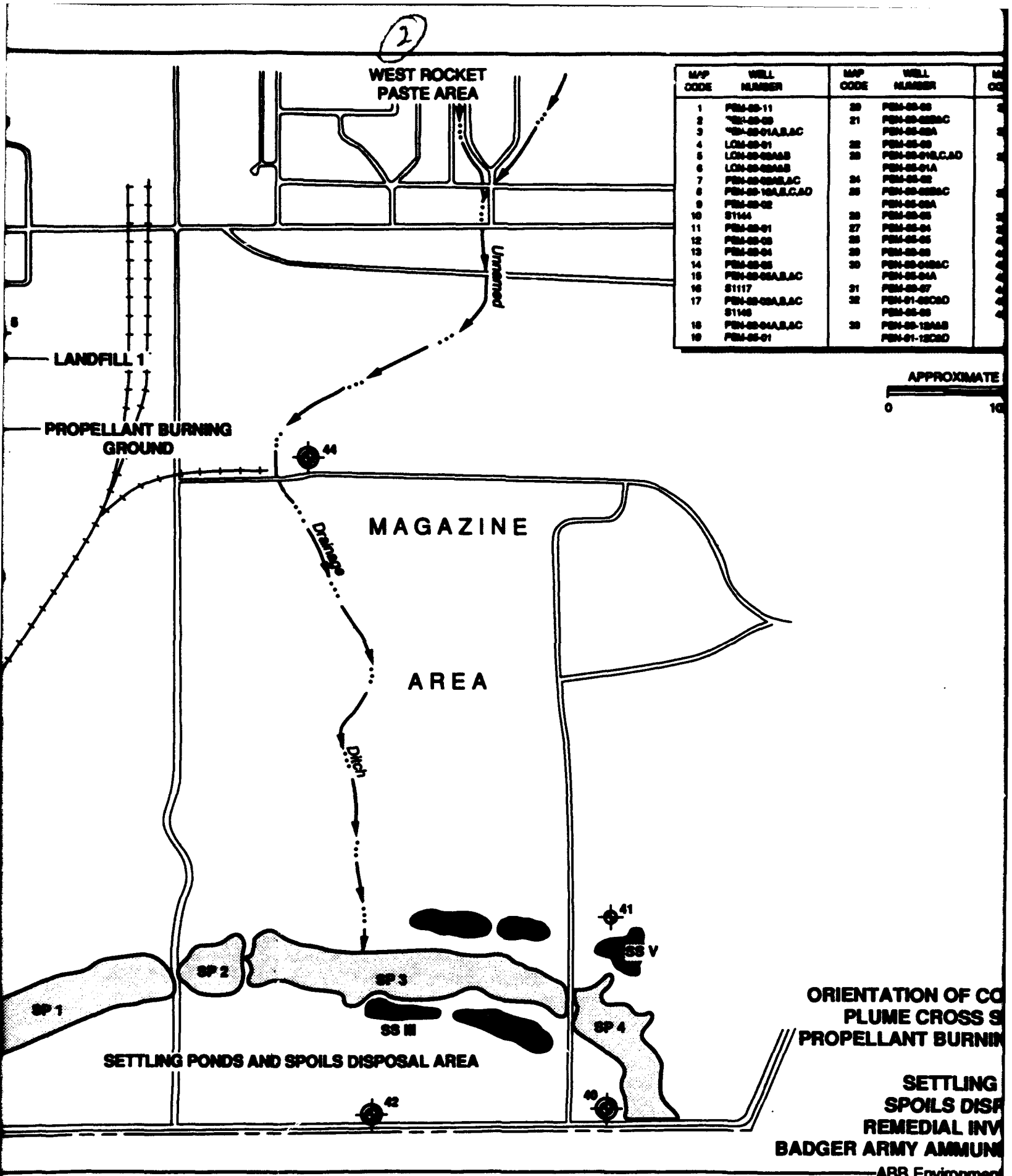


MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER
1	PBM-00-11	20	PBM-00-09	34	SPN-00-01C
2	PBM-00-09	21	PBM-00-02B&C		S1101 & S1129
3	PBM-00-01A,B,&C		PBM-00-03A	35	SPN-00-03A,B,&C
4	LOM-00-01	22	PBM-00-08		SPN-01-03D
5	LOM-00-03A&B	23	PBM-00-01B,C,&D	36	SPN-00-03B&C
6	LOM-00-03A&B		PBM-00-01A		SPN-01-03D
7	PBM-00-03A,B,&C	24	PBM-00-02		S1147
8	PBM-00-10A,B,C,&D	25	PBM-00-03B&C	37	SPN-00-04B&C
9	PBM-00-02		PBM-00-03A		S1148, SPN-01-04D
10	S1144	26	PBM-00-05	38	S1102, S1103, S1149
11	PBM-00-01	27	PBM-00-04	39	S1102A&B
12	PBM-00-03	28	PBM-00-06	40	SPN-00-05A&B
13	PBM-00-04	29	PBM-00-03	41	S1110
14	PBM-00-05	30	PBM-00-04B&C	42	S1104, S1105, S1106
15	PBM-00-05A,B,&C		PBM-00-04A	43	S1109
16	S1117	31	PBM-00-07	44	S1115, S1116
17	PBM-00-03A,B,&C	32	PBM-01-06C&D	45	LOM-01-01
	S1145		PBM-00-06	46	LOM-01-02
18	PBM-00-04A,B,&C	33	PBM-00-12A&B		
19	PBM-00-01		PBM-01-12C&D		

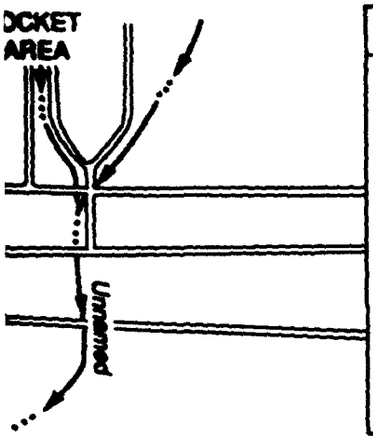
FIGURE 6-34
INTERPRETIVE
PLAN VIEW OF TRCLE PLUME
PROPELLANT BURNING GROUND,
LANDFILL 1,
SETTLING PONDS AND
SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.


N
A
A'
BAAP Well No. 5
LANDFILL 1
PROPELLANT BURNING GROUND
U.S. Route 12
Wastewater Treatment Plant
Interim Remedial Measure Facility
SP 1
SP 2
SETTLING PONDS AND S
Creek



MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER
1	PEM-89-11	20	PEM-89-09
2	*PEM-89-09	21	PEM-89-09BAC
3	*PEM-89-01A,B,AC		PEM-89-09A
4	LCM-89-01	22	PEM-89-09
5	LCM-89-09AAB	23	PEM-89-01B,C,AD
6	LCM-89-09AAB		PEM-89-01A
7	PEM-89-09AB,AC	24	PEM-89-02
8	PEM-89-10A,B,C,AD	25	PEM-89-09BAC
9	PEM-89-02		PEM-89-09A
10	S1144	26	PEM-89-09
11	PEM-89-01	27	PEM-89-04
12	PEM-89-09	28	PEM-89-05
13	PEM-89-04	29	PEM-89-09
14	PEM-89-05	30	PEM-89-04BAC
15	PEM-89-05A,B,AC		PEM-89-04A
16	S1117	31	PEM-89-07
17	PEM-89-09A,B,AC	32	PEM-91-09CBD
	S1146		PEM-89-09
18	PEM-89-04A,B,AC	33	PEM-89-12AAB
19	PEM-89-01		PEM-91-12CBD



MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER
1	PSM-89-11	20	PSM-89-06	34	SPN-89-01C
2	PSM-89-09	21	PSM-89-08B&C		S1101 & S1135
3	PSM-89-01A,B,&C		PSM-89-08A	35	SPN-89-08A,B,&C
4	LOM-89-01	22	PSM-89-03		SPN-91-08D
5	LOM-89-03A&B	23	PSM-89-01B,C,&D	36	SPN-89-08B&C
6	LOM-89-08A&B		PSM-89-01A		SPN-91-08D
7	PSM-89-08A,B,&C	24	PSM-89-02		S1147
8	PSM-89-10A,B,C,&D	25	PSM-89-03B&C	37	SPN-89-04B&C
9	PSM-89-02		PSM-89-03A		S1148, SPN-91-04D
10	S1144	26	PSM-89-05	38	S1102, S1103, S1149
11	PSM-89-01	27	PSM-89-04	39	S1105A&B
12	PSM-89-08	28	PSM-89-05	40	SPN-89-05A&B
13	PSM-89-04	29	PSM-89-08	41	S1110
14	PSM-89-05	30	PSM-89-04B&C	42	S1104, S1106, S1108
15	PSM-89-05A,B,&C		PSM-89-04A	43	S1109
16	S1117	31	PSM-89-07	44	S1115, S1116
17	PSM-89-03A,B,&C	32	PSM-91-08C&D	45	LOM-91-01
	S1145		PSM-89-09	46	LOM-91-02
18	PSM-89-04A,B,&C	33	PSM-89-13A&B		
19	PSM-89-01		PSM-91-13C&D		

APPROXIMATE SCALE IN FEET

0 1000 2000

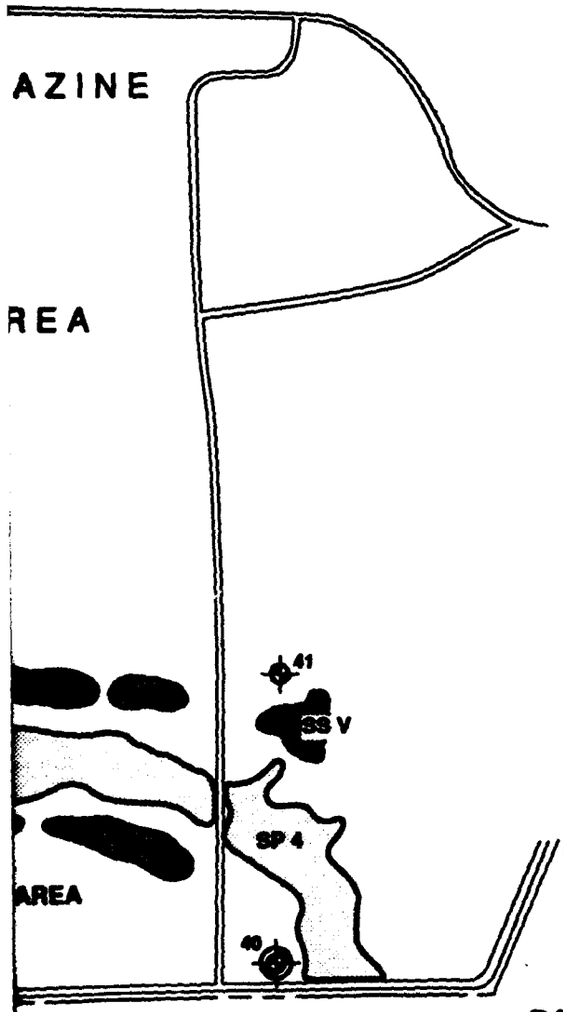
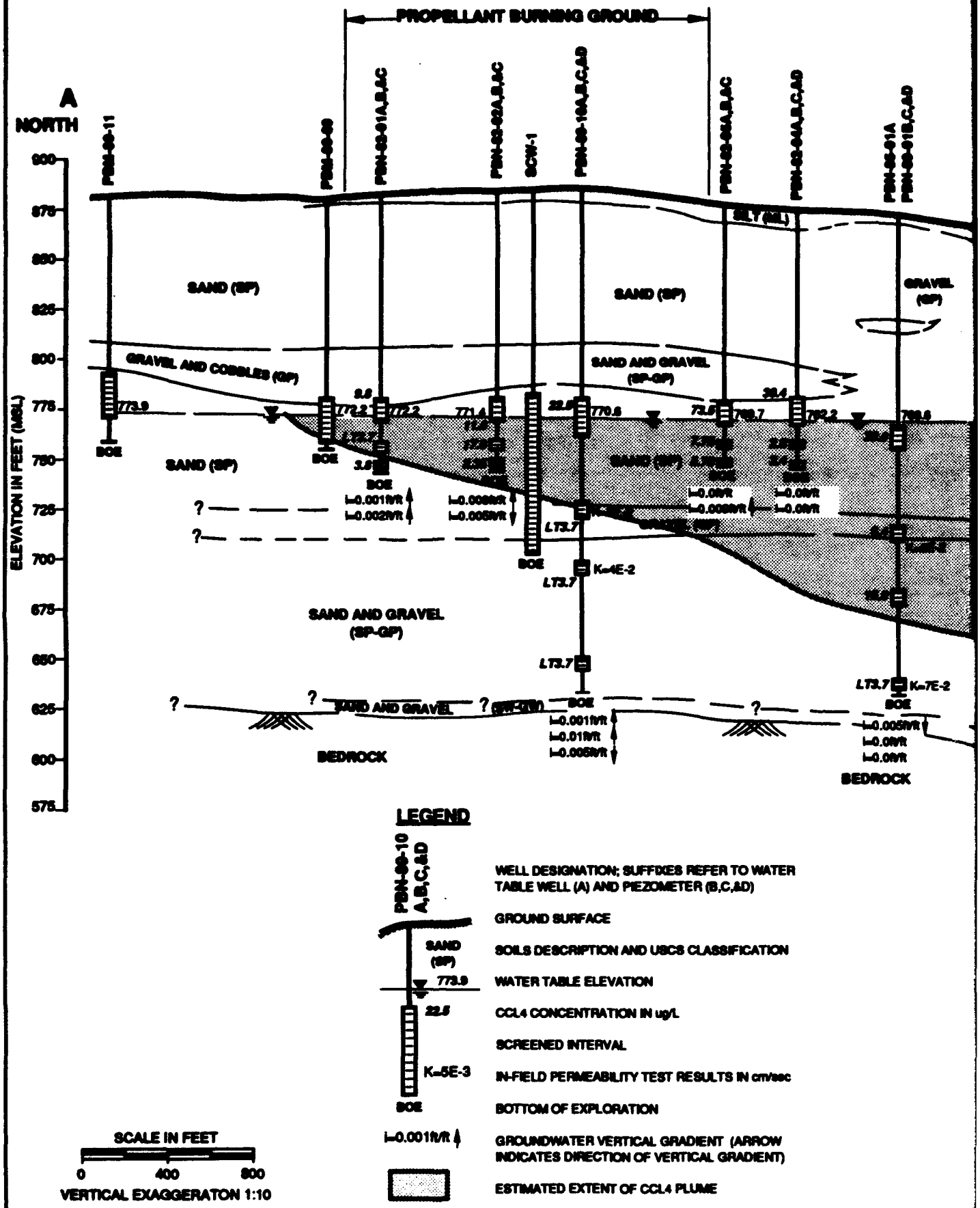


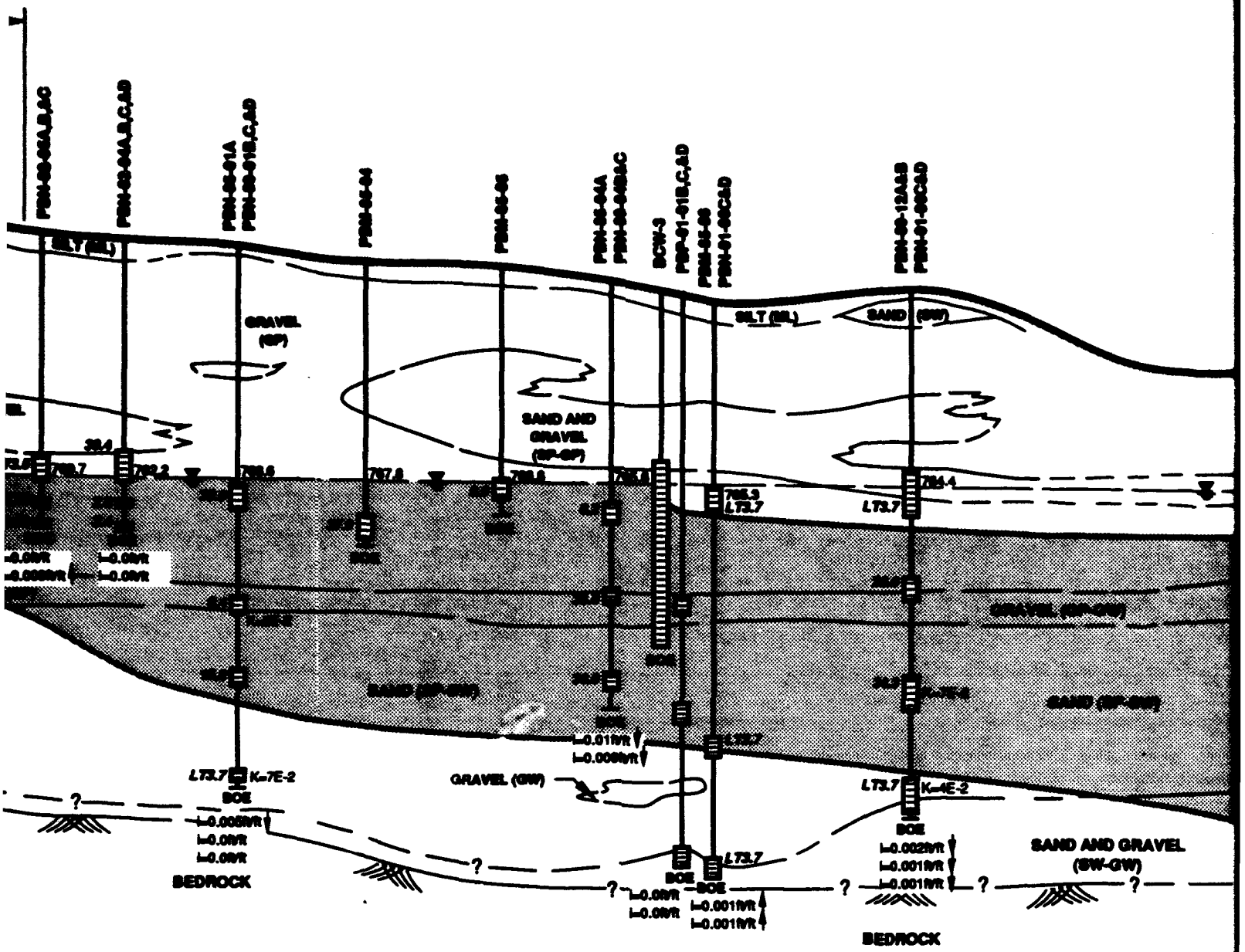
FIGURE 6-35
ORIENTATION OF CONTAMINANT PLUME CROSS SECTION A-A'
PROPELLANT BURNING GROUND, LANDFILL 1, SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.


PROPELLANT BURNING GROUND
A
NORTH
ELEVATION IN FEET (MSL)
900
875
850
825
800
775
750
725
700
675
650
625
600
575
PBN-89-11
PBN-89-90
PBN-89-91A,B,&C
PBN-89-92A,B,&C
SCW-1
PBN-89-100A,B,C,&D
PBN-89-94A,B,C,&D
PBN-89-91A
PBN-89-91B,C,&D
SILT (ML)
SAND (SP)
GRAVEL (GP)
GRAVEL AND COBBLES (GP)
SAND AND GRAVEL (SP-GP)
773.9
772.2
771.4
770.6
769.7
769.6
BOE
K=4E-2
K=7E-2
LT3.7
i=0.001ft/ft
i=0.002ft/ft
i=0.006ft/ft
i=0.005ft/ft
i=0.01ft/ft
i=0.0ft/ft
SAND AND GRAVEL
BEDROCK
LEGEND
PBN-89-10 A,B,C,&D
WELL DESIGNATION; SUFFIXES REFER TO WATER TABLE WELL (A) AND PIEZOMETER (B,C,&D)
GROUND SURFACE
SAND (SP)
SOILS DESCRIPTION AND USCS CLASSIFICATION
773.9
WATER TABLE ELEVATION
22.5
CCL4 CONCENTRATION IN ug/L
SCREENED INTERVAL
K=5E-3
IN-FIELD PERMEABILITY TEST RESULTS IN cm/sec
BOE
BOTTOM OF EXPLORATION
i=0.001ft/ft
GROUNDWATER VERTICAL GRADIENT (ARROW INDICATES DIRECTION OF VERTICAL GRADIENT)
ESTIMATED EXTENT OF CCL4 PLUME
SCALE IN FEET
0
400
800
VERTICAL EXAGGERATON 1:10

93020250 67

2



IEFER TO WATER
:R (B,C,AD)

CLASSIFICATION

SULTS IN cm/sec

IENT (ARROW
CAL GRADIENT)

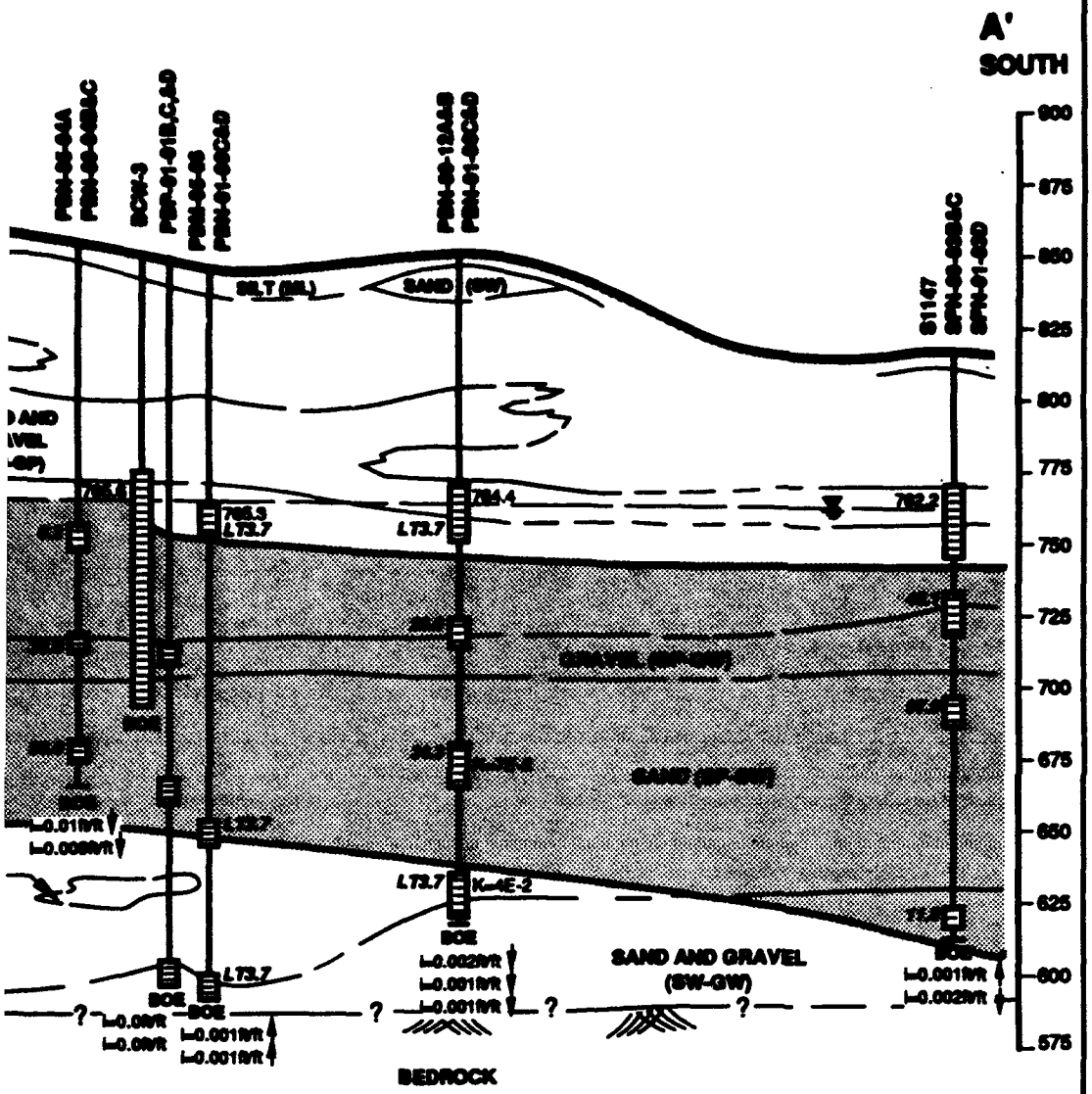
UME

NOTES:

1. SEE FIGURE 2-2 FOR LOCATION AND ORIENTATION OF PROFILE.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. ON MULTIPLE WELL NESTS, GRADIENTS ARE LISTED IN ORDER OF SHALLOW TO DEEP WELLS; i.e., A TO B, B TO C AND C TO D.
4. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91 ARE LISTED.
5. BEDROCK SURFACE ELEVATION ESTIMATED FROM PBS-89-10 AND PRODUCTION WELL NO. 5.
6. BEDROCK SURFACE ELEVATION ESTIMATED FROM PBN-89-12D (LOCATED ADJACENT TO PBN-89-10), SPN-91-04D (LOCATED APPROXIMATELY 1200 FEET EAST OF SPN-91-03D), AND PRODUCTION WELL NO. 5 (LOCATED APPROXIMATELY 1000 FEET NORTH OF PBN-89-10).
7. PSP-91-01B,C,&D IS USED ONLY FOR GEOLOGIC INFORMATION AND AQUIFER ANALYSIS. IT IS NOT A MONITORING WELL CLUSTER.

F
CONTAMINA
CROSS SECT
PROPELLANT BURNING
SETTLING P
SPOILS DISPO
REMEDIAL INVE
BADGER ARMY AMMUNIT

ABB Environmental



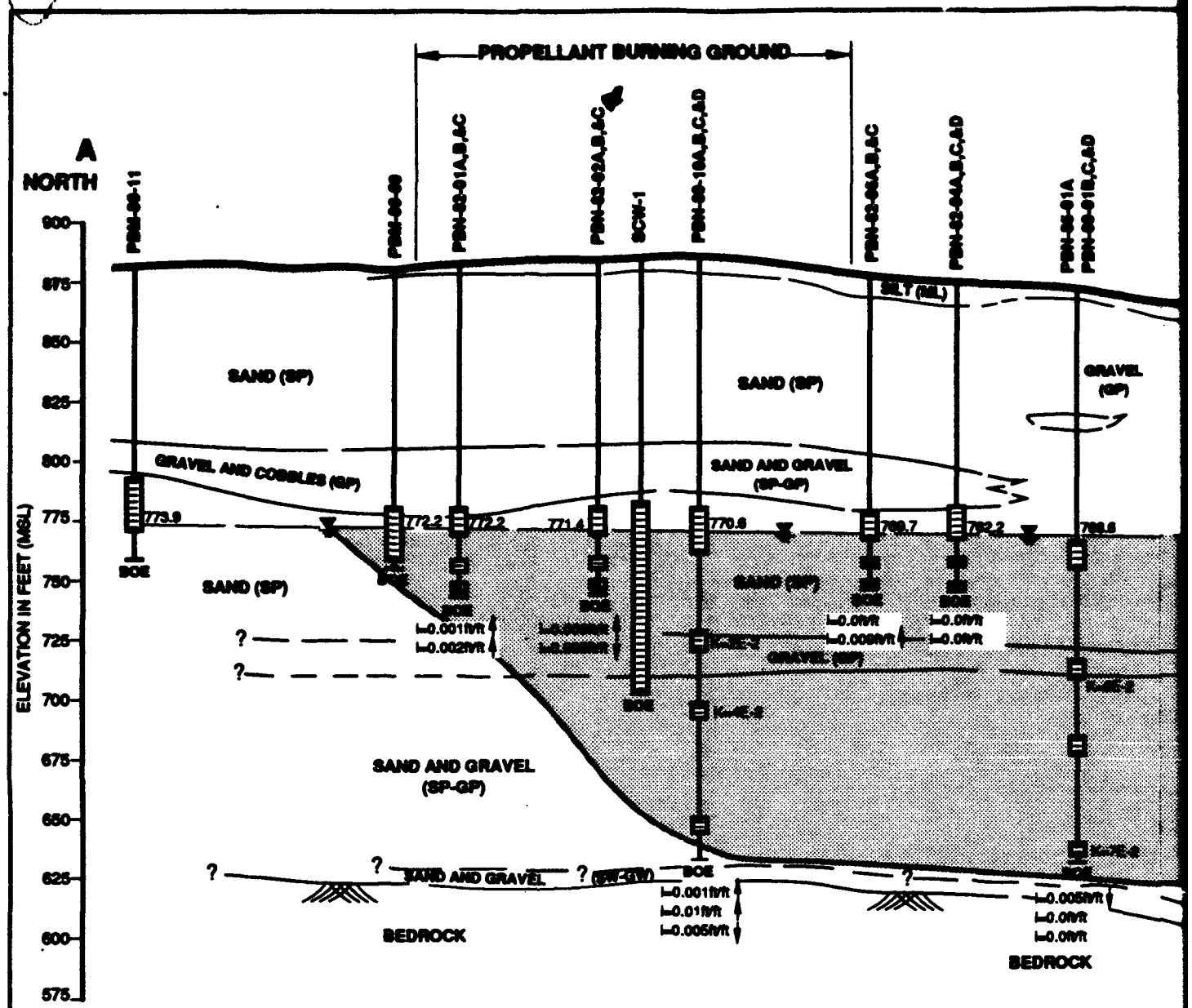
I AND ORIENTATION OF PROFILE.
NTERPRETATION OF AVAILABLE SUBSURFACE
ETWEEN EXPLORATIONS MAY VARY FROM

ADIENTS ARE LISTED IN ORDER OF SHALLOW
TO C AND C TO D.
WATER TABLE WELLS ON 12/15/91 ARE LISTED.
N ESTIMATED FROM PBB-89-10 AND

N ESTIMATED FROM PBN-89-12D (LOCATED
91-04D (LOCATED APPROXIMATELY 1200 FEET
DUCTION WELL NO. 5 (LOCATED
RTH OF PBN-89-10).
/ FOR GEOLOGIC INFORMATION AND AQUIFER
RING WELL CLUSTER.

FIGURE 6-36
CONTAMINANT PLUME
CROSS SECTION - CCL4
PROPELLANT BURNING GROUND,
SETTLING POINDS AND
SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



LEGEND

PBN-89-10 A,B,C,&D	WELL DESIGNATION; SUFFIXES REFER TO WATER TABLE WELL (A) AND PIEZOMETER (B,C,&D)
	GROUND SURFACE
SAND (SP)	SOILS DESCRIPTION AND USCS CLASSIFICATION
773.9	WATER TABLE ELEVATION
	SCREENED INTERVAL
K=5E-3	IN-FIELD PERMEABILITY TEST RESULTS IN cm/sec
BOE	BOTTOM OF EXPLORATION
i=0.001ft/ft	GROUNDWATER VERTICAL GRADIENT (ARROW INDICATES DIRECTION OF VERTICAL GRADIENT)
	ESTIMATED EXTENT OF TRCLE PLUME

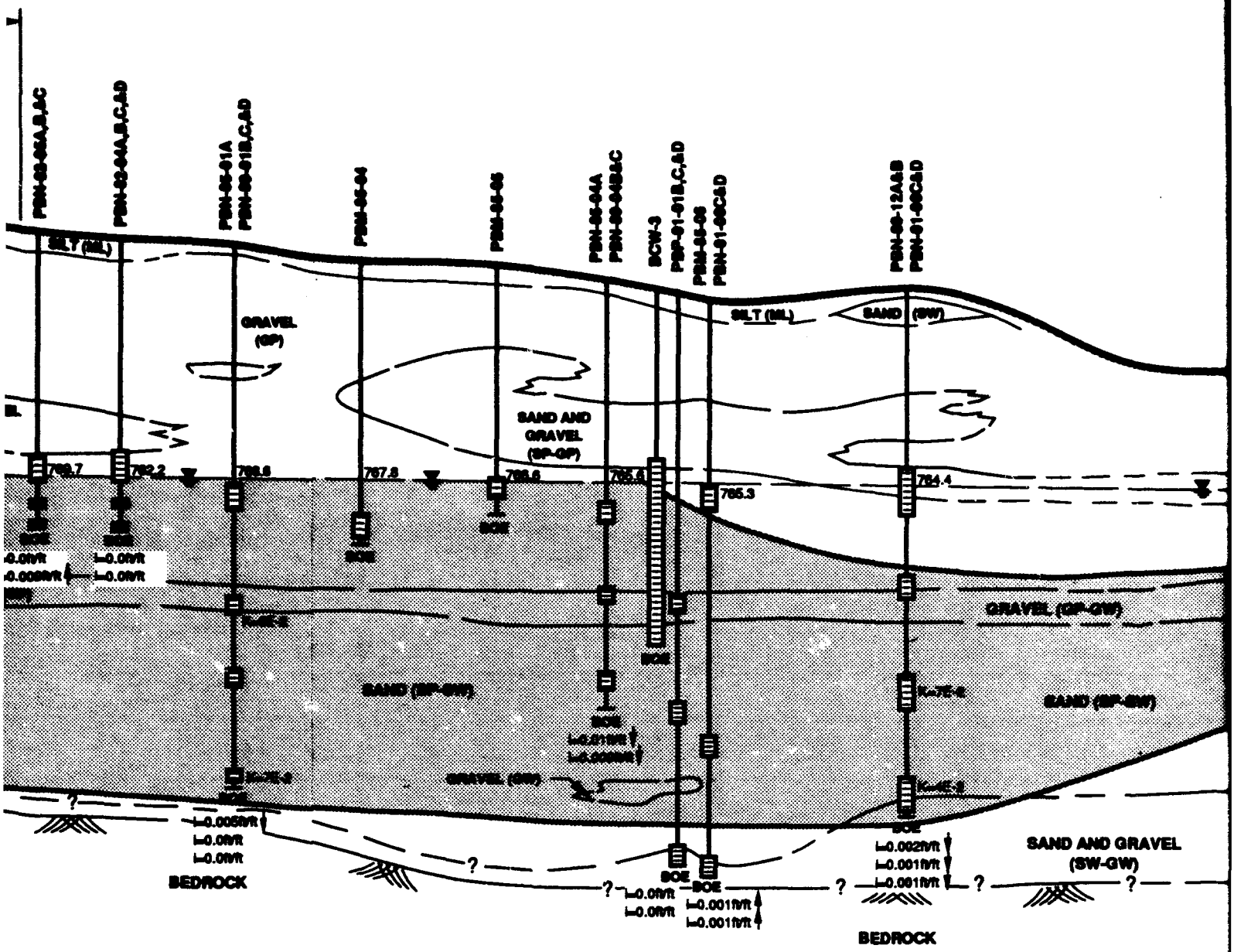
SCALE IN FEET

0 400 800

VERTICAL EXAGGERATON 1:10

93020250 89

(2)



EFER TO WATER
R (B,C,&D)

LASSIFICATION

SULTS IN cm/sec

ENT (ARROW
CAL GRADIENT)

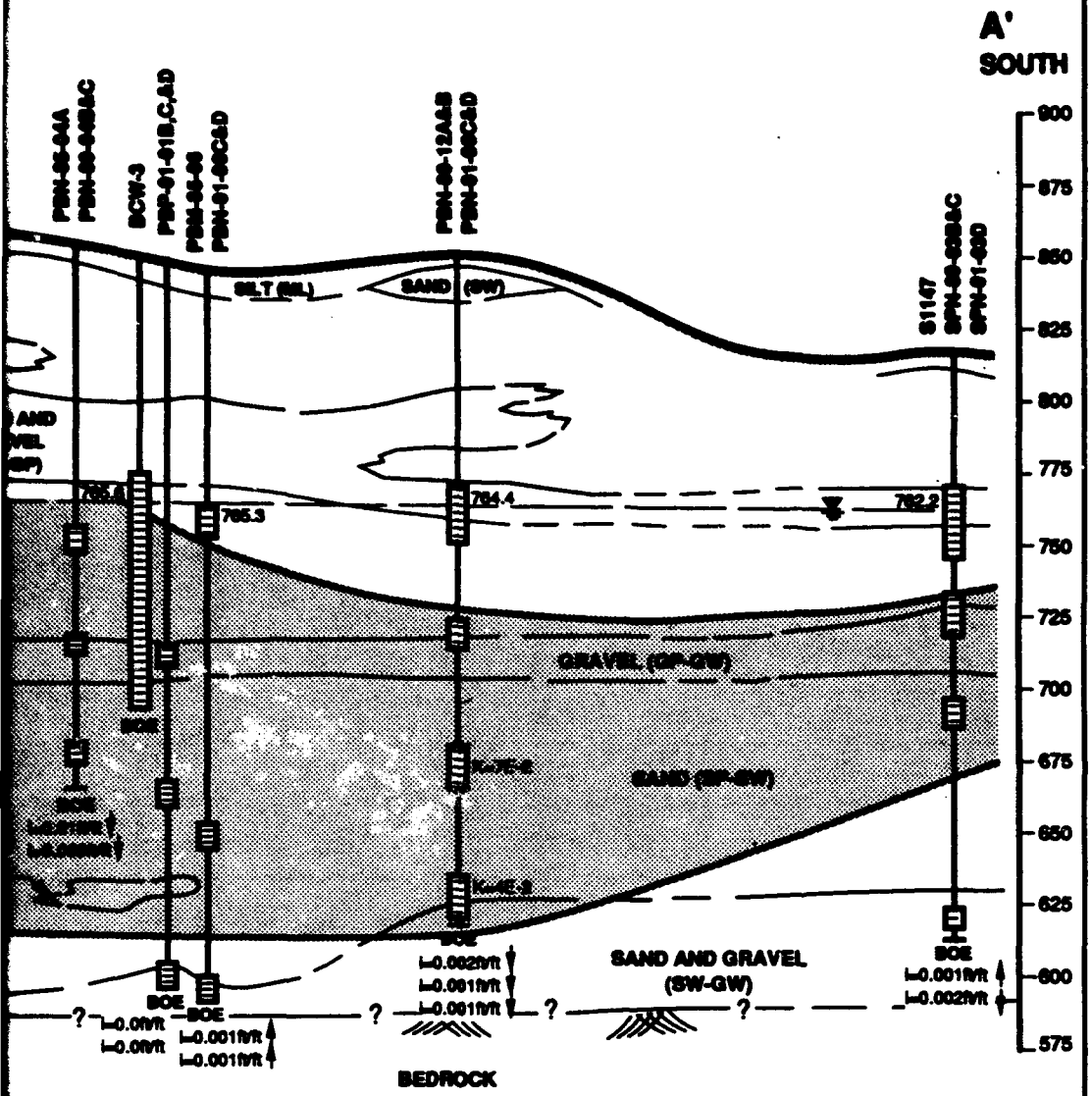
LUME

NOTES:

1. SEE FIGURE 2-2 FOR LOCATION AND ORIENTATION OF PROFILE.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. ON MULTIPLE WELL NESTS, GRADIENTS ARE LISTED IN ORDER OF SHALLOW TO DEEP WELLS; i.e., A TO B, B TO C AND C TO D.
4. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91 ARE LISTED.
5. BEDROCK SURFACE ELEVATION ESTIMATED FROM PBS-89-10 AND PRODUCTION WELL NO. 5.
6. BEDROCK SURFACE ELEVATION ESTIMATED FROM PBN-89-12D (LOCATED ADJACENT TO PBN-89-10), SPN-91-04D (LOCATED APPROXIMATELY 1200 FEET EAST OF SPN-91-03D), AND PRODUCTION WELL NO. 5 (LOCATED APPROXIMATELY 1000 FEET NORTH OF PBN-89-10).
7. PBP-91-01B,C,&D IS USED ONLY FOR GEOLOGIC INFORMATION AND AQUIFER ANALYSIS. IT IS NOT A MONITORING WELL CLUSTER.

F
CONTAMINA
CROSS SECTI
PROPELLANT BURNIN
SETTLING P
SPOILS DISP
REMEDIAL INVE
BADGER ARMY AMMUNIT

ABB Environmenta



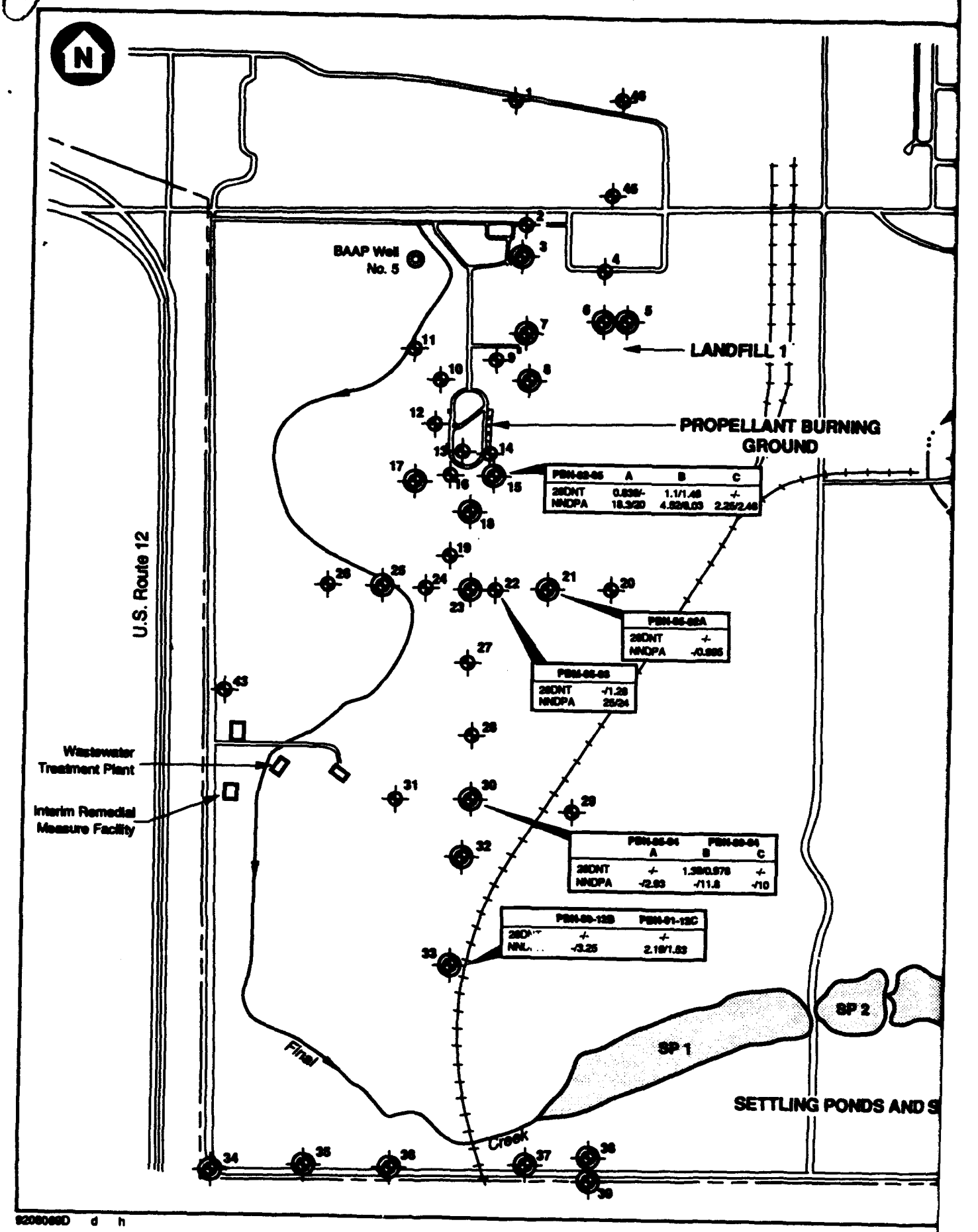
AND ORIENTATION OF PROFILE.
TERPRETATION OF AVAILABLE SUBSURFACE
TWEEN EXPLORATIONS MAY VARY FROM

DIENTS ARE LISTED IN ORDER OF SHALLOW
O C AND C TO D.
ATER TABLE WELLS ON 12/15/91 ARE LISTED.
ESTIMATED FROM PBB-89-10 AND

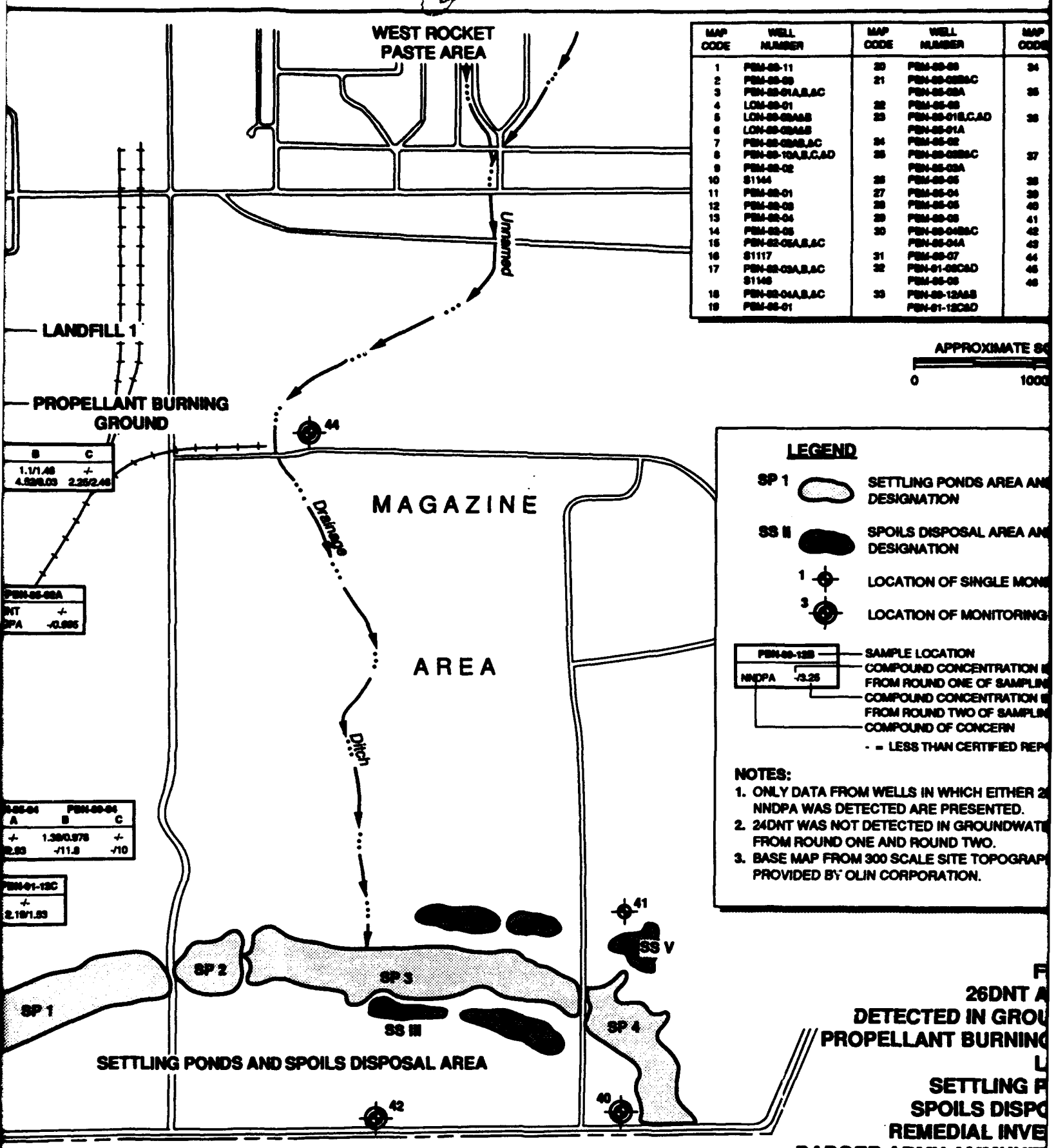
ESTIMATED FROM PBN-89-12D (LOCATED
1-04D (LOCATED APPROXIMATELY 1200 FEET
DUCTION WELL NO. 5 (LOCATED
TH OF PBN-89-10).
FOR GEOLOGIC INFORMATION AND AQUIFER
NG WELL CLUSTER.

FIGURE 6-37
CONTAMINANT PLUME
CROSS SECTION - TRCLE
PROPELLANT BURNING GROUND,
SETTLING POINDS AND
SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.


N
BAAP Well No. 5
LANDFILL 1
PROPELLANT BURNING GROUND
U.S. Route 12
Wastewater Treatment Plant
Interim Remedial Measure Facility
SP 1
SP 2
SETTLING PONDS AND S
Creek
PBN-93-05 A B C
2ADNT 0.839/- 1.1/1.46 -/-
NNDPA 18.3/20 4.52/6.03 2.25/2.46
PBN-93-05A
2ADNT -/-
NNDPA -/0.695
PBN-93-05
2ADNT -/1.28
NNDPA 25/24
PBN-93-04 A PBN-93-04 B C
2ADNT -/- 1.39/0.978 -/-
NNDPA -/2.93 -/11.8 -/10
PBN-93-13B PBN-91-13C
2ADNT -/- -/-
NNDPA -/3.25 2.19/1.83

9208066D d h



MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER	MAP CODE
1	PBM-88-11	20	PBM-88-08	34
2	PBM-88-09	21	PBM-88-02B&C	
3	PBM-88-01A,B,&C		PBM-88-03A	35
4	LCM-88-01	22	PBM-88-06	
5	LCM-88-02A&B	23	PBM-88-01B,C,&D	36
6	LCM-88-02A&B		PBM-88-01A	
7	PBM-88-03A,B,&C	24	PBM-88-02	
8	PBM-88-10A,B,C,&D	25	PBM-88-03B&C	37
9	PBM-88-02		PBM-88-03A	
10	S1144	26	PBM-88-05	38
11	PBM-88-01	27	PBM-88-04	39
12	PBM-88-03	28	PBM-88-05	40
13	PBM-88-04	29	PBM-88-06	41
14	PBM-88-05	30	PBM-89-04B&C	42
15	PBM-88-05A,B,&C		PBM-88-04A	43
16	S1117	31	PBM-89-07	44
17	PBM-88-03A,B,&C	32	PBM-91-08C&D	45
	S1146		PBM-88-08	46
18	PBM-88-04A,B,&C	33	PBM-89-12A&B	
19	PBM-88-01		PBM-91-12C&D	

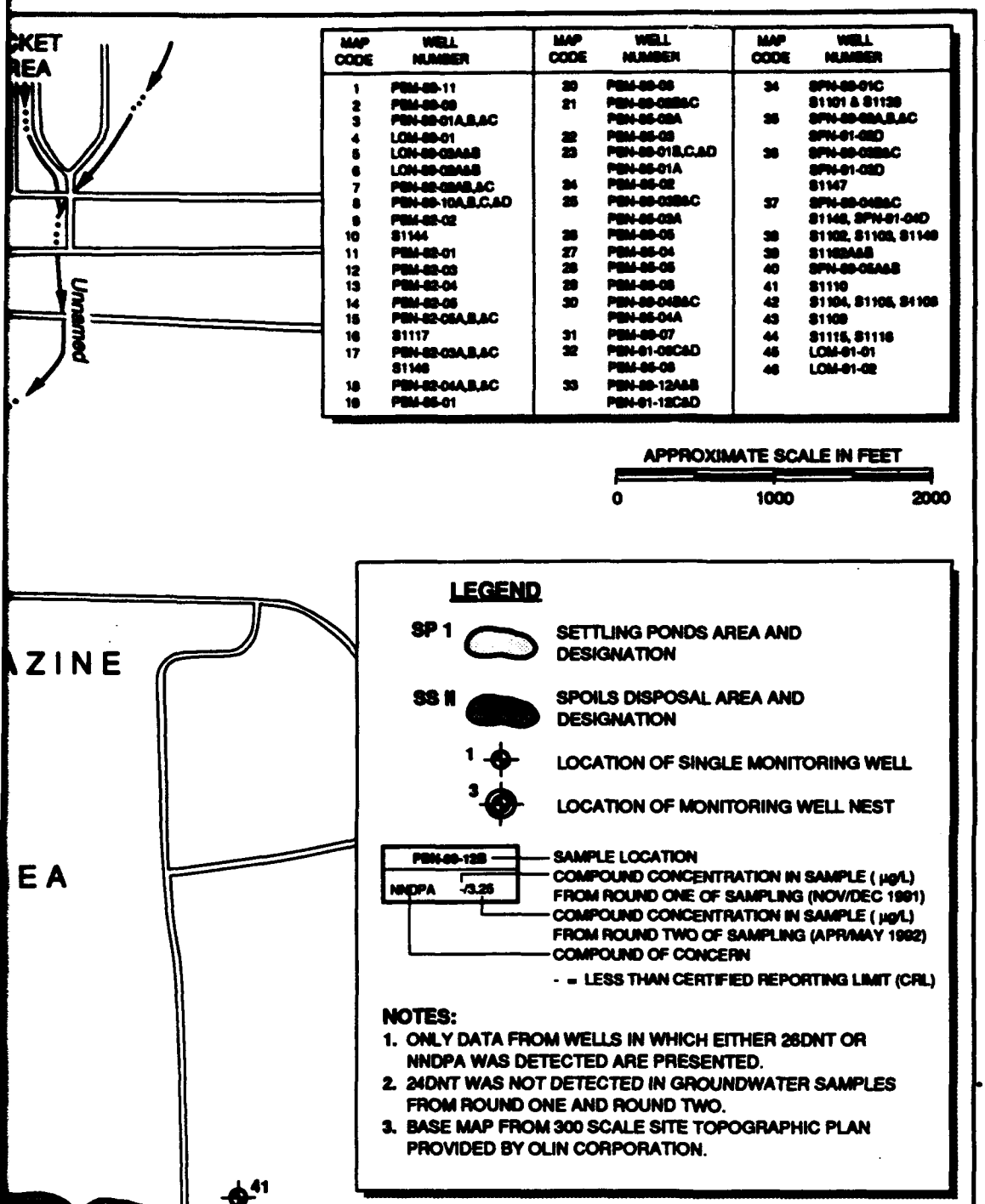
B	C
1.1/1.46	+
4.92/8.03	2.25/2.46

PBM-88-08A	
DNT	+
DPA	-/0.995

88-04 A	PBM-89-04 B	C
+	1.39/0.978	+
2.93	-/11.8	-/10

PBM-91-12C
+
2.19/1.53

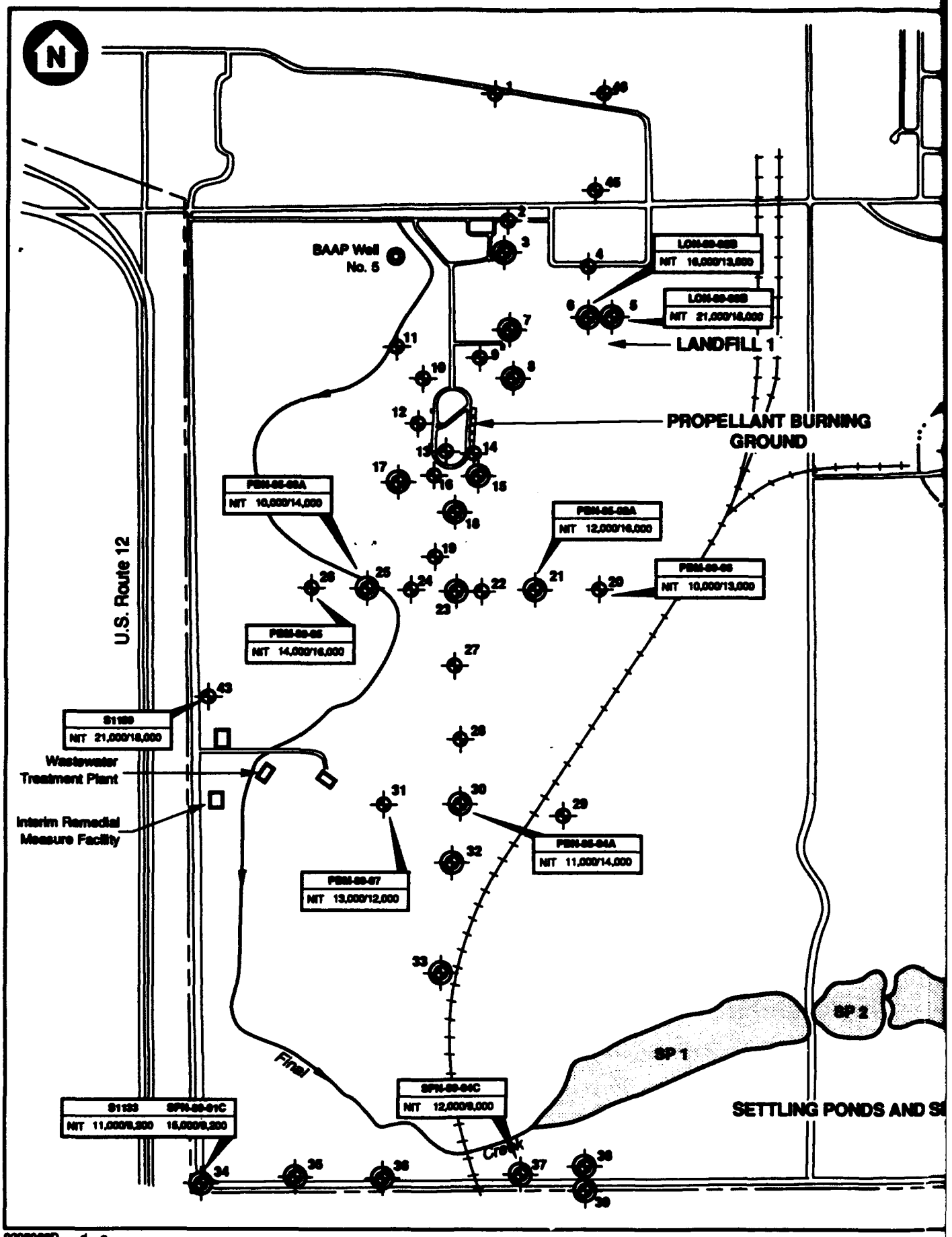
PBM-89-12B	
NNDPA	-/3.25



MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER
1	PSN-89-11	20	PSN-89-08	34	SPN-89-01C
2	PSN-89-09	21	PSN-89-03B&C		S1101 & S1139
3	PSN-89-01A,B,&C		PSN-85-03A	35	SPN-89-03A,B,&C
4	LON-89-01	22	PSN-85-03		SPN-91-03D
5	LON-89-03A&B	23	PSN-89-01B,C,&D	36	SPN-89-03B&C
6	LON-89-03A&B		PSN-85-01A		SPN-91-03D
7	PSN-89-03A,B,&C	24	PSN-85-02		S1147
8	PSN-89-10A,B,C,&D	25	PSN-89-03B&C	37	SPN-89-04B&C
9	PSN-82-02		PSN-85-03A		S1148, SPN-91-04D
10	S1144	26	PSN-89-05	38	S1102, S1103, S1149
11	PSN-82-01	27	PSN-85-04	39	S1102A&B
12	PSN-82-03	28	PSN-85-05	40	SPN-89-05A&B
13	PSN-82-04	29	PSN-89-06	41	S1110
14	PSN-82-06	30	PSN-89-04B&C	42	S1104, S1105, S1108
15	PSN-82-05A,B,&C		PSN-85-04A	43	S1109
16	S1117	31	PSN-89-07	44	S1115, S1116
17	PSN-82-03A,B,&C	32	PSN-91-09C&D	45	LOM-91-01
	S1146		PSN-85-06	46	LOM-91-02
18	PSN-82-04A,B,&C	33	PSN-89-12A&B		
19	PSN-85-01		PSN-91-12C&D		

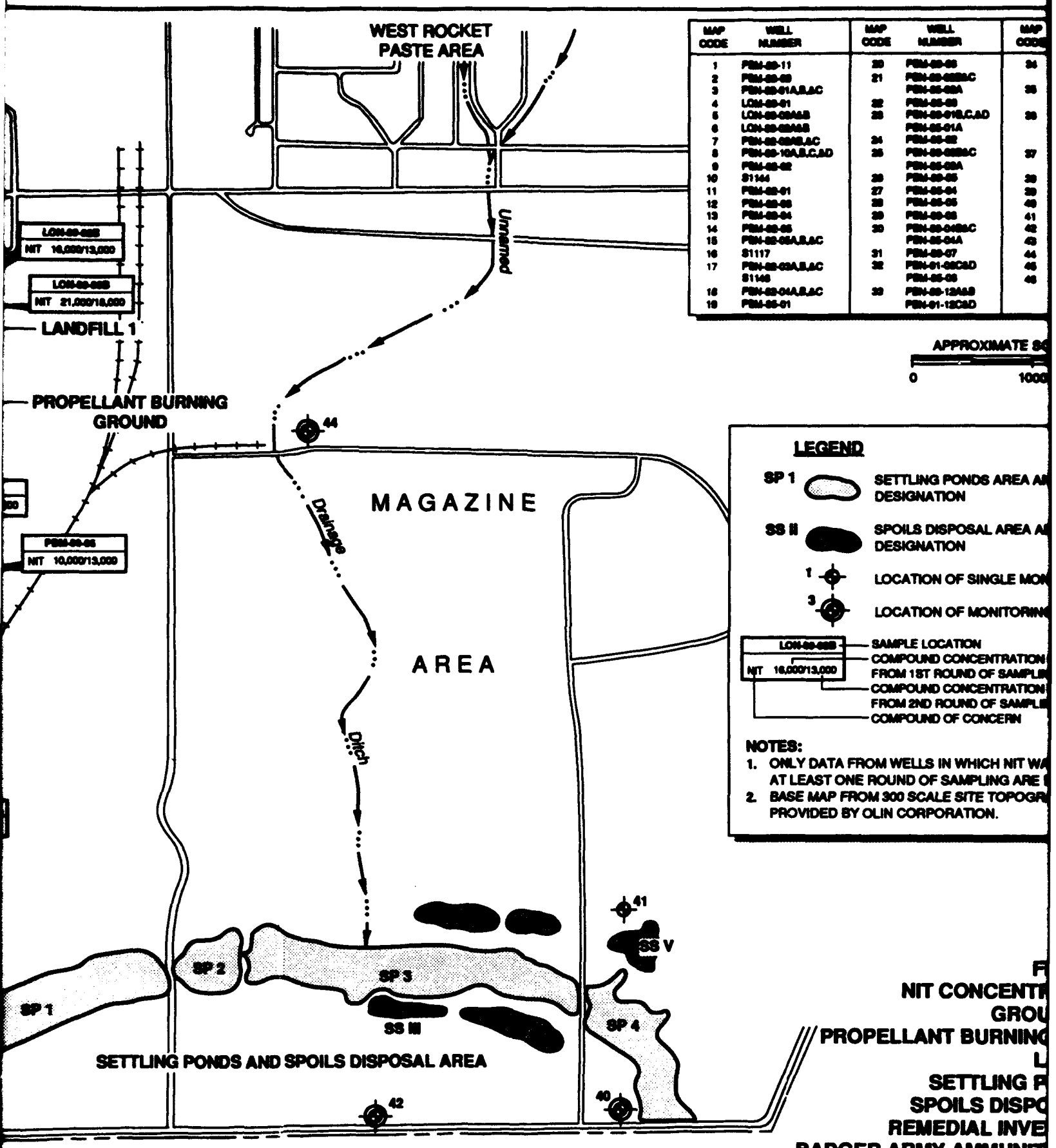
FIGURE 6-38
26DNT AND NNDPA DETECTED IN GROUNDWATER
PROPELLANT BURNING GROUND, LANDFILL 1, SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

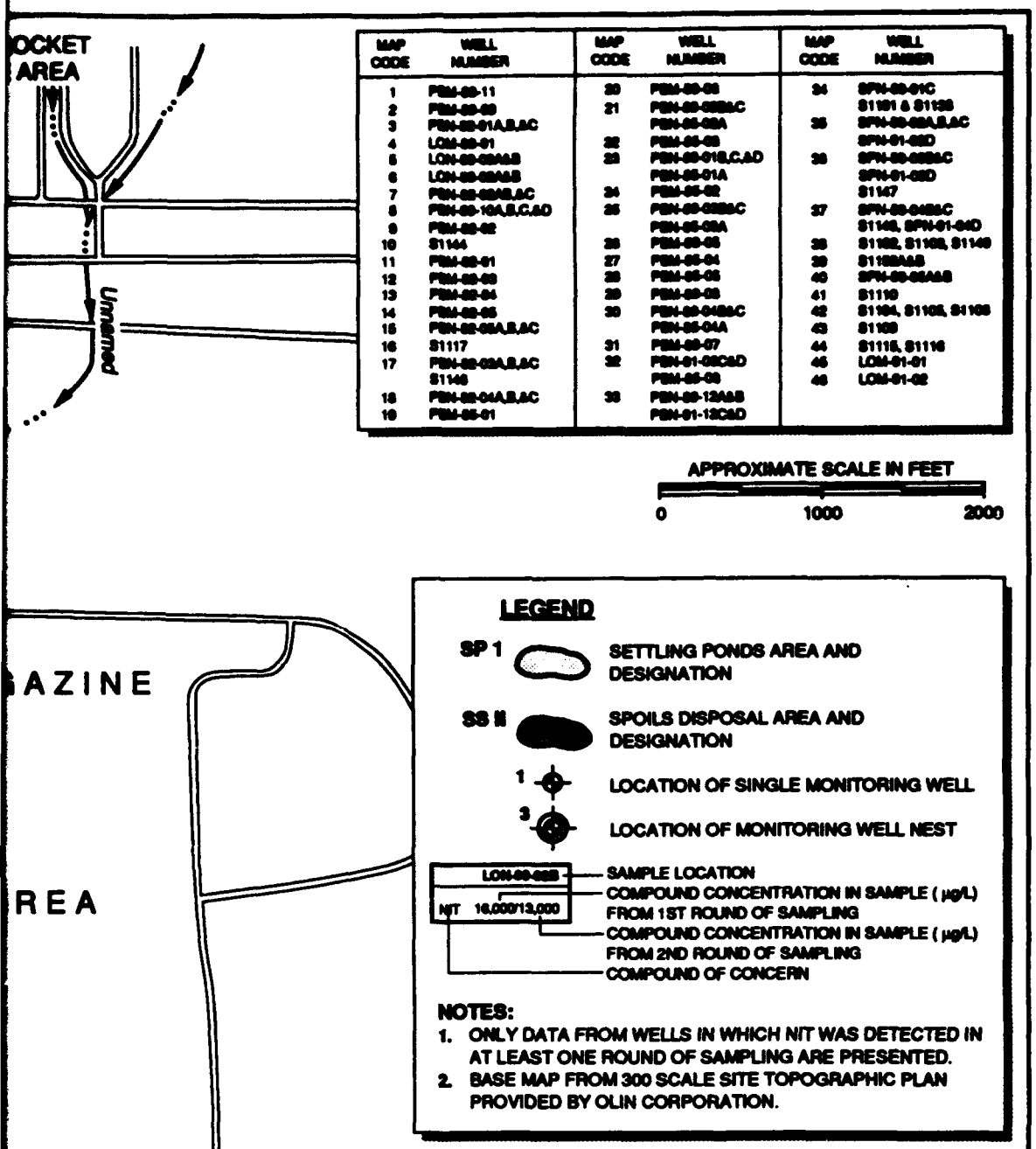

N
BAAP Well No. 5
LANDFILL 1
PROPELLANT BURNING GROUND
U.S. Route 12
Wastewater Treatment Plant
Interim Remedial Measure Facility
SP 1
SP 2
SETTLING PONDS AND S
Final
Creek
NIT 10,000/14,000
NIT 12,000/16,000
NIT 10,000/13,000
NIT 14,000/16,000
NIT 21,000/18,000
NIT 11,000/14,000
NIT 13,000/12,000
NIT 12,000/9,000
NIT 11,000/9,200 15,000/9,200

9208068D d g

2



MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER	MAP CODE
1	PBM-89-11	20	PBM-89-08	34
2	PBM-89-09	21	PBM-89-08B&C	
3	PBM-89-01A,B,&C		PBM-85-03A	35
4	LOM-89-01	22	PBM-85-08	
5	LOM-89-03A&B	23	PBM-89-01B,C,&D	36
6	LOM-89-03A&B		PBM-85-01A	
7	PBM-89-03A,B,&C	24	PBM-85-02	
8	PBM-89-10A,B,C,&D	25	PBM-89-03B&C	37
9	PBM-85-02		PBM-85-03A	
10	S1144	26	PBM-89-05	38
11	PBM-89-01	27	PBM-85-04	39
12	PBM-89-08	28	PBM-85-05	40
13	PBM-89-04	29	PBM-89-08	41
14	PBM-89-05	30	PBM-89-04B&C	42
15	PBM-89-05A,B,&C		PBM-85-04A	43
16	S1117	31	PBM-89-07	44
17	PBM-89-03A,B,&C	32	PBM-91-08C&D	45
	S1146		PBM-85-08	46
18	PBM-89-04A,B,&C	33	PBM-89-12A&B	
19	PBM-85-01		PBM-91-12C&D	



MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER
1	PBM-89-11	20	PBM-89-08	34	SPN-89-01C
2	PBM-89-09	21	PBM-89-08B&C		S1101 & S1138
3	PBM-89-01A,B,&C		PBM-89-08A	35	SPN-89-08A,B,&C
4	LOM-89-01	22	PBM-89-09		SPN-91-08D
5	LOM-89-08A&B	23	PBM-89-01B,C,&D	36	SPN-89-08B&C
6	LOM-89-08A&B		PBM-89-01A		SPN-91-08D
7	PBM-89-08A,B,&C	24	PBM-89-02		S1147
8	PBM-89-10A,B,C,&D	25	PBM-89-08B&C	37	SPN-89-04B&C
9	PBM-89-02		PBM-89-08A		S1148, SPN-91-04D
10	S1144	26	PBM-89-05	38	S1102, S1103, S1149
11	PBM-89-01	27	PBM-89-04	39	S1105A&B
12	PBM-89-03	28	PBM-89-06	40	SPN-89-08A&B
13	PBM-89-04	29	PBM-89-03	41	S1110
14	PBM-89-05	30	PBM-89-04B&C	42	S1104, S1105, S1106
15	PBM-89-08A,B,&C		PBM-89-04A	43	S1109
16	S1117	31	PBM-89-07	44	S1115, S1116
17	PBM-89-09A,B,&C	32	PBM-91-08C&D	45	LOM-91-01
	S1146		PBM-89-08	46	LOM-91-02
18	PBM-89-04A,B,&C	33	PBM-89-12A&B		
19	PBM-89-01		PBM-91-12C&D		

FIGURE 6-39
NIT CONCENTRATIONS IN GROUNDWATER
PROPELLANT BURNING GROUND, LANDFILL 1, SETTLING PONDS AND SPOILS DISPOSAL AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

TABLE 7-1
SUMMARY OF THE REMEDIAL INVESTIGATION FIELD PROGRAM - DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITES	PROGRAM ELEMENTS			
	SOIL VAPOR SURVEY	REMOTE SENSING GEOPHYSICS	MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING*	SOIL BORINGS AND SOIL SAMPLING
Deterrent Burning Ground	VOC-SST/MS, 110 collectors	GBHL at 4 wells, GPR and TC	7 new wells; 24 samples from 7 new and 5 existing wells	3 soil borings with a total of 44 analytical soil samples.
Existing Landfill	--	GBHL at 4 wells	14 new wells; 58 samples from 14 new and 15 existing wells	--

Notes:

GBHL = Geophysical Borehole Logging
GPR = Ground Penetrating Radar
TC = Terrain Conductivity
VOC-SST/MS = Volatile Organic Compounds - Surface Static Trapping/Mass Spectrometry
* Includes 2 rounds of groundwater sampling

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TABLE 7-2
SUMMARY OF BORINGS COMPLETED -
DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

BORING NUMBER	DEPTH OF SOIL BORING FROM GROUND SURFACE (ft)	TOTAL NUMBER OF SPLIT-SPOON SAMPLES	NUMBER OF SUBSURFACE SOIL SAMPLES FOR CHEMICAL ANALYSIS	PURPOSE
Deterrent Burning Ground				
DBB-91-01	117	19	16	Borings were made at the locations of the former Deterrent Burning Pits to provide chemical data to characterize the type and vertical distribution of contaminants in the unsaturated soils below the burning pits.
DBB-91-02	122	22	14	
DBB-91-03	122	22	14	

TABLE 7-3
CHEMICAL ANALYSES PERFORMED ON SUBSURFACE SOIL SAMPLES -
DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS														OTHER			ORGANICS				
	METALS								TCLP METALS				ANIONS									
SAMPLE LOCATION	PP	TAL	CD	CR	HG	FE	NI	PB	CD	CR	HG	PB	NIT	SO4	TOC	pH	TPHC	VOC	BN/A	NG	NAM	DNT
DETERRENT BURNING GROUND																						
DBB-01-01	16	—	—	—	—	—	—	—	16	16	16	16	16	16	—	—	—	16	16	16	16	16
DBB-01-02	14	—	—	—	—	—	—	—	14	14	14	14	14	14	—	—	—	14	14	14	14	14
DBB-01-03	14	—	—	—	—	—	—	—	14	14	14	14	14	14	—	—	—	14	14	14	14	14
TOTALS	44	0	0	0	0	0	0	0	[illegible]	44	44	44	44	44	0	0	0	44	44	44	44	44

NOTES:

PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, PB, HG, NI, SB, SE, TL, ZN)
TAL = Toxic Analyte List (23) (AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)
VOC = volatile organic compounds by GC/MS
GC/MS = Gas Chromatography/Mass Spectrometry
BN/A = base-neutral and acid-extractable organics by GC/MS
NAM = nitrosamines by GC
DNT = 2,4- and 2,6-dinitrotoluene by HPLC
HPLC = High Performance Liquid Chromatrography

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TABLE 7-4
SUMMARY OF MONITORING WELLS INSTALLED -
DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE AND WELL IDENTIFIER	DRILLING METHOD	BORING DEPTH FROM GROUND SURFACE (ft.)	BOTTOM ELEVATION OF SCREENS (ft. MSL)	LENGTH OF WELL SCREEN (ft.)	LOCATION	PURPOSE
Deterrent Burning Area						
DBM-89-01	Dual-wall driven casing	127	771.99	20	Downgradient of Deterrent Burning Ground	To provide horizontal definition of the plume south of Deterrent Burning Ground.
DBN-89-02 A DBN-89-02 B	Dual-wall driven casing Dual-wall driven casing	120 160	767.10 731.90	20 5	Downgradient of Deterrent Burning Ground	To provide horizontal and vertical definition of the plume southeast of Deterrent Burning Ground.
DBM-89-03	Dual-wall driven casing	140	766.85	20	Downgradient of Deterrent Burning Ground	To provide horizontal definition of the plume southeast of Deterrent Burning Ground.
DBN-89-04 A DBN-89-04 B	Dual-wall driven casing Dual-wall driven casing	155 180	763.89 731.14	20 5	Upgradient of Deterrent Burning Ground	To define background conditions upgradient of Deterrent Burning Ground; there is a potential for contamination from either the Existing Landfill or the Oleum Plant.
DBM-89-05	Dual-wall driven casing	127	765.43	20	Downgradient of Deterrent Burning Ground	To provide horizontal definition of the plume south of Deterrent Burning Ground.
Existing Landfill						
ELM-89-01	Dual-wall driven casing	166	740.73	20	Downgradient of Existing Landfill	To provide horizontal plume definition downgradient and south of Existing Landfill.
ELN-89-02 A ELN-89-02 B	Dual-wall driven casing Dual-wall driven casing	160 180	773.10 741.19	20 5	Downgradient of Existing Landfill	To provide horizontal and vertical plume definition downgradient and south of Existing Landfill.
ELM-89-03	Dual-wall driven casing	180	765.28	20	Downgradient of Existing Landfill	To provide horizontal and vertical plume definition downgradient and southeast of Existing Landfill

continued

TABLE 7-4
SUMMARY OF MONITORING WELLS INSTALLED - DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE AND WELL IDENTIFIER	DRILLING METHOD	BORING DEPTH FROM GROUND SURFACE (ft.)	BOTTOM ELEVATION OF SCREENS (ft. MSL)	LENGTH OF WELL SCREEN (ft.)	LOCATION	PURPOSE
ELN-89-04 A [illegible] 89-04 B	Dual-wall driven casing Dual-wall driven casing	168 199	783.43 727.63	20 5	Downgradient of Existing Landfill	To provide horizontal and vertical plume definition downgradient and east of Existing Landfill.
ELM-89-05	Dual-wall driven casing	140	772.95	20	Potentially downgradient of Existing Landfill	To provide background water quality data upgradient of Existing Landfill.
ELN-89-06 B	Dual-wall driven casing	200	725.22	5	Downgradient of Existing Landfill	To provide horizontal and vertical definition of the plume downgradient of Existing Landfill in association with Existing Well S1153.
ELM-89-07	Dual-wall driven casing	170	764.19	20	Downgradient of ELM-89-03	To provide horizontal plume definition downgradient and southeast of Existing Landfill.
ELM-89-08	Hollow-stem augers	149	759.04	5	Downgradient of ELN-89-02A and ELN-89-02B	To provide horizontal plume definition downgradient and south of Existing Landfill.
ELM-89-09	Hollow-stem augers	160	765.79	5	Downgradient of Existing Landfill	To provide horizontal plume definition downgradient and west of Existing Landfill.
ELN-91-07 A ELN-91-07 B	Dual-wall driven casing Dual-wall driven casing	130 150	769.5 748.9	10 10	Downgradient of all Existing Landfill Wells	To document no impact conditions at downgradient edge of flow systems along BAAP boundary.
ELM-91-10	Dual-wall driven casing	154	766.8	15	Between ELN-89-04 and ELN-89-06 well nests.	To provide horizontal plume definition along BAAP boundary.

Notes:
ft = feet
MSL = Mean Sea Level

TABLE 7-5
SUMMARY OF MONITORING WELLS LOGGED WITH BOREHOLE GEOPHYSICS - DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE/WELL NO.	BORING DEPTH FROM TOP OF PVC RISER (feet)	APPROXIMATE DEPTH TO WATER FROM TOP OF PVC RISER (feet)	DATE LOGGED	DATE INSTALLED	DRILLING METHOD
1. DBN-89-04B	190	141	05/09/89	02/07/89	Dual-wall driven casing
2. DBM-82-02	154	135	05/10/89	03/20/82	Mud rotary
3. DBN-89-02B	152	107	05/10/89	02/02/89	Dual-wall driven casing
4. ELM-89-09	157	140	05/10/89	04/13/89	Hollow-stem augers
5. ELN-89-02B	181	142	05/10/89	04/18/89	Dual-wall driven casing
6. ELM-89-03	151	138	05/11/89	01/25/89	Dual-wall driven casing
7. ELN-89-06B	182	130	05/11/89	04/04/89	Dual-wall driven casing
8. DBN-82-01C	169	128	05/11/89	03/22/82	Mud rotary
*DBN-89-04B	190	141	05/11/89	02/07/89	Dual-wall driven casing
9. ELN-82-02C	164	138	05/14/89	04/02/82	Mud rotary
10. ELN-89-04B	200	149	05/14/89	04/03/89	Dual-wall driven casing
11. ELN-82-03C	177	148	05/14/89	03/24/82	Mud rotary
12. ELM-89-08	147	127	05/14/89	04/01/89	Hollow-stem augers
*DBM-82-02	154	135	05/14/89	03/20/82	Mud rotary
*DBN-89-02B	152	107	05/14/89	02/02/89	Dual-wall driven casing
*ELM-89-09	157	140	05/14/89	03/01/89	Hollow-stem augers
*ELN-89-02B	181	142	05/14/89	04/18/89	Dual-wall driven casing

Notes:

* Wells were relogged as part of the Quality Assurance/Quality Control Procedures.
PVC = polyvinyl chloride

TABLE 7-6
WELLS INCLUDED IN GROUNDWATER SAMPLING PROGRAM
DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITES	NEW WELLS	EXISTING WELLS
Deterrent Burning Ground	DBM-89-01 DBN-89-02A,B DBM-89-03 DBN-89-04A,B DBM-89-05	DBM-82-01 DBM-82-02 DBN-82-01B,C S1122
Subtotal	7	5
Existing Landfill	ELM-89-01 ELN-89-02A,B ELM-89-03 ELN-89-04A,B ELM-89-05 ELN-89-06B ELM-89-07 ELM-89-08 ELM-89-09 ELN-91-07A, B ELM-91-10	ELN-82-01A,B,C ELN-82-02A,B,C ELN-82-03A,B,C ELN-82-04A,B,C S1134 S1135 S1153
Subtotal	14	15
TOTAL WELLS	21	20

Notes:

A,B,C,D - Shallowest to deepest: A indicates shallowest well; D indicates deepest well in a well rest.

TABLE 7-7
CHEMICAL ANALYSES PERFORMED ON GROUNDWATER SAMPLES –
DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS																	ORGANICS					TPH
	METALS									ANIONS			OTHER										
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	NI	NIT	CL	SO4	HARD	ALK	TDS	TOC	NH3N2	VOC	BN/A	NG	NAM	DNT	
DETERRENT BURNING GROUND																							
DBM-82-01	B	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
DBM-82-02	B	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
DBM-89-01	B	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
DBM-89-02 A	B	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
DBM-89-02 B	B	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
DBM-89-03	B	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
DBM-89-05	B	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
DBN-82-01 B	B	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
DBN-82-01 C	B	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
DBN-89-04 A	B	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
DBN-89-04 B	B	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
S1122	B	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
EXISTING LANDFILL																							
ELM-89-01	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELM-89-03	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELM-89-05	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELM-89-07	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELM-89-08	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELM-89-09	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELM-91-10	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
ELN-82-01 A	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELN-82-01 B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELN-82-01 C	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELN-82-02 A	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELN-82-02 B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELN-82-02 C	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELN-82-03 A	—	2	—	—	—	—	—	—	—	2	2	2	2	2	2	—	—	2	2	—	—	—	—
ELN-82-03 B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELN-82-03 C	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELN-82-04 A	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELN-82-04 B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELN-82-04 C	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELN-89-02 A	—	2	—	—	—	—	—	—	—	2	2	2	2	2	2	—	—	2	2	—	—	—	—
ELN-89-02 B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELN-89-04 A	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—

TABLE 7-7
CHEMICAL ANALYSES PERFORMED ON GROUNDWATER SAMPLES -
DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS																	ORGANICS					TPH
	METALS									ANIONS			OTHER										
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	NI	NIT	CL	SO4	HARD	ALK	TDS	TOC	NH3N2	VOC	BN/A	NG	NAM	DNT	
ELN-89-04 B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELN-89-06 B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
ELN-91-07 A	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
ELN-91-07 B	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	B	B	—
S1134	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
S1135	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
S1153	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
TOTALS	24	56	0	0	0	0	0	0	0	80	80	80	80	80	80	0	0	80	80	0	30	30	0

NOTES:

BN/A = base-neutral and acid-extractable organics by GC/MS
DNT = 2,4- and 2,6-dinitrotoluene by HPLC
GC/MS = Gas Chromatography/Mass Spectrometry
HPLC = High Performance Liquid Chromatrography
NAM = nitrosamines by GC
PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, [illegible], NI, SB, SE, TL, ZN)
TAL = Toxic Analyte List (23) (AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)
VOC = volatile organic compounds by GC/MS
B = Analyzed in both Rounds (One and Two).
1 = Analyzed in Round One only.
2 = Analyzed in Round Two only.

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TABLE 7-8
ELEVATION OF GLACIOLACUSTRINE UNIT -
DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL DESIGNATION	GROUNDWATER ELEVATION* FT. MSL	SCREEN ELEVATION FT. MSL	LACUSTRINE SILT AND CLAY ELEVATION AND COMMENTS FT. MSL
DBM-89-01	780.14	788.6 to 768.6	767 to 775, silt with clay, some fine sand
DBN-89-02A	777.04	785.3 to 765.3	780 to 772, stratified silt, clay and sand
DBN-89-02B	776.94	739.8 to 734.8	
DBM-89-03	777.00	783.4 to 763.4	No silt and clay, silty sand above gravel at elevation 790
DBN-89-04A	780.25	782.5 to 762.5	752 to 748, silt and clay above sand and gravel
DBN-89-04B	776.79	735.9 to 730.9	
DBM-89-05	783.89	790.9 to 770.9	773, clay at bottom of boring
DBM-82-01	777.08	763.7 to 743.7	777 to 754, silty clay above fine to coarse sand
DBM-82-02	780.56	782.3 to 762.3	783 to 763, silty clay and fine sand
S1122	777.12	780.6 to 760.6	778 to 767, clayey silt with some fine sand and gravel
DBN-82-01B	777.06	748.2 to 746.2	
DBN-82-01C	777.13	739.7 to 737.7	
ELN-91-07A	774.88	779.5 to 769.5	No silt and clay, only gravelly soils at depth
ELN-91-07B	776.90	758.9 to 748.9	
ELM-91-10	777.11	781.8 to 766.8	Below 766.2 clayey silt with fine sand at bottom of boring
ELM-89-01	778.05	775.0 to 755.0	760 to 765, clayey silt above sand and gravel
ELN-89-02A	776.88	780.4 to 760.4	779 to 769, stratified clayey silt with fine sand
ELN-89-02B	776.24	744.5 to 739.5	
ELM-89-03	777.00	784.0 to 764.0	No silt and clay, fine-medium sand lenses at 754 to 744
ELN-89-04A	776.86	782.1 to 762.1	No silt and clay, fine sand above gravel at 745
ELN-89-04B	776.06	730.8 to 725.8	
ELM-89-05	777.47	785.2 to 765.2	No silt and clay, bottom of boring at 758
ELN-89-06B	776.73	729.1 to 724.1	No silt and clay, fine sand over gravel at 776
S1153	777.07		

continued

TABLE 7-8
ELEVATION OF GLACIOLACUSTRINE UNIT -
DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL DESIGNATION	GROUNDWATER ELEVATION* FT. MSL	SCREEN ELEVATION FT. MSL	LACUSTRINE SILT AND CLAY ELEVATION AND COMMENTS FT. MSL
ELM-89-07	776.22	783.4 to 763.4	No silt and clay, only gravelly soils at depth
ELM-89-08	776.97	778.0 to 758.0	No silt and clay
ELM-89-09	779.21	784.6 to 764.6	No silt and clay, bottom of boring at 760
ELN-82-01A	777.82	780.5 to 770.5	773 to 771, clayey silt at bottom of boring
ELN-82-01B	777.76	760.6 to 758.6	
ELN-82-01C	777.44	751.0 to 749.0	
ELN-82-02A	777.39	781.8 to 771.8	749 to 751, silty clay observed in bottom of Deep "C" well
ELN-82-02B	777.43	764.7 to 762.7	
ELN-82-02C	777.41	753.1 to 751.1	
ELN-82-03A	777.28	780.2 to 770.2	772 to 770, silty clay observed at bottom of boring
ELN-82-03B	777.11	761.1 to 759.1	
ELN-82-03C	777.11	751.0 to 749.0	
ELN-82-04A	778.09	780.4 to 770.4	Silt and clay at elevation 771 in Warzyn cross section (Warzyn, 1982)
ELN-82-04B	777.83	758.5 to 756.5	
ELN-82-04C	777.27	750.2 to 748.2	

Notes:

* Groundwater elevations measured on December 15, 1991
FT MSL = feet, mean sea level

TABLE 7-9
VERTICAL GROUNDWATER GRADIENTS -
DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL NEST	WATER LEVEL DIFFERENCE (FT.)/SCREEN SEPARATION (FT.)[4]	VERTICAL GRADIENT AND DIRECTION (FT/FT)	COMMENT (WATER LEVEL DIFFERENCE)
DBN-89-04A and B[1]	3.46/40	0.09d[2]	Substantial
DBN-89-02A and B	0.10/37	0.003d[3]	Small
S1122 and DBN-82-01B	0.06/22	0.003d	Small
DBN-82-01B and C	0.07/10	0.007u	Small
ELN-91-07A and B	0.02/23	0.0009u	Insignificant
ELN-89-02A and B[1]	0.64/27	0.02d	
ELN-89-04A and B	0.80/44	0.02d	
ELN-89-06B and S1153	0.34/49	0.008d	
ELN-82-01A and B	0.06/16	0.004d	Small
ELN-82-01B and C[1]	0.32/9	0.04d	
ELN-82-02A and B	0.04/14	0.003u	Insignificant[5]
ELN-82-02B and C	0.02/11	0.002d	Insignificant
ELN-82-03A and B[1]	0.17/15	0.01d	Small
ELN-82-03B and C	0.00/10	0.00	No Difference
ELN-82-04A and B	0.26/18	0.01d	
ELN-82-04B and C[1]	0.56/8	0.07d	

Notes:

1 Indicates well nest clearly screened across fine-grained lacustrine soils
2 d = downward gradient
3 u = upward gradient
4 All measurements based on December 15, 1991 water level measurements.
5 Both wells are above the glaciolacustrine unit

Water level differences were concluded to be insignificant at less than 0.05 ft.

Water level differences were concluded to be small at less than 0.2 ft.

TABLE 7-10
FIELD HYDRAULIC CONDUCTIVITY TEST RESULTS -
DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL DESIGNATION	MAXIMUM WATER LEVEL DEPRESSION (FEET)	HYDRAULIC CONDUCTIVITY (CM/SEC)	GEOLOGIC CONDITIONS
DBM-89-01	1.5	$3x10^{-2}$	Fine sand (SP) over silt and clay (ML)
DBN-89-02A	1.4	$8x10^{-2}$	Silt and clay (CL-ML) over gravel (GP)
DBN-89-02B	2.5	$1x10^{-1}$	Gravel with sand (GP)
DBM-89-03	0.9	$1x10^{-1}$	Gravel with sand (GW-GP)
DBN-89-04A	2.0	$3x10^{-2}$	Fine to medium sand with gravel (SP)
DBN-89-04B	2.2	$5x10^{-2}$	Gravel with sand (GP)
DBM-89-05	3.4	$6x10^{-3}$	Fine to medium sand (SP)
DBM-82-01	2.9	$7x10^{-3}$	Silty clay and fine to coarse sand (CL-SP)
ELN-91-07A	1.8	$5x10^{-3}$	Medium coarse sand with gravel (SW)
ELN-91-07B	6.5	$2x10^{-2}$	Coarse to fine sand (SW)
ELM-91-10	1.5	$2x10^{-2}$	Medium fine sand (SP)
ELM-89-01	3.6	$8x10^{-3}$	Medium sand and silty sand (SP-SM)
ELN-89-04A	2.4	$4x10^{-2}$	Find sand with little gravel (SP)
ELN-89-04B	7.0	$1x10^{-1}$	Gravel with little sand (GP)
ELM-89-05	2.4	$1x10^{-2}$	Sand with gravel (SP-SW)
ELM-89-06B	8.0	$5x10^{-2}$	Well graded gravel over fine sand (GW-SP)
ELM-89-07	1.2	$1x10^{-1}$	Medium to fine gravel with some coarse sand (GP)
ELM-89-08	2.0	$4x10^{-2}$	Sand with gravel (SP-GB)

continued

TABLE 7-10
FIELD HYDRAULIC CONDUCTIVITY TEST RESULTS -
DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL DESIGNATION	MAXIMUM WATER LEVEL DEPRESSION (FEET)	HYDRAULIC CONDUCTIVITY (CM/SEC)	GEOLOGIC CONDITIONS
ELM-89-09	2.3	$3x10^{-2}$	Sand (SP)
ELN-82-03C	5.1	$6x10^{-3}$	Coarse to fine sand (SP)
ELN-82-04A	1.1	$3x10^{-4}$	Medium fine sand (SM)
S1153	2.2	$5x10^{-3}$	Medium fine sand, some gravel (SW-SM)

Notes:

Hydraulic Conductivity Tests completed during March and November, 1989, and November and December 1991.

Field data and calculations are presented in Appendix I.

Values for hydraulic conductivities represent an averaged value of multiple tests performed on each well.

Water level recovery at these wells impacted by inertial effects, resulting in water level recovery above static water levels. Hydraulic conductivity measurements may be greater than the calculated values at these wells.

cm/sec = centimeters per second

TABLE 7-11
HORIZONTAL GROUNDWATER GRADIENTS -
DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL NEST	HORIZONTAL GRADIENT[1] AND DIRECTION (FT/FT)	COMMENT
DBM-82-02 ELM-89-09	0.004	Above lacustrine silt; northeasterly flow vector
DBM-89-05 ELM-89-01	0.005	Above lacustrine silt; northeasterly flow vector
DBN-89-04A ELN-82-04A	0.003	Above lacustrine silt; northeasterly flow vector
ELM-89-09 ELN-82-03A	0.002	Above lacustrine silt; easterly flow vector
ELM-89-08 ELN-91-07B	0.00005	Below lacustrine silt; east-southeasterly flow vector
ELN-82-03C ELN-89-06B	0.0008	Below lacustrine silt; east-southeasterly flow vector

Notes:

[1] All gradients based on December 15, 1991 water level measurement.

ft/ft = feet per foot

TABLE 7-12
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		DBB-91-01	DBB-91-01	DBB-91-01	DBB-91-01	DBB-91-01	DBB-91-01	DBB-91-01	DBB-91-01	DBB-91-01	DBB-91-01
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91
DEPTH:		2.000	4.000	6.000	8.000	10.000	15.000	20.000	25.000	30.000	42.000
VOCs	13DMB	-	-	-	-	-	0.290	0.584	-	-	-
	C6H6	3.950	0.143	5.250	1.060	0.341	0.371	0.170	76.600	-	-
	CH2CL2	-	-	-	-	-	-	-	-	-	-
	MEC6H5	0.138	-	-	-	-	0.273	0.194	2.070	-	-
	TXYLEN										
SVOCs	2MNAP	-	-	-	-	-	-	-	-	-	-
	24DNT	2700.000	3400.000	37000.000	30000.000	10000.000	4300.000	3300.000	12000.000	8.400	12.100
	26DNT	2.110	28.900	62.000 GT	62.000 GT	62.000 GT	970.000	940.000	62.000 GT	4.670	4.660
	3NT	-	-	-	4.830	6.900	6.440	6.050	14.300	-	-
	B2EHP	1.350	-	-	-	-	-	-	-	-	-
	DEP	-	-	-	-	-	25.900	9.530	-	-	-
	DNBP	-	-	46.500	-	62.000 GT	62.000 GT	62.000 GT	42.100	2.290	1.840
	FANT	-	-	-	-	-	-	-	-	-	-
	NNDMEA	-	-	-	-	-	0.018	-	-	-	-
	NNDPA	4.700	98.000	127.000	730.000	2200.000	2400.000	1800.000	5200.000	1.740	1.040
	PHANTR	-	-	-	-	-	-	-	-	-	-
	PYR	-	-	-	-	-	-	-	-	-	-
Metals	AS	-	-	3.010	-	-	-	-	-	-	-
	CR	3.640	2.440	5.900	2.410	2.930	1.910	1.980	2.240	1.400	3.940
	CU	12.400	-	8.180	6.860	6.010	-	-	5.820	4.570	4.080
	NI	3.390	-	4.510	3.980	4.430	-	-	-	-	3.190
	PB	13.300	4.970	20.200	2.610	7.490	1.480	2.380	4.890	6.180	2.840
	SE	-	-	-	-	-	-	-	-	-	-
	ZN	16.500	8.860	18.200	6.350	6.400	2.720	3.610	6.800	4.780	9.370
Anions	NIT	6.090	13.200	15.300	12.900	18.700	2.610	2.880	3.500	1.050	1.410
	SO4	-	-	-	-	-	-	-	-	-	-

Notes and flagging codes are presented at the end of this table.

TABLE 7-12
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		DBB-91-01	DBB-91-01	DBB-91-01	DBB-91-01	DBB-91-01	DBB-91-01	DBB-91-02	DBB-91-02	DBB-91-02	DBB-91-02
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91
DEPTH:		44.000	52.000	72.000	92.000	112.000	117.000	4.000	6.000	8.000	10.000
VOCs	13DMB	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	1.560	0.194	-	-
	CH2CL2	-	-	-	-	-	-	-	-	-	-
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	TXYLEN										
SVOCs	2MNAP	-	-	-	-	-	-	-	-	-	-
	24DNT	-	-	-	-	-	-	1200.000	2500.000	16.800	-
	26DNT	1.760	1.480	-	-	-	-	6.200 GT	230.000	6.200 GT	-
	3NT	-	-	-	-	-	-	-	-	-	-
	B2EHP	-	-	-	1.460	-	-	1.450	-	-	-
	DEP	-	-	-	-	-	-	-	-	-	-
	DNBP	-	-	-	-	-	-	6.200 GT	6.200 GT	6.200 GT	-
	FANT	-	-	-	-	-	-	-	-	-	-
	NNDMEA	-	-	-	-	-	-	-	0.015	-	-
	NNDPA	0.179	0.121	0.326	-	-	-	390.000	460.000	2.200 L	0.193
	PHANTR	-	-	-	-	-	-	-	-	-	-
	PYR	-	-	-	-	-	-	-	-	-	-
Metals	AS	-	-	-	-	-	-	4.070	3.390	7.880	-
	CR	3.950	3.660	2.960	2.090	2.040	2.820	13.200	11.700	8.410	4.940
	CU	8.040	4.650	4.040	-	-	-	15.900	14.200	12.800	7.940
	NI	3.680	-	-	-	-	-	10.200	6.820	4.910	3.700
	PB	1.720	2.460	1.750	1.370	1.200	1.800	10.000	8.000	9.100	3.060
	SE	-	-	-	-	-	-	-	-	-	-
	ZN	7.070	4.220	3.830	-	4.090	4.280	26.700	20.600	9.780	8.910
Anions	NIT	-	-	-	2.050	-	-	2.270	1.600	3.430	2.170
	SO4	-	-	8.130	12.700	-	-	-	-	-	5.190

Notes and flagging codes are presented at the end of this table.

TABLE 7-12
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		DBB-91-02	DBB-91-02	DBB-91-02	DBB-91-02	DBB-91-02	DBB-91-02	DBB-91-02	DBB-91-02	DBB-91-02	DBB-91-02
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91	10/15/91
DEPTH:		14.000	16.000	20.000	27.000	42.000	62.000	72.000	92.000	112.000	122.000
VOCs	13DMB	-	-	-	-	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-	-	-	-	-
	CH2CL2	-	-	-	-	-	-	-	-	-	-
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	TXYLEN										
SVOCs	2MNAP	-	-	-	-	-	-	-	-	-	-
	24DNT	-	-	-	3.650	-	-	-	-	-	-
	26DNT	-	-	-	0.558	-	-	-	-	-	-
	3NT	-	-	-	-	-	-	-	-	-	-
	B2EHP	-	-	1.620	-	-	-	-	-	-	-
	DEP	-	-	-	-	-	-	-	-	-	-
	DNBP	-	-	-	2.980	-	-	-	-	-	-
	FANT	-	-	-	-	-	-	-	-	-	-
	NNDMEA	-	-	-	-	-	-	-	-	-	-
	NNDPA	-	-	0.093	-	0.168	-	0.081	-	-	0.098
	PHANTR	-	-	-	-	-	-	-	-	-	-
	PYR	-	-	-	-	-	-	-	-	-	-
Metals	AS	-	-	-	-	-	-	-	-	-	-
	CR	2.900	1.580	2.730	2.960	3.830	2.510	2.150	3.050	3.680	3.240
	CU	-	-	4.380	5.330	6.590	3.200	-	-	3.550	-
	NI	-	-	-	-	3.680	-	-	-	-	-
	PB	0.699	0.874	1.500	1.610	1.810	1.810	0.946	0.737	1.220	0.987
	SE	-	-	-	-	-	-	-	-	-	-
	ZN	2.590	-	5.640	9.780	6.390	4.260	-	3.000	4.590	4.310
Anions	NIT	5.270	3.510	3.320	2.210	1.800	1.470	1.780	2.170	1.970	2.580
	SO4	-	-	-	6.350	-	-	28.600	-	8.480	75.700

Notes and flagging codes are presented at the end of this table.

TABLE 7-12
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA -
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		DBB-91-03	DBB-91-03	DBB-91-03	DBB-91-03	DBB-91-03	DBB-91-03	DBB-91-03	DBB-91-03	DBB-91-03	DBB-91-03
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/16/91	10/16/91	10/16/91	10/16/91	10/16/91	10/16/91	10/16/91	10/16/91	10/16/91	10/16/91
DEPTH:		4.000	8.000	12.000	14.000	16.000	18.000	20.000	22.000	27.000	42.000
VOCs	13DMB										
	C6H6	0.001 S	0.002 S	-	-	-	-	-	-	-	-
	CH2CL2	-	0.002 S	-	0.003 S	0.019 S	0.011 S	-	0.008 S	0.003 S	-
	MEC6H5	-	-	-	-	-	-	-	-	-	-
	TXYLEN	-	-	0.001 S	0.002 S	-	-	-	-	-	-
SVOCs	2MNAP	-	-	-	0.090	-	-	-	-	-	-
	24DNT	41.600	2900.000	790.000	6000.000	2400.000	13.700	6.210	1.830	-	-
	26DNT	8.700	1400.000	1000.000	6.200 GT	6.200 GT	32.800	0.589	1.460	-	-
	3NT	-	1.520	4.970	6.200 GT	2.190	-	-	-	-	-
	B2EHP	1.530	1.160	4.350	5.790	1.600	0.850	-	2.090	-	-
	DEP	-	-	-	-	-	-	-	-	-	-
	DNBP	3.250	2.990	6.200 GT	6.200 GT	6.200 GT	2.170	-	-	-	1.500
	FANT	0.139	-	-	-	-	-	-	-	-	-
	NNDMEA	-	-	-	-	-	-	-	-	-	-
	NNDPA	7.660	24.000	150.000	820.000	280.000	10.500	-	1.140	-	-
	PHANTR	0.183	-	-	-	-	-	-	-	-	-
	PYR	0.144	-	-	-	-	-	-	-	-	-
Metals	AS	-	-	-	-	-	-	-	-	-	-
	CR	7.950	7.320	7.410	2.820	2.150	3.870	2.490	2.270	3.080	4.080
	CU	23.100	12.300	8.800	3.780	-	3.980	3.300	3.290	4.050	5.170
	NI	5.280	3.340	4.940	-	-	-	-	-	-	-
	PB	7.000	3.820	5.390	1.150	1.600	2.430	1.680	1.740	2.220	1.400
	SE	-	-	-	-	-	-	2.970	-	-	-
	ZN	13.300	16.900	10.400	4.760	3.860	5.410	4.990	5.200	5.440	6.360
Anions	NIT	2.510	8.020	8.910	13.000	4.220	5.820	1.610	1.880	1.610	1.700
	SO4	-	-	-	-	-	-	240.000	150.000	86.400	29.900

Notes and flagging codes are presented at the end of this table.

TABLE 7-12
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		DBB-91-03	DBB-91-03	DBB-91-03	DBB-91-03
Sample Type:		BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG
DATE SAMPLED:		10/16/91	10/16/91	10/16/91	10/16/91
DEPTH:		62.000	82.000	102.000	122.000
VOCs	13DMB				
	C6H6	-	-	-	-
	CH2CL2	-	-	-	-
	MEC6H5	-	-	-	-
	TXYLEN	-	-	-	-
SVOCs	2MNAP	-	-	-	-
	24DNT	-	-	-	-
	26DNT	-	-	-	-
	3NT	-	-	-	-
	B2EHP	-	-	-	-
	DEP	-	-	-	-
	DNBP	-	-	-	-
	FANT	-	-	-	-
	NNDMEA	-	-	-	-
	NNDPA	-	-	-	-
	PHANTR	-	-	-	-
	PYR	-	-	-	-
Metals	AS	-	-	-	-
	CR	3.230	3.880	12.100	3.820
	CU	3.900	4.670	9.540	-
	NI	-	2.900	3.730	-
	PB	1.330	1.230	4.220	0.986
	SE	-	-	-	-
	ZN	5.630	5.500	106.000	6.640
Anions	NIT	2.290	1.550	1.840	2.130
	SO4	110.000	-	-	54.300

Notes and flagging codes are presented at the end of this table.

TABLE 7-12
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range but within acceptable limits

Appendix K contains complete analytical results.

USATHAMA chemical codes are defined in the RI Report Glossary

TABLE 7-13
SUMMARY OF TCLP METALS DATA FOR SUBSURFACE SOIL -
DETERRENT BURNING GROUND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

		TCLP LEACHATE CONCENTRATION (µg/ℓ)				
SAMPLE LOCATION	DEPTH	CD	CR	PB	HG	NOTES
TCLP RL[1]		1,000	5,000	5,000	200	
Minimum Reporting Value		6.8	16.8	43.4	0.1	
DBB-91-01	2	LT	LT	LT	0.9	TCLP RL not exceeded
DBB-91-01	4	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-01	6	LT	LT	LT	0.2	TCLP RL not exceeded
DBB-91-01	8	LT	LT	LT	0.3	TCLP RL not exceeded
DBB-91-01	10	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-01	15	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-01	20	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-01	25	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-01	30	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-01	42	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-01	44	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-01	52	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-01	72	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-01	92	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-01	112	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-01	117	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-02	4	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-02	6	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-02	8	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-02	10	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-02	14	LT	LT	LT	0.8	TCLP RL not exceeded
DBB-91-02	16	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-02	20	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-02	27	LT	LT	LT	0.2	TCLP RL not exceeded

continued

TABLE 7-13
SUMMARY OF TCLP METALS DATA FOR SUBSURFACE SOIL - DETERRENT BURNING GROUND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

		TCLP LEACHATE CONCENTRATION (μg/ℓ)				
SAMPLE LOCATION	DEPTH	CD	CR	PB	HG	NOTES
DBB-91-02	42	LT	LT	LT	0.2	TCLP RL not exceeded
DBB-91-02	62	LT	LT	LT	0.8	TCLP RL not exceeded
DBB-91-02	72	LT	21.8	LT	0.3	TCLP RL not exceeded
DBB-91-02	92	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-02	112	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-02	122	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-03	4	LT	35.9	LT	LT	TCLP RL not exceeded
DBB-91-03	8	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-03	12	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-03	14	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-03	16	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-03	18	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-03	20	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-03	22	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-03	27	7.9	LT	LT	LT	TCLP RL not exceeded
DBB-91-03	42	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-03	62	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-03	82	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-03	102	LT	LT	LT	LT	TCLP RL not exceeded
DBB-91-03	122	LT	LT	LT	LT	TCLP RL not exceeded

Notes:

[1] TCLP Regulatory Levels (RLs) exist for the following metals: AS, BA, CD, CR, SE, PB, HG, and AG. However, these results were reported only for CD, CR, PB, and HG. (List of USATHAMA Chemical Codes for definitions of chemical abbreviations).

TABLE 7-14
SUMMARY OF GROUNDWATER CHEMICAL DATA -
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		DBM-82-01		DBM-82-02		DBM-89-01		DBM-89-03		DBM-89-05	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		12/10/91	04/11/92	12/09/91	04/11/92	12/10/91	04/13/92	12/10/91	04/11/92	12/08/91	04/11/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	111TCE	-	-	8.34	12.1	-	-	-	-	-	-
	13DMB	-	-	-	-	-	-	-	-	4.300 S	-
	CH2CL2	4.31 P	7.75 B	5.49	7.45 B	4.51 P	-	5.1 P	7.94 B	5.39	-
	CHCL3	-	-	-	-	-	-	-	-	-	-
	MEC6H5	-	-	-	-	-	-	-	-	5.460 P	-
SVOCs	2BUXEL					5.5 S					
	2E1HXL										
	26DNT	2.17	1.29	-	-	-	-	-	-	-	-
	B2EHP	27.1 P	-	-	72	-	-	-	-	-	98.7
	NNDPA	16.7	14.5	-	1.02	-	-	-	-	-	-
Metals	CD	-	-	-	-	-	-	-	-	-	-
	CR	6.74	-	9.98	-	8.88	-	4.98	-	-	-
	CU	-	-	6.69	-	-	5.37	-	-	-	-
	ZN	-	-	-	-	-	-	-	20.8	-	-
Anions	NIT	16000	2600	4400	2300	3200	2200	6700	2300	6600	4200
	CL	5100	5200	29000 P	37000	14000	18000	5600	7300	3600	4600
	SO4	30000	32000	450000	630000	27000	27000	25000	31000	31000	32000
Indicator parameter	ALK	311000	289000	514000	477000	227000	230000	266000	256000	280000	250000
	HARD	278000	298000	818000	968000	248000	258000	254000	296000	248000	292000
	TDS	328000	300000	1090000	1310000	268000	244000	281000	272000	313000	297000
	pH(1)	7.4	7.2	7.1	7.0	7.7	8.0	7.6	7.4	7.7	7.5
	Sp.Cond.(2)	510	494	1072	1304	417	444	422	472	529	488

Notes and flagging codes are presented at the end of this table.

TABLE 7-14
SUMMARY OF GROUNDWATER CHEMICAL DATA -
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		DBN-82-01B				DBN-82-01C				DBN-89-02A				DBN-89-02B				DBN-89-04A			
Sample Type:		WELL				WELL				WELL				WELL				WELL			
UNITS:		UGL				UGL				UGL				UGL				UGL			
DATE SAMPLED:		12/07/91		04/12/92		12/09/91		04/12/92		12/12/91		04/13/92		12/12/91		04/13/92		12/07/91		04/10/92	
ROUND:		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO	
VOCs	111TCE	-		-		-		-		-		-		-		-		3.730	P	4.06	P
	13DMB	-		-		3.4	S	-		-		-		-		-		-		-	
	CH2CL2	5.2	P	5.88	B	5.29		5.78	B	4.8	P	6.08	B	4.51	P	5.29	B	5.100	P	7.94	B
	CHCL3	-		-		-		0.563	P	-		0.614	P	-		-		-		-	
	MEC6H5	-		-		-		-		-		-		-		-		-		-	
SVOCs	2BUXEL																				
	2E1HXL													20	S						
	26DNT	-		-		-		-		-		-		-		-		-		-	
	B2EHP	-		159		66.9		27.1	P	-		-		43	P	98.7		-		25.5	P
	NNDPA	-		-		-		-		-		-		-		-		-		-	
Metals	CD	-		-		-		-		3.23		-		-		-		-		-	
	CR	-		-		-		-		8.74		-		13.4		-		8.1		-	
	CU	-		-		-		-		6.41		7.25		77.2		6.1		-		-	
	ZN	-		-		-		-		-		-		-		-		-		-	
Anions	NIT	2900		1000		3600		990		3400		2700		2100		900		6800		6600	
	CL	4100		5700		7200		8300		6900		6300		9400		9500		3600		5200	
	SO4	29000		34000		32000		33000		26000		23000		34000		33000		20000		20000	
Indicator parameter	ALK	294000		212000		154000		192000		230000		296000		150000		184000		284000		286000	
	HARD	238000		224000		177000		214000		306000		327000		190000		211000		324000		332000	
	TDS	209000		231000		217000		220000		352000		321000		260000		228000		327000		355000	
	pH(1)	7.6		7.7		7.8		7.5		7.7		7.6		7.8		7.5		7.3		7.2	
	Sp.Cond.(2)	434		271		316		257		462		514		343		374		572		548	

Notes and flagging codes are presented at the end of this table.

TABLE 7-14
SUMMARY OF GROUNDWATER CHEMICAL DATA -
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		DBN-89-04B		S1122	
Sample Type:		WELL		WELL	
UNITS:		UGL		UGL	
DATE SAMPLED:		12/07/91	04/10/92	12/07/91	04/12/92
ROUND:		ONE	TWO	ONE	TWO
VOCs	111TCE	-	-	-	-
	13DMB	-	-	-	-
	CH2CL2	5.29	7.75 B	5.29	-
	CHCL3	-	-	-	-
	MEC6H5	-	-	-	-
SVOCs	2BUXEL				
	2E1HXL	50 S			
	26DNT	-	-	-	-
	B2EHP	87.6	27 P	-	28 P
	NNDPA	-	-	-	-
Metals	CD	-	-	-	-
	CR	6.64	-	7.81	-
	CU	-	-	-	5.43
	ZN	-	-	-	-
Anions	NIT	5600	9200	3300	1300
	CL	4800	6900	6400	6200
	SO4	25000	23000	28000	26000
Indicator parameter	ALK	222000	250000	198000	336000
	HARD	280000	304000	326000	368000
	TDS	209000	331000	359000	351000
	pH(1)	7.6	7.4	7.1	7.1
	Sp.Cond.(2)	491	505	622	386

Notes and flagging codes are presented at the end of this table.

TABLE 7-14
SUMMARY OF GROUNDWATER CHEMICAL DATA -
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		ELM-89-01				ELM-89-03				ELM-89-05				ELM-89-07				ELM-89-08			
Sample Type:		WELL				WELL				WELL				WELL				WELL			
UNITS:		UGL				UGL				UGL				UGL				UGL			
DATE SAMPLED:		12/04/91		04/12/92		12/08/91		04/10/92		12/08/91		04/10/92		12/09/91		04/13/92		12/09/91		04/13/92	
ROUND:		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO	
VOCs	111TCE	4.06	P	5.6		-		-		-		-		-		-		-		-	
	112TCE	-		-		-		-		-		-		0.462	P	-		-		-	
	12DMB	-		-		-		-		-		-		-		-		-		-	
	13DMB	-		-		-		-		-		-		5.9	S	-		-		-	
	ACET	-		-		-		-		-		-		-		-		-		-	
	C6H6	-		-		-		-		-		-		-		-		-		-	
	CH2CL2	4.41	P	5.78	B	5.0	P	7.25	B	5.49		7.84	B	4.8	P	5.88	B	5.1	P	6.86	B
	CH3CL	-		-		-		-		-		-		-		-		-		-	
	CHCL3	-		-		-		-		-		-		-		-		-		-	
	MEC6H5	-		-		-		-		4.72	P	-		5.28	P	-		-		-	
	MEK	-		-		-		-		-		-		-		-		-		-	
	TCLEE	-		-		-		-		-		-		-		-		-		-	
	TRCLE	-		-		-		1.8		0.382	P	-		-		-		-		-	
SVOCs	2EHXL			-		-						-				-					
	4MP	-		-		-		-		-		-		-		-		-		-	
	B2EHP	41.4	P	-		-		130		-		-		-		-		28	P	-	
	PHENOL	-		-		-		-		-		-		-		-		-		-	
	TRIMBZ			-								-		4	S	-					
Metals	AG	-		-		-		-		-		-		-		-		-		-	
	BA	58.0		51		48		30.6		32.2		32.2		30.4		31.3		28.2		26.9	
	BE	-		-		-		-		-		-		-		-		-		-	
	CA	100000	GT	180000		83000		75000		85000		81000		70000		72000		61000		67000	
	CR	19.5		-		8.67		-		13.8		-		7.04		-		5.81		-	
	CU	-		-		-		-		-		-		-		4.7		-		-	
	FE	150		-		31.9		-		42.3		-		39.0		-		37.0		-	
	HG	-		-		-		-		-		4.25		-		-		-		-	
	K	1730	T	1550	T	1200	T	2720	T	992	T	2260	T	1320	T	1590	T	1110	T	1260	T
	MG	50000	GT	110000		44000		38000		50000		44000		39000		40000		32000		34000	
	MN	-		-		-		-		-		-		-		-		-		-	
	NA	-		30000	T	-		13000	T	-		10000	T	-		12000	T	-		16000	T
	NI	-		-		-		-		-		-		-		-		-		-	
	PB	-		-		-		-		5.94		-		-		-		-		-	
	SE	-		-		-		-		-		-		-		-		-		-	
	V	-		15.6		-		-		-		-		-		9.85		-		7.22	
	ZN	-		-		-		-		-		-		-		-		-		-	
Anions	NIT	4800		4300		2900		1300		5500		2600		3000		1700		8000		8000	
	CL	21000		20000		8200		7700		15000		15000		6000		7600		6600		7600	
	SO4	340000		330000		47000		44000		26000		25000		39000		46000		28000		29000	
Indicator parameter	ALK	424000		488000		316000		288000		354000		357000		286000		298000		248000		246000	
	HARD	730000		754000		570000		346000		348000		416000		316000		336000		256000		296000	
	TDS	1010000		928000		380000		359000		348000		413000		328000		352000		283000		311000	
	pH(1)	7.5		6.9		7.4		7.3		7.4		7.5		7.5		7.8		7.6		7.9	
	Sp.Cond.(2)	1018		724		546		565		556		612		564		537		517		490	

Notes and flagging codes are presented at the end of this table.

TABLE 7-14
SUMMARY OF GROUNDWATER CHEMICAL DATA -
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		ELM-89-09				ELM-91-10				ELN-82-01A				ELN-82-01B				ELN-82-01C			
Sample Type:		WELL				WELL				WELL				WELL				WELL			
UNITS:		UGL				UGL				UGL				UGL				UGL			
DATE SAMPLED:		12/10/91		04/09/92		12/08/91		04/13/92		11/25/91		04/09/92		11/25/91		04/09/92		11/25/91		04/09/92	
ROUND:		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO	
VOCs	111TCE	3.07	P	7.68		-		-		-		-		-		-		-		-	
	112TCE	0.365	P	-		-		-		-		-		-		-		-		-	
	12DMB	-		-		-		-		-		-		-		-		-		-	
	13DMB	-		-		-		-		-		-		-		-		-		-	
	ACET	-		-		-		-		-		-		-		-		-		-	
	C6H6	-				-		-		-		-		-		-		-		-	
	CH2CL2	4.41	P		B	5.29		4.31	P	5.59		5.98	B	-		6.86	B	4.61	P	6.47	B
	CH3CL	-				-		-		-		-		-		-		-		-	
	CHCL3	-				-		-		-		-		-		-		-		-	
	MEC6H5	-				-		-		-		-		-		-		-		-	
	MEK	-		-		-		-		-		-		-		-		-		-	
	TCLEE	-		-		-		-		-		-		-		-		-		-	
	TRCLE	-		-		-		-		-		-		-		-		-		-	
SVOCs	2E1HXL			-		-		-		-		-				-		-		-	
	4MP	-		-		-		-		-		-		60.5	S	-		-		-	
	B2EHP	44.6	P	-		-		-		-		-		40.3	P	43.8	P	-		-	
	PHENOL	-		-		-		-		-		-		12.1	S	-		-		-	
	TRIMBZ			-								-								-	
Metals	AG	-		-		-		0.517		-		-		-		-		-		-	
	BA	68		70.0		97		81		15.2		15.4		41.7	X	34.4		25.5		24	
	BE	-		0.362		-		-		-		-		-		-		-		-	
	CA	100000	GT	130000		100000	GT X	24000000		6500000		6000000		6200000		5200000		5700000		6000000	
	CR	13		-		15.6		-		10.8		-		8.48		-		9.49		-	
	CU	-		5.33		6.41		7.96		-		8.87		4.77		4.71		-		-	
	FE	51.7		-		25.8		69.0		-		-		488		-		-		-	
	HG	-		-		-		-		-		-		-		-		-		-	
	K	4900	T	10000	T	2530	T	2380	T	969.0	T	1480	T	2610	T	2340	T	890.0	T	1410	T
	MG	50000	GT	120000		50000	GT X	11000000		3700000		3200000		3500000		3100000		2900000		3000000	
	MN	-		-		73.3		28.3		-		-		127		47.4		-		-	
	NA	24000	T	25000	T	19000	T	24000	T	3010	T	6400	T	2890	T	8600	T	2940	T	8800	T
	NI	-		-		-		-		-		-		9.69		9.95		-		-	
	PB	-		-		-		-		-		-		-		-		-		-	
	SE	-		-		-		-		-		-		-		-		-		-	
	V	-		-		-		19.1		4.66		-		4.82		-		4.14		-	
	ZN	-		-		-		25.6		-		770		300		-		56.3		-	
Anions	NIT	9300		7200		1900		550		1200		740		970		960		700		1000	
	CL	15000		17000		30000	P	35000		1680		1450		2320		6700		3900		4300	
	SO4	340000		330000		200000		190000		34000		33000		9500		22000		27000		27000	
Indicator parameter	ALK	582000		494000		534000		710000		264000		310000		290000		234000		225000		200000	
	HARD	706000		754000		366000		902000		282000		284000		270000		244000		252000		260000	
	TDS	963000		887000		892000		977000		327000		323000		320000		284000		273000		297000	
	pH(1)	7.0		7.0		7.1		7.0		6.5		7.7		7.7		7.7		7.0		7.5	
	Sp.Cond.(2)	1138		1081		1079		1260		562		465		581		458		477		429	

Notes and flagging codes are presently at the end of this table.

TABLE 7-14
SUMMARY OF GROUNDWATER CHEMICAL DATA -
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		ELN-82-02A			ELN-82-02B			(3) ELN-82-02C			ELN-82-03A	ELN-82-03B		ELN-82-03C
Sample Type:		WELL			WELL			WELL			WELL	WELL		WELL
UNITS:		UGL			UGL			UGL			UGL	UGL		UGL
DATE SAMPLED:		12/09/91		04/27/92	12/09/91		04/26/92	12/09/91		04/26/92	04/11/92	11/25/91	04/11/92	11/25/91
ROUND:		ONE		TWO	ONE		TWO	ONE		TWO	TWO	ONE	TWO	ONE
VOCs	111TCE	-		-	-		-	-		-	-	-	-	-
	112TCE	-		-	-		-	-		-	-	0.702	-	-
	12DMB	-		-	-		-	-		-	-	-	-	-
	13DMB	4.6	S	-	6.1	S	-	3.2	S	-	-	-	-	-
	ACET	-		-	-		-	-		-	-	-	-	-
	C6H6	-		-	-		-	-		-	-	-	-	-
	CH2CL2	4.9	P	7.84	B	5.2	P	7.75	B	5.0	P	7.25	B	6.76	B	6.08	7.06	B	5.69
	CH3CL	-		-	-		-	-		-	-	-	-	-	-	-
	CHCL3	-		-	-		-	-		-	-	-	-	-	-	-
	MEC6H5	4.81	P	-	6.85	P	-	-		-	-	-	-	-	-	-
	MEK	-		-	-		-	-		-	-	-	-	-	-	-
	TCLEE	-		-	-		-	-		-	-	-	-	-	-	-
	TRCLE	-		0.605	-		-	-		-	-	-	-	-	-	-
SVOCs	2E1HXL															
	4MP	-		-	-		-	-		-	-	-	-	-	-	-
	B2EHP	43.8	P	46.2	P	33.4	P	-		127	-	-	27.1	P	-	-
	PHENOL	-		-	-		-	-		-	-	-	-	-	-	-
	TRIMBZ											-				-
Metals	AG	-		-	-		-	-		-	-	-	-	-	-	-
	BA	130		130	91		98	87.0		110	19.3	18.9	13.7	25.3
	BE	-		0.627	-		0.746	-		0.918	0.706	-	0.372	-
	CA	100000	GT	180000	100000	GT	19000000	100000	GT	19000000	19000000	100000	GT	120000	X	87000
	CR	13.9		-	11.6		-	10.4		-	-	12.7	-	11.7
	CU	-		-	-		-	11.7		4.83	-	-	-	-
	FE	253		310	95.9		33	41.3		-	27.9	-	-	-
	HG	-		-	-		-	-		-	-	-	-	-
	K	1170	T	2250	T	1140	T	2250	T	1820	T	2350	T	220000	T	1630	T	24000	T	1320	T
	MG	50000	GT	77000	50000	GT	9100000	50000	GT	8400000	9800000	5000000	GT	61000	X	48000
	MN	350		480	45.7		39.5	131.0		144	9.98	-	-	-
	NA	-		33000	T	16000	T	19000	T	18000	T	27000	T	20000	T	-	21000	T	-
	NI	-		20.7	-		-	18.5		-	-	-	-	10.6
	PB	-		-	8.61		-	-		-	-	-	-	-
	SE	-		-	-		-	-		-	-	4.03	-	-
	V	-		-	-		-	-		-	-	4.51	-	4.7
	ZN	760		144	-		49.1	460		33.2	93.1	61.5	-	-
Anions	NIT	2300		290	1900		430	2400		250	420	1900	1200	1400
	CL	69000		38000	20000		21000	19000		37000	13000	19000	15000	8100
	SO4	63000		59000	X	65000	54000	44000		58000	310000	200000	220000	61000
Indicator parameter	ALK	628000		558000	751000		660000	396000		708000	635000	364000	364000	316000
	HARD	670000		596000	540000		728000	522000		776000	744000	558000	552000	378000
	TDS	872000		636000	697000		721000	500000		825000	947000	691000	648000	420000
	pH(1)	6.8		6.9	6.8		6.9	6.8		6.9	7.1	7.4	7.3	7.5
	Sp.Cond.(2)	1330		1208	1145		108	969		118	1038	802	879	561

Notes and flagging codes are presented at the end of this table.

TABLE 7-14
SUMMARY OF GROUNDWATER CHEMICAL DATA -
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		ELN-82-03C		ELN-82-04A			ELN-82-04B			ELN-82-04C			ELN-89-02A		ELN-89-02B		
Sample Type:		WELL		WELL			WELL			WELL			WELL		WELL		
UNITS:		UGL		UGL			UGL			UGL			UGL		UGL		
DATE SAMPLED:		04/11/92		12/05/91		04/10/92	12/05/91		04/10/92	12/05/91		04/10/92	04/13/92		12/06/91		04/12/92
ROUND:		TWO		ONE		TWO	ONE		TWO	ONE		TWO	TWO		ONE		TWO
VOCs	111TCE	-		-		-	-		-	-		-	-		-		-
	112TCE	-		-		-	-		-	-		-	-		-		-
	12DMB	-		-		-	-		-	-		-	-		-		-
	13DMB	-		-		-	-		-	-		-	-		-		-
	ACET	-		-		-	-		-	-		-	-		-		-
	C6H6	-		-		-	-		-	-		-	-		-		-
	CH2CL2	7.16	B	4.31	P	5.39	B	3.82	P	5.29	B	5.39	8.43	B	7.06	B	4.12	P	5.2	P
	CH3CL	-		-		-	-		-	-		-	-		-		-		-	
	CHCL3	-		-		-	-		-	-		-	-		0.875		-		-	
	MEC6H5	-		-		-	-		-	-		-	-		-		-		-	
	MEK	-		-		-	-		-	-		-	-		-		-		-	
	TCLEE	-		-		-	-		-	-		-	-		-		-		-	
	TRCLE	-		-		-	0.987		-	-		-	-		-		-		-	
SVOCs	2E1HXL																12	S		
	4MP	-		-		-	-		-	-		-	-		-		-		-	
	B2EHP	-		-		-	-		-	-		51	66.9		122				-	
	PHENOL	-		-		-	-		-	-		-	-						-	
	TR1MBZ																			
Metals	AG	-		-		-	-		-	-		-	-		-		-		-	
	BA	17.5		73		67	26.3		23.9	28.7		25.4	760		29.3		26.4			
	BE	-		-		-	-		-	-		-	-		-		-			
	CA	73000		120000	X	120000	X	65000		66000		74000	38000		470000		65000		60000	
	CR	-		7.15		-	48.5		-	15.4		5.14	140		7.74		-			
	CU	-		8.46		11.9	8.2		7.71	-		4.89	5.22		-		5.69			
	FE	-		77.3		29.9	296		-	67.2		38.3	-		29.4		-			
	HG	-		-		-	-		-	-		-	-		-		-			
	K	2640	T	1640	T	2860	T	1150	T	2530	T	1610	T	21000	T	8700	T	1360	T	1150	T
	MG	39000		52000		47000	37000		35000	45000		32000	-		35000		31000			
	MN	-		13.3		-	14.3		-	-		-	-		-		-			
	NA	13000	T	3290	T	10000	T	-		21000	T	-	13000	T	15000	T	-		6500	T
	NI	-		-		9.45	24.4		-	-		-	-		-		-			
	PB	-		-		-	-		-	-		-	-		-		-			
	SE	-		-		-	-		-	-		-	-		-		-			
	V	-		-		-	-		-	-		-	12.2		-		5.88			
	ZN	-		2300		3900	-		37.4	-		-	-		25		-			
Anions	NIT	1100		5800		4000	3700		1300	5700		2400	4000		7300		4300			
	CL	6200		4600		3500	2900	P	2900	P	4500	7200	13000		8100		8000			
	SO4	57000	X	29000		31000	28000		27000	28000		23000	50000		29000		30000			
Indicator parameter	ALK	350000		474000		450000	238000		724000	268000		245000	622000		214000		230000			
	HARD	332000		318000		468000	303000		296000	320000		210000	1120000		228000		220000			
	TDS	371000		513000		496000	343000		305000	355000		279000	435000		265000		284000			
	pH(1)	7.6		6.0		6.9	6.0		7.6	6.0		7.4	9.8		7.7		7.7			
	Sp.Cond.(2)	590		601		695	354		468	426		497	340		462		452			

Notes and flagging codes are presented at the end of this table.

TABLE 7-14
SUMMARY OF GROUNDWATER CHEMICAL DATA -
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		(4) ELN-89-04A				ELN-89-04B				ELN-89-06B				ELN-91-07A				ELN-91-07B			
Sample Type:		WELL				WELL				WELL				WELL				WELL			
UNITS:		UGL				UGL				UGL				UGL				UGL			
DATE SAMPLED:		12/05/91		04/27/92		12/05/91		04/25/92		12/08/91		04/10/92		12/08/91		04/11/92		12/08/91		04/11/92	
ROUND:		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO	
VOCs	111TCE	-		-		-		-		-		-		-		-		-		-	
	112TCE	-		-		-		-		-		-		-		-		-		-	
	12DMB	-		-		-		-		-		-		-		-		4.4	S	-	
	13DMB	-		-		-		-		-		-		-		-		9.5	S	-	
	ACET	-		-		-		-		-		-		-		-		12	S	-	
	C6H6	-		-		-		-		-		-		-		-		2.65		-	
	CH2CL2	4.8	P	7.65	B	5.2	P	6.08	B	5.29		7.75	B	5	P	5.98	B	5.1	P	5.49	B
	CH3CL	3.65		-		-		-		-		-		-		-		-		-	
	CHCL3	-		-		-		-		-		-		-		-		-		-	
	MEC6H5	-		-		-		-		-		-		-		-		11.1		-	
	MEK	-		-		-		-		-		-		-		-		160	S	73	S
	TCLEE	-		-		-		-		-		0.297	P	-		-		-		-	
	TRCLE	-		-		-		-		-		-		-		-		-		-	
SVOCs	2E1HXL																				
	4MP	-		-		-		-		-		-		-		-		-		-	
	B2EHP	28.7	P	-		43.8	P	193		63.7		-		-		-		111		-	
	PHENOL	-		-		-		-		-		-		-		-		-		-	
	TRIMBZ																	5	S		
Metals	AG	-		-		-				-		-		-		-		-		-	
	BA	110		130		22		34.4		19		16.5		33.3		24.7		33		28.8	
	BE	-		0.811		-		-		-		-		-		-		-		-	
	CA	100000	GT	230000		72000		80000		76000		72000		74000		79000		96000		80000	
	CR	12.7		-		7.79		-		12.7		-		6.3		-		8.81		-	
	CU	-		-		-		-		-		-		-		-		-		-	
	FE	36.2		-		48.4		-		37.4		-		68.1		-		42.8		-	
	HG	-		-		-		-		-		-		-		-		-		-	
	K	1380	T	1980	T	1220	T	1510	T	1130	T	19000	T	1990	T	1930	T	1490	T	1480	T
	MG	50000	GT	110000		39000		43000		45000		41000		43000		43000		50000		44000	
	MN	232	X	148		-		-		-		-		16.4		-		8.89		-	
	NA	19000	T	25000	T	-		8400	T	-		13000	T	-		15000	T	-		16000	T
	NI	-		-		-		-		-		-		-		-		-		-	
	PB	-		-		-		5.94		-		-		-		-		-		-	
	SE	-		-		-		-		-		-		-		-		-		-	
	V	-		-		-		-		-		-		-		6.68		-		5.7	
	ZN	40.2		-		-		-		-		-		-		-		-		-	
Anions	NIT	160		130		1800		2700		3000		960		4500		2800		2800		1000	
	CL	30000	P	32000	P	8200		11000		8500		7900		33000		36000		8500		9300	
	SO4	65000		69000		31000		30000		54000		51000		20000		17000		50000		52000	
Indicator parameter	ALK	586000		724000		254000		268000		212000		307000		346000		318000		366000		316000	
	HARD	754000		792000		328000		382000		332000		368000		250000		342000		446000		356000	
	TDS	841000		863000		352000		305000		372000		367000		332000		344000		340000		365000	
	pH(1)	7.0		7.0		8.0		7.6		7.5		7.6		7.5		7.6		7.4		7.7	
	Sp.Cond.(2)	1568		1192		587		611		642		534		523		639		506		608	

Notes and flagging codes are presented at the end of this table.

TABLE 7-14
SUMMARY OF GROUNDWATER CHEMICAL DATA -
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		S1134		S1135		S1153	
Sample Type:		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL	
DATE SAMPLED:		12/04/91	04/28/92	12/06/91	04/28/92	12/05/91	04/28/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO
VOCs	111TCE	-	-	-	-	-	-
	112TCE	2.31	1.15	-	-	-	-
	12DMB	-	-	-	-	-	-
	13DMB	-	-	-	-	-	-
	ACET	-	-	-	-	-	-
	C6H6	-	-	-	-	-	-
	CH2CL2	5.2 P	7.06 B	3.24 P	7.55 B	3.63 P	7.45 B
	CH3CL	-	-	-	-	-	-
	CHCL3	-	-	-	-	-	-
	MEC6H5	-	-	-	-	-	-
	MEK	-	-	-	-	-	-
	TCLEE	-	-	-	-	-	-
	TRCLE	-	0.276 P	-	-	-	-
SVOCs	2E1HXL						
	4MP	-	-	-	-	-	-
	B2EHP	139	126	73.6	-	-	31.8 P
	PHENOL	-	-	-	-	-	-
	TRIMBZ						
Metals	AG	-	-	-	-	-	-
	BA	28.9	32.2	24	23.4	38.8	38.2
	BE	-	1.1	-	1.14	-	0.515
	CA	100000 GT	240000	100000 GT	21000000	9500000	9600000
	CR	25.6	-	17.6	-	8.44	-
	CU	6.21	-	-	6.55	-	-
	FE	81.3	-	60.6	-	43.5	30.9
	HG	-	-	-	-	-	-
	K	2080 T	16000T	2150 T	24000 T	1440 T	1800 T
	MG	50000 GT	120000	50000 GT	11000000	4600000	4500000
	MN	25	17.6	20.1	7.85	-	-
	NA	-	17000T	-	30000 T	-	11000T
	NI	10.2	-	-	-	-	-
	PB	-	-	-	-	-	-
	SE	5.01	-	-	-	-	-
	V	-	-	-	-	-	-
	ZN	2900	970	2400	168	-	-
Anions	NIT	2200	1300	2400	1400	2800	1800
	CL	14000	13000	42000	31000 P	20000	20000
	SO4	390000	380000	580000	410000	34000	37000
Indicator parameter	ALK	532000	504000	488000	436000	332000	376000
	HARD	910000	848000	1100000	910000	432000	404000
	TDS	1140000	1020000	1370000	1080000	464000	443000
	pH(1)	6.0	7.3	7.0	7.0	7.4	7.3
	Sp.Cond.(2)	1239	1206	1499	1245	780	627

Notes and flagging codes are presented at the end of this table.

TABLE 7-14
SUMMARY OF GROUNDWATER CHEMICAL DATA-
DETERRENT BURNING GROUND/ EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
(3)	=	ELN-82-02C was resampled on 12/13/91 for TAL, Hardness, and NIT; original sample dated 12/9/91 was not preserved. Analytical results from both samples are reported in the IRDMIS, only the preserved results are reported in this table.
(4)	=	ELN-89-04A was resampled on 12/10/91 for TAL and hardness, original sample dated 12/5/91 was not filtered in the field. Analytical results from both samples are reported in the IRDMIS, only the filtered results are reported in this table.
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

Appendix K contains complete analytical results.

USATHAMA chemical codes are defined in the RI Report Glossary

TABLE 7-15
CHEMICAL AND PHYSICAL PROPERTIES OF MAJOR ORGANIC CONTAMINANTS - DETERRENT BURNING GROUND/EXISTING LANDFILL[A]

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

CHEMICALS	CAS#	MOLECULAR WEIGHT (g/mole)	DENSITY	WATER SOLUBILITY (mg/ℓ)	VAPOR PRESSURE (mmHg)	HENRY'S LAW CONSTANT (atm-m³/mole)	K_{oc}[B] (mℓ/g)	K_{ow}[C] (mℓ/mℓ)
Volatile Organic Compounds								
111TCE	71-55-6	133	1.32	1.50×10^3	123	1.44×10^{-2}	152	316
112TCE	79-00-5	133	1.32	4.50×10^3	19	7.42×10^{-4}	56	117
TRCLE	79-01-6	132	1.45	1.10×10^3	57.9	9.10×10^{-3}	126	240
C6H6	71-43-2	78	0.8786	1.75×10^3	95.2	5.58×10^{-3}	83	132
XYLEN	1330-20-7	106		1.98×10^2	10	7.04×10^{-3}	240	1.82×10^3
(ortho)	95-47-6	106	0.88	1.75×10^2	10			8.91×10^2
(meta)	108-38-3	106	0.864	1.30×10^2	10			1.82×10^3
(para)	106-42-3	106	0.86	1.98×10^2	10			1.41×10^3
Semivolatiles								
24DNT	121-14-2	182	1.32 (CRC)	2.40×10^2	5.10×10^{-3}	5.09×10^{-9}	45/250 (HO)	1.29×10^5 100
26DNT	606-20-2	182	1.28 (CRC)	1.32×10^3	1.80×10^{-2}	3.27×10^{-8}	92	100
NNDPA	86-30-6	198[1]	1.23 (CRC)	1.13×10^2	$6.3E \times 10^{-4}$	1.4×10^{-6}	650 (ADL)	1.35×10^3 (ADL)

Notes:

[A] All data from the Risk Assessment Guidance for Superfund (USEPA, 1989a) unless otherwise noted: ADL = Arthur D. Little, 1985; CRC = CRC Handbook of Chemistry and Physics (Weast, 1980-81); and HO = Ho, 1988.

[B] K_{oc} = partition coefficient between the organic chemical and carbon.

[C] K_{ow} = partition coefficient of the chemical between octanol and water.

See List of USATHAMA Chemical Codes for definitions of chemical abbreviations.

TABLE 7-16
ESTIMATES OF DISTANCES TRAVELED BY ORGANIC CONTAMINANTS IN GROUNDWATER

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

$Vc = V/[1 + K_d(b/n)]$ $K_d = K_{oc}*f_{oc}$; f_{oc} is assumed to be 0.01

Deterrent Burning Ground

UPPER FLOW ZONE	CONTAMINANT VELOCITY Vc, Ft/Yr	PARTITION COEFFICIENT K_d, mℓ/g	K_{oc}	SOIL DENSITY b, g/mℓ	SOIL POROSITY N=POROSITY	YEARS	DISTANCE, FT.
Groundwater	20.0	NA	NA	2	0.3	40	800.0
111TCE	1.80	1.52	152	2	0.3	40	71.9
24DNT	5.0	0.45	45	2	0.3	40	200
24DNT	1.13	2.50	250	2	0.3	40	45.3
26DNT	2.80	0.92	92	2	0.3	40	112.1
NNDPA	0.45	6.50	650	2	0.3	40	18.0

LOWER FLOW ZONE	Vc, ft/yr	K_d, mℓ/g	k_{oc}	b, g/mℓ	N=POROSITY	YEARS	DISTANCE, FT.
Groundwater	150	NA	NA	2	0.3	40	6,000
111TCE	13.5	1.52	152	2	0.3	40	539
24DNT	37.5	0.45	45	2	0.3	40	1,500
24DNT	8 49	2.50	250	2	0.3	40	340
26DNT	21.0	0.92	92	2	0.3	40	841
NNDPA	3.38	6.50	650	2	0.3	40	135

Notes:

NA = not applicable
ft/yr = feet per year
mℓ/g = milliliters per gram
g/mℓ = grams per milliliters

See list of USATHAMA Chemical Codes for definitions of chemical abbreviations.

W0039213T.7/14

TABLE 7-17
COMPOUNDS OF POTENTIAL CONCERN
DETERRENT BURNING GROUND
SUBSURFACE SOIL[1]

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	EXPOSURE POINT CONCENTRATION µg/g
24DNT	37,000
26DNT	1,400
3NT	6.9
AS	7.88
B2EHP	4.35
C6H6	5.25
CR	13.2
DNBP	62
FANT	0.139
MEC6H5	0.138
NI	10.2
NIT	18.7
NNDPA	2,200
PHANTR	0.183
PYR	0.144
SO4	5.19
TXYLEN	0.001
ZN	26.7

Notes:

Exposure point concentration is the maximum detected concentration.
µg/g = milligrams per gram, equivalent to parts per million (ppm)

[1] Assessment of subsurface soil contamination (2 to 12 feet) was performed using samples from borings DBB-91-01 through DBB-91-03.

TABLE 7-18
SUMMARY OF RISK ESTIMATES
DETERRENT BURNING GROUND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

EXPOSURE SCENARIO	EXPOSURE ROUTE	CANCER RISK	HAZARD INDEX
Future Construction Worker	Soil Ingestion	$1x10^{-4}$	0.2
	Inhalation of Particulates	$4x10^{-8}$	0.000009
	Total for Construction Worker	$1x10^{-4}$	0.2

TABLE 7-19
COMPARISON OF GROUNDWATER TO STANDARDS
UNITS: $\mu g/\ell$
DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND OF POTENTIAL CONCERN	FREQUENCY OF DETECTION	MAXIMUM DETECTED CONCENTRATION	MINIMUM DETECTED CONCENTRATION	SDWA (1)		WI GROUNDWATER STANDARDS (2)		CALCULATED CONCENTRATION (3)
				MCL	MCLG	ES	PAL	
111TCE	8:80	12.1	3.07	200	200	200	40	-
112TCE	5:8	2.31	0.365	5	3	0.6	0.06	-
26DNT	2:80	2.17	1.29	-	-	0.05	0.005	-
BA	56:56	760	13.7	2,000	2,000	1,000(c)	200(c)	-
BE	10:80	1.14	0.362	-	-	-	-	0.02
CD	1:80	3.23	-	5	5	10(d)	1(d)	-
CL	80:80	69,000	1,450	250,000(a)	-	-	-	-
CR	38:80	140	4.98	100	100	50(e)	5(e)	-
CU	25:80	77.2	4.7	TT	1,300	-	-	-
HG	1:81	4.25	-	2	2	2	0.2	-
MN	21:56	480	7.85	50(a)	-	50(f)	25(f)	-
NA	38:56	33,000	2,890	20,000(b)	-	-	-	-
NIT	80:80	16,000	130	10,000	10,000	10,000	2,000	-
NNDPA	3:80	16.7	1.02	-	-	-	-	20
PB	4:80	8.61	5.94	TT	0	50(g)	5(g)	-
NI	8:80	24.4	9.45	100	100	-	-	-

continued

TABLE 7-19
COMPARISON OF GROUNDWATER TO STANDARDS
UNITS: μg/ℓ
DETERRENT BURNING GROUND/EXISTING LANDFILL

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND OF POTENTIAL CONCERN	FREQUENCY OF DETECTION	MAXIMUM DETECTED CONCENTRATION	MINIMUM DETECTED CONCENTRATION	SDWA (1)		WI GROUNDWATER STANDARDS (2)		CALCULATED CONCENTRATION (3)
				MCL	MCLG	ES	PAL	
SE	2:80	5.01	4.03	50	50	10(h)	1(h)	-
SO4	80:80	630,000	9,500	250,000(a)	-	250,000(f)	125,000(f)	
V	13:56	19.1	4.14	-	-	-	-	260
ZN	21:80	3,900	20.8	5,000(a)	-	5,000(f)	2,500(f)	7,300

Sources:

(1) U.S. Environmental Protection Agency (EPA), 1991, "Fact Sheet: National Primary Drinking Water Standards." Office of Water, Washington, D.C., August 1991; EPA, 1991, "Fact Sheet: National Secondary Drinking Water Standards," Office of Water, Washington, D.C., September 1991; and EPA, 1990, "National Primary and Secondary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals, Final Rule," 57FR31776, July 17, 1992 (see Subsection 3.6 for details).
(2) Wisconsin Administrative Code, Chapter NR 140.10, Table 1 (see Subsection 3.6 for details).
(3) Calculated to be protective at risk of 10^{-6} or HI of 1 (see Subsection 4.5 for details).

Notes:

(a) Secondary drinking water standard, suggested level.
(b) Reporting level. Monitoring is required and data is reported to health officials to protect individuals on restricted sodium diet.
(c) WI proposing change to ES = 2,000 μg/ℓ and PAL = 400 μg/ℓ
(d) WI proposing change to ES = 5 μg/ℓ and PAL = 0.5 μg/ℓ
(e) WI proposing change to ES = 100 μg/ℓ and PAL = 10 μg/ℓ
(f) Value for protection of public welfare (usually aesthetic concerns) rather than for protection of human health
(g) WI proposing change to ES = 15 μg/ℓ and PAL = 1.5 μg/ℓ
(h) WI proposing change to ES = 50 μg/ℓ and PAL = 10 μg/ℓ

μg/ℓ = micrograms per liter
SDWA = Safe Drinking Water Act
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
WI = Wisconsin
ES = Enforcement Standard
PAL = Preventive Action Limit
TT = Treatment technique requirement in effect Copper action level - 1,300 μg/ℓ Lead action level - 15 μg/

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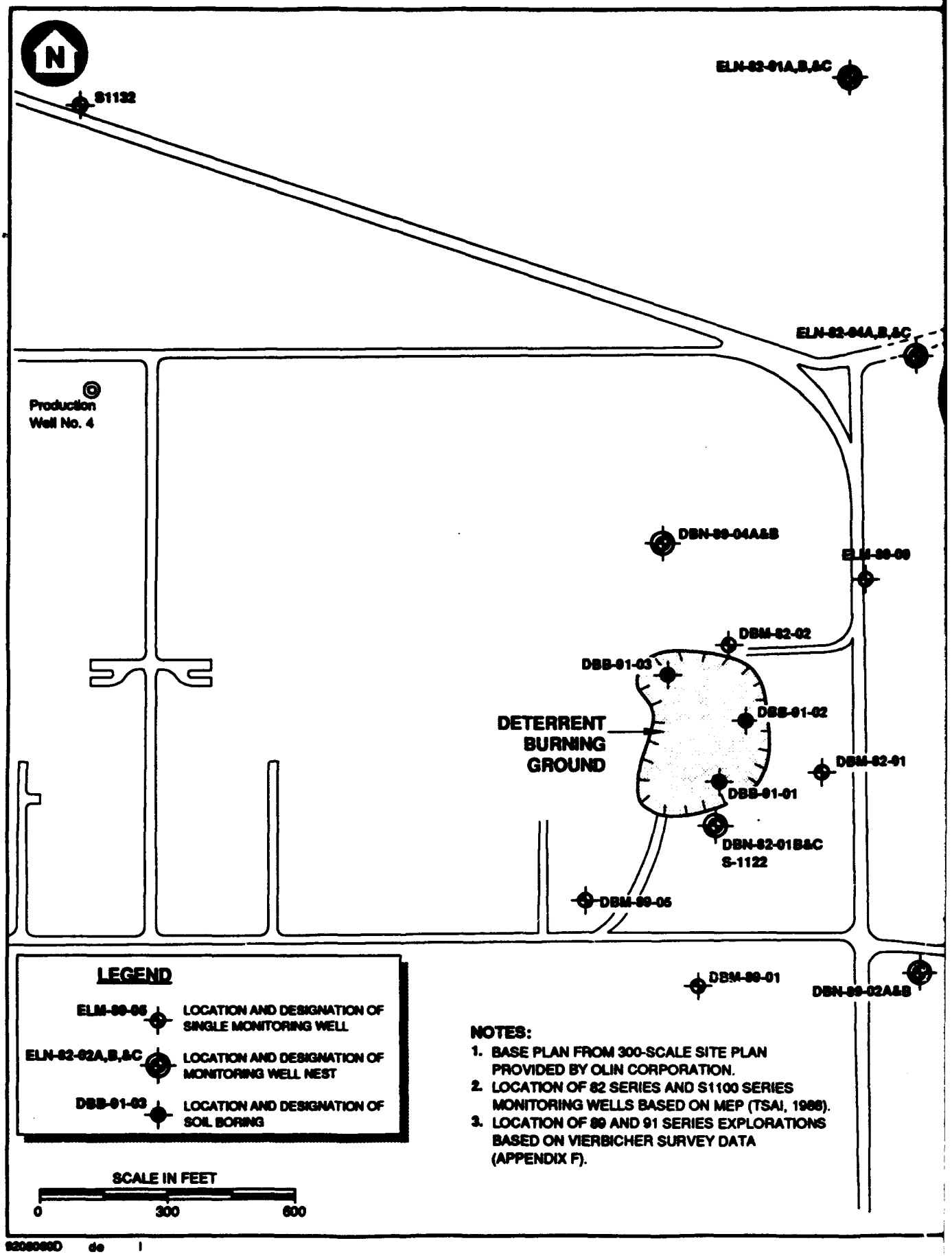

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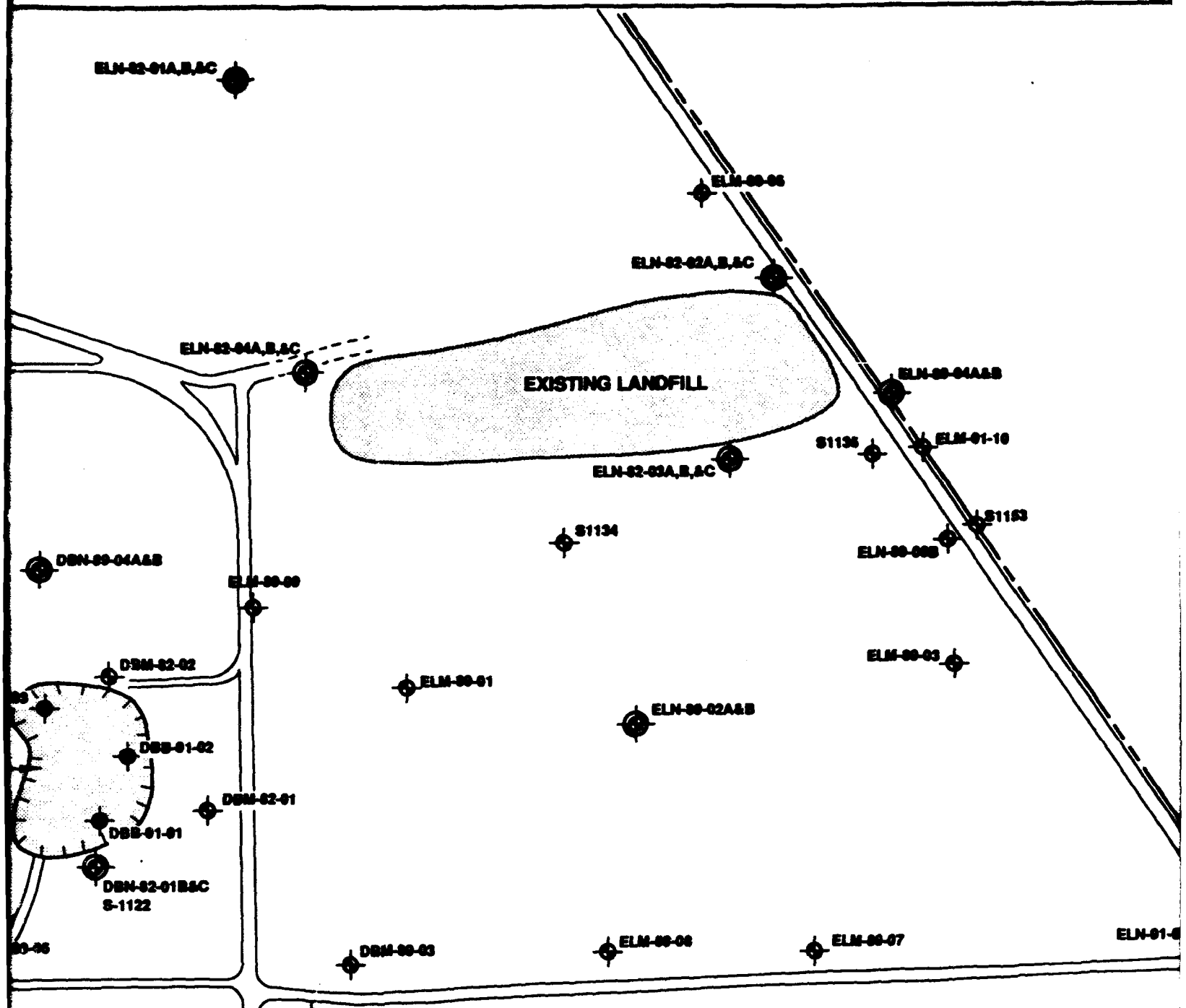

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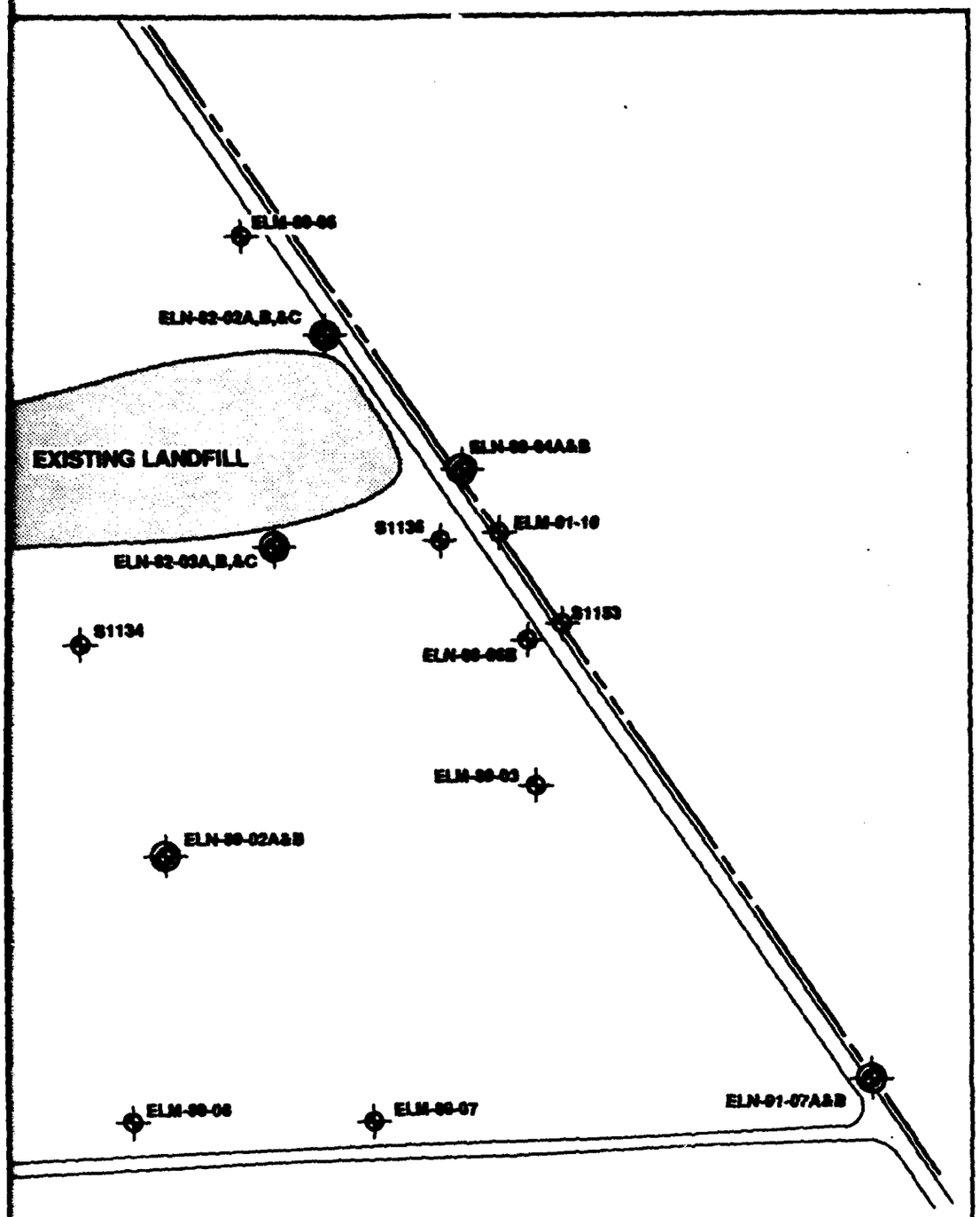
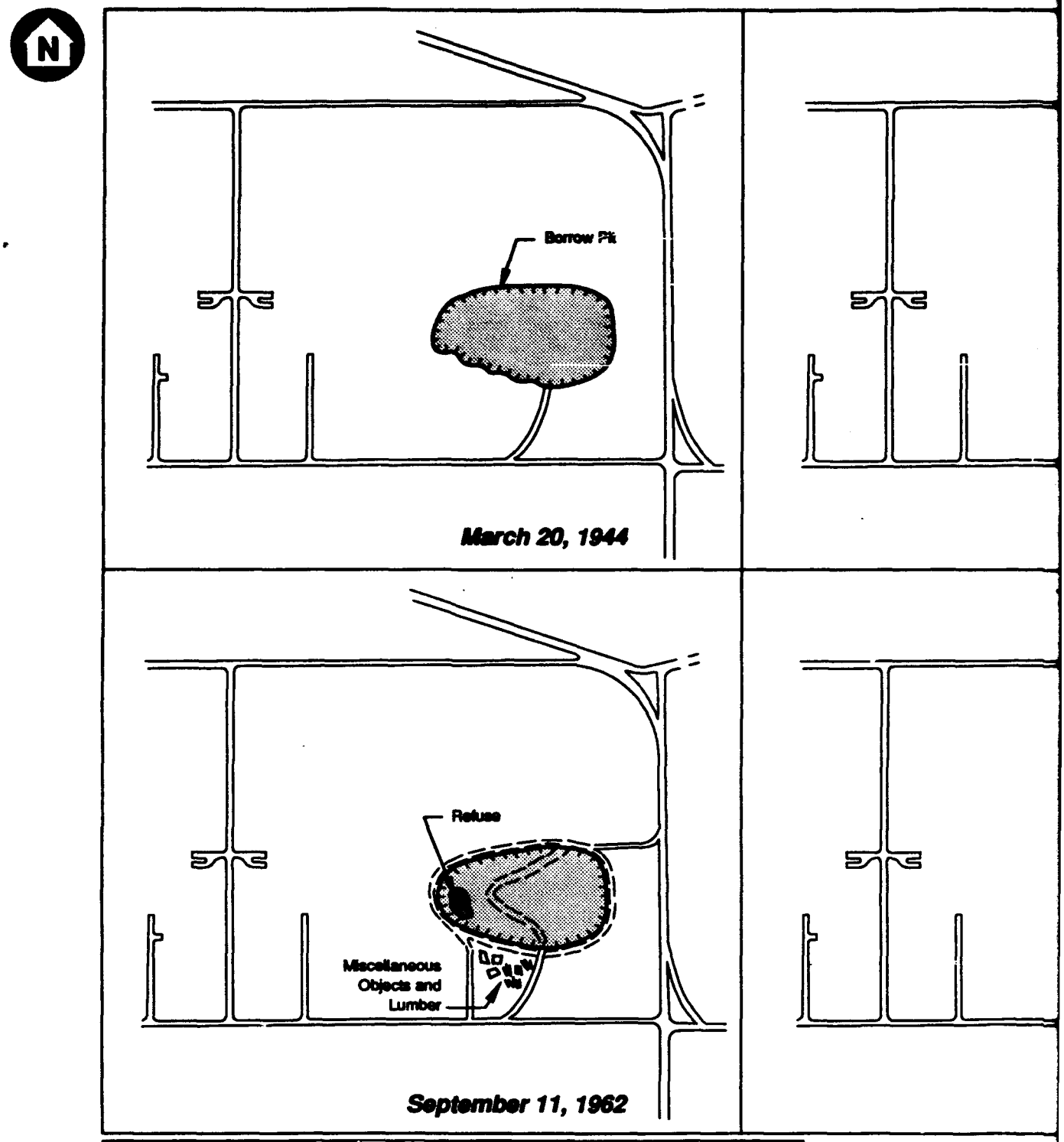


FIGURE 7-1
SITE LOCATION PLAN AND
SOIL BORING AND MONITORING WELL LOCATIONS
DETERRENT BURNING GROUND AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



LEGEND

- TOP EDGE OF SLOPE
- AREA OF ACTIVITY
- ACCESS ROAD
- MOUNDED MATERIAL
- FILLED AREA
- INTERPRETED DETERRENT BURNING PIT

NOTES:

1. BASE PLAN FROM 300 SCALE SITE PLAN PROVIDED BY OLIN CORPORATION.
2. CHRONOLOGICAL EVOLUTION BASED ON AIR-PHOTO INTERPRETATION. SEE SECTION 7.1.

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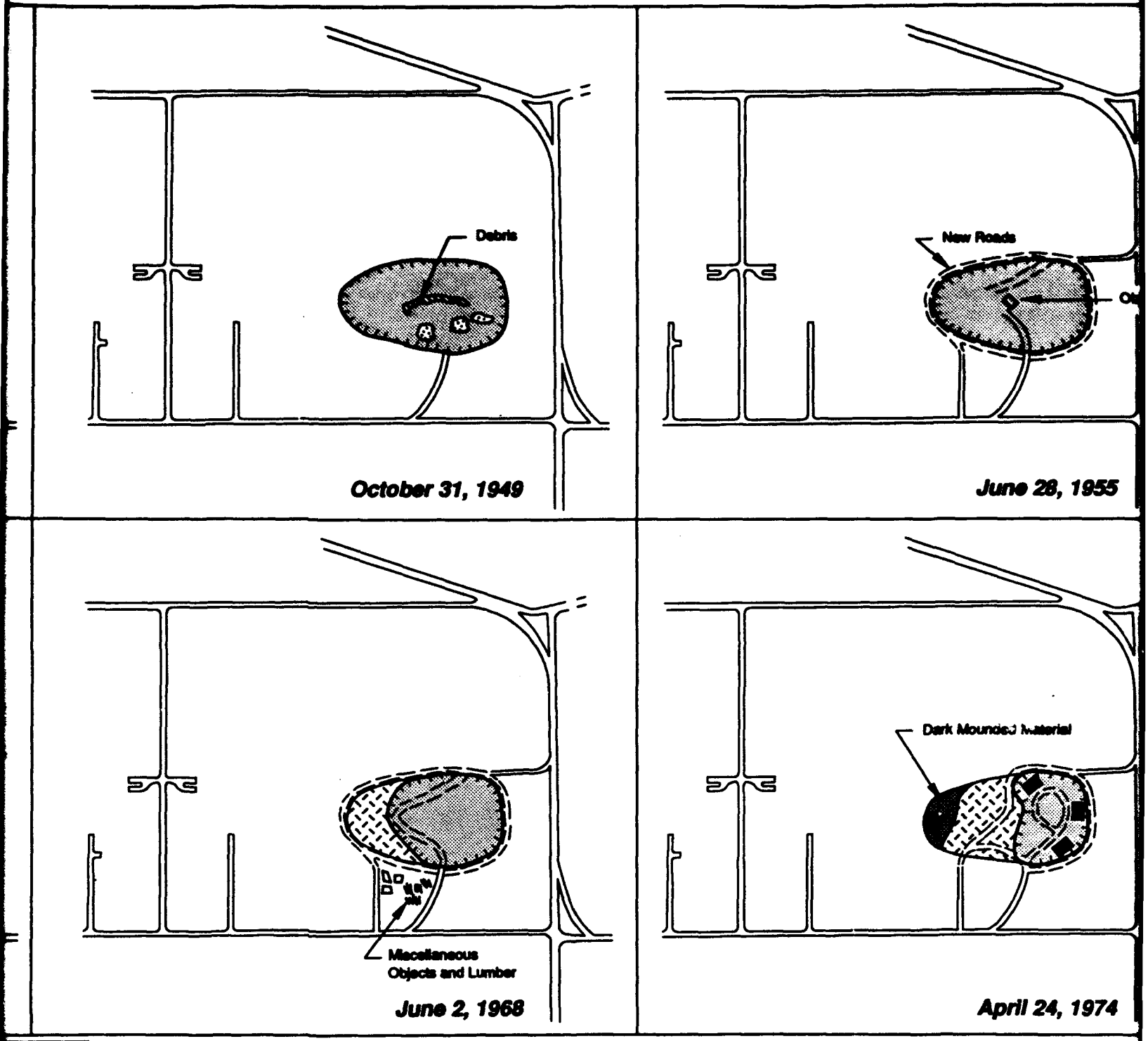

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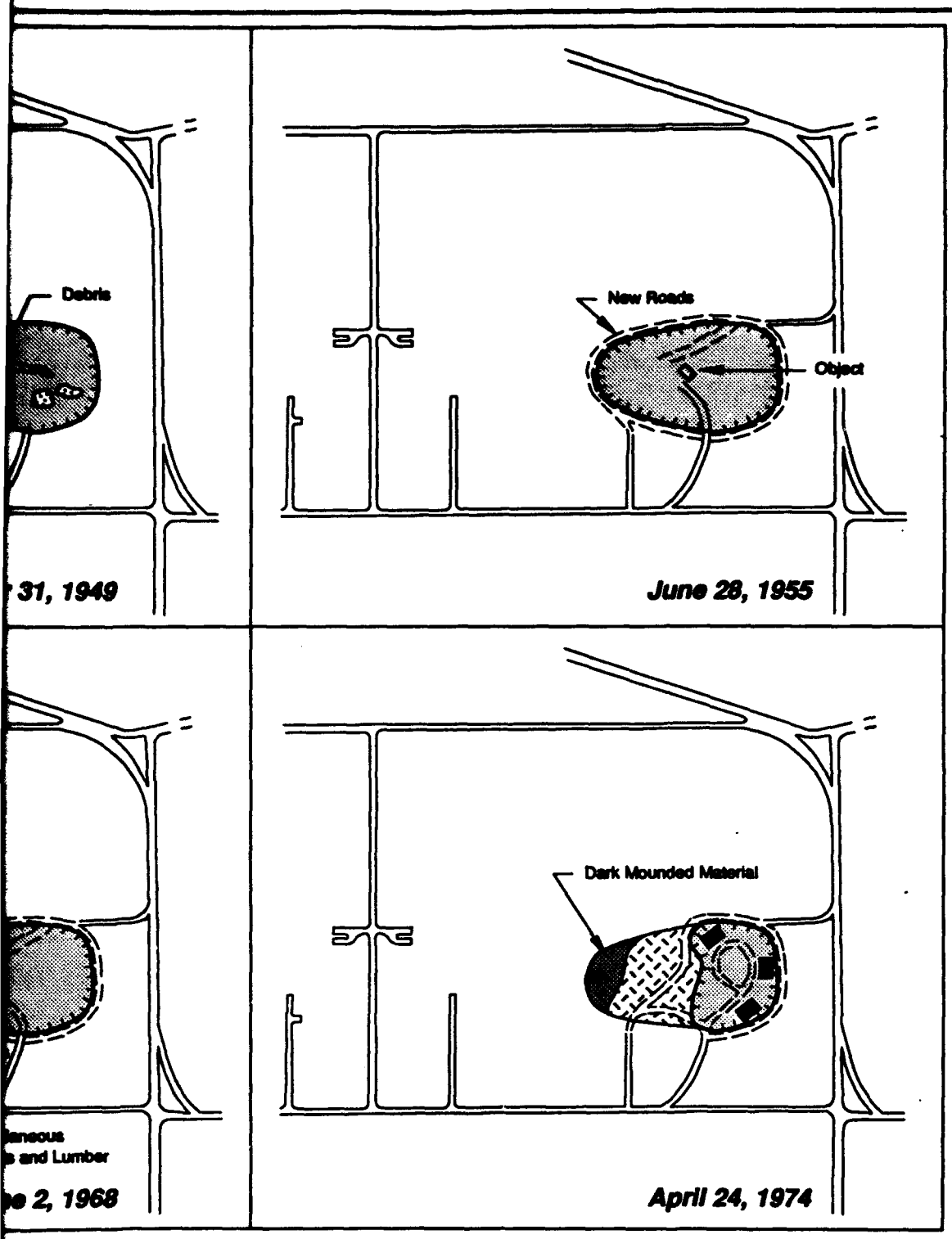

FIGURE 7-2
CHRONOLOGICAL EVOLUTION OF THE DETERRENT BURNING GROUND REMEDIAL INVESTIGATON BADGER ARMY AMMUNITION PLANT

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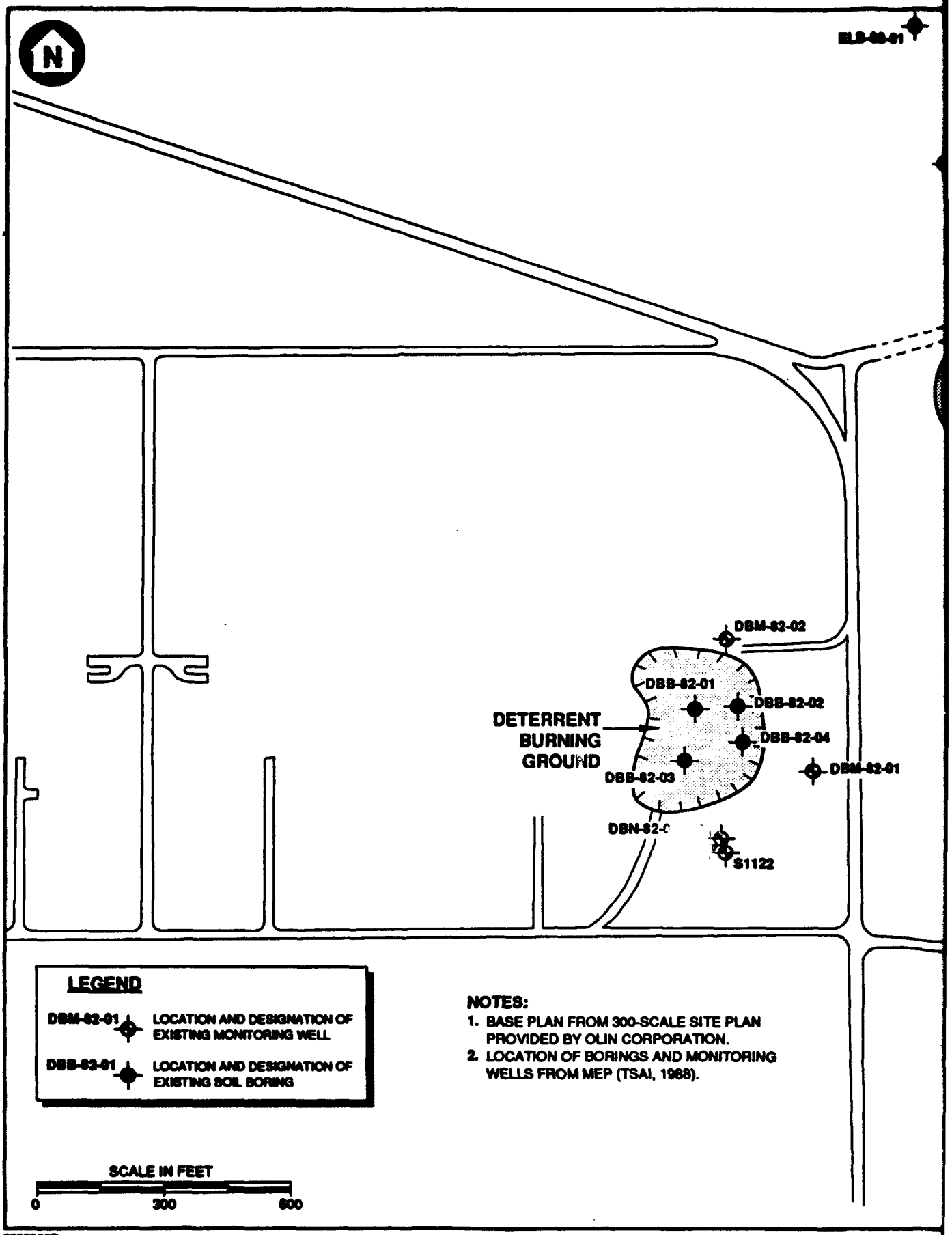
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DBB-82-02
DETERRENT
BURNING
GROUND
DBB-82-04
DBB-82-03
DBM-82-01
S1122
LEGEND
DBM-82-01 LOCATION AND DESIGNATION OF EXISTING MONITORING WELL
DBB-82-01 LOCATION AND DESIGNATION OF EXISTING SOIL BORING
NOTES:
1. BASE PLAN FROM 300-SCALE SITE PLAN PROVIDED BY OLIN CORPORATION.
2. LOCATION OF BORINGS AND MONITORING WELLS FROM MEP (TSAI, 1988).
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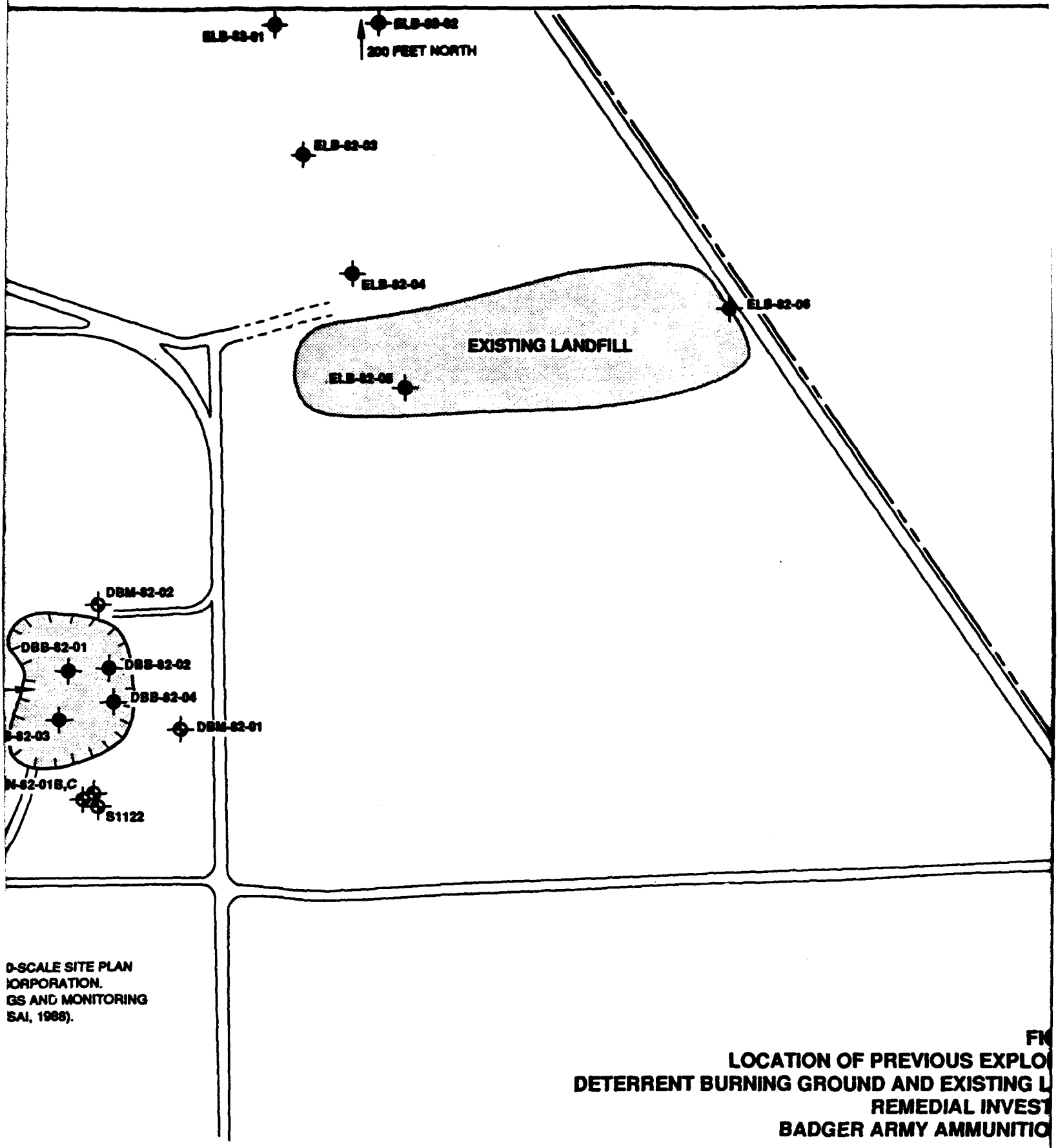

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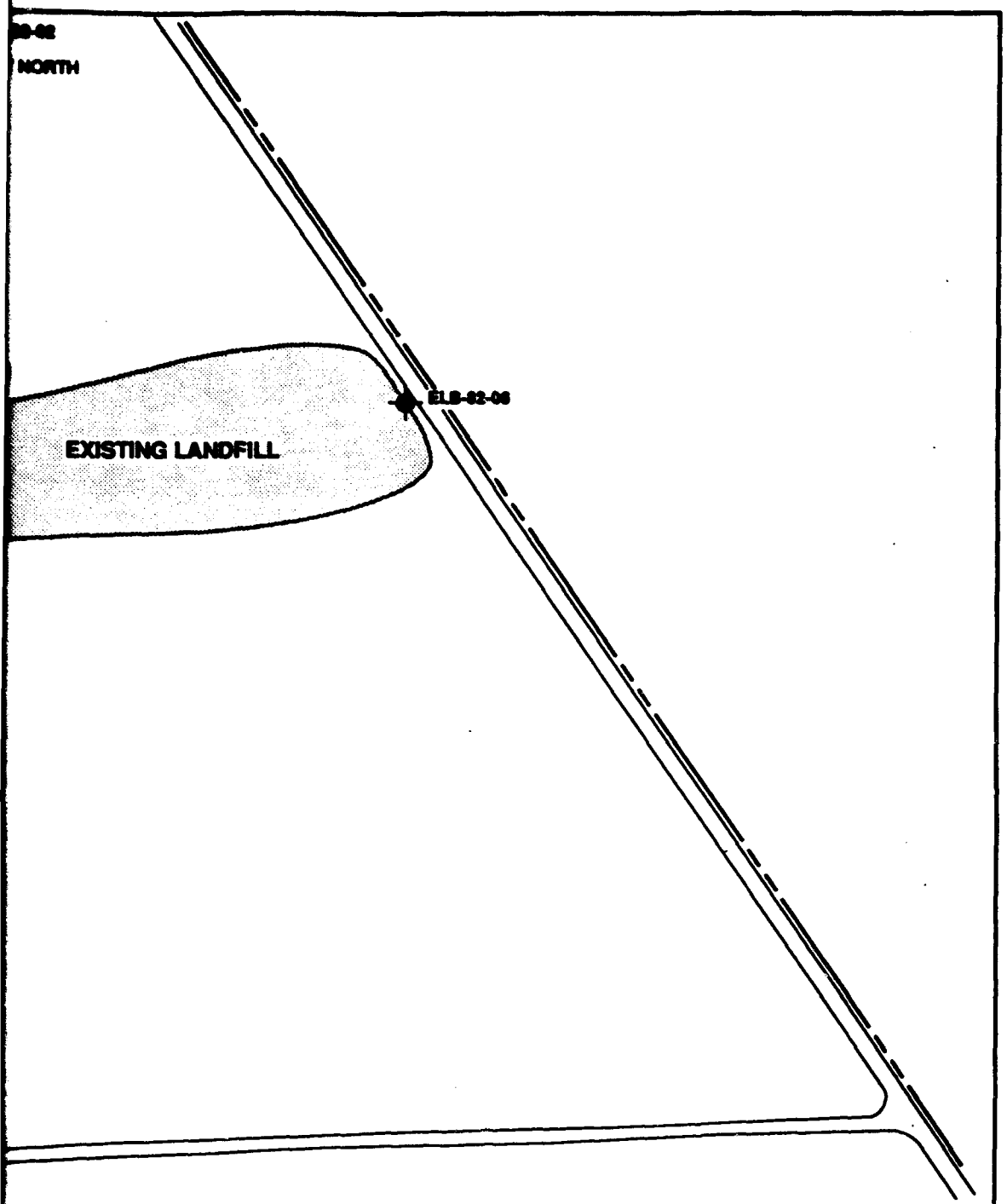
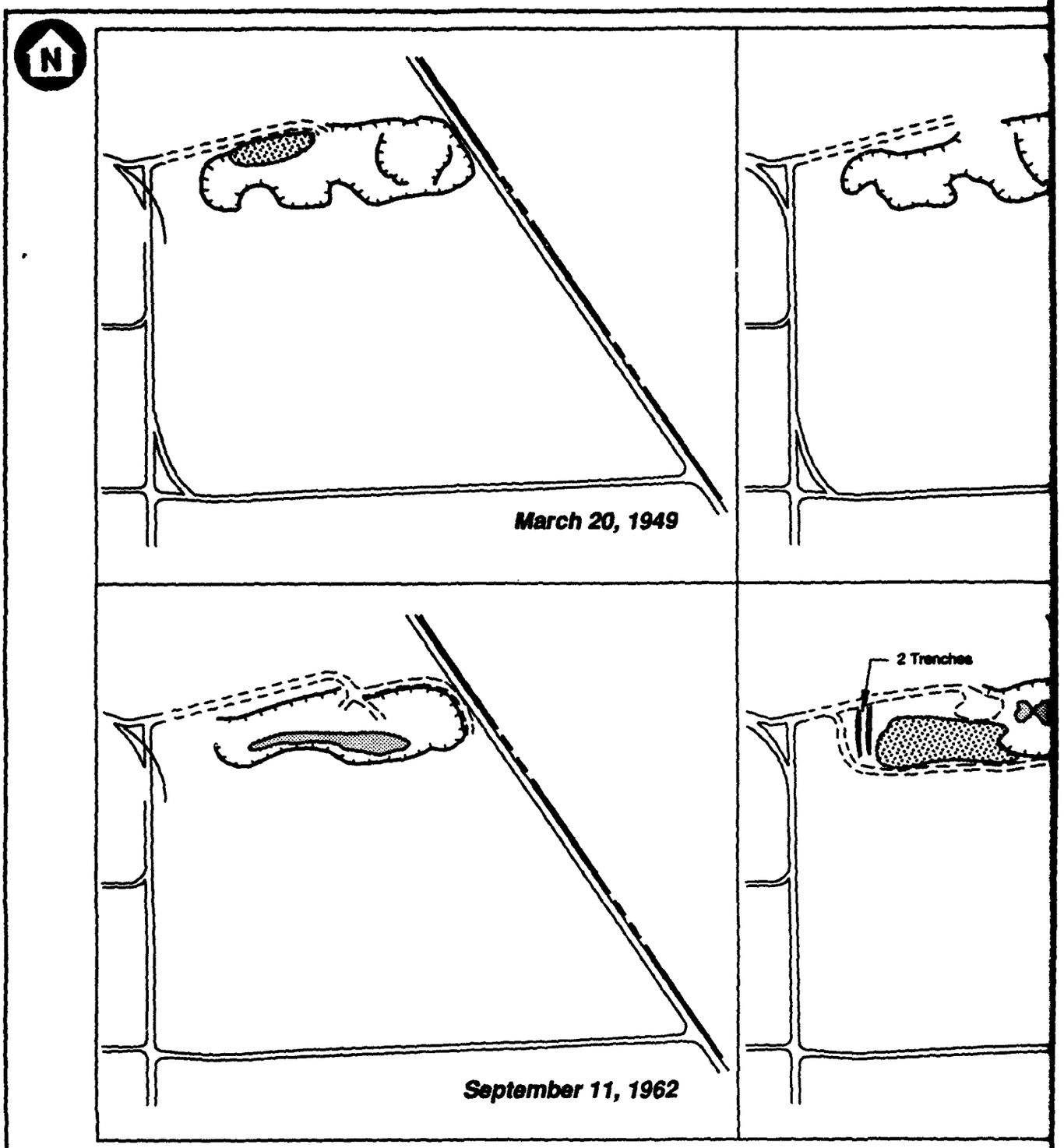


FIGURE 7-3
LOCATION OF PREVIOUS EXPLORATIONS
DETERRENT BURNING GROUND AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



LEGEND

- TOP EDGE OF SLOPE
- ACCESS ROAD
- MOUNDED MATERIAL
- REFUSE

NOTES:

1. BASE PLAN FROM 300 SCALE SITE PLAN PROVIDED BY OLIN CORPORATION.
2. CHRONOLOGICAL EVOLUTION BASED ON AIR-PHOTO INTERPRETATION. SEE SECTION 7.1.

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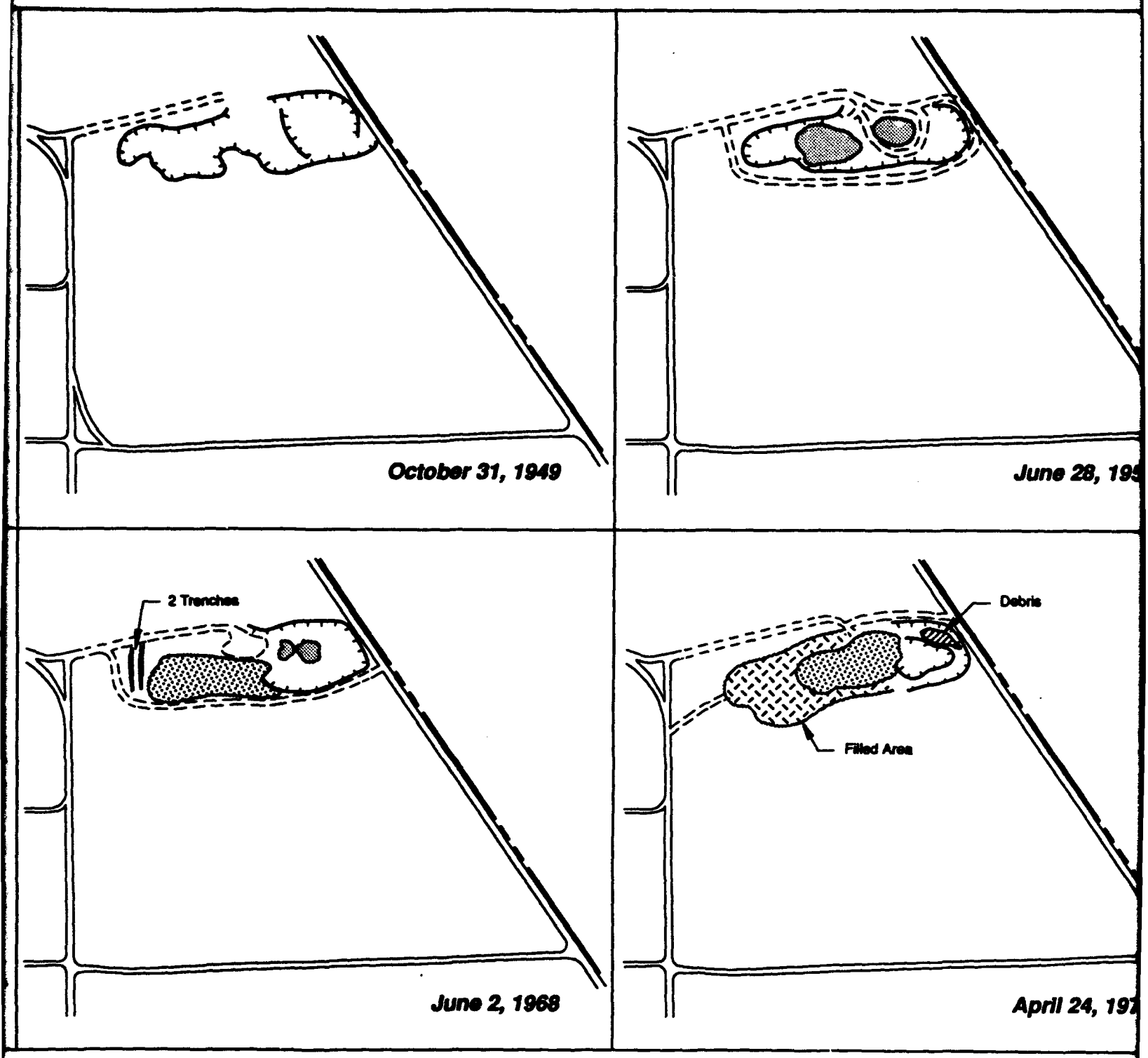

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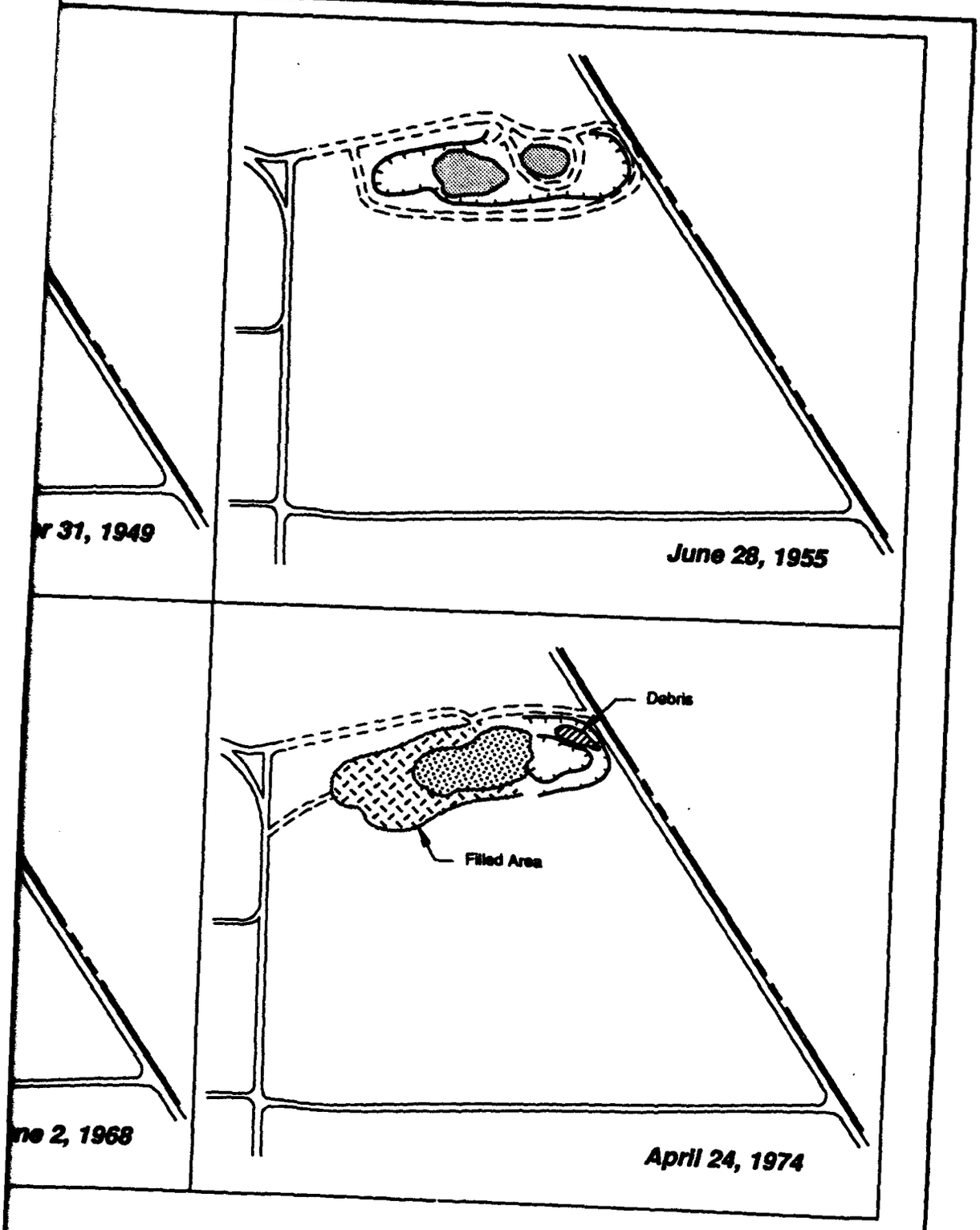

FIGURE 7-4
CHRONOLOGICAL EVOLUTION OF THE EXISTING LANDFILL
REMEDIAL INVESTIGATON
BADGER ARMY AMMUNITION PLANT

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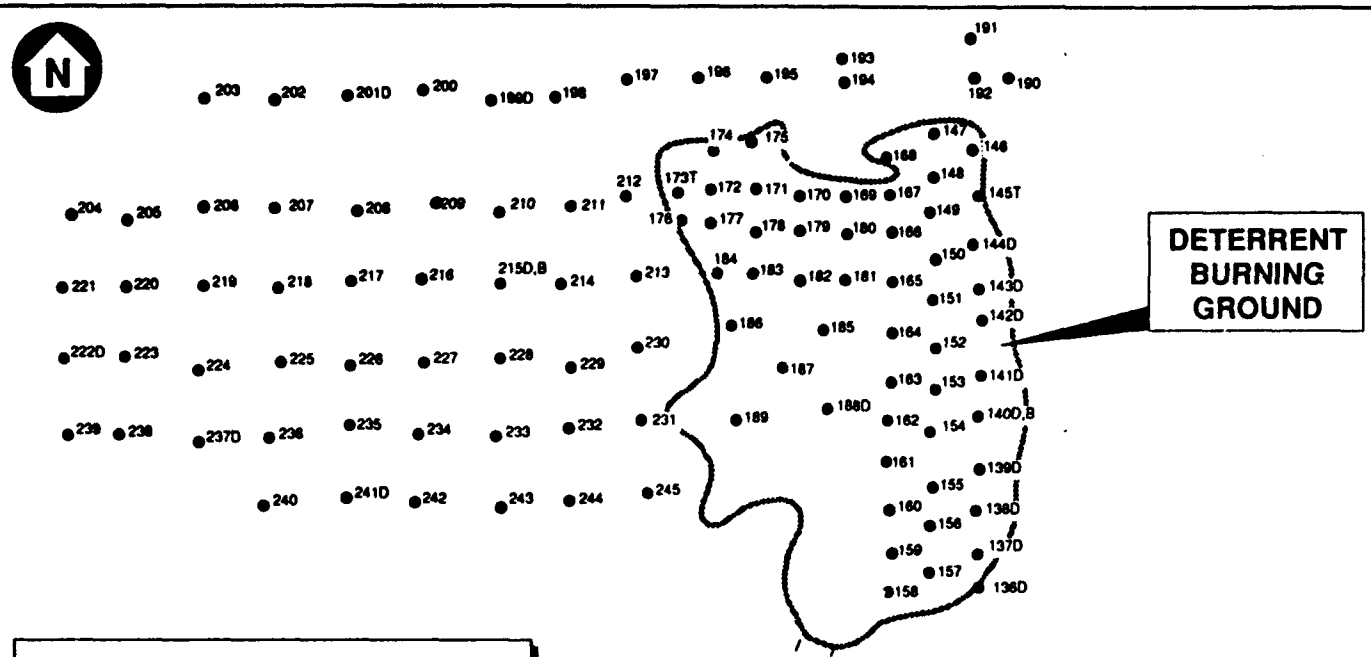

FIGURE 7-5
PETREX SOIL GAS SAMPLE LOCATIONS
DETERRENT BURNING GROUND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

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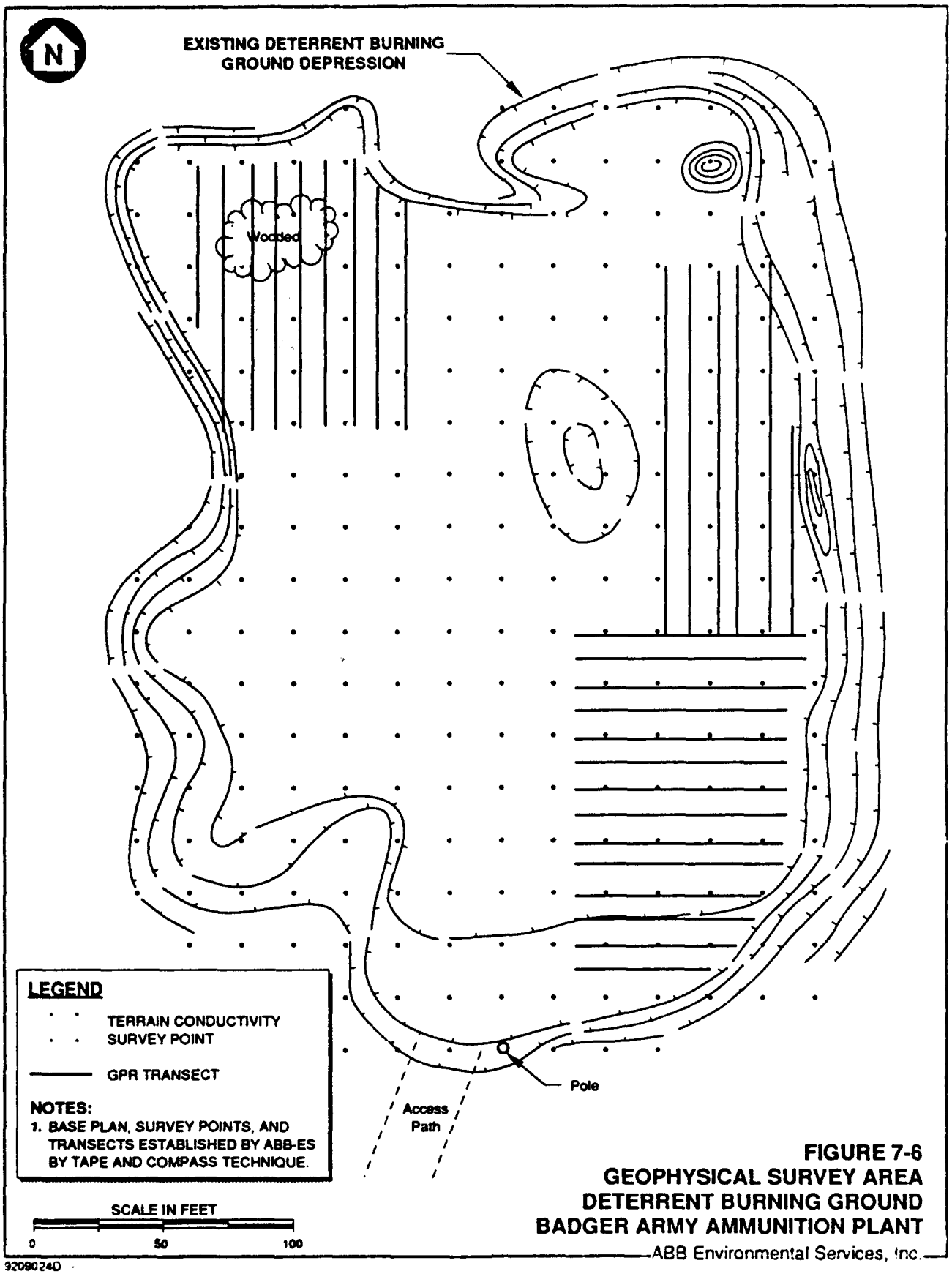

FIGURE 7-6
GEOPHYSICAL SURVEY AREA
DETERRENT BURNING GROUND
BADGER ARMY AMMUNITION PLANT

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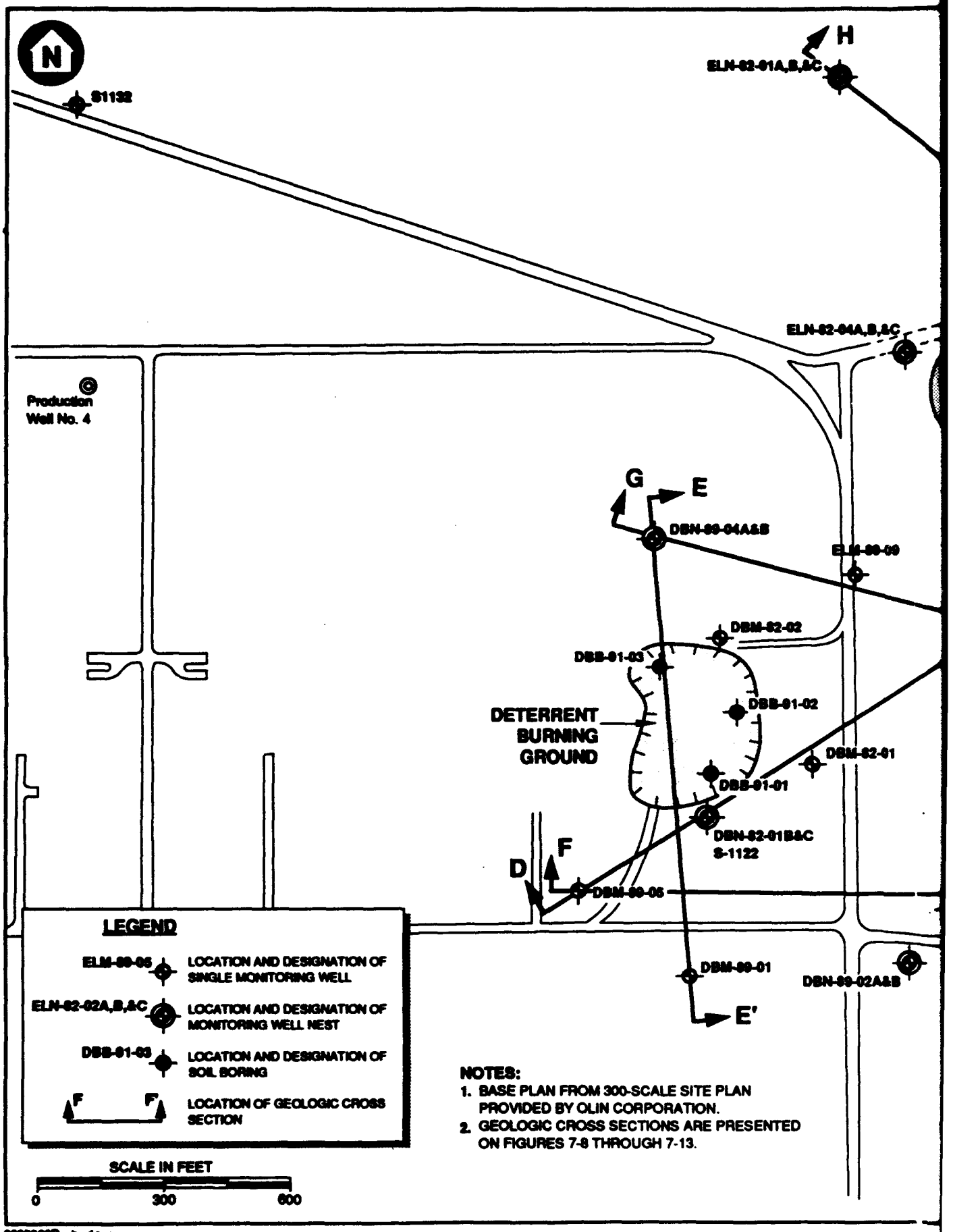

NOTES:
1. BASE PLAN FROM 300-SCALE SITE PLAN PROVIDED BY OLIN CORPORATION.
2. GEOLOGIC CROSS SECTIONS ARE PRESENTED ON FIGURES 7-8 THROUGH 7-13.

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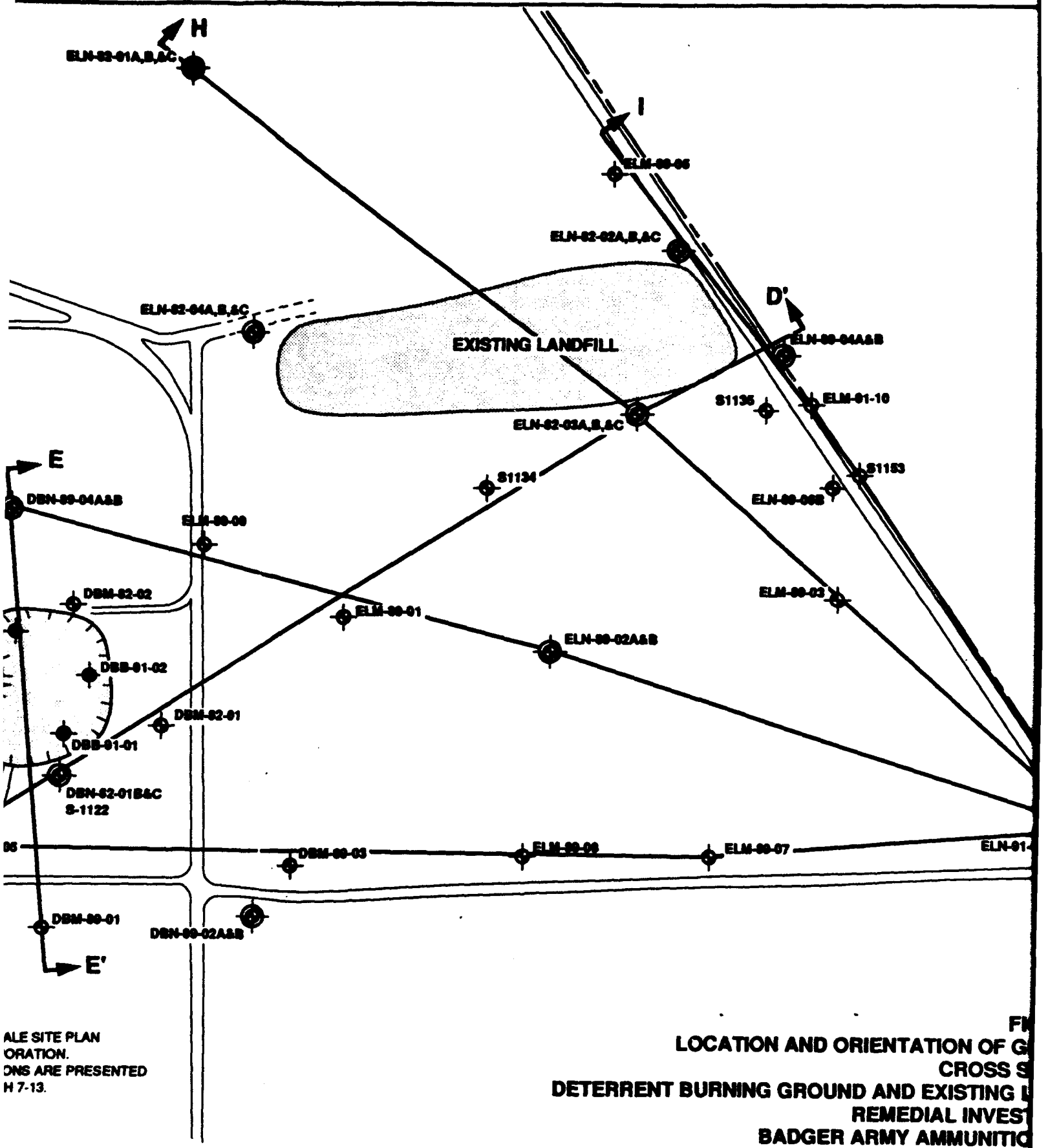

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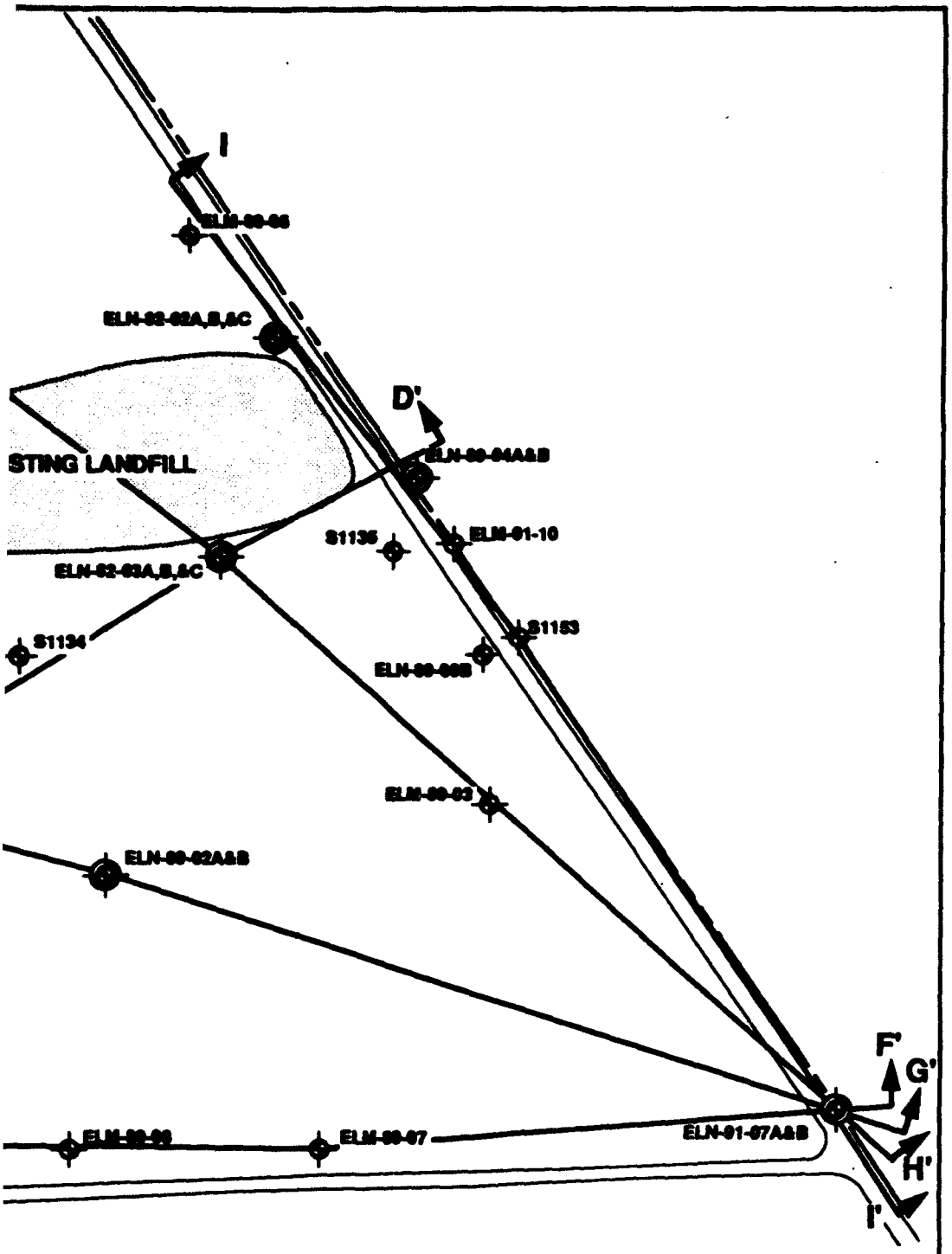
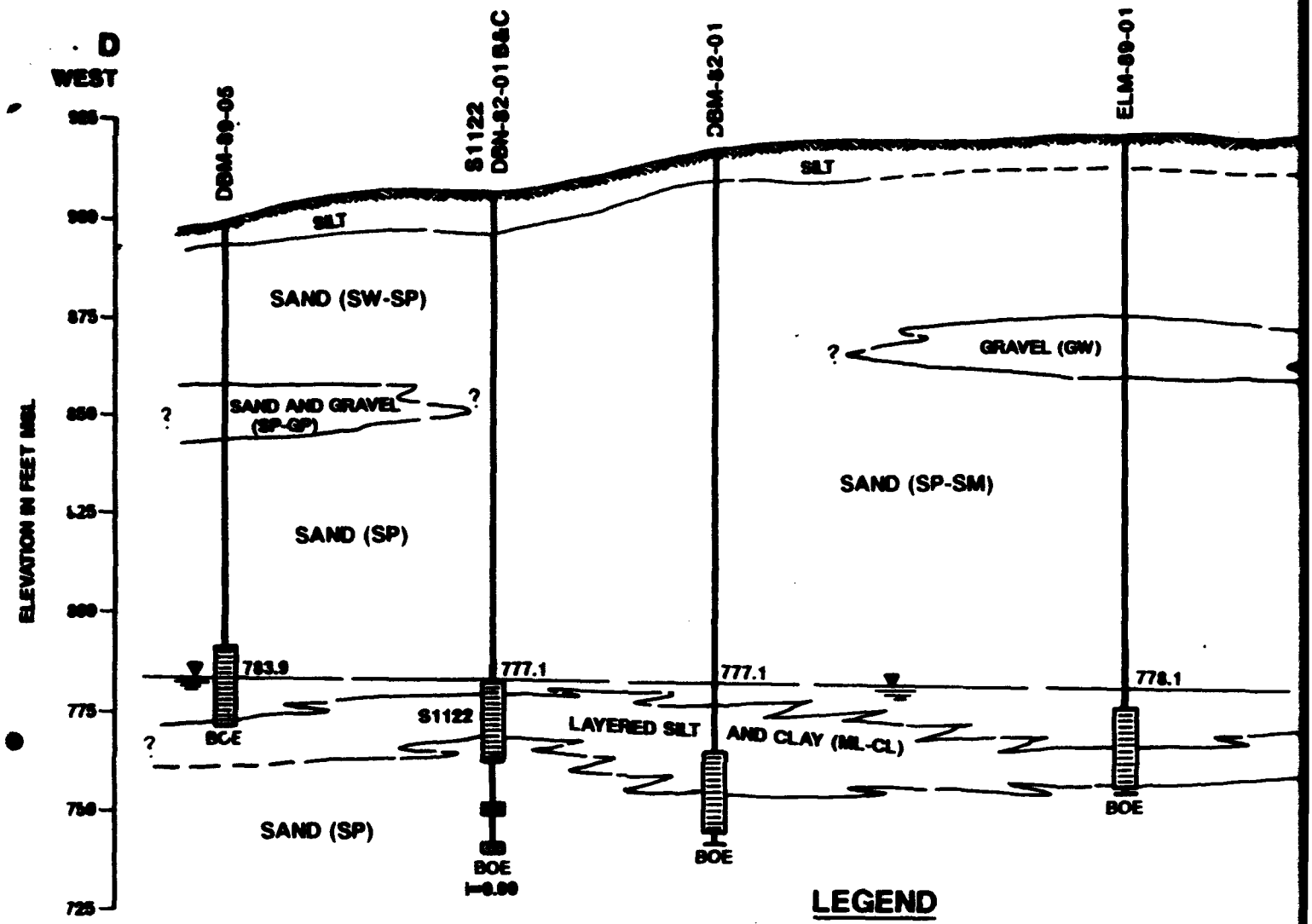


FIGURE 7-7
LOCATION AND ORIENTATION OF GEOLOGIC CROSS SECTIONS
DETERRENT BURNING GROUND AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



NOTES

1. SEE FIGURE 7-7 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. ON MULTIPLE WELL NESTS, GRADIENTS ARE LISTED IN ORDER OF SHALLOW TO DEEP WELLS; i.e., A TO B, B TO C, C TO D.
4. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91 ARE LISTED.
5. WATER LEVEL IN S1122 REFLECTS A COMBINATION OF BOTH SHALLOW AND DEEP FLOW SYSTEMS.
6. LAYERED SILT AND CLAY GRADES TO FINE SAND AND BECOMES DISCONTINUOUS EAST OF ELN-92-03C.

LEGEND

DBN-89-04A,B&C	WELL DESIGNATION; SUFFIXES REFE WATER TABLE WELL (A) AND PIEZO
(OFFSET 120 FEET SOUTH)	OFFSET DISTANCE OF WELL FROM T
	GROUND SURFACE
SAND WITH GRAVEL (SP)	SOILS DESCRIPTION AND USCS CLASSIFICATION
780.3	WATER TABLE ELEVATION
	SCREENED INTERVAL
K= 5E-3	IN-FIELD PERMEABILITY TEST RESU
BOE	BOTTOM OF EXPLORATION
i=0.05 ft/ft	GROUNDWATER VERTICAL GRADIEN

ALE

0 200 400 FEET

VERTICAL EXAGGERATION 1:5

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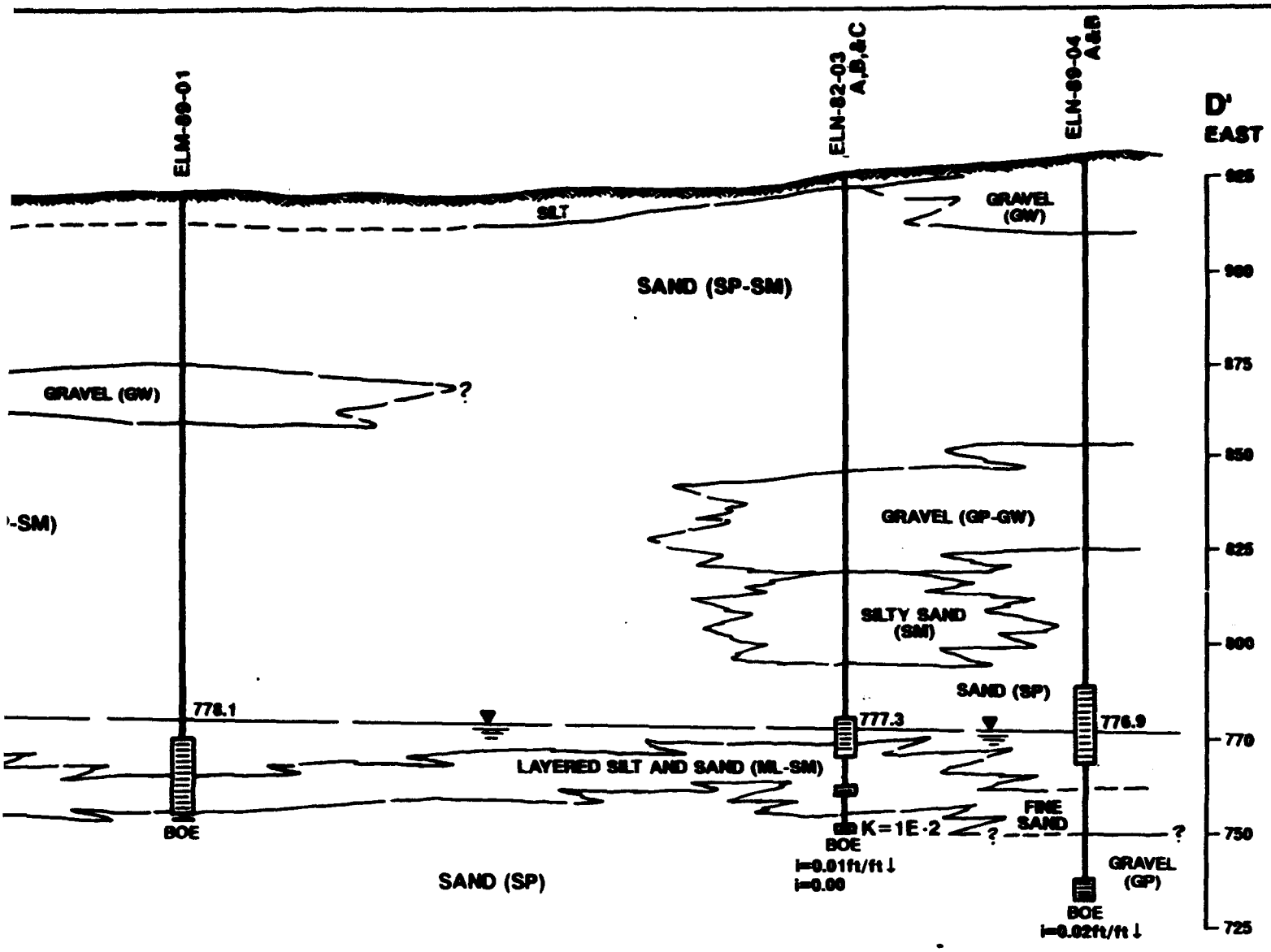

WELL DESIGNATION; SUFFIXES REFER TO WATER TABLE WELL (A) AND PIEZOMETER (B&C)

OFFSET DISTANCE OF WELL FROM TRANSECT

GROUND SURFACE

SOILS DESCRIPTION AND USCS CLASSIFICATION

WATER TABLE ELEVATION

SCREENED INTERVAL

IN-FIELD PERMEABILITY TEST RESULT IN cm/sec

BOTTOM OF EXPLORATION

GROUNDWATER VERTICAL GRADIENT

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DETERRENT BURNING GROUND AND EXISTING

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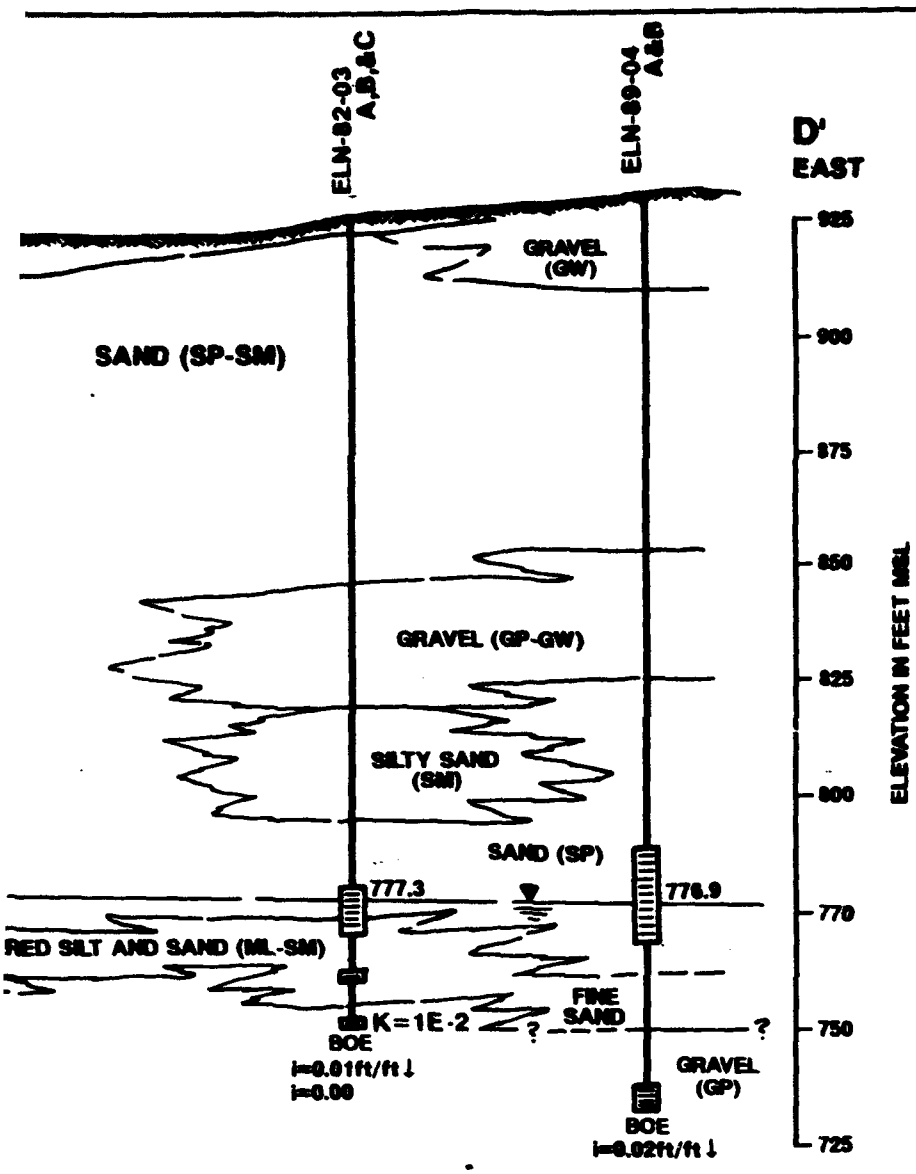
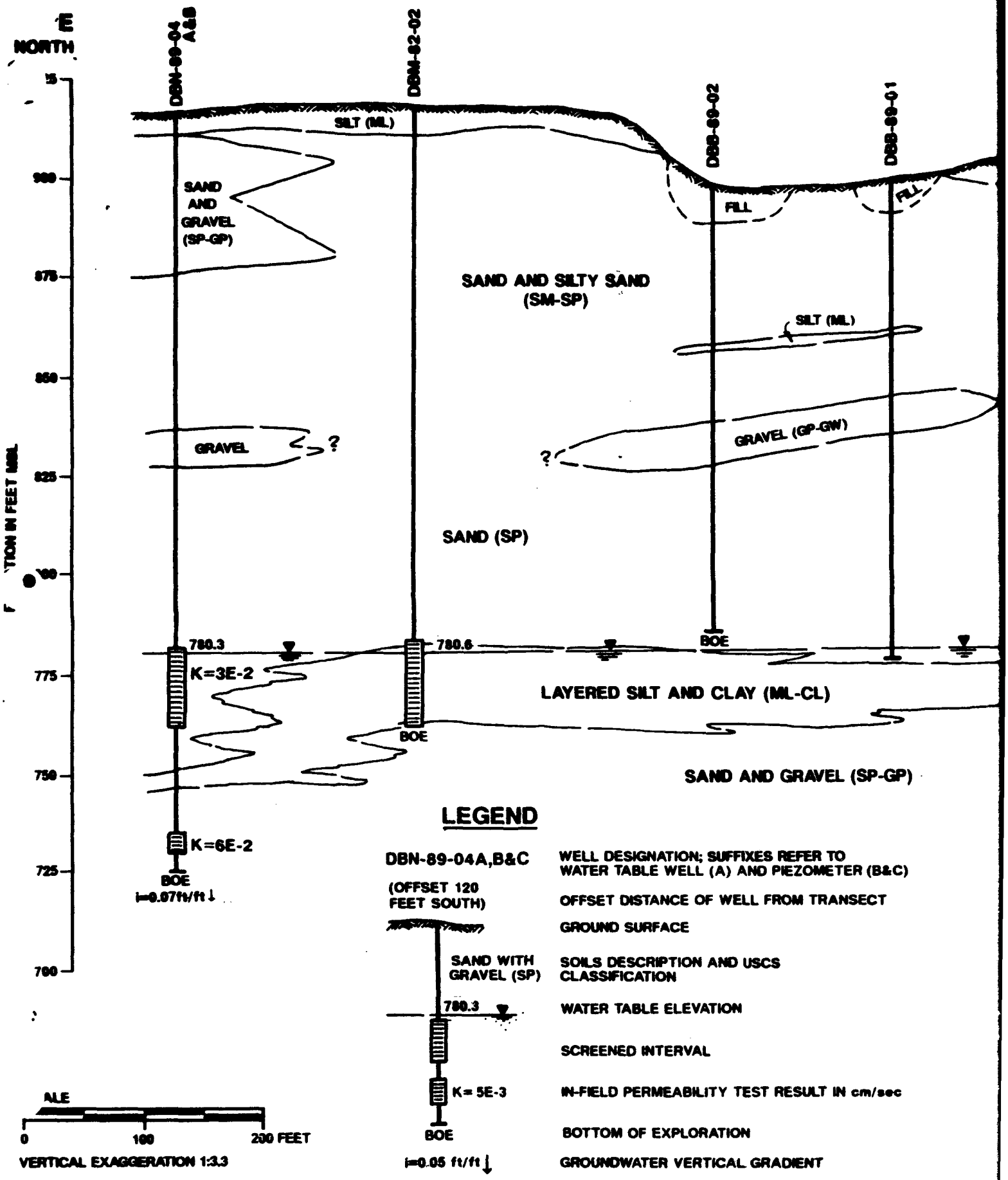
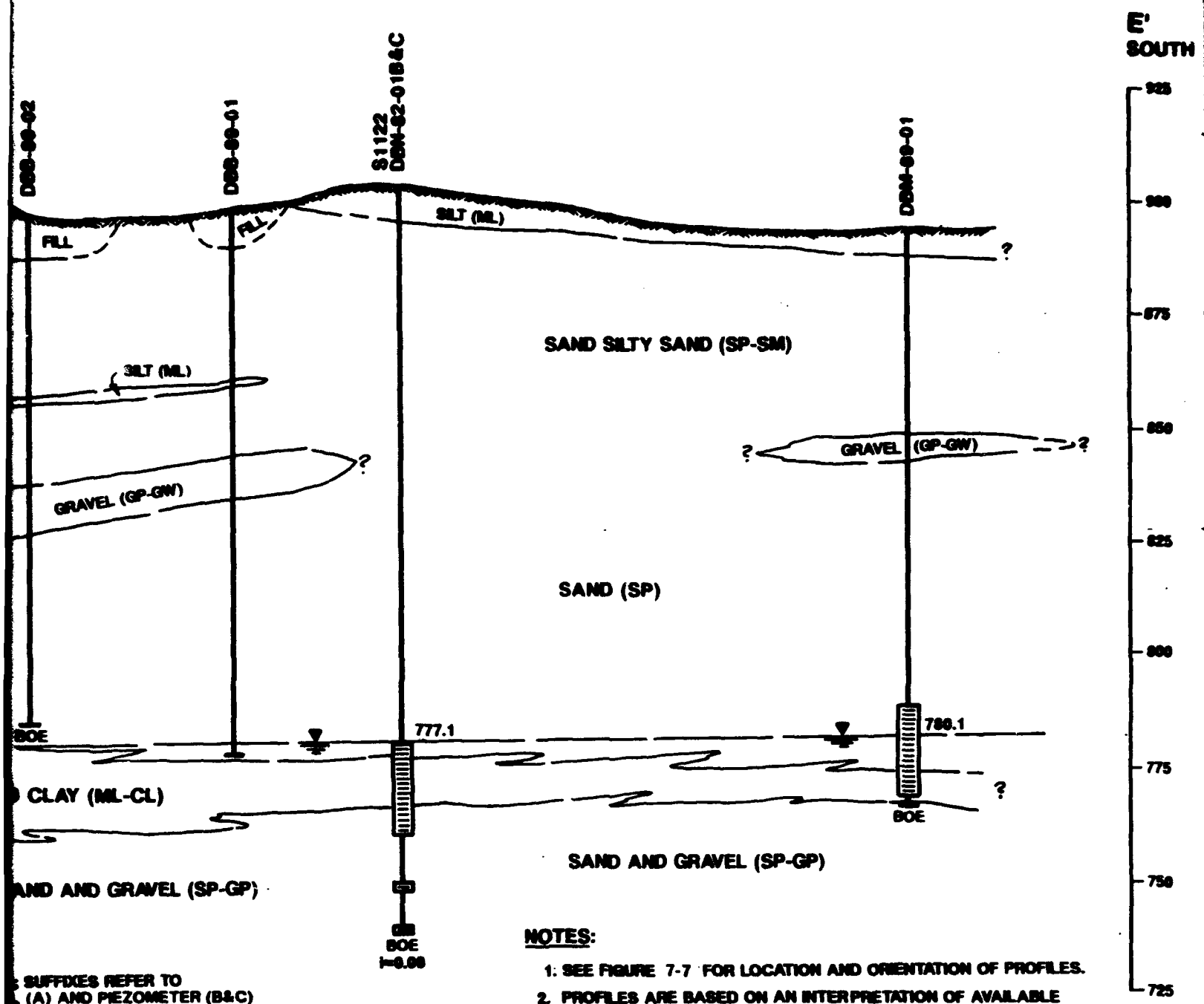


FIGURE 7-8
GEOLOGIC CROSS SECTION D-D'
DETERRENT BURNING GROUND AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.


NORTH
DBN-89-04 A&B
DBN-82-02
DBB-89-02
DBB-89-01
SILT (ML)
SAND AND GRAVEL (SP-GP)
FILL
FILL
SAND AND SILTY SAND (SM-SP)
SILT (ML)
GRAVEL
?
?
GRAVEL (GP-GW)
SAND (SP)
780.3
780.6
BOE
K=3E-2
LAYERED SILT AND CLAY (ML-CL)
BOE
SAND AND GRAVEL (SP-GP)
K=6E-2
BOE
i=0.07ft/ft
ELEVATION IN FEET MSL
875
850
825
775
750
725
700
LEGEND
DBN-89-04A,B&C
WELL DESIGNATION; SUFFIXES REFER TO WATER TABLE WELL (A) AND PIEZOMETER (B&C)
(OFFSET 120 FEET SOUTH)
OFFSET DISTANCE OF WELL FROM TRANSECT
GROUND SURFACE
SAND WITH GRAVEL (SP)
SOILS DESCRIPTION AND USCS CLASSIFICATION
780.3
WATER TABLE ELEVATION
SCREENED INTERVAL
K= 5E-3
IN-FIELD PERMEABILITY TEST RESULT IN cm/sec
BOE
BOTTOM OF EXPLORATION
i=0.05 ft/ft
GROUNDWATER VERTICAL GRADIENT
SCALE
0
100
200 FEET
VERTICAL EXAGGERATION 1:3.3

2



SUFFIXES REFER TO
(A) AND PIEZOMETER (B&C)
OF WELL FROM TRANSECT

AND USCS

ATION

L

ITY TEST RESULT IN cm/sec

RATION

TICAL GRADIENT

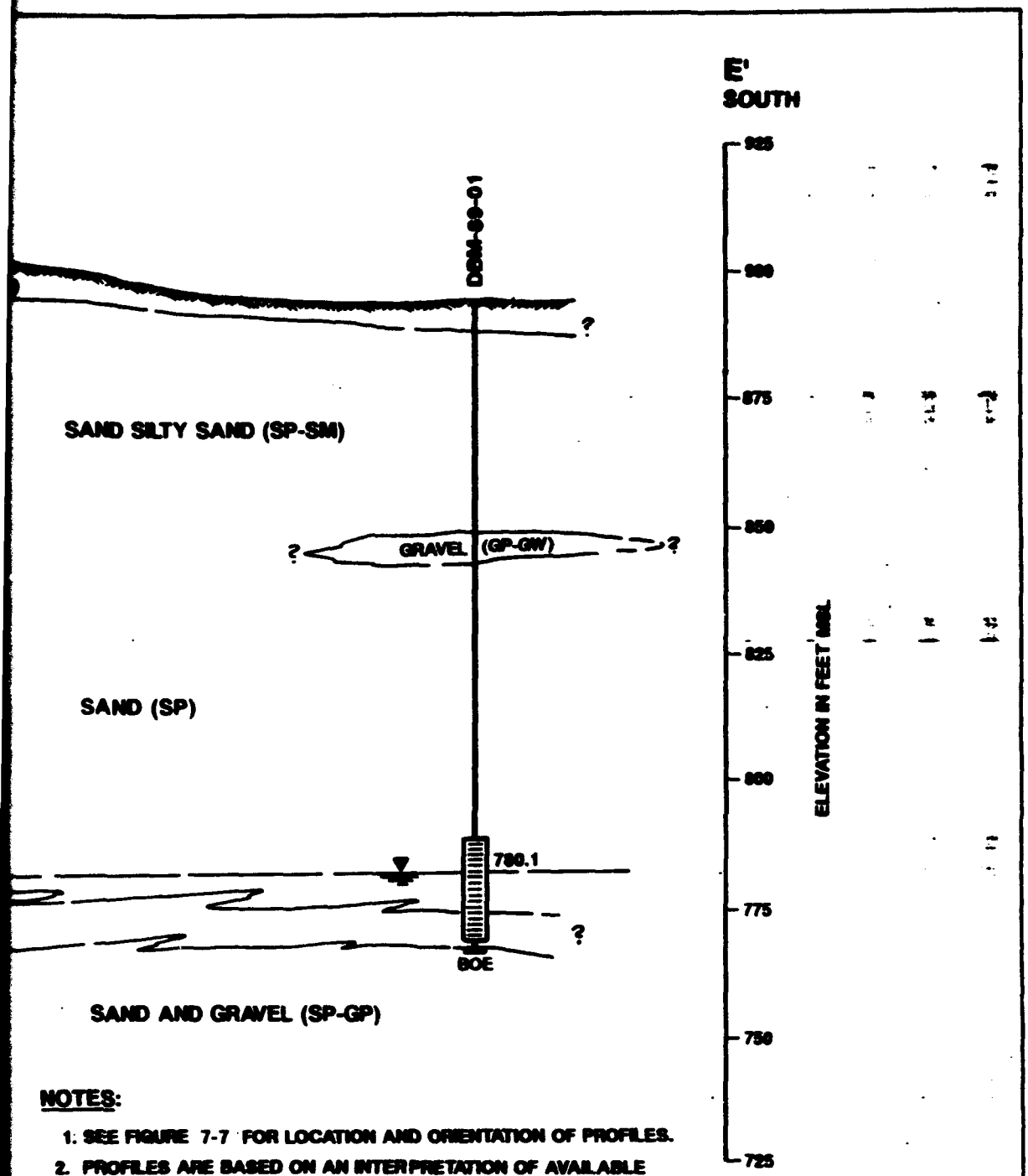
NOTES:

1. SEE FIGURE 7-7 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. ON MULTIPLE WELL NESTS, GRADIENTS ARE LISTED IN ORDER OF SHALLOW TO DEEP WELLS; i.e., A TO B, B TO C, C TO D.
4. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91 ARE LISTED.
5. WATER LEVEL AT S1122 REFLECTS A COMBINATION OF BOTH SHALLOW AND DEEP FLOW SYSTEMS.
6. LAYERED SILT AND CLAY IS DISCONTINUOUS IN SOME AREAS.

F

GEOLOGIC CROSS SEC
DETERRENT BURNING GROUND AND EXISTING
REMEDIAL INVES
BADGER ARMY AMMUNITI

ABB Environmental S

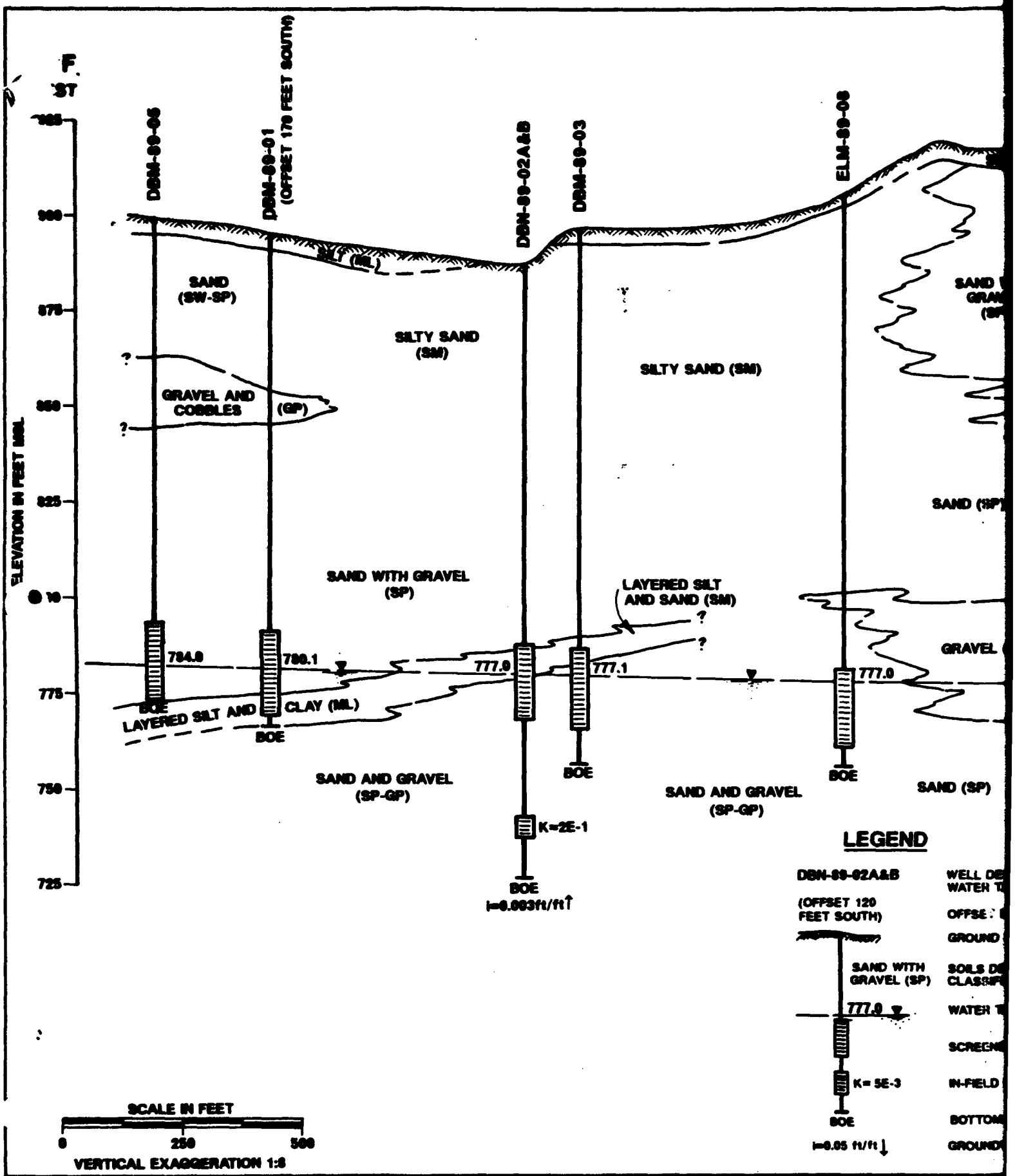


NOTES:

1. SEE FIGURE 7-7 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. ON MULTIPLE WELL NESTS, GRADIENTS ARE LISTED IN ORDER OF SHALLOW TO DEEP WELLS; i.e., A TO B, B TO C, C TO D.
4. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91 ARE LISTED.
5. WATER LEVEL AT S1122 REFLECTS A COMBINATION OF BOTH SHALLOW AND DEEP FLOW SYSTEMS.
6. LAYERED SILT AND CLAY IS DISCONTINUOUS IN SOME AREAS.

FIGURE 7-9
GEOLOGIC CROSS SECTION E-E'
DETERRENT BURNING GROUND AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



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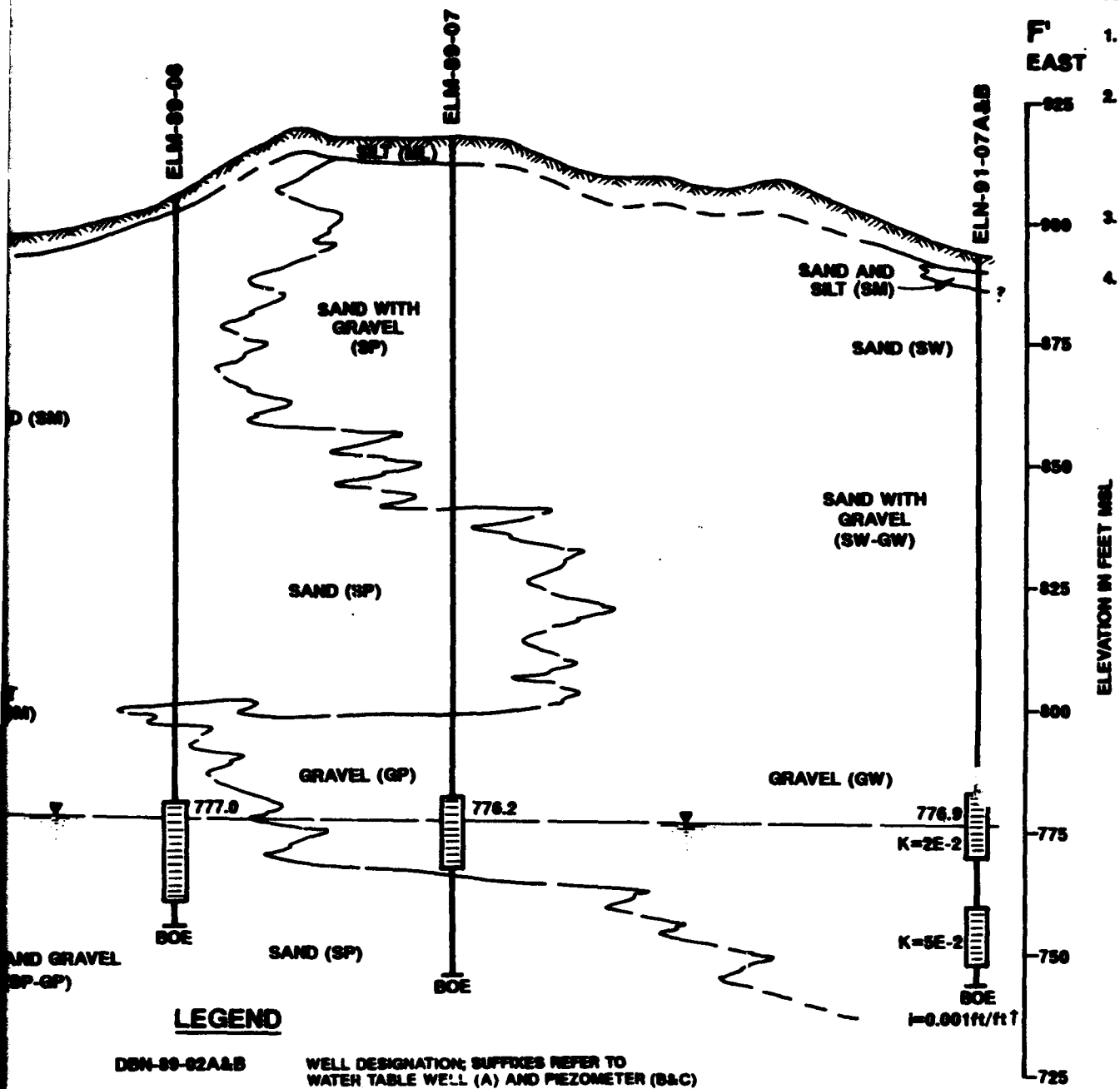


NOTES:

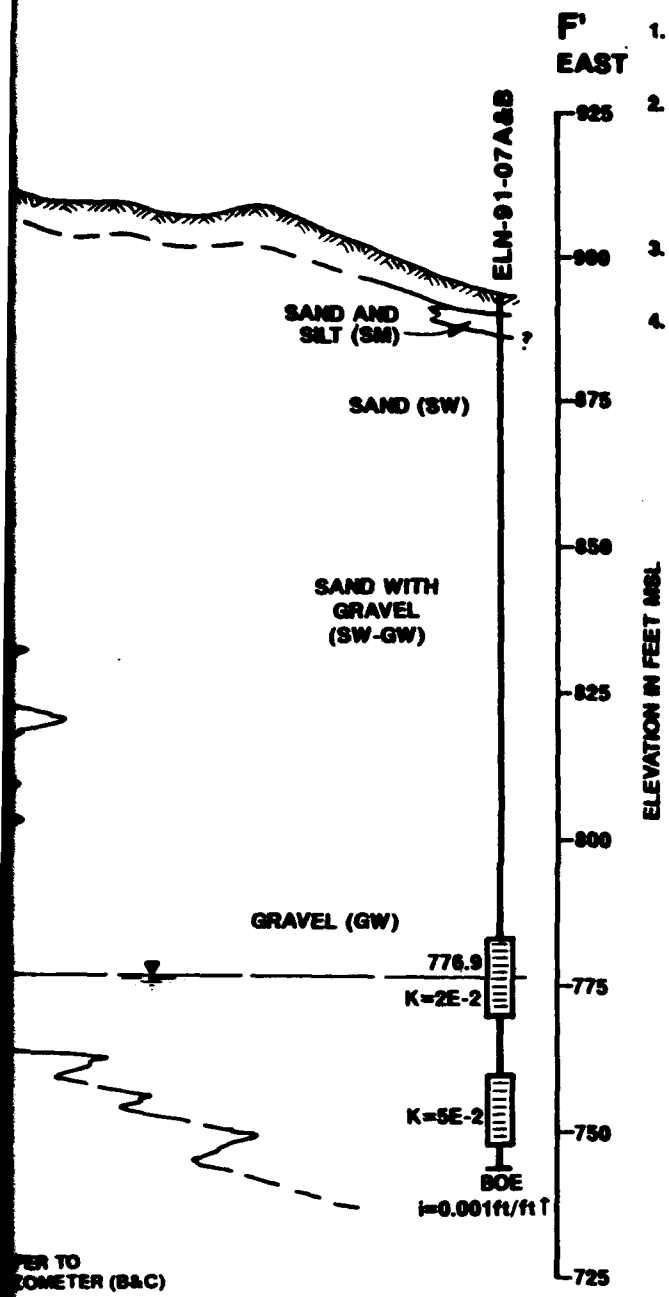
1. SEE FIGURE 7-7 FOR LOC ORIENTATION OF PROFIL
2. PROFILES ARE BASED ON INTERPRETATION OF AVA SUBSURFACE DATA. ACT BETWEEN EXPLORATION THOSE SHOWN.
3. WATER LEVELS MEASURE TABLE WELLS ON 12/15/91
4. LAYERED SILT AND CLAY SAND AND BECOMES DISC EAST OF DBN-89-02B.

LEGEND

DBN-89-02A&B	WELL DESIGNATION; SUFFIXES REFER TO WATER TABLE WELL (A) AND PIEZOMETER (B&C)
(OFFSET 120 FEET SOUTH)	OFFSET DISTANCE OF WELL FROM TRANSECT
	GROUND SURFACE
SAND WITH GRAVEL (SP)	SOILS DESCRIPTION AND USCS CLASSIFICATION
777.0	WATER TABLE ELEVATION
	SCREENED INTERVAL
K= 5E-3	IN-FIELD PERMEABILITY TEST RESULT IN cm/sec
BOE	BOTTOM OF EXPLORATION
i=0.05 ft/ft	GROUNDWATER VERTICAL GRADIENT

FIGUR
GEOLOGIC CROSS SECTI
DETERRENT BURNING GROUND AND EXISTING LA
REMEDIAL INVESTIG
BADGER ARMY AMMUNITION

ABB Environmental Servi



NOTES:

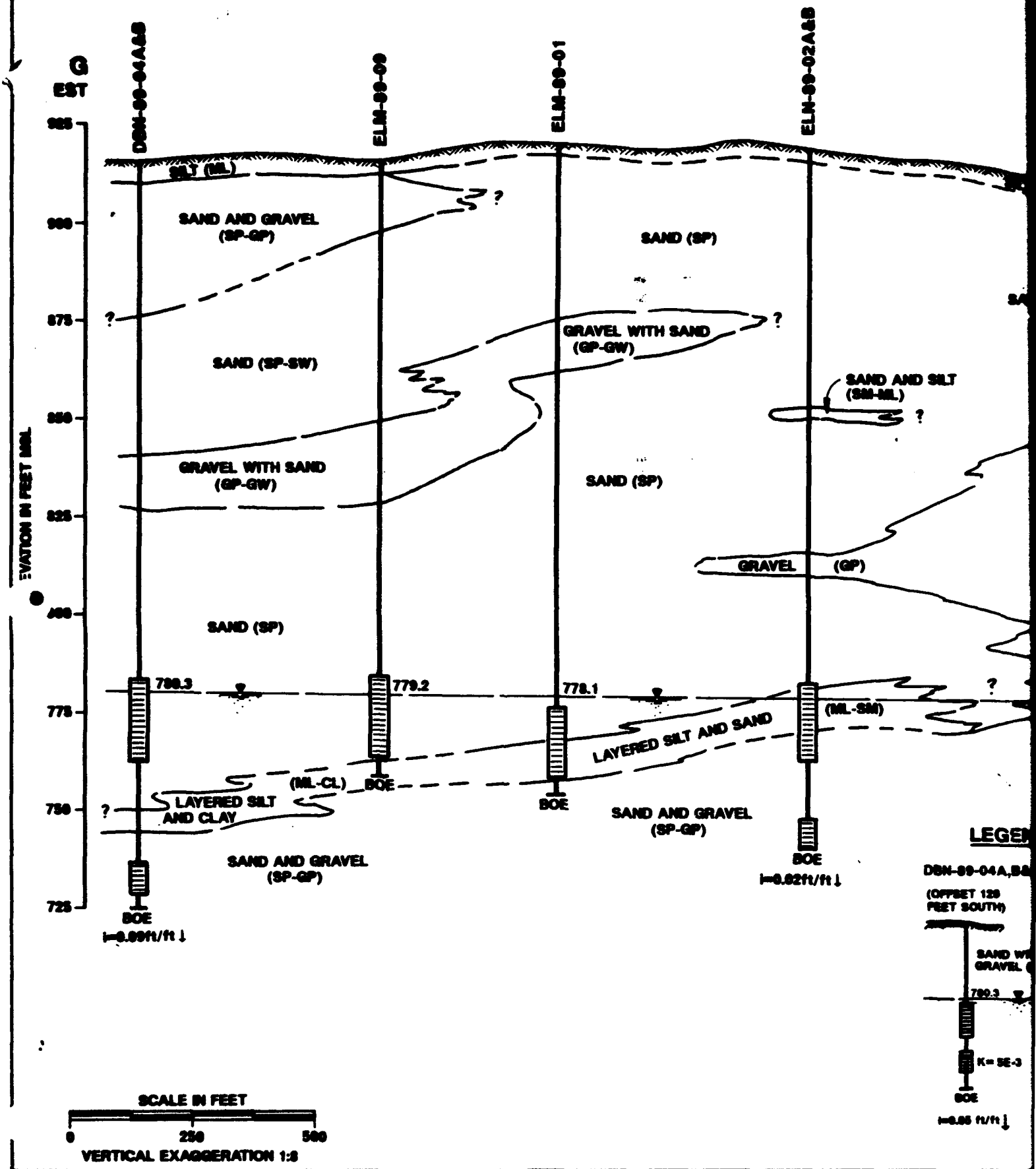
1. SEE FIGURE 7-7 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91 ARE LISTED.
4. LAYERED SILT AND CLAY GRADES TO SILTY SAND AND BECOMES DISCONTINUOUS EAST OF DBN-90-02B.

ER TO
OMETER (B&C)
TRANSECT

ULT IN cm/sec

ENT

FIGURE 7-10
GEOLOGIC CROSS SECTION F-F'
DETERRENT BURNING GROUND AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT
ABB Environmental Services, Inc.



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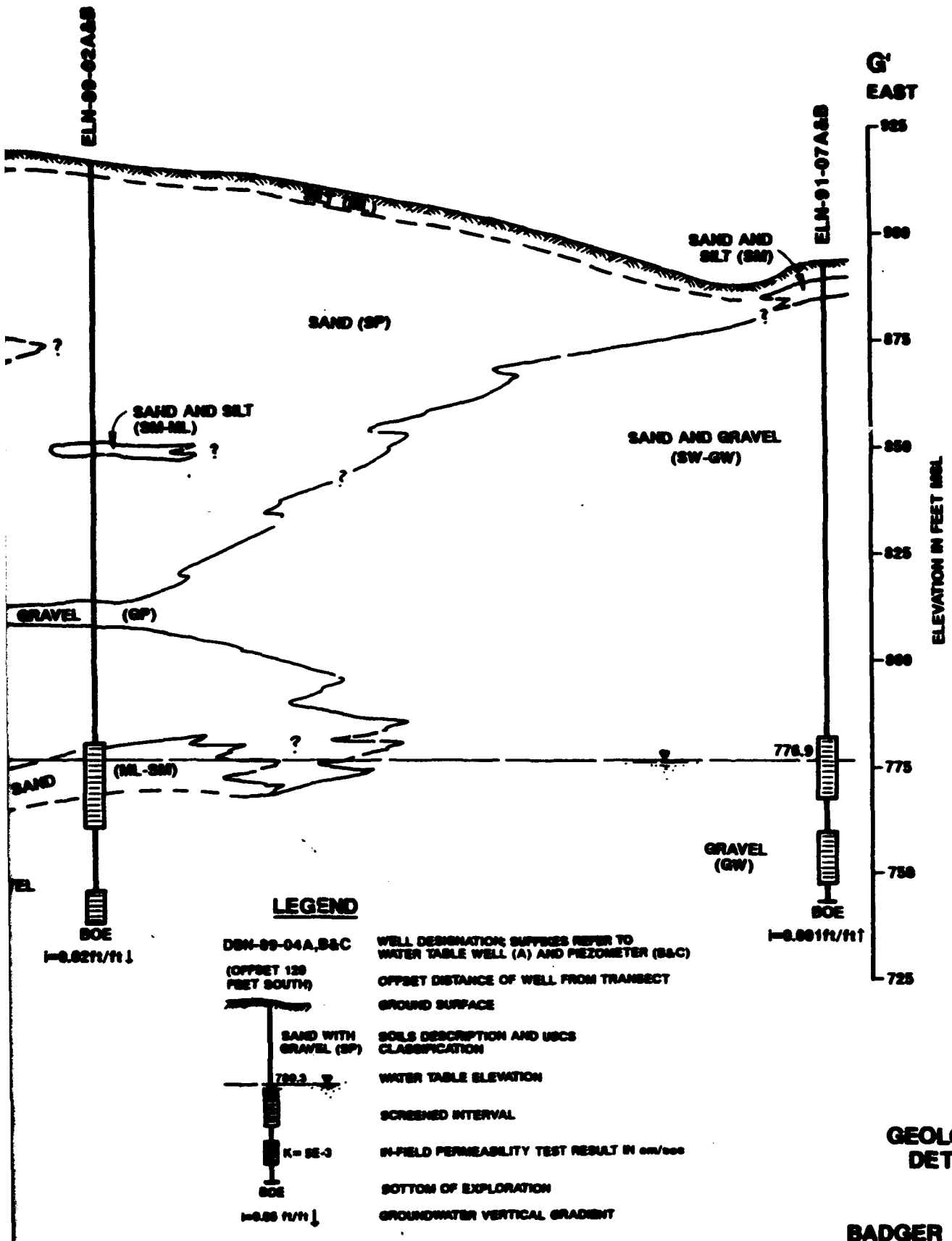
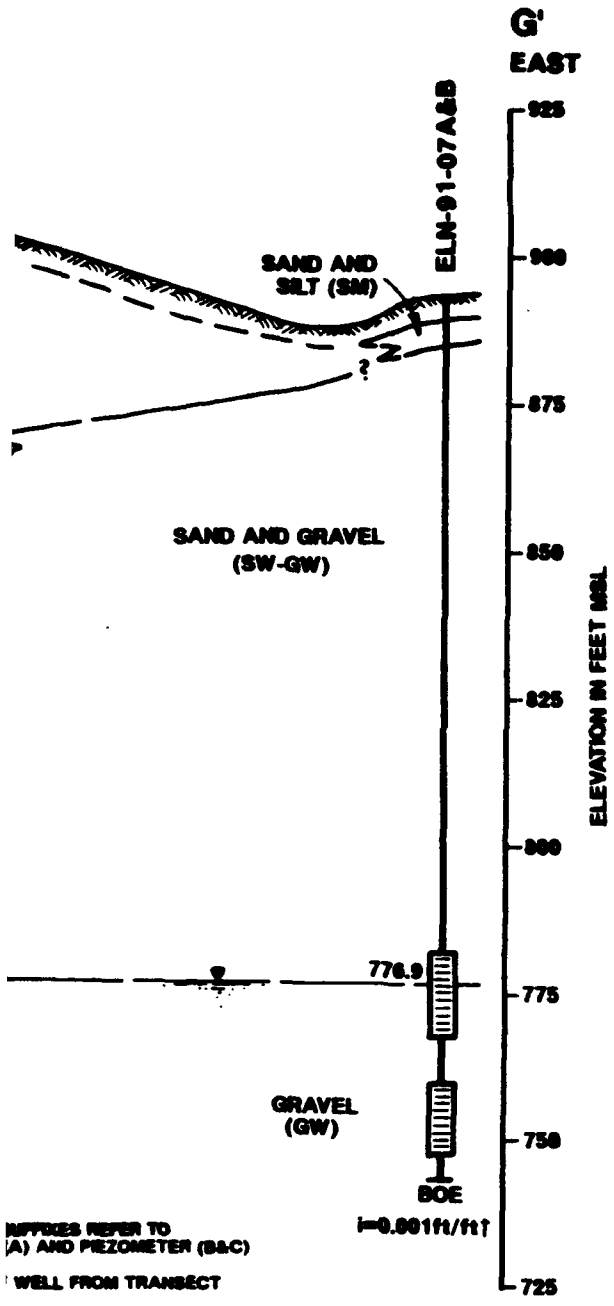


NOTES:

1. SEE FIGURE 7-7 FOR LOC ORIENTATION OF PROFILE
2. PROFILES ARE BASED ON INTERPRETATION OF AVA SUBSURFACE DATA. ACT BETWEEN EXPLORATIONS THOSE SHOWN.
3. WATER LEVELS MEASURE TABLE WELLS ON 12/16/91
4. LAYERED SILT AND CLAY SILT AND SAND AND DISC DISCONTINUOUS EAST OF

FIGU
GEOLOGIC CROSS SECTI
DETERRENT BURNING G
AND EXISTING LA
REMEDIAL INVESTI
BADGER ARMY AMMUNITION

ABB Environmental Serv



NOTES:

1. SEE FIGURE 7-7 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91 ARE LISTED.
4. LAYERED SILT AND CLAY GRADES TO A SILT AND SAND AND BECOMES DISCONTINUOUS EAST OF ELM-89-01.

IFFIXES REFER TO
(A) AND PIEZOMETER (B&C)
WELL FROM TRANSECT

ND USCS

TION

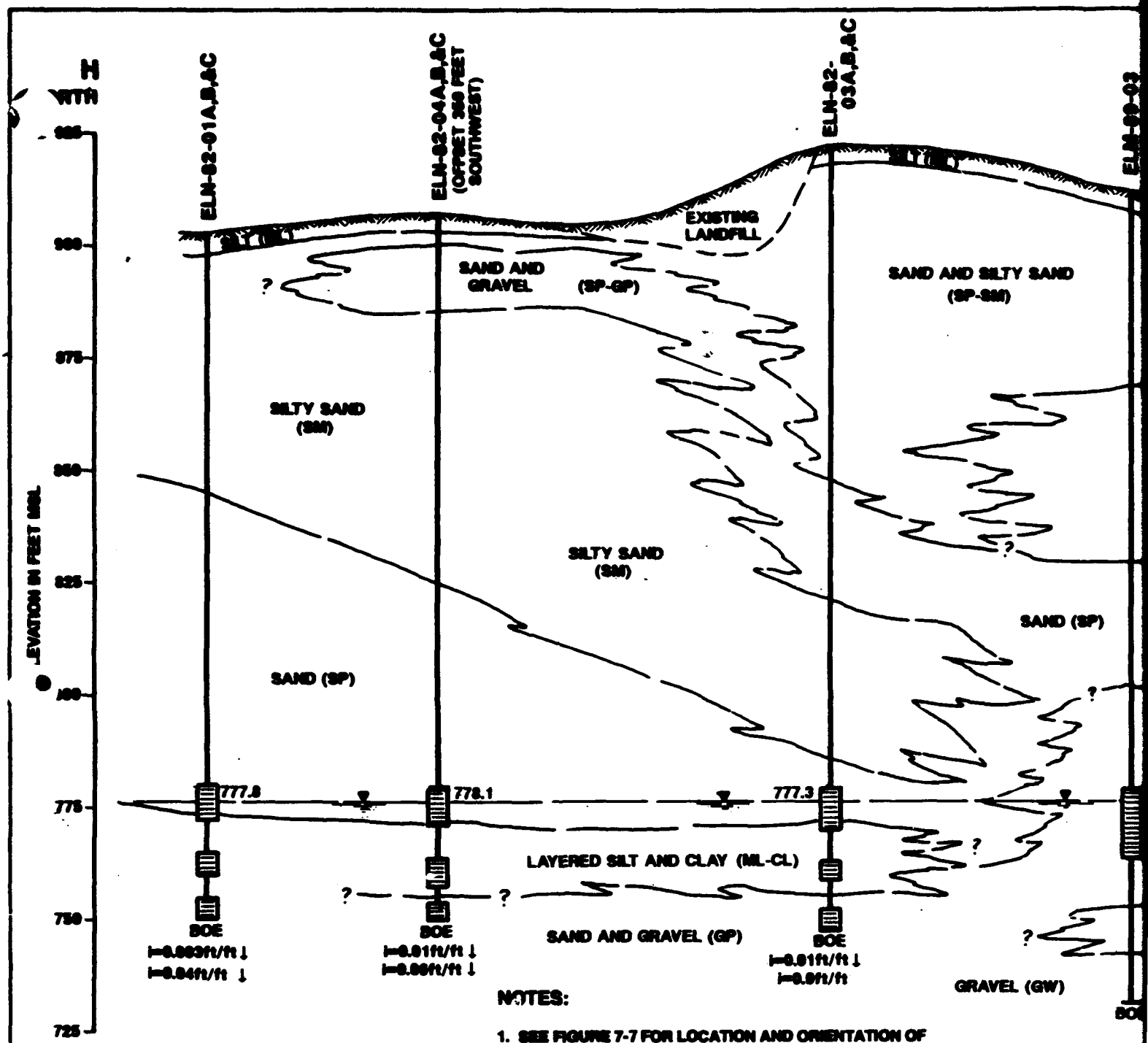
TY TEST RESULT IN cm/sec

ITION

ICAL GRADIENT

FIGURE 7-11
GEOLOGIC CROSS SECTION G-G'
DETERRENT BURNING GROUND
AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



NOTES:

1. SEE FIGURE 7-7 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. ON MULTIPLE WELL NESTS, GRADIENTS ARE LISTED IN ORDER OF SHALLOW TO DEEP WELLS; i.e., A TO B, B TO C, C TO D.
4. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91 ARE LISTED.
5. LAYERED SILT AND CLAY GRADES TO SAND (SW) SOUTHEAST OF ELN-92-03C AND BECOMES DISCONTINUOUS.

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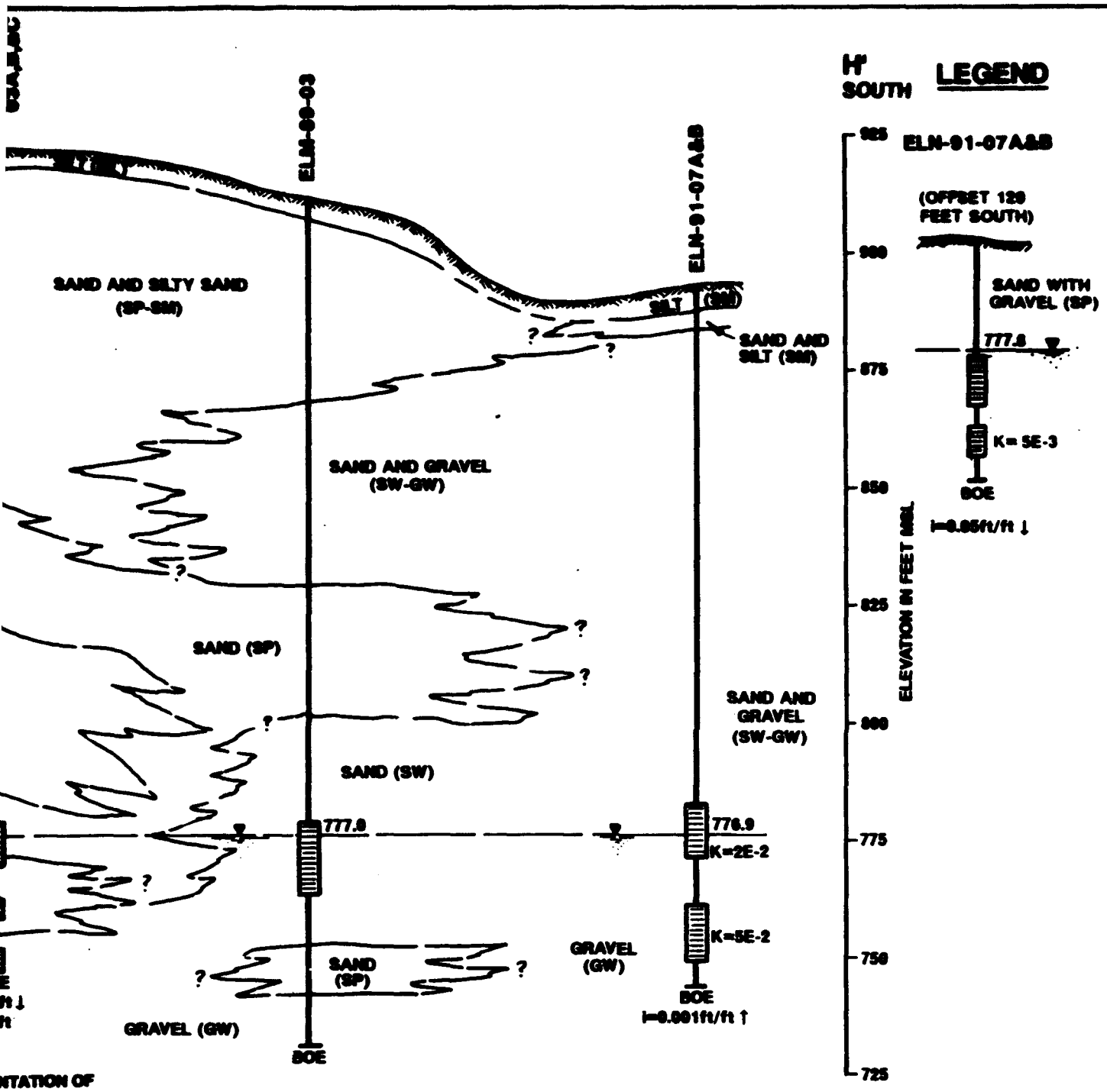
2



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S BETWEEN
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, B TO C, C TO D.

BLE WELLS ON

ND (SW) SOUTHEAST
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WELL DESIG
SUFFIXES R
TABLE WELL
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OFFSET DIS
FROM TRAN

GROUND SU

SOILS DESC
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WATER TABL

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TEST REMAI

BOTTOM OF

GROUNDWAT
GRADIENT

FIGURE
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DETERRENT BURNING GR
AND EXISTING LAN
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BADGER ARMY AMMUNITION P

ABB Environmental Servic

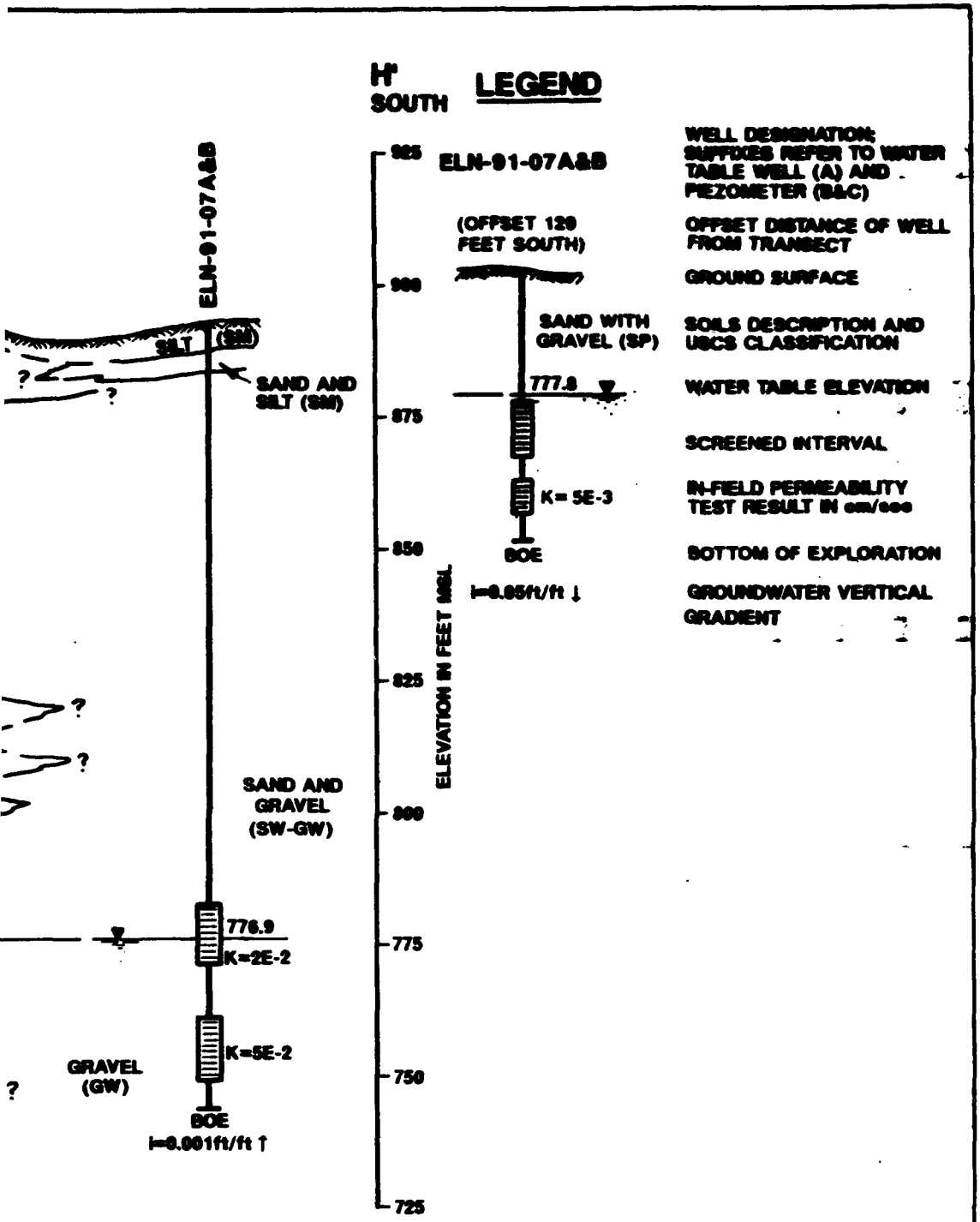
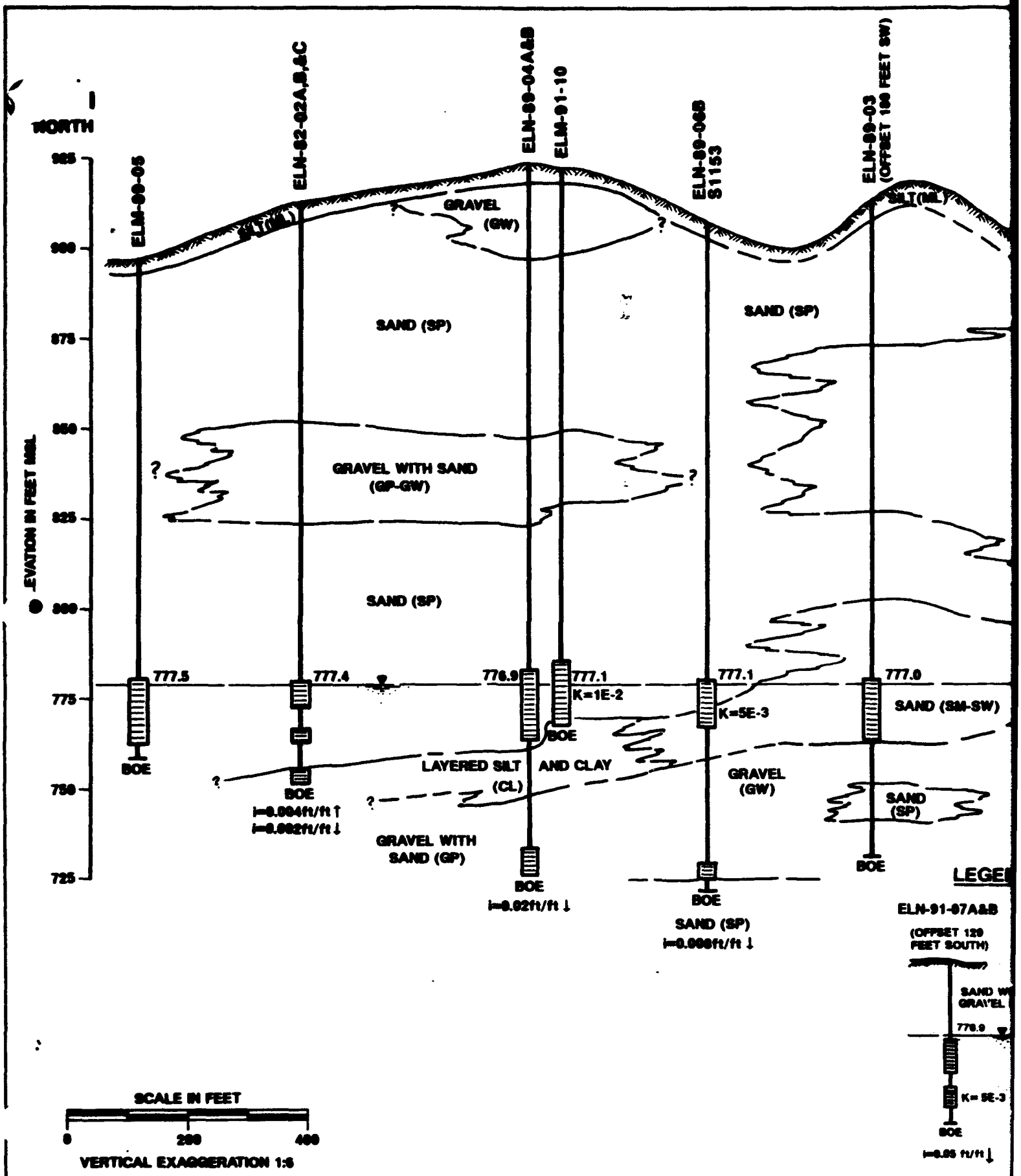


FIGURE 7-12
GEOLOGIC CROSS SECTION H-H'
DETERRENT BURNING GROUND
AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



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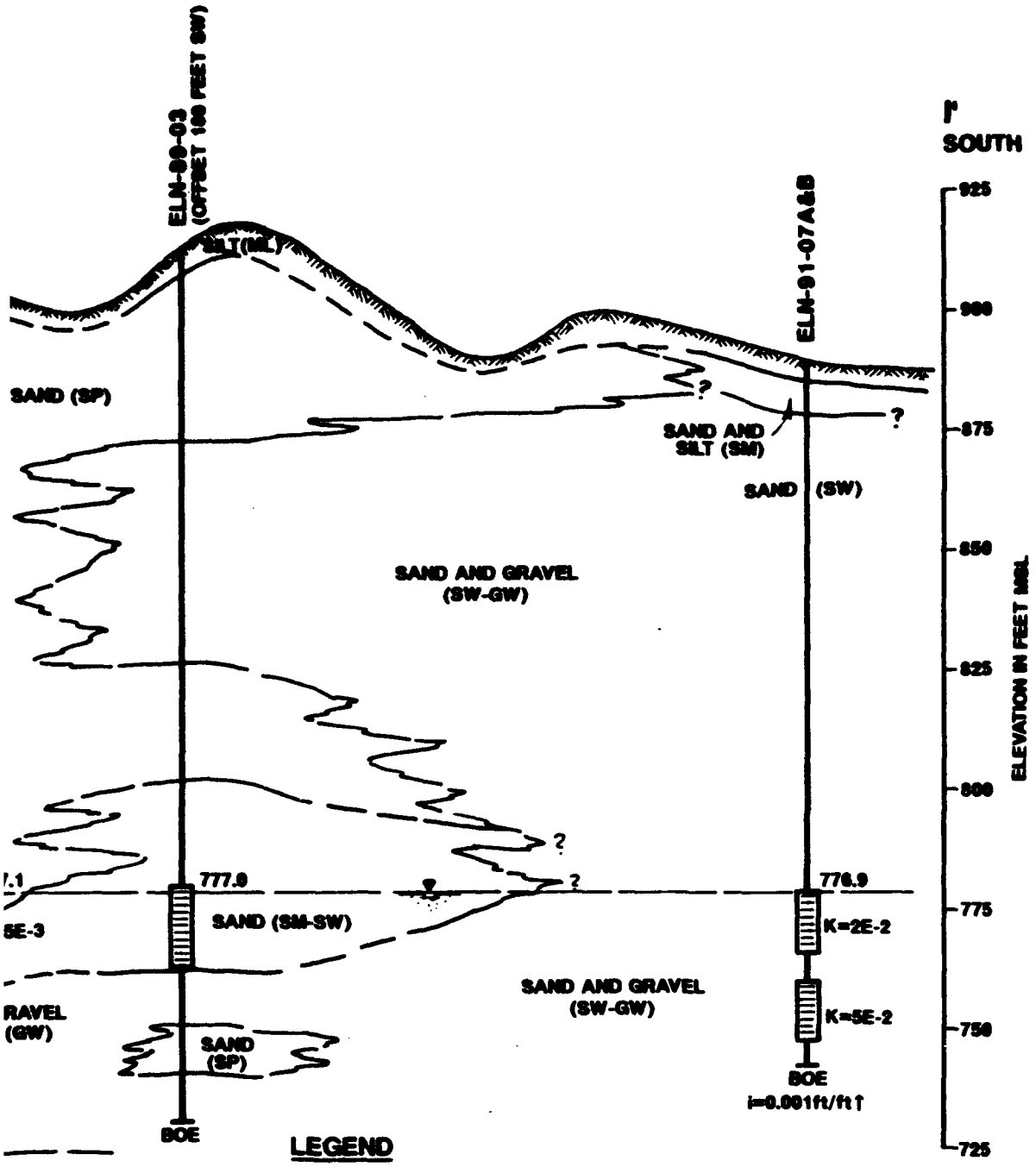


NOTES:

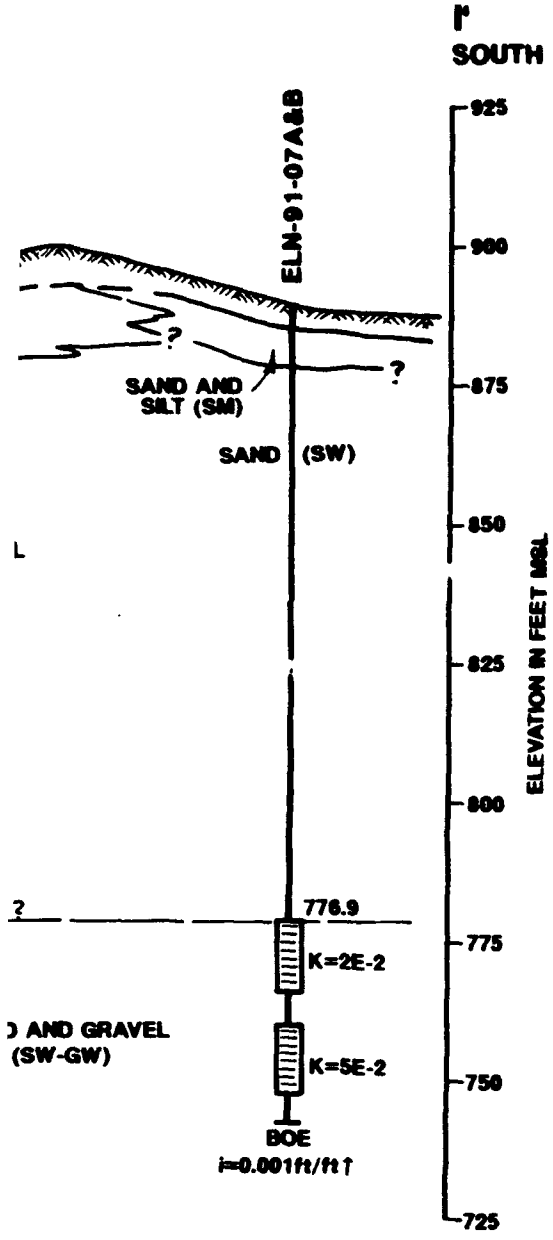
1. SEE FIGURE 7-7 FOR LOCATION OF PROFILES.
2. PROFILES ARE BASED ON AN IN OF AVAILABLE SUBSURFACE DA CONDITIONS BETWEEN EXPLOR FROM THOSE SHOWN.
3. ON MULTIPLE WELL NESTS, GRA LISTED IN ORDER OF SHALLOW i.e., A TO B, B TO C, C TO D.
4. WATER LEVELS MEASURED IN W WELLS ON 12/15/91 ARE LISTED.
5. LAYERED SILT AND CLAY SECO OUS SOUTH OF ELM-91-10 AND A GRADE TO SAND (SM-SW).

LEGEND

ELN-91-07A&B	WELL DESIGNATION; SUFFIXES REFER TO WATER TABLE WELL (A) AND PIEZOMETER (B&C)
(OFFSET 120 FEET SOUTH)	OFFSET DISTANCE OF WELL FROM TRANSECT
	GROUND SURFACE
SAND WITH GRAVEL (SP)	SOILS DESCRIPTION AND USCS CLASSIFICATION
776.9	WATER TABLE ELEVATION
	SCREENED INTERVAL
K= 5E-3	IN-FIELD PERMEABILITY TEST RESULT IN cm/sec
BOE	BOTTOM OF EXPLORATION
i=0.05 ft/ft↓	GROUNDWATER VERTICAL GRADIENT

FIGU
GEOLOGIC CROSS SEC
DETERRENT BURNING
AND EXISTING L
REMEDIAL INVEST
BADGER ARMY AMMUNITION

ABB Environmental Ser



; SUFFIXES REFER TO
. (A) AND PIEZOMETER (B&C)

OF WELL FROM TRANSECT

I AND USCS

ATION

IL

LITY TEST RESULT IN cm/sec

RATION

ITICAL GRADIENT

NOTES:

1. SEE FIGURE 7-7 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. ON MULTIPLE WELL NESTS, GRADIENTS ARE LISTED IN ORDER OF SHALLOW TO DEEP WELLS; i.e., A TO B, B TO C, C TO D.
4. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91 ARE LISTED.
5. LAYERED SILT AND CLAY BECOMES DISCONTINUOUS SOUTH OF ELM-91-10 AND APPEARS TO GRADE TO SAND (SM-SW).

FIGURE 7-13
GEOLOGIC CROSS SECTION I-I'
DETERRENT BURNING GROUND
AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

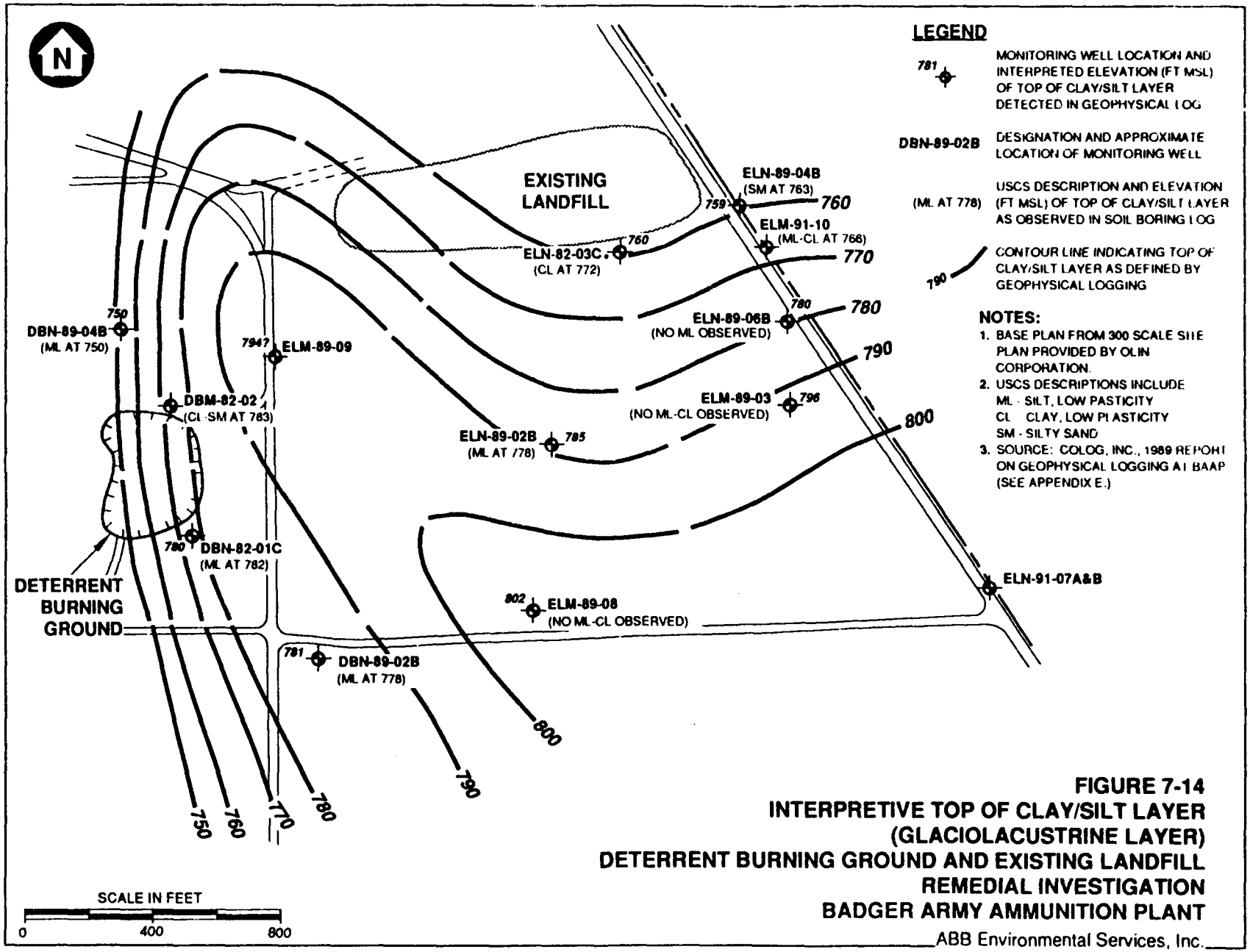


FIGURE 7-14
INTERPRETIVE TOP OF CLAY/SILT LAYER (GLACIOLACUSTRINE LAYER)
DETERRENT BURNING GROUND AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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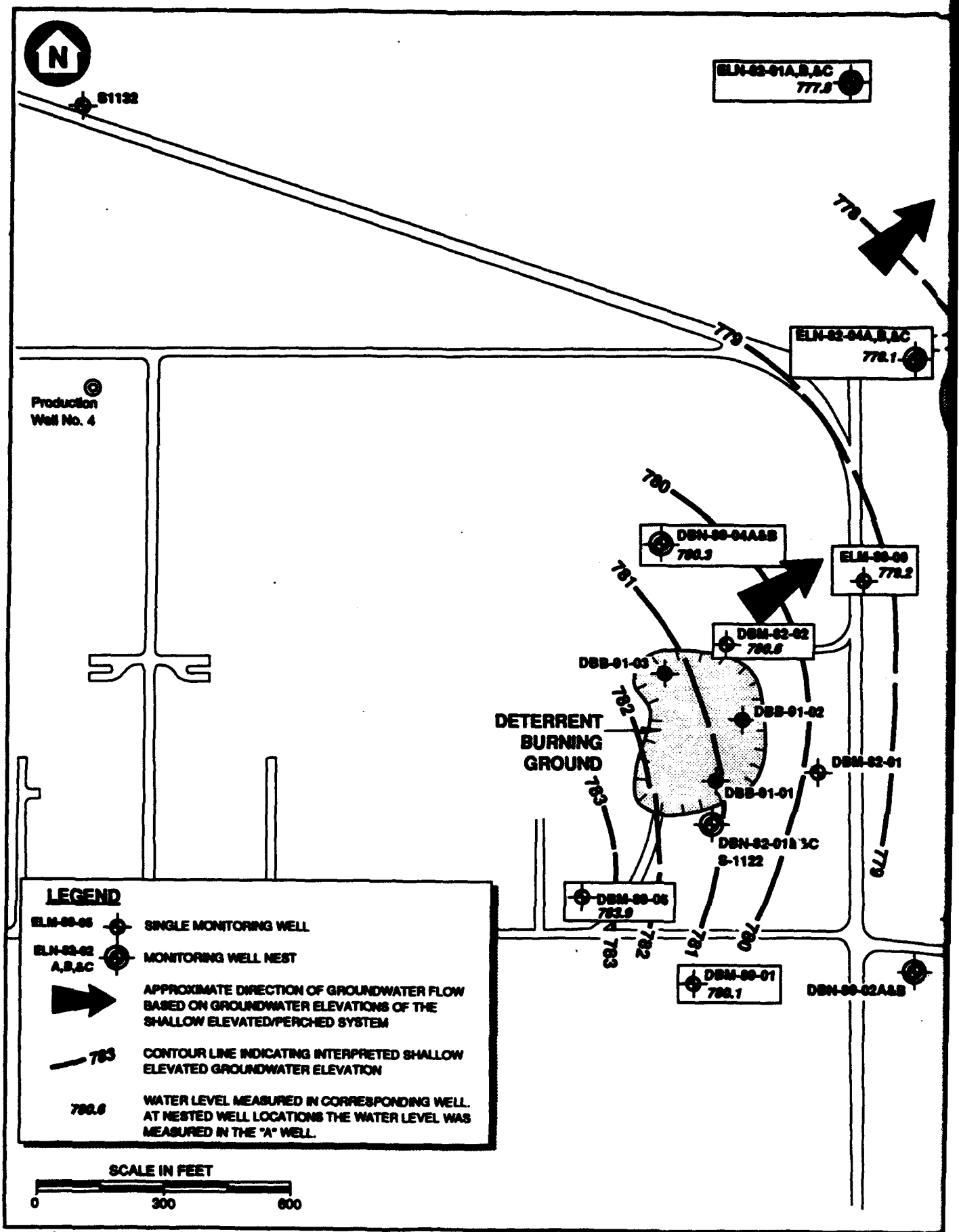

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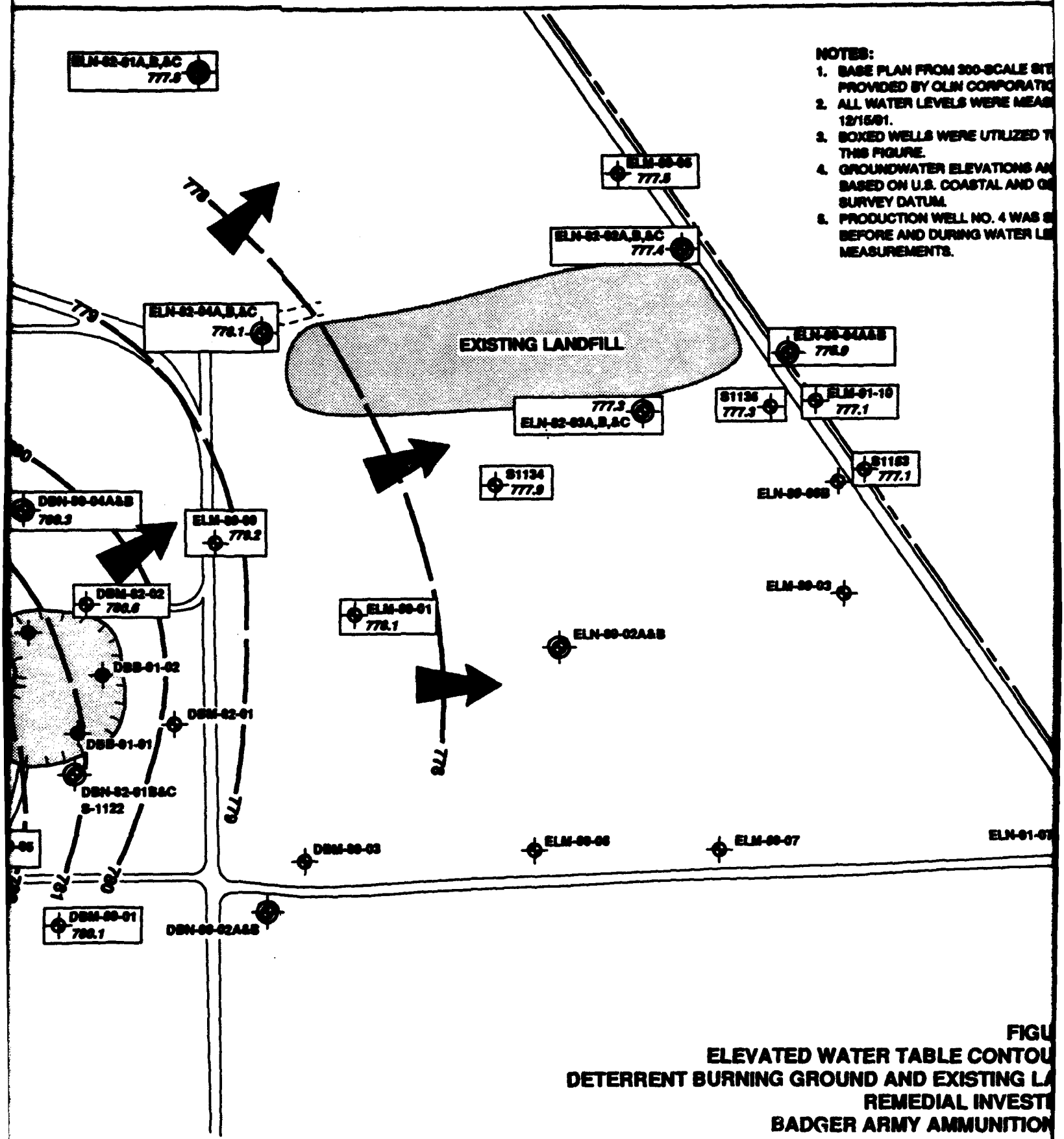

FIGU
ELEVATED WATER TABLE CONTOU
DETERRENT BURNING GROUND AND EXISTING LA
REMEDIAL INVESTI
BADGER ARMY AMMUNITION

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3

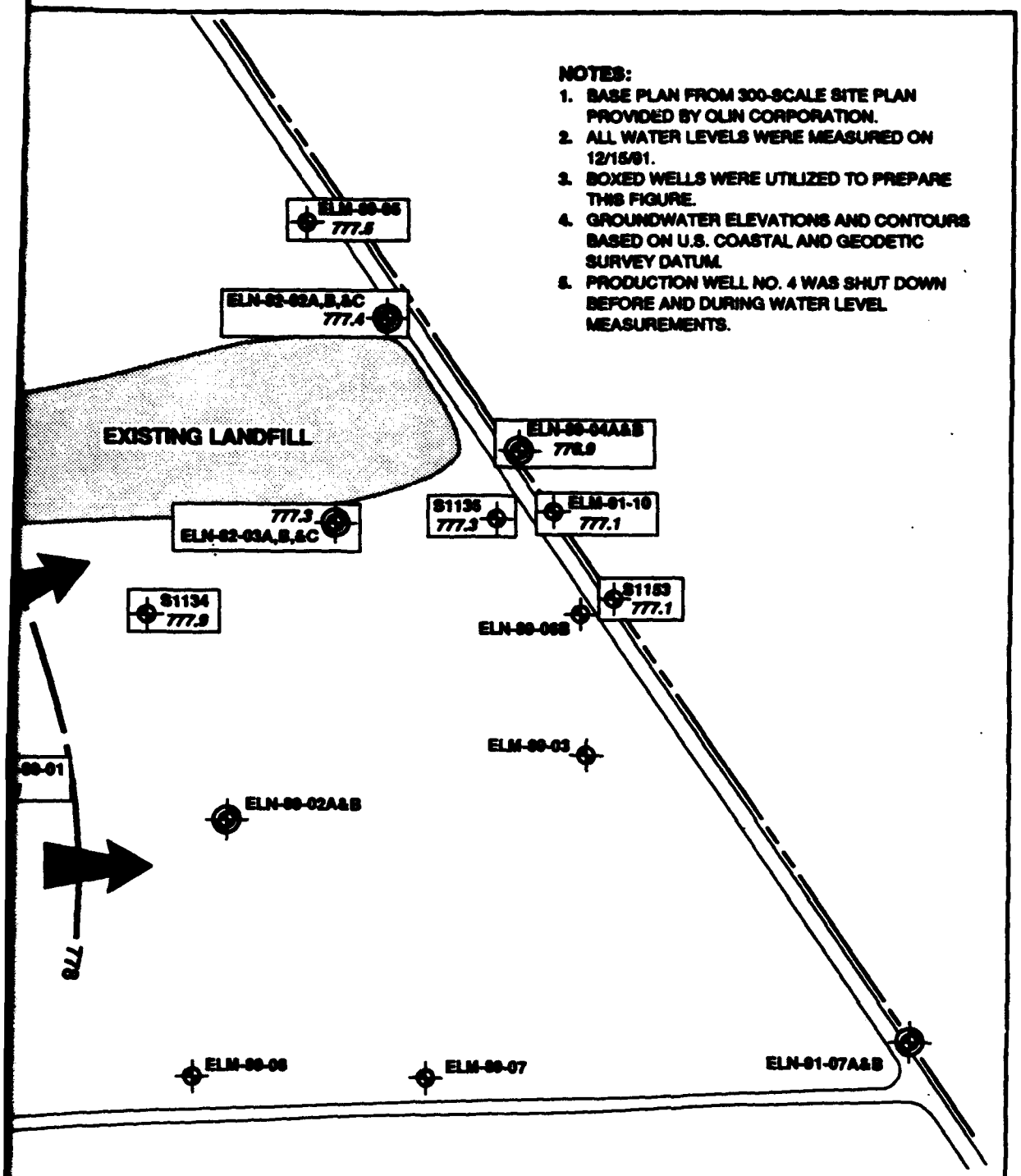
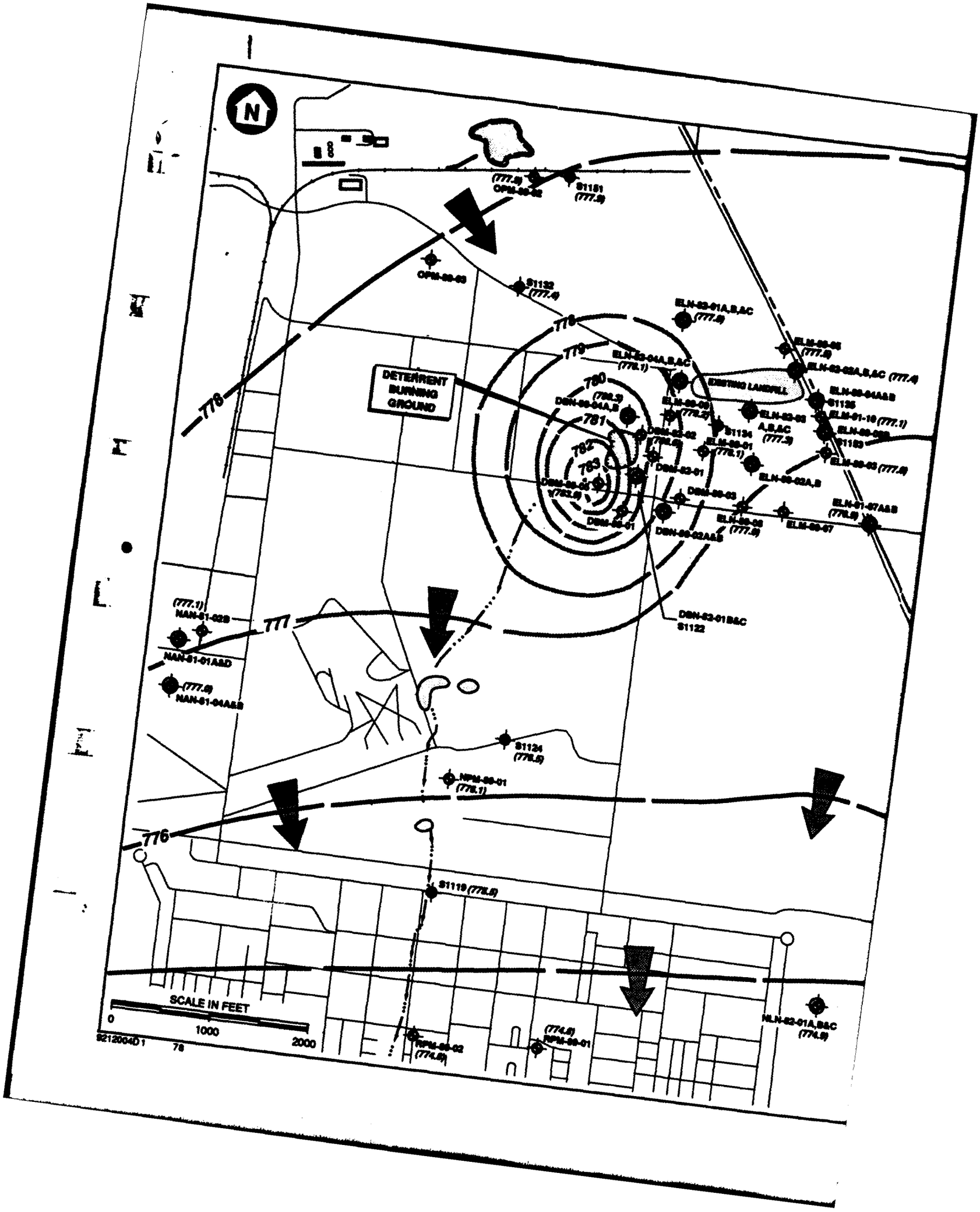


FIGURE 7-15
ELEVATED WATER TABLE CONTOUR PLAN
DETERRENT BURNING GROUND AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.


N
DETERRENT BURNING GROUND
EXISTING LANDFILL
OPM-89-03
S1132 (777.4)
S1151 (777.9)
ELN-93-01A,B,AC (777.9)
ELN-93-04A,B,AC (778.1)
ELN-93-02A,B,AC (777.4)
ELN-89-04AAB
S1135
ELN-91-10 (777.1)
ELN-93-03 A,B,AC (777.3)
S1134
ELN-89-01 (778.1)
ELN-89-03 (777.9)
ELN-89-03A,B
ELN-91-07AAB (778.9)
ELN-89-07
ELN-89-06 (777.9)
DBN-89-04A,B
DBN-93-02 (778.9)
DBN-93-01
DBN-89-03
DBN-89-02AAB
DBN-93-01B&C
S1122
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780
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(777.1) NAN-91-02B
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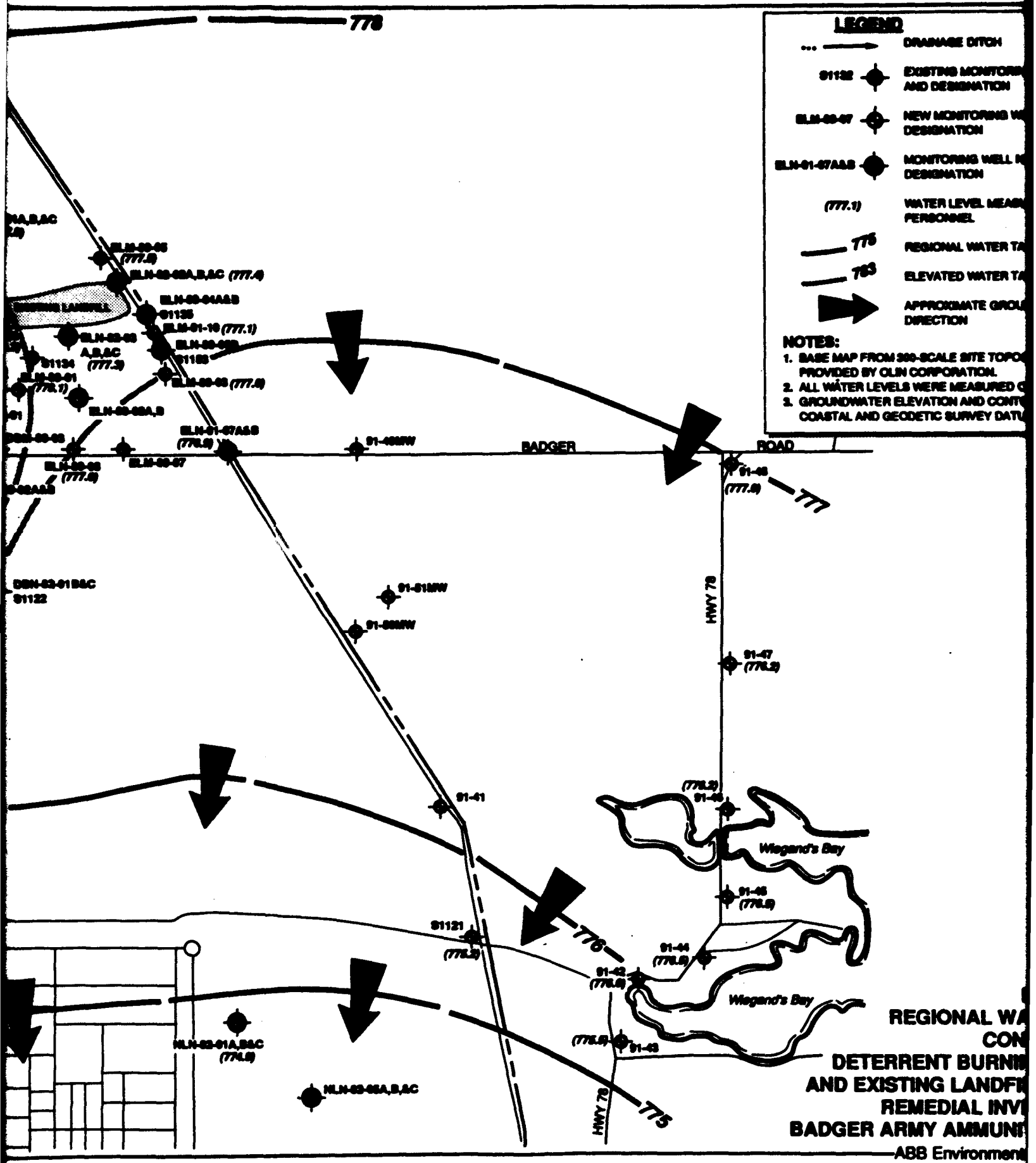
LEGEND
DRAINAGE DITCH
S1132
EXISTING MONITORI
AND DESIGNATION
ELM-03-07
NEW MONITORING W
DESIGNATION
ELN-01-07AAB
MONITORING WELL
DESIGNATION
(777.1)
WATER LEVEL MEAS
PERSONNEL
775
REGIONAL WATER TA
753
ELEVATED WATER TA
APPROXIMATE GROU
DIRECTION
NOTES:
1. BASE MAP FROM 200-SCALE SITE TOPO
PROVIDED BY OLIN CORPORATION.
2. ALL WATER LEVELS WERE MEASURED
3. GROUNDWATER ELEVATION AND CONT
COASTAL AND GEODETIC SURVEY DAT
778
BADGER
ROAD
HWY 78
91-41
91-42
91-43
91-44
91-45
91-46
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Wiegand's Bay
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DETERRENT BURNI
AND EXISTING LANDFI
REMEDIAL INV
BADGER ARMY AMMUNI
ABB Environment

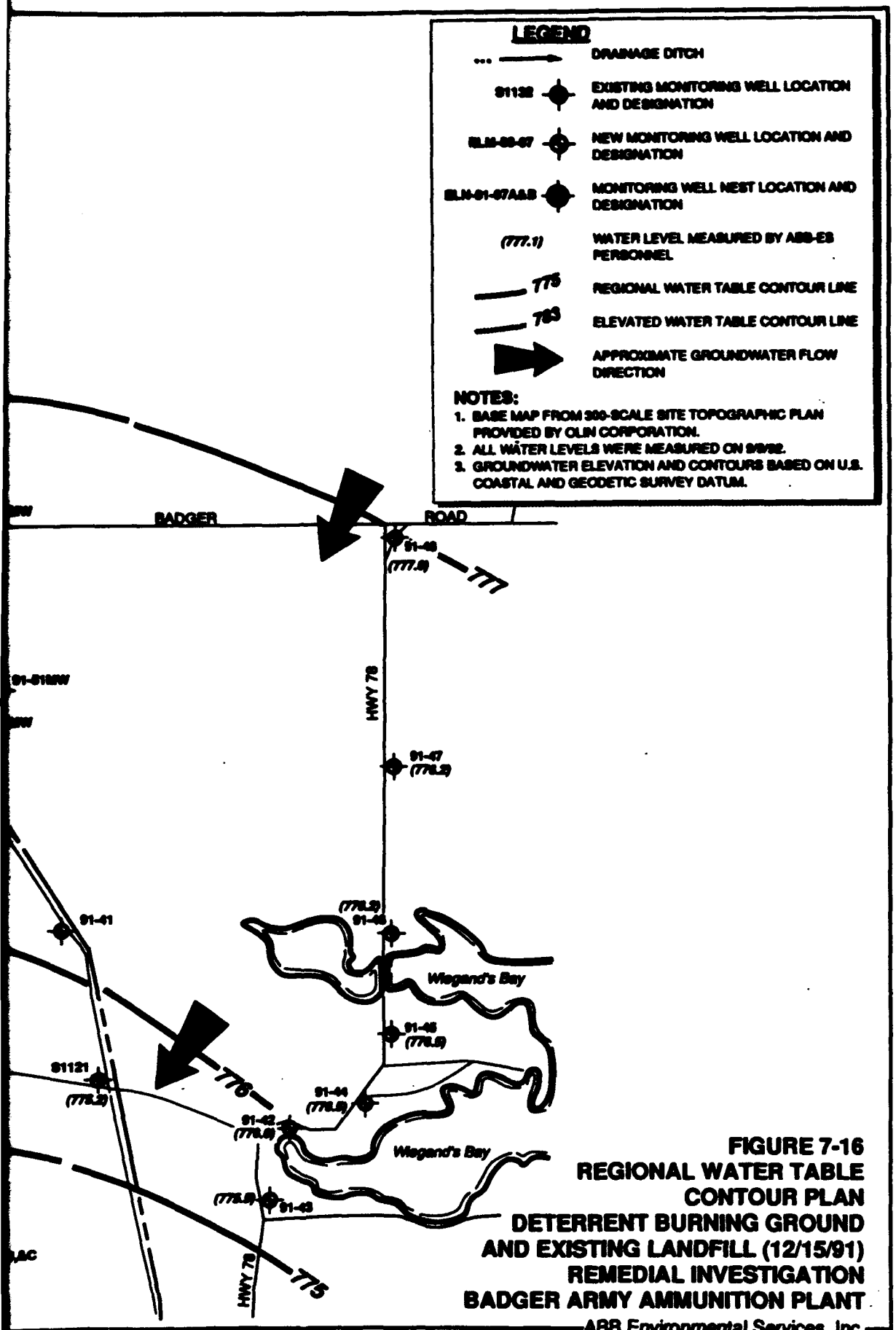
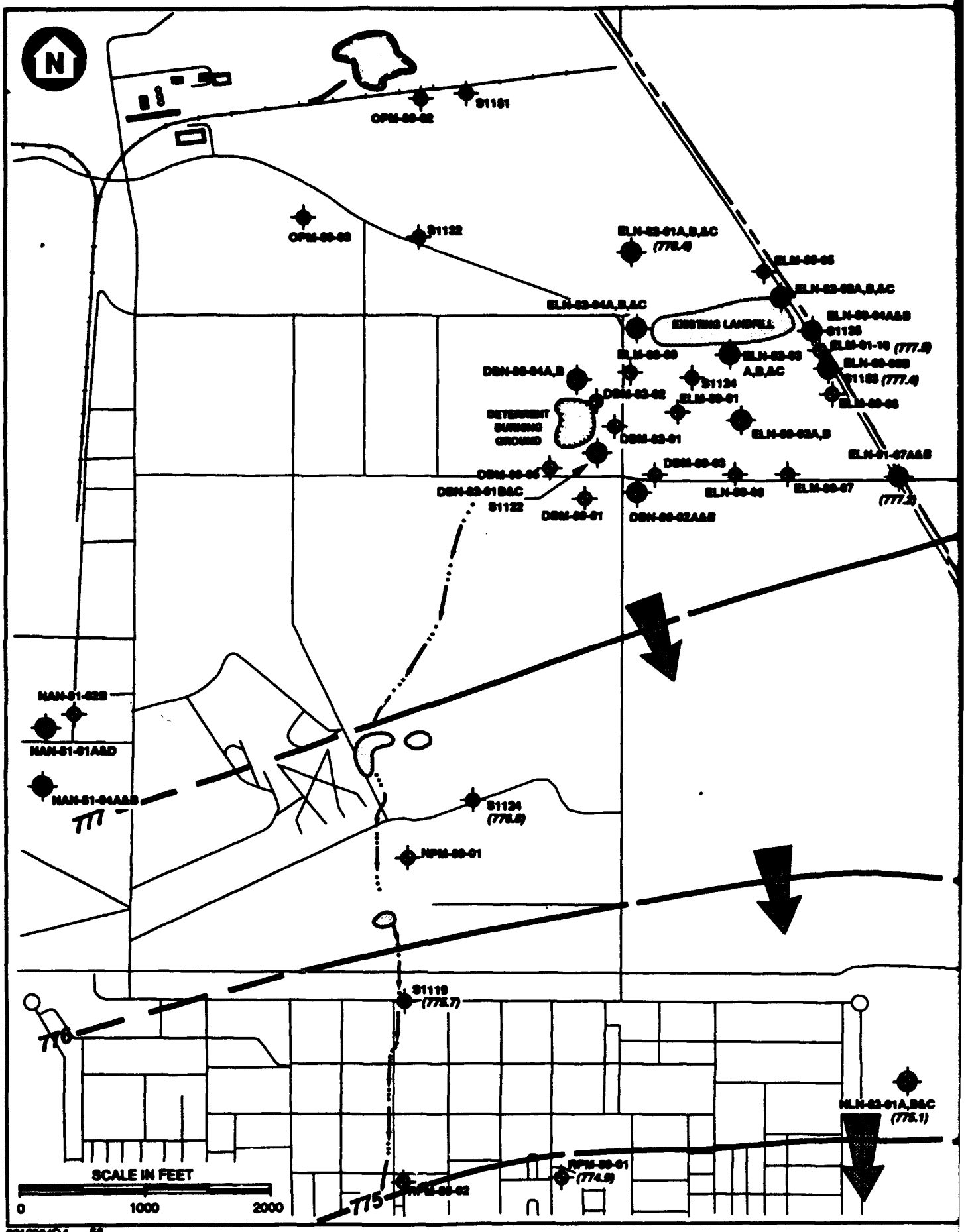


FIGURE 7-16
REGIONAL WATER TABLE CONTOUR PLAN
DETERRENT BURNING GROUND AND EXISTING LANDFILL (12/15/91)
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



9212004D1 56

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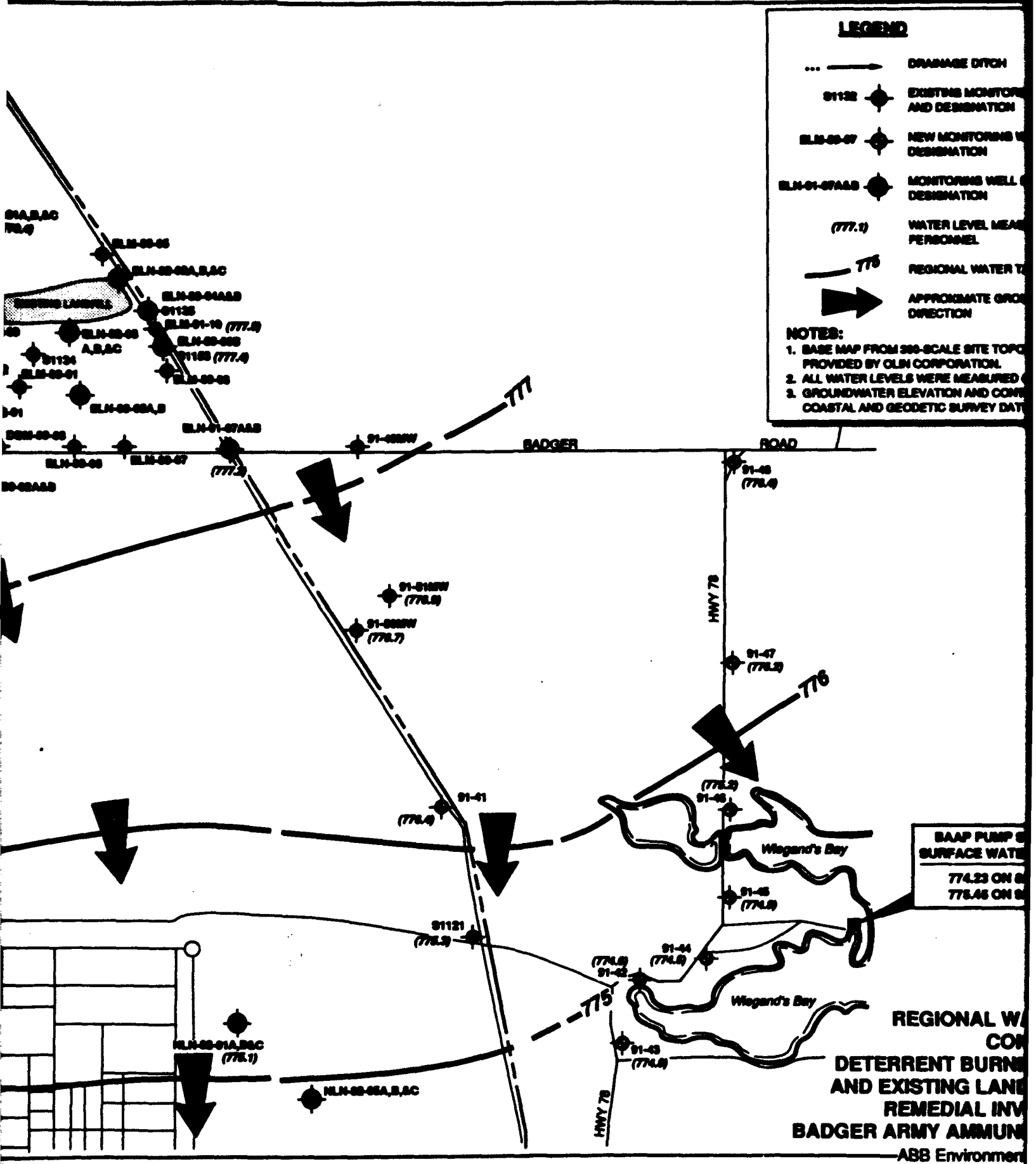
LEGEND
DRAINAGE DITCH
EXISTING MONITORI
AND DESIGNATION
NEW MONITORING W
DESIGNATION
MONITORING WELL
DESIGNATION
(777.1)
WATER LEVEL MEA
PERSONNEL
REGIONAL WATER T
APPROXIMATE GRO
DIRECTION
NOTES:
1. BASE MAP FROM 200-SCALE SITE TOPO
PROVIDED BY OLIN CORPORATION.
2. ALL WATER LEVELS WERE MEASURED
3. GROUNDWATER ELEVATION AND CONV
COASTAL AND GEODETIC SURVEY DAT
BADGER ROAD
HWY 78
Wiegand's Bay
Wiegand's Bay
91-41
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91-44
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91-48
91121
91132
ELJI-01-07AAB
ELJI-03-07
ELJI-03-01A,B,C
ELJI-03-05A,B,C
ELJI-03-05A,B
ELJI-03-06
ELJI-03-07
ELJI-03-04AAB
ELJI-01-10
ELJI-03-01
ELJI-03-02AAB
91134
91135
91133
777
776
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775.45 ON
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AND EXISTING LAN
REMEDIAL INV
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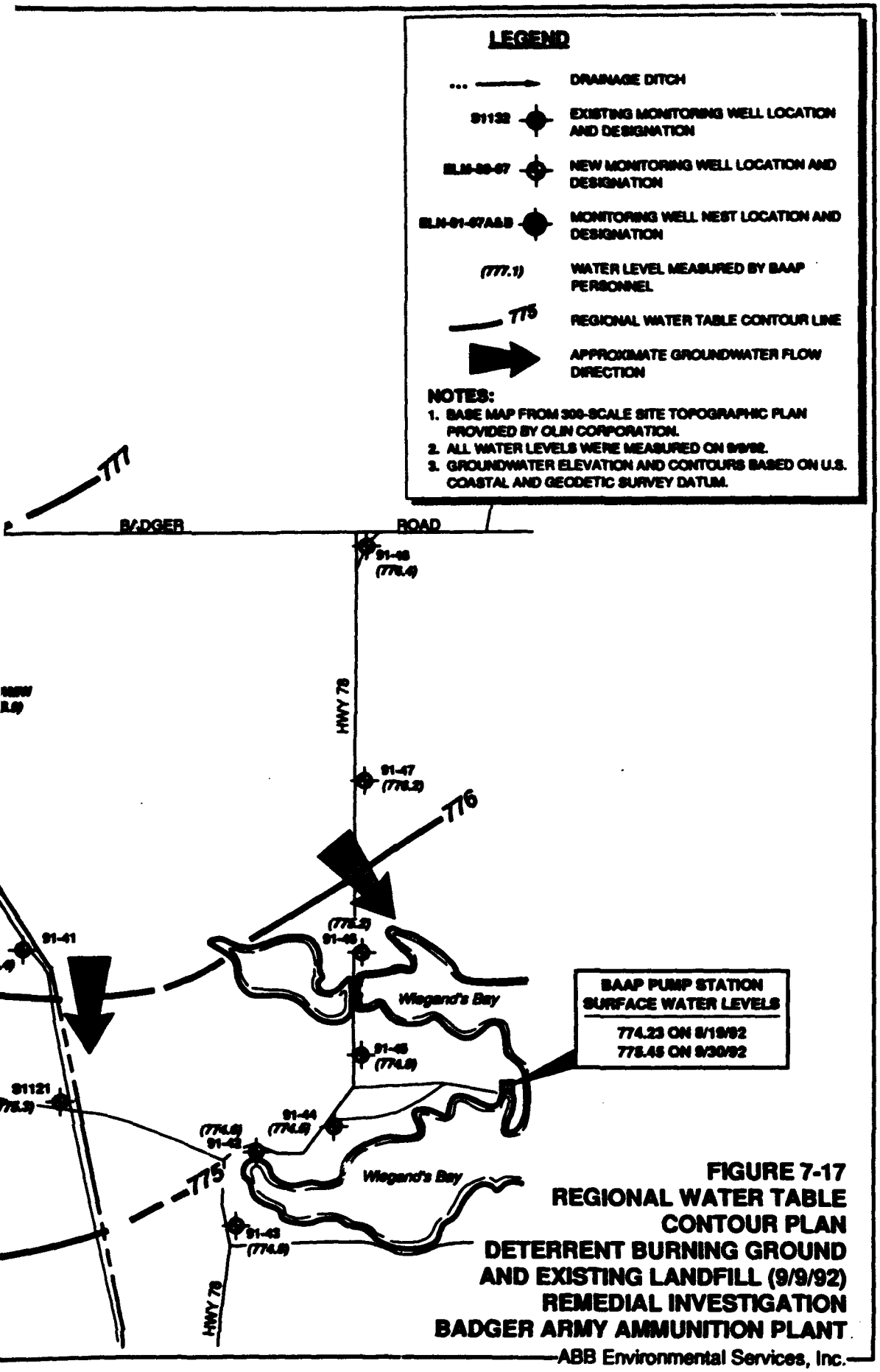
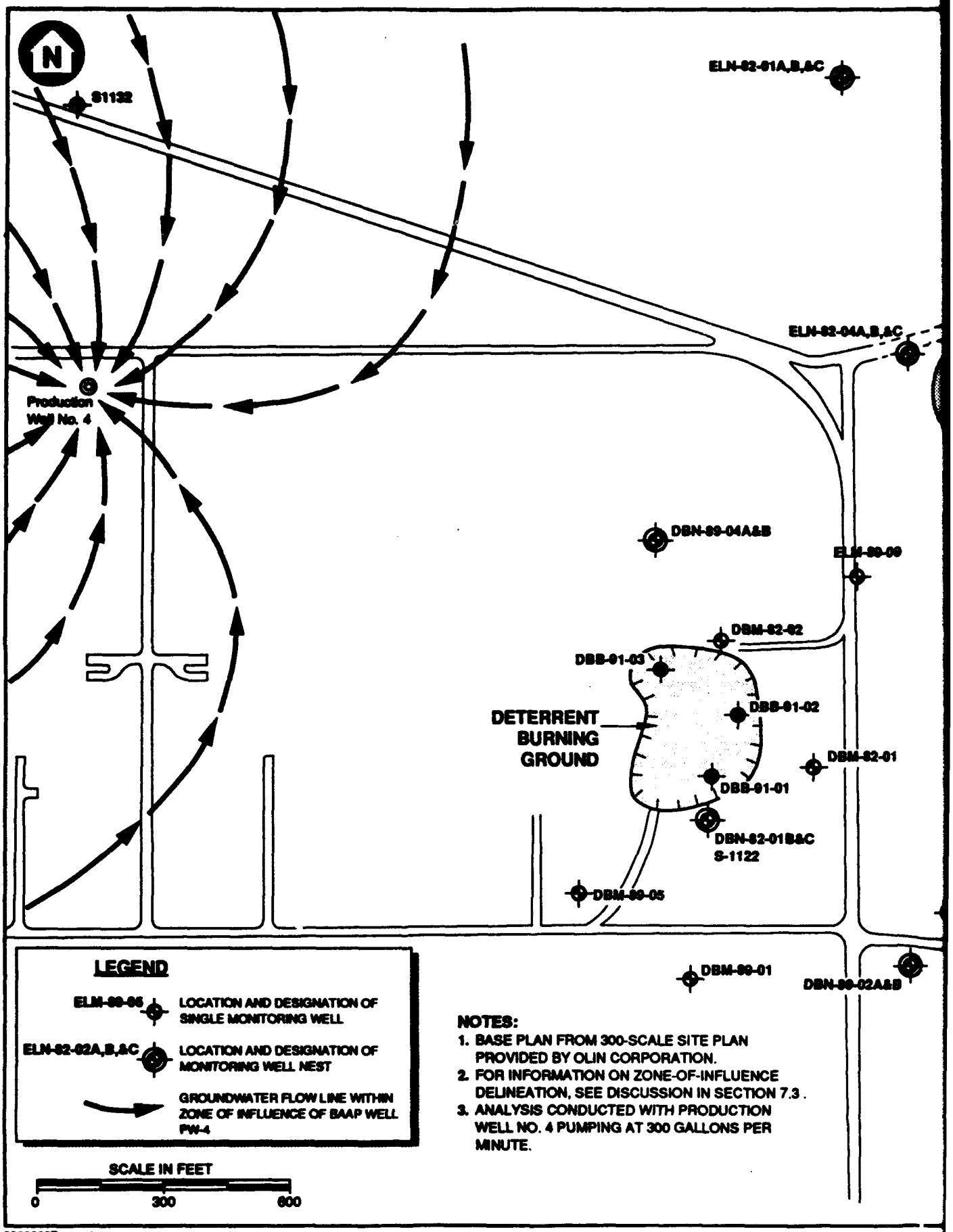


FIGURE 7-17
REGIONAL WATER TABLE CONTOUR PLAN
DETERRENT BURNING GROUND AND EXISTING LANDFILL (9/9/92)
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

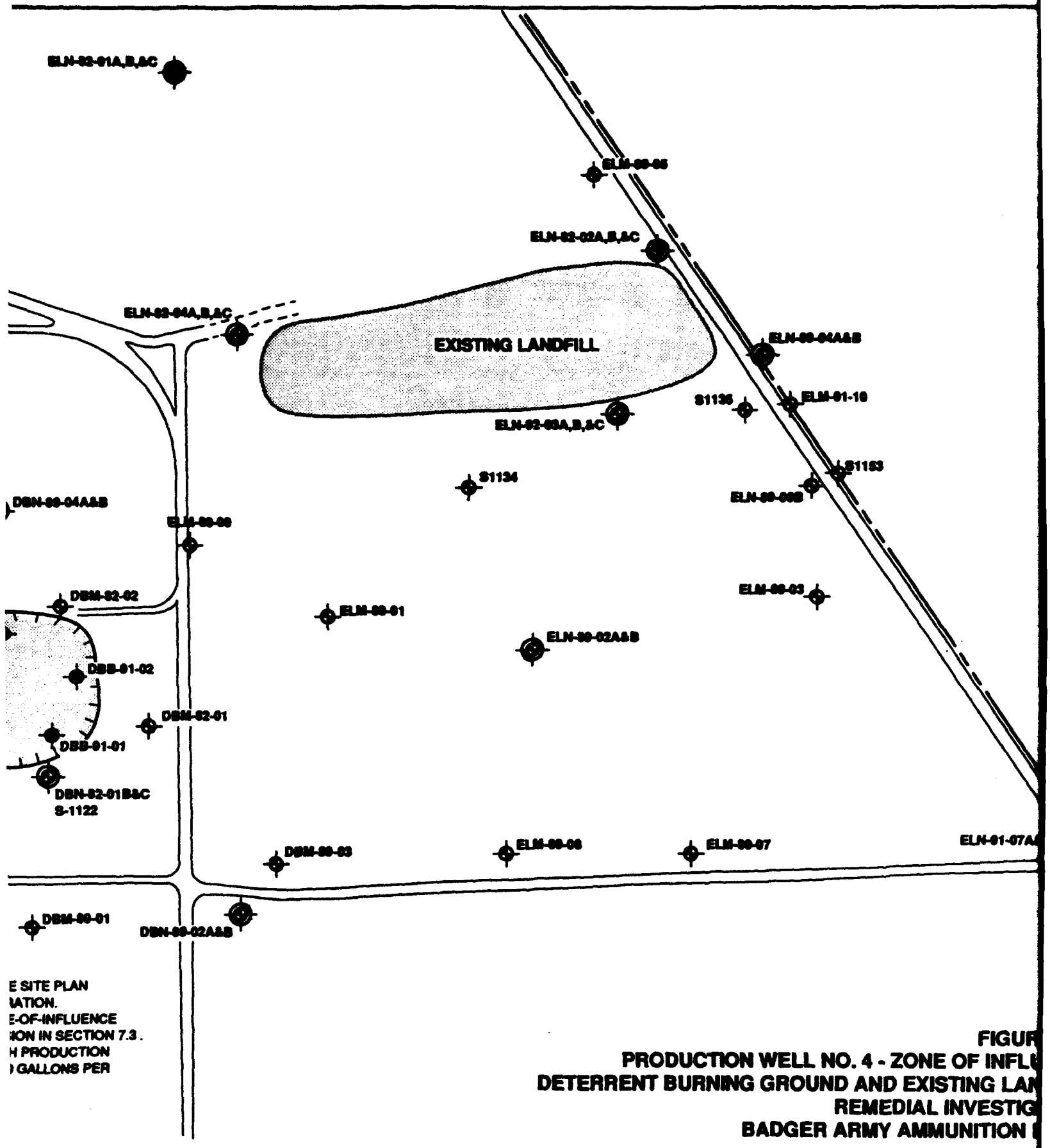
ABB Environmental Services, Inc.



NOTES:
1. BASE PLAN FROM 300-SCALE SITE PLAN PROVIDED BY OLIN CORPORATION.
2. FOR INFORMATION ON ZONE-OF-INFLUENCE DELINEATION, SEE DISCUSSION IN SECTION 7.3 .
3. ANALYSIS CONDUCTED WITH PRODUCTION WELL NO. 4 PUMPING AT 300 GALLONS PER MINUTE.

9208060D de m

2



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E-OF-INFLUENCE
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H PRODUCTION
) GALLONS PER

FIGUR
PRODUCTION WELL NO. 4 - ZONE OF INFL
DETERRENT BURNING GROUND AND EXISTING LA
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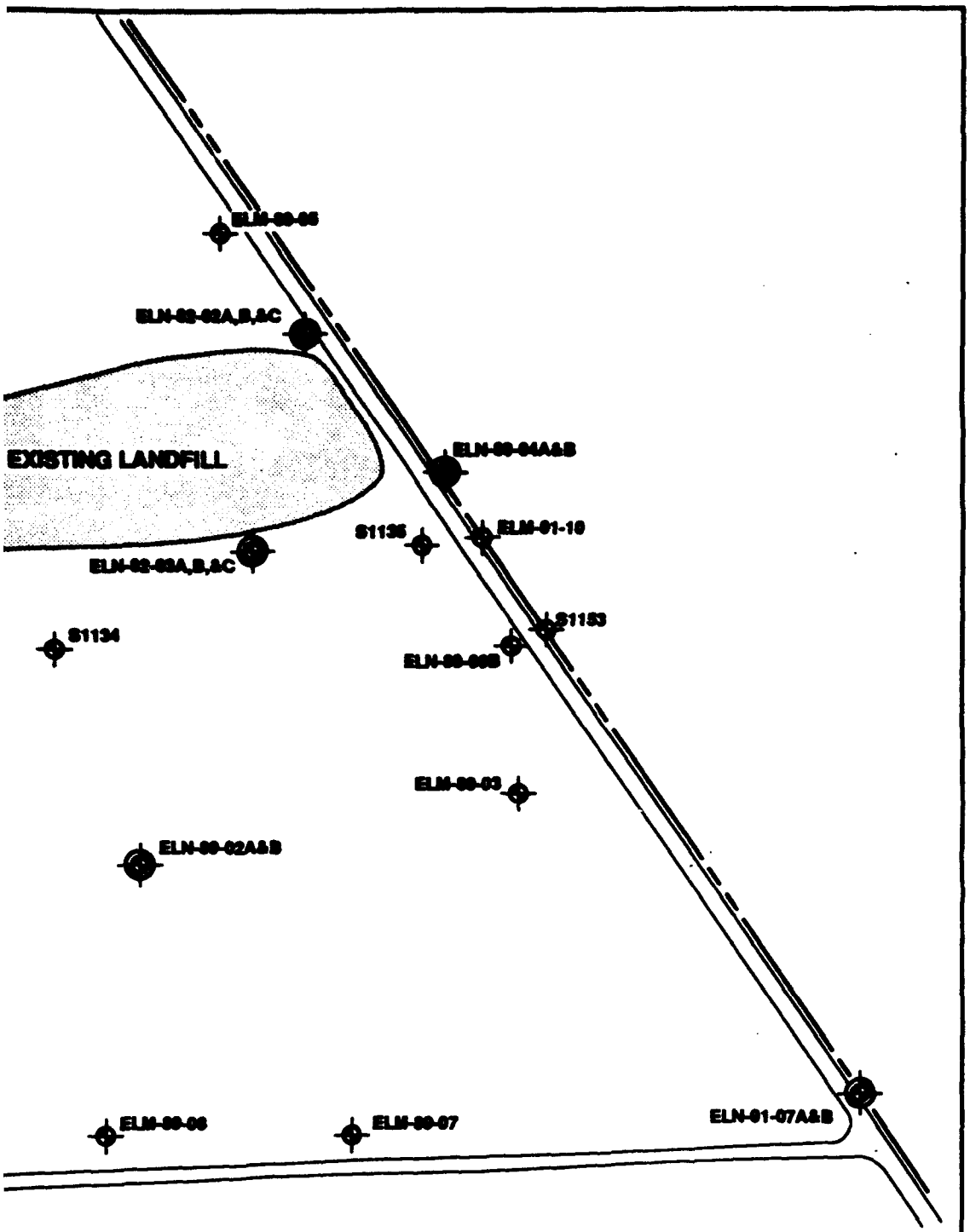
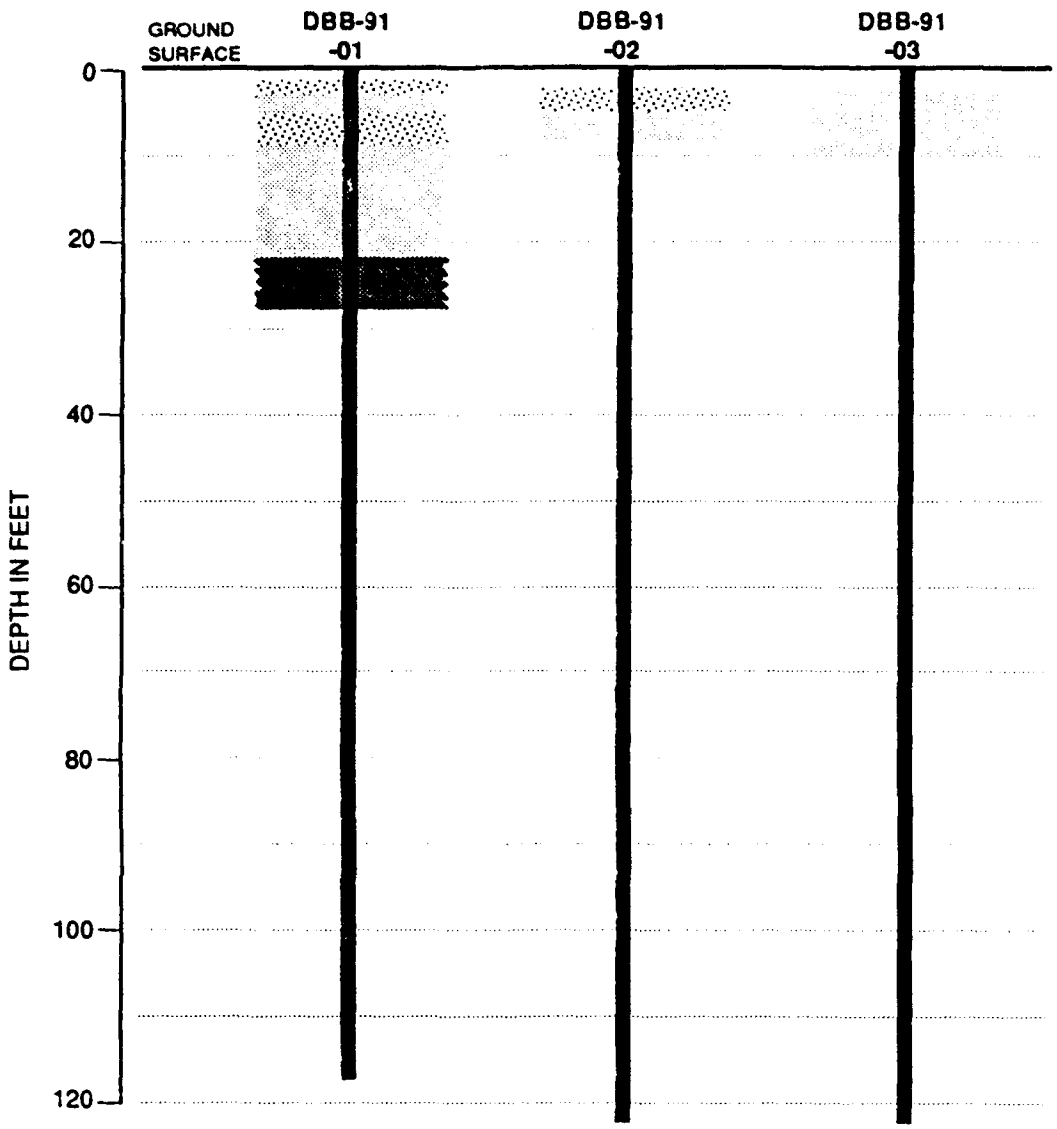


FIGURE 7-18
PRODUCTION WELL NO. 4 - ZONE OF INFLUENCE
DETERRENT BURNING GROUND AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



C6H6 CONCENTRATION

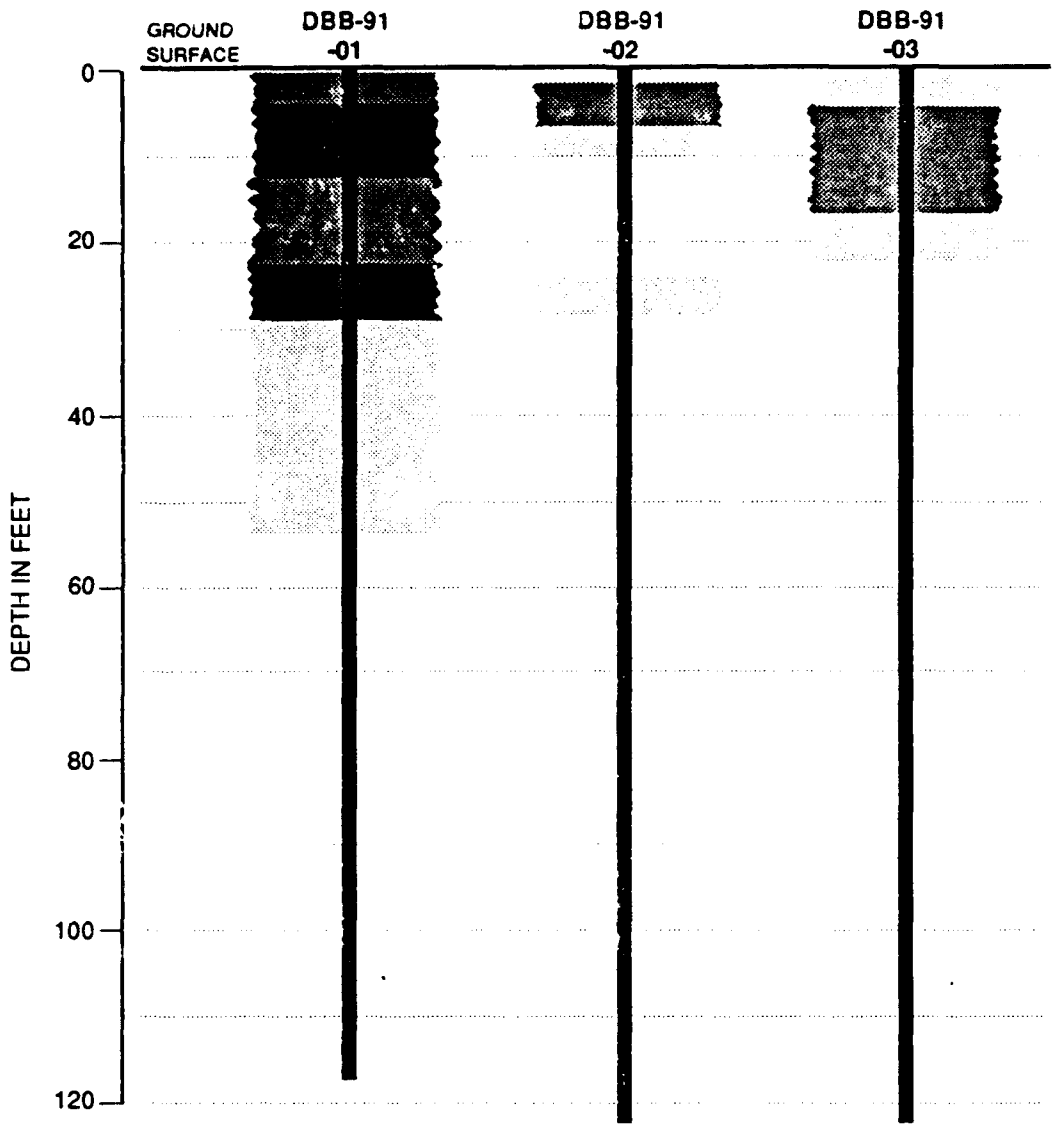
- > 10 mg/kg
- 1.0 to 9.99 mg/kg
- ND to 0.99 mg/kg

NOTE:
SEE TABLE 7-12 AND APPENDIX K FOR CHEMICAL DATA SUMMARY.

FIGURE 7-19
TOTAL C6H6 CONCENTRATIONS IN SUBSURFACE SOILS
DETERRENT BURNING GROUND WASTE PITS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

9208043Da 1



TOTAL DNTs CONCENTRATION

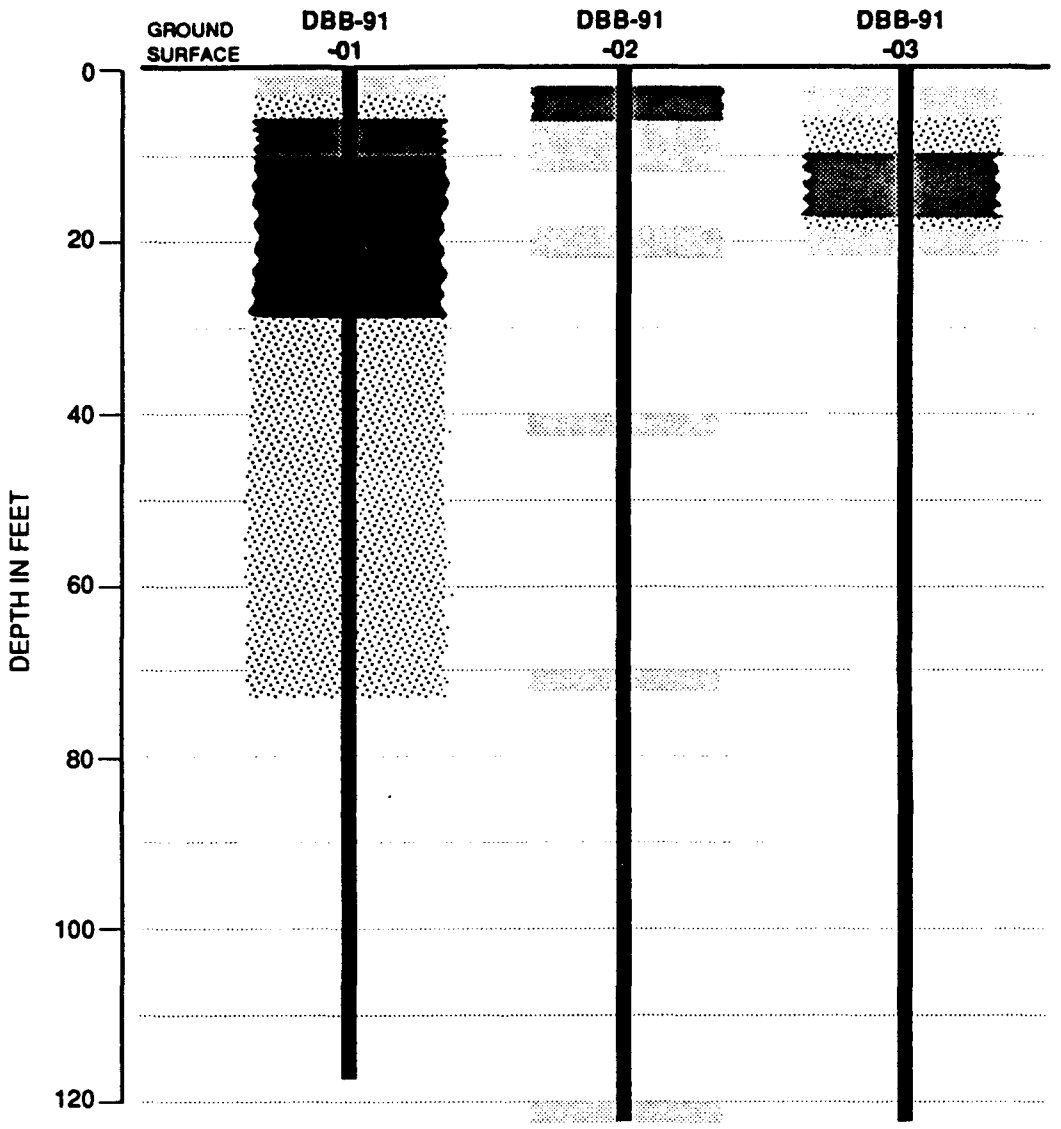
- > 10,000 mg/kg
- 1,000 to 9,999 mg/kg
- 100 to 999 mg/kg
- ND to 99 mg/kg

NOTE:
SEE TABLE 7-12 AND APPENDIX K FOR CHEMICAL DATA SUMMARY.

FIGURE 7-20
TOTAL DNTs CONCENTRATIONS IN SUBSURFACE SOILS
DETERRENT BURNING GROUND WASTE PITS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

9208043Da 2



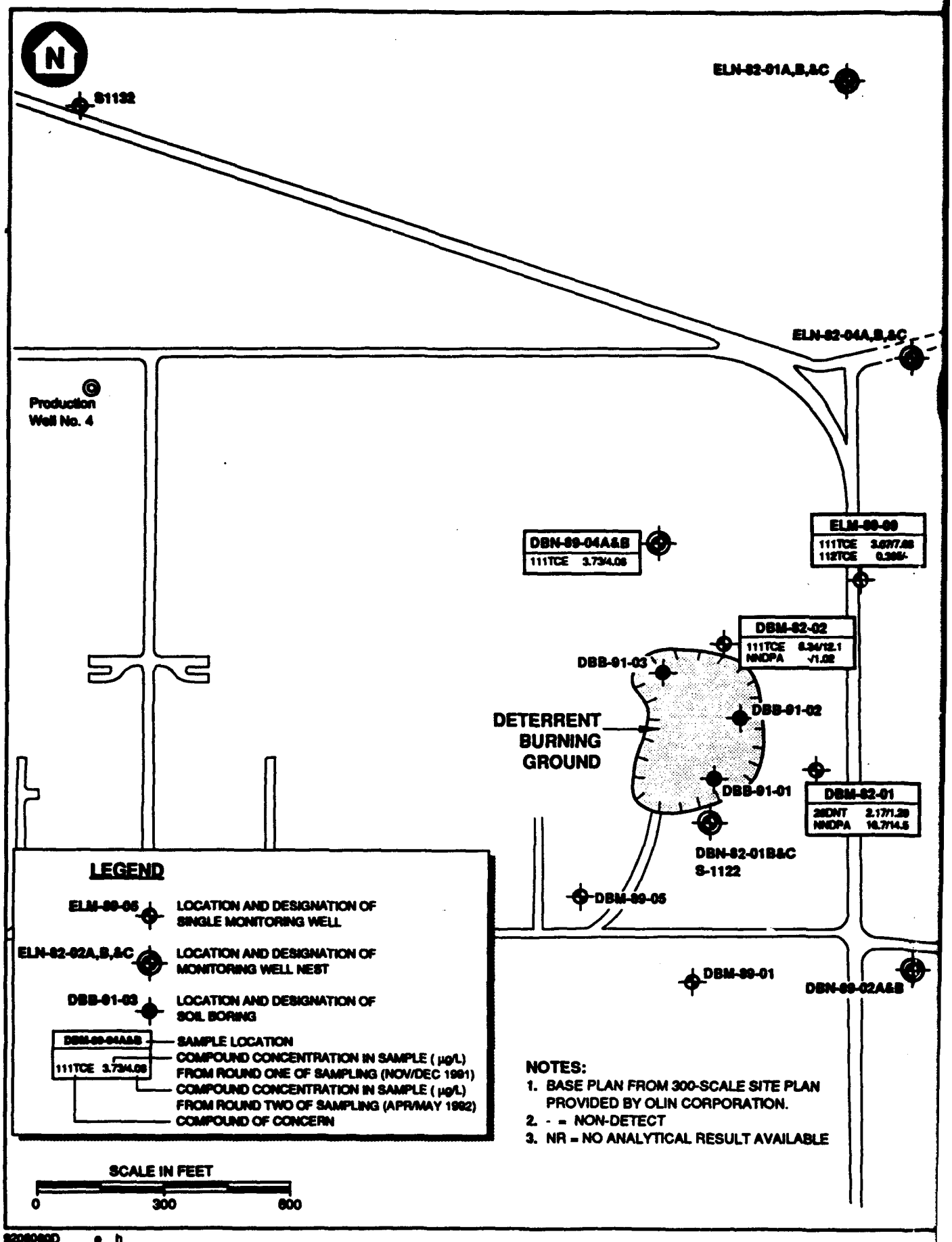
NNDPA CONCENTRATION

- > 1,000 mg/kg
- 100 to 999 mg/kg
- 10 to 99.9 mg/kg
- ND to 9.9 mg/kg

NOTE:
SEE TABLE 7-12 AND APPENDIX K FOR CHEMICAL DATA SUMMARY.

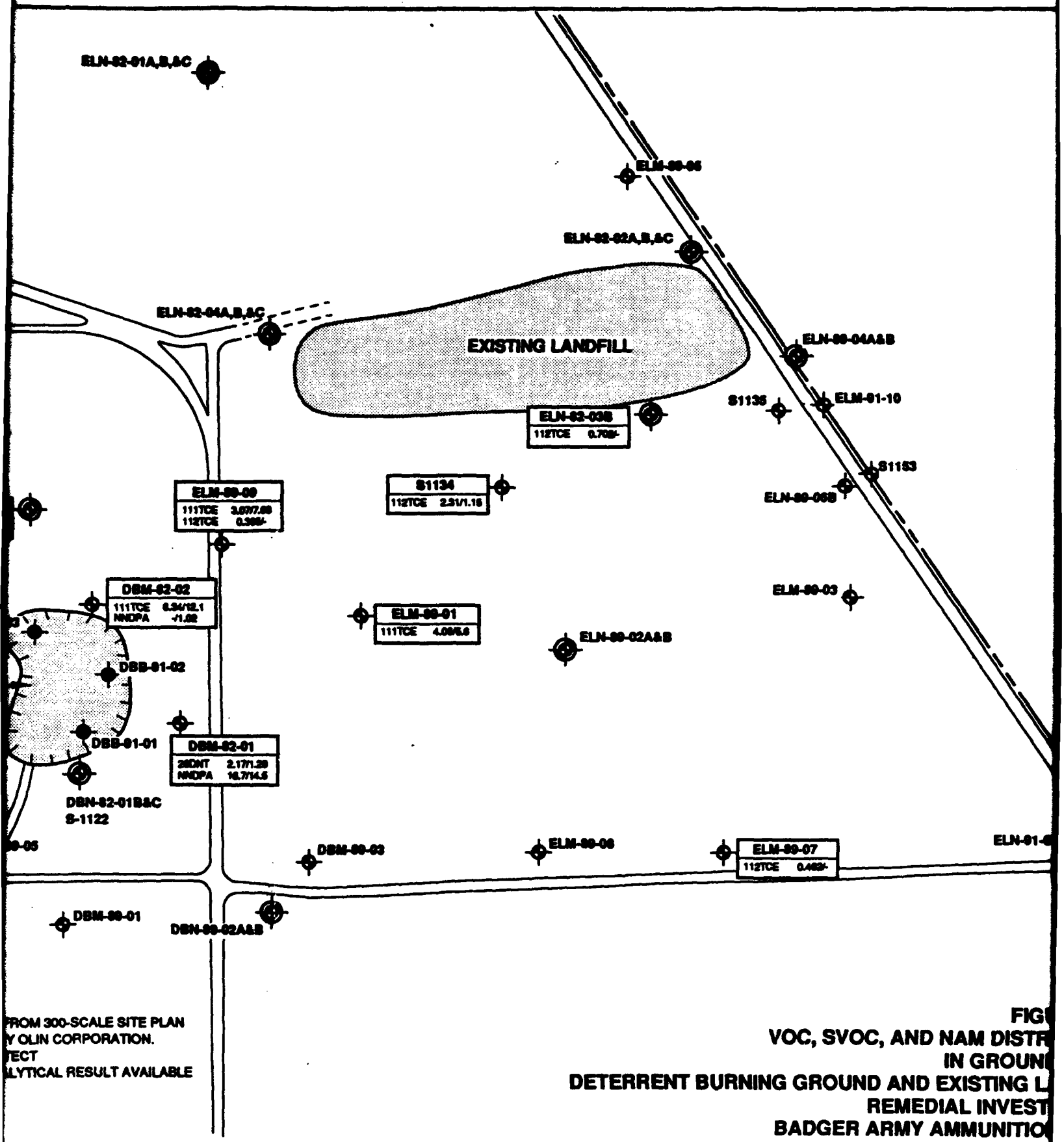
FIGURE 7-21
NNDPA CONCENTRATIONS IN SUBSURFACE SOILS
DETERRENT BURNING GROUND WASTE PITS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.


N
S1132
ELN-92-01A,B,&C
ELN-92-04A,B,&C
Production Well No. 4
DBN-89-04A&B
111TCE 3.73/4.08
ELM-89-09
111TCE 3.67/7.88
112TCE 0.38/-
DBM-92-02
111TCE 6.34/12.1
NNDPA -/1.02
DBB-91-03
DBB-91-02
DETERRENT BURNING GROUND
DBB-91-01
DBM-92-01
26DNT 2.17/1.29
NNDPA 16.7/14.5
DBN-92-01B&C
S-1122
DBM-89-05
DBM-89-01
DBN-89-02A&B
LEGEND
ELM-89-05 LOCATION AND DESIGNATION OF SINGLE MONITORING WELL
ELN-92-02A,B,&C LOCATION AND DESIGNATION OF MONITORING WELL NEST
DBB-91-03 LOCATION AND DESIGNATION OF SOIL BORING
DBM-89-04A&B SAMPLE LOCATION
111TCE 3.73/4.08
COMPOUND CONCENTRATION IN SAMPLE (µg/L) FROM ROUND ONE OF SAMPLING (NOV/DEC 1991)
COMPOUND CONCENTRATION IN SAMPLE (µg/L) FROM ROUND TWO OF SAMPLING (APR/MAY 1992)
COMPOUND OF CONCERN
NOTES:
1. BASE PLAN FROM 300-SCALE SITE PLAN PROVIDED BY OLIN CORPORATION.
2. - = NON-DETECT
3. NR = NO ANALYTICAL RESULT AVAILABLE
SCALE IN FEET
0
300
600

9209080D e h

2



FROM 300-SCALE SITE PLAN
Y OLIN CORPORATION.
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LYTICAL RESULT AVAILABLE

FIG
VOC, SVOC, AND NAM DISTR
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DETERRENT BURNING GROUND AND EXISTING L
REMEDIAL INVEST
BADGER ARMY AMMUNITIO

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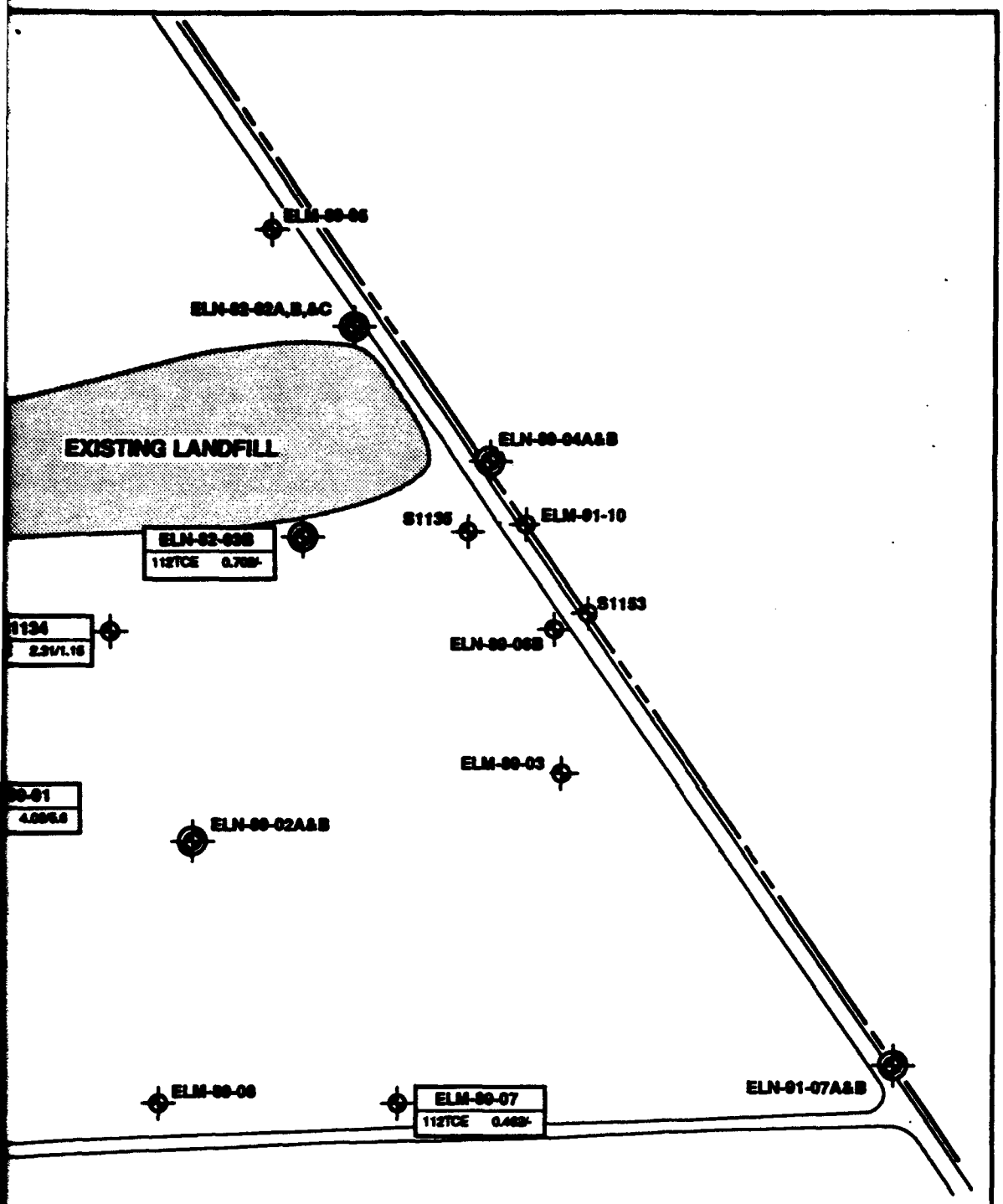
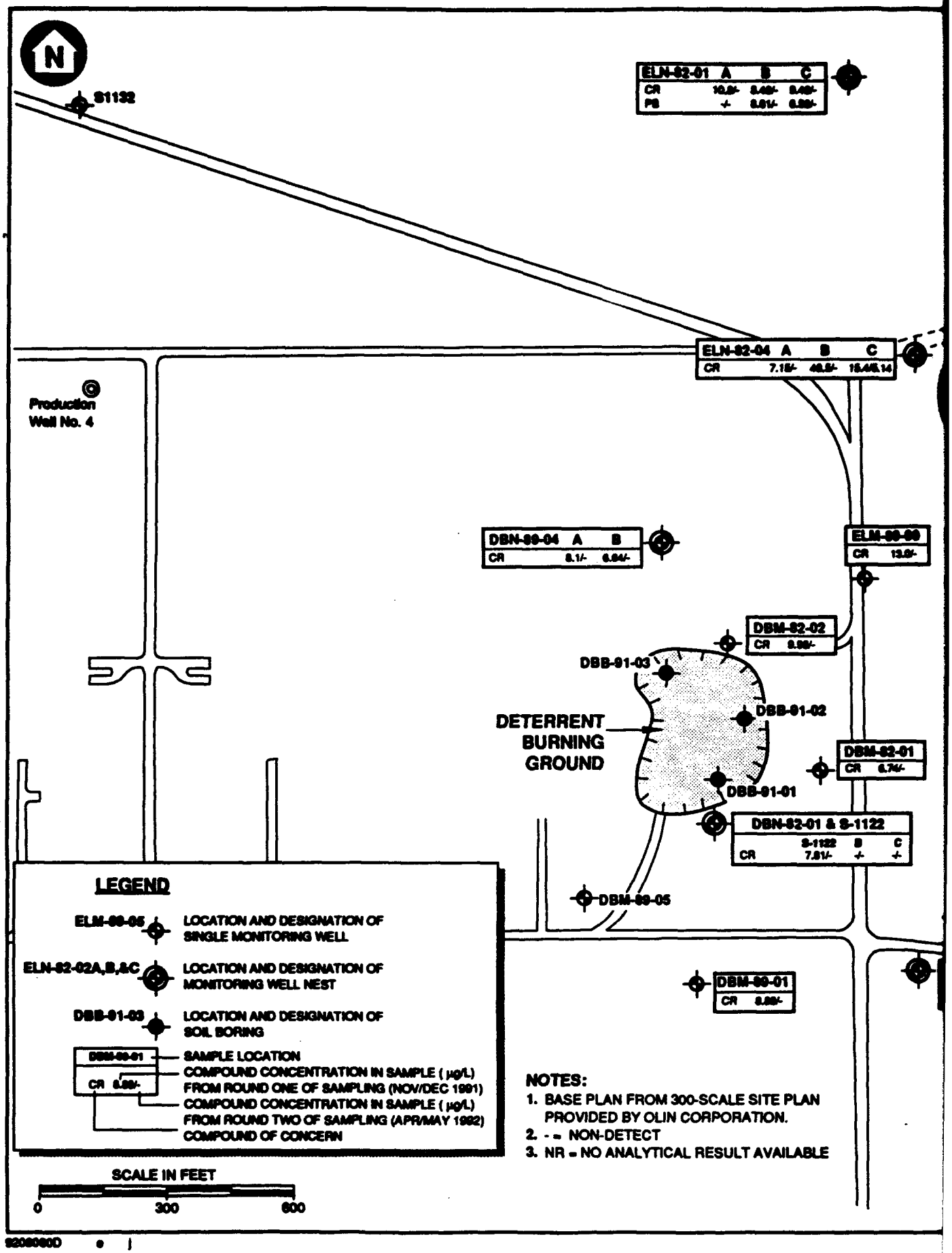
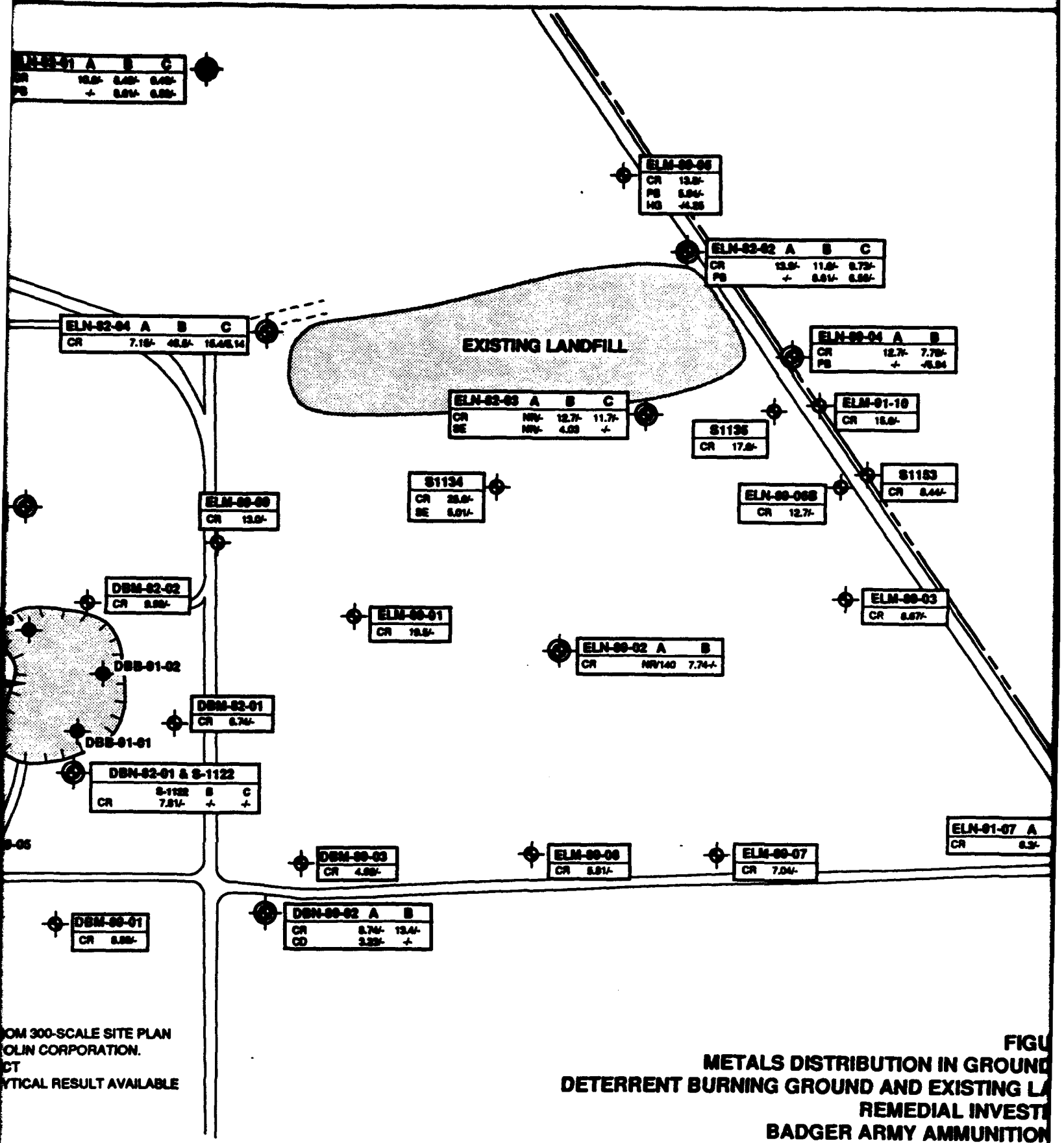


FIGURE 7-22
VOC, SVOC, AND NAM DISTRIBUTION IN GROUNDWATER
DETERRENT BURNING GROUND AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.


N
S1132
ELN-92-01 A B C
CR 10.0/- 8.40/- 8.40/-
PB -/- 8.61/- 8.88/-
ELN-92-04 A B C
CR 7.15/- 48.5/- 15.44/6.14
Production Well No. 4
DBN-89-04 A B
CR 8.1/- 6.84/-
ELM-89-09
CR 13.0/-
DBM-92-02
CR 8.98/-
DBB-91-03
DBB-91-02
DETERRENT BURNING GROUND
DBM-92-01
CR 6.74/-
DBB-91-01
DBN-92-01 & S-1122
S-1122 B C
CR 7.81/- -/- -/-
DBM-89-05
DBM-89-01
CR 8.88/-
LEGEND
ELM-89-05 LOCATION AND DESIGNATION OF SINGLE MONITORING WELL
ELN-92-02A,B,&C LOCATION AND DESIGNATION OF MONITORING WELL NEST
DBB-91-03 LOCATION AND DESIGNATION OF SOIL BORING
DBM-89-01 SAMPLE LOCATION
CR 8.88/- COMPOUND CONCENTRATION IN SAMPLE (µg/L) FROM ROUND ONE OF SAMPLING (NOV/DEC 1991)
COMPOUND CONCENTRATION IN SAMPLE (µg/L) FROM ROUND TWO OF SAMPLING (APR/MAY 1992)
COMPOUND OF CONCERN
NOTES:
1. BASE PLAN FROM 300-SCALE SITE PLAN PROVIDED BY OLIN CORPORATION.
2. - = NON-DETECT
3. NR = NO ANALYTICAL RESULT AVAILABLE
SCALE IN FEET
0
300
600

2



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OLIN CORPORATION.
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METALS DISTRIBUTION IN GROUND
DETERRENT BURNING GROUND AND EXISTING LA
REMEDIAL INVESTI
BADGER ARMY AMMUNITION

ABB Environmental Se

3

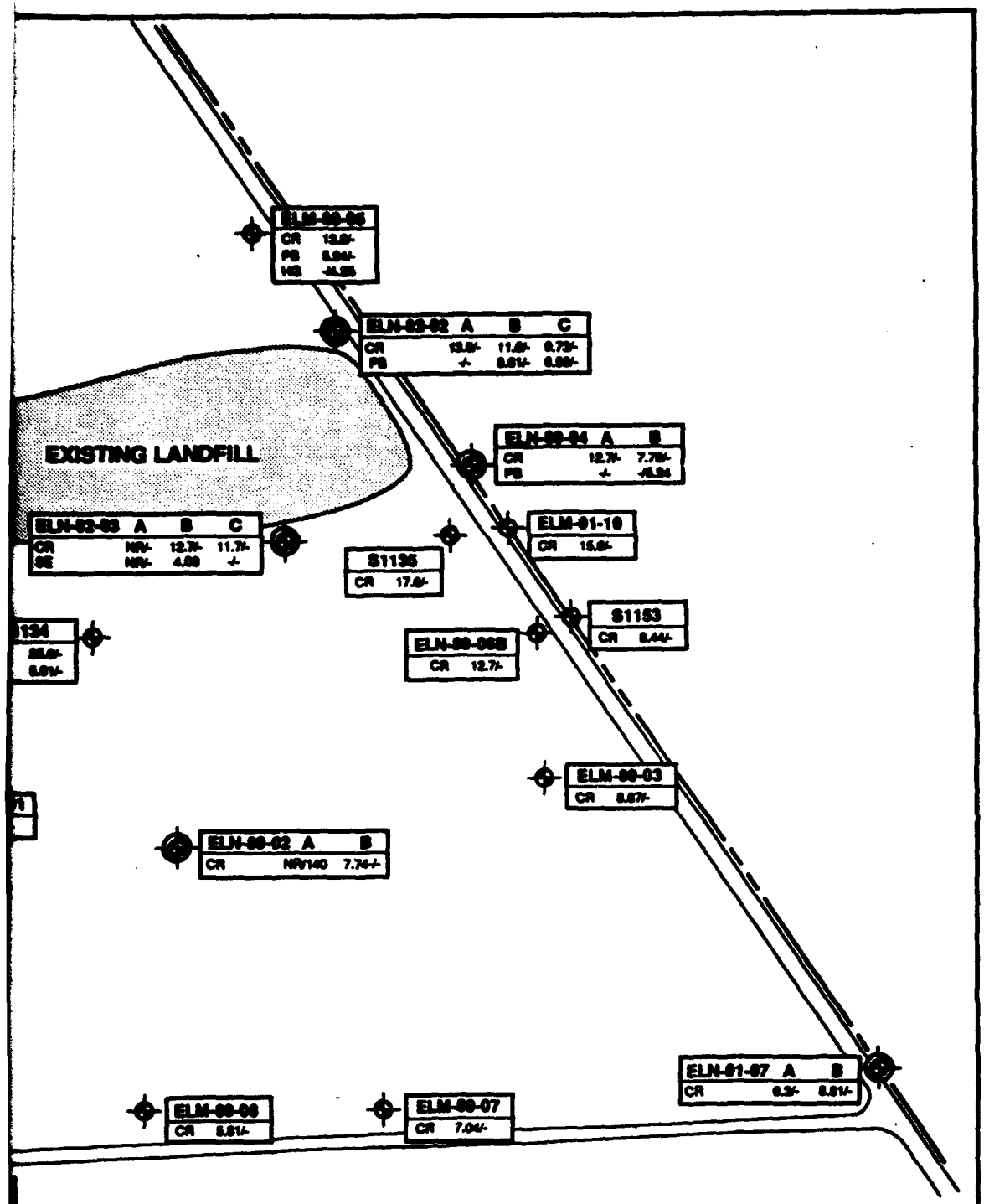
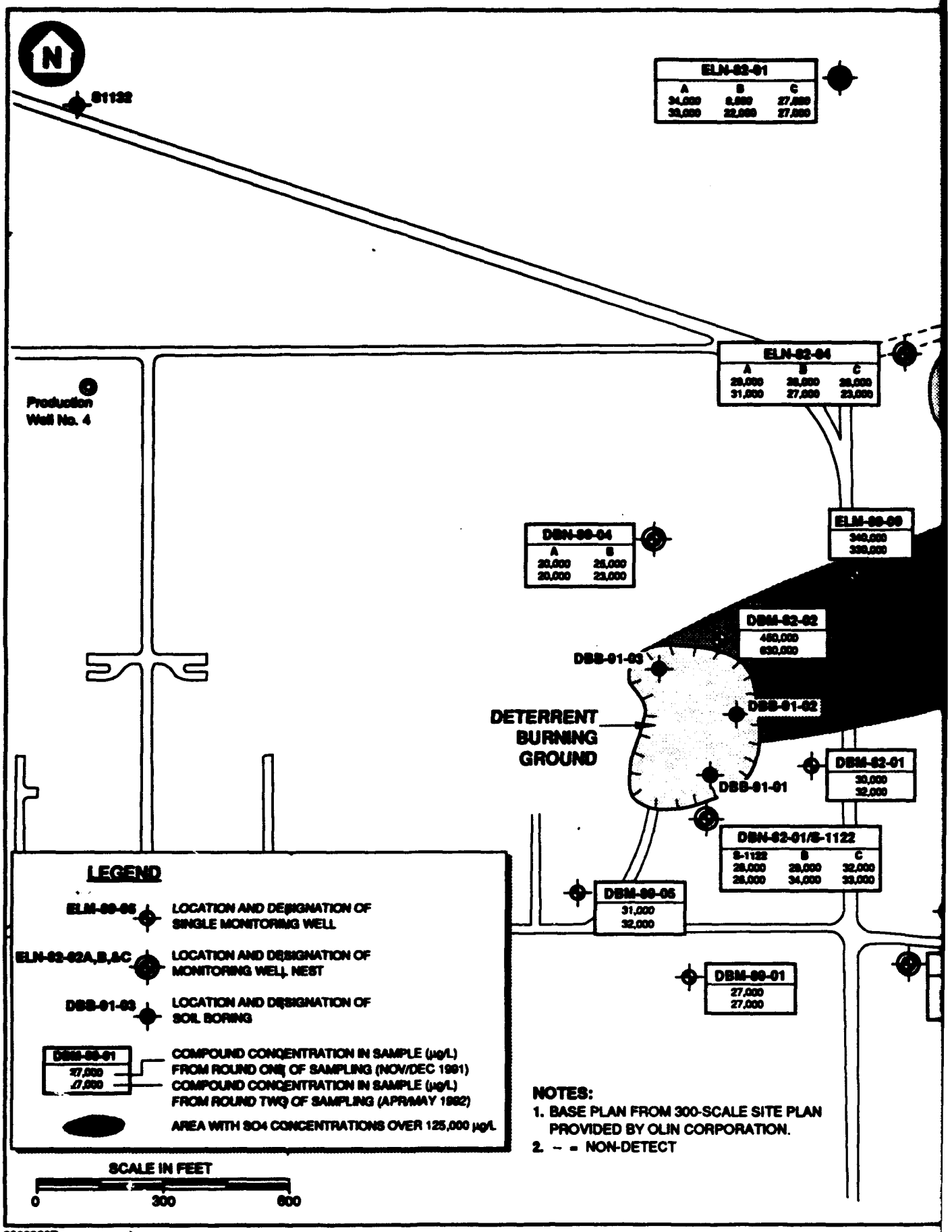


FIGURE 7-23
METALS DISTRIBUTION IN GROUNDWATER
DETERRENT BURNING GROUND AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



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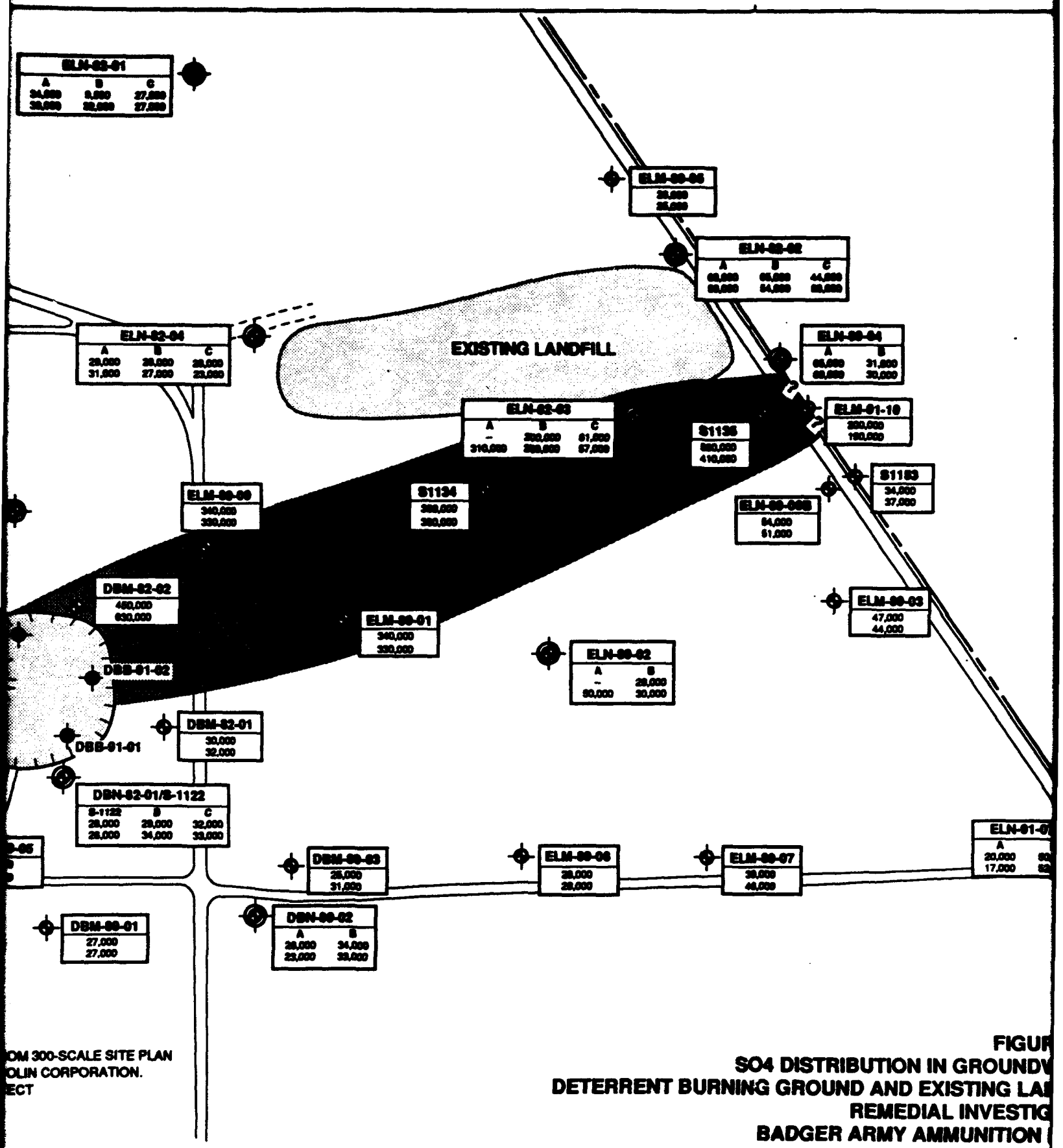
2



OM 300-SCALE SITE PLAN
OLIN CORPORATION.
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FIGUR
SO4 DISTRIBUTION IN GROUNDV
DETERRENT BURNING GROUND AND EXISTING LA
REMEDIAL INVESTIG
BADGER ARMY AMMUNITION

ABB Environmental Servi

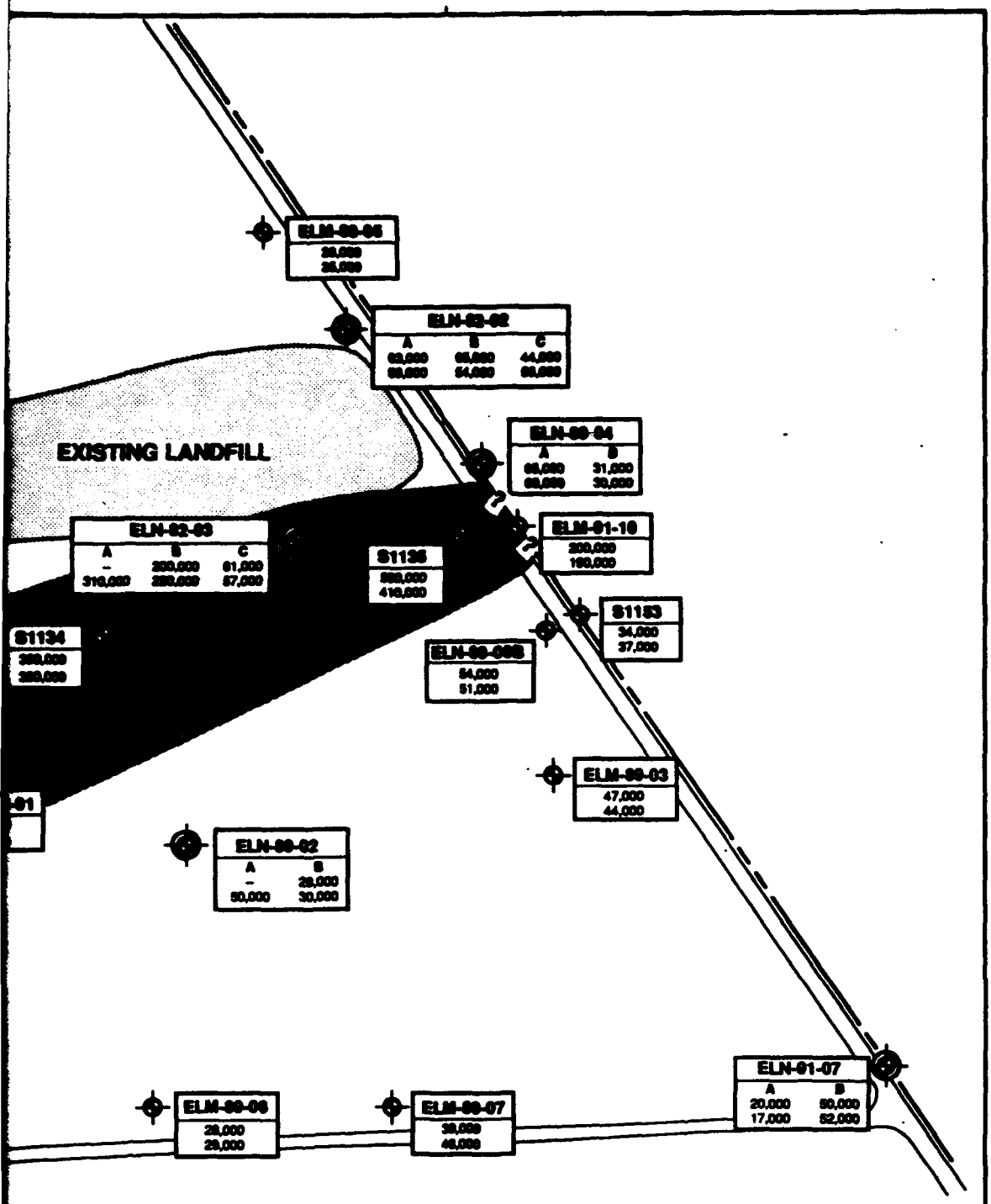
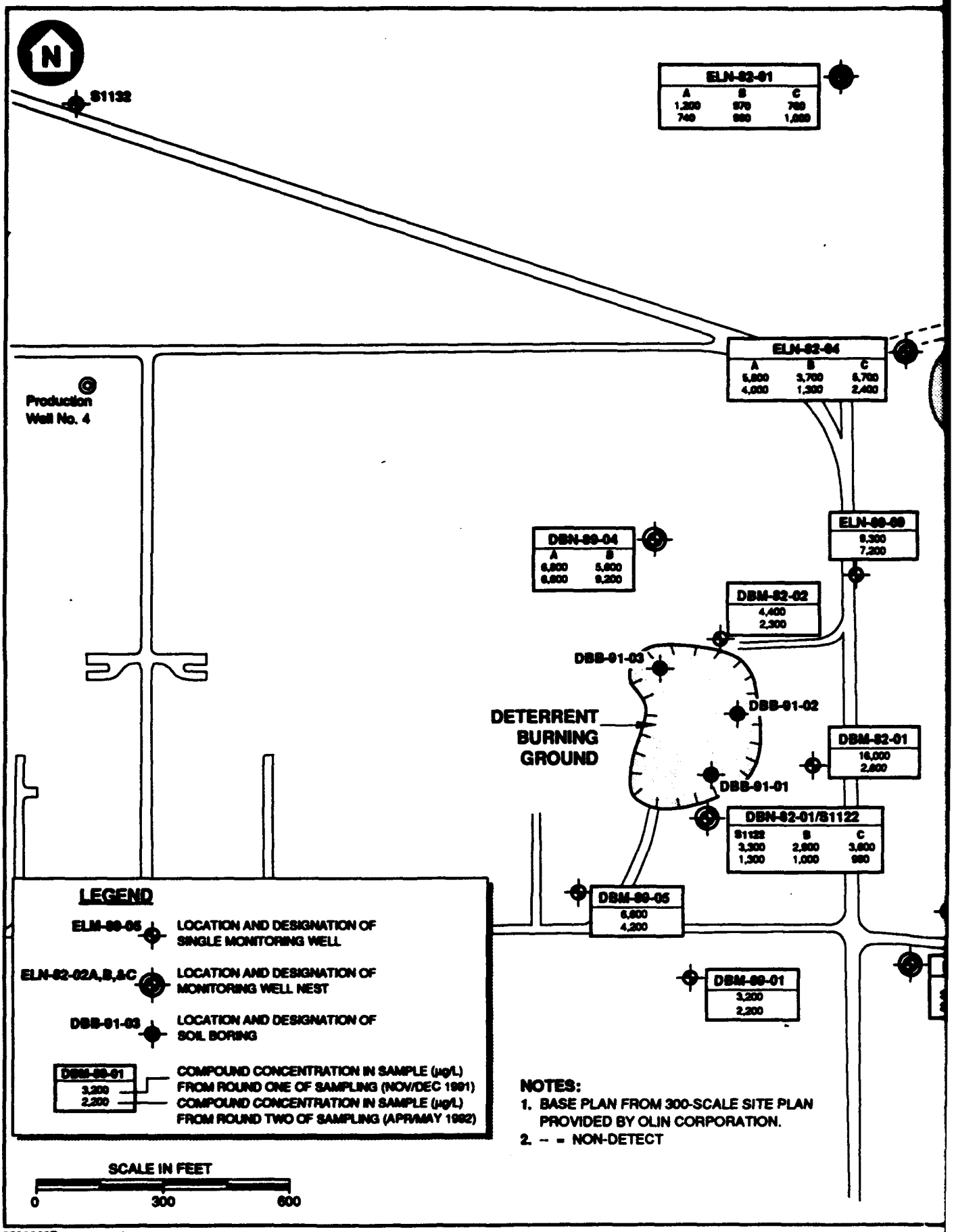


FIGURE 7-24
SO4 DISTRIBUTION IN GROUNDWATER
DETERRENT BURNING GROUND AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.


N
S1132
ELN-92-01
A B C
1,200 970 760
740 980 1,000
ELN-92-04
A B C
5,800 3,700 5,700
4,000 1,300 2,400
Production Well No. 4
ELN-89-09
9,300
7,200
DBN-89-04
A B
6,800 5,600
6,600 9,200
DBM-92-02
4,400
2,300
DBB-91-03
DBB-91-02
DETERRENT BURNING GROUND
DBM-92-01
16,000
2,600
DBB-91-01
DBN-92-01/S1122
S1122 B C
3,300 2,900 3,600
1,300 1,000 980
DBM-89-05
6,600
4,200
DBM-89-01
3,200
2,200
LEGEND
ELM-89-05 LOCATION AND DESIGNATION OF SINGLE MONITORING WELL
ELN-92-02A,B,&C LOCATION AND DESIGNATION OF MONITORING WELL NEST
DBB-91-03 LOCATION AND DESIGNATION OF SOIL BORING
DBM-89-01
3,200
2,200
COMPOUND CONCENTRATION IN SAMPLE (µg/L) FROM ROUND ONE OF SAMPLING (NOV/DEC 1991)
COMPOUND CONCENTRATION IN SAMPLE (µg/L) FROM ROUND TWO OF SAMPLING (APR/MAY 1992)
NOTES:
1. BASE PLAN FROM 300-SCALE SITE PLAN PROVIDED BY OLIN CORPORATION.
2. -- = NON-DETECT
SCALE IN FEET
0 300 600

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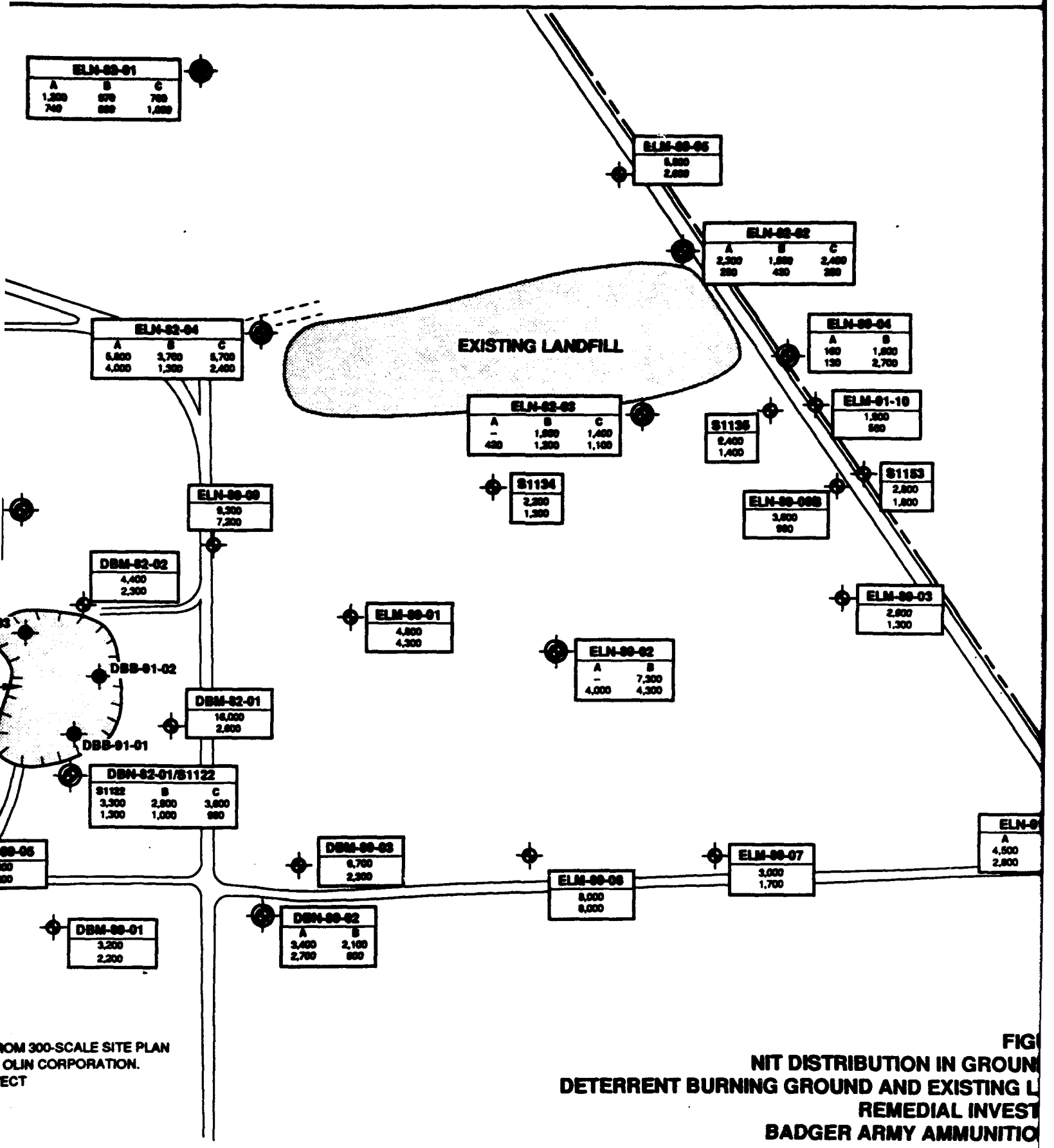
2



OM 300-SCALE SITE PLAN
OLIN CORPORATION.
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NIT DISTRIBUTION IN GROUN
DETERRENT BURNING GROUND AND EXISTING L
REMEDIAL INVEST
BADGER ARMY AMMUNITIO

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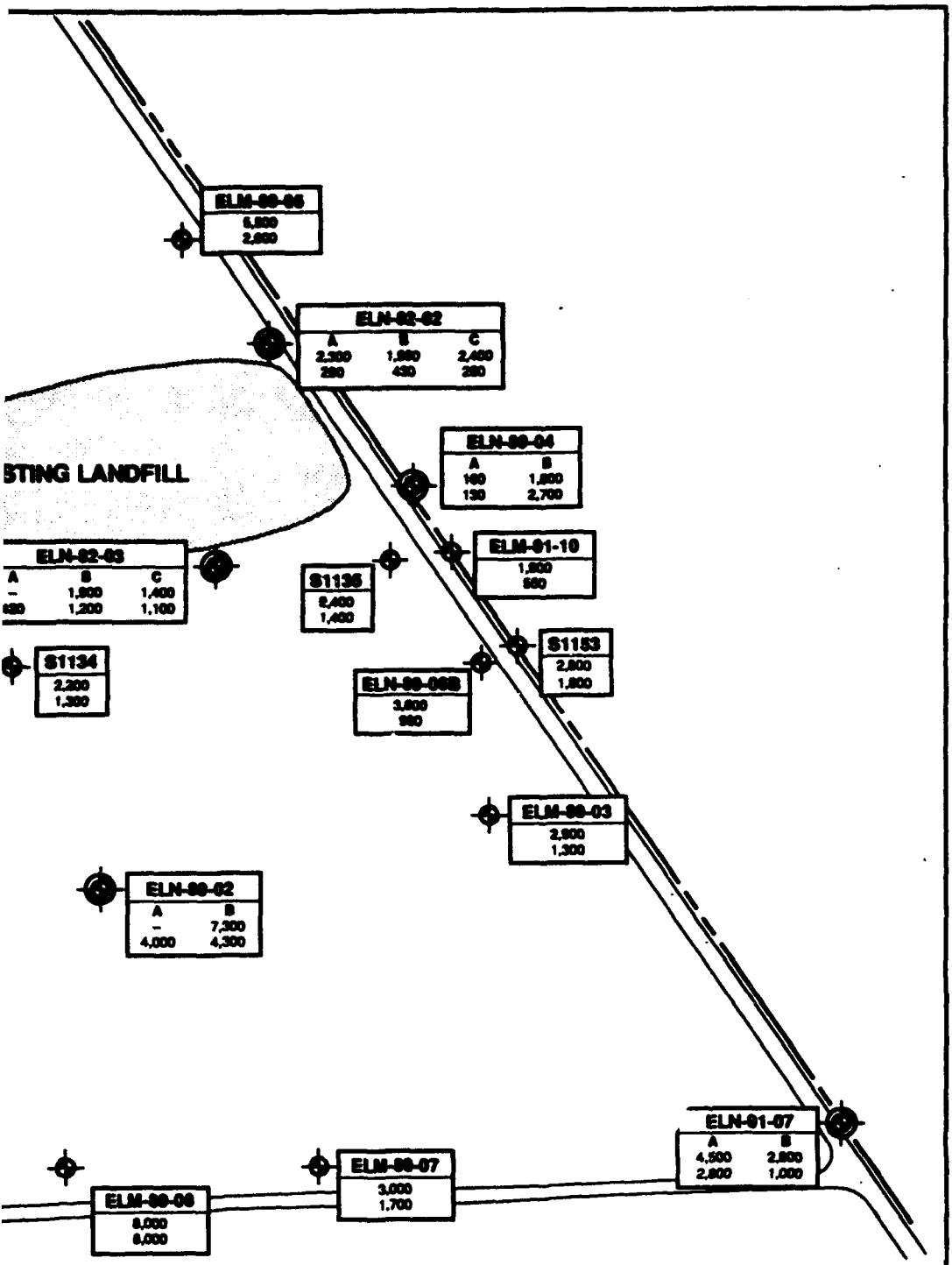

FIGURE 7-25
NIT DISTRIBUTION IN GROUNDWATER
DETERRENT BURNING GROUND AND EXISTING LANDFILL
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

TABLE 8-1
HISTORY OF ACID SPILLS -
NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SPILL DATE	CAUSE	MATERIAL	AMOUNT (TONS)	CONTROL
4/79	Tank leakage	Oleum	47	Diked, neutralized
6/81	Tank overflow	Sulfuric acid	0.4	Diked, neutralized
9/81	Tank seal failure	Nitric acid	0.5	Diked, neutralized
10/81	Tank car leakage	Nitrous acid	7.8	Diked, neutralized
6/82	Tank overflow	Sulfuric acid	27	Diked, neutralized
6/82	Tank leakage	Nitric acid	<4	Diked, neutralized
10/82	Tank leakage	Sulfuric acid	0.4	Diked, neutralized
11/84	Pipe failure	Mixed acids	185	Recovered, diked, neutralized

Source: Tsai et al., 1988.

TABLE 8-2
SUMMARY OF THE REMEDIAL INVESTIGATION FIELD PROGRAM - NITROGLYCERINE POND/ROCKET PASTE AREA/NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITES	PROGRAM ELEMENTS				
	SOIL VAPOR SURVEY	REMOTE SENSING GEOPHYSICS	MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING*	SOIL BORINGS AND SOIL SAMPLING	SEDIMENT, SURFACE SOIL, AND SURFACE WATER SAMPLING
Nitroglycerine Pond and Rocket Paste Area	--	--	4 new wells; 20 samples from 4 new and 6 existing wells	--	70 surface soil samples 8 sediment samples 4 surface water samples
New Acid Area	--	--	6 samples from existing wells	--	--

Notes:

* Includes 2 rounds of groundwater sampling

W0039213 T8/1

TABLE 8-3
SUMMARY OF MONITORING WELLS INSTALLED -
NITROGLYCERINE POND/ROCKET PASTE AREA/NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE AND WELL IDENTIFIER	DRILLING METHOD	BORING DEPTH FROM GROUND SURFACE (ft.)	BOTTOM ELEVATION OF SCREENS (ft. MSL)	LENGTH OF WELL SCREEN (ft.)	LOCATION	PURPOSE
Nitroglycerine Pond						
NPM-89-01	Drill through casing hammer	111	762.5	20	Downgradient and 700 feet south of the Nitroglycerine Pond and the Batch Nitroglycerine Area.	To provide horizontal definition of any potential plumes from the Nitroglycerine Pond and the Batch Nitroglycerine Area.
Rocket Paste Area						
RPM-89-01	Drill through casing hammer	127	761.9	20	Adjacent to the Rocket Area drainage ditch and downgradient of the Rocket Paste Pond.	To characterize water quality at the water table downgradient of the Rocket Paste Pond and adjacent to the Rocket Paste Area drainage ditch.
RPM-89-02	Drill through casing hammer	115	761.2	20	Downgradient and southeast of the Rocket Paste Pond.	To characterize groundwater quality and elevation downgradient and southeast of the Rocket Paste Pond.
RPM-91-01	Dual-wall driven casing	110	766.0	10	Downgradient and east of the Rocket Paste Area.	To assess groundwater quality downgradient of the east Rocket Paste Area.

TABLE 8-4
FIELD HYDRAULIC CONDUCTIVITY TEST RESULTS -
NITROGLYCERINE POND/ROCKET PASTE AREA/NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL DESIGNATION	MAXIMUM WATER LEVEL DEPRESSION (FEET)	HYDRAULIC CONDUCTIVITY (CM/SEC)	GEOLOGIC CONDITIONS
RPM-89-01[1]	1.3	$2x10^{-1}$	Medium to coarse sand and medium to coarse gravel (SP-GP)
RPM-89-02	1.7	$1x10^{-1}$	Fine to coarse sand with little gravel (SP)

Notes:

Hydraulic Conductivity Tests completed during March and November, 1989, and November and December 1991.

Field data and calculations are presented in Appendix I.

Values for hydraulic conductivities represent an averaged value of multiple tests performed on each well.

[1] Water level recovery at these wells impacted by inertial effects, resulting in water level recovery above static water levels. Hydraulic conductivity measurements may be greater than the calculated values at these wells.

cm/sec = centimeters per second

TABLE 8-5
WELLS INCLUDED IN GROUNDWATER SAMPLING PROGRAM -
NITROGLYCERINE POND/ROCKET PASTE AREA/NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITES	NEW WELLS	EXISTING WELLS
Nitroglycerine Pond and Rocket Paste Area	RPM-89-01 RPM-89-02 RPM-91-01 NPM-89-01	S1118 S1119 S1120 S1124 S1125 S1150
Subtotal	4	6
New Acid Area		NAN-81-01A NAN-81-02B NAN-81-03B,C NAN-81-04B,C
Subtotal	0	6
Magazine Area		S1115 S1116
Subtotal	0	2
Southeastern/Eastern Boundary		S1110 S1111 S1112 S1113 S1114 S1121
Subtotal	0	6
TOTAL WELLS	4	20

TABLE 8-6
CHEMICAL ANALYSES PERFORMED ON SURFACE SOIL AND SEDIMENT SAMPLES -
NITROGLYCERINE POND/ ROCKET PASTE AREA/ NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS														OTHER			ORGANICS				
	TOTAL METALS								TCLP METALS				ANIONS									
SAMPLE LOCATION	PP	AL	CA	NA	CD	CR	HG	PB	CD	CR	HG	PB	NIT	SO4	NH3N2	TOC	pH	VOC	BN/A	NG	NAM	DNT
NPS-01-01	—	—	—	—	1	1	1	1	—	—	—	—	—	—	1	—	—	—	—	1	—	—
NPS-01-02	—	—	—	—	1	1	1	1	—	—	—	—	—	—	1	—	—	—	—	1	—	—
NPS-01-03	—	—	—	—	1	1	1	1	—	—	—	—	—	—	1	—	—	—	—	1	—	—
NPS-01-04	—	—	—	—	1	1	1	1	—	—	—	—	—	—	1	—	—	—	—	1	—	—
NPS-01-05	—	—	—	—	1	1	1	1	—	—	—	—	—	—	1	—	—	—	—	1	—	—
NPS-01-06	—	—	—	—	1	1	1	1	—	—	—	—	—	—	1	—	—	—	—	1	—	—
NPS-01-07	—	—	—	—	1	1	1	1	—	—	—	—	—	—	1	—	—	—	—	1	—	—
NPS-01-08	—	—	—	—	1	1	1	1	—	—	—	—	—	—	1	—	—	—	—	1	—	—
NPS-01-09	—	—	—	—	1	1	1	1	—	—	—	—	—	—	1	—	—	—	—	1	—	—
NPS-01-10	—	—	—	—	1	1	1	1	—	—	—	—	—	—	1	—	—	—	—	1	—	—
ROCKET PASTE AREA																						
RPS-01-01	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-01-02	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-01-03	—	—	—	—	1	1	1	1	—	—	—	—	1	1	—	—	—	—	1	1	1	1
RPS-01-04	—	—	—	—	1	1	1	1	—	—	—	—	1	1	—	—	—	—	1	1	1	1
RPS-01-05	—	—	—	—	1	1	1	1	—	—	—	—	1	1	—	—	—	—	1	1	1	1
RPS-01-06	—	—	—	—	1	1	1	1	—	—	—	—	1	1	—	—	—	—	1	1	1	1
RPS-01-07	—	—	—	—	1	1	1	1	—	—	—	—	1	1	—	—	—	—	1	1	1	1
RPS-01-08	—	—	—	—	1	1	1	1	—	—	—	—	1	1	—	—	—	—	1	1	1	1
RPS-01-09	—	—	—	—	1	1	1	1	—	—	—	—	1	1	—	—	—	—	1	1	1	1
RPS-01-10	—	—	—	—	1	1	1	1	—	—	—	—	1	1	—	—	—	—	1	1	1	1
RPS-01-11	—	—	—	—	1	1	1	1	—	—	—	—	1	1	—	—	—	—	1	1	1	1
RPS-01-12	—	—	—	—	1	1	1	1	—	—	—	—	1	1	—	—	—	—	1	1	1	1
RPS-01-13	—	—	—	—	1	1	1	1	—	—	—	—	1	1	—	—	—	—	1	1	1	1
RPS-01-14	—	—	—	—	1	1	1	1	—	—	—	—	1	1	—	—	—	—	1	1	1	1
RPS-01-15	—	—	—	—	1	1	1	1	—	—	—	—	1	1	—	—	—	—	1	1	1	1
RPS-01-16	—	—	—	—	1	1	1	1	—	—	—	—	1	1	—	—	—	—	1	1	1	1
RPS-01-17	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-01-18	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-01-19	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-01-20	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1

TABLE 6-6
CHEMICAL ANALYSES PERFORMED ON SURFACE SOIL AND SEDIMENT SAMPLES -
NITROGLYCERINE POND/ ROCKET PASTE AREA/ NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS														OTHER			ORGANICS				
	TOTAL METALS								TCLP METALS				ANIONS									
SAMPLE LOCATION	PP	AL	CA	NA	CD	CR	HG	PB	CD	CR	HG	PB	NIT	SO4	NH3N2	TOC	pH	VOC	BN/A	NG	NAM	DNT
RPS-91-21	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-22	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-23	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-24	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-25	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-26	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-27	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-28	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-29	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-30	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-31	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-32	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-33	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-34	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-35	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-36	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-37	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-38	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-39	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-40	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-41	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-42	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-43	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-44	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-45	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-46	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-47	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-48	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-49	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-50	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-51	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-52	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1

TABLE 8-6
CHEMICAL ANALYSES PERFORMED ON SURFACE SOIL AND SEDIMENT SAMPLES -
NITROGLYCERINE POND/ ROCKET PASTE AREA/ NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS														OTHER			ORGANICS				
	TOTAL METALS								TCLP METALS				ANIONS									
SAMPLE LOCATION	PP	AL	CA	NA	CD	CR	HG	PB	CD	CR	HG	PB	NIT	SO4	NH3N2	TOC	pH	VOC	BN/A	NG	NAM	DNT
RPS-91-53	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-54	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-55	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-56	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-57	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-58	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-59	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-60	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-61	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-62	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-63	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-64	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-65	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-66	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-67	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
RPS-91-68	—	—	—	—	1	1	1	1	1	1	1	1	1	1	—	—	—	—	1	1	1	1
TOTALS	0	0	0	0	77	77	77	77	53	53	53	53	67	67	10	0	0	0	67	77	67	67

NOTES:
PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, PB, HG, NI, SB, SE, TL, ZN)
TAL = Toxic Analyte List (23) (AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)
VOC = volatile organic compounds by GC/MS
GC/MS = Gas Chromatography/Mass Spectrometry
BN/A = base-neutral and acid-extractable organics by GC/MS
NAM = nitrosamines by GC
DNT = 2,4- and 2,6-dinitrotoluene by HPLC
HPLC = High Performance Liquid Chromatrography

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TABLE 8-7
CHEMICAL ANALYSES PERFORMED ON SURFACE WATER SAMPLES
NITROGLYCERINE POND/ROCKET PASTE POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS								ORGANICS			
SAMPLE LOCATION	TAL METAL	NIT	NH3N2	2KJEL	SO4	CL	ALK	HARD	VOC	BN/A	NG	DNT
NITROGLYCERINE POND												
.PW-91-01	1	1	1	1	1	1	1	1	1	1	1	1
NPW-91-02	1	1	1	1	1	1	1	1	1	1	1	1
ROCKET PASTE POND												
RPW-91-01	1	1	1	1	1	1	1	1	1	1	1	1
RPW-91-02	1	1	1	1	1	1	1	1	1	1	1	1
TOTALS	4	4	4	4	4	4	4	4	4	4	4	4

NOTES:

BN/A = base-neutral and acid-extractable organics by GC/MS
DNT = 2,4- and 2,6-dinitrotoluene by HPLC
GC/MS = Gas Chromatography/Mass Spectrometry
HPLC = High Performance Liquid Chromatrography
NAM = nitrosamines by GC
N2KJEL = Nitrogen by Kjeldahl Method
PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, PB, HG, NI, SB, SE, TL, ZN)
TAL = Toxic Analyte List (23) (AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)
VOC = volatile organic compounds by GC/MS

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TABLE 8-8
CHEMICAL ANALYSES PERFORMED ON GROUNDWATER SAMPLES –
NITROGLYCERINE POND/ ROCKET PASTE AREA/ NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS																	ORGANICS					TPH
	METALS									ANIONS			OTHER										
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	NI	NIT	CL	SO4	HARD	ALK	TDS	TOC	NH3N2	VOC	BN/A	NG	NAM	DNT	
NITROGLYCERINE POND																							
NPM-89-01	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	B	B	—	B	—	—	—
S1124	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	B	B	—	B	—	—	—
ROCKET PASTE AREA																							
RPM-89-01	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	B	B	B	B	B	B	—
RPM-89-02	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	B	B	B	B	B	B	—
RPM-91-01	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	B	B	B	B	B	B	—
S1118	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	B	B	—	B	—	—	—
S1119	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	B	B	—	B	—	—	—
S1120	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	B	B	—	B	—	—	—
S1125	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	B	B	—	B	—	—	—
S1150	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	B	B	—	B	—	—	—
NEW ACID AREA																							
NAN-81-01 A	—	—	B	B	B	B	—	B	B	B	B	B	B	B	B	—	—	B	—	—	—	—	—
NAN-81-02 B	—	—	B	B	B	B	—	B	B	B	B	B	B	B	B	—	—	B	—	—	—	—	—
NAN-81-03 B	—	—	B	B	B	B	—	B	B	B	B	B	B	B	B	—	—	B	—	—	—	—	—
NAN-81-03 C	—	—	B	B	B	B	—	B	B	B	B	B	B	B	B	—	—	B	—	—	—	—	—
NAN-81-04 B	—	—	B	B	B	B	—	B	B	B	B	B	B	B	B	—	—	B	—	—	—	—	—
NAN-81-04 C	—	—	B	B	B	B	—	B	B	B	B	B	B	B	B	—	—	B	—	—	—	—	—
MAGAZINE AREA																							
S1115(1)	B	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	B	—	—	—
S1116	B	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	—	B	—	—	—

TABLE 8-8
CHEMICAL ANALYSES PERFORMED ON GROUNDWATER SAMPLES -
NITROGLYCERINE POND/ ROCKET PASTE AREA/ NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS																	ORGANICS					TPH
	METALS									ANIONS			OTHER										
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	NI	NIT	CL	SO4	HARD	ALK	TDS	TOC	NH3N2	VOC	BN/A	NG	NAM	DNT	
SOUTHEASTERN/EASTERN BOUNDARY																							
S1110	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	—	—	—	—	—	—
S1111	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	—	—	—	—	—	—
S1112	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	—	—	—	—	—	—
S1113	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
S1114	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
S1121	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	2	—	—	—	—

NOTES:

PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, PB, HG, NI, SB, SE, TL, ZN)
TAL = Toxic Analyte List (23) (AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)
VOC = volatile organic compounds by GC/MS
GC/MS = Gas Chromatography/Mass Spectrometry
BN/A = base-neutral and acid-extractable organics by GC/MS
NAM = nitrosamines by GC
DNT = 2,4- and 2,6-dinitrotoluene by HPLC
HPLC = High Performance Liquid Chromatrography
(1) AG was not analyzed for in Round Two.
B = Analyzed in Both Rounds (One and Two).
2 = Analyzed in Round Two Only.

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TABLE 8-9
SUMMARY OF SURFACE SOIL AND SEDIMENT CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		NPS-91-01	NPS-91-02	NPS-91-03	NPS-91-04	NPS-91-05	NPS-91-06	NPS-91-07	NPS-91-08	NPS-91-09	NPS-91-10
Sample Type:		POND	POND	POND	POND	POND	POND	POND	POND	POND	POND
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/20/91	09/20/91	09/22/91	09/22/91	09/22/91	09/22/91	09/22/91	09/22/91	09/20/91	09/20/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SVOCs	123PDA										
	24DNT										
	26DNT										
	B2EHP										
	BAANTR										
	BBFANT										
	BGHIPY										
	CHRY										
	DEP										
	FANT										
	NG	-	-	-	-	-	-	-	-	9.390	15.800
	NNDMEA										
	NNDNPA										
	NNDPA										
	PHANTR										
	PYR										
Metals	CR	40.500	30.900	30.600	16.300	4.900	20.700	7.000	28.900	39.500	32.100
	HG	12.000	20.000	14.000	3.500	0.159	5.100	0.752	14.000	2.400	-
	PB	410.000	110.000	270.000	140.000	32.000	190.000	58.000	240.000	2000.000	10000.000
Anions	NIT										
	SO4										
Indicator parameter	NH3	3.870	6.850	72.500	15.100	2.280	66.700	6.110	22.900	17.700	4.470

Notes and flagging codes are presented at the end of this table.

TABLE 8-9
SUMMARY OF SURFACE SOIL AND SEDIMENT CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		RPS-91-01	RPS-91-02	RPS-91-03	RPS-91-04	RPS-91-05	RPS-91-06	RPS-91-07	RPS-91-08	RPS-91-09	RPS-91-10
Sample Type:		DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/20/91	09/20/91	09/17/91	09/17/91	09/17/91	09/17/91	09/17/91	09/17/91	09/17/91	09/17/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SVOCs	123PDA										
	24DNT	-	-	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	B2EHP	-	-	-	-	-	-	-	-	-	-
	BAANTR	-	-	-	-	-	-	-	-	-	-
	BBFANT	-	-	-	-	-	-	-	-	-	-
	BGHIPY	-	-	-	-	-	-	-	-	-	-
	CHRY	-	-	-	-	-	-	-	-	0.080	-
	DEP	-	2.460	-	-	-	1.780	6.200 GT	-	6.200 GT	1.930
	FANT	-	-	-	-	-	-	-	-	0.060	-
	NG	1.760	-	-	-	0.729	-	1.630	-	3.280	1.220
	NNDMEA	-	-	-	-	-	-	-	-	-	-
	NNDNPA	-	-	-	-	-	-	-	-	-	-
	NNDPA	4.980	0.738	-	-	0.245	0.355	0.976	0.199	1.740	0.768
	PHANTR	-	-	-	-	-	-	-	-	-	-
	PYR	-	-	-	-	-	-	-	-	-	-
Metals	CR	45.700	33.800	4.410	17.400	17.800	15.400	6.220	15.300	13.100	11.800
	HG	0.157	0.080	-	-	-	-	-	-	-	-
	PB	2600.000	1100.000	470.000	3500.000	24.000	110.000	120.000	9.500	120.000	14.300
Anions	NIT	2.220	1.960	2.350	4.150	4.860	5.300	3.290	6.550	4.480	3.180
	SO4	150.000	210.000	6.280	10.200	-	-	-	6.810	-	-
Indicator parameter	NH3										

Notes and flagging codes are presented at the end of this table.

TABLE 8-9
SUMMARY OF SURFACE SOIL AND SEDIMENT CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		RPS-91-11	RPS-91-12	RPS-91-13	RPS-91-14	RPS-91-15	RPS-91-16	RPS-91-17	RPS-91-18	RPS-91-19	RPS-91-20
Sample Type:		DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/17/91	09/17/91	09/17/91	09/17/91	09/17/91	09/17/91	09/18/91	09/18/91	09/18/91	09/18/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SVOCs	123PDA										
	24DNT	-	24.100	6.200 GT	9.230	-	-	-	-	-	-
	26DNT	-	2.120	1.250	6.360	-	-	-	-	-	-
	B2EHP	1.560	-	-	-	-	-	-	-	-	-
	BAANTR	-	-	-	-	-	-	-	-	-	-
	BBFANT	-	-	-	-	-	-	-	-	-	-
	BGHIPY	-	-	-	-	-	-	-	-	-	-
	CHRY	-	-	0.305	0.322	-	-	-	-	-	-
	DEP	6.200 GT	6.200 GT	6.200 GT	5.880	2.980	-	7.550	6.200 GT	-	6.200 GT
	FANT	-	-	0.235	0.323	-	-	0.048	0.091	-	-
	NG	9.570	130.000	290.000	3.870	-	4.770	-	15.900	-	2.330
	NNDMEA	-	-	-	-	-	-	-	-	-	-
	NNDNPA	-	-	-	-	-	-	-	-	-	-
	NNDPA	47.000	260.000	450.000	49.000	2.090	1.940	0.121	0.375	0.538	0.101
	PHANTR	-	-	0.115	0.279	-	-	-	0.097	-	-
	PYR	-	-	0.252	0.380	-	-	-	-	-	-
Metals	CR	21.400	12.600	38.700	23.300	15.400	13.700	21.600	19.200	27.800	11.600
	HG	-	-	0.067	0.067	0.560	0.054	-	0.069	-	-
	PB	1100.000	19.000	170.000	58.000	15.300	190.000	110.000	1400.000	16.000	130.000
Anions	NIT	9.030	3.200	9.410	6.670	6.250	1.360	5.530	6.340	3.700	4.090
	SO4	-	-	-	-	-	-	7.670	-	8.370	17.100
Indicator parameter	NH3										

Notes and flagging codes are presented at the end of this table.

TABLE 8-9
SUMMARY OF SURFACE SOIL AND SEDIMENT CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		RPS-91-21	RPS-91-22	RPS-91-23	RPS-91-24	RPS-91-25	RPS-91-26	RPS-91-27	RPS-91-28	RPS-91-29	RPS-91-30
Sample Type:		DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH
UNITS		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/18/91	09/18/91	09/18/91	09/18/91	09/18/91	09/18/91	09/18/91	09/18/91	09/18/91	09/18/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SVOCs	123PDA										
	24DNT	-	-	-	-	-	-	-	-	-	
	26DNT	-	-	-	-	-	-	-	-	-	-
	B2EHP	1.610	-	-	-	-	-	-	-	-	
	BAANTR	-	-	-	-	-	-	-	-	-	-
	BBFANT	-	-	-	-	-	-	-	-	-	-
	BGHIPY	-	-	-	-	-	-	-	-	-	
	CHRY	-	-	-	-	0.189	-	-	-	0.147	-
	DEP	-	-	6.200 GT	6.200 GT	6.200 GT	-	6.200 GT	6.29	5.250	6.200 GT
	FANT	-	-	0.155	-	0.179	-	-	-	0.111	0.068
	NG	-	-	4.840	2.390	3.870	12.100	1.700	0.873	5.820	-
	NNDMEA	-	-	-	-	-	-	-	-	-	-
	NNDNPA	-	-	-	-	-	-	-	-	-	-
	NNDPA	-	-	3.470	2.480	1.700	-	36.000	0.167	1.960	2.550
	PHANTR	-	-	0.096	0.129	0.119	-	-	-	-	0.056
	PYR	-	-	0.223	-	0.221	-	-	-	0.179	-
Metals	CR	9.920	3.410	20.600	19.600	13.800	6.470	6.620	6.650	16.500	12.400
	HG	-	-	-	-	-	-	-	-	-	-
	PB	64.000	15.000	580.000	180.000	130.000	22.000	54.000	12.000	110.000	730.000
Anions	NIT	2.000	2.200	3.580	8.540	5.380	1.690	4.130	-	4.130	2.950
	SO4	-	-	7.520	11.600	11.000	-	-	-	-	-
Indicator parameter	NH3										

Notes and flagging codes are presented at the end of this table.

TABLE 8-9
SUMMARY OF SURFACE SOIL AND SEDIMENT CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		RPS-91-31	RPS-91-31	RPS-91-32	RPS-91-32	RPS-91-33	RPS-91-33	RPS-91-34	RPS-91-34	RPS-91-35	RPS-91-35
Sample Type:		DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/18/91	09/18/91	09/18/91	09/18/91	09/18/91	09/18/91	09/18/91	09/18/91	09/18/91	09/18/91
DEPTH:		0.000	0.500	0.000	0.700	0.000	0.500	0.000	0.300	0.000	0.500
SVOCs	123PDA							19.000 S	19.000 S		
	24DNT	-	-	-	-	-	-	-	-	-	-
	26DNT	-	-	-	-	-	-	-	-	-	-
	B2EHP	-	-	-	-	-	-	-	-	-	-
	BAANTR	-	-	-	-	-	-	0.173	-	-	-
	BBFANT	-	-	-	-	-	-	-	-	-	-
	BGHIPY	-	-	-	-	-	-	-	-	-	-
	CHRY	-	-	-	-	-	-	-	-	-	-
	DEP	6.200 GT	49.800 S	6.200 GT	47.100 S	0.652	-	6.200 GT	4.980 S	2.050	2.110 S
	FANT	-	-	0.052	-	-	-	0.159	-	-	-
	NG	27.900		48.500		1.250		26.100		1.700	
	NNDMEA	-	-	-	-	-	-	0.040	-	-	-
	NNDNPA	-	-	-	-	-	-	-	-	-	-
	NNDPA	1.780	-	3.700	-	-	-	81.000	-	2.460	-
	PHANTR	-	-	0.102	-	-	-	0.111	-	-	-
	PYR	-	-	-	-	-	-	-	-	-	-
Metals	CR	5.590		14.700		14.600		31.600		66.500	
	HG	-		-		-		-		-	
	PB	42.000		120.000		12.600		75.000		150.000	
Anions	NH1	5.380		2.240		2.440		3.780		3.040	
	SO4	-		-		-		-		-	
Indicator parameter	NH3										

Notes and flagging codes are presented at the end of this table.

TABLE 8-9
SUMMARY OF SURFACE SOIL AND SEDIMENT CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		RPS-91-36	RPS-91-36	RPS-91-37	RPS-91-38	RPS-91-39	RPS-91-40
Sample Type:		DTCH	DTCH	DTCH	DTCH	DTCH	DTCH
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/18/91	09/18/91	09/19/91	09/19/91	09/19/91	09/19/91
DEPTH:		0.000	0.500	0.000	0.000	0.000	0.000
SVOCs	123PDA						
	24DNT	-	-	-	93.100	33.200	560.000
	26DNT	-	-	-	6.200 GT	6.200 GT	23.100
	B2EHP	-	-	-	-	-	-
	BAANTR	-	-	-	-	-	0.280
	BBFANT	-	-	-	-	-	2.130
	BGHIPY	-	-	-	-	-	-
	CHRY	-	-	0.211	-	-	0.865
	DEP	-	-	-	6.200 GT	1.860	-
	FANT	-	-	0.164	-	-	1.120
	NG	-		-	310.000	240.000	1400.000
	NNDMEA	-	-	-	0.150	0.022	0.302
	NNDNPA	-	-	-	0.230	0.096	0.226
	NNDPA	0.092	-	0.429	3.590	900.000	10000.000
	PHANTR	-	-	0.101	0.146	-	-
	PYR	-	-	0.299	-	-	0.932
Metals	CR	12.500		9.000	18.400	15.600	109.000
	HG	-		-	0.161	0.098	0.716
	PB	8.500		100.000	290.000	260.000	2200.000
Anions	NIT	4.130		4.170	4.840	3.330	120.000
	SO4	-		-	-	-	7.560
Indicator parameter	NH3						

Notes and flagging codes are presented at the end of this table.

TABLE 8-9
SUMMARY OF SURFACE SOIL AND SEDIMENT CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		RPS-91-41	RPS-91-42	RPS-91-43	RPS-91-44	RPS-91-45	RPS-91-46	RPS-91-47	RPS-91-48	RPS-91-49	RPS-91-50
Sample Type:		DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH
UNITS.		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/19/91	09/19/91	09/19/91	09/19/91	09/19/91	09/19/91	09/19/91	09/19/91	09/19/91	09/19/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SVOCs	123PDA										
	24DNT	3.950	-	-	-	-	-	-	8.340	3.150	810.000
	26DNT	-	-	-	-	-	-	-	0.790	-	32.500
	B2EHP	-	-	-	-	-	-	-	-	-	-
	BAANTR	-	-	-	-	-	-	-	-	-	-
	BBFANT	-	-	-	-	-	-	-	-	-	-
	BGHIPY	-	-	-	-	-	-	-	-	-	-
	CHRY	-	-	-	-	-	-	-	-	-	-
	DEP	-	-	-	-	-	-	-	1.860	0.901	6.200 GT
	FANT	-	-	-	-	-	-	-	-	-	0.118
	NG	4.330	-	-	-	-	-	1.120 N	23.300	27.200	1500.000
	NNDMEA	-	-	-	-	-	-	-	-	-	0.123
	NNDNPA	-	-	-	-	-	-	-	-	-	0.160
	NNDPA	59.000	3.920	1.770	0.345	1.050	1.060	2.950	250.000	120.000	2600.000
	PHANTR	-	-	-	-	-	-	-	-	-	0.197
	PYR	-	-	-	-	-	-	-	-	-	-
Metals	CR	12.500	14.600	6.400	24.800	3.730	10.300	13.200	26.000	23.500	39.600
	HG	0.083	-	-	0.055	-	-	0.061	-	0.071	0.212
	PB	78.000	21.000	20.000	40.000	160.000	43.000	32.000	32.000	78.000	140.000
Anions	NIT	7.190	9.110	4.890	7.140	4.960	2.680	12.500	2.660	12.700	6.110
	SO4	-	-	-	-	-	-	17.800	-	16.200	-
Indicator parameter	NH3										

Notes and flagging codes are presented at the end of this table.

TABLE 8-9
SUMMARY OF SURFACE SOIL AND SEDIMENT CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		RPS-91-51	RPS-91-52	RPS-91-53	RPS-91-54	RPS-91-55	RPS-91-56	RPS-91-57	RPS-91-58	RPS-91-59	RPS-91-60
Sample Type:		DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/19/91	09/19/91	09/19/91	09/19/91	09/19/91	09/19/91	09/20/91	09/20/91	09/20/91	09/20/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SVOCs	123PDA										
	24DNT	86.300	-	-	-	-	-	-	-	-	-
	26DNT	6.530	-	-	-	-	-	-	-	-	-
	B2EHP	-	-	-	-	-	-	-	-	-	-
	BAANTR	0.666	-	-	-	-	-	-	-	-	-
	BBFANT	2.030	-	-	-	-	-	-	-	-	-
	BGHIPY	1.910	-	-	-	-	-	-	-	-	-
	CHRY	1.000	-	-	-	-	-	-	-	-	-
	DEP	2.510	-	-	-	6.200 GT	1.650	-	-	6.200 GT	-
	FANT	0.274	-	-	-	0.058	0.050	0.059	-	-	0.083
	NG	7.550	1.210 N	3.300	9.500	48.200	2.170 N	1.840	-	31.500	2.190
	NNDMEA	0.059	-	-	-	-	-	-	-	0.023	-
	NNDNPA	0.127	-	-	-	-	-	-	-	-	-
	NNDPA	2400.000	1.350	13.000	240.000	19.000	1.420	0.467	-	3.910	12.000
	PHANTR	0.231	-	-	-	0.076	-	-	-	-	-
	PYR	0.683	-	-	-	-	-	-	-	-	-
Metals	CR	30.800	7.040	7.100	13.800	35.500	19.900	19.300	9.760	16.000	19.900
	HG	0.134	-	0.060	-	-	0.056	-	-	0.117	-
	PB	490.000	15.000	35.000	29.000	140.000	100.000	55.000	40.000	52.000	57.000
Anions	NIT	7.040	2.730	3.780	9.460	6.000	3.650	3.930	4.730	7.550	7.320
	SO4	6.390	8.020	6.210	-	-	-	-	-	-	-
Indicator parameter	NH3										

Notes and flagging codes are presented at the end of this table.

TABLE 8-9
SUMMARY OF SURFACE SOIL AND SEDIMENT CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		RPS-91-61	RPS-91-62	RPS-91-63	RPS-91-64	RPS-91-65	RPS-91-66	RPS-91-67	RPS-91-68
Sample Type:		DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH	DTCH
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		09/20/91	09/20/91	09/20/91	09/20/91	09/20/91	09/20/91	09/20/91	09/20/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SVOCs	123PDA								
	24DNT	-	-	-	-	-	-	6.850	-
	26DNT	-	-	-	-	-	-	0.783	-
	B2EHP	-	-	-	-	-	-	-	-
	BAANTR	-	-	0.193	-	-	-	-	-
	BBFANT	-	-	-	-	-	-	-	-
	BGHIPY	-	-	-	-	-	-	-	-
	CHRY	-	-	-	-	-	-	-	-
	DEP	-	-	-	-	-	-	-	-
	FANT	-	-	-	-	-	-	0.046	-
	NG	0.709	-	-	1.540	-	-	-	-
	NNDMEA	-	-	-	-	-	-	-	-
	NNDNPA	-	-	-	-	-	-	-	-
	NNDPA	3.370	-	0.476	86.000	0.138	1.370	200.000	0.129
	PHANTR	-	-	-	-	-	-	-	-
	PYR	-	-	-	-	-	-	-	-
Metals	CR	10.700	15.500	21.100	20.900	7.730	8.620	10.800	10.400
	HG	-	-	-	-	-	-	-	-
	PB	34.000	29.000	44.000	32.000	19.000	27.000	72.000	19.000
Anions	NIT	6.950	4.170	3.560	9.690	8.460	6.120	4.100	2.910
	SO4	-	-	-	12.800	22.900	-	-	-
Indicator parameter	NH3								

Notes and flagging codes are presented at the end of this table.

TABLE 8-9
SUMMARY OF SOIL AND SEDIMENT CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	[illegible] than the Certified Reporting Limit (CRL)
GT	=	[illegible] than the reported value
B	=	[illegible] found in blank as well as sample
G	=	[illegible]ted results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

Appendix K contains complete analytical results.

USATHAMA chemical codes are defined in the RI Report Glossary

TABLE 8-10
SUMMARY OF SURFACE WATER CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		NPW-91-01	NPW-91-02	RPW-91-01	RPW-91-02
Sample Type:		POND	POND	POND	POND
UNITS:		UGL	UGL	UGL	UGL
DATE SAMPLED:		09/22/91	09/22/91	09/20/91	09/20/91
DEPTH:		0.000	0.000	0.000	0.000
SVOCs	N2KJEL	1800.000	3100.000	2600.000	3800.000
	NH3N2	63.400	147.000	33.800	63.400
Metals	AL	3020.000	2140.000	5410.000	31400.000
	AS	5.430	4.980	8.600	15.000
	BA	47.300	63.100	121.000	290.000
	BE	-	-	-	2.170
	CA	11700.000	15200.000	30800.000	38200.000
	CR	-	-	-	59.500
	CU	-	-	21.300	79.100
	FE	3970.000	2920.000	7980.000	31700.000
	HG	0.325	0.324	-	-
	K	12800.000	15000.000	43000.000	44000.000
	MG	5340.000	5880.000	14900.000	20900.000
	MN	81.700	207.000	152.000	503.000
	NA	7790.000	8320.000	1190.000	2000.000
	PB	41.200	45.900	910.000	3100.000
	V	8.370	6.620	22.300	57.100
	ZN	-	-	34.900	151.000
Anions	CL	1680.000	1930.000	2700.000	2730.000
	NIT	-	-	10.500	-
	SO4	4070.000	4470.000	32000.000	35000.000
Indicator parameter	ALK	116000	78100	128000	124000
	HARD	58200	54100	491000	129000

Notes and flagging codes are presented at the end of this table.

TABLE 8-10
SUMMARY OF SURFACE WATER CHEMICAL DATA
NITROGLYCERINE POND/ ROCKET PASTE AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

Appendix K contains complete analytical results

USATHAMA chemical codes are defined in the RI Report Glossary

TABLE 8-11
SUMMARY OF GROUNDWATER CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA/ NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		NPM-89-01			RPM-89-01			RPM-89-02			RPM-91-01		
Sample Type:		WELL			WELL			WELL			WELL		
UNITS:		UGL			UGL			UGL			UGL		
DATE SAMPLED:		11/25/91		04/14/92	12/12/91		04/15/92	12/12/91		04/21/92	12/12/91		04/22/92
ROUND:		ONE		TWO	ONE		TWO	ONE		TWO	ONE		TWO
VOCs	13DMB	-		-	-		-	-		-	-		-
	ACET	-		-	-		-	-		-	-		-
	CCL4	-		-	-		-	-		-	-		-
	CH2CL2	-		6.76	B 4.02	P	4.12	P 4.9	P	5.78	B 4.71	P	5.69 B
	CHCL3	-		-	-		-	-		-	-		1.51
	DEETH												
	MEC6H5	-		-	-		-	-		-	-		-
	TRCLE	-		-	-		-	-		-	-		-
SVOCs	B2EHP				92.4		-	-		32	P -		-
	TRIMBZ												
Metals	BA												
	CA												
	CD	-		-	-		-	-		-	-		-
	CR	9.52		-	6.31		-	-		-	5.5		-
	CU												
	FE												
	K												
	MG												
	NA												
	NI												
	PB	-		-	-		-	11.2		17	-		-
	V												
	ZN												
Anions	NIT	2400		1900	3100		1600	2600		1900	5200		4100
	CL	25000	X	25000 P	14000		15000	26000	P	26000 P	7500		7600
	SO4	36000		36000	38000		37000	38000		37000	31000		32000
Indicator parameter	ALK	278000		284000	209000		270000	272000		293000	327000		315000
	HARD	330000		330000	302000		310000	324000		345000	380000		373000
	NH3	-		-	-		-	-		-	-		-
	TDS	392000		357000	375000		304000	360000		384000	413000		381000
	pH(1)	7.0		7.6	7.6		7.6	8.2		7.5	7.5		7.5
	Sp.Cond (2)	673		585	484		638	652		597	570		585

Notes and flagging codes are presented at the end of this table.

TABLE 8-11
SUMMARY OF GROUNDWATER CHEMICAL DATA -
NITROGLYCERINE POND/ ROCKET PASTE AREA/ NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		NAN-81-01A			NAN-81-02B			NAN-81-03B			NAN-81-03C			NAN-81-04B		
Sample Type:		WELL			WELL			WELL			WELL			WELL		
UNITS:		UGL			UGL			UGL			UGL			UGL		
DATE SAMPLED:		12/11/91		04/12/92	12/11/91		04/12/92	12/11/91		04/12/92	12/11/91		04/13/92	12/11/91		04/14/92
ROUND:		ONE		TWO	ONE		TWO	ONE		TWO	ONE		TWO	ONE		TWO
VOCs	13DMB	-		-	-		-	-		-	-		-	-		-
	ACET	-		-	-		-	-		-	-		-	-		-
	CCL4	-		-	-		-	-		-	-		-	-		-
	CH2CL2	4.120	P	-	4.610	P	5.490	B	4.310	P	5.780	B	3.920	P	6.86	B	4.9	P	5.980	B
	CHCL3	-		-	-		-	-		-	-		-	-		-	-		-	
	DEETH																			
	MEC6H5	-		-	-		-	-		-	-		-	-		-	-		-	
	TRCLE	-		-	-		-	-		-	-		-	-		-	-		-	
SVOCs	B2EHP																			
	TRIMBZ																			
Metals	BA																			
	CA	85000		79000	100000		96000	70000		65000	81000		81000	75000		78000
	CD	-		-	-		-	-		-	3.29		-	3.41		-
	CR	-		-	9.120		8.23	5.370		-	8.83		-	8.46		-
	CU															
	FE															
	K															
	MG															
	NA	-		99000	29000	T	30000	20000	T	19000	-		73000	21000	T	24000
	NI	-		-	-		25.600	-		-	21		19.200	-		-
	PB	-		-	-		-	-		-	-		-	-		-
	V															
	ZN															
Anions	NIT	7300		8500	11000	X	9800	4000		2000	11000	X	10000	5200		2200
	CL	24000	P	26000	P	37000		45000	23000	P	27000	X	27000	P	29000	P	23000	P	23000
	SO4	64000		81000	100000		100000	39000		45000	150000		150000	81000		110000
Indicator parameter	ALK	246000		290000	248000		342000	240000		240000	252000		262000	228000		236000
	HARD	330000		348000	402000		416000	256000		284000	276000		342000	290000		342000
	NH3															
	TDS	384000		411000	507000		503000	316000		311000	524000		531000	388000		40[illegible]000
	pH(1)	7.6		7.5	7.5		7.4	7.7		7.5	7.7		7.2	7.7		7.7
	Sp.Cond.(2)	639		668	737		753	521		500	796		731	590		594

Notes and flagging codes are presented at the end of this table.

TABLE 8-11
SUMMARY OF GROUNDWATER CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA/ NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		NAN-81-04C				S1110				S1111				S1112				S1113			
Sample Type:		WELL				WELL				WELL				WELL				WELL			
UNITS:		UGL				UGL				UGL				UGL				UGL			
DATE SAMPLED:		12/11/91		04/14/92		12/12/91		04/22/92		12/12/91		04/22/92		11/24/91		04/22/92		11/23/91		04/15/92	
ROUND:		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO	
VOCs	13DMB	-		-														-		-	
	ACET	-		-														-		-	
	CCL4	-		-														36.3		-	
	CH2CL2	4.61	P	5.78	B													3.63	P	2.84	P
	CHCL3	-		-														-		0.543	P
	DEETH			30	S																
	MEC6H5	-		-														-		-	
	TRCLE	-		-														-		-	
SVOCs	B2EHP																	-		-	
	TRIMBZ																				
Metals	BA																	110		98.000	
	CA	65000		61000														80000		82000	
	CD	-		-														-		-	
	CR	-		-														9.2		-	
	CU																	-		4.69	
	FE																	-		-	
	K																	2200	T	2130	T
	MG																	42000		41000	
	NA	18000	T	12000														2720	T	11000	T
	NI	-		-														-		-	
	PB	-		-														-		-	
	V																	5.42		12.5	
	ZN																	148		-	
Anions	NIT	2500		1800		4000		2900		1100		810		4400		3700		3400		2700	
	CL	14000		14000		14000		15000		3200	P	4600		23000		25000	X	26000	P	30000	P
	SO4	51000		52000		31000		31000		18000		17000		28000		28000		12000		14000	
Indicator parameter	ALK	192000		194000		268000		270000		331000		314000		302000		305000		307000		301000	
	HARD	274000		262000		292000		324000		308000		323000		352000		362000		354000		360000	
	NH3																				
	TDS	291000		273000		359000		323000		344000		335000		400000		383000		344000		356000	
	pH(1)	7.8		7.5		7.4		7.7		7.3		7.7		7.7		7.6		7.4		7.5	
	Sp.Cond.(2)	470		455		391		510		384		514		533		578		559		624	

Notes and flagging codes are presented at the end of this table.

TABLE 8-11
SUMMARY OF GROUNDWATER CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA/ NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		S1114				S1115				S1116				S1118				S1119			
Sample Type:		WELL				WELL				WELL				WELL				WELL			
UNITS:		UGL				UGL				UGL				UGL				UGL			
DATE SAMPLED:		11/23/91		04/22/92		11/24/91		04/23/92		11/24/91		04/23/92		12/12/91		04/22/92		12/10/91		04/21/92	
ROUND:		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO	
VOCs	13DMB	-		-		-		-		-		-		-		-		-		-	
	ACET	-		-		-		-		-		-		-		-		7.5	S	-	
	CCL4	3.630		-		-		-		-		-		-		-		-		-	
	CH2CL2	3.820	P	5.39	B	4.61	P	7.55	B	4.61	P	7.84	B	4.12	P	5.78	B	4.8	P	5.69	B
	CHCL3	0.835		-		-		-		-		0.594	P	-		-		-		-	
	DEETH																				
	MEC6H5	-		-		-		-		-		-		-		-		-		-	
	TRCLE	0.531		-		-		-		-		-		-		-		-		-	
SVOCs	B2EHP	145		-																	
	TRIMBZ																				
Metals	BA	24.8		24.4																	
	CA	61000		70000																	
	CD			-		-		-		-		-		-		-		-		-	
	CR	7.55		-		11.9		-		11		-		6.85		-		6.51		4.71	
	CU	-		-		4.790		17.4		-		-									
	FE	136		-																	
	K	1040	T	1500	T																
	MG	34000		35000																	
	NA	2350	T	3030	T																
	NI	-		-		-		-		-		-									
	PB	-		-		-		-		-		-		-		-		-		7.46	
	V	5.25		17.8																	
	ZN	26		-		89		-		197		-									
Anions	NIT	3400		5400		5000		4500		3800		3400		8000		6600		3500		1700	
	CL	6300		7600		14000		14000		31000	P	32000	P	19000		19000		18000		18000	
	SO4	20000		22000		17000		19000		28000		30000		51000		49000		37000		37000	
Indicator	ALK	241000		304000		240000		248000		262000		334000		261000		293000		258000		284000	
parameter	HARD	278000		283000		282000		308000		328000		323000		342000		343000		258000		322000	
	NH3													-		-		-			
	TDS	269000		272000		320000		311000		371000		369000		401000		377000		345000		353000	
	pH(1)	7.8		7.9		7.7		7.6		7.1		7.6		7.6		7.7		8.3		7.6	
	Sp.Cond.(2)	437		454		430		421		593		494		545		578		628		576	

Notes and flagging codes are presented at the end of this table.

TABLE 8-11
SUMMARY OF GROUNDWATER CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA/ NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		S1120				S1121				S1124				S1125				S1150			
Sample Type:		WELL				WELL				WELL				WELL				WELL			
UNITS:		UGL				UGL				UGL				UGL				UGL			
DATE SAMPLED:		12/08/91		04/22/92		12/09/91		04/13/92		12/09/91		04/14/92		12/10/91		04/14/92		11/24/91		04/14/92	
ROUND:		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO	
VOCs	13DMB	6.1	S	-		4.7	S	-		6.8	S	-		-		-		-		-	
	ACET	-		-		-		-		-		-		-		-		-		14.0	S
	CCL4	-		-		-		-		-		-		-		-		-		-	
	CH2CL2	5.0	P	6.86	B	5.49		7.25	B	5.2	P	5.88	B	4.61	P	7.35	B	4.41	P	4.61	P
	CHCL3	-		-		-		-		-		-		-		-		-		0.634	P
	DEETH																				
	MEC6H5	-		-		-		-		5.19	P	-		-		-		-		-	
	TRCLE	-		-		-		-		-		-		-		-		-		-	
SVOCs	B2EHP					-		-													
	TRIMBZ	20	S							7.0	S										
Metals	BA					28.3		30.9													
	CA					67000		80000													
	CD	-		-		-		-		-		-		-		-		-		-	
	CR	7 26		-		-		-		7.73		-		5.5		-		6.16		-	
	CU					-		4.76													
	FE					28.8		28.4													
	K					1140	T	1390	T												
	MG					39000		43000													
	NA					25000	T	25000	T												
	NI					-		-													
	PB	-		10 200		-		-		-		-		-		-		-		-	
	V					-		9.18													
	ZN					-		-													
Anions	NIT	3100		2100		2600		990		5700		2500		4600		1400		4900		4000	
	CL	9400		9800		63000		89000		20000		24000		3800		3900		24000	X	27000	X
	SO4	27000		27000		10000		10000		21000		19000		25000		25000		38000		38000	
Indicator parameter	ALK	296000		249000		278000		294000		469000		458000		294000		262000		244000		232000	
	HARD	864000		316000		338000		366000		438000		451000		240000		278000		314000		306000	
	NH3	88		-						-		-		-		-		55.5		-	
	TDS	300000		315000		375000		391000		496000		503000		313000		269000		387000		288000	
	pH(1)	7.7		7.7		8.3		7.8		8.3		7.5		8.4		7.7		6.5		7.4	
	Sp.Cond.(2)	532		488		740		676		849		802		557		481		633		506	

Notes and flagging codes are presented at the end of this table.

TABLE 8-11
SUMMARY OF GROUNDWATER CHEMICAL DATA-
NITROGLYCERINE POND/ ROCKET PASTE AREA/ NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S		Results based on internal standard
T		Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

Appendix K contains complete analytical results

USATHAMA chemical codes are defined in the RI Report Glossary

TABLE 8-12
TCLP METALS DATA SUMMARY
CONCENTRATION IN SEDIMENT -
NITROGLYCERINE POND/ROCKET PASTE AREA/NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	TCLP LEACHATE CONCENTRATION (µg/ℓ)			
SAMPLE LOCATION	CD	CR	PB	HG
TCLP RL[1]	1,000	5,000	5,000	200
Minimum Reporting Value	6.8	16.8	43.4	0.1
NPS-89-01	NT	NT	NT	LT
NPS-89-02	NT	NT	NT	0.3
NPS-89-03	NT	NT	NT	LT
NPS-89-04	NT	NT	NT	LT
NPS-89-05	NT	NT	NT	LT
NPS-89-06	NT	NT	NT	LT
NPS-89-07	NT	NT	NT	LT
NPS-89-08	NT	NT	NT	LT
NPS-89-09	NT	NT	NT	LT
NPS-89-10	NT	NT	NT	LT
RPS-90-01	LT	LT	4,378	NT
RPS-90-02	LT	LT	3,806	NT
RPS-90-03	LT	LT	26,480	NT
RPS-90-04	LT	LT	427	NT
RPS-90-05	LT	LT	NT	NT
RPS-90-06	LT	LT	1,011	NT
RPS-90-07	LT	LT	728	NT
RPS-90-08	LT	LT	NT	NT
RPS-90-09	LT	LT	368	NT
RPS-90-10	8	LT	7,449	NT
RPS-90-11	LT	LT	541	NT
RPS-90-12	LT	LT	4,755	NT
RPS-90-13	LT	LT	1,081	NT
RPS-90-14	LT	LT	NT	NT
RPS-90-15	LT	LT	NT	NT
RPS-90-16	LT	LT	2[illegible]	NT
RPS-91-17	LT	LT	[illegible]	LT

continued

TABLE 8-12
TCLP METALS DATA SUMMARY
CONCENTRATION IN SEDIMENT -
NITROGLYCERINE POND/ROCKET PASTE AREA/NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	TCLP LEACHATE CONCENTRATION (μg/ℓ)			
SAMPLE LOCATION	CD	CR	PB	HG
TCLP RL[1]	1,000	5,000	5,000	200
RPS-91-18	LT	LT	1,660	LT
RPS-91-19	LT	LT	LT	LT
RPS-91-20	LT	LT	517	LT
RPS-91-21	LT	LT	90	LT
RPS-91-22	LT	LT	LT	LT
RPS-91-23	LT	LT	427	LT
RPS-91-24	LT	LT	256	LT
RPS-91-25	LT	LT	242	LT
RPS-91-26	LT	LT	111	LT
RPS-91-27	LT	LT	170	LT
RPS-91-28	LT	LT	91	LT
RPS-91-29	LT	LT	LT	LT
RPS-91-30	LT	LT	968	LT
RPS-91-31	LT	LT	3,860	LT
RPS-91-32	LT	LT	152	LT
RPS-91-33	LT	LT	LT	LT
RPS-91-34	LT	LT	LT	LT
RPS-91-35	LT	LT	92	LT
RPS-91-36	LT	LT	LT	LT
RPS-91-37	LT	LT	LT	0.1
RPS-91-38	LT	LT	427	LT
RPS-91-39	LT	LT	136	LT
RPS-91-40	7.7	LT	305	0.2
RPS-91-41	LT	LT	LT	LT
RPS-91-42	LT	LT	LT	LT
RPS-91-43	LT	LT	LT	LT

continued

TABLE 8-12
TCLP METALS DATA SUMMARY
CONCENTRATION IN SEDIMENT -
NITROGLYCERINE POND/ROCKET PASTE AREA/NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	TCLP LEACHATE CONCENTRATION (μg/ℓ)			
SAMPLE LOCATION	CD	CR	PB	HG
TCLP RL[1]	1,000	5,000	5,000	200
RPS-91-44	LT	LT	LT	LT
RPS-91-45	LT	LT	LT	LT
RPS-91-46	LT	LT	LT	LT
RPS-91-47	LT	LT	LT	LT
RPS-91-48	LT	LT	LT	LT
RPS-91-49	LT	LT	LT	LT
RPS-91-50	LT	LT	LT	LT
RPS-91-51	LT	LT	95	LT
RPS-91-52	LT	LT	LT	LT
RPS-91-53	LT	LT	LT	LT
RPS-91-54	LT	LT	LT	LT
RPS-91-55	LT	LT	LT	0.1
RPS-91-56	LT	LT	LT	LT
RPS-91-57	LT	LT	LT	LT
RPS-91-58	LT	LT	LT	LT
RPS-91-59	LT	LT	LT	LT
RPS-91-60	LT	LT	LT	LT
RPS-91-61	LT	LT	LT	LT
RPS-91-62	LT	LT	LT	LT
RPS-91-63	LT	LT	LT	LT
RPS-91-64	LT	LT	LT	LT
RPS-91-65	LT	LT	LT	LT

continued

TABLE 8-12
TCLP METALS DATA SUMMARY
CONCENTRATION IN SEDIMENT -
NITROGLYCERINE POND/ROCKET PASTE AREA/NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	TCLP LEACHATE CONCENTRATION (µg/ℓ)			
SAMPLE LOCATION	CD	CR	PB	HG
TCLP RL[1]	1,000	5,000	5,000	200
RPS-91-66	LT	LT	LT	LT
RPS-91-67	LT	LT	LT	0.1
RPS-91-68	LT	25	LT	LT

Notes:

1 TCLP Regulatory Levels (RLs) exist for the following metals: AS, BA, CD, CR, SE, PB, HG, and AG However, these results were reported only for CD, CR, PB, and HG. (List of USATHAMA Chemical Codes for definitions of chemical abbreviations).

NT = Not tested

LT = Less than TCLP RL

TABLE 8-13
COMPOUNDS OF POTENTIAL CONCERN
NITROGLYCERINE POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND OF CONCERN	EXPOSURE POINT CONCENTRATION		
	SURFACE SOIL[1] (µg/g)	POND SEDIMENT[2] (µg/g)	SURFACE WATER[3] (mg/ℓ)
AL	--	--	3.02
AS	--	--	0.00543
BA	--	--	0.0631
CL	--	--	1.93
CR	--	40.5	--
HG	2.4	20	0.000325
MN	--	--	0.207
NG	15.8	--	--
NH3	17.7	72.5	--
NH3N2	--	--	0.147
PB	10,000	410	0.0459
SO4	--	--	4.47
V	--	--	0.00837

Notes:

-- = Not identified as a compound of potential concern
Exposure point concentration is the maximum detected concentration
µg/g = micrograms per gram; equivalent to parts per million (ppm)
mg/ℓ = milligram per liter
[1] Assessment of surface soil contamination was performed using samples from NPS-91-09 and NPS-91-10.
[2] Assessment of sediment contamination was performed using samples from NPS-91-01 through NPS-91-08.
[3] Assessment of surface water contamination was performed using samples NPW-91-01 and NPW-91-02.

TABLE 8-14
SUMMARY OF RISK ESTIMATES
NITROGLYCERINE POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

EXPOSURE SCENARIO	EXPOSURE ROUTE	CANCER RISK	HAZARD INDEX
Current and Future Grounds Maintenance Worker	Soil Ingestion	ND	0.008
	Inhalation of Particulates and Volatiles	ND	0.000008
	Total	ND	0.008
Future Residential	Soil Ingestion	ND	0.1
Future Child Playing	Ingestion of Sediment	ND	0.03
	Ingestion of Surface Water	$4x10^{-8}$	0.0006
	Dermal Contact with Surface Water	$4x10^{-8}$	0.0006
	Total for Child Playing	$8x10^{-8}$	0.0312

Notes:

ND = Not determined - cancer slope factors not available for compounds of potential concern.

TABLE 8-15
COMPOUNDS OF POTENTIAL CONCERN
ROCKET PASTE AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND OF CONCERN	EXPOSURE POINT CONCENTRATION		
	SURFACE SOIL[1] (µg/g)	POND SEDIMENT[2] (µg/g)	SURFACE WATER[3] (mg/ℓ)
24DNT	8.0	--	--
26DNT	32.5	--	--
BAANTR	0.666	--	--
BBFANT	2.13	--	--
BGHIPY	1.91	--	--
CHRY	1	--	--
DEP	49.8	2.46	--
FANT	1.12	--	--
NG	1,500	1.76	--
NNDMEA	0.302	--	--
NNDNPA	0.23	--	--
NNDPA	10,000	4.98	--
PHANTR	0.279	--	--
PYR	0.932	--	--
AL	--	--	3.14
AS	--	--	0.015
BA	--	--	0.29
BE	--	--	0.00219
CL	--	--	2.73
CR	109	45.7	0.0595
CU	--	--	0.0791
HG	0.716	0.157	--
MN	--	--	0.503
NH3N2	--	--	0.0634
NI	--	--	0.0407

continued

TABLE 8-15
COMPOUNDS OF POTENTIAL CONCERN
ROCKET PASTE AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND OF CONCERN	EXPOSURE POINT CONCENTRATION		
	SURFACE SOIL[1] (µg/g)	POND SEDIMENT[2] (µg/g)	SURFACE WATER[3] (mg/ℓ)
NIT	120	2.22	0.0105
PB	3,500	2,600	3.1
SO4	22.9	210	35
V	--	--	0.0571
ZN	--	--	0.151

Notes:

-- = Not identified as a compound of potential concern
Exposure point concentration is the maximum detected concentration
µg/g = micrograms per gram; equivalent to parts per million (ppm)
mg/ℓ = milligrams per liter
[1] Assessment of surface soil contamination (0 to 2 feet) was performed using samples from RPS-91-03 through RPS-91-68.
[2] Assessment of sediment contamination was performed using samples from RPS-91-01 and RPS-91-02.
[3] Assessment of surface water contamination was performed using samples RPW-91-01 and RPW-91-02.

TABLE 8-16
SUMMARY OF RISK ESTIMATES
ROCKET PASTE AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

EXPOSURE SCENARIO	EXPOSURE ROUTE	CANCER RISK	HAZARD INDEX
Current and Future Grounds Maintenance Worker	Soil Ingestion	$2x10^{-5}$	0.04
	Inhalation of Particulates and Volatiles	$7x10^{-9}$	ND
	Total for Grounds Maintenance Worker	$2x10^{-5}$	0.04
Future Residential	Soil Ingestion	$1x10^{-3}$	6.0
Future Child Playing	Ingestion of Sediment	$1x10^{-9}$	0.003
	Ingestion of Surface Water	$1x10^{-7}$	0.002
	Dermal Contact with Surface Water	$1x10^{-7}$	0.002
	Total for Child Playing	$2x10^{-7}$	0.007

Notes:

ND = Not determined - no toxicity factors available for compounds of potential concern.

TABLE 8-17
COMPARISON OF GROUNDWATER TO STANDARDS
UNITS: $\mu g/\ell$
NITROGLYCERINE POND/ROCKET PASTE AREA/NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND OF POTENTIAL CONCERN	FREQUENCY OF DETECTION	MAXIMUM DETECTED CONCENTRATION	MINIMUM DETECTED CONCENTRATION	SDWA (1)		WI GROUNDWATER STANDARDS (2)		CALCULATED CONCENTRATION (3)
				MCL	MCLG	ES	PAL	
BA	6:6	110	24.4	2,000	2,000	1,000(c)	200(c)	-
CD	2:42	3.41	3.29	5	5	10(d)	1(d)	-
CHCL3	5:42	1.51	0.543	-	-	6	0.6	-
CL	48:48	89,000	3,200	250,000(a)	-	250,000(e)	125,000(e)	-
CR	19:42	11.9	4.71	100	100	50(f)	5(f)	-
CU	4:10	17.4	4.69	TT	1,300	-	-	-
NA	16:18	99,000	2,350	20,000(b)	-	-	-	-
NIT	48:48	11,000	810	10,000	10,000	10,000	2,000	-
PB	4:42	17	7.46	TT	0	50(g)	5(g)	
SO4	48:48	150,000	10,000	250,000(a)	-	-	-	-
TRCLE	1:42	0.531	-	5	0	5	0 18	

continued

TABLE 8-17
COMPARISON OF GROUNDWATER TO STANDARDS
UNITS: μg/ℓ
NITROGLYCERINE POND/ROCKET PASTE AREA/NEW ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND OF POTENTIAL CONCERN	FREQUENCY OF DETECTION	MAXIMUM DETECTED CONCENTRATION	MINIMUM DETECTED CONCENTRATION	SDWA (1)		WI GROUNDWATER STANDARDS (2)		CALCULATED CONCENTRATION (3)
				MCL	MCLG	ES	PAL	
V	5:6	17.8	5.25	-	-	-	-	260
ZN	4:10	197	26.1	5,000(a)	-	5,000(e)	2,500(e)	7,300

Sources:

(1) U.S. Environmental Protection Agency (EPA), 1991, "Fact Sheet: National Primary Drinking Water Standards." Office of Water, Washington, D.C., August 1991; EPA, 1991, "Fact Sheet: National Secondary Drinking Water Standards," Office of Water, Washington, D.C., September 1991; and EPA, 1990, "National Primary and Secondary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals, Final Rule," 57FR31776, July 17, 1992 (see Subsection 3.6 for details).
(2) Wisconsin Administrative Code, Chapter NR 140.10, Table 1 (see Subsection 3.6 for details).
(3) Calculated to be protective at risk of 10^{-6} or HI of 1 (see Subsection 4.5 for details).

Notes:

(a) Secondary drinking water standard, suggested level.
(b) Reporting level. Monitoring is required and data is reported to health officials to protect individuals on restricted sodium diet.
(c) WI proposing change to ES = 2,000 μg/ℓ and PAL = 400 μg/ℓ
(d) WI proposing change to ES = 5 μg/ℓ and PAL = 0.5 μg/ℓ
(e) Value for protection of public welfare (usually aesthetic concerns) rather than protection of public health.
(f) WI proposing change to ES = 100 μg/ℓ and PAL = 10 μg/ℓ
(g) WI proposing change to ES = 15 μg/ℓ and PAL = 1.5 μg/ℓ

μg/ℓ = micrograms per liter
SDWA = Safe Drinking Water Act
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
WI = Wisconsin
ES = Enforcement Standard
PAL = Preventive Action Limit
TT = Treatment technique requirement in effect
Copper action level = 1,300 μg/ℓ, Lead action level = 15 μg/ℓ

TABLE 8-18
ECOLOGICAL CONTAMINANTS OF CONCERN[A]
NITROGLYCERINE POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil[C]		
HG	1:2	2.4
NG	2:2	15.8
NH3	2:2	17.7
PB	2:2	10,000
Surface Water[D]		
AL	2:2	3,020
AS	2:2	5.43
BA	2:2	63.1
CL	2:2	1,930
FE	2:2	3,970
HG	2:2	0.325
MN	2:2	207
NH3N2	2:2	147
PB	2:2	45.9
SO4	2:2	4,470
V	2:2	8.37
Sediment[E]		
CR	8:8	40.5
HG	8:8	20
NH3	8:8	72.5
PB	8:8	410

Notes:

A Constitutents selected based on criteria presented in Tables Q-18, Q-19, and Q-20 and discussed in Section 5.0.
B 95th percentile or maximum; units in $\mu g/g$ (surface soil and sediment) and $\mu g/\ell$ (surface water).
C Assessment of surface soil contamination was performed using samples from NPS-91-09 and NPS-91-10.
D Assessment of surface water contamination was performed using samples NPW-91-01 and NPW-91-02.
E Assessment of sediment contamination was performed using samples NPS-91-01 and NPS-91-08.

TABLE 8-19
ECOLOGICAL CONTAMINANTS OF CONCERN[A]
ROCKET PASTE AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil[C]		
24DNT	12:72	810
26DNT	10:72	32.5
BAANTR	4:72	0.666
CHRY	8:72	1
CR	66:66	109
DEP	37:72	49.8
FANT	20:72	1.12
HG	17:66	0.716
NG	42:66	1,500
NIT	65:66	120
NNDMEA	7:22	0.302
NNDNPA	5:72	0.23
NNDPA	58:72	10,000
PB	66:66	3,500
PHANTR	14:72	0.279
PYR	8:72	0.932
SO4	17:66	22.9
Surface Water[D]		
AL	2:2	31,400
AS	2:2	15
BA	2:2	290
BE	1:2	2.17
CL	2:2	2,730
CR	1:2	59.5
CU	2:2	79.1
FE	2:2	31,700

continued

TABLE 8-19
ECOLOGICAL CONTAMINANTS OF CONCERN[A]
ROCKET PASTE AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
MN	2:2	503
NH3N2	2:2	63.4
NI	1:2	40.7
NIT	1:2	10.5
PB	2:2	3,100
SO4	2:2	35,000
V	2:2	57.1
ZN	2:2	151
Sediment[E]		
CR	2	45.7
DEP	1	2.46
NG	1	1.76
NIT	2	2.22
NNDPA	2	4.98
PB	2	2,500
SO4	2	210

Notes:

A Constitutents selected based on criteria presented in Tables Q-16 and Q-17 and discussed in Section 5.0.
B 95th percentile or maximum; units in $\mu g/g$ (surface soil) and $\mu g/\ell$ (surface water).
C Assessment of surface soil contamination (0 to 2 feet) was performed using samples from RPS-91-03 through RPS-91-68.
D Assessment of surface water contamination was performed using samples from RPW-91-01 and RPW-91-02.
E Assessment of sediment contamination was performed using samples from RPS-91-01 and RPS-91-02.

TABLE 8-20
RISK EVALUATION FOR AQUATIC RECEPTORS
NITROGLYCERINE POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	EXPOSURE POINT CONCENTRATION[A]	RTV[B]	HAZARD QUOTIENT[C]
Surface Water			
AL	3,020	248	4
AS	5.43	153	0.035
BA	63.1	1,360	0.046
FE	31,700	1,000	31.7
CL	1,930	230,000	0.02
HG	0.325	0.012	27
MN	207	100	2.1
NH3N2	147	2,100	0.07
PB	45.9	3.2	14
SO4	4,470	1,060,000	0.0042
V	8.37	200	0.042
Sediments			
CR	40.5	100	0.41
HG	20	0.1	200
NH3	72.5	75	0.97
PB	410	50	8.2

Notes:

A Analytical results presented in Tables Q-19 and Q-20 and summarized in Table 8-18.

B Reference Toxicity Value (RTV) derived from available quality criteria and effects threshold levels as presented in Table Q-3.

C Calculated by dividing the exposure point concentration by the RTV; values in excess of 1.0E+00 indicate that the protective RTV was exceeded by environmental concentrations.

TABLE 8-21
SUMMARY OF RISK EVALUATION FOR TERRESTRIAL RECEPTORS
NITROGLYCERINE POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	HAZARD INDICES[A]	
RECEPTOR	ACUTE RISK[B]	CHRONIC RISK[C]
Short-tailed shrew	1.9E+04	3.8E+05
Eastern meadowlark	4.3E+02	4.8E+02
Garter snake	9.3E+02	7.4E+03
Red fox	1.7E+01	1.3E+00
Red-tailed hawk	5.0E+01	2.3E+00

Notes:

A Sum of the individual Hazard Quotients for each surface soil contaminant of concern; each HQ calculated by dividing the estimated exposure dosage by the Reference Toxicity Value (RTV). Hazard Quotients are presented in Appendix R, Tables R-55 and R-56 for acute and chronic exposures, respectively.

B Based on comparison with acute RTVs.

C Based on comparison with chronic RTVs.

TABLE 8-22
RISK EVALUATION FOR AQUATIC RECEPTORS
ROCKET PASTE AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	EXPOSURE POINT CONCENTRATION[A]	RTV[B]	HAZARD QUOTIENT[C]
Surface Water			
AL	31,400	748	41.9
AS	15	153	0.098
BA	290	1,360	0.21
BE	2.17	5.3	0.41
CL	2,730	230,000	0.029
CR	59.5	9.74	6.1
CU	79.1	2.27	35
FE	31,700	1,000	32
MN	503	100	5
NH3N2	63.4	2,100	0.03
NI	40.7	66.13	0.62
NIT	10.5	5,000	0.0021
PB	3,100	3.2	970
SO4	35,000	1,060,000	0.033
V	57.1	200	0.29
ZN	151	49.59	3
Sediment			
CR	45.7	100	.46
NIT	2.22	54.5	.004
PB	2,600	50	52
SO4	210	-	-
DEP	2.46	-	-

continued

TABLE 8-22
RISK EVALUATION FOR AQUATIC RECEPTORS
ROCKET PASTE AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	EXPOSURE POINT CONCENTRATION[A]	RTV[B]	HAZARD QUOTIENT[C]
NNDPA	4.98	-	-
NG	1.75	-	-

Notes:

A Analytical results presented in Tables Q-17 and summarized in Table 8-19.

B Reference Toxicity Value (RTV) derived from available quality criteria and effects threshold levels as presented in Table Q-3

C Calculated by dividing the exposure point concentration by the RTV; values in excess of 1.0E+00 indicate that the protective RTV was exceeded by environmental concentrations.

TABLE 8-23
SUMMARY OF RISK EVALUATION FOR TERRESTRIAL RECEPTORS
ROCKET PASTE AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

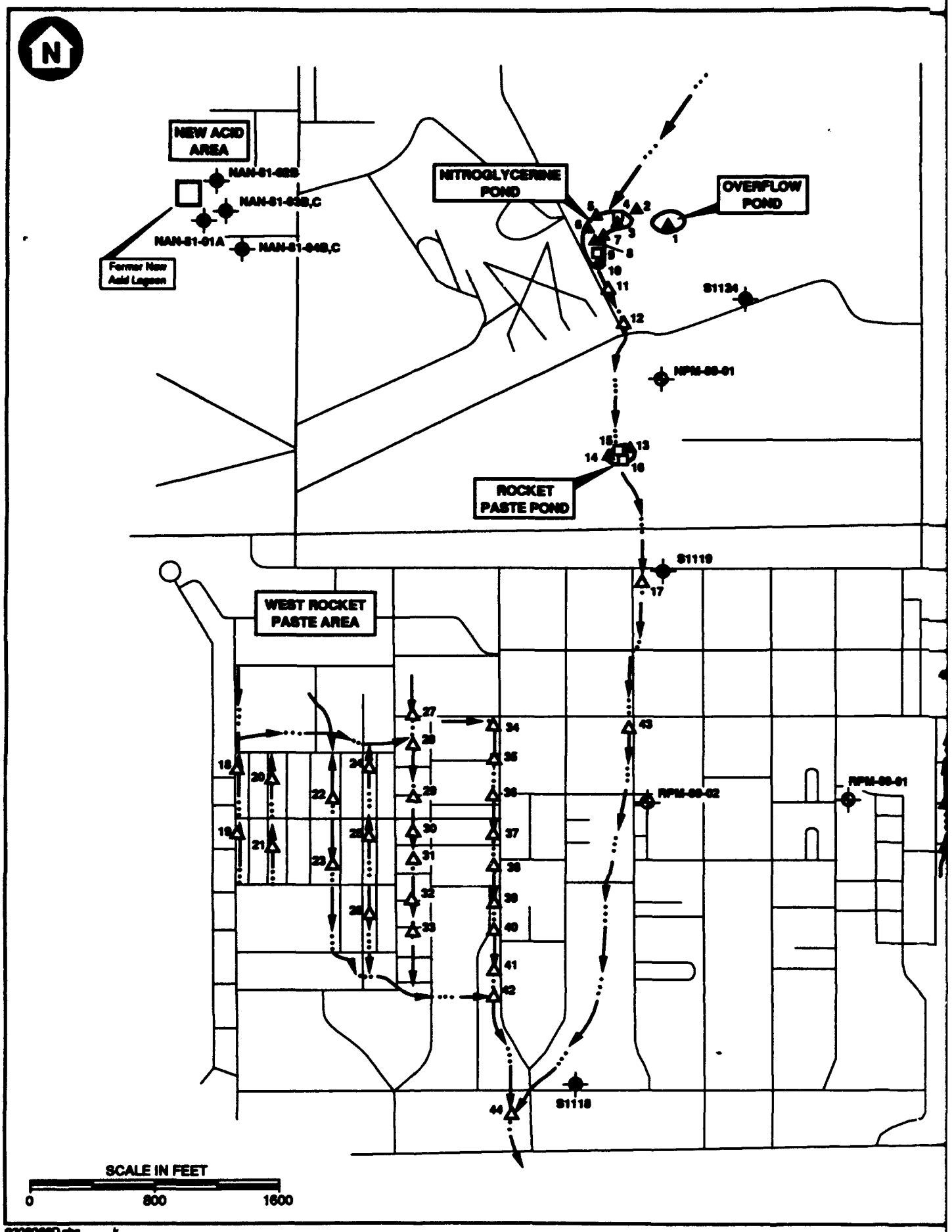
	HAZARD INDICES[A]	
RECEPTOR	ACUTE RISK[B]	CHRONIC RISK[C]
Short-tailed shrew	6.6E+03	1.3E+05
Eastern meadowlark	1.5E+02	4.4E+02
Garter snake	3.3E+02	6.5E+03
Red fox	1.9E+01	1.4E+02
Red-tailed hawk	2.9E+01	3.0E+02

Notes:

A Sum of the individual Hazard Quotients for each surface soil contaminant of concern; each HQ calculated by dividing the estimated exposure dosage by the Reference Toxicity Value (RTV). Hazard Quotients are presented in Appendix R, Tables R-53 and R-54 for acute and chronic exposures, respectively.

B Based on comparison with acute RTVs.

C Based on comparison with chronic RTVs.



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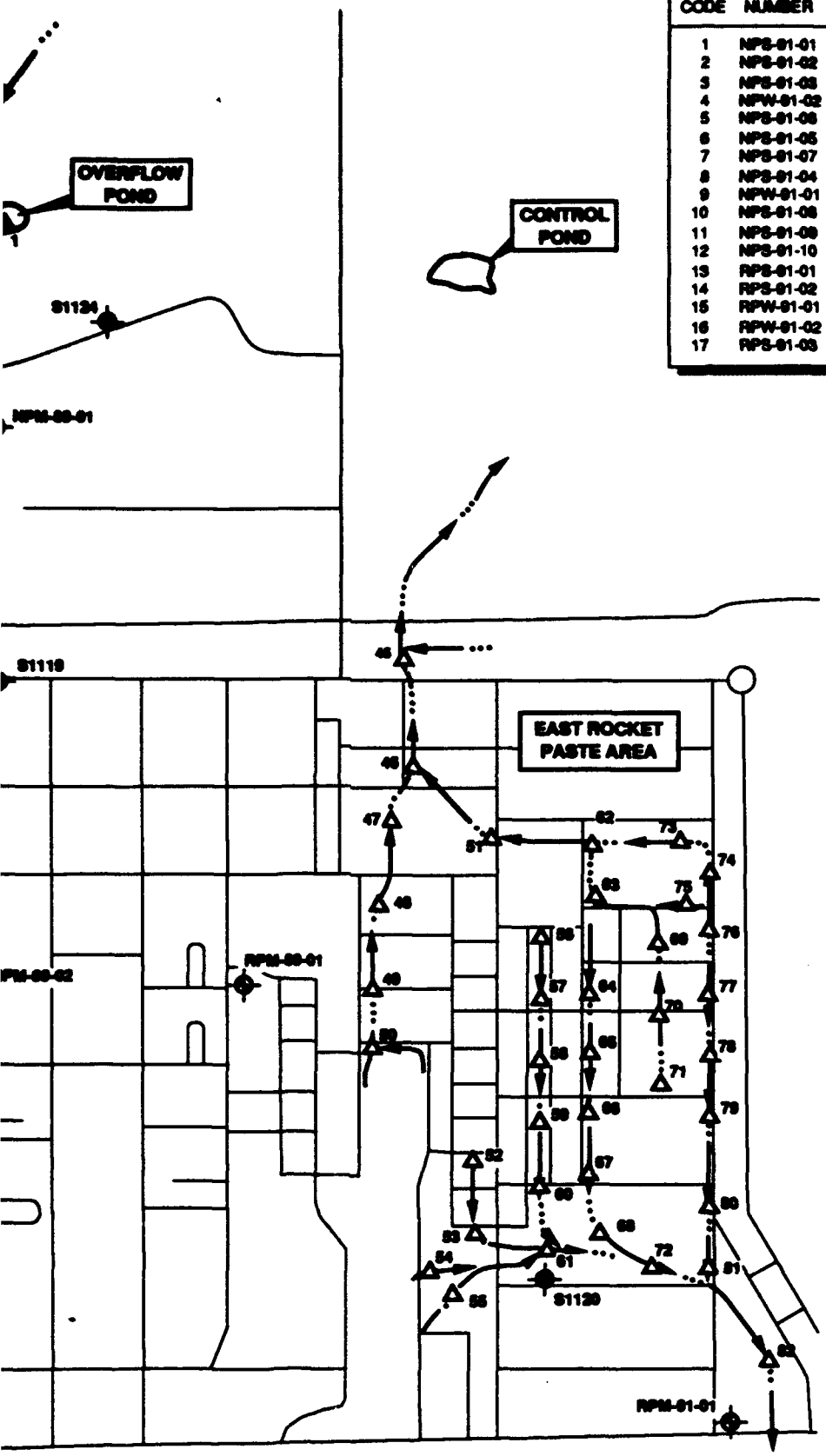
MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	M CO
1	NPS-91-01	18	RPS-91-34	35	RPS-91-17	52	RPS-91-60	6
2	NPS-91-02	19	RPS-91-35	36	RPS-91-18	53	RPS-91-61	7
3	NPS-91-03	20	RPS-91-32	37	RPS-91-19	54	RPS-91-62	7
4	NPW-91-02	21	RPS-91-33	38	RPS-91-08	55	RPS-91-63	7
5	NPS-91-06	22	RPS-91-30	39	RPS-91-20	56	RPS-91-65	7
6	NPS-91-05	23	RPS-91-31	40	RPS-91-21	57	RPS-91-58	7
7	NPS-91-07	24	RPS-91-36	41	RPS-91-22	58	RPS-91-57	7
8	NPS-91-04	25	RPS-91-10	42	RPS-91-07	59	RPS-91-14	7
9	NPW-91-01	26	RPS-91-29	43	RPS-91-04	60	RPS-91-59	7
10	NPS-91-08	27	RPS-91-08	44	RPS-91-16	61	RPS-91-59	7
11	NPS-91-09	28	RPS-91-23	45	RPS-91-11	62	RPS-91-48	7
12	NPS-91-10	29	RPS-91-24	46	RPS-91-64	63	RPS-91-49	8
13	RPS-91-01	30	RPS-91-25	47	RPS-91-65	64	RPS-91-50	8
14	RPS-91-02	31	RPS-91-09	48	RPS-91-66	65	RPS-91-13	8
15	RPW-91-01	32	RPS-91-26	49	RPS-91-67	66	RPS-91-51	
16	RPW-91-02	33	RPS-91-27	50	RPS-91-68	67	RPS-91-52	
17	RPS-91-03	34	RPS-91-05	51	RPS-91-54	68	RPS-91-53	



LEGEND

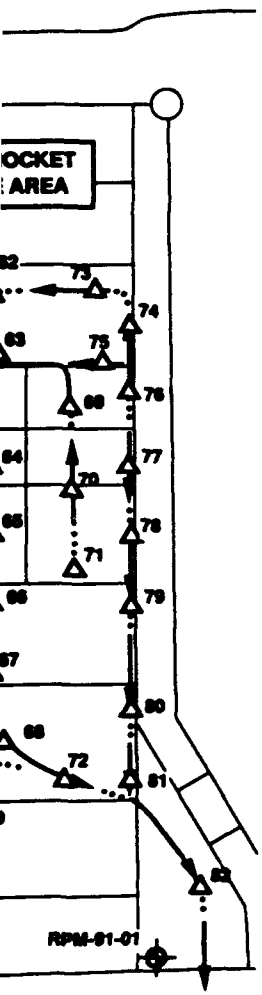
- PAVED ROAD OR TRAMW
- DRAINAGE DITCH
- S1119 EXISTING MONITORING W
- RPM-89-02 NEW MONITORING WELL
- SEDIMENT SAMPLE
- SURFACE SOIL SAMPLE
- SURFACE WATER SAMPL

NOTES:

1. BASE MAP FROM 300 SCALE SITE TOPO PLAN PROVIDED BY OLIN CORPORATIO
2. S1100 SERIES AND 81 SERIES WELL LO BASED ON MEP (TSAI, 1988)
3. 1989 AND 91 SERIES WELL LOCATIONS VIERBICHER SURVEY DATA (APPENDIX
4. SURFACE SOIL AND SURFACE WATER S LOCATIONS BASED ON FIELD SURVEY BY ABB-ES.

FI
SITE LOCATION P
SEDIMENT, SURFACE S
SURFACE WATER SAMPLE LO
NITROGLYCERIN
ROCKET PASTE AREA AND NEW AC
REMEDIAL INVEST
BADGER ARMY AMMUNITIO
ABB Environmental S

MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER
1	NPS-91-01	18	RPS-91-34	35	RPS-91-17	52	RPS-91-60	69	RPS-91-12
2	NPS-91-02	19	RPS-91-35	36	RPS-91-18	53	RPS-91-61	70	RPS-91-45
3	NPS-91-03	20	RPS-91-32	37	RPS-91-19	54	RPS-91-62	71	RPS-91-46
4	NPW-91-02	21	RPS-91-33	38	RPS-91-06	55	RPS-91-63	72	RPS-91-47
5	NPS-91-06	22	RPS-91-30	39	RPS-91-20	56	RPS-91-55	73	RPS-91-38
6	NPS-91-05	23	RPS-91-31	40	RPS-91-21	57	RPS-91-56	74	RPS-91-37
7	NPS-91-07	24	RPS-91-28	41	RPS-91-22	58	RPS-91-57	75	RPS-91-44
8	NPS-91-04	25	RPS-91-10	42	RPS-91-07	59	RPS-91-14	76	RPS-91-36
9	NPW-91-01	26	RPS-91-29	43	RPS-91-04	60	RPS-91-58	77	RPS-91-39
10	NPS-91-08	27	RPS-91-08	44	RPS-91-16	61	RPS-91-59	78	RPS-91-40
11	NPS-91-09	28	RPS-91-23	45	RPS-91-11	62	RPS-91-48	79	RPS-91-41
12	NPS-91-10	29	RPS-91-24	46	RPS-91-64	63	RPS-91-49	80	RPS-91-42
13	RPS-91-01	30	RPS-91-25	47	RPS-91-65	64	RPS-91-50	81	RPS-91-43
14	RPS-91-02	31	RPS-91-09	48	RPS-91-66	65	RPS-91-13	82	RPS-91-15
15	RPW-91-01	32	RPS-91-26	49	RPS-91-67	66	RPS-91-51		
16	RPW-91-02	33	RPS-91-27	50	RPS-91-68	67	RPS-91-52		
17	RPS-91-03	34	RPS-91-05	51	RPS-91-54	68	RPS-91-53		



LEGEND

PAVED ROAD OR TRAMWAY

DRAINAGE DITCH

S1119 EXISTING MONITORING WELLS

RPM-89-02 NEW MONITORING WELLS

SEDIMENT SAMPLE

SURFACE SOIL SAMPLE

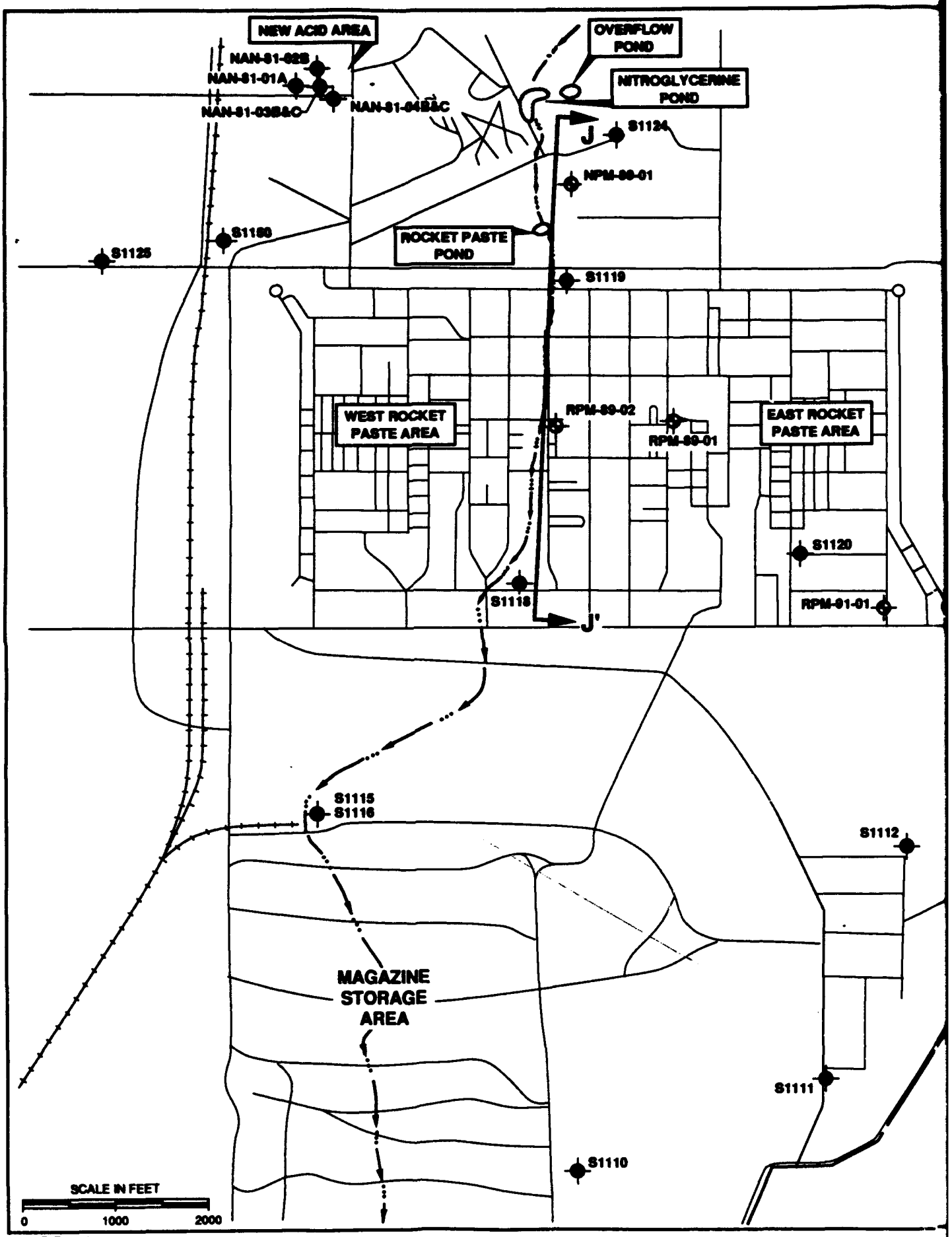
SURFACE WATER SAMPLE

NOTES:

1. BASE MAP FROM 300 SCALE SITE TOPOGRAPHIC PLAN PROVIDED BY OLIN CORPORATION.
2. S1100 SERIES AND 81 SERIES WELL LOCATIONS BASED ON MEP (TSAI, 1988)
3. 1989 AND 91 SERIES WELL LOCATIONS BASED ON VIERBICHER SURVEY DATA (APPENDIX F).
4. SURFACE SOIL AND SURFACE WATER SAMPLE LOCATIONS BASED ON FIELD SURVEY CONDUCTED BY ABB-ES.

FIGURE 8-1
SITE LOCATION PLAN AND SEDIMENT, SURFACE SOIL AND SURFACE WATER SAMPLE LOCATIONS NITROGLYCERINE POND, ROCKET PASTE AREA AND NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



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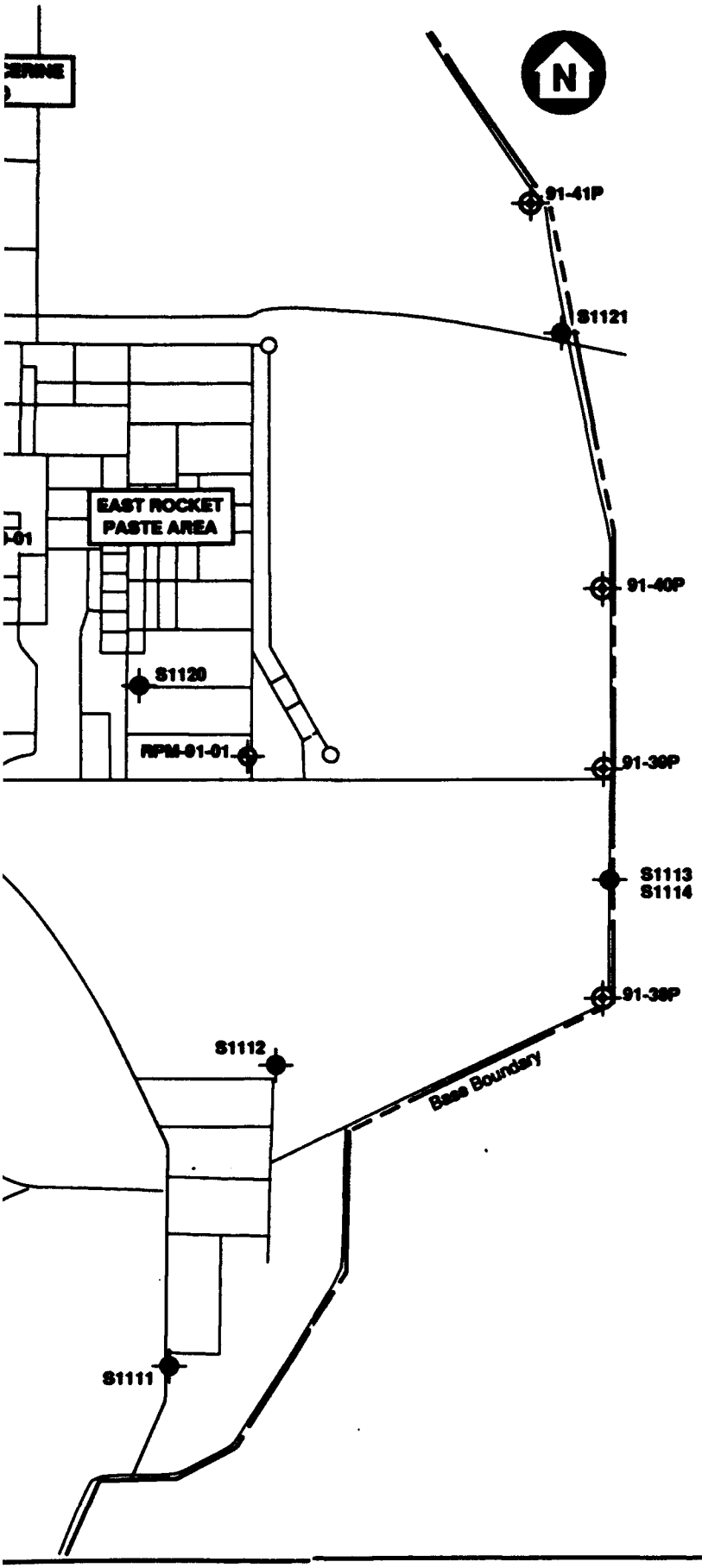


LEGEND

PAVED ROAD OR TRAMWAY

DRAINAGE DITCH

S1119 — EXISTING MONITORING WELL LOCATIO AND DESIGNATION

RPM-99-02 — NEW MONITORING WELL LOCATION A DESIGNATION

91-40P — NEW FUDS PIEZOMETER LOCATION A DESIGNATION

J J' — ORIENTATION OF GEOLOGIC CROSS SECTION

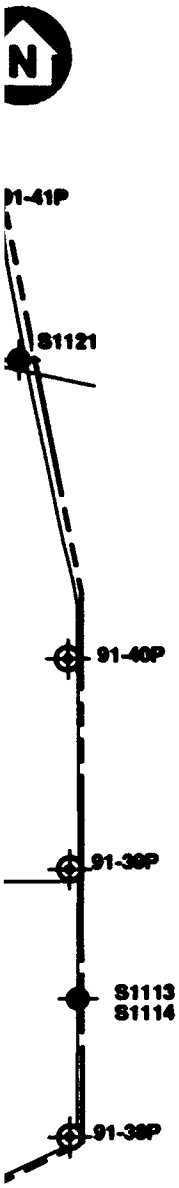
NOTES:

1. BASE MAP FROM 300 SCALE SITE TOPOGRAPHIC PLAN PROVIDED BY OLIN CORPORATION.
2. S1100 SERIES AND 81 SERIES WELL LOCATIONS BASED ON MEP (TSAI, 1988).
3. 1989 AND 91 SERIES WELL LOCATIONS BASED ON VIERBICHER SURVEY DATA (APPENDIX F).
4. NEW MONITORING WELLS INSTALLED UNDER THE DIRECTION OF ABB-ES.
5. EXISTING MONITORING WELLS INSTALLED UNDER THE DIRECTION OF OLIN CORPORATION.
6. FUDS PIEZOMETERS INSTALLED UNDER THE DIRECTION OF COE - ST. PAUL DISTRICT.

FIGU
MONITORING WELL LOCATIONS
ORIENTATION OF GEOLOGIC CROSS SECTIO
NITROGLYCERINE
ROCKET PASTE AREA AND NEW ACID
REMEDIAL INVESTIGA
BADGER ARMY AMMUNITION P

ABB Environmental Servic

3



LEGEND

PAVED ROAD OR TRAMWAY

DRAINAGE DITCH

S1119 — EXISTING MONITORING WELL LOCATION AND DESIGNATION

RPM-99-02 — NEW MONITORING WELL LOCATION AND DESIGNATION

91-40P — NEW FUDS PIEZOMETER LOCATION AND DESIGNATION

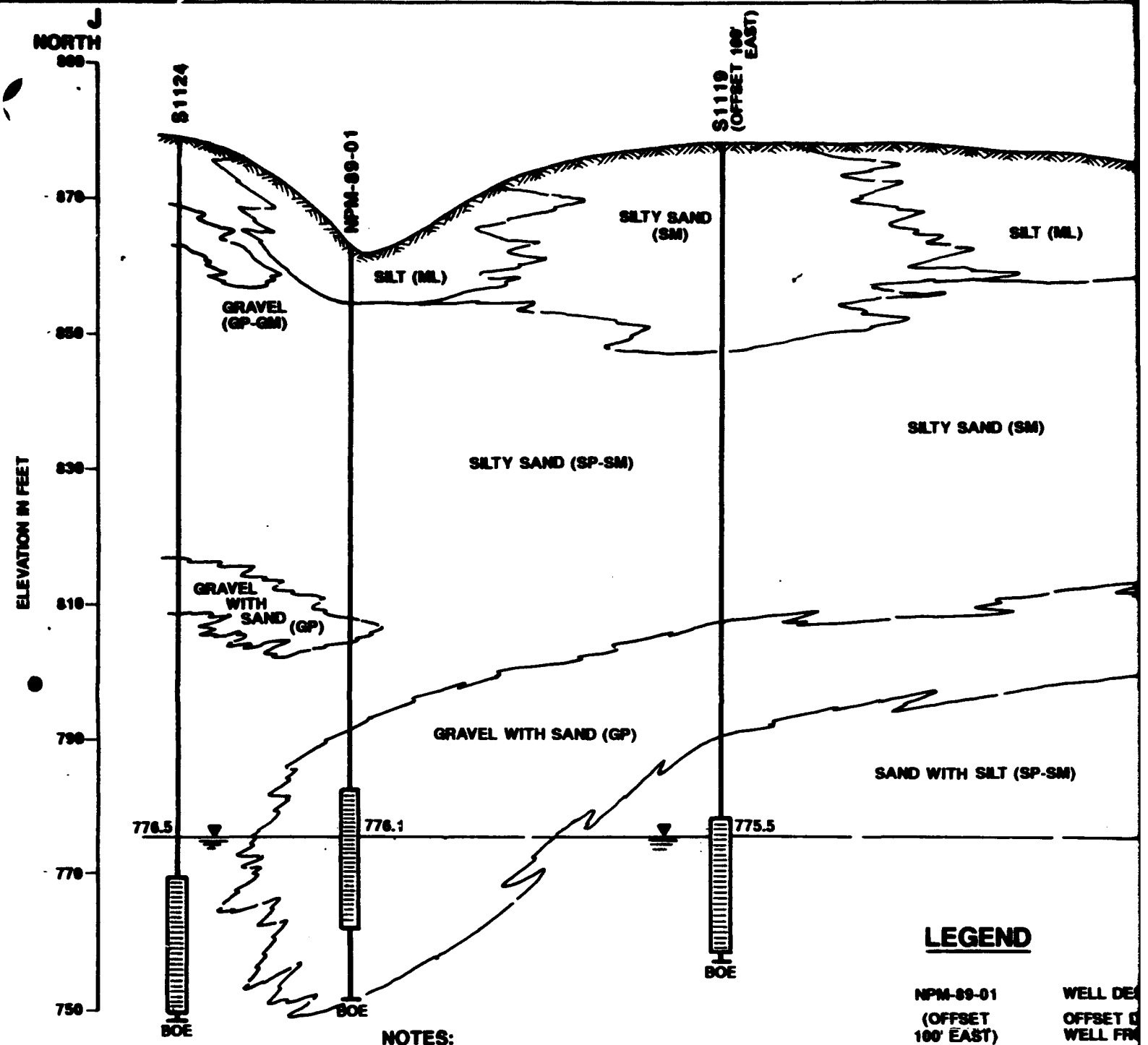
J J' — ORIENTATION OF GEOLOGIC CROSS SECTION

NOTES:

1. BASE MAP FROM 300 SCALE SITE TOPOGRAPHIC PLAN PROVIDED BY OLIN CORPORATION.
2. S1100 SERIES AND 81 SERIES WELL LOCATIONS BASED ON MEP (TSAI, 1988).
3. 1989 AND 91 SERIES WELL LOCATIONS BASED ON VIERBICHER SURVEY DATA (APPENDIX F).
4. NEW MONITORING WELLS INSTALLED UNDER THE DIRECTION OF ABB-ES.
5. EXISTING MONITORING WELLS INSTALLED UNDER THE DIRECTION OF OLIN CORPORATION.
6. FUDS PIEZOMETERS INSTALLED UNDER THE DIRECTION OF COE - ST. PAUL DISTRICT.

FIGURE 8-2
MONITORING WELL LOCATIONS AND ORIENTATION OF GEOLOGIC CROSS SECTION J-J'
NITROGLYCERINE POND, ROCKET PASTE AREA AND NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

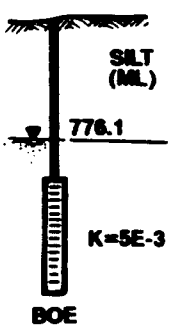
ABB Environmental Services, Inc.



NOTES:

1. SEE FIGURE 8-2 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91

LEGEND



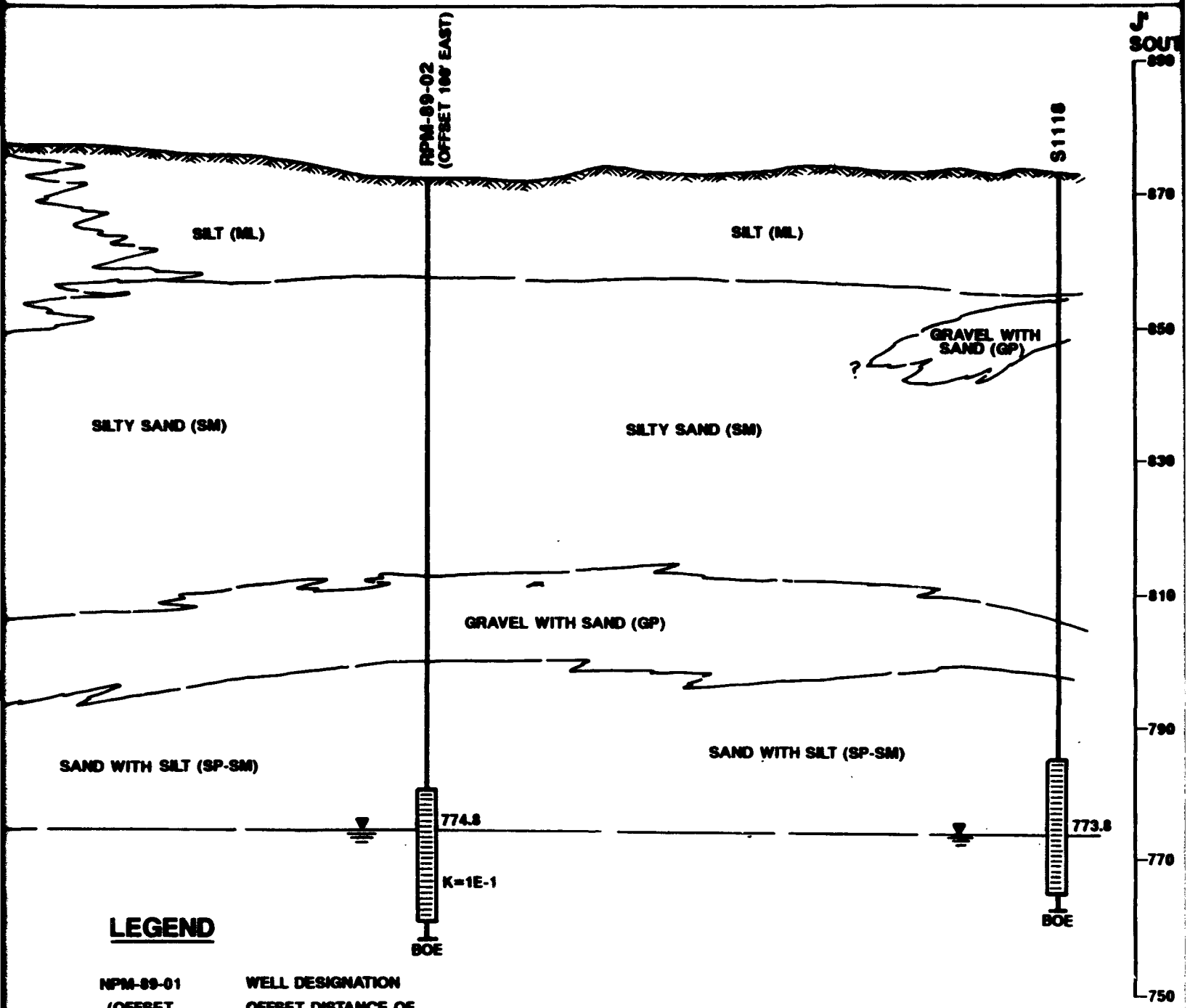
WELL DE
OFFSET D
WELL FR
GROUND
SOILS DE
USCS CL
WATER TA
SCREENE
IN-FIELD
TEST RES
BOTTOM

SCALE IN FEET

0 400 800

VERTICAL EXAGGERATION 1:20

2



LEGEND

RPM-89-01	WELL DESIGNATION
(OFFSET 100' EAST)	OFFSET DISTANCE OF WELL FROM TRANSECT
	GROUND SURFACE
SILT (ML)	SOILS DESCRIPTION AND USCS CLASSIFICATION
776.1	WATER TABLE ELEVATION
	SCREENED INTERVAL
K=5E-3	IN-FIELD PERMEABILITY TEST RESULTS IN CM/SEC
BOE	BOTTOM OF EXPLORATION

FIGU
GEOLOGIC CROSS SECTI
NITROGLYCERINE
ROCKET PASTE AREA AND NEW ACID
REMEDIAL INVESTIG
BADGER ARMY AMMUNITION

ABB Environmental Servi

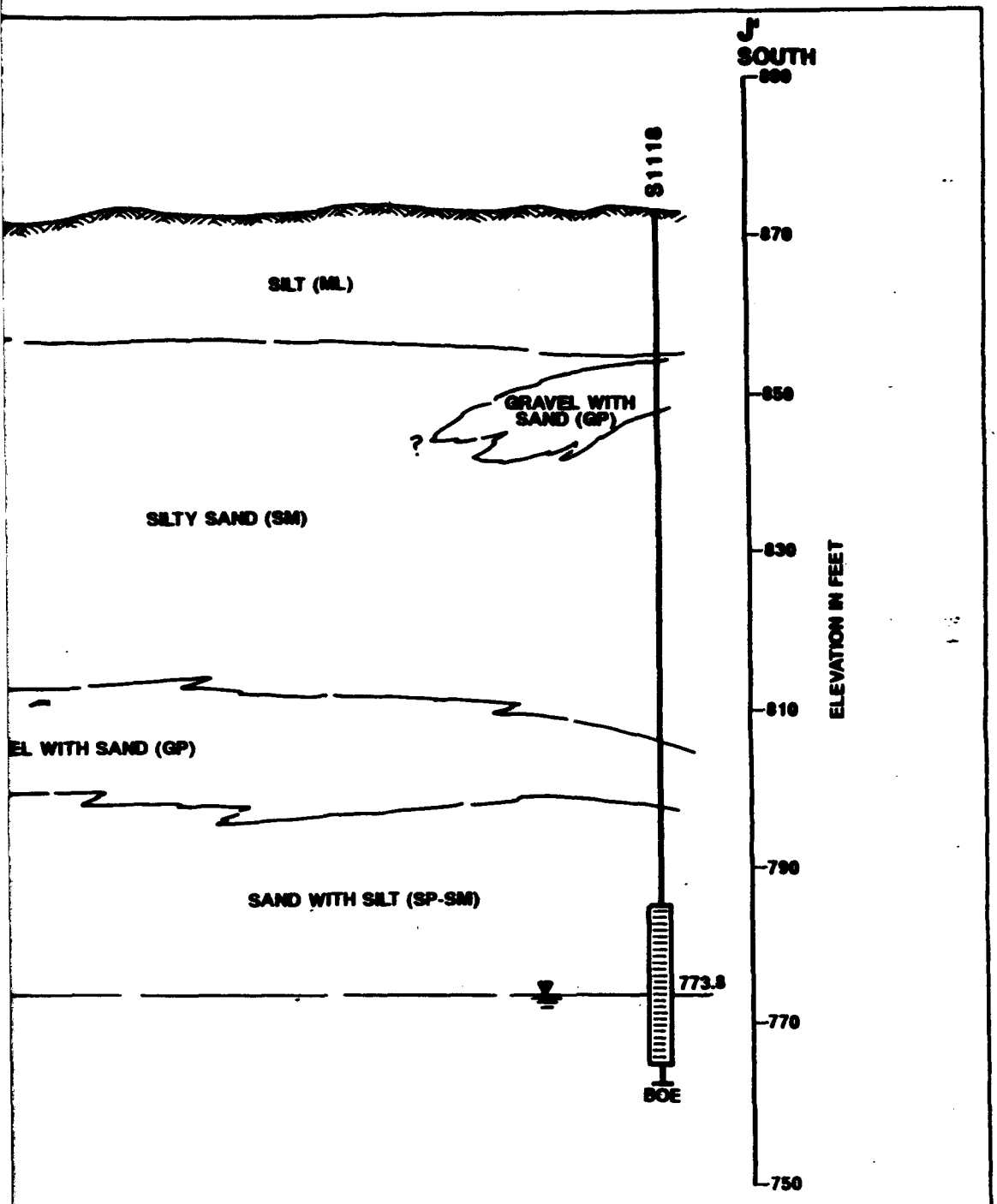
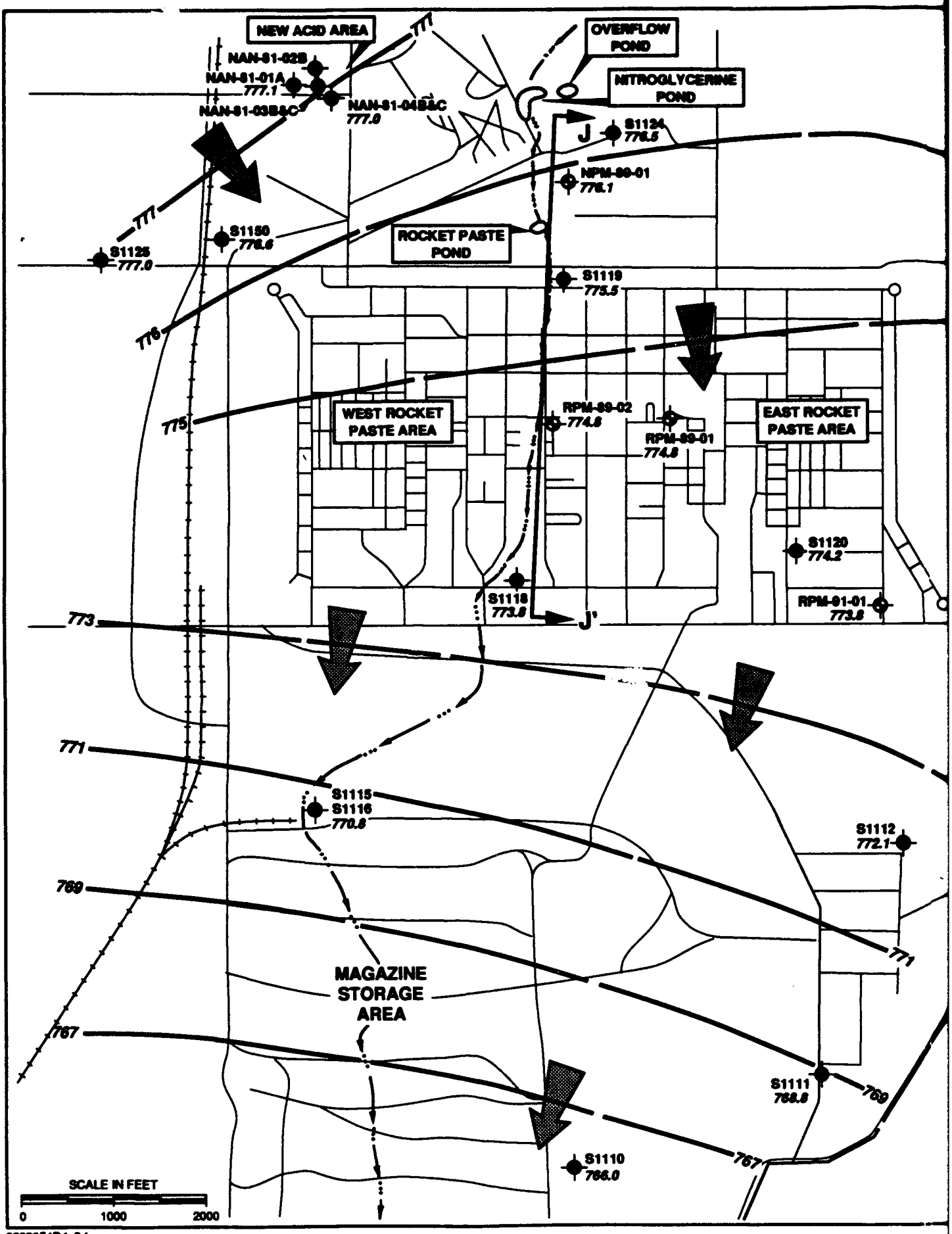


FIGURE 8-3
GEOLOGIC CROSS SECTION J-J'
NITROGLYCERINE POND,
ROCKET PASTE AREA AND NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLAN

ABB Environmental Services, Inc.



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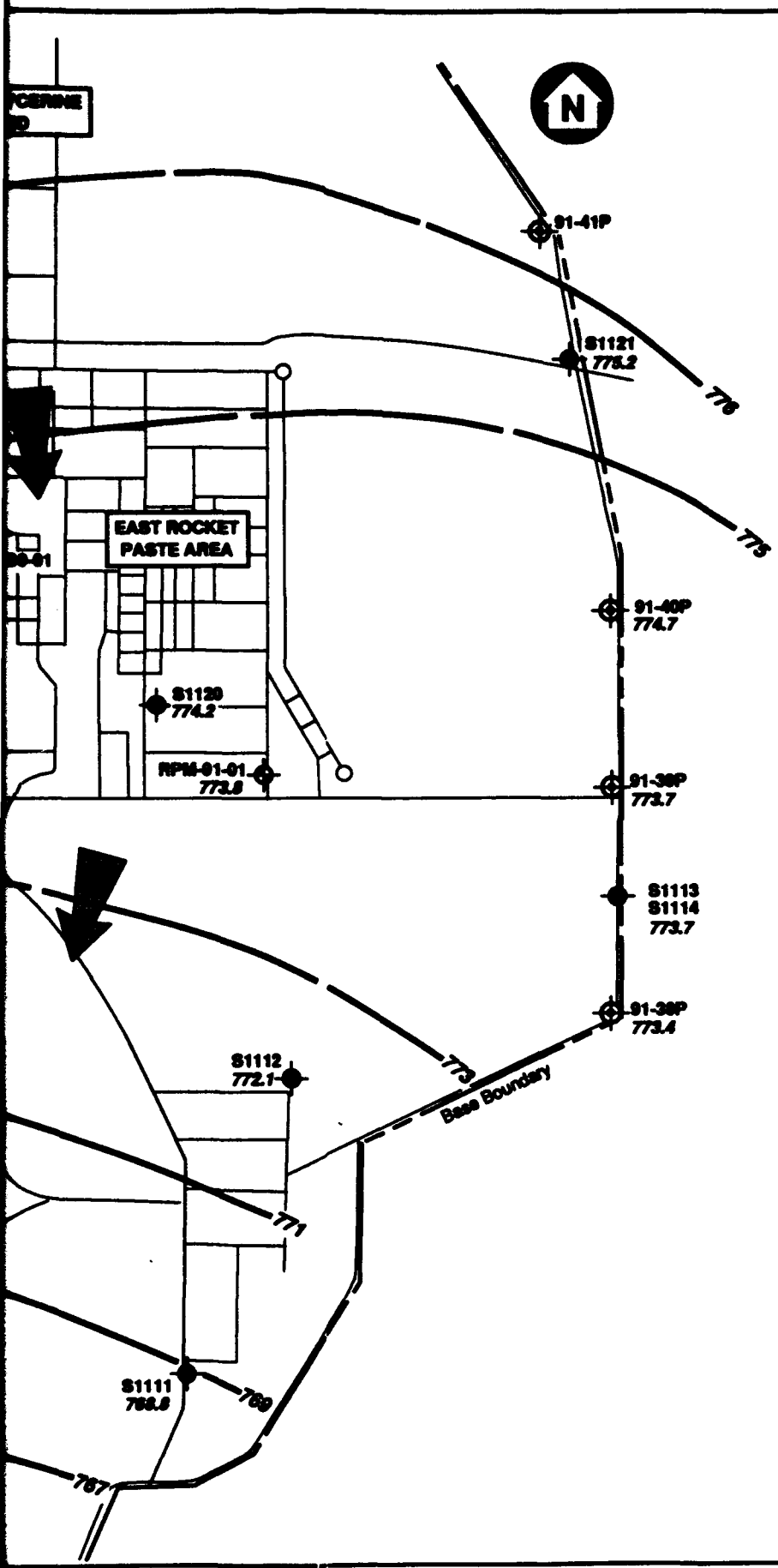


LEGEND

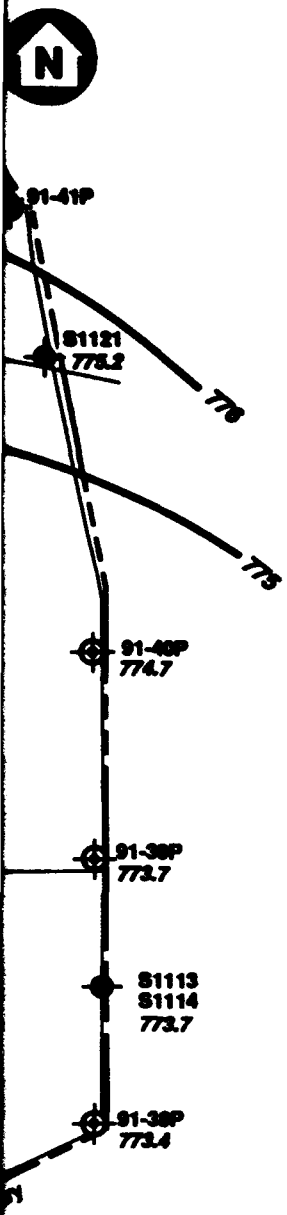
———	PAVED ROAD OR TRAMWAY
... →	DRAINAGE DITCH
S1119 ⊕	EXISTING MONITORING WELL LOCATION AND DESIGNATION
RPM-99-02 ⊕	NEW MONITORING WELL LOCATION AND DESIGNATION
91-40P ⊕	NEW FUDS PIEZOMETER LOCATION AND DESIGNATION
774.7	STABILIZED WATER ELEVATION
775	CONTOUR LINE INDICATES GROUNDWATER ELEVATION
➡	APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTES:

1. BASE MAP FROM 300 SCALE SITE TOPOGRAPHIC PLAN PROVIDED BY OLIN CORPORATION.
2. ALL WATER LEVELS WERE MEASURED ON 12/15/91 AND ARE ROUNDED TO THE NEAREST 0.10 FOOT.
3. S1100 SERIES AND 81 SERIES WELL LOCATIONS BASED ON MEP (TSAI, 1988).
4. 1989 AND 91 SERIES WELL LOCATIONS BASED ON VIERBICHER SURVEY DATA (APPENDIX F).
5. GROUNDWATER ELEVATION AND CONTOURS BASED ON U.S. COASTAL AND GEODETIC SURVEY DATUM.
6. NEW MONITORING WELLS INSTALLED UNDER THE DIRECTION OF ABB-ES.
7. EXISTING MONITORING WELLS INSTALLED UNDER THE DIRECTION OF OLIN CORPORATION.
8. FUDS PIEZOMETERS INSTALLED UNDER THE DIRECTION OF COE - ST. PAUL DISTRICT.

FIGURE
WATER TABLE CONTOUR P
NITROGLYCERINE PO
ROCKET PASTE AREA AND NEW ACID A
REMEDIAL INVESTIGAT
BADGER ARMY AMMUNITION PL

ABB Environmental Service



LEGEND

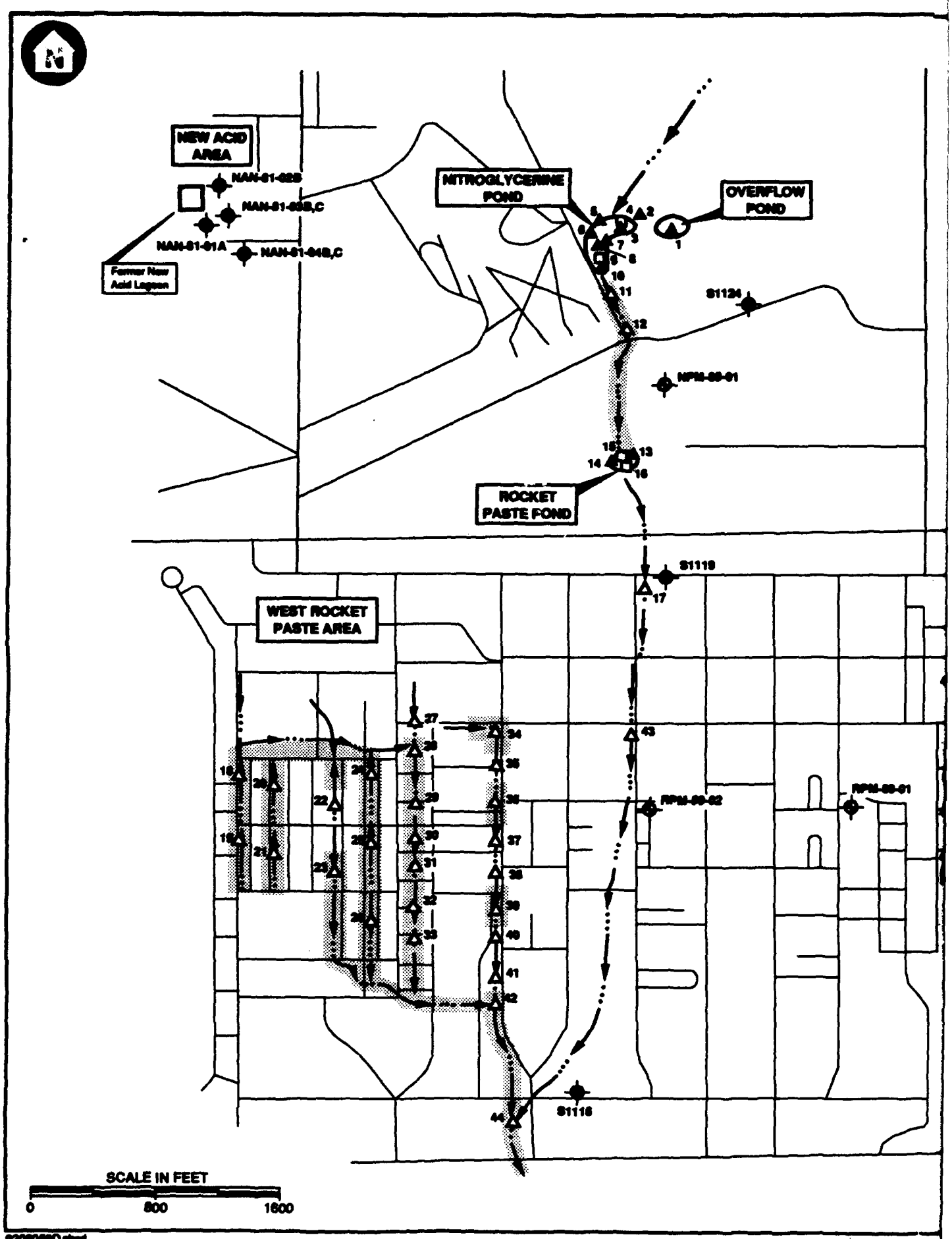
———	PAVED ROAD OR TRAMWAY
... ——→	DRAINAGE DITCH
S1119 ⊕	EXISTING MONITORING WELL LOCATION AND DESIGNATION
RPM-99-02 ⊕	NEW MONITORING WELL LOCATION AND DESIGNATION
91-40P ⊕	NEW FUDS PIEZOMETER LOCATION AND DESIGNATION
774.7	STABILIZED WATER ELEVATION
—— 775	CONTOUR LINE INDICATES GROUNDWATER ELEVATION
➡	APPROXIMATE GROUNDWATER FLOW DIRECTION

NOTES:

1. BASE MAP FROM 300 SCALE SITE TOPOGRAPHIC PLAN PROVIDED BY OLIN CORPORATION.
2. ALL WATER LEVELS WERE MEASURED ON 12/15/91 AND ARE ROUNDED TO THE NEAREST 0.10 FOOT.
3. S1100 SERIES AND 81 SERIES WELL LOCATIONS BASED ON MEP (TSAI, 1988).
4. 1989 AND 91 SERIES WELL LOCATIONS BASED ON VIERBICHER SURVEY DATA (APPENDIX F).
5. GROUNDWATER ELEVATION AND CONTOURS BASED ON U.S. COASTAL AND GEODETIC SURVEY DATUM.
6. NEW MONITORING WELLS INSTALLED UNDER THE DIRECTION OF ABB-ES.
7. EXISTING MONITORING WELLS INSTALLED UNDER THE DIRECTION OF OLIN CORPORATION.
8. FUDS PIEZOMETERS INSTALLED UNDER THE DIRECTION OF COE - ST. PAUL DISTRICT.

FIGURE 8-4
WATER TABLE CONTOUR PLAN
NITROGLYCERINE POND,
ROCKET PASTE AREA AND NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.


NEW ACID AREA
NAN-91-02B
NAN-91-03B,C
NAN-91-01A
NAN-91-04B,C
Former New Acid Lagoon
NITROGLYCERINE POND
OVERFLOW POND
S1124
NPM-99-01
ROCKET PASTE POND
S1119
WEST ROCKET PASTE AREA
RPM-99-02
RPM-99-01
S1118
SCALE IN FEET
0
800
1600

2

MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	M CO
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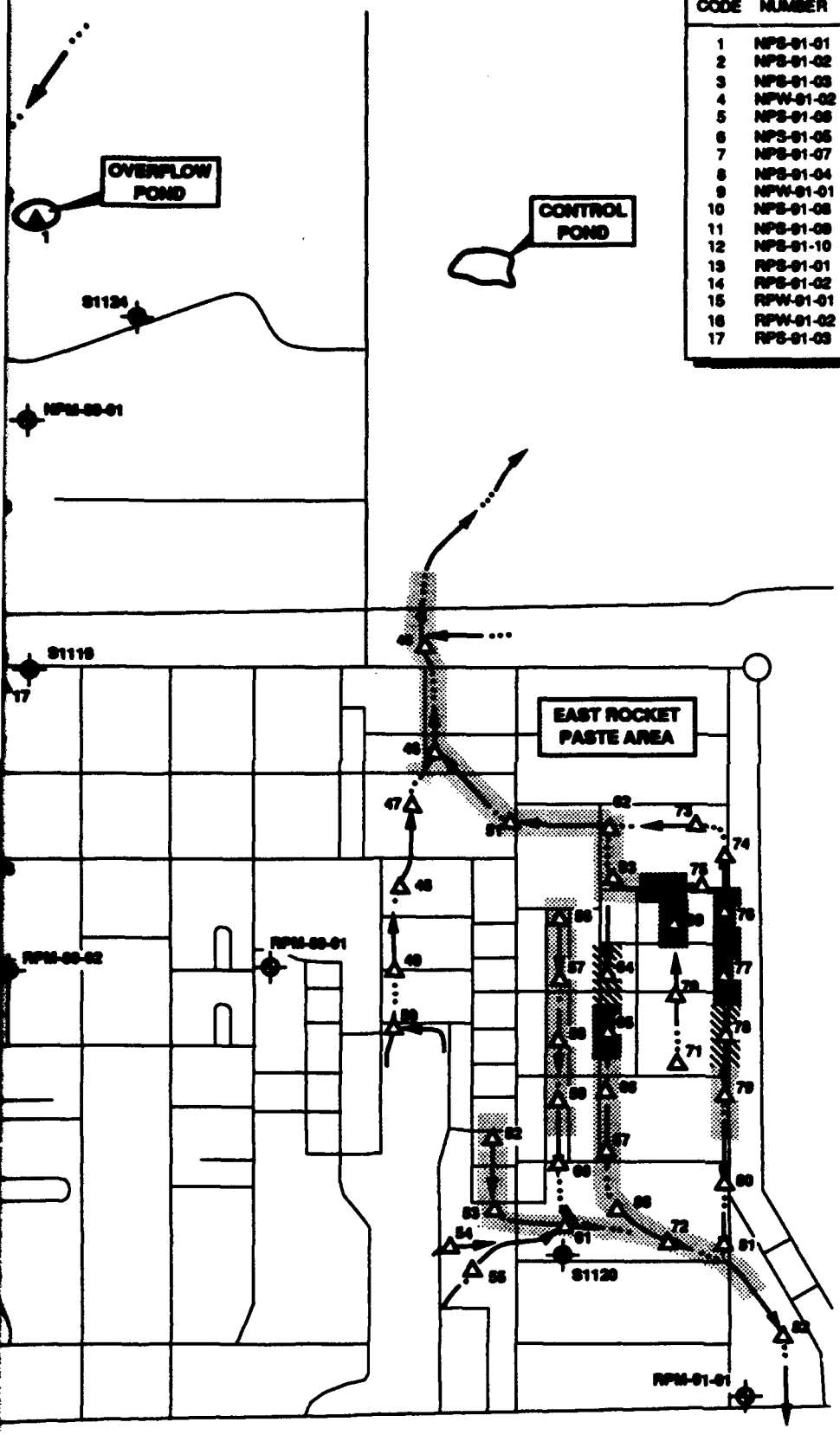
2	NPS-01-02	19	RPS-01-35	36	RPS-01-18	53	RPS-01-61	7
3	NPS-01-03	20	RPS-01-32	37	RPS-01-19	54	RPS-01-62	7
4	NPW-01-02	21	RPS-01-33	38	RPS-01-06	55	RPS-01-63	7
5	NPS-01-06	22	RPS-01-30	39	RPS-01-20	56	RPS-01-55	7
6	NPS-01-05	23	RPS-01-31	40	RPS-01-21	57	RPS-01-56	7
7	NPS-01-07	24	RPS-01-28	41	RPS-01-22	58	RPS-01-57	7
8	NPS-01-04	25	RPS-01-10	42	RPS-01-07	59	RPS-01-14	7
9	NPW-01-01	26	RPS-01-29	43	RPS-01-04	60	RPS-01-58	7
10	NPS-01-08	27	RPS-01-08	44	RPS-01-16	61	RPS-01-59	7
11	NPS-01-09	28	RPS-01-23	45	RPS-01-11	62	RPS-01-46	7
12	NPS-01-10	29	RPS-01-24	46	RPS-01-04	63	RPS-01-49	6
13	RPS-01-01	30	RPS-01-25	47	RPS-01-05	64	RPS-01-50	6
14	RPS-01-02	31	RPS-01-09	48	RPS-01-08	65	RPS-01-13	6
15	RPW-01-01	32	RPS-01-26	49	RPS-01-07	66	RPS-01-51	
16	RPW-01-02	33	RPS-01-27	50	RPS-01-03	67	RPS-01-52	
17	RPS-01-03	34	RPS-01-05	51	RPS-01-54	68	RPS-01-53	



LEGEND

PAVED ROAD OR TRAMM

DRAINAGE DITCH

S1119 EXISTING MONITORING W

RPM-00-02 NEW MONITORING WELL

SEDIMENT SAMPLE

SURFACE SOIL SAMPLE

SURFACE WATER SAMPL

NG CONCENTRATIONS

>1000 µg/g

100 to 999 µg/g

>CRL to 99 µg/g

NOTES:

1. SEE TABLE 8-9 OR APPENDIX K FOR C DATA SUMMARY.
2. CRL = CERTIFIED REPORTING LIMIT

FI
NG CONCENT
NITROGLYCERI
ROCKET PASTE AREA AND NEW A
REMEDIAL INVEST
BADGER ARMY AMMUNITIO
ABB Environmental S

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MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER
1	NPS-91-01	18	RPS-91-34	35	RPS-91-17	52	RPS-91-60	69	RPS-91-12
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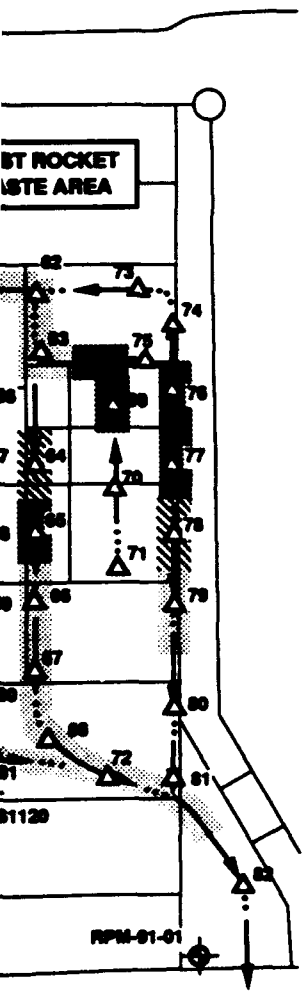
3	NPS-91-03	20	RPS-91-32	37	RPS-91-19	54	RPS-91-62	71	RPS-91-46
4	NPW-91-02	21	RPS-91-33	38	RPS-91-06	55	RPS-91-63	72	RPS-91-47
5	NPS-91-06	22	RPS-91-30	39	RPS-91-20	56	RPS-91-55	73	RPS-91-38
6	NPS-91-05	23	RPS-91-31	40	RPS-91-21	57	RPS-91-56	74	RPS-91-37
7	NPS-91-07	24	RPS-91-28	41	RPS-91-22	58	RPS-91-57	75	RPS-91-44
8	NPS-91-04	25	RPS-91-10	42	RPS-91-07	59	RPS-91-14	76	RPS-91-36
9	NPW-91-01	26	RPS-91-29	43	RPS-91-04	60	RPS-91-58	77	RPS-91-39
10	NPS-91-08	27	RPS-91-08	44	RPS-91-16	61	RPS-91-59	78	RPS-91-40
11	NPS-91-09	28	RPS-91-23	45	RPS-91-11	62	RPS-91-48	79	RPS-91-41
12	NPS-91-10	29	RPS-91-24	46	RPS-91-64	63	RPS-91-49	80	RPS-91-42
13	RPS-91-01	30	RPS-91-25	47	RPS-91-65	64	RPS-91-50	81	RPS-91-43
14	RPS-91-02	31	RPS-91-09	48	RPS-91-66	65	RPS-91-13	82	RPS-91-15
15	RPW-91-01	32	RPS-91-26	49	RPS-91-67	66	RPS-91-51		
16	RPW-91-02	33	RPS-91-27	50	RPS-91-68	67	RPS-91-52		
17	RPS-91-03	34	RPS-91-05	51	RPS-91-54	68	RPS-91-53		

TROL
ND



LEGEND

PAVED ROAD OR TRAMWAY

DRAINAGE DITCH

S1119 EXISTING MONITORING WELLS

RPM-99-02 NEW MONITORING WELLS

SEDIMENT SAMPLE

SURFACE SOIL SAMPLE

SURFACE WATER SAMPLE

NG CONCENTRATIONS

>1000 µg/g

100 to 999 µg/g

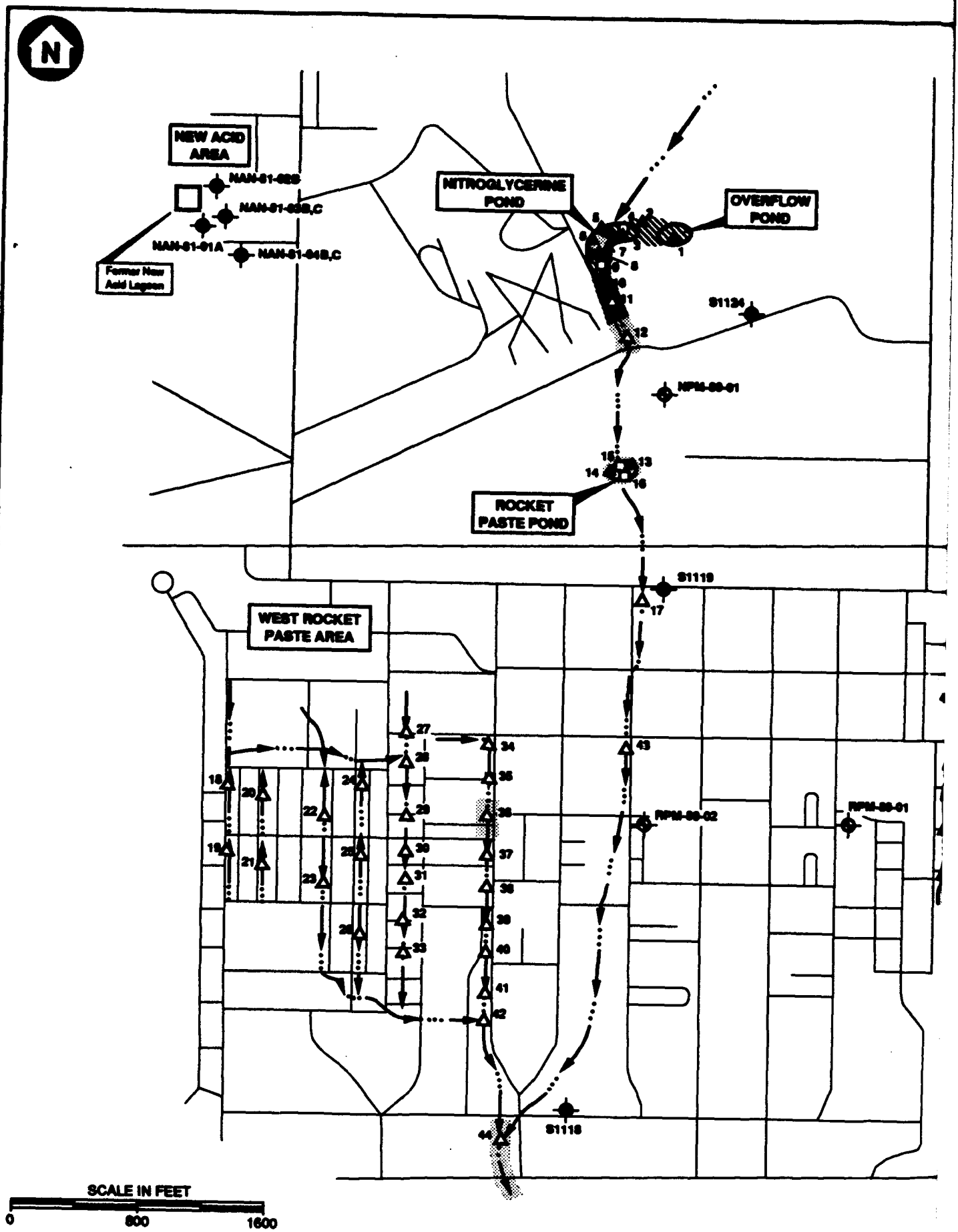
>CRL to 99 µg/g

NOTES:

1. SEE TABLE 8-9 OR APPENDIX K FOR CHEMICAL DATA SUMMARY.
2. CRL = CERTIFIED REPORTING LIMIT

FIGURE 8-5
NG CONCENTRATIONS
NITROGLYCERINE POND,
ROCKET PASTE AREA AND NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



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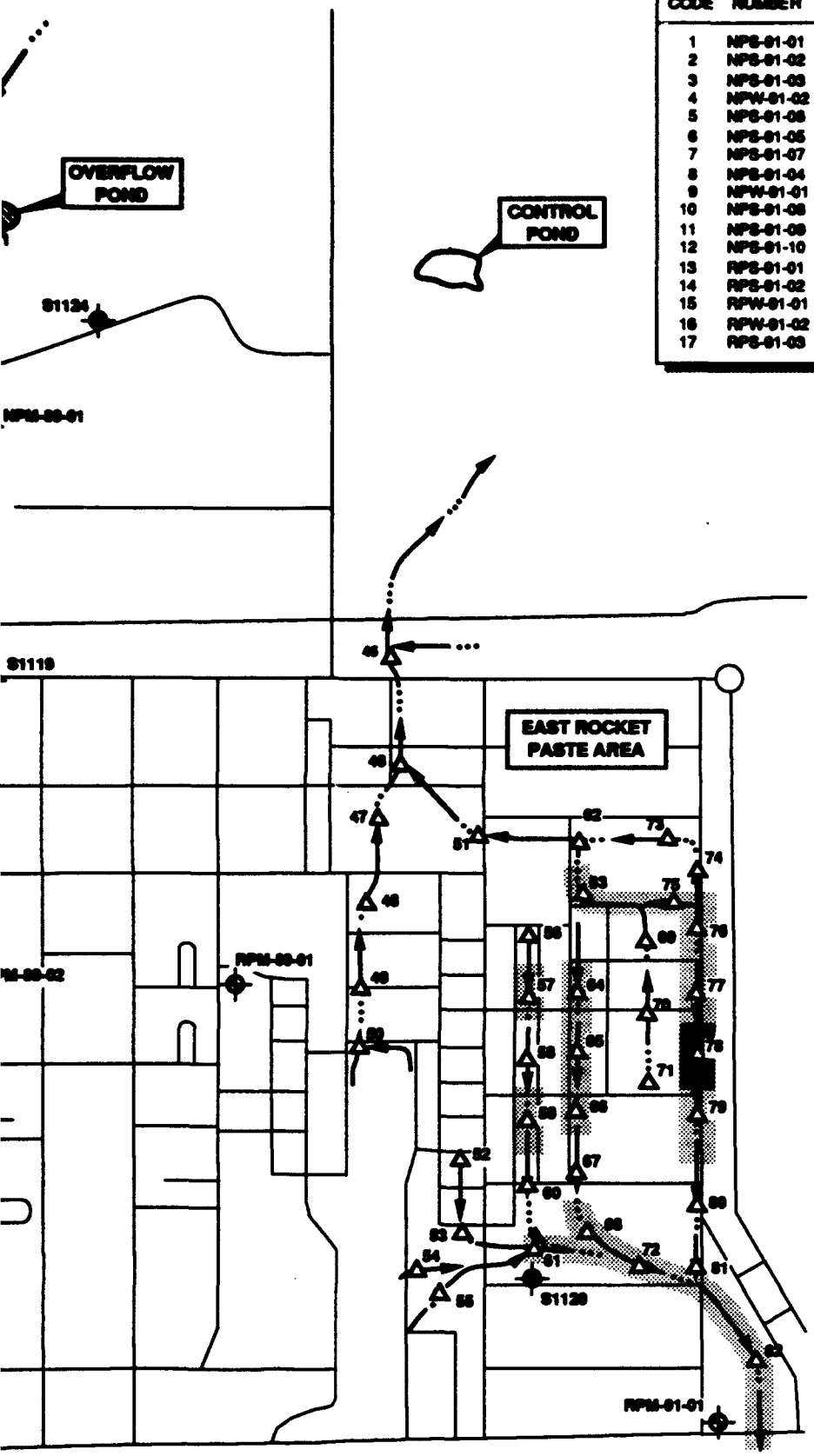
3	NPS-01-03	20	RPS-01-32	37	RPS-01-19	54	RPS-01-62	7
4	NPW-01-02	21	RPS-01-33	38	RPS-01-06	55	RPS-01-63	7
5	NPS-01-06	22	RPS-01-30	39	RPS-01-20	56	RPS-01-65	7
6	NPS-01-05	23	RPS-01-31	40	RPS-01-21	57	RPS-01-66	7
7	NPS-01-07	24	RPS-01-28	41	RPS-01-22	58	RPS-01-67	7
8	NPS-01-04	25	RPS-01-10	42	RPS-01-07	59	RPS-01-14	7
9	NPW-01-01	26	RPS-01-29	43	RPS-01-04	60	RPS-01-68	7
10	NPS-01-08	27	RPS-01-08	44	RPS-01-16	61	RPS-01-69	7
11	NPS-01-09	28	RPS-01-23	45	RPS-01-11	62	RPS-01-46	7
12	NPS-01-10	29	RPS-01-24	46	RPS-01-64	63	RPS-01-49	6
13	RPS-01-01	30	RPS-01-25	47	RPS-01-05	64	RPS-01-50	6
14	RPS-01-02	31	RPS-01-09	48	RPS-01-06	65	RPS-01-13	6
15	RPW-01-01	32	RPS-01-26	49	RPS-01-07	66	RPS-01-51	
16	RPW-01-02	33	RPS-01-27	50	RPS-01-08	67	RPS-01-52	
17	RPS-01-03	34	RPS-01-05	51	RPS-01-54	68	RPS-01-53	



LEGEND

- PAVED ROAD OR TRAMW
- DRAINAGE DITCH
- S1119 EXISTING MONITORING W
- RPM-00-02 NEW MONITORING WELL
- SEDIMENT SAMPLE
- SURFACE SOIL SAMPLE
- SURFACE WATER SAMPL

HG CONCENTRATIONS

- >10 µg/g
- 0.5 to 9.9 µg/g
- >CRL to 0.5 µg/g

NOTES:

1. SEE TABLE 8-9 OR APPENDIX K FOR CH DATA SUMMARY.
2. CRL = CERTIFIED REPORTING LIMIT

FIG
HG CONCENTR
NITROGLYCERIN
ROCKET PASTE AREA AND NEW AC
REMEDIAL INVEST
BADGER ARMY AMMUNITIO

ABB Environmental Se

MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER
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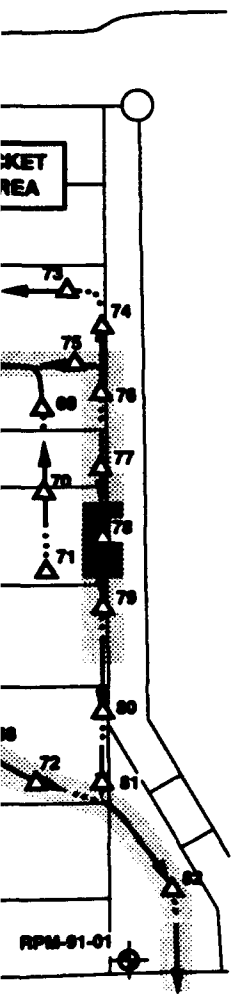
2	NPS-91-02	19	RPS-91-35	36	RPS-91-18	53	RPS-91-61	70	RPS-91-45
3	NPS-91-03	20	RPS-91-32	37	RPS-91-19	54	RPS-91-62	71	RPS-91-46
4	NPW-91-02	21	RPS-91-33	38	RPS-91-06	55	RPS-91-63	72	RPS-91-47
5	NPS-91-06	22	RPS-91-30	39	RPS-91-20	56	RPS-91-55	73	RPS-91-38
6	NPS-91-05	23	RPS-91-31	40	RPS-91-21	57	RPS-91-56	74	RPS-91-37
7	NPS-91-07	24	RPS-91-28	41	RPS-91-22	58	RPS-91-57	75	RPS-91-44
8	NPS-91-04	25	RPS-91-10	42	RPS-91-07	59	RPS-91-14	76	RPS-91-36
9	NPW-91-01	26	RPS-91-29	43	RPS-91-04	60	RPS-91-58	77	RPS-91-39
10	NPS-91-08	27	RPS-91-08	44	RPS-91-16	61	RPS-91-59	78	RPS-91-40
11	NPS-91-09	28	RPS-91-23	45	RPS-91-11	62	RPS-91-48	79	RPS-91-41
12	NPS-91-10	29	RPS-91-24	46	RPS-91-64	63	RPS-91-49	80	RPS-91-42
13	RPS-91-01	30	RPS-91-25	47	RPS-91-65	64	RPS-91-50	81	RPS-91-43
14	RPS-91-02	31	RPS-91-09	48	RPS-91-66	65	RPS-91-13	82	RPS-91-15
15	RPW-91-01	32	RPS-91-26	49	RPS-91-67	66	RPS-91-51		
16	RPW-91-02	33	RPS-91-27	50	RPS-91-68	67	RPS-91-52		
17	RPS-91-03	34	RPS-91-05	51	RPS-91-54	68	RPS-91-53		



LEGEND

PAVED ROAD OR TRAMWAY

DRAINAGE DITCH

S1119 EXISTING MONITORING WELLS

RPM-89-02 NEW MONITORING WELLS

SEDIMENT SAMPLE

SURFACE SOIL SAMPLE

SURFACE WATER SAMPLE

HG CONCENTRATIONS

>10 µg/g

0.5 to 9.9 µg/g

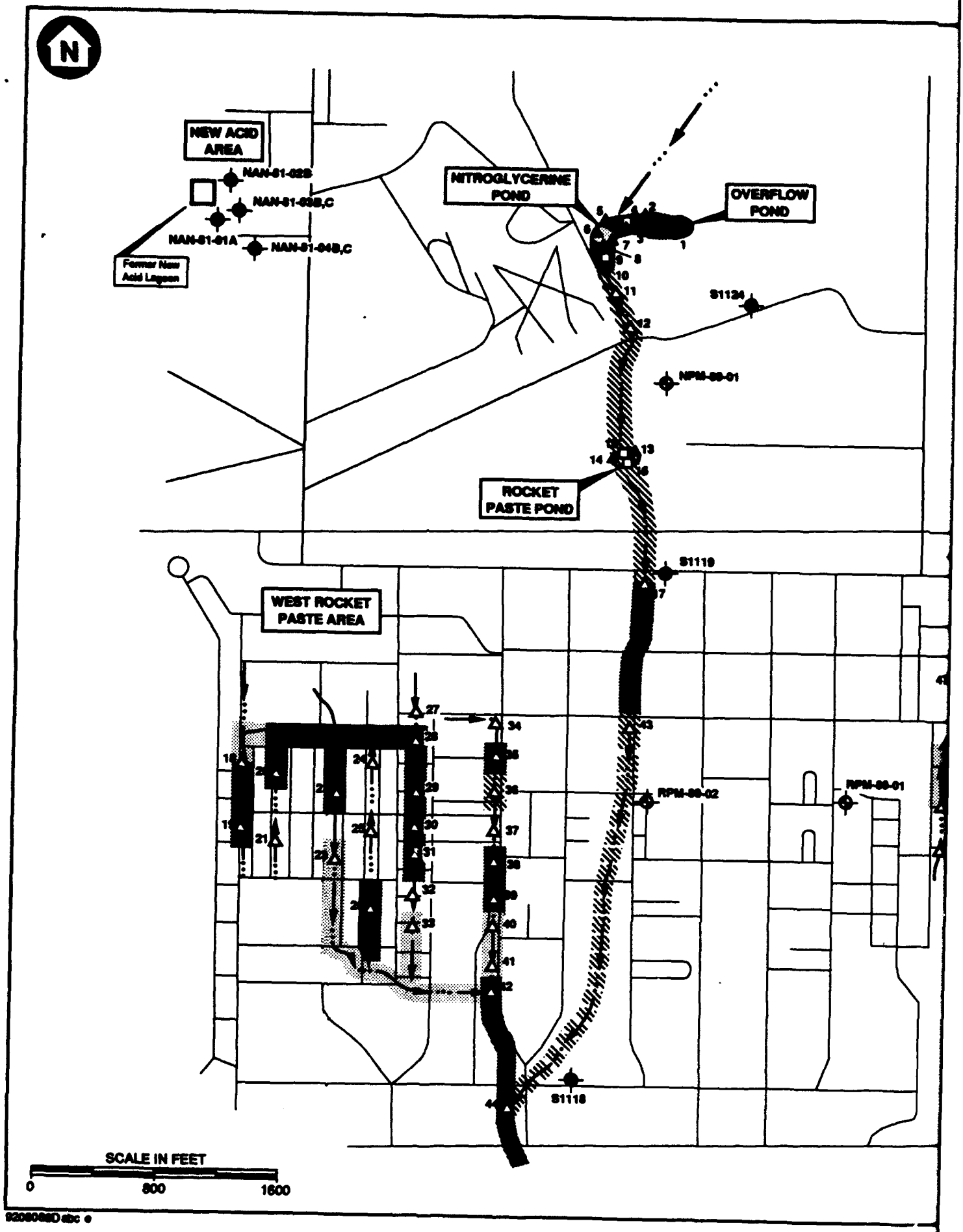
>CRL to 0.5 µg/g

NOTES:

1. SEE TABLE 8-9 OR APPENDIX K FOR CHEMICAL DATA SUMMARY.
2. CRL = CERTIFIED REPORTING LIMIT

FIGURE 8-6
HG CONCENTRATIONS
NITROGLYCERINE POND,
ROCKET PASTE AREA AND NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



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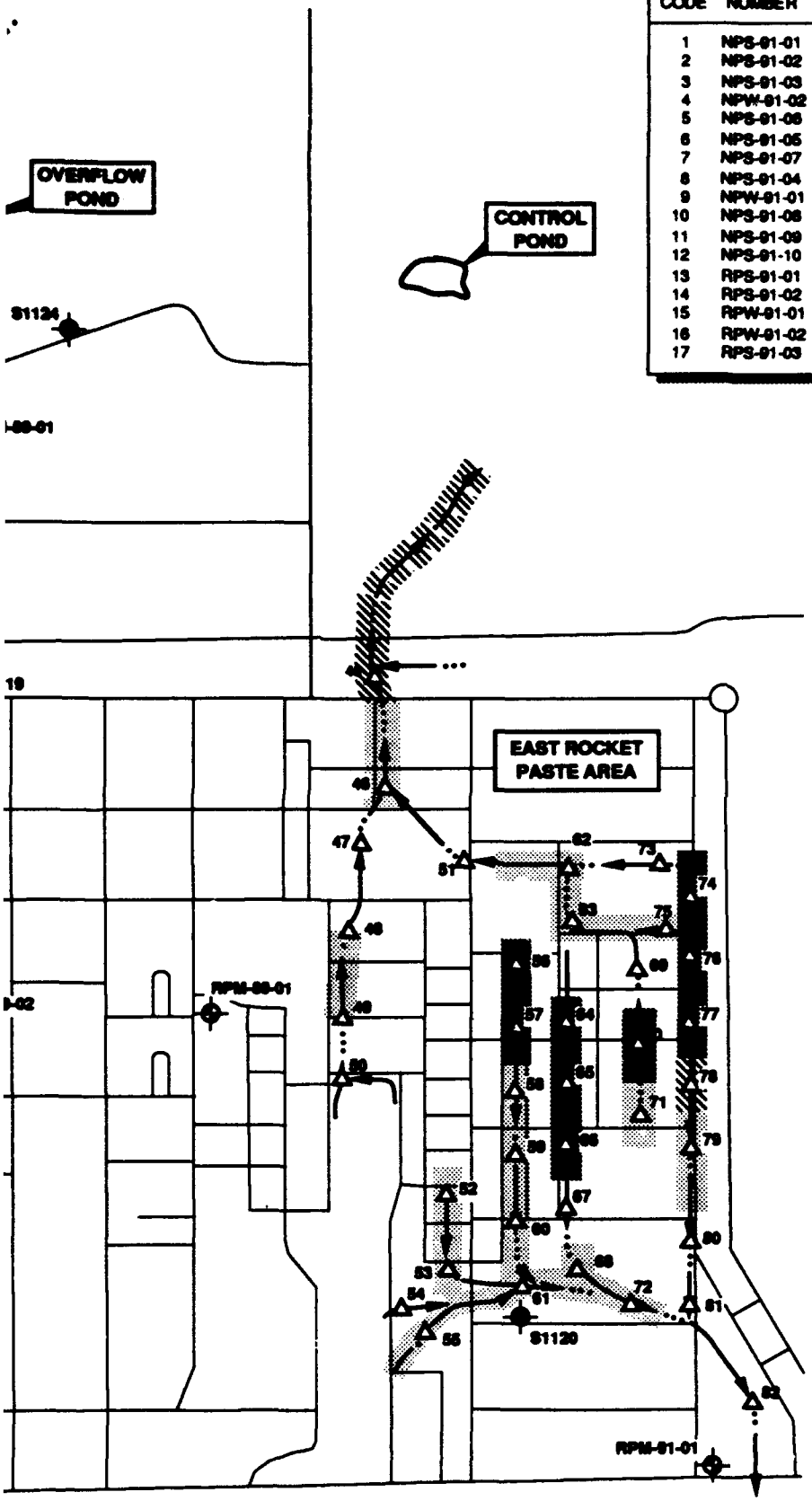
2	NPS-91-02	19	RPS-91-35	36	RPS-91-18	53	RPS-91-61	70
3	NPS-91-03	20	RPS-91-32	37	RPS-91-19	54	RPS-91-62	71
4	NPW-91-02	21	RPS-91-33	38	RPS-91-08	55	RPS-91-63	72
5	NPS-91-06	22	RPS-91-30	39	RPS-91-20	56	RPS-91-55	73
6	NPS-91-05	23	RPS-91-31	40	RPS-91-21	57	RPS-91-56	74
7	NPS-91-07	24	RPS-91-26	41	RPS-91-22	58	RPS-91-57	75
8	NPS-91-04	25	RPS-91-10	42	RPS-91-07	59	RPS-91-14	76
9	NPW-91-01	26	RPS-91-29	43	RPS-91-04	60	RPS-91-58	77
10	NPS-91-08	27	RPS-91-06	44	RPS-91-16	61	RPS-91-59	78
11	NPS-91-09	28	RPS-91-23	45	RPS-91-11	62	RPS-91-48	79
12	NPS-91-10	29	RPS-91-24	46	RPS-91-64	63	RPS-91-49	80
13	RPS-91-01	30	RPS-91-25	47	RPS-91-65	64	RPS-91-50	81
14	RPS-91-02	31	RPS-91-09	48	RPS-91-66	65	RPS-91-13	82
15	RPW-91-01	32	RPS-91-28	49	RPS-91-67	66	RPS-91-51	
16	RPW-91-02	33	RPS-91-27	50	RPS-91-68	67	RPS-91-52	
17	RPS-91-03	34	RPS-91-05	51	RPS-91-54	68	RPS-91-53	



LEGEND

- PAVED ROAD OR TRAMWAY
- DRAINAGE DITCH
- S1119 EXISTING MONITORING WEL
- RPM-89-02 NEW MONITORING WELLS
- SEDIMENT SAMPLE
- SURFACE SOIL SAMPLE
- SURFACE WATER SAMPLE

PB CONCENTRATIONS

- >1000 µg/g
- 100 to 999 µg/g
- 30 to 99.9 µg/g
- ESTIMATED CONCENTRATION

NOTES:

1. SEE TABLE 8-9 OR APPENDIX K FOR CHEM DATA SUMMARY.
2. CONCENTRATIONS <30 µg/g ARE CONSIDE BACKGROUND. SEE SECTION 2.0.
3. CONCENTRATIONS ARE INDICATED AS ESTIMATED WHERE DATA POINTS ARE LIM

FIGU
PB CONCENTRA
NITROGLYCERINE
ROCKET PASTE AREA AND NEW ACID
REMEDIAL INVESTIG
BADGER ARMY AMMUNITION

ABB Environmental Serv

MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER
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2	NPS-91-02	19	RPS-91-35	36	RPS-91-18	53	RPS-91-61	70	RPS-91-45
3	NPS-91-03	20	RPS-91-32	37	RPS-91-19	54	RPS-91-62	71	RPS-91-46
4	NPW-91-02	21	RPS-91-33	38	RPS-91-06	55	RPS-91-63	72	RPS-91-47
5	NPS-91-06	22	RPS-91-30	39	RPS-91-20	56	RPS-91-55	73	RPS-91-38
6	NPS-91-05	23	RPS-91-31	40	RPS-91-21	57	RPS-91-56	74	RPS-91-37
7	NPS-91-07	24	RPS-91-28	41	RPS-91-22	58	RPS-91-57	75	RPS-91-44
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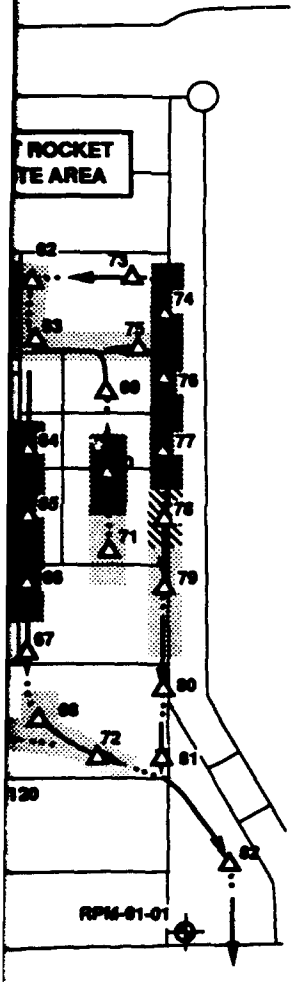
9	NPW-91-01	26	RPS-91-29	43	RPS-91-04	60	RPS-91-58	77	RPS-91-39
10	NPS-91-08	27	RPS-91-08	44	RPS-91-16	61	RPS-91-59	78	RPS-91-40
11	NPS-91-09	28	RPS-91-23	45	RPS-91-11	62	RPS-91-48	79	RPS-91-41
12	NPS-91-10	29	RPS-91-24	46	RPS-91-64	63	RPS-91-49	80	RPS-91-42
13	RPS-91-01	30	RPS-91-25	47	RPS-91-65	64	RPS-91-50	81	RPS-91-43
14	RPS-91-02	31	RPS-91-09	48	RPS-91-66	65	RPS-91-13	82	RPS-91-15
15	RPW-91-01	32	RPS-91-26	49	RPS-91-67	66	RPS-91-51		
16	RPW-91-02	33	RPS-91-27	50	RPS-91-68	67	RPS-91-52		
17	RPS-91-03	34	RPS-91-05	51	RPS-91-54	68	RPS-91-53		



LEGEND

PAVED ROAD OR TRAMWAY

DRAINAGE DITCH

S1119 EXISTING MONITORING WELLS

RPM-89-02 NEW MONITORING WELLS

SEDIMENT SAMPLE

SURFACE SOIL SAMPLE

SURFACE WATER SAMPLE

PB CONCENTRATIONS

>1000 µg/g

100 to 999 µg/g

30 to 99.9 µg/g

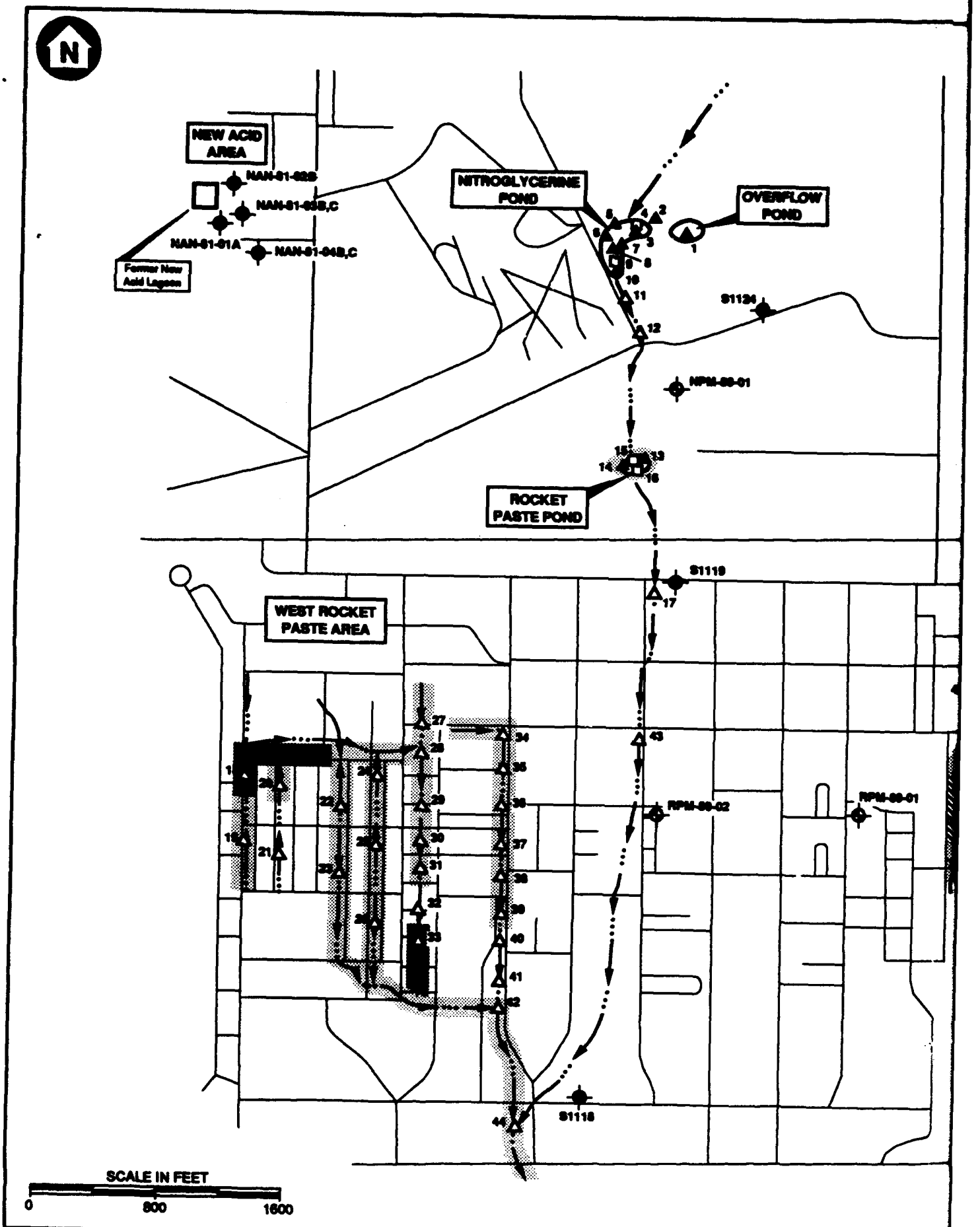
ESTIMATED CONCENTRATION

NOTES:

1. SEE TABLE 8-9 OR APPENDIX K FOR CHEMICAL DATA SUMMARY.
2. CONCENTRATIONS <30 µg/g ARE CONSIDERED BACKGROUND. SEE SECTION 2.0.
3. CONCENTRATIONS ARE INDICATED AS ESTIMATED WHERE DATA POINTS ARE LIMITED.

FIGURE 8-7
PB CONCENTRATIONS
NITROGLYCERINE POND,
ROCKET PASTE AREA AND NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



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MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	M CO
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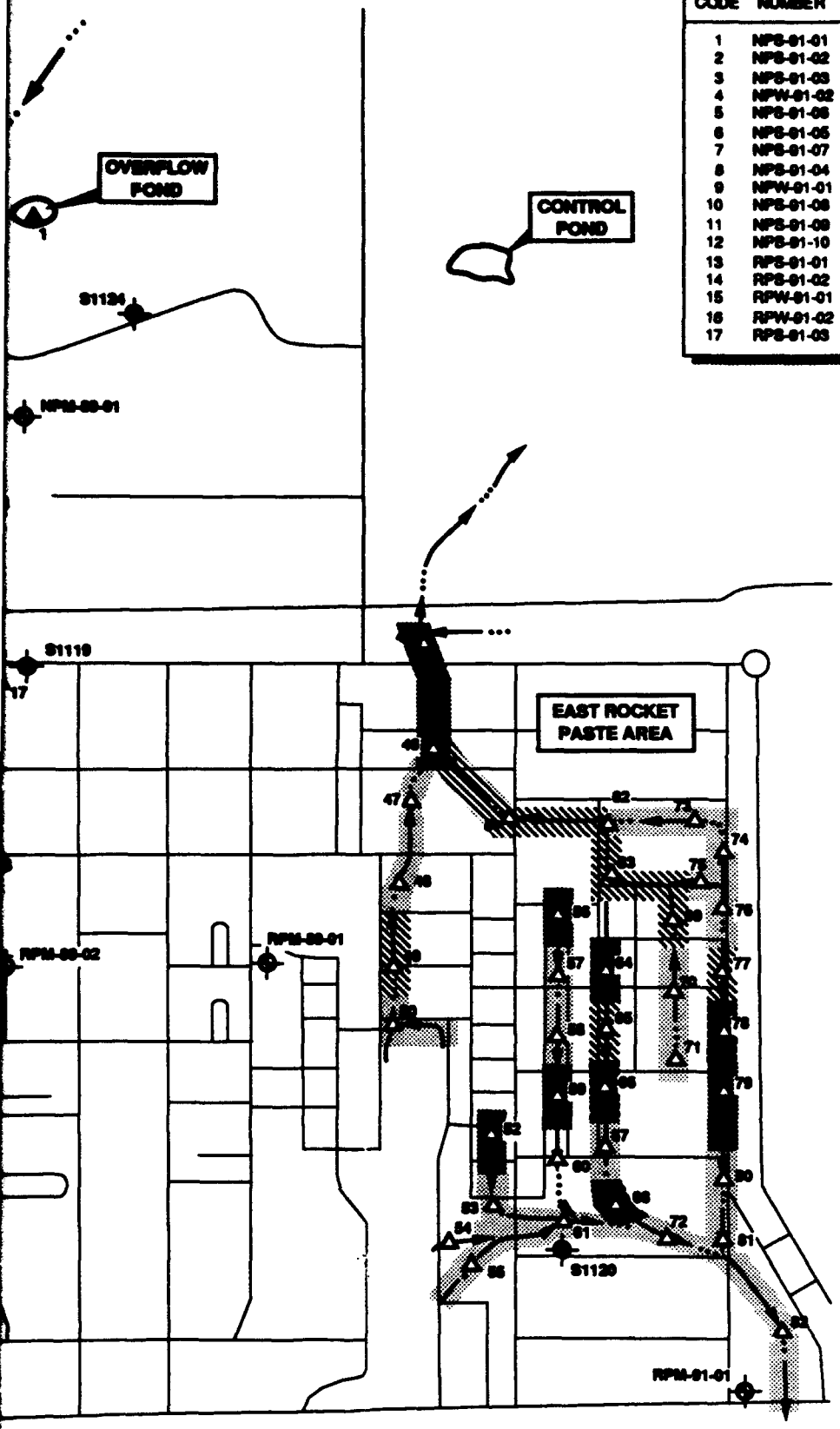
2	NPS-01-02	19	RPS-01-35	36	RPS-01-18	53	RPS-01-51	7
3	NPS-01-03	20	RPS-01-32	37	RPS-01-19	54	RPS-01-52	7
4	NPW-01-02	21	RPS-01-33	38	RPS-01-08	55	RPS-01-53	7
5	NPS-01-06	22	RPS-01-30	39	RPS-01-20	56	RPS-01-55	7
6	NPS-01-05	23	RPS-01-31	40	RPS-01-21	57	RPS-01-56	7
7	NPS-01-07	24	RPS-01-28	41	RPS-01-22	58	RPS-01-57	7
8	NPS-01-04	25	RPS-01-10	42	RPS-01-07	59	RPS-01-14	7
9	NPW-01-01	26	RPS-01-29	43	RPS-01-04	60	RPS-01-58	7
10	NPS-01-08	27	RPS-01-06	44	RPS-01-16	61	RPS-01-59	7
11	NPS-01-09	28	RPS-01-23	45	RPS-01-11	62	RPS-01-49	7
12	NPS-01-10	29	RPS-01-24	46	RPS-01-04	63	RPS-01-49	6
13	RPS-01-01	30	RPS-01-25	47	RPS-01-05	64	RPS-01-59	6
14	RPS-01-02	31	RPS-01-09	48	RPS-01-06	65	RPS-01-13	6
15	RPW-01-01	32	RPS-01-26	49	RPS-01-07	66	RPS-01-51	
16	RPW-01-02	33	RPS-01-27	50	RPS-01-08	67	RPS-01-52	
17	RPS-01-03	34	RPS-01-05	51	RPS-01-54	68	RPS-01-59	



LEGEND

- PAVED ROAD OR TRAMW
- DRAINAGE DITCH
- S1119 EXISTING MONITORING W
- RPM-99-02 NEW MONITORING WELL
- SEDIMENT SAMPLE
- SURFACE SOIL SAMPLE
- SURFACE WATER SAMPL

NNDPA CONCENTRATIONS

- >1000 µg/g
- 100 to 999 µg/g
- 10 to 99 µg/g
- >CRL to 9.9 µg/g

NOTES:

1. SEE TABLE 8-9 OR APPENDIX K FOR CI DATA SUMMARY.
2. CRL = CERTIFIED REPORTING LIMIT

FI
NNDPA CONCENT
NITROGLYCERIN
ROCKET PASTE AREA AND NEW AC
REMEDIAL INVEST
BADGER ARMY AMMUNITIO
ABB Environmental S

MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER
1	NPS-91-01	18	RPS-91-34	35	RPS-91-17	52	RPS-91-60	69	RPS-91-12
2	NPS-91-02	19	RPS-91-35	36	RPS-91-18	53	RPS-91-61	70	RPS-91-45
3	NPS-91-03	20	RPS-91-32	37	RPS-91-19	54	RPS-91-62	71	RPS-91-46
4	NPW-91-02	21	RPS-91-33	38	RPS-91-06	55	RPS-91-63	72	RPS-91-47
5	NPS-91-06	22	RPS-91-30	39	RPS-91-20	56	RPS-91-55	73	RPS-91-38
6	NPS-91-05	23	RPS-91-31	40	RPS-91-21	57	RPS-91-56	74	RPS-91-37
7	NPS-91-07	24	RPS-91-28	41	RPS-91-22	58	RPS-91-57	75	RPS-91-44
8	NPS-91-04	25	RPS-91-10	42	RPS-91-07	59	RPS-91-14	76	RPS-91-39
9	NPW-91-01	26	RPS-91-29	43	RPS-91-04	60	RPS-91-58	77	RPS-91-39
10	NPS-91-08	27	RPS-91-08	44	RPS-91-16	61	RPS-91-59	78	RPS-91-40
11	NPS-91-09	28	RPS-91-23	45	RPS-91-11	62	RPS-91-48	79	RPS-91-41
12	NPS-91-10	29	RPS-91-24	46	RPS-91-64	63	RPS-91-49	80	RPS-91-42
13	RPS-91-01	30	RPS-91-25	47	RPS-91-65	64	RPS-91-50	81	RPS-91-43
14	RPS-91-02	31	RPS-91-09	48	RPS-91-66	65	RPS-91-13	82	RPS-91-15
15	RPW-91-01	32	RPS-91-26	49	RPS-91-67	66	RPS-91-51		
16	RPW-91-02	33	RPS-91-27	50	RPS-91-68	67	RPS-91-52		
17	RPS-91-03	34	RPS-91-05	51	RPS-91-54	68	RPS-91-53		

LEGEND

PAVED ROAD OR TRAMWAY

DRAINAGE DITCH

S1119 EXISTING MONITORING WELLS

RPM-89-02 NEW MONITORING WELLS

SEDIMENT SAMPLE

SURFACE SOIL SAMPLE

SURFACE WATER SAMPLE

NNDPA CONCENTRATIONS

>1000 µg/g

100 to 999 µg/g

10 to 99 µg/g

>CRL to 9.9 µg/g

NOTES:

1. SEE TABLE 8-9 OR APPENDIX K FOR CHEMICAL DATA SUMMARY.
2. CRL = CERTIFIED REPORTING LIMIT

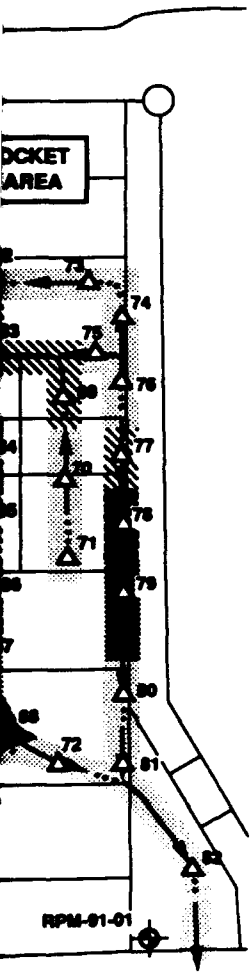
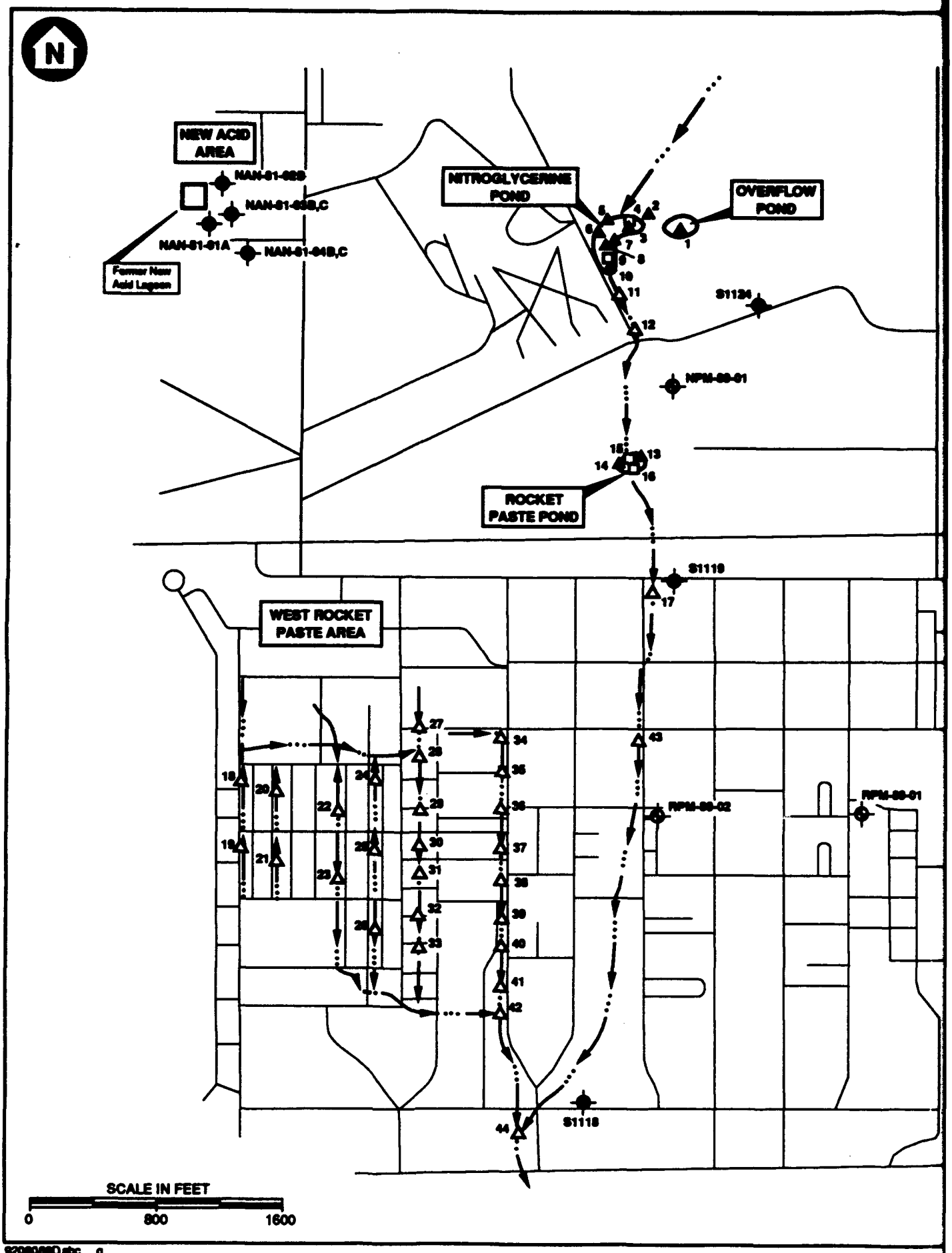


FIGURE 8-8
NNDPA CONCENTRATIONS
NITROGLYCERINE POND,
ROCKET PASTE AREA AND NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



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MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER
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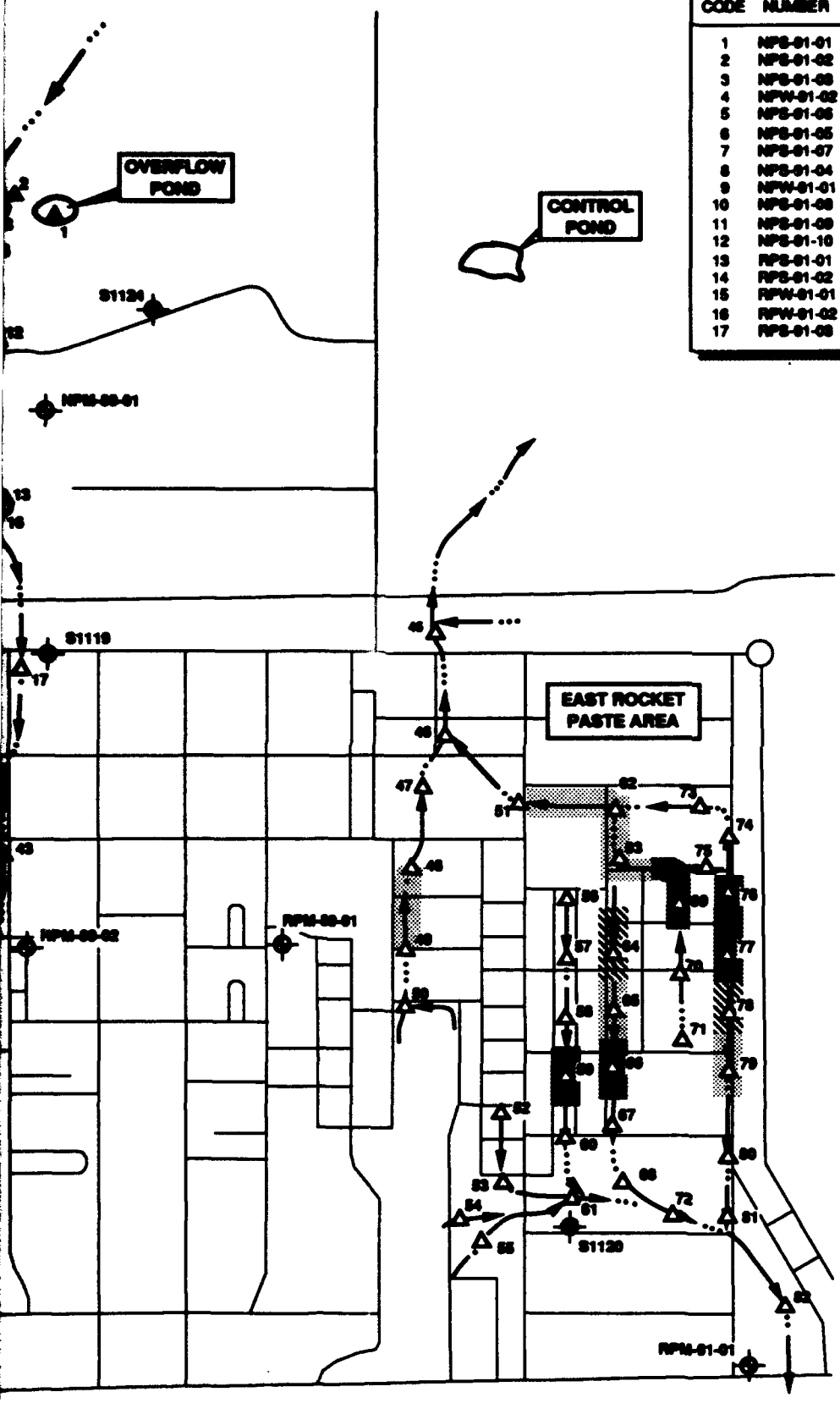
3	NPS-01-03	20	RPS-01-32	37	RPS-01-19	54	RPS-01-62
4	NPW-01-02	21	RPS-01-38	38	RPS-01-48	55	RPS-01-63
5	NPS-01-06	22	RPS-01-30	39	RPS-01-20	56	RPS-01-65
6	NPS-01-05	23	RPS-01-31	40	RPS-01-21	57	RPS-01-56
7	NPS-01-07	24	RPS-01-39	41	RPS-01-22	58	RPS-01-57
8	NPS-01-04	25	RPS-01-10	42	RPS-01-07	59	RPS-01-14
9	NPW-01-01	26	RPS-01-29	43	RPS-01-04	60	RPS-01-58
10	NPS-01-08	27	RPS-01-08	44	RPS-01-10	61	RPS-01-59
11	NPS-01-09	28	RPS-01-33	45	RPS-01-11	62	RPS-01-49
12	NPS-01-10	29	RPS-01-34	46	RPS-01-64	63	RPS-01-49
13	RPS-01-01	30	RPS-01-35	47	RPS-01-65	64	RPS-01-50
14	RPS-01-02	31	RPS-01-09	48	RPS-01-66	65	RPS-01-13
15	RPW-01-01	32	RPS-01-36	49	RPS-01-67	66	RPS-01-51
16	RPW-01-02	33	RPS-01-27	50	RPS-01-68	67	RPS-01-52
17	RPS-01-03	34	RPS-01-05	51	RPS-01-54	68	RPS-01-53



LEGEND

- PAVED ROAD OR TRA
- DRAINAGE DITCH
- S1119 EXISTING MONITORIN
- RPM-99-02 NEW MONITORING WE
- SEDIMENT SAMPLE
- SURFACE SOIL SAMP
- SURFACE WATER SA

TOTAL DNT CONCENTRATIONS

- >100 µg/g
- 10 to 99 µg/g
- >CRL TO 9.9 µg/g

NOTES:

1. SEE TABLE 8-9 OR APPENDIX K FOR DATA SUMMARY.
2. CRL = CERTIFIED REPORTING LIMIT

TOTAL DNT CONCEN
NITROGLYCER
ROCKET PASTE AREA AND NEW
REMEDIAL INVE
BADGER ARMY AMMUNIT

ABB Environmental

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MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER
1	NPS-01-01	18	RPS-01-34	35	RPS-01-17	52	RPS-01-60	69	RPS-01-12
2	NPS-01-02	19	RPS-01-35	36	RPS-01-18	53	RPS-01-61	70	RPS-01-45
3	NPS-01-03	20	RPS-01-32	37	RPS-01-19	54	RPS-01-62	71	RPS-01-46
4	NPW-01-02	21	RPS-01-33	38	RPS-01-06	55	RPS-01-63	72	RPS-01-47
5	NPS-01-06	22	RPS-01-30	39	RPS-01-20	56	RPS-01-55	73	RPS-01-38
6	NPS-01-05	23	RPS-01-31	40	RPS-01-21	57	RPS-01-56	74	RPS-01-37
7	NPS-01-07	24	RPS-01-28	41	RPS-01-22	58	RPS-01-57	75	RPS-01-44
8	NPS-01-04	25	RPS-01-10	42	RPS-01-07	59	RPS-01-14	76	RPS-01-36
9	NPW-01-01	26	RPS-01-29	43	RPS-01-04	60	RPS-01-58	77	RPS-01-39
10	NPS-01-08	27	RPS-01-08	44	RPS-01-16	61	RPS-01-59	78	RPS-01-40
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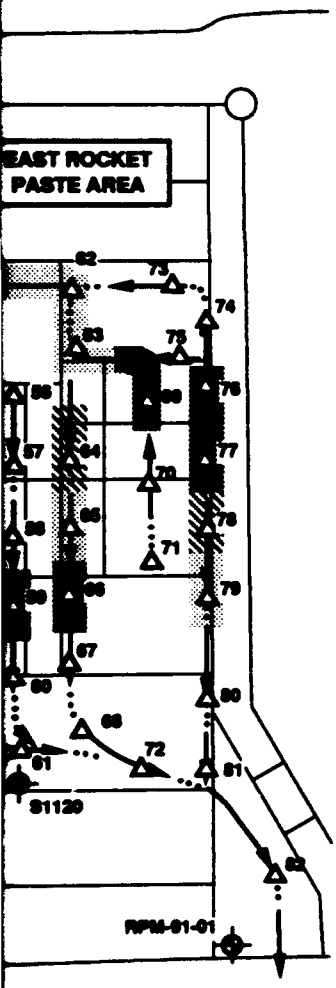
14	RPS-01-02	31	RPS-01-09	48	RPS-01-66	65	RPS-01-13	82	RPS-01-15
15	RPW-01-01	32	RPS-01-26	49	RPS-01-67	66	RPS-01-51		
16	RPW-01-02	33	RPS-01-27	50	RPS-01-68	67	RPS-01-52		
17	RPS-01-03	34	RPS-01-05	51	RPS-01-54	68	RPS-01-53		



LEGEND

- PAVED ROAD OR TRAMWAY
- DRAINAGE DITCH
- S1119 EXISTING MONITORING WELLS
- RPM-00-02 NEW MONITORING WELLS
- SEDIMENT SAMPLE
- SURFACE SOIL SAMPLE
- SURFACE WATER SAMPLE

TOTAL DNT CONCENTRATIONS

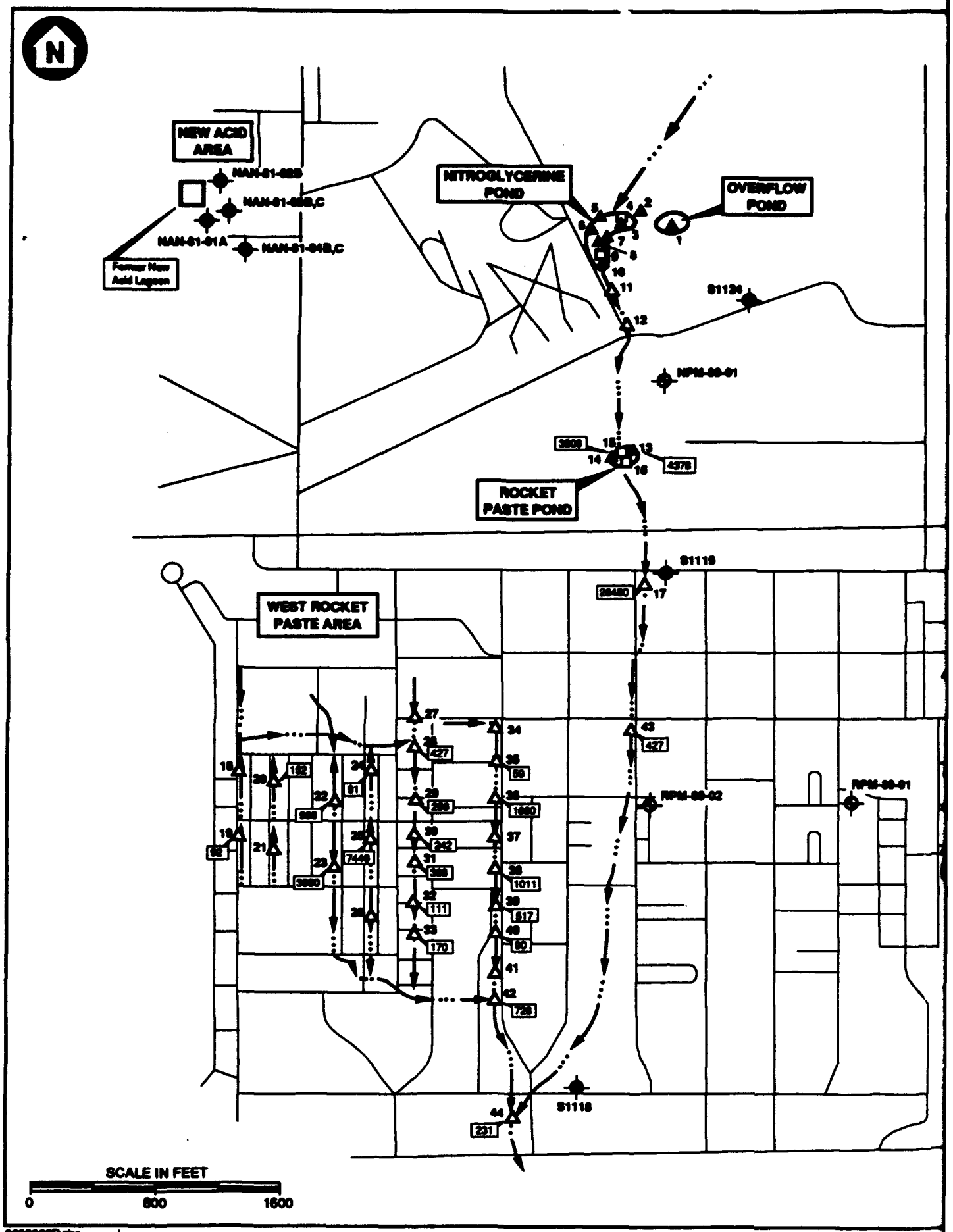
- >100 µg/g
- 10 to 99 µg/g
- >CRL TO 9.9 µg/g

NOTES:

1. SEE TABLE 8-9 OR APPENDIX K FOR CHEMICAL DATA SUMMARY.
2. CRL = CERTIFIED REPORTING LIMIT

FIGURE 8-9
TOTAL DNT CONCENTRATIONS
NITROGLYCERINE POND,
ROCKET PASTE AREA AND NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



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3	NPS-01-03	20	RPS-01-32	37	RPS-01-19	54	RPS-01-02
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6	NPS-01-05	23	RPS-01-31	40	RPS-01-21	57	RPS-01-06
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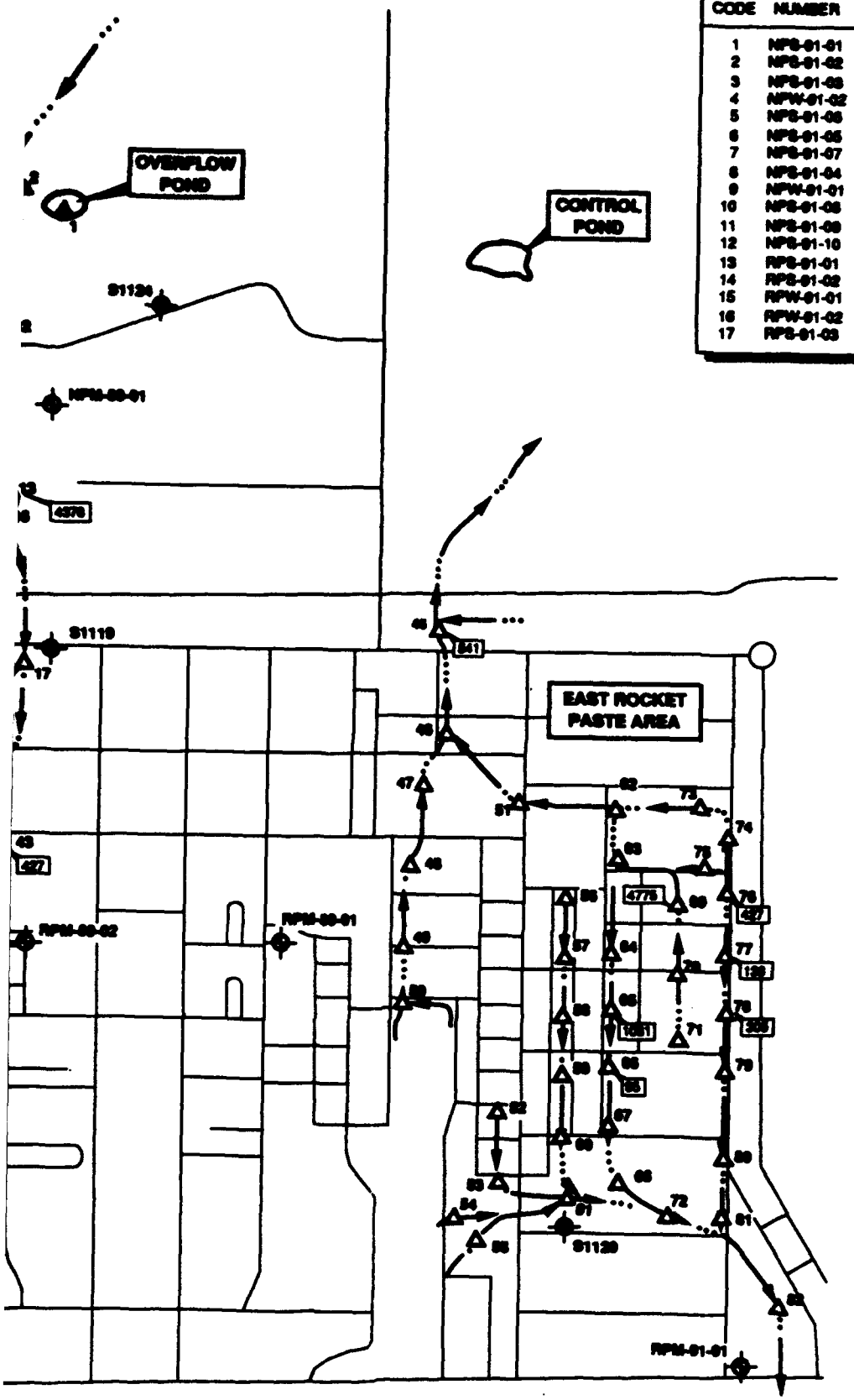
13	RPS-01-01	30	RPS-01-25	47	RPS-01-05	64	RPS-01-09
14	RPS-01-02	31	RPS-01-09	48	RPS-01-06	65	RPS-01-13
15	RPW-01-01	32	RPS-01-26	49	RPS-01-07	66	RPS-01-51
16	RPW-01-02	33	RPS-01-27	50	RPS-01-08	67	RPS-01-52
17	RPS-01-03	34	RPS-01-05	51	RPS-01-54	68	RPS-01-53



LEGEND

- PAVED ROAD OR TRA
- DRAINAGE DITCH
- S1119 — EXISTING MONITORIN
- RPM-00-02 — NEW MONITORING WE
- SEDIMENT SAMPLE
- SURFACE SOIL SAMP
- SURFACE WATER SA
- 51 — PB CONCENTRATION (µg/L)

NOTES:

1. SEE TABLE 8-9 OR APPENDIX K FOR DATA SUMMARY.

F
TCLP PB CONCEN
NITROGLYCER
ROCKET PASTE AREA AND NEW
REMEDIAL INVE
BADGER ARMY AMMUNIT

ABB Environmental

3

MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER	MAP CODE	SAMPLE NUMBER
1	NPS-91-01	18	RPS-91-34	35	RPS-91-17	52	RPS-91-60	69	RPS-91-12
2	NPS-91-02	19	RPS-91-35	36	RPS-91-18	53	RPS-91-61	70	RPS-91-45
3	NPS-91-03	20	RPS-91-32	37	RPS-91-19	54	RPS-91-62	71	RPS-91-46
4	NPW-91-02	21	RPS-91-33	38	RPS-91-06	55	RPS-91-63	72	RPS-91-47
5	NPS-91-06	22	RPS-91-30	39	RPS-91-20	56	RPS-91-55	73	RPS-91-38
6	NPS-91-05	23	RPS-91-31	40	RPS-91-21	57	RPS-91-58	74	RPS-91-37
7	NPS-91-07	24	RPS-91-28	41	RPS-91-22	58	RPS-91-57	75	RPS-91-44
8	NPS-91-04	25	RPS-91-10	42	RPS-91-07	59	RPS-91-14	76	RPS-91-36
9	NPW-91-01	26	RPS-91-29	43	RPS-91-04	60	RPS-91-56	77	RPS-91-39
10	NPS-91-08	27	RPS-91-08	44	RPS-91-16	61	RPS-91-59	78	RPS-91-40
11	NPS-91-09	28	RPS-91-23	45	RPS-91-11	62	RPS-91-48	79	RPS-91-41
12	NPS-91-10	29	RPS-91-24	46	RPS-91-64	63	RPS-91-49	80	RPS-91-42
13	RPS-91-01	30	RPS-91-25	47	RPS-91-65	64	RPS-91-50	81	RPS-91-43
14	RPS-91-02	31	RPS-91-09	48	RPS-91-66	65	RPS-91-13	82	RPS-91-15
15	RPW-91-01	32	RPS-91-26	49	RPS-91-67	66	RPS-91-51		
16	RPW-91-02	33	RPS-91-27	50	RPS-91-68	67	RPS-91-52		
17	RPS-91-03	34	RPS-91-05	51	RPS-91-54	68	RPS-91-53		

LEGEND

PAVED ROAD OR TRAMWAY

DRAINAGE DITCH

S1119 EXISTING MONITORING WELLS

RPM-89-02 NEW MONITORING WELLS

SEDIMENT SAMPLE

SURFACE SOIL SAMPLE

SURFACE WATER SAMPLE

91 PB CONCENTRATION IN SAMPLE (µg/L)

NOTES:

1. SEE TABLE 8-9 OR APPENDIX K FOR CHEMICAL DATA SUMMARY.

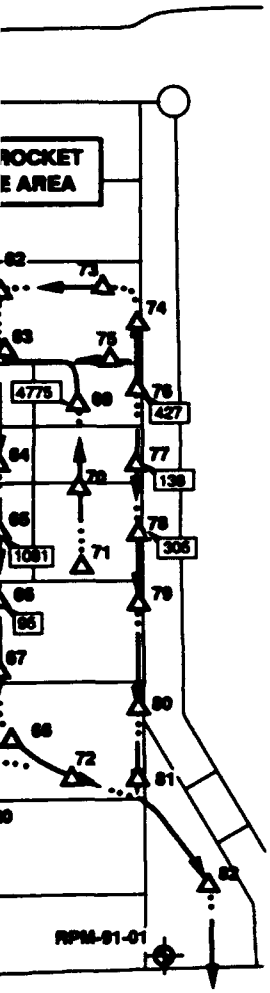


FIGURE 8-10
TCLP PB CONCENTRATIONS
NITROGLYCERINE POND,
ROCKET PASTE AREA AND NEW ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

TABLE 9-1
SUMMARY OF THE REMEDIAL INVESTIGATION FIELD PROGRAM - OLEUM PLANT AND OLEUM PLANT POND/BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	PROGRAM ELEMENTS				
SITES	SOIL VAPOR SURVEY	REMOTE SENSING GEOPHYSICS	MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING*	SOIL BORINGS AND SOIL SAMPLING	SEDIMENT, SURFACE SOIL, AND SURFACE WATER SAMPLING
Oleum Plant and Oleum Plant Pond	--	--	3 new wells; 10 samples from 3 new and 2 existing wells	5 deep borings, 24 analytical samples; 8 shallow borings; 22 analytical samples	10 sediment samples 5 surface water samples
Ballistics Pond	--	--	4 samples from existing wells	--	--

Notes:

* Includes 2 rounds of groundwater sampling

TABLE 9-2
SUMMARY OF BORINGS COMPLETED -
OLEUM PLANT AND OLEUM PLANT POND/BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

BORING NUMBER	DEPTH OF SOIL BORING FROM GROUND SURFACE (ft)	TOTAL NUMBER OF SPLIT-SPOON SAMPLES	NUMBER OF SUBSURFACE SOIL SAMPLES FOR CHEMICAL ANALYSIS	PURPOSE
Oleum Plant				
OPB-91-01[1]	66	5	4	This deep boring was drilled at the former bulk sulfur storage area to characterize the type and vertical distribution of residual contamination.
OPB-91-06	12	3	3	These shallow borings were drilled in and around the Oleum Plant production facilities. The samples from these shallow borings will be used to characterize the vertical and areal extent of potential shallow soil contamination at the Oleum Plant production facility
OPB-91-07	12	3	3	
OPB-91-08	11	3	3	
OPB-91-09	12	3	3	
OPB-91-10	8	2	2	
OPB-91-11	12	3	3	
OPB-91-12	10	3	3	
OPB-91-13	9	2	2	
Oleum Plant and Pond				These deep borings were drilled in the Oleum Plant Pond. They are located near the presumed outfall (02), at the edge of the pond (03), and near the edge of the apparent high waterline (04 and 05). These borings will be used in conjunction with sediment samples to characterize the areal and vertical distribution of residual soil contamination below the pond.
OPB-91-02	68	10	5	
OPB-91-03	101	14	5	
OPB-91-04	92	13	5	
OPB-91-05	93	13	5	

Notes: [1]OPB-91-01 was first drilled using a hollow-stem auger. Boring encountered refusal at 12 feet, 7 feet, 5 feet. The boring was completed using the TH 60 drive through casing technique.

W0039213T.9/2

TABLE 9-3
SUMMARY OF MONITORING WELLS INSTALLED - OLEUM PLANT AND OLEUM PLANT POND/BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE AND WELL IDENTIFIER	DRILLING METHOD	BORING DEPTH FROM GROUND SURFACE (ft.)	BOTTOM ELEVATION OF SCREENS (ft. MSL)	LENGTH OF WELL SCREEN (ft.)	LOCATION	PURPOSE
Oleum Plant and Oleum Plant Pond						
OPM-89-01	Drill through casing hammer	88	837.8	20	Downgradient and southeast of the former sulfur storage area and old lagoon.	To provide horizontal definition of any potential plumes associated with the former sulfur storage or lagoon area.
OPM-89-02	Drill through casing hammer	118	764.6	20	Downgradient and approximately 600 feet southeast of the Oleum Plant.	To provide horizontal definition of any potential plumes from the Oleum Plant Pond.
OPM-89-03	Drill through casing hammer	162	765.7	20	Downgradient and approximately 1,200 feet southeast of the Oleum Plant.	To provide horizontal definition of any potential plumes from the Oleum Plant.

Notes:

MSL = Mean Sea Level

W0039213T.9/3

TABLE 9-4
WELLS INCLUDED IN GROUNDWATER SAMPLING PROGRAM -
OLEUM PLANT AND OLEUM PLANT POND/BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITES	NEW WELLS	EXISTING WELLS
Oleum Plant and Oleum Plant Pond	OPM-89-01 OPM-89-02 OPM-89-03	S1132 S1151
Ballistics Pond		S1127 S1128
TOTAL WELLS	3	4

TABLE 9-5
CHEMICAL ANALYSES PERFORMED ON SURFACE WATER SAMPLES -
OLEUM PLANT AND OLEUM PLANT POND/BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SAMPLE LOCATION	INORGANICS									ORGANICS			
	METALS	TAL METALS	NIT	NH3N2	N2KJEL	S04	CL	ALK	HARD	VOC	BN/A	NG	DNT
BALLISTICS POND													
BPW-91-01	—	1	1	—	—	1	1	1	1	1	1	—	—
BPW-91-02	—	1	1	—	—	1	1	1	1	1	1	—	—
BPW-90-01	1	—	1	—	—	1	1	1	1	—	—	—	—
BPW-90-02	1	—	1	—	—	1	1	1	1	—	—	—	—
BPW-90-03	1	—	1	—	—	1	1	1	1	—	—	—	—
TOTALS	3	2	5	0	0	5	5	5	5	2	2	0	0

NOTES:

BN/A = base-neutral and acid-extractable organics by GC/MS
DNT = 2,4- and 2,6-dinitrotoluene by HPLC
GC/MS = Gas Chromatography/Mass Spectrometry
HPLC = High Performance Liquid Chromatrography
METALS = AL, CA, FE, MG, NA, PB
NAM = nitrosamines by GC
N2KJEL = Nitrogen by Kjeldahl Method
PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, PB, HG, NI, SB, SE, TL, ZN)
TAL = Toxic Analyte List (23) (AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)
VOC = volatile organic compounds by GC/MS

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TABLE 9-6
CHEMICAL ANALYSES PERFORMED ON SEDIMENT SAMPLES -
OLEUM PLANT AND OLEUM PLANT POND/BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS														OTHER			ORGANICS				
	TOTAL METALS								TCLP METALS				ANIONS									
SAMPLE LOCATION	PP	AL	CA	NA	CD	CR	HG	PB	CD	CR	HG	PB	NIT	SO4	NH3N2	TOC	pH	VOC	BN/A	NG	NAM	DNT
OLEUM PLANT AND POND																						
OPS-91-01	—	—	1	1	—	—	—	—	—	—	—	—	1	1	—	1	1	—	—	—	—	—
OPS-91-02	—	—	1	1	—	—	—	—	—	—	—	—	1	1	—	1	1	—	—	—	—	—
OPS-91-03	—	—	1	1	—	—	—	—	—	—	—	—	1	1	—	1	1	—	—	—	—	—
OPS-91-04	—	—	1	1	—	—	—	—	—	—	—	—	1	1	—	1	1	—	—	—	—	—
BALLISTICS POND																						
BPS-91-01	—	1	—	—	—	—	—	1	—	—	—	—	1	1	1	—	—	1	1	—	—	—
BPS-91-02	—	1	—	—	—	—	—	1	—	—	—	—	1	1	1	—	—	1	1	—	—	—
BPS-91-03	—	1	—	—	—	—	—	1	—	—	—	—	1	1	1	—	—	1	1	—	—	—
BPS-91-04	—	1	—	—	—	—	—	1	—	—	—	—	1	1	1	—	—	1	1	—	—	—
BPS-91-05	—	1	—	—	—	—	—	1	—	—	—	—	1	1	1	—	—	1	1	—	—	—
BPS-91-06	—	1	—	—	—	—	—	1	—	—	—	—	1	1	1	—	—	1	1	—	—	—
TOTALS	0	6	4	4	0	0	0	6	0	0	0	0	10	10	6	4	4	6	6	0	0	0

NOTES:
PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, PB, HG, NI, SB, SE, TL, ZN)
TAL = Toxic Analyte List (2 AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)
VOC = volatile organic con unds by GC/MS
GC/MS = Gas Chromatography/Mass Spectrometry
BN/A = base-neutral and acid-extractable organics by GC/MS
NAM = nitrosamines by GC
DNT = 2,4- and 2,6-dinitrotoluene by HPLC
HPLC = High Performance Liquid Chromatrography

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TABLE 9-7
CHEMICAL ANALYSES PERFORMED ON SUBSURFACE SOIL SAMPLES -
OLEUM PLANT AND OLEUM PLANT POND/BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS														OTHER			ORGANICS				
	METALS								TCLP METALS				ANIONS									
SAMPLE LOCATION	PP	TAL	CD	CR	HG	FE	NI	PB	CD	CR	HG	PB	NIT	SO4	TOC	pH	TPHC	VOC	BN/A	NG	NAM	DNT
OLEUM PLANT AND POND																						
OPB-91-01	—	—	4	4	4	4	—	4	—	—	—	—	4	4	4	4	—	—	—	—	—	—
OPB-91-02	—	—	5	5	5	—	5	5	—	—	—	—	5	5	5	5	—	—	—	—	—	—
OPB-91-03	—	—	5	5	5	—	5	5	—	—	—	—	5	5	5	5	—	—	—	—	—	—
OPB-91-04	—	—	5	5	5	5	—	5	—	—	—	—	5	5	5	5	—	—	—	—	—	—
OPB-91-05	—	—	5	5	5	5	—	5	—	—	—	—	5	5	5	5	—	—	—	—	—	—
OPB-91-06	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	—	—	—	—	—	—	—
OPB-91-07	—	—	—	—	—	—	—	—	—	—	—	—	3	3	—	—	—	—	—	—	—	—
OPB-91-08	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—	—	—
OPB-91-09	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—	—	—
OPB-91-10	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—
OPB-91-11	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—	—	—
OPB-91-12	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—	—	—
OPB-91-13	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—
TOTALS	0	0	24	24	24	14	10	24	0	0	0	0	30	46	24	24	0	0	0	0	0	0

NOTES:

PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, PB, HG, NI, SB, SE, TL, ZN)
TAL = Toxic Analyte List (23) (AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)
VOC = volatile organic compounds by GC/MS
GC/MS = Gas Chromatography/Mass Spectrometry
BN/A = base-neutral and acid-extractable organics by GC/MS
NAM = nitrosamines by GC
DNT = 2,4- and 2,6-dinitrotoluene by HPLC
HPLC = High Performance Liquid Chromatrography

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TABLE 9-8
CHEMICAL ANALYSES PERFORMED ON GROUNDWATER SAMPLES –
OLEUM ; : ANT AND OLEUM PLANT POND/BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS																	ORGANICS					TPH
	METALS									ANIONS			OTHER										
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	NI	NIT	CL	SO4	HARD	ALK	TDS	TOC	NH3N2	VOC	BN/A	NG	NAM	DNT	
BALLISTICS POND																							
S1127	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	B	—	B	—	—	—	—	—
S1128	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	B	—	B	—	—	—	—	—
OLEUM PLANT AND POND																							
OPM-89-01	—	—	1	1	1	1	B	B	—	B	B	B	B	B	B	—	—	B	—	—	—	—	—
OPM-89-02	—	—	1	1	1	1	B	B	—	B	B	B	B	B	B	—	—	B	—	—	—	—	—
OPM-89-03	—	—	1	1	1	1	B	B	—	B	B	B	B	B	B	—	—	B	—	—	—	—	—
S1132	—	—	1	1	1	1	B	B	—	B	B	B	B	B	B	—	—	B	—	—	—	—	—
S1151	—	—	1	1	1	1	B	B	—	B	B	B	B	B	B	—	—	B	—	—	—	—	—

NOTES:

PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, PB, HG, NI, SB, SE, TL, ZN)
TAL = Toxic Analyte List (23) (AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)
VOC = volatile organic compounds by GC/MS
GC/MS = Gas Chromatography/Mass Spectrometry
BN/A = base-neutral and acid-extractable organics by GC/MS
NAM = nitrosamines by GC
'NT = 2,4- and 2,6-dinitrotoluene by HPLC
HPLC = High Performance Liquid Chromatrography
B = Analyzed in Both Rounds (One and Two).
1 = Analyzed in Round One Only.

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TABLE 9-9
FIELD HYDRAULIC CONDUCTIVITY TEST RESULTS -
OLEUM PLANT AND OLEUM PLANT POND/BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL DESIGNATION	MAXIMUM WATER LEVEL DEPRESSION (FEET)	HYDRAULIC CONDUCTIVITY (CM/SEC)	GEOLOGIC CONDITIONS
OPM-89-03	0.9	$1x10^{-1}$	Fine sand with gravel (SP) over gravel (GP)

Notes:

Hydraulic Conductivity Tests completed during March and November, 1989, and November and December 1991.

Field data and calculations are presented in Appendix I.

Values for hydraulic conductivities represent an averaged value of multiple tests performed on each well.

Water level recovery at these wells impacted by inertial effects, resulting in water level recovery above static water levels. Hydraulic conductivity measurements may be greater than the calculated values at these wells.

cm/sec = centimeters per second

TABLE 9-10
HORIZONTAL GROUNDWATER GRADIENTS
OLEUM PLANT AND OLEUM PLANT POND/BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL PAIRS	HORIZONTAL GRADIENT (ft/ft)[1]	COMMENT
Oleum Plant and Oleum Plant Pond		
OPM-89-02 S1132	0.0004	Southerly and easterly flow vectors in deep regional system
DBN-89-04B	0.0004	Southerly and easterly flow vector in deep regional flow system
Ballistics Pond		
S1127 S1128	0.008	Southerly flow vector in shallow flow system

Notes:

[1] Gradient calculations are presented in Appendix H. All gradient calculations based on 12/13/89 water level measurements

ft/ft = feet per foot

TABLE 9-11
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
OLEUM PLANT AND OLEUM PLANT POND/ BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		OPB-91-01	OPB-91-01	OPB-91-01	OPB-91-01	OPB-91-02	OPB-91-02	OPB-91-02	OPB-91-02	OPB-91-02	OPB-91-03
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/23/91	10/23/91	10/23/91	10/29/91	10/10/91	10/10/91	10/10/91	10/10/91	10/10/91	10/10/91
DEPTH:		2.000	6.000	16.000	21.000	2.000	7.000	12.000	22.000	62.000	2.000
Metals	CR	14.400	13.000	13.500	18.000	4.860	22.900	28.200	10.200	3.150	30.300
	FE	16500.000	16300.000	11700.000	27300.000						
	HG	-	-	-	-	0.115	-	-	-	-	-
	NI					4.210	16.000	12.000	13.400	6.640	23.100
	PB	6.820	10.400	5.790	42.000	4.760	18.000	13.000	20.000	5.600	16.000
Anions	NIT	1.680	1.980	1.680	1.280	1.680	6.190	-	-	1.110	1.130
	SO4	8500.000	14000.000	200.000	260.000	60.700	220.000	58.300	12.100	7.640	27.600
Indicator	PH	6.500	7.640	8.950	9.230	8.160	6.760	10.400	5.600	7.980	6.300
parameter	TOC	9120.000	4980.000	9230.000	8680.000	5840.000	13800.000	4660.000	975.000	3050.000	23100.000

Notes and flagging codes are presented at the end of this table.

TABLE 9-11
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA -
OLEUM PLANT AND OLEUM PLANT POND/ BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID.		OPB-91-03	OPB-91-03	OPB-91-03	OPB-91-03	OPB-91-04	OPB-91-04	OPB-91-04	OPB-91-04	OPB-91-04	OPB-91-05
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/10/91	10/10/91	10/10/91	10/10/91	10/10/	10/10/91	10/10/91	10/10/91	10/11/91	10/10/91
DEPTH:		6.000	11.000	21.000	101.000	2.000	6.000	11.000	21.000	91.000	2.000
Metals	CR	22.000	2.050	4.060	2.640	21.300	25.800	21.500	8.090	7.120	21.600
	FE					11200.000	22300.000	43600.000	8360.000	8270.000	18800.000
	HG	-	-	-	-	-	-	-	-	-	-
	NI	15.400	6.420	3.960	-						
	PB	6.100	8.200	2.590	2.260	15.000	14.000	12.000	2.690	15.000	18.000
Anions	NIT	-	1.380	1.430	1.340	1.230	1.340	1.960	1.320	1.910	-
	SO4	230.000	89.700	380.000	-	39.900	17.600	11.100	-	15.900	110
Indicator parameter	PH	7.800	8.200	8.060	12.800	5.850	7.060	7.820	13.100	9.720	.960
	TOC	2960.000	2170.000	1500.000	910.000	11900.000	4840.000	6340.000	6360.000	3930.000	11700.000

Notes and flagging codes are presented at the end of this table.

TABLE 9-11
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
OLEUM PLANT AND OLEUM PLANT POND/ BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		OPB-91-05	OPB-91-05	OPB-91-05	OPB-91-05	OPB-91-06	OPB-91-06	OPB-91-06	OPB-91-07	OPB-91-07	OPB-91-07
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/10/91	10/10/91	10/10/91	10/11/91	10/23/91	10/23/91	10/23/91	10/23/91	10/23/91	10/23/91
DEPTH:		7.000	12.000	22.000	92.000	2.000	7.000	12.000	2.000	7.000	11.000
Metals	CR	26.300	9.130	6.490	4.970						
	FE	34100.000	11700.000	7350.000	5770.000						
	HG	-	-	-	-						
	NI										
	PB	15.000	13.000	13.000	2.300						
Anions	NIT	1.800	1.590	1.260	1.180	2.140	1.340	1.980	3.460	1.580	2.120
	SO4	12.800	7.910	-	-	-	-	-	-	-	-
Indicator parameter	PH	7.350	9.290	9.670	9.240						
	TOC	1700.000	3670.000	5860.000	13300.000						

Notes and flagging codes are presented at the end of this table.

TABLE 9-11
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA -
OLEUM PLANT AND OLEUM PLANT POND/ BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		OPB-91-08	OPB-91-08	OPB-91-08	OPB-91-09	OPB-91-09	OPB-91-09	OPB-91-10	OPB-91-10	OPB-91-11	OPB-91-11
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/23/91	10/23/91	10/23/91	10/23/91	10/23/91	10/23/91	10/23/91	10/23/91	10/23/91	10/23/91
DEPTH:		2.000	7.000	11.000	2.000	6.000	12.000	2.000	7.000	2.000	6.000
Metals	CR										
	FE										
	HG										
	NI										
	PB										
Anions	NIT										
	SO4	1800.000	79.000	110.000	-	33.900	6.520	-	-	-	24.900
Indicator parameter	PH										
	TOC										

Notes and flagging codes are presented at the end of this table.

TABLE 9-11
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
OLEUM PLANT AND OLEUM PLANT POND/ BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		OPB-91-11	OPB-91-12	OPB-91-12	OPB-91-12	OPB-91-13	OPB-91-13
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/23/91	10/23/91	10/23/91	10/23/91	10/23/91	10/23/91
DEPTH:		11.000	2.000	6.000	11.000	2.000	6.000
Metals	CR						
	FE						
	HG						
	NI						
	PB						
Anions	NIT						
	SO4	190.000	1000.000	1400.000	3400.000	-	310.000
Indicator parameter	PH						
	TOC						

Notes and flagging codes are presented at the end of this table.

TABLE 9-11
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
OLEUM PLANT AND OLEUM PLANT POND/ BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
.	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

Appendix K contains complete analytical results

USATHAMA chemical codes are defined in the RI Glossary Report

TABLE 9-12
SUMMARY OF SEDIMENT CHEMICAL DATA-
OLEUM PLANT AND OLEUM PLANT POND/ BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		BPS-91-01	BPS-91-02	BPS-91-03	BPS-91-04	BPS-91-05	BPS-91-06	OPS-91-01	OPS-91-02	OPS-91-03	OPS-91-04
Sample Type:		POND	POND	POND	POND	POND	POND	POND	POND	POND	POND
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/02/91	10/02/91	10/02/91	10/02/91	10/02/91	10/02/91	10/03/91	10/03/91	10/03/91	10/03/91
DEPTH:		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SVOCs	B2EHP	-	1.270	-	6.100	-	-				
	PHANTR	-	-	-	0.428	-	-				
Metals	AL	17200.000	20500.000	22300.000	58000.000	10200.000	19700.000				
	CA							36900.000	4380.000	4700.000	4730.000
	NA							120.000	-	67.200	70.000
	PB	33.000	8.800	19.000	54.000	2.070	3.240				
Anions	NIT	5.160	-	-	-	-	-	15.500	14.000	45.000	50.000
	SO4	62.700	114.000	63.900	490.000	76.400	77.700	590.000	300.000	160.000	230.000
Indicator parameter	NH3	13.900	215.000	23.800	71.200	17.700	-				
	PH							13.200	8.200	11.800	7.540
	TOC							23400.000	32300.000	37400.000	25400.000

Notes and flagging codes are presented at the end of this table.

TABLE 9-12
SUMMARY OF SEDIMENT CHEMICAL DATA-
OLEUM PLANT AND OLEUM PLANT POND/ BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

Appendix K contains complete analytical results

USATHAMA chemical codes are defined in the RI Report Glossary

TABLE 9-13
SUMMARY OF SURFACE WATER CHEMICAL DATA-
OLEUM PLANT AND OLEUM PLANT POND/ BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		BPW-90-01	BPW-90-02	BPW-90-03	BPW-91-01	BPW-91-02
Sample Type:		POND	POND	POND	POND	POND
UNITS:		UGL	UGL	UGL	UGL	UGL
DATE SAMPLED:		09/27/90	09/27/90	09/27/90	10/02/91	10/02/91
DEPTH:		1.0	7.0	12.0	0.000	0.000
Metals	AL	756.00	930.00	1080.00	180.000	123.000
	BA				36.700	34.600
	CA	6190.00	6280.00	6730.00	6510.000	6260.000
	FE	879.00	1040.00	1380.00	315.000	217.000
	K				1490.000	1940.000
	MG	3030.00	3110.00	3160.00	2920.000	2810.000
	MN				79.000	76.800
	NA	3600.00	3540.00	3550.00	3780.000	3580.000
	V				5.230	–
	ZN				67.900	35.400
Anions	CL	2980.00	2930.00	3380.00	3750.000	4050.000
	NIT	–	11.223	–	51.400	43.100
	SO4	12000.00	12000.00	8520.00	14000.000	15000.000
Indicator	ALK	16000	18000	21000	21100	21100
parameter	HARD	27000	27600	28900	29100	29100
	pH(1)	8.6	9.0	9.0	7.3	7.8
	Sp.Cond.(2)	76	68	75	206	204

Notes and flagging codes are presented at the end of this table.

TABLE 9-13
SUMMARY OF SURFACE WATER CHEMICAL DATA-
OLEUM PLANT AND OLEUM PLANT POND/ BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

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TABLE 9-14
SUMMARY OF GROUNDWATER CHEMICAL DATA-
OLEUM PLANT AND OLEUM PLANT POND/ BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		OPM-89-01		OPM-89-02		OPM-89-03		S1127		S1128	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		12/05/91	04/09/92	11/24/91	04/08/92	12/06/91	04/08/92	12/03/91	04/13/92	12/04/91	04/13/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	CH2Cl2	4.510 P	6.270 B	4.310 P	4.900 P	2.940 P	4.410 P	5.88	8.040 B	5.39	6.270 B
Metals	CA	100000	100000	52000	480000	63000	68000				
	CR	8.17	–	5.59	–	7.67	–				
	NA	–	120000	–	16000	–	11000				
Anions	NIT	680	530	1400	620	860	810	580	400	290	300
	CL	110000	130000	2600 P	2400 P	9400	9500	3600	4800	3700	5400
	SO4	200000	170000	28000	28000	76000	74000	12000	15000	15000	14000
Indicator parameter	ALK	204000	254000	200000	174000	218000	210000	118000	82000	94000	94000
	HARD	450000	476000	234000	228000	254000	396000	128000	96000	124000	104000
	TDS	608000	701000	264000	255000	356000	339000	159000	81000	151000	95000
	TOC							2800	1500	–	1600
	pH(1)		7.5	6.6	7.7	7.6	7.8	8.2	8.0	8.1	8.0
	Sp.Cond.(2)		972	466	385	457	545	242	184	235	207

Notes and flagging codes are presented at the end of this table.

TABLE 9-14
SUMMARY OF GROUNDWATER CHEMICAL DATA-
OLEUM PLANT AND OLEUM PLANT POND/ BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		S1132		S1151	
Sample Type:		WELL		WELL	
UNITS:		UGL		UGL	
DATE SAMPLED:		12/05/91	04/09/92	11/24/91	04/08/92
ROUND:		ONE	TWO	ONE	TWO
VOCs	CH2CL2	4.710 P	4.220 P	4.120 P	-
Metals	CA	58000	56000	65000	70000
	CR	6.31	-	7.27	-
	NA	3130. T	11000	-	7700
Anions	NIT	560	500	1200	1500
	CL	2500 X	2700 P	1910	2070
	SO4	34000	32000	33000	35000
Indicator parameter	ALK	192000	346000	263000	274000
	HARD	238000	252000	290000	296000
	TDS	269000	268000	304000	324000
	pH(1)	8.0	6.0	6.6	7.6
	Sp.Cond.(2)	442	425	568	491

Notes and flagging codes are presented at the end of this table.

TABLE 9-14
SUMMARY OF GROUNDWATER CHEMICAL DATA-
OLEUM POND AND OLEUM PLANT POND/ BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

Appendix K contains complete analytical results

USATHAMA chemical codes are defined in the RI Report Glossary

TABLE 9-15
COMPOUNDS OF POTENTIAL CONCERN
OLEUM PLANT AND OLEUM PLANT POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUNDS OF POTENTIAL CONCERN	EXPOSURE POINT CONCENTRATION		
	SURFACE SOIL (µg/g)	SUBSURFACE SOIL[2] (µg/g)	SEDIMENT[3] (µg/g)
CR	14.4	30.3	--
HG	--	0.115	--
NI	--	23.1	--
NIT	3.46	6.19	50
SO4	8,500	14,000	590

Notes:

-- = Not identified as a compound of potential concern
Exposure point concentration is the maximum detected concentration
µg/g = microgram per kilogram; equivalent to parts per million (ppm)
[1] Assessment of surface soil contamination (0 to 2 feet) was performed using samples from borings OPB-91-01 and OPB-91-06 through OPB-91-
[2] Assessment of subsurface soil contamination (2 to 12 feet) was performed using samples from borings OPB-91-01 through OPB-91-05.
[3] Assessment of sediment contamination was performed using samples OPS-91-01 through OPS-91-04.

TABLE 9-16
SUMMARY OF RISK ESTIMATES
OLEUM PLANT AND OLEUM PLANT POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

EXPOSURE SCENARIO	EXPOSURE ROUTE	CANCER RISK	HAZARD INDEX
Current and Future Grounds Maintenance Worker	Soil Ingestion	NA	0.000003
	Inhalation of Particulates and Vapors	NA	ND
	Total Grounds Maintenance Worker	NA	0.000003
Future Residential	Soil Ingestion	NA	0.0005
Future Construction Worker	Soil Ingestion	ND	0.02
	Inhalation of Particulates	$4x10^{-6}$	0.0002
	Total for Construction Worker	$4x10^{-6}$	0.02
Future Child Playing	Ingestion of Sediment	NA	0.04

Notes:

ND = not determined - toxicity factors not available for compounds of potential concern
NA = not applicable - no carcinogenic compounds of potential concern

TABLE 9-17
COMPOUNDS OF POTENTIAL CONCERN
BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUNDS OF POTENTIAL CONCERN	EXPOSURE POINT CONCENTRATION	
	SEDIMENT[1] (µg/g)	SURFACE WATER[2] (mg/ℓ)
AL	58,000	0.18
B2EHP	6.1	--
BA	--	0.0367
CL	--	4.05
MN	--	0.0791
NH3	215	--
NIT	5.16	0.0514
PB	54	--
PHANTR	0.428	--
SO4	490	15
V	--	0.00523
ZN	--	0.0679

Notes:

-- = Not identified as a compound of potential concern
Exposure point concentration is the maximum detected concentration
µg/g = micrograms per gram; equivalent to parts per million (ppm)
mg/ℓ = milligrams per liter
[1] Assessment of sediment contamination was performed using samples BPS-91-01 through BPS-91-06.
[2] Assessment of surface water contamination was performed using samples BPW-91-01 and BPW-91-02.

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TABLE 9-18
SUMMARY OF RISK ESTIMATES
BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

EXPOSURE SCENARIO	EXPOSURE ROUTE	CANCER RISK	HAZARD INDEX
Future Child Playing	Ingestion of Sediment	$5x10^{-9}$	0.0001
	Ingestion of Surface Water	NA	0.00007
	Dermal Contact with Surface Water	NA	0.00007
	Total for Child Playing	$5x10^{-9}$	0.0002

Notes:

NA = not applicable - no carcinogenic compounds of potential concern

TABLE 9-19
COMPARISON OF GROUNDWATER TO STANDARDS -
UNITS: $\mu g/\ell$
OLEUM PLANT AND OLEUM PLANT POND/BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUNDS OF POTENTIAL CONCERN	FREQUENCY OF DETECTION	MAXIMUM DETECTED CONCENTRATION	MINIMUM DETECTED CONCENTRATION	SDWA (1)		WI GROUNDWATER STANDARDS (2)		CALCULATED CONCENTRATION (3)
				MCL	MCLG	ES	PAL	
CL	14:14	130,000	1,910	250,000(a)	-	-	-	-
CR	5:10	8.17	5.59	100	100	50(c)	5(c)	-
NA	6:10	120,000	3,130	20,000(b)	-	-	-	-
NIT	14:14	1,500	290	10,000	10,000	10,000	2,000	-
SO4	14:14	200,000	1,200	250,000(a)	-	250,000(d)	125,000(d)	-

Sources:

(1) U.S. Environmental Protection Agency (EPA), 1991, "Fact Sheet: National Primary Drinking Water Standards" Office of Water, Washington, D.C., August 1991; EPA, 1991, "Fact Sheet: National Secondary Drinking Water Standards," Office of Water, Washington, D.C., September 1991; and EPA, 1990, "National Primary and Secondary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals, Final Rule," 57FR31776, July 17, 1992 (see Subsection 3.6 for details).

(2) Wisconsin Administrative Code, Chapter NR 140.10, Table 1 (see Subsection 3.6 for details).

(3) Calculated to be protective at risk of 10^{-6} or HI of 1 (see Subsection 4.5 for details).

Notes:

(a) Secondary drinking water standard, suggested level.
(b) Reporting level. Monitoring is required and data is reported to health officials to protect individuals on restricted sodium diet.
(c) WI proposing change to ES = 100 $\mu g/\ell$ and PAL = 10 $\mu g/\ell$
(d) Value for protection of public welfare (usually aesthetic concerns) rather than for protection of public health.

$\mu g/\ell$ = micrograms per liter
SDWA = Safe Drinking Water Act
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
WI = Wisconsin
ES = Enforcement Standard
PAL = Preventive Action Limit
TT = *Treatment technique requirement in effect*
Copper action level = 1,300 $\mu g/\ell$; Lead action level = 15 $\mu g/\ell$

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TABLE 9-20
ECOLOGICAL CONTAMINANTS OF CONCERN[A] -
OLEUM PLANT AND OLEUM PLANT POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil[C]		
NIT	3:3	3.46
SO4	3:9	8,500
Sediment[D]		
NIT	4:4	0
SO4	4:4	590

Notes:

A Constituents selected based on criteria presented in Tables Q-21 and Q-22 and discussed in Section 5.0.

B 95th percentile or maximum; units in $\mu g/g$.

C Assessment of surface soil contamination (0 to 2 feet) was performed using samples from borings OPB-91-01 and OPB-91-06 through OPB-91-13.

D Assessment of sediment contamination was performed using samples OPS-91-01 through OPS-91-04.

TABLE 9-21
ECOLOGICAL CONTAMINANTS OF CONCERN[A] -
BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Water[C]		
AL	2:2	180
BA	2:2	36.7
CL	5:5	4,050
FE	2:2	315
MN	2:2	79.1
NIT	3:5	51.4
SO4	5:5	15,000
V	1:2	5.23
ZN	2:2	67.9
Sediment[D]		
AL	6:6	58,000
B2EHP	2:6	6.1
NH3	5:6	215
NIT	1:6	5.16
PB	6:6	54
PHANTR	1:6	0.428
SO4	6:6	490

Notes:

A Constituents selected based on criteria presented in Tables Q-23 and Q-24 and discussed in Section 5.0.

B 95th percentile or maximum; units in $\mu g/\ell$ (surface water) and $\mu g/g$ (sediment).

C Assessment of surface water contamination was performed using samples BPW-91-01 and BPW-91-02.

D Assessment of sediment contamination was performed using samples BPS-91-01 through BPS-91-06.

TABLE 9-22
RISK EVALUATION FOR AQUATIC RECEPTORS
OLEUM PLANT POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	EXPOSURE POINT CONCENTRATION[a]	RTV[b]	HAZARD QUOTIENT[c]
Sediment			
NIT	50	545	0.09
SO4	590	NA	--

Notes:

[a] Analytical results presented in Tables Q-21 and Q-22.

[b] Reference Toxicity Value (RTV) derived from available quality criteria and effects threshold levels as presented in Table Q-3.

[c] Calculated by dividing the exposure point concentration by the RTV; values in excess of 1.0E+00 indicate that the protective RTV was exceeded by environmental concentrations.

NA = none available.

TABLE 9-23
SUMMARY OF RISK EVALUATION FOR TERRESTRIAL RECEPTORS
OLEUM PLANT

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	HAZARD INDICES[a]	
RECEPTOR	ACUTE RISK[b]	CHRONIC RISK[c]
Short-tailed shrew	1.2E+00	1.2E+01
Eastern meadowlark	7.6E-02	7.0E-01
Garter snake	5.6E-02	5.2E-01
Red fox	2.2E-02	4.0E-03
Red-tailed hawk	6.0E-02	5.6E-03

Notes:

a Sum of the individual Hazard Quotients for each surface soil contaminant of concern; each HQ calculated by dividing the estimated exposure dose by the Reference Toxicity Value (RTV). Hazard Quotients are presented in Appendix R, Tables R-57 and R-58 for acute and chronic exposure respectively.

b Based on comparison to acute RTVs.

c Based on comparison to chronic RTVs.

TABLE 9-24
RISK EVALUATION FOR AQUATIC RECEPTORS
BALLISTICS POND

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	EXPOSURE POINT CONCENTRATION[a]	RTV[b]	HAZARD QUOTIENT[c]
Surface Water			
AL	180	748	0.24
BA	36.7	1,360	0.027
CL	4,050	230,000	0.043
FE	315	1,000	.315
MN	79.1	100	0.79
NIT	51.4	5,000	0.01
SO4	15,000	1,060,000	0.014
V	5.23	200	0.026
ZN	67.9	49.59	1.4
Sediment			
AL	58,000	NA	--
B2EHP	6.1	NA	--
NH3	215	75	2.9
NIT	5.16	545	0.0095
PB	54	50	1.1
PHANTR	0.428	1,390	0.00031
SO4	490	NA	--

lotes:

Analytical results presented in Tables Q-23 and Q-24.

Reference Toxicity Value (RTV) derived from available quality criteria and effects threshold levels as presented in Table Q-3.

Calculated by dividing the exposure point concentration by the RTV; values in excess of 1.0E+00 indicate that the protective RTV was exceeded by environmental concentrations.

A = none available.

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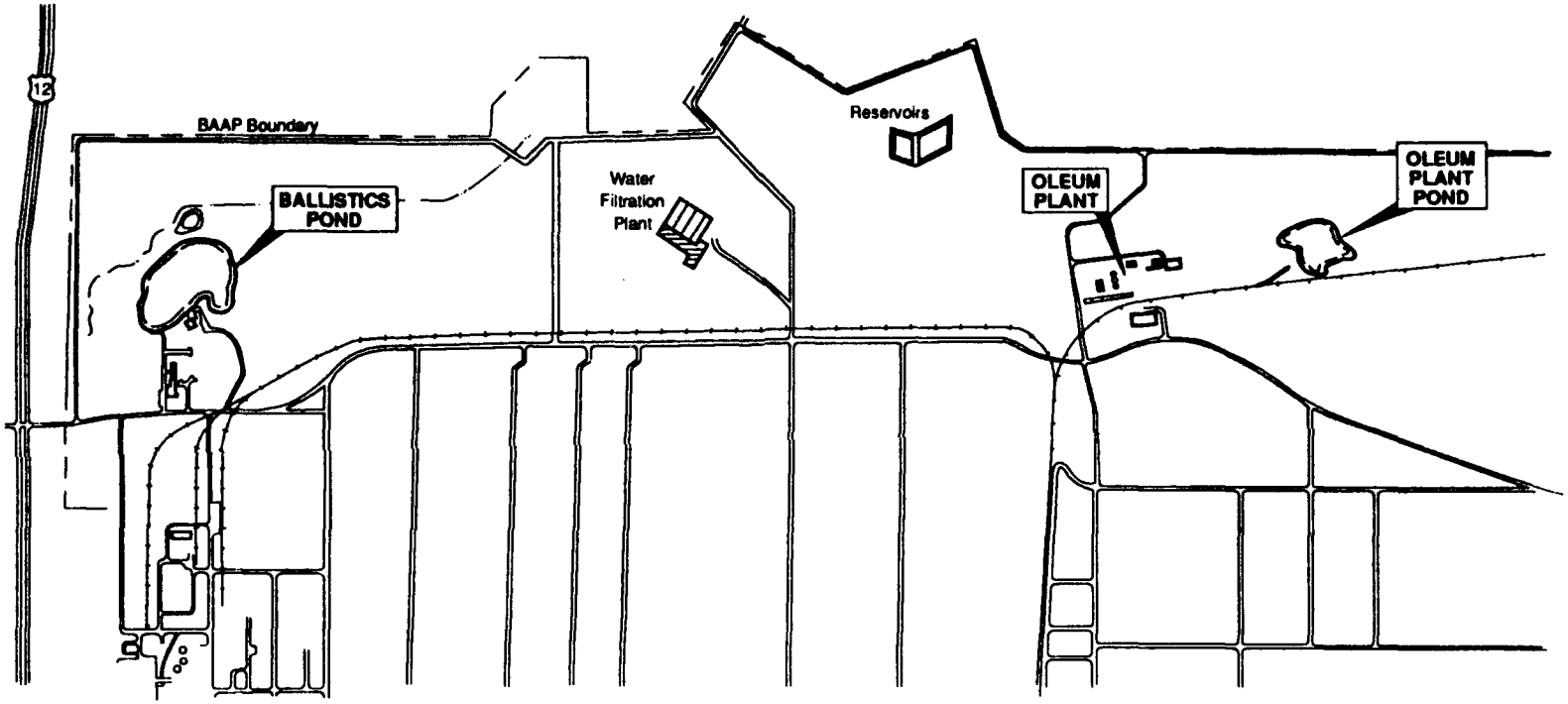

NOTE:
1. BASE MAP FROM 300-SCALE SITE TOPOGRAPHIC PLAN PROVIDED BY OLIN CORPORATION.

SCALE IN FEET
0 1000 2000

FIGURE 9-1
GENERAL SITE PLAN
OLEUM PLANT, OLEUM PLANT POND AND BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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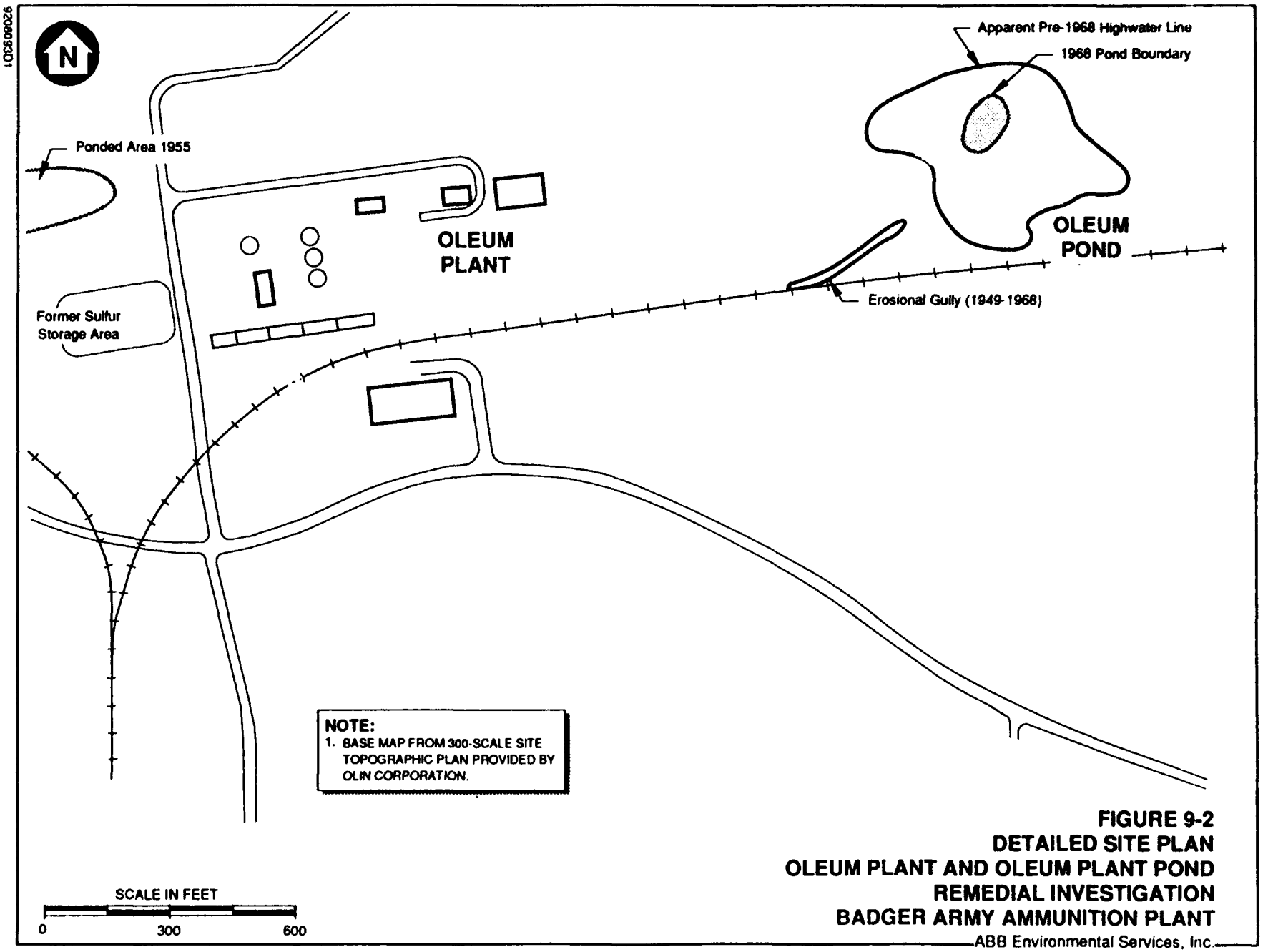

FIGURE 9-2
DETAILED SITE PLAN
OLEUM PLANT AND OLEUM PLANT POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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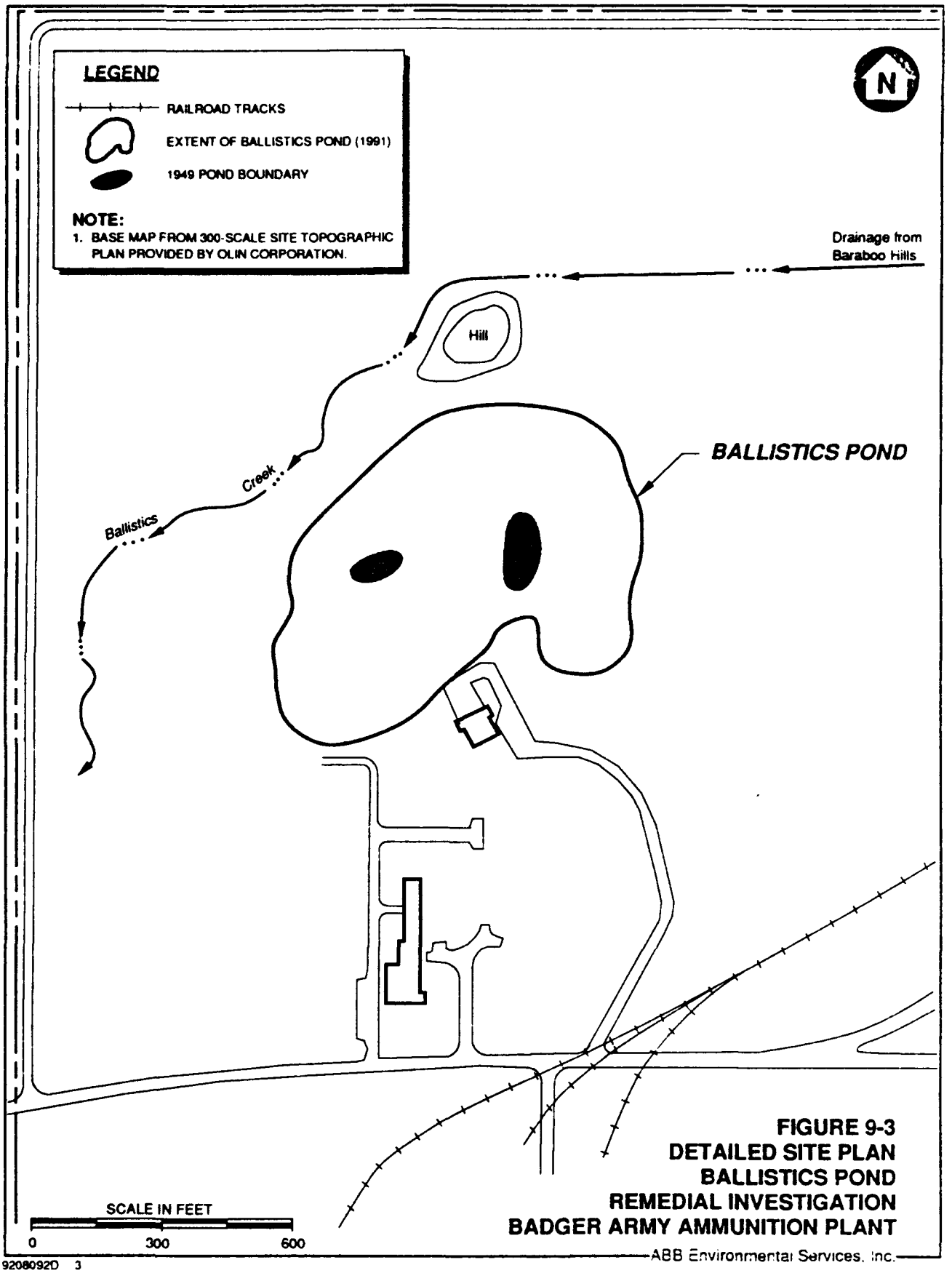

FIGURE 9-3
DETAILED SITE PLAN
BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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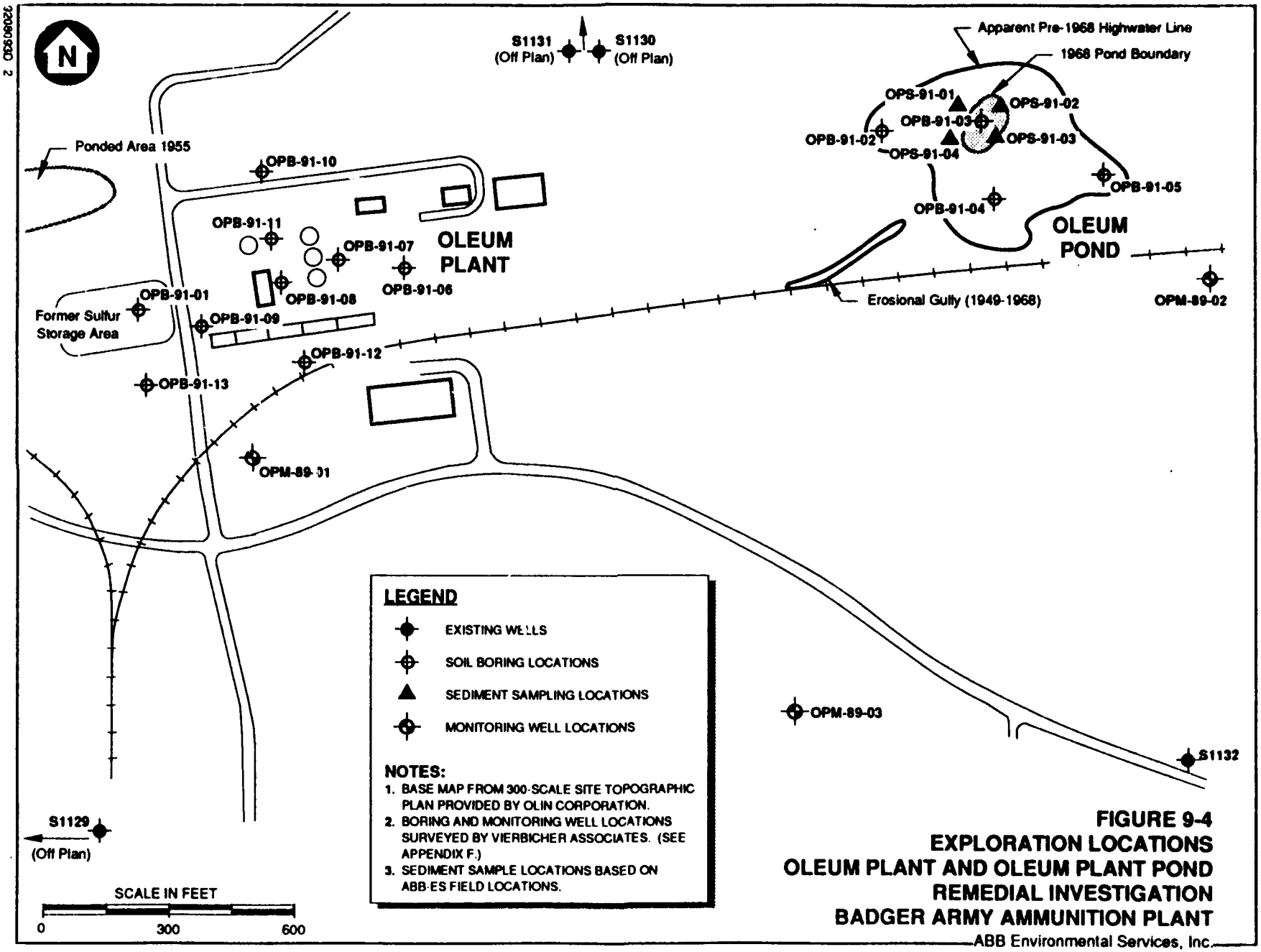

FIGURE 9-4
EXPLORATION LOCATIONS
OLEUM PLANT AND OLEUM PLANT POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

92060930 2

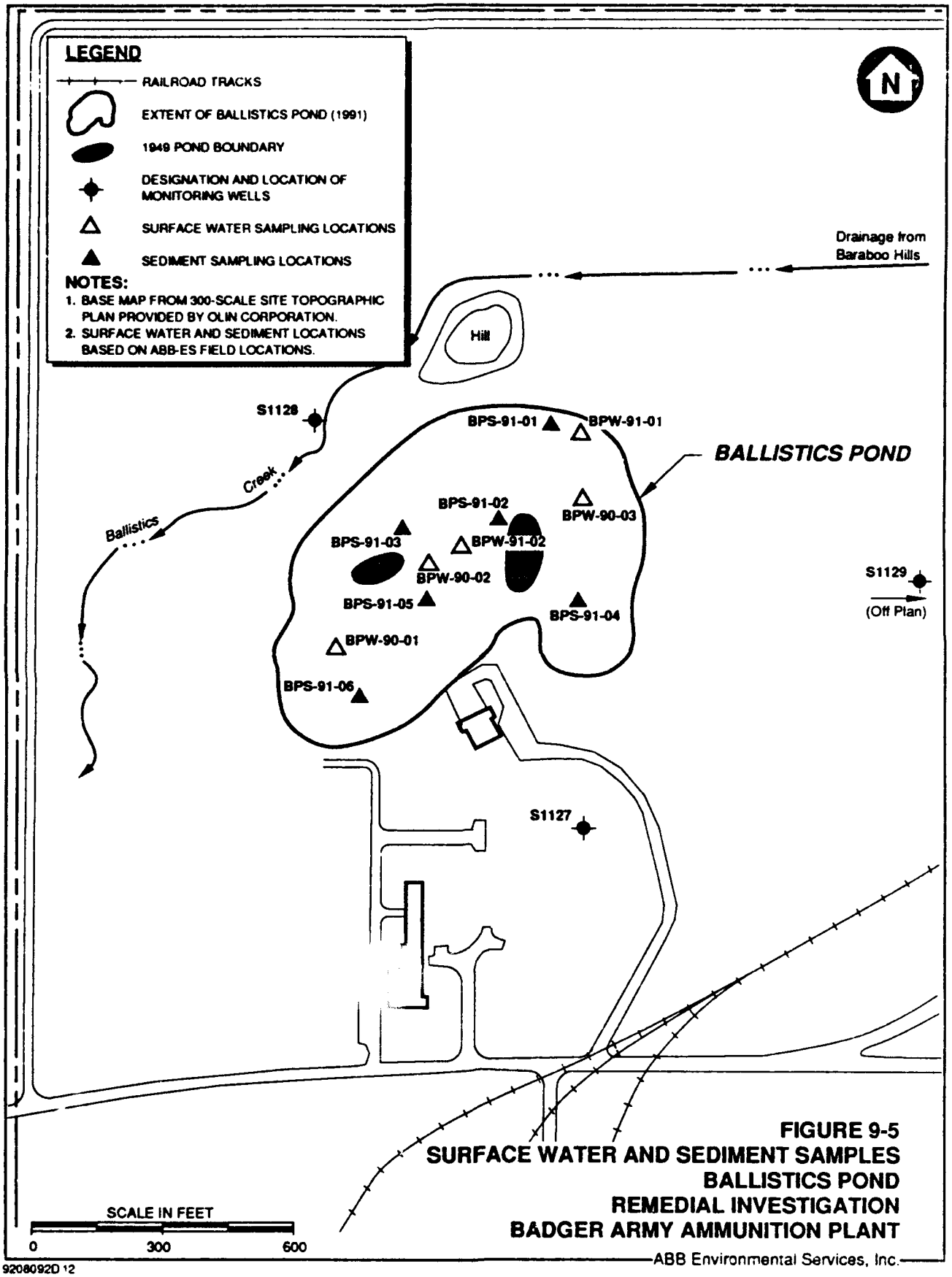

FIGURE 9-5
SURFACE WATER AND SEDIMENT SAMPLES
BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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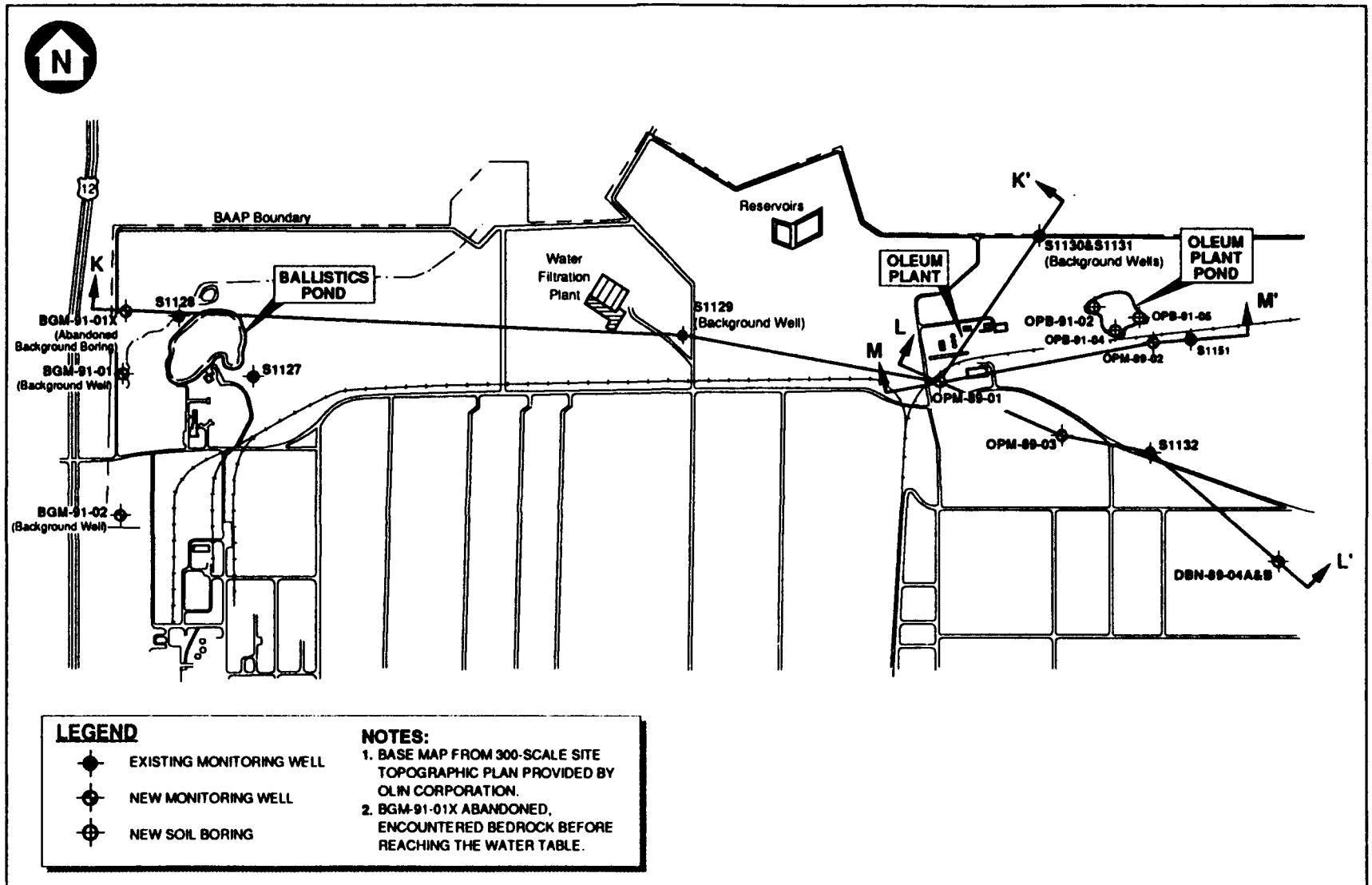

FIGURE 9-6
ORIENTATION OF GEOLOGIC CROSS SECTIONS
OLEUM PLANT, OLEUM PLANT POND AND BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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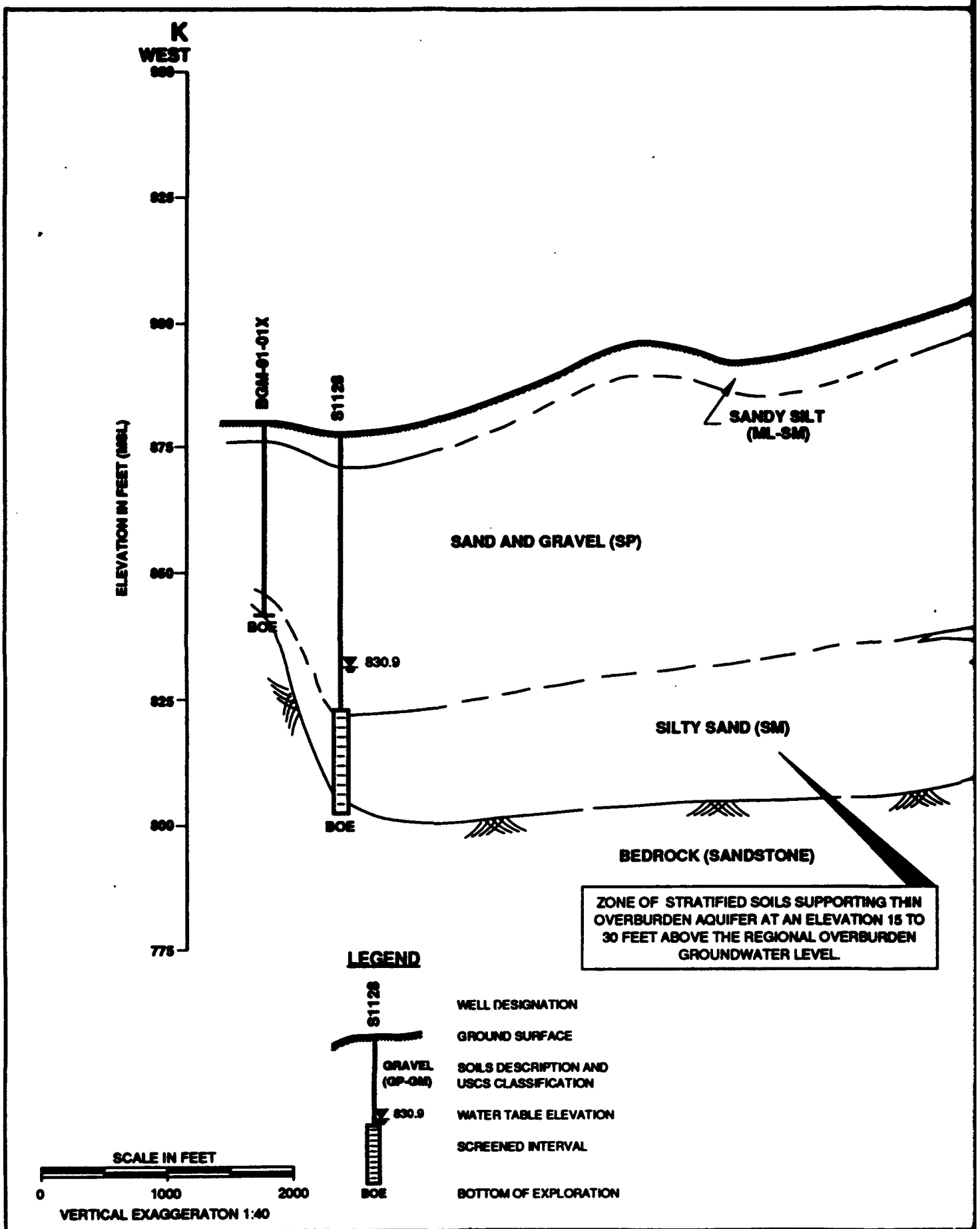
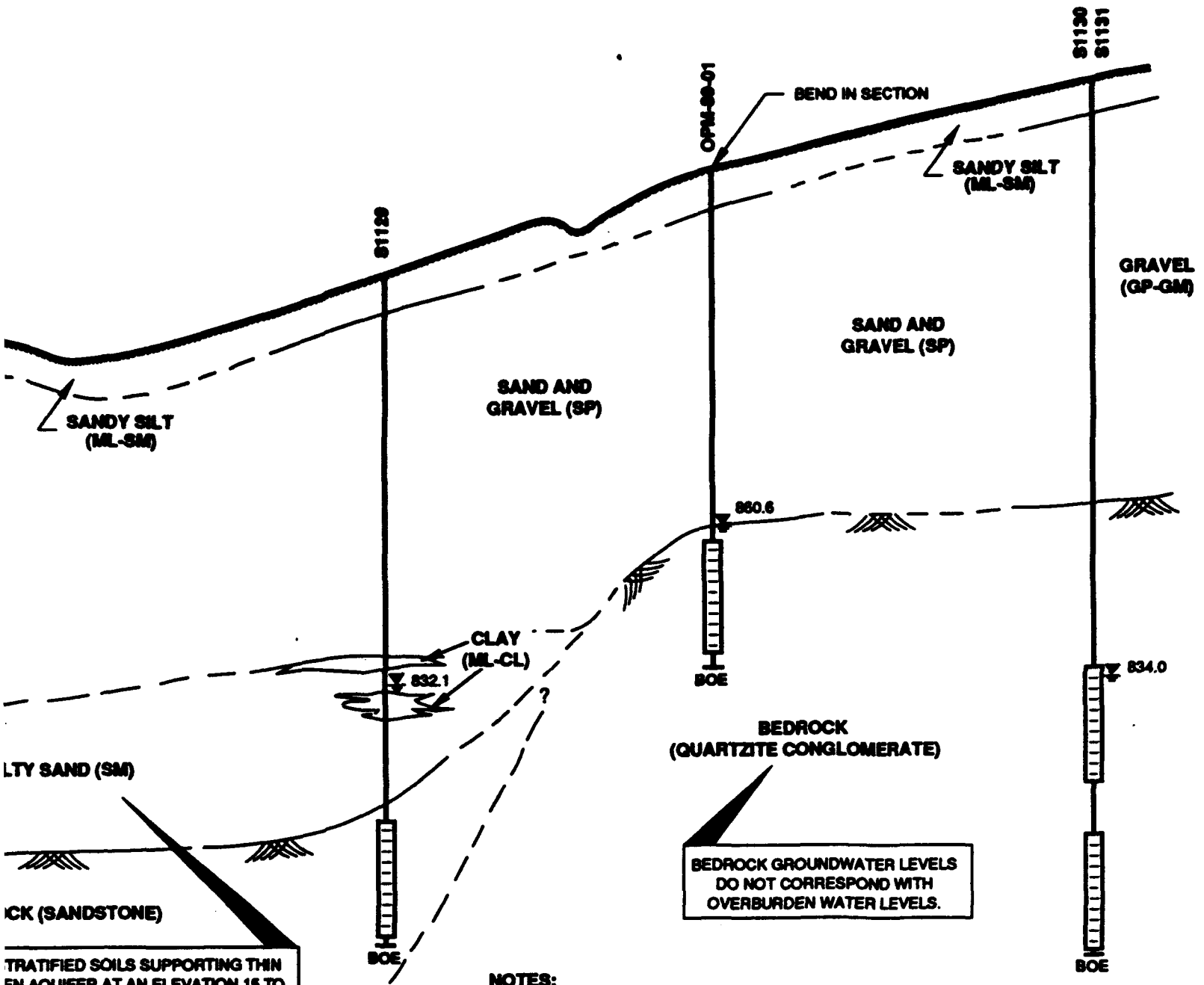

K
WEST
ELEVATION IN FEET (MSL)
925
900
875
850
825
800
775
BGM-91-01X
S1128
BOE
830.9
BOE
SANDY SILT
(ML-SM)
SAND AND GRAVEL (SP)
SILTY SAND (SM)
BEDROCK (SANDSTONE)
ZONE OF STRATIFIED SOILS SUPPORTING THIN OVERBURDEN AQUIFER AT AN ELEVATION 15 TO 30 FEET ABOVE THE REGIONAL OVERBURDEN GROUNDWATER LEVEL
LEGEND
S1128
WELL DESIGNATION
GROUND SURFACE
GRAVEL
(GP-GM)
SOILS DESCRIPTION AND
USCS CLASSIFICATION
830.9
WATER TABLE ELEVATION
SCREENED INTERVAL
BOE
BOTTOM OF EXPLORATION
SCALE IN FEET
0
1000
2000
VERTICAL EXAGGERATON 1:40

2

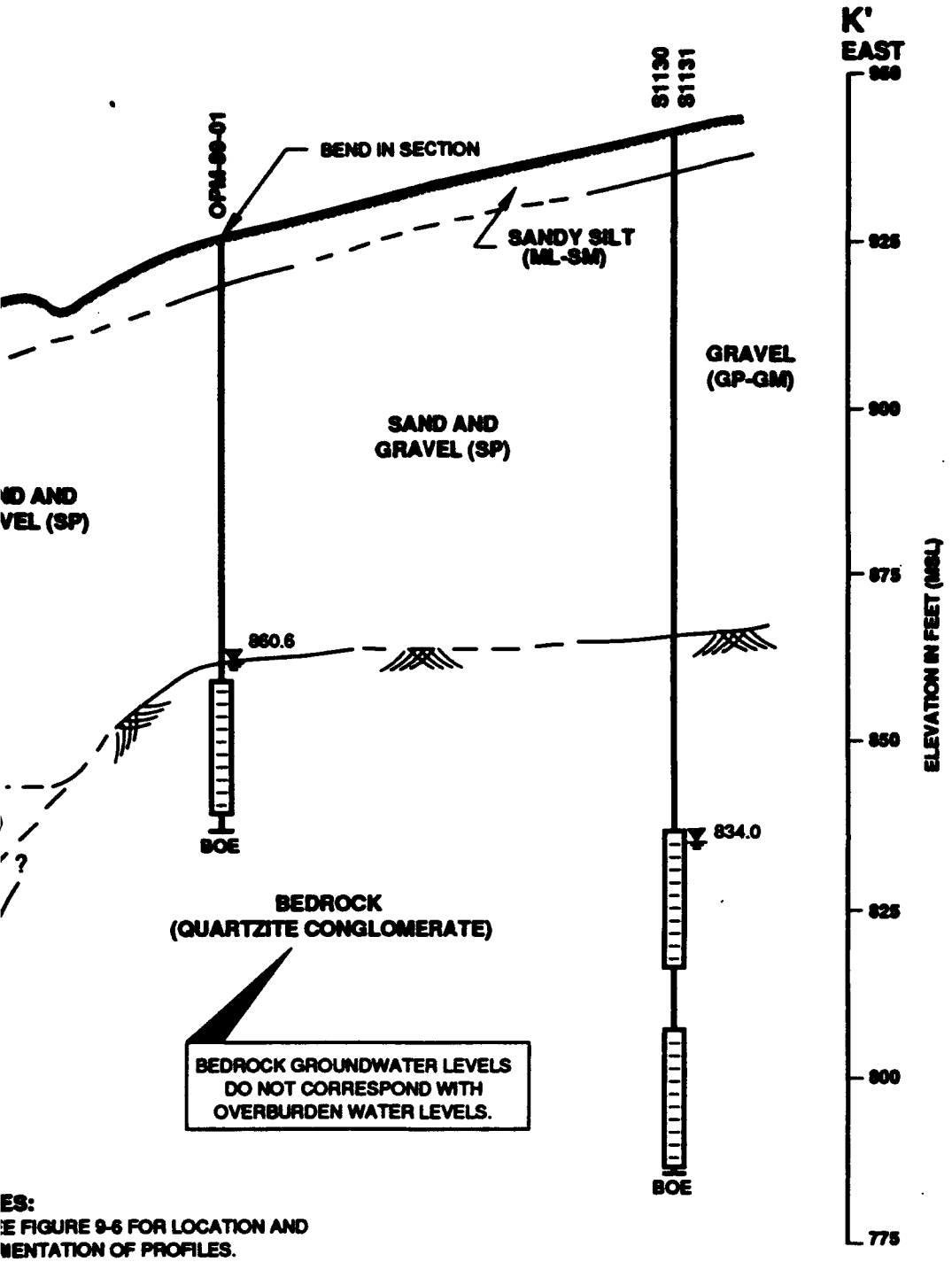


NOTES:

1. SEE FIGURE 9-6 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91.

GEOLOGIC CROSS S
OLEUM PLANT, OLEUM PLANT POND AND BALLI
REMEDIAL INV
BADGER ARMY AMMUNI

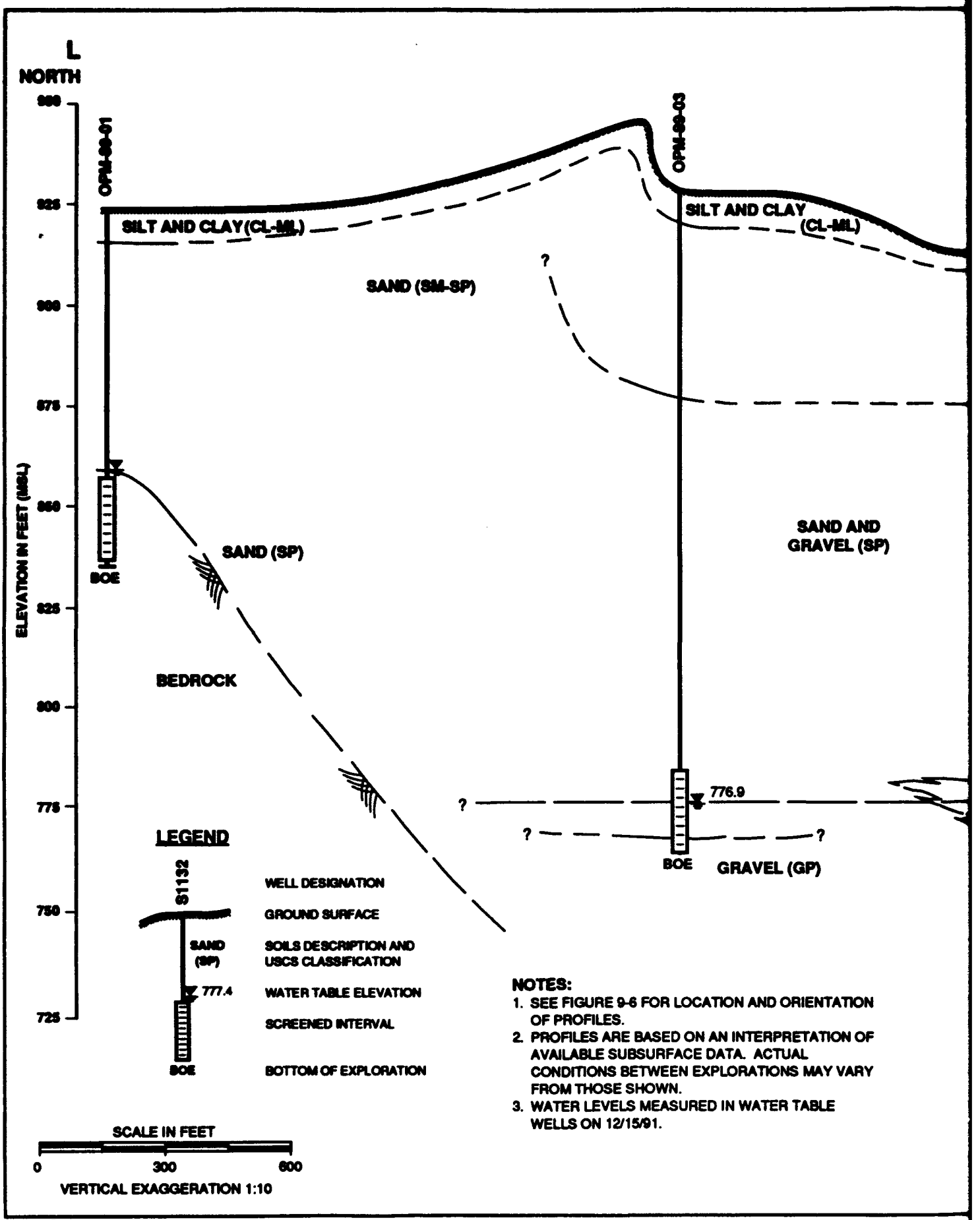
ABB Environment



ES:
E FIGURE 9-6 FOR LOCATION AND
IENTATION OF PROFILES.
IOFILES ARE BASED ON AN INTERPRETATION
AVAILABLE SUBSURFACE DATA. ACTUAL
NDITIONS BETWEEN EXPLORATIONS MAY
RY FROM THOSE SHOWN.
ATER LEVELS MEASURED IN WATER TABLE
ELLS ON 12/15/91.

FIGURE 9-7
GEOLOGIC CROSS SECTION K-K'
OLEUM PLANT, OLEUM PLANT POND AND BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



NOTES:

1. SEE FIGURE 9-6 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91.

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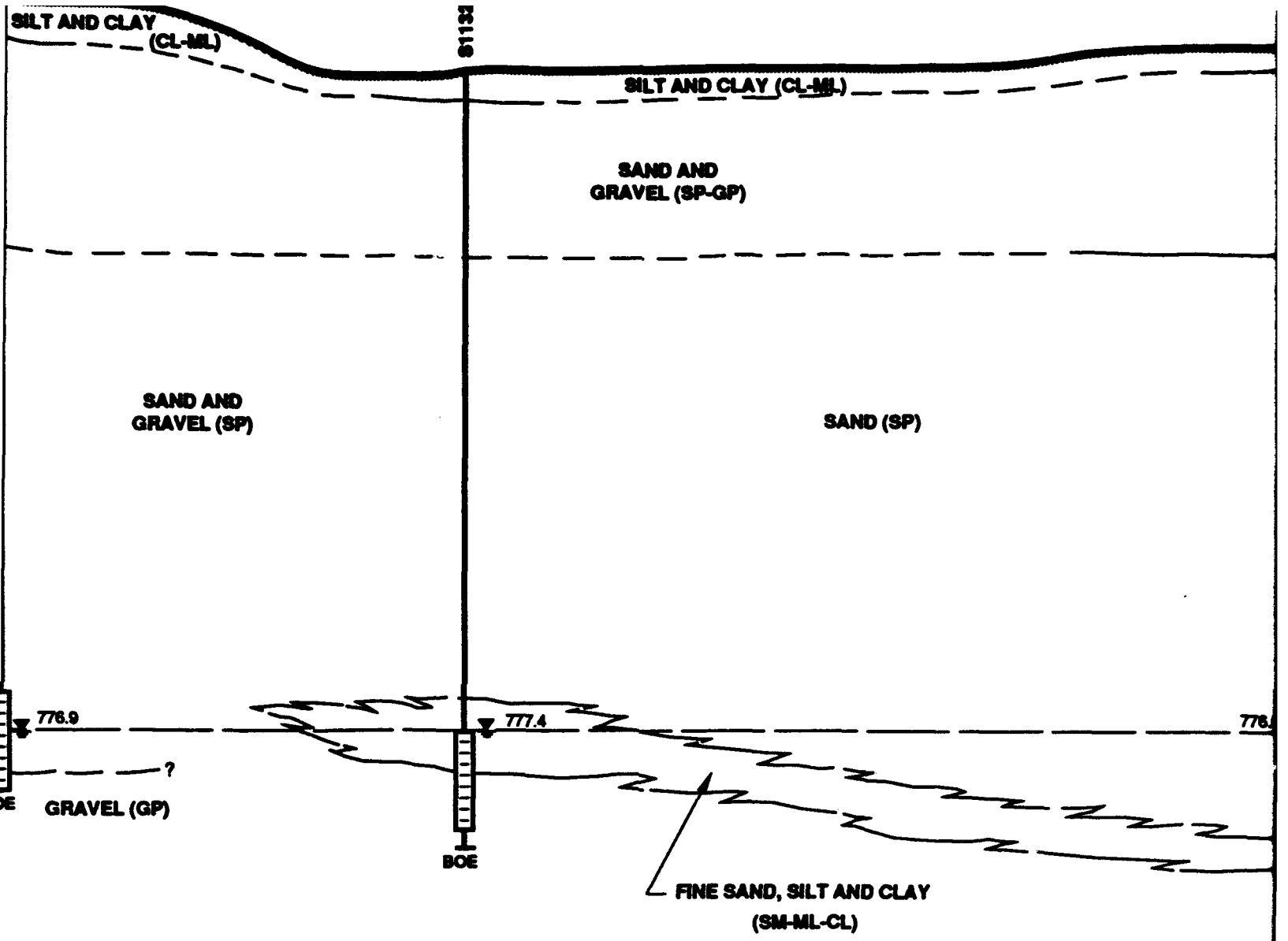


LOCATION AND ORIENTATION

ON AN INTERPRETATION OF
ACE DATA. ACTUAL
N EXPLORATIONS MAY VARY

URED IN WATER TABLE

GEOLOGIC CROSS S
OLEUM PLANT, OLEUM PLANT POND AND BALLI
REMEDIAL INV
BADGER ARMY AMMUNI

ABB Environment

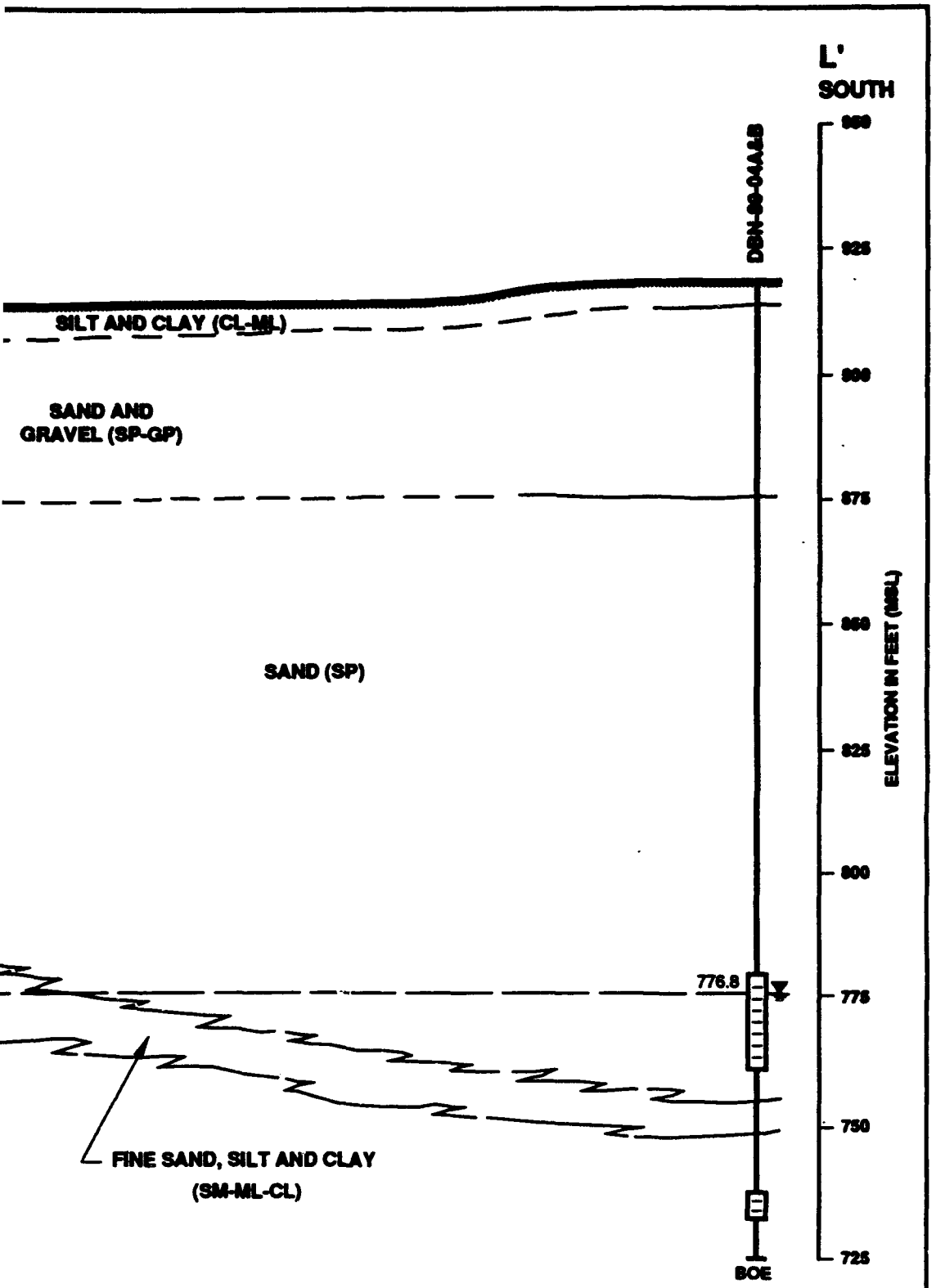
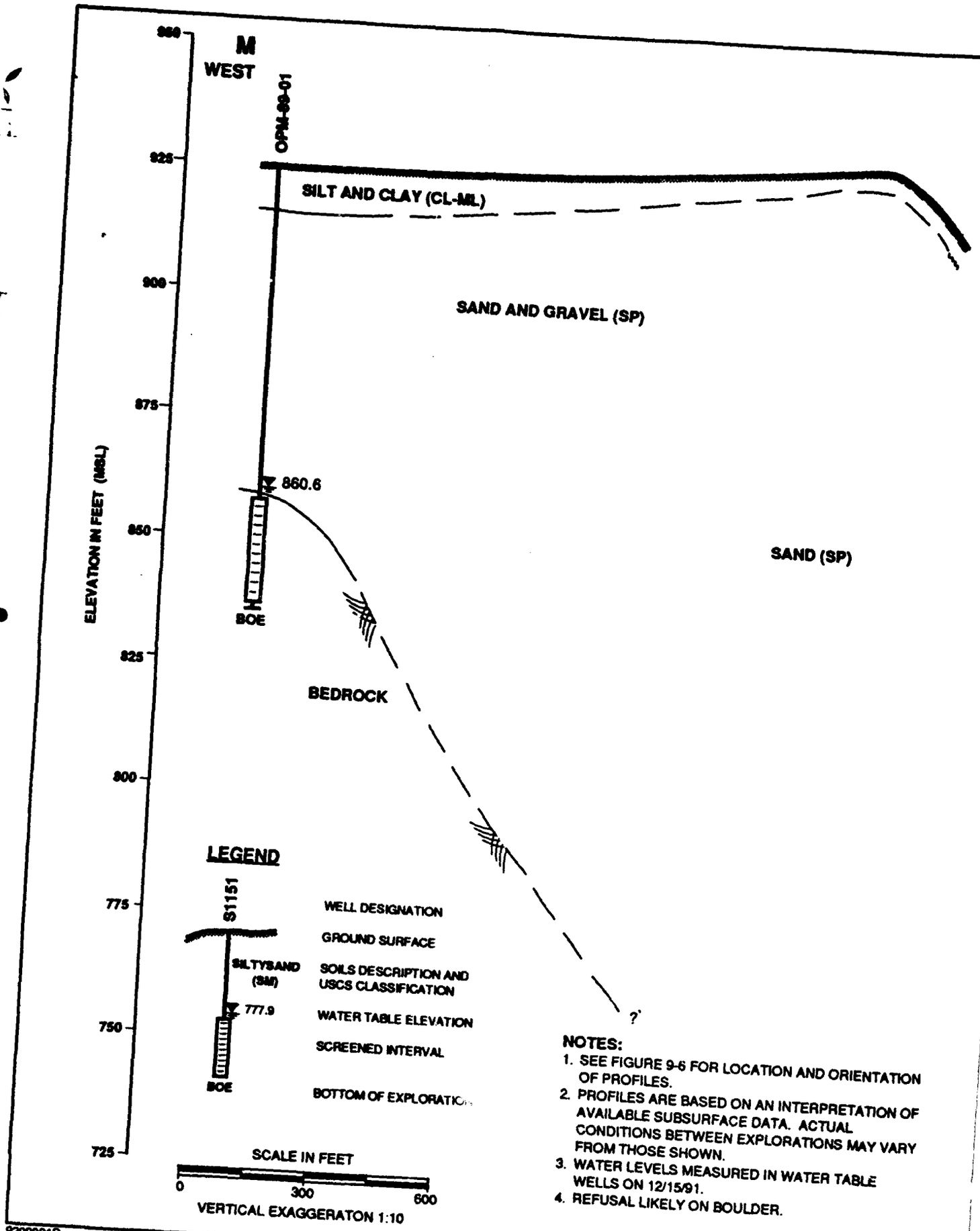


FIGURE 9-8
GEOLOGIC CROSS SECTION L-L'
OLEUM PLANT, OLEUM PLANT POND AND BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT
ABB Environmental Services, Inc.



NOTES:

1. SEE FIGURE 9-6 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91.
4. REFUSAL LIKELY ON BOULDER.

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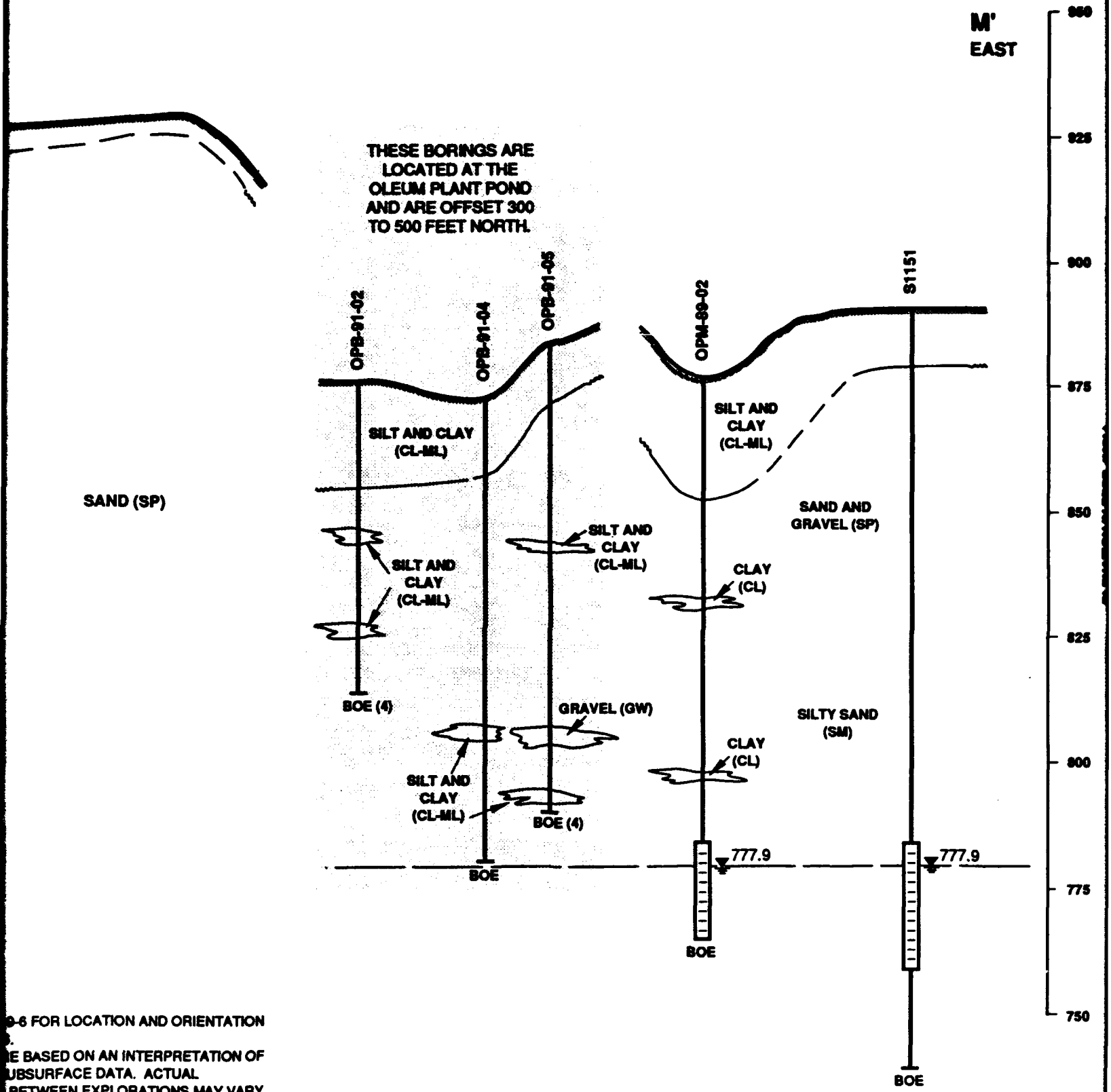


9-6 FOR LOCATION AND ORIENTATION
.
E BASED ON AN INTERPRETATION OF
UBSURFACE DATA. ACTUAL
BETWEEN EXPLORATIONS MAY VARY
E SHOWN.
LS MEASURED IN WATER TABLE
/15/91.
ELY ON BOULDER.

GEOLOGIC CROSS SE
OLEUM PLANT, OLEUM PLANT POND AND BALLIS
REMEDIAL INVE
BADGER ARMY AMMUNIT

ABB Environment

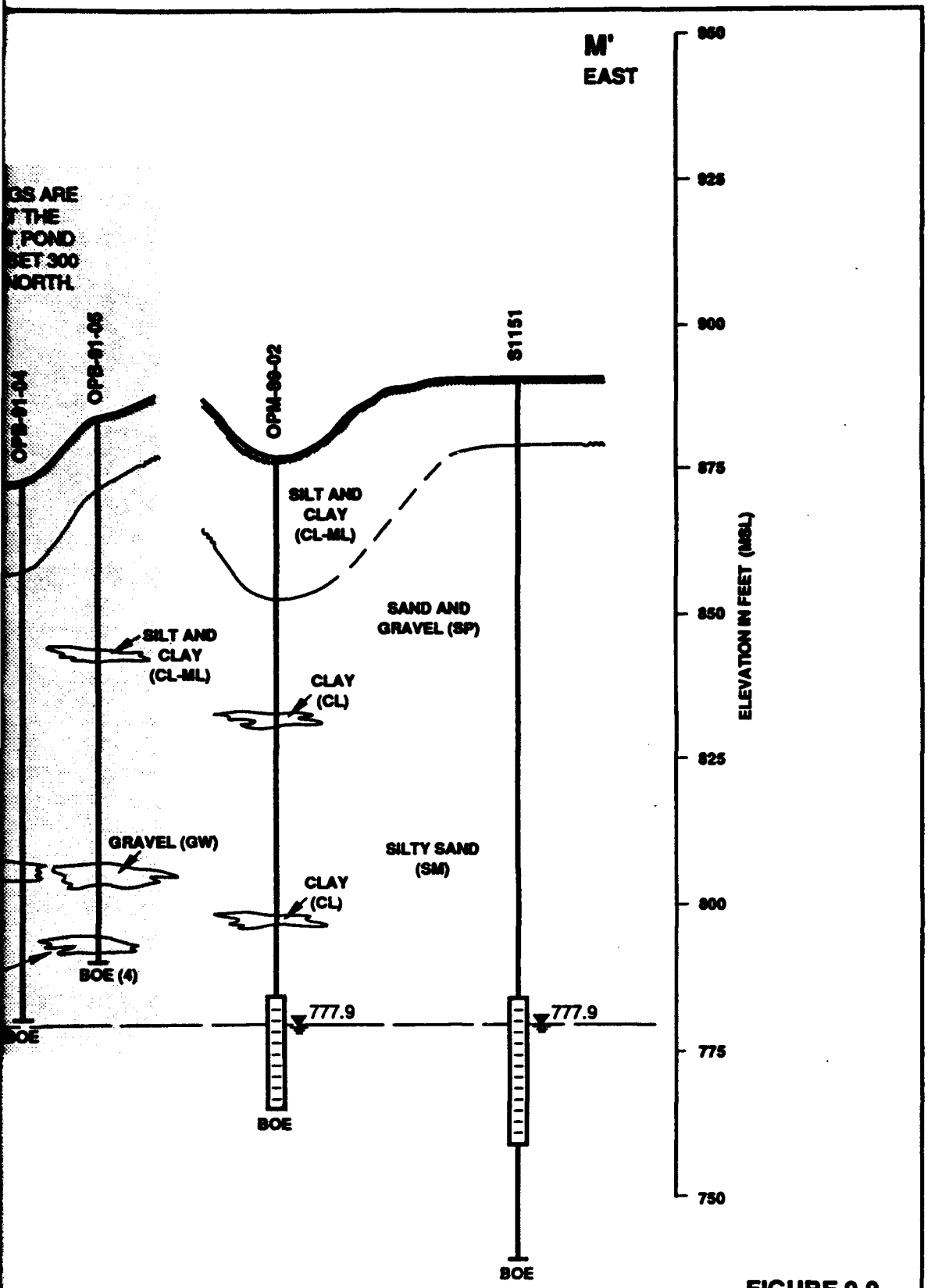
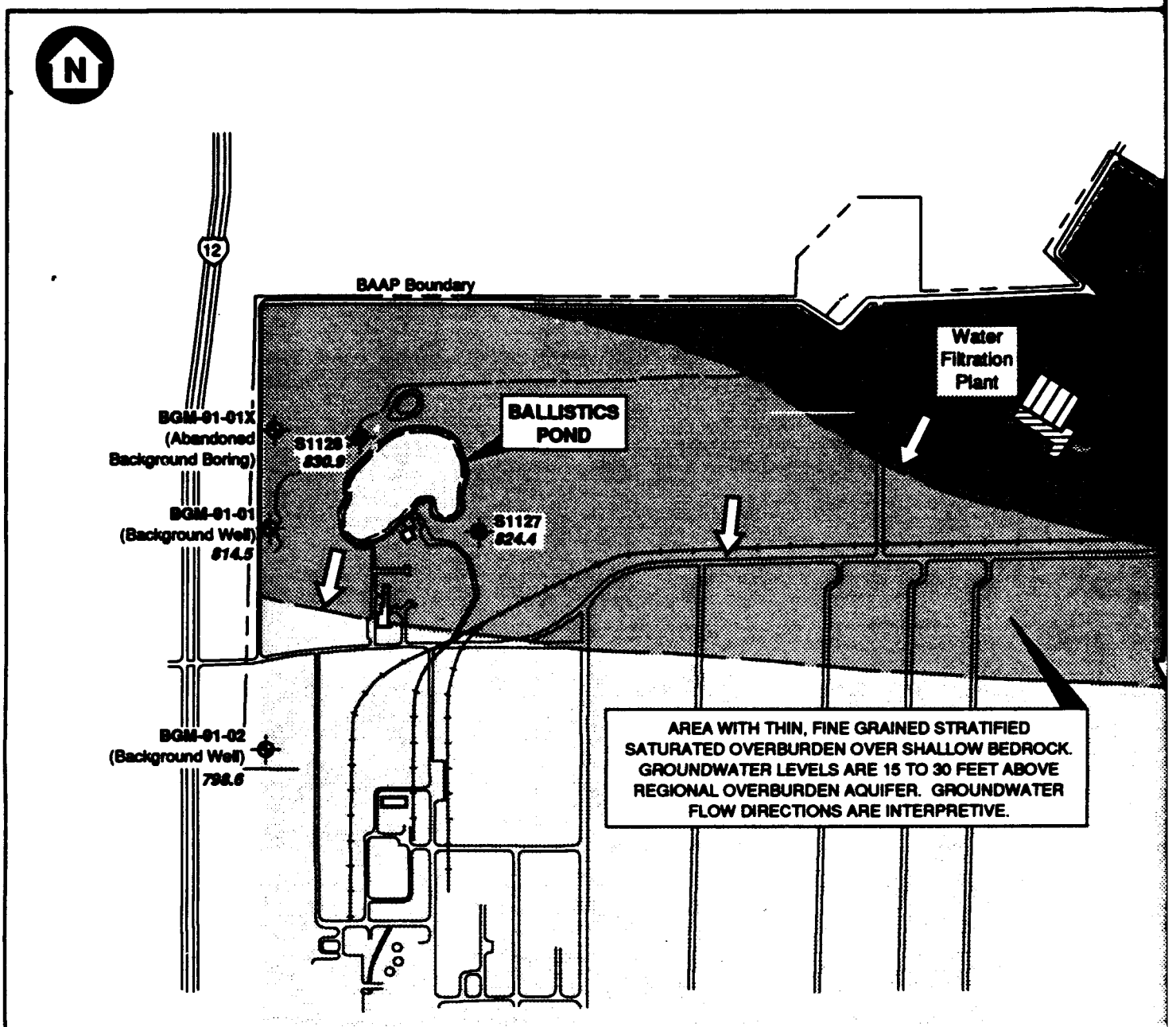


FIGURE 9-9
GEOLOGIC CROSS SECTION M-M'
OLEUM PLANT, OLEUM PLANT POND AND BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



LEGEND

- EXISTING MONITORING WELL
- NEW MONITORING WELL
- 798.6 WATER TABLE ELEVATION
- INTERPRETIVE GROUNDWATER FLOW DIRECTION

NOTES:

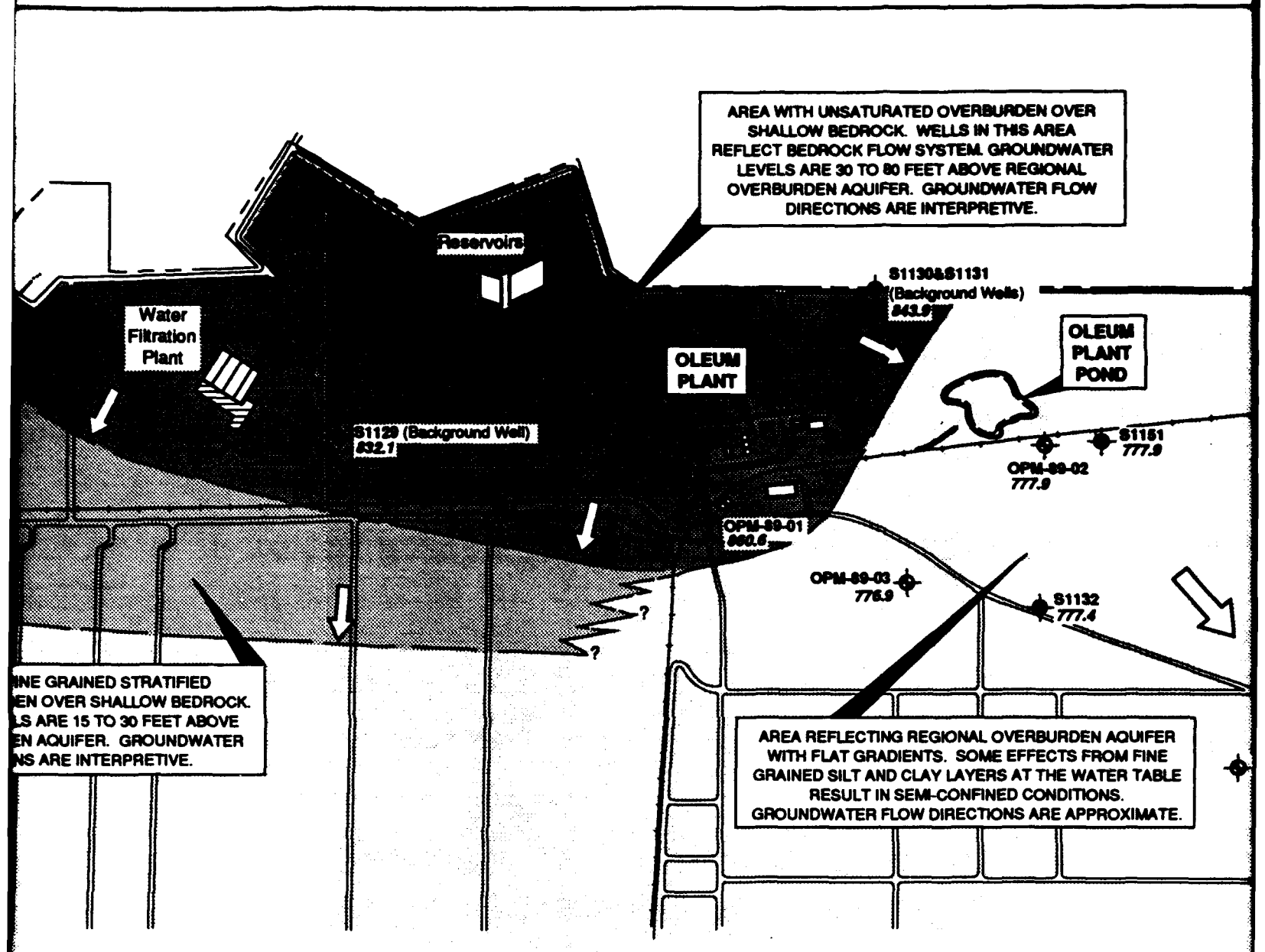
1. BASE MAP FROM 300-SCALE SITE TOPOGRAPHIC PLAN PROVIDED BY OLIN CORPORATION.
2. WATER LEVELS MEASURED IN WATER TABLE WELL ON 12/15/91.
3. BGM-91-01X ABANDONED, ENCOUNTERED BEDROCK BEFORE REACHING THE WATER TABLE.

SCALE IN FEET

0 1000 2000

9209021D a ef

2



M 300-SCALE SITE
PLAN PROVIDED
RATION.
MEASURED IN
VELL ON 12/15/91.
NDONED,
BEDROCK BEFORE
WATER TABLE.

FIG
INTERPRETIVE GROUNDWATER FLOW DIR
OLEUM PLANT, OLEUM PLANT POND AND BALLIST
REMEDIAL INVES
BADGER ARMY AMMUNITIO

ABB Environmental

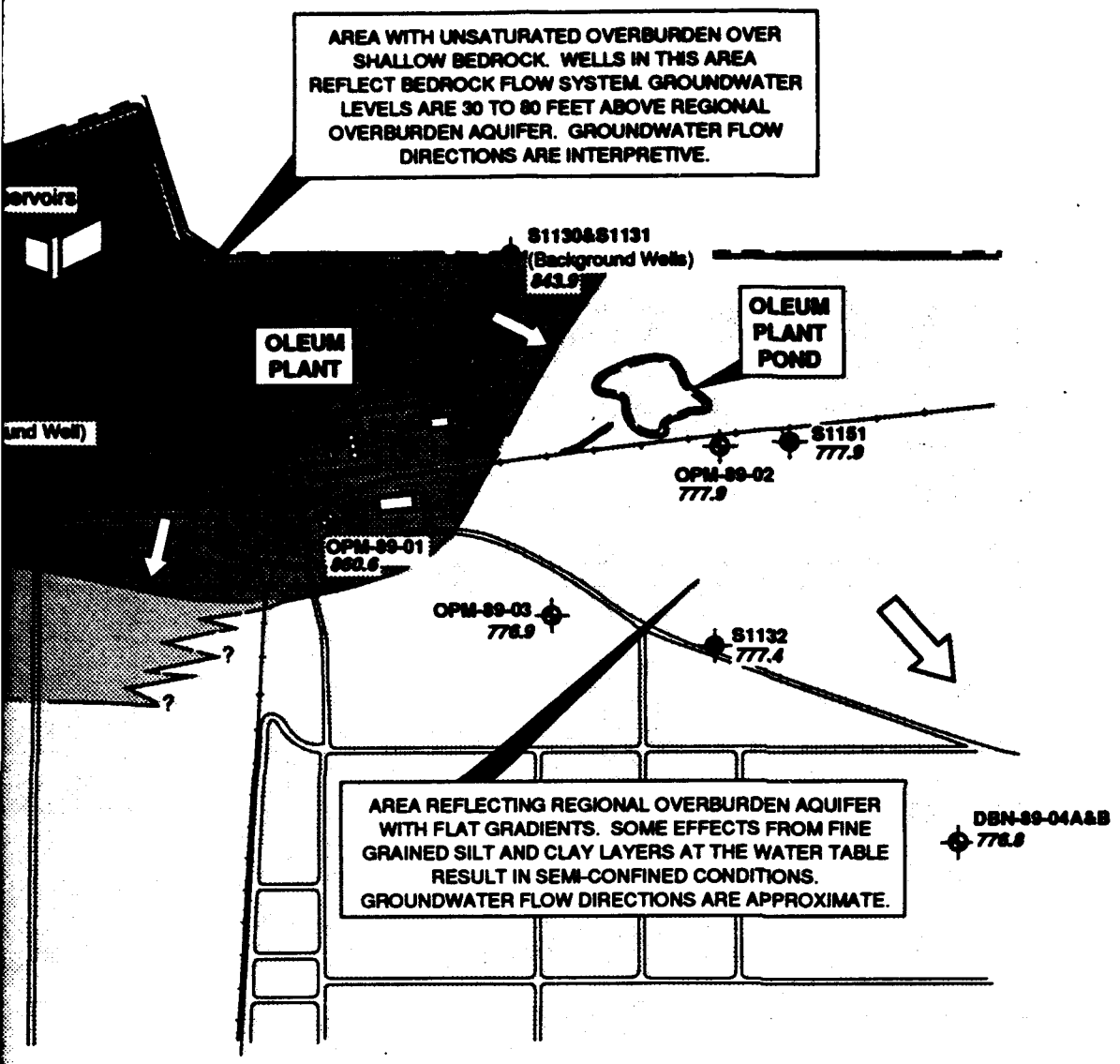
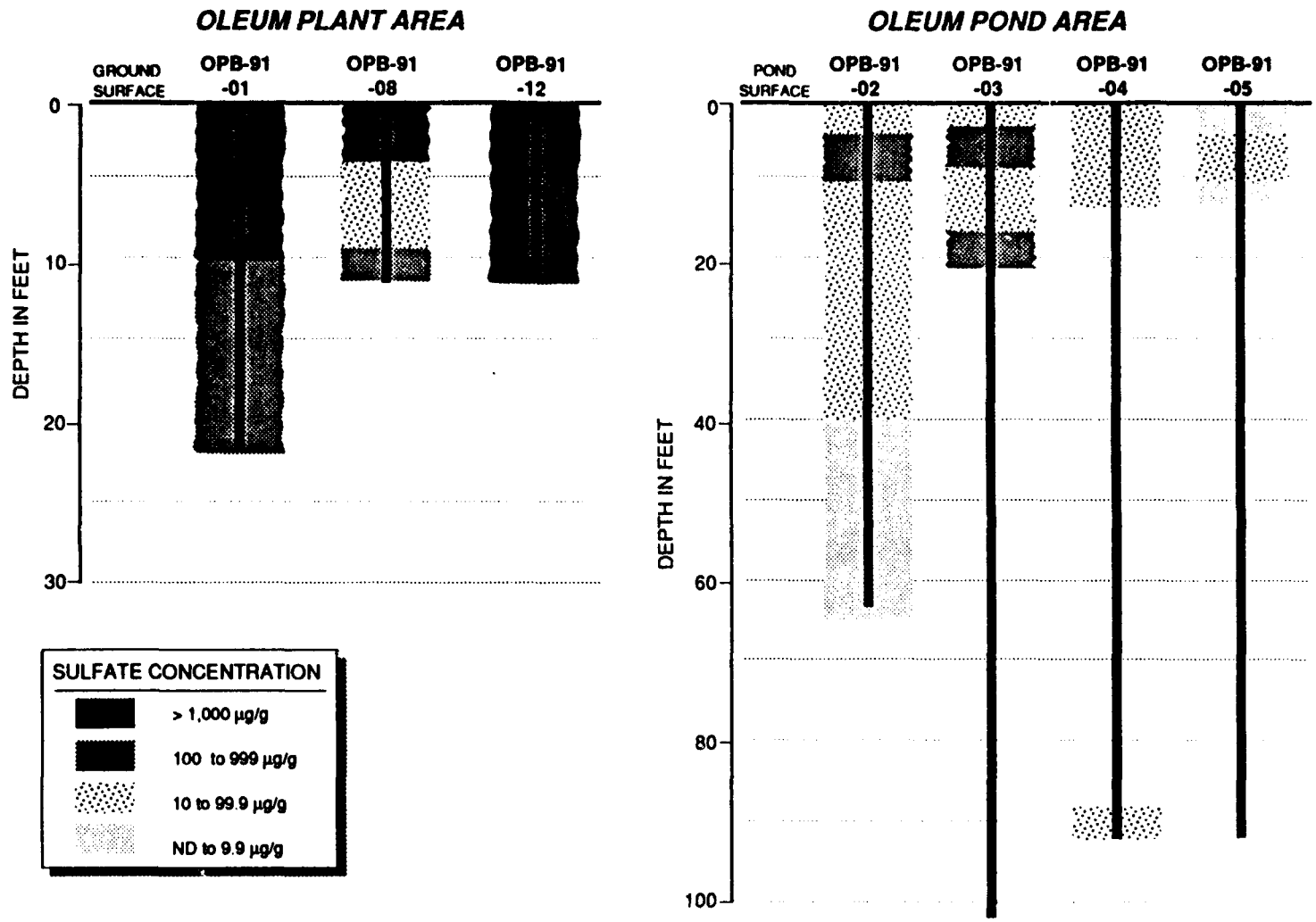


FIGURE 9-10
INTERPRETIVE GROUNDWATER FLOW DIRECTIONS
OLEUM PLANT, OLEUM PLANT POND AND BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



NOTE:
1. SEE TABLE 9-11 AND APPENDIX K FOR CHEMICAL DATA SUMMARY.

FIGURE 9-11
SO4 DISTRIBUTION IN SUBSURFACE SOILS
OLEUM PLANT, OLEUM PLANT POND AND BALLISTICS POND
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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TABLE 10-1
HISTORY OF ACID AND FUEL OIL SPILLS -
OLD ACID AREA/OLD FUEL OIL TANK AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SPILL DATE	CAUSE	MATERIAL	AMOUNT	CONTROL
1970-72	Tank leakage	Acid	25 tons	Unknown
10/82	Tank leakage	Sulfuric acid	6.5 tons	Diked, neutralized
5/91	Pipeline Rupture	No. 2 Fuel Oil	5,000 gallons	Groundwater, pumping
?	Tank leakage/ Overflow	Fuel Oil	unknown	None

Source: Tsai et al., 1988.

TABLE 10-2
SUMMARY OF THE REMEDIAL INVESTIGATION FIELD PROGRAM -
OLD ACID AREA/OLD FUEL OIL TANK AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITES	PROGRAM ELEMENTS			
	SOIL VAPOR SURVEY	REMOTE SENSING GEOPHYSICS	MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING*	SOIL BORINGS AND SOIL SAMPLING
Old Acid Area	--	--	3 new wells; 8 samples from 3 new and 1 existing wells	3 deep borings, 5 samples from each; 10 shallow borings, 2 samples from each
Old Fuel Oil Tank	--	--	1 new well; 2 samples from the new well	2 borings, 5 samples from each

Notes:

* Includes 2 rounds of groundwater sampling

TABLE 10-3
SUMMARY OF BORINGS COMPLETED - OLD ACID AREA/OLD FUEL OIL TANK AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

BORING NUMBER	DEPTH OF SOIL BORING FROM GROUND SURFACE (ft)	TOTAL NUMBER OF SPLIT-SPOON SAMPLES	NUMBER OF SUBSURFACE SOIL SAMPLES FOR CHEMICAL ANALYSIS	PURPOSE
Old Acid Area				
OAB-91-01	92	14	5	This deep boring was drilled directly downgradient of the nitric acid and sulfuric acid concentration facilities to determine whether residual contamination exists in the soil directly downgradient of these potential source areas.
OAB-91-02	92	13	5	This boring was drilled downgradient of the Old Acid Area storage tank to provide chemical data to characterize the type and vertical distribution of residual subsurface soil contamination.
OAB-91-03	91	13	5	This boring was drilled downgradient, adjacent to waste acid neutralization facility to characterize the vertical distribution of subsurface soil contamination near the facility.
OAB-91-04[1]	3.0	NA	2	These shallow hand-auger borings and samples were made in and around the Old Acid Plant Production Facilities to evaluate the areal extent of shallow soil contamination.
OAB-91-05[1]	2.0	NA	2	
OAB-91-06[1]	2.0	NA	2	
OAB-91-07[1]	2.0	NA	2	
OAB-91-08[1]	3.0	NA	2	
OAB-91-09[1]	2.5	NA	2	
OAB-91-10[1]	2.5	NA	2	
OAB-91-11[1]	3.0	NA	2	
OAB-91-12[1]	3.0	NA	2	
OAB-91-13[1]	2.5	NA	2	This boring and samples provide background shallow soils data for the Old Acid Area.

continued

TABLE 10-3
SUMMARY OF BORINGS COMPLETED - OLD ACID AREA/OLD FUEL OIL TANK AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

BORING NUMBER	DEPTH OF SOIL BORING FROM GROUND SURFACE (ft)	TOTAL NUMBER OF SPLIT-SPOON SAMPLES	NUMBER OF SUBSURFACE SOIL SAMPLES FOR CHEMICAL ANALYSIS	PURPOSE
Oil Fuel Oil Tank				
FTB-91-01	92.0	13	5	This boring was drilled at the location of a former fuel oil storage tank to characterize the type and vertical distribution of residual contamination.
FTB-91-02	89.0	13	5	This boring was drilled downgradient of the former fuel oil storage tank and upgradient of the most recent fuel oil spill as reported by BAAP in May 1991.

Notes:

[1] OPB-91-04 through OAB-91-13 were collected using hand bucket auger.
ft = feet
NA = not applicable

TABLE 10-4
SUMMARY OF MONITORING WELLS INSTALLED - OLD ACID AREA/OLD FUEL OIL TANK AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE AND WELL IDENTIFIER	DRILLING METHOD	BORING DEPTH FROM GROUND SURFACE (ft.)	BOTTOM ELEVATION OF SCREENS (ft. MSL)	LENGTH OF WELL SCREEN (ft.)	LOCATION	PURPOSE
Old Acid Area						
OAM-89-01	Hollow-stem augers	102	771.7	20	Downgradient of the former acid storage tanks.	To provide water quality definition downgradient of the old acid production facility and the acid storage tanks that reportedly leaked.
OAM-89-02	Hollow-stem augers	102	772.4	20	Downgradient of the former waste acid treatment facilities.	To provide water quality data at the water table approximately 600 feet downgradient of the waste acid neutralization facility.
OAM-91-01	Dual-wall driven casing	100.0	779.6	10	Downgradient of the Old Acid Plant.	To provide groundwater flow data and assess groundwater quality downgradient of the Old Acid Plant.
Old Fuel Oil Tank						
FTM-89-01	Hollow-stem augers	103	772.9	20	Downgradient of the fuel oil spill site.	To provide water quality data at the water table approximately 150 feet downgradient of the former fuel oil tank.

Notes:

ft = feet
MSL = Mean Sea Level

TABLE 10-5
WELLS INCLUDED IN GROUNDWATER SAMPLING PROGRAM -
OLD ACID AREA/OLD FUEL OIL TANK AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITES	NEW WELLS	EXISTING WELLS
Old Acid Area	OAM-89-01 OAM-89-02 OAM-91-01	S1126
Subtotal	3	1
Old Fuel Oil Tank	FTM-89-01	
Subtotal	1	0
TOTAL WELLS	4	1

TABLE 10-6
CHEMICAL ANALYSES PERFORMED ON SUBSURFACE SOIL SAMPLES -
OLD ACID AREA/ OLD FUEL OIL TANK

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS														OTHER			ORGANICS				
	METALS								TCLP METALS				ANIONS									
SAMPLE LOCATION	PP	TAL	CD	CR	HG	FE	NI	PB	CD	CR	HG	PB	NIT	SO4	TOC	pH	TPHC	VOC	BN/A	NG	NAM	DNT
OLD ACID AREA																						
OAB-91-01	—	—	5	5	—	—	5	5	—	—	—	—	5	5	—	5	—	5	—	—	—	—
OAB-91-02	—	—	5	5	—	—	5	5	—	—	—	—	5	5	—	5	—	5	—	—	—	—
OAB-91-03	—	—	5	5	—	—	5	5	—	—	—	—	5	5	—	5	—	5	—	—	—	—
OAB-91-04	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—
OAB-91-05	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—
OAB-91-06	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—
OAB-91-07	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—
OAB-91-08	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—
OAB-91-09	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—
OAB-91-10	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—
OAB-91-11	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—
OAB-91-12	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—
OAB-91-13	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	—	—	—	—
OLD FUEL OIL TANK																						
FTB-91-01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	5	5	—	—	—
FTB-91-02	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	5	5	—	—	—
TOTALS	0	0	15	15	0	0	15	15	0	0	0	0	35	35	0	15	10	25	10	0	0	0

NOTES:

PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, PB, HG, NI, SB, SE, TL, ZN)
TAL = Toxic Analyte List (23) (AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)
VOC = volatile organic compounds by GC/MS
GC/MS = Gas Chromatography/Mass Spectrometry
BN/A = base-neutral and acid-extractable organics by GC/MS
NAM = nitrosamines by GC
DNT = 2,4- and 2,6-dinitrotoluene by HPLC
HPLC = High Performance Liquid Chromatrography

USA012.wk1

TABLE 10-7
CHEMICAL ANALYSES PERFORMED ON GROUNDWATER SAMPLES -
OLD ACID AREA/OLD FUEL OIL TANK AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS																	ORGANICS					TPH
	METALS									ANIONS			OTHER										
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	NI	NIT	CL	SO4	HARD	ALK	TDS	TOC	NH3N2	VOC	BN/A	NG	NAM	DNT	
OLD ACID AREA																							
OAM-89-01	—	—	1	1	1	1	—	B	1	B	B	B	B	B	B	—	—	B	—	—	—	—	—
OAM-89-02	—	—	1	1	1	1	—	B	1	B	B	B	B	B	B	—	—	B	—	—	—	—	—
S1126	—	—	1	1	1	1	—	B	1	B	B	B	B	B	B	—	—	B	—	—	—	—	—
OAM-91-01	—	—	1	1	1	1	—	B	1	B	B	B	B	B	B	—	—	B	—	—	—	—	—
OLD FUEL OIL TANK																							
FTM-89-01	—	—	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	B

NOTES:

PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, PB, HG, NI, SB, SE, TL, ZN)
TAL = Toxic Analyte List (23) (AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)
VOC = volatile organic compounds by GC/MS
GC/MS = Gas Chromatography/Mass Spectrometry
BN/A = base-neutral and acid-extractable organics by GC/MS
NAM = nitrosamines by GC
DNT = 2,4- and 2,6-dinitrotoluene by HPLC
HPLC = High Performance Liquid Chromatrography
B = Analyzed in Both Rounds (One and Two).
1 = Analyzed in Round One Only.

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TABLE 10-8
FIELD HYDRAULIC CONDUCTIVITY TEST RESULTS -
OLD ACID AREA/OLD FUEL OIL TANK AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL DESIGNATION	MAXIMUM WATER LEVEL DEPRESSION (FEET)	HYDRAULIC CONDUCTIVITY (cm/sec)	GEOLOGIC CONDITIONS
OAM-89-01	3.1	$2x10^{-2}$	Medium to fine sand (SP)
FTM-89-01	3.6	$3x10^{-2}$	Medium to fine sand (SP)

Notes:

Hydraulic Conductivity Tests completed during March and November, 1989, and November and December 1991.

Field data and calculations are presented in Appendix I.

Values for hydraulic conductivities represent an averaged value of multiple tests performed on each well.

Water level recovery at these wells impacted by inertial effects, resulting in water level recovery above static water levels. Hydraulic conductivity measurements may be greater than the calculated values at these wells.

cm/sec = centimeters per second

TABLE 10-9
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA -
OLD ACID AREA/ OLD FUEL OIL TANK AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		FTB-91-01	FTB-91-01	FTB-91-01	FTB-91-01	FTB-91-01	FTB-91-02	FTB-91-02	FTB-91-02	FTB-91-02	FTB-91-02
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/22/91	10/22/91	10/22/91	10/22/91	10/22/91	10/22/91	10/22/91	10/22/91	10/22/91	10/22/91
DEPTH:		2.000	7.000	12.000	17.000	92.000	2.000	6.000	11.000	21.000	89.000
VOCs	ACET	-	-	-	-	-	-	-	-	-	-
	CH2CL2	-	-	-	-	-	-	-	-	-	-
	MEK	-	-	-	-	-	-	-	-	-	-
SVOCs	2MNAP	-	1.070	-	-	-	-	-	-	-	-
	ANAPNE	-	0.077	-	-	-	-	-	-	-	-
	B2EHP	-	-	-	-	-	-	1.230	1.800	-	-
	BAANTR	-	0.080	0.118	-	-	0.122	-	-	-	1.380
	BGHIPY	-	0.396	-	-	-	-	-	-	-	-
	CHRY	-	0.076	0.113	-	-	-	-	-	-	-
	DNBP	-	-	2.100	-	-	-	-	-	-	-
	FANT	-	0.037	-	-	-	-	-	-	-	-
	FLRENE	-	0.160	-	-	-	-	-	-	-	-
	PHANTR	-	0.194	0.088	-	-	-	-	-	-	-
Metals	CR										
	NI										
	PB										
Anions	NIT										
	SO4										
Indicator parameter	pH(1)										
	TPHC	430.000	1180.000	-	21.800	-	-	-	-	-	-

Notes and flagging codes are presented at the end of this table.

TABLE 10-9
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA -
OLD ACID AREA/ OLD FUEL OIL TANK
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		OAB-91-01	OAB-91-01	OAB-91-01	OAB-91-01	OAB-91-01	OAB-91-02	OAB-91-02	OAB-91-02	OAB-91-02	OAB-91-02
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/09/91	10/09/91	10/09/91	10/09/91	10/09/91	10/09/91	10/09/91	10/09/91	10/09/91	10/09/91
DEPTH:		2.000	6.000	11.000	21.000	91.000	2.000	7.000	12.000	22.000	92.000
VOCs	ACET	-	-	0.004 S	0.002 S	0.004 S	-	0.008 S	-	-	-
	CH2CL2	-	-	-	-	-	-	-	-	-	-
	MEK	0.006 S	0.008 S	0.007 S	0.006 S	0.007 S	0.006 S	0.008 S	0.006 S	0.002 S	-
SVOCs	2MNAP										
	ANAPNE										
	B2EHP										
	BAANTR										
	BGHIPY										
	CHRY										
	DNBP										
	FANT										
	FLRENE										
	PHANTR										
Metals	CR	14.400	17.600	3.880	3.810	3.820	16.400	13.500	2.400	1.280	6.880
	NI	56.900	17.300	4.810	3.190	-	20.100	11.600	8.360	4.600	3.110
	PB	1500.000	64.000	3.240	4.630	0.726	4.870	240.000	3.030	2.880	15.000
Anions	NIT	1.380	8.280	2.780	1.930	1.240	-	2.610	1.520	1.720	2.300
	SO4	3900.000	240.000	53.200	32.100	-	31.300	2500.000	350.000	56.800	27.400
Indicator parameter	pH(1)	7.880	9.280	9.020	9.140	10.400	9.060	8.440	8.440	8.930	11.100
	TPHC										

Notes and flagging codes are presented at the end of this table.

TABLE 10-9
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA -
OLD ACID AREA/ OLD FUEL OIL TANK
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		OAB-91-03	OAB-91-03	OAB-91-03	OAB-91-03	OAB-91-03	OAB-91-04	OAB-91-04	OAB-91-05	OAB-91-05	OAB-91-06
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/16/91	10/16/91	10/16/91	10/16/91	10/16/91	10/03/91	10/03/91	10/03/91	10/03/91	10/03/91
DEPTH:		2.000	6.000	11.000	21.000	91.000	0.000	2.000	0.000	2.000	0.000
VOCs	ACET	-	-	-	-	-					
	CH2CL2	-	0.002 S	-	-	-					
	MEK	-	-	-	-	0.003 S					
SVOCs	2MNAP										
	ANAPNE										
	B2EHP										
	BAANTR										
	BGHIPY										
	CHRY										
	DNBP										
	FANT										
	FLRENE										
	PHANTR										
Metals	CR	20.500	10.400	13.300	4.580	2.170					
	NI	17.300	7.840	14.800	2.910	-					
	PB	11.000	3.920	8.600	2.700	0.845					
Anions	NIT	1.740	2.210	1.980	2.220	3.040	1.450	1.180	1.470	1.450	-
	SO4	130.000	36.000	44.800	-	-	20000.000	2300.000	18000.000	16000.000	56 800
Indicator parameter	pH(1)	8.470	5.940	6.550	8.950	9.610					
	TPHC										

Notes and flagging codes are presented at the end of this table.

TABLE 10-9
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
OLD ACID AREA/ OLD FUEL OIL TANK
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		OAB-91-06	OAB-91-07	OAB-91-07	OAB-91-08	OAB-91-08	OAB-91-09	OAB-91-09	OAB-91-10	OAB-91-10	OAB-91-11
Sample Type:		BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/03/91	10/03/91	10/03/91	10/03/91	10/03/91	10/03/91	10/03/91	10/03/91	10/03/91	10/03/91
DEPTH:		1.500	0.000	1.500	1.000	2.000	0.000	2.000	0.000	2.000	0.000
VOCs	ACET										
	CH2CL2										
	MEK										
SVOCs	2MNAP										
	ANAPNE										
	B2EHP										
	BAANTR										
	BGHIPY										
	CHRY										
	DNBP										
	FANT										
	FLRENE										
	PHANTR										
Metals	CR										
	NI										
	PB										
Anions	NIT	-	1.090	1.110	-	-	-	1.160	-	1.790	-
	SO4	8200.000	5.780	16.000	170.000	36.200	-	-	-	-	-
Indicator parameter	pH(1)										
	TPHC										

Notes and flagging codes are presented at the end of this table.

TABLE 10-9
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
OLD ACID AREA/ OLD FUEL OIL TANK
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		OAB-91-11	OAB-91-12	OAB-91-12	OAB-91-13	OAB-91-13
Sample Type:		BORE	BORE	BORE	BORE	BORE
UNITS:		UGG	UGG	UGG	UGG	UGG
DATE SAMPLED:		10/03/91	10/03/91	10/03/91	10/03/91	10/03/91
DEPTH:		2.000	0.000	2.000	0.000	2.000
VOCs	ACET					
	CH2CL2					
	MEK					
SVOCs	2MNAP					
	ANAPNE					
	B2EHP					
	BAANTR					
	BGHIPY					
	CHRY					
	DNBP					
	FANT					
	FLRENE					
	PHANTR					
Metals	CR					
	NI					
	PB					
Anions	NIT	-	1.480	1.690	5.610	-
	SO4	6.100	-	12.400	-	16.600
Indicator parameter	PH(1)					
	TPHC					

Notes and flagging codes are presented at the end of this table.

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TABLE 10-9
SUMMARY OF SUBSURFACE SOIL CHEMICAL DATA-
OLD ACID AREA/ OLD FUEL OIL TANK
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

Appendix K contains complete analytical results

USATHAMA chemical codes are defined in the RI Report Glossary

TABLE 10-10
SUMMARY OF GROUNDWATER CHEMICAL DATA-
OLD ACID AREA/ OLD FUEL OIL TANK AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		OAM-89-01			OAM-89-02			OAM-91-01		FTM-89-01			S1126	
Sample Type:		WELL			WELL			WELL		WELL			WELL	
UNITS:		UGL			UGL			UGL		UGL			UGL	
DATE SAMPLED:		12/11/91		04/14/92	12/11/91		04/15/92	12/11/91	04/14/92	12/11/91		04/21/92	12/11/91	04/15/92
ROUND:		ONE		TWO	ONE		TWO	ONE	TWO	ONE		TWO	ONE	TWO
VOCs	ACET	7.6	S	-	-		-	-	-				-	-
	CH2CL2	4.31	P	4.22 P	4.41	P	2.750 P	4.410 P	4.220 P	4.61	P	3.92 P	4.9 P	2.940 P
	CHCL3	-		-	-		0.855	-	-	1.91		1.11	0.704 P	3.220
Metals	CA	98000		85000	95000		94000	83000	72000				94000	90000
	CR	7.54		-	7.3		-	5.430	-				9.64	-
	NA			31000			30000		10000					32000
Anions	NIT	5400		1200	3600		1300	1500	1100 X	4000		2200	5300	1900
	CL	43000		39000	42000		42000	8500	4200	880000		1200000	44000	51000
	SO4	90000		85000	76000		88000	21000	28000	360000		410000	60000	46000
Indicator parameter	ALK	328000		310000	340000		324000	246000	262000	338000		396000	370000	310000
	HARD	382000		404000	368000		419000	314000	288000	886000		904000	346000	400000
	TDS	487000		453000	465000		480000	353000	280000	2060000		2500000	463000	420000
	pH(1)	7.3		7.5	7.2		7.5	7.4	7.6	7.1		7.2	7.3	7.4
	Sp.Cond.(2)	617		742	626		683	416	488	2370		997	602	637

Notes and flagging codes are presented at the end of this table.

TABLE 10-10
SUMMARY OF GROUNDWATER CHEMICAL DATA-
OLD ACID AREA/ OLD FUEL OIL TANK
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

USATHAMA chemical codes are defined in the RI Report Glossary

TABLE 10-11
COMPOUNDS OF POTENTIAL CONCERN
OLD ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUNDS OF POTENTIAL CONCERN	EXPOSURE POINT CONCENTRATION	
	SURFACE SOIL[1] (μg/g)	SURFACE THROUGH SUBSURFACE SOIL[2] (μg/g)
ACET	--	0.008
CR	20.5	20.5
NI	56.9	56.9
NIT	5.61	8.28
PB	1,500	1,500
SO4	20,000	20,000

Notes:

-- = Not identified as a compound of potential concern
Exposure point concentration is the maximum detected concentration
μg/g = micrograms per gram; equivalent to parts per million (ppm)
[1] Assessment of surface soil contamination (0 to 2 feet) was performed using samples from borings OAB-91-01 through OAB-91-13.
[2] Assessment of subsurface soil contamination (0 to 12 feet) was performed using samples from borings OAB-91-01 through OAB-91-13.

TABLE 10-12
SUMMARY OF RISK ESTIMATES
OLD ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

EXPOSURE SCENARIO	EXPOSURE ROUTE	CANCER RISK	HAZARD INDEX
Current and Future Grounds Maintenance Worker	Soil Ingestion	ND	0.0003
	Inhalation of Particulates	ND	ND
	Total for Grounds Maintenance Worker	ND	0.0003
Future Residential	Soil Ingestion	ND	0.04
Future Construction Worker	Soil Ingestion	ND	0.01
	Inhalation of Particulates	$2x10^{-8}$	ND
	Total for Construction Worker	$2x10^{-8}$	0.01

Notes:

ND = not determined - no toxicity factors available for compounds of potential concern

TABLE 10-13
COMPOUNDS OF POTENTIAL CONCERN
OLD FUEL OIL TANK AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUNDS OF POTENTIAL CONCERN	EXPOSURE POINT CONCENTRATION
	SUBSURFACE SOIL[1] (μg/g)
2MNAP	1.07
ANAPNE	0.077
B2EHP	1.8
BAANTR	0.122
BGHIPY	0.396
CHRY	0.113
DNBP	2.1
FANT	0.037
FLRENE	0.16
PHANTR	0.194

Notes:

Exposure point concentration is the maximum detected concentration
μg/g = micrograms per gram; equivalent to parts per million (ppm)
[1] Assessment of subsurface soil contamination (2 to 12 feet) was performed using samples from FTB-91-01 and FTB-91-02.

TABLE 10-14
SUMMARY OF RISK ESTIMATES
OLD FUEL OIL TANK AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

EXPOSURE SCENARIO	EXPOSURE ROUTE	CANCER RISK	HAZARD INDEX
Future Construction Worker	Soil Ingestion	$9x10^{-9}$	0.001
	Inhalation of Particulates	$5x10^{-11}$	ND
	Total for Construction Worker	$9x10^{-9}$	0.001

Notes:

ND = not determined - no toxicity factors available for compounds of potential concern.

TABLE 10-15
COMPARISON OF GROUNDWATER TO STANDARDS
UNITS: $\mu g/\ell$
OLD ACID AREA/OLD FUEL OIL TANK AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUNDS OF POTENTIAL CONCERN	FREQUENCY OF DETECTION	MAXIMUM DETECTED CONCENTRATION	MINIMUM DETECTED CONCENTRATION	SDWA (1)		WI GROUNDWATER STANDARDS (2)		CALCULATED CONCENTRATION (3)
				MCL	MCLG	ES	PAL	
CHCL3	5:10	3.22	0.704	-	-	6	0.6	-
CL	10:10	1,200,000	4,200	250,000(a)	-	250,000(c)	125,000(c)	-
CR	4:8	9.64	5.43	100	100	50(d)	5(d)	-
NA	4:8	32,000	10,000	20,000(b)	-	-	-	-
NIT	10:10	5,400	1,100	10,000	10,000	10,000	2,000	-
SO4	10:10	410,000	21,000	250,000(a)	-	250,000(c)	125,000(c)	-

Sources:

(1) U.S. Environmental Protection Agency (EPA), 1991, "Fact Sheet: National Primary Drinking Water Standards." Office of Water, Washington, D.C., August 1991; EPA, 1991, "Fact Sheet: National Secondary Drinking Water Standards," Office of Water, Washington, D.C., September 1991; and EPA, 1990, "National Primary and Secondary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals, Final Rule," 57FR31776, July 17, 1992 (see Subsection 3.6 for details).

(2) Wisconsin Administrative Code, Chapter NR 140.10, Table 1 (see Subsection 3.6 for details).

(3) Calculated to be protective at risk of 10^{-6} or HI of 1 (see [illegible] 4.5 for details).

Notes:

(a) Secondary drinking water standard, suggested level.

(b) Reporting level. Monitoring is required and data is reported to health officials to protect individuals on restricted sodium diet.

(c) Value for protection of human welfare (usually aesthetic concerns) rather than protection of public health.

$\mu g/\ell$ = micrograms per liter
SDWA = Safe Drinking Water Act
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
WI = Wisconsin
ES = Enforcement Standard
PAL = Preventive Action Limit
TT = Treatment technique requirement in effect
Copper action level = 1,300 $\mu g/\ell$
Lead action level = 15 $\mu g/\ell$

(d) WI proposing change to ES = 100 $\mu g/\ell$ and PAL = 10 $\mu g/\ell$

TABLE 10-16
ECOLOGICAL CONTAMINANTS OF CONCERN[A]
OLD ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUND	FREQUENCY	EXPOSURE POINT CONCENTRATION[B]
Surface Soil		
NI	3:3	56.9
NIT	13:23	1.79
PB	3:3	1,500
SO4	16:23	18,000

Notes:

A Constitutents selected based on criteria presented in Table Q-25 and discussed in Section 5.0.

B 95th percentile or maximum; units in $\mu g/g$.

C Assessment of surface soil contamination (0 to 2 feet) was performed using samples from borings OAB-91-01 through OAB-91-13.

TABLE 10-17
SUMMARY OF RISK EVALUATION FOR TERRESTRIAL RECEPTORS
OLD ACID AREA

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	HAZARD INDICES[a]	
RECEPTOR	ACUTE RISK[b]	CHRONIC RISK[c]
Short-tailed shrew	2.8E+03	5.7E+04
Eastern meadowlark	6.3E+01	1.8E+02
Garter snake	1.4E+02	2.8E+03
Red fox	3.1E+00	1.3E+00
Red-tailed hawk	9.8E+00	2.0E+00

Notes:

[a] Sum of the individual Hazard Quotients for each surface soil contaminant of concern; each HQ calculated by dividing the estimated exposure dosage by the Reference Toxicity Value (RTV). Hazard Quotients are presented in Appendix R, Tables R-59 and R-60 for acute and chronic exposures, respectively.

[b] Based on comparison to acute RTVs.

[c] Based on comparison to chronic RTVs.

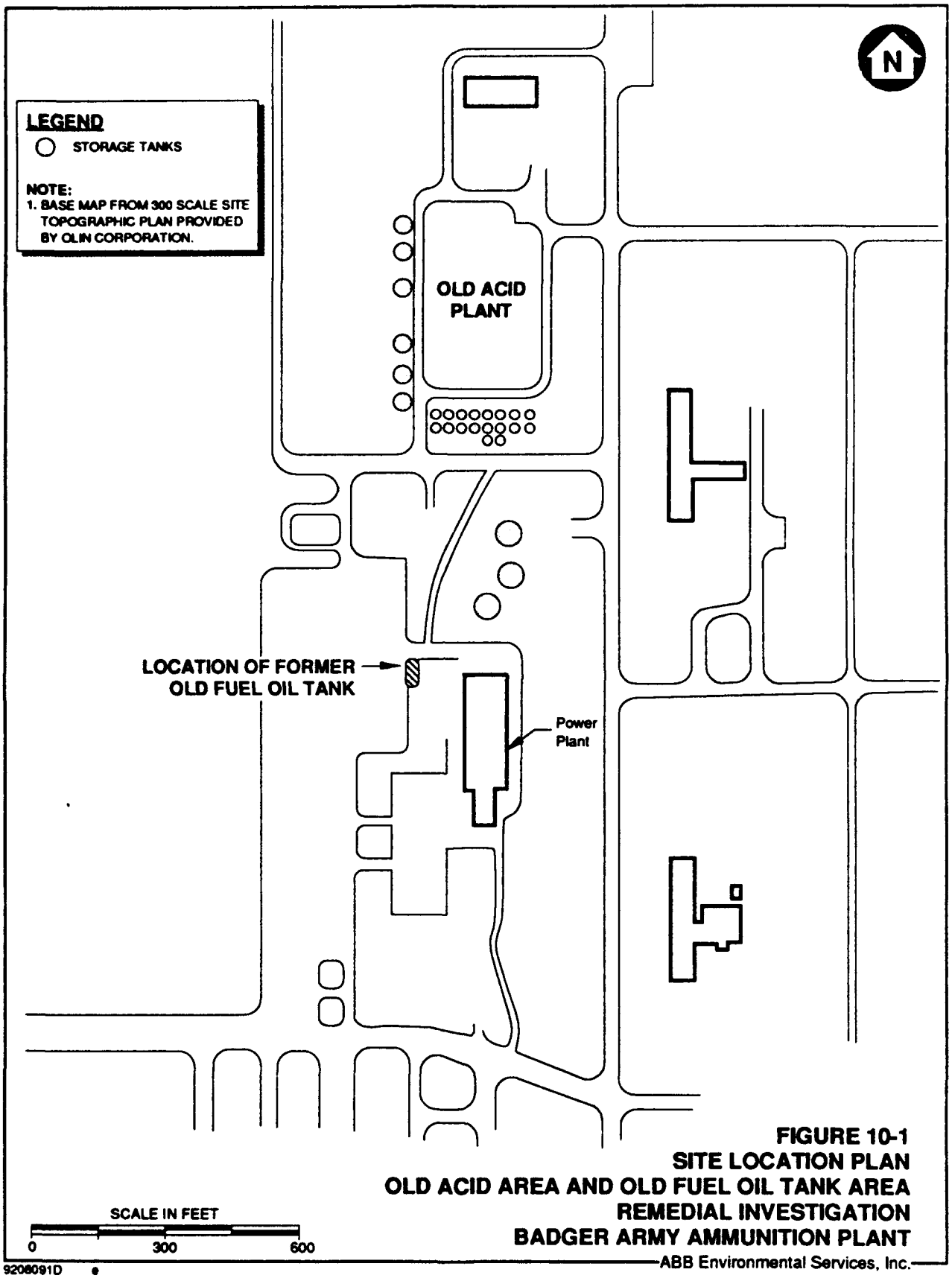

FIGURE 10-1
SITE LOCATION PLAN
OLD ACID AREA AND OLD FUEL OIL TANK AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

9206091D

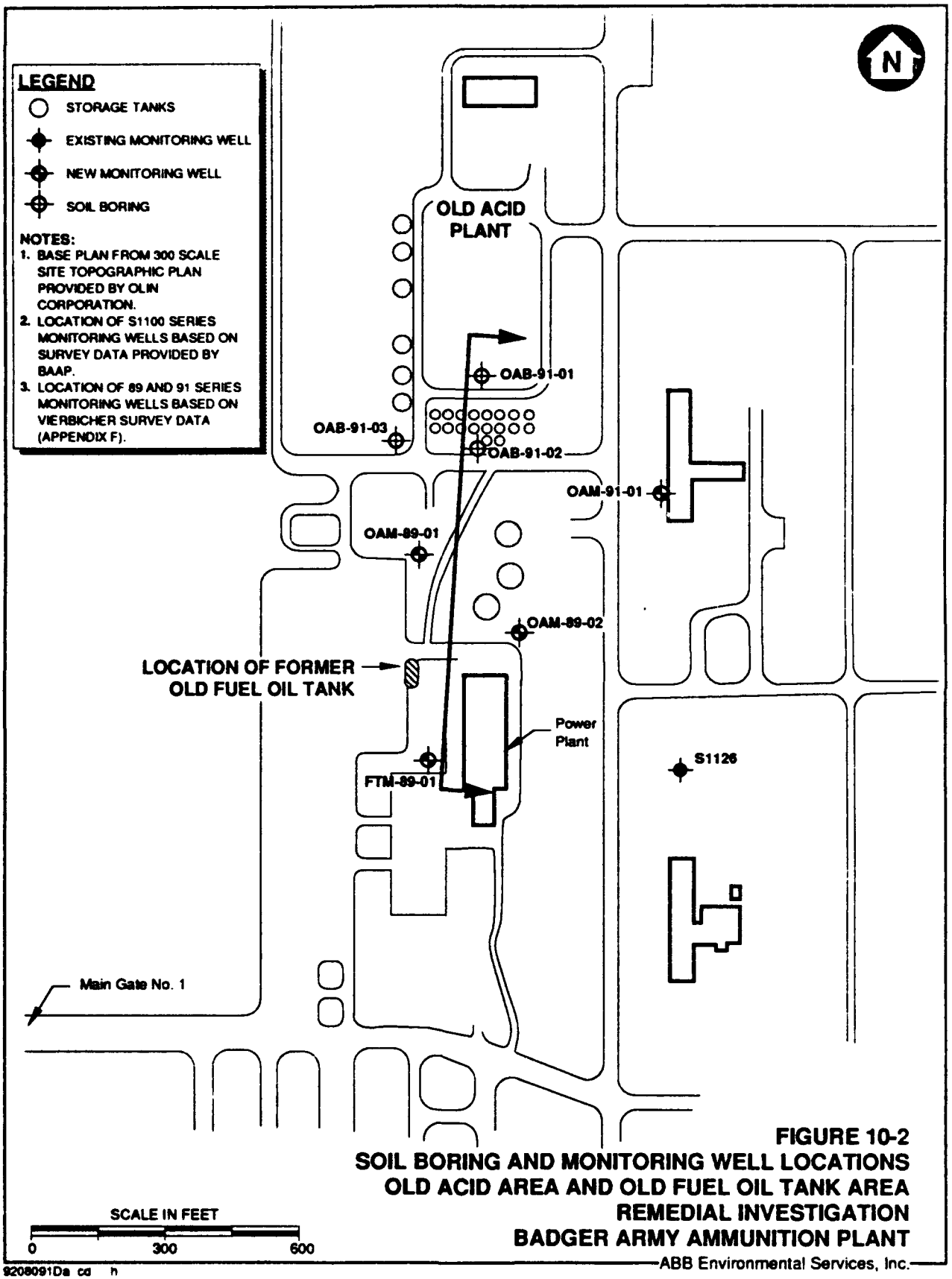

FIGURE 10-2
SOIL BORING AND MONITORING WELL LOCATIONS
OLD ACID AREA AND OLD FUEL OIL TANK AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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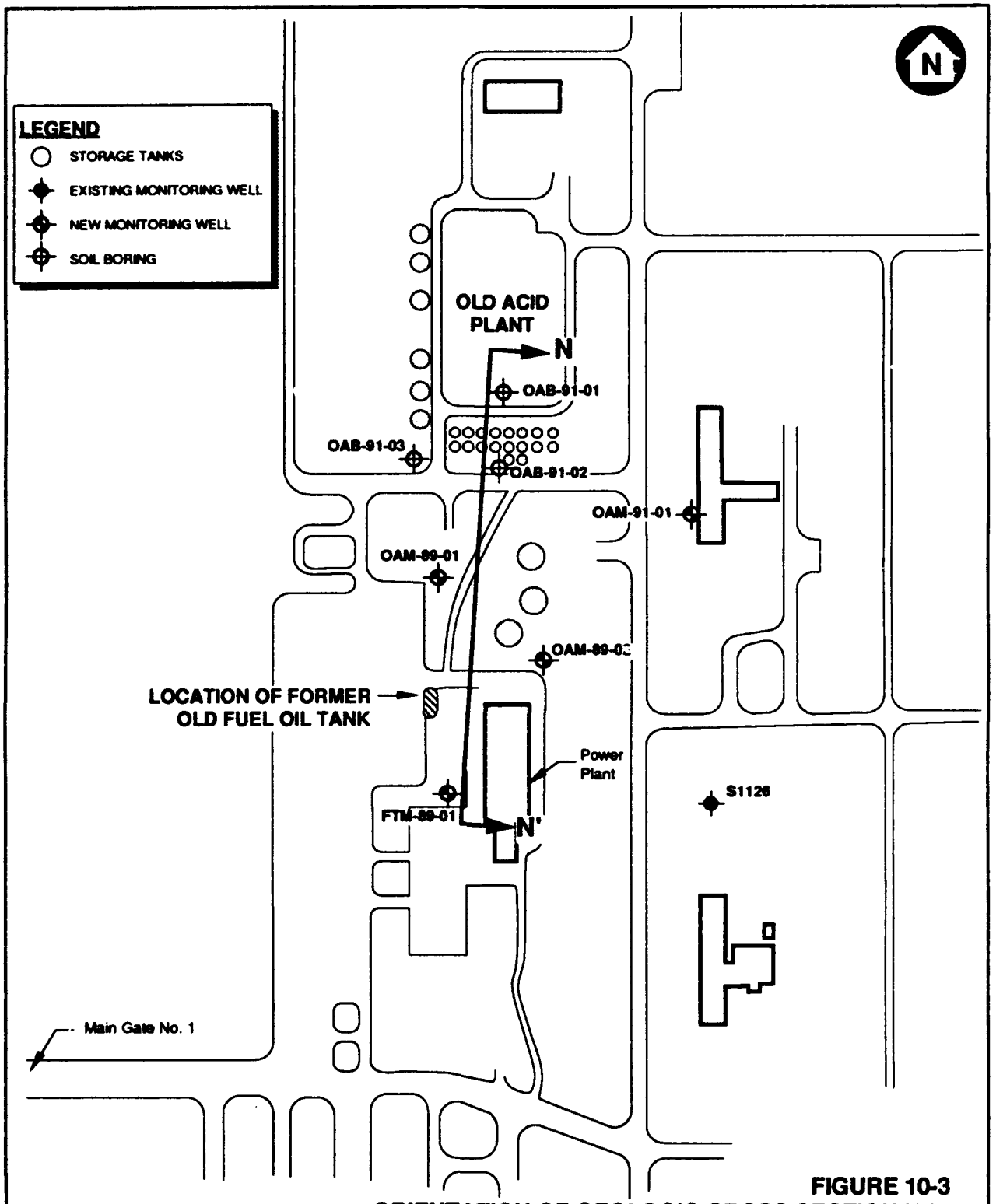

FIGURE 10-3
ORIENTATION OF GEOLOGIC CROSS SECTION N-N'
OLD ACID AREA AND OLD FUEL OIL TANK AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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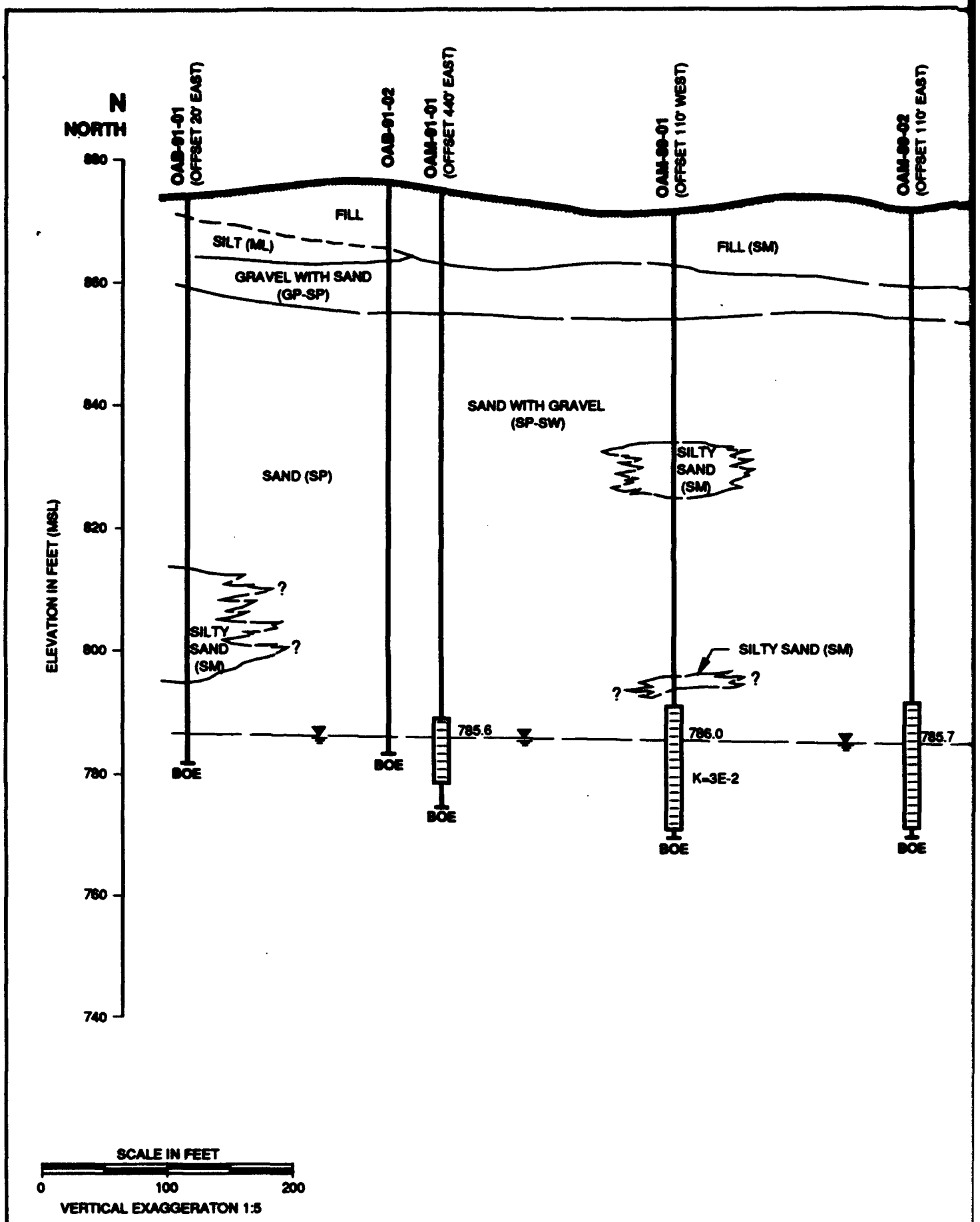
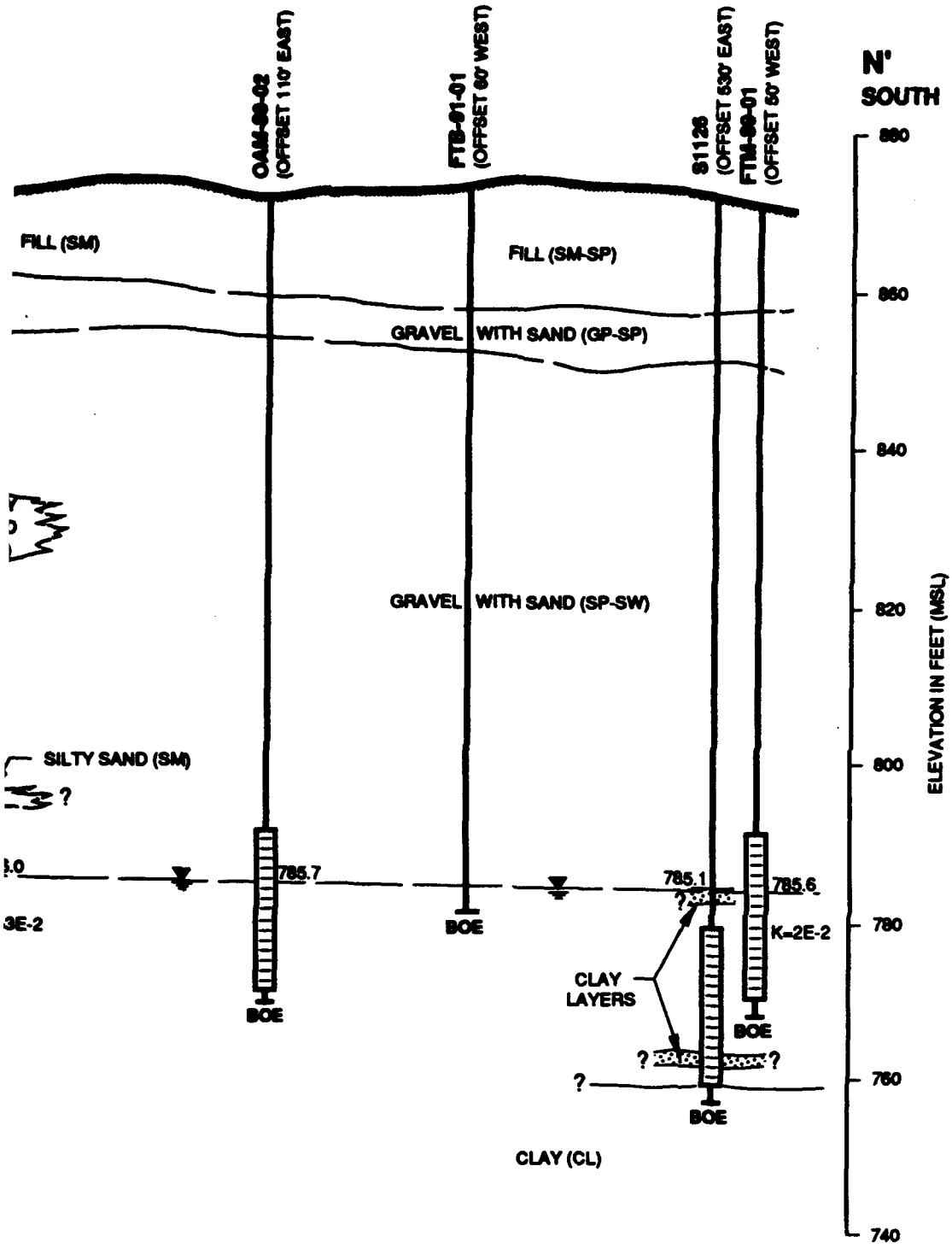
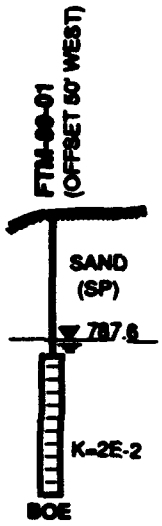

N
NORTH
OAB-91-01 (OFFSET 20' EAST)
OAB-91-02
OAM-91-01 (OFFSET 440' EAST)
OAM-90-01 (OFFSET 110' WEST)
OAM-90-02 (OFFSET 110' EAST)
ELEVATION IN FEET (MSL)
860
840
820
800
780
760
740
FILL
SILT (ML)
GRAVEL WITH SAND (GP-SP)
FILL (SM)
SAND WITH GRAVEL (SP-SW)
SAND (SP)
SILTY SAND (SM)
SILTY SAND (SM)
SILTY SAND (SM)
785.6
786.0
785.7
K-3E-2
BOE
BOE
BOE
BOE
BOE
SCALE IN FEET
0
100
200
VERTICAL EXAGGERATON 1:5

9303041D

2



LEGEND



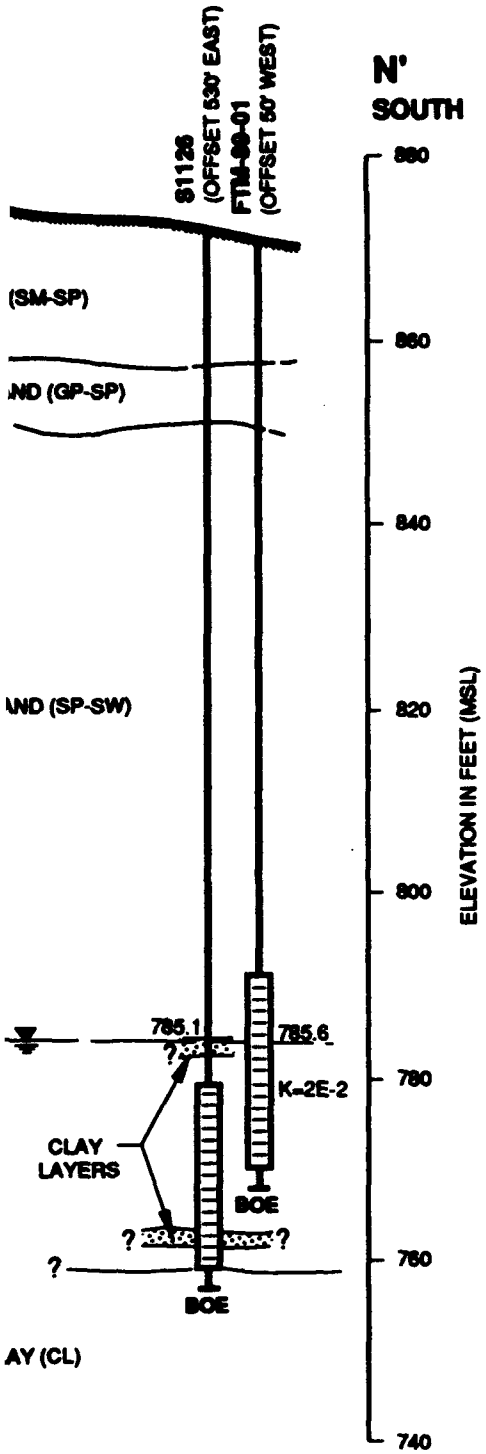
WELL DESIGNA
OFFSET DISTA
FROM TRANSE
GROUND SURF
SOILS DESCRI
CLASSIFICATIO
WATER TABLE
SCREENED INT
IN-FIELD PERM
RESULTS IN cm
BOTTOM OF EX

NOTES:

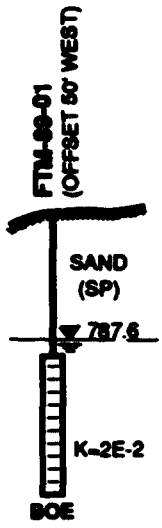
1. SEE FIGURE 10-3 FOR LOCATIO ORIENTATION OF PROFILE.
2. PROFILES ARE BASED ON AN IN OF AVAILABLE SUBSURFACE DA CONDITIONS BETWEEN EXPLOR VARY FROM THOSE SHOWN.
3. WATER LEVELS MEASURED IN W WELLS ON 12/15/91 ARE LISTED.

F

GEOLOGIC CROSS SE
OLD ACID AREA AND OLD FUEL OIL T
REMEDIAL INVE
BADGER ARMY AMMUNIT



LEGEND



- WELL DESIGNATION
- OFFSET DISTANCE OF WELL FROM TRANSECT
- GROUND SURFACE
- SOILS DESCRIPTION AND USCS CLASSIFICATION
- WATER TABLE ELEVATION
- SCREENED INTERVAL
- IN-FIELD PERMEABILITY TEST RESULTS IN cm/sec
- BOTTOM OF EXPLORATION

NOTES:

1. SEE FIGURE 10-3 FOR LOCATION AND ORIENTATION OF PROFILE.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91 ARE LISTED.

FIGURE 10-4
GEOLOGIC CROSS SECTION N-N'
OLD ACID AREA AND OLD FUEL OIL TANK AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

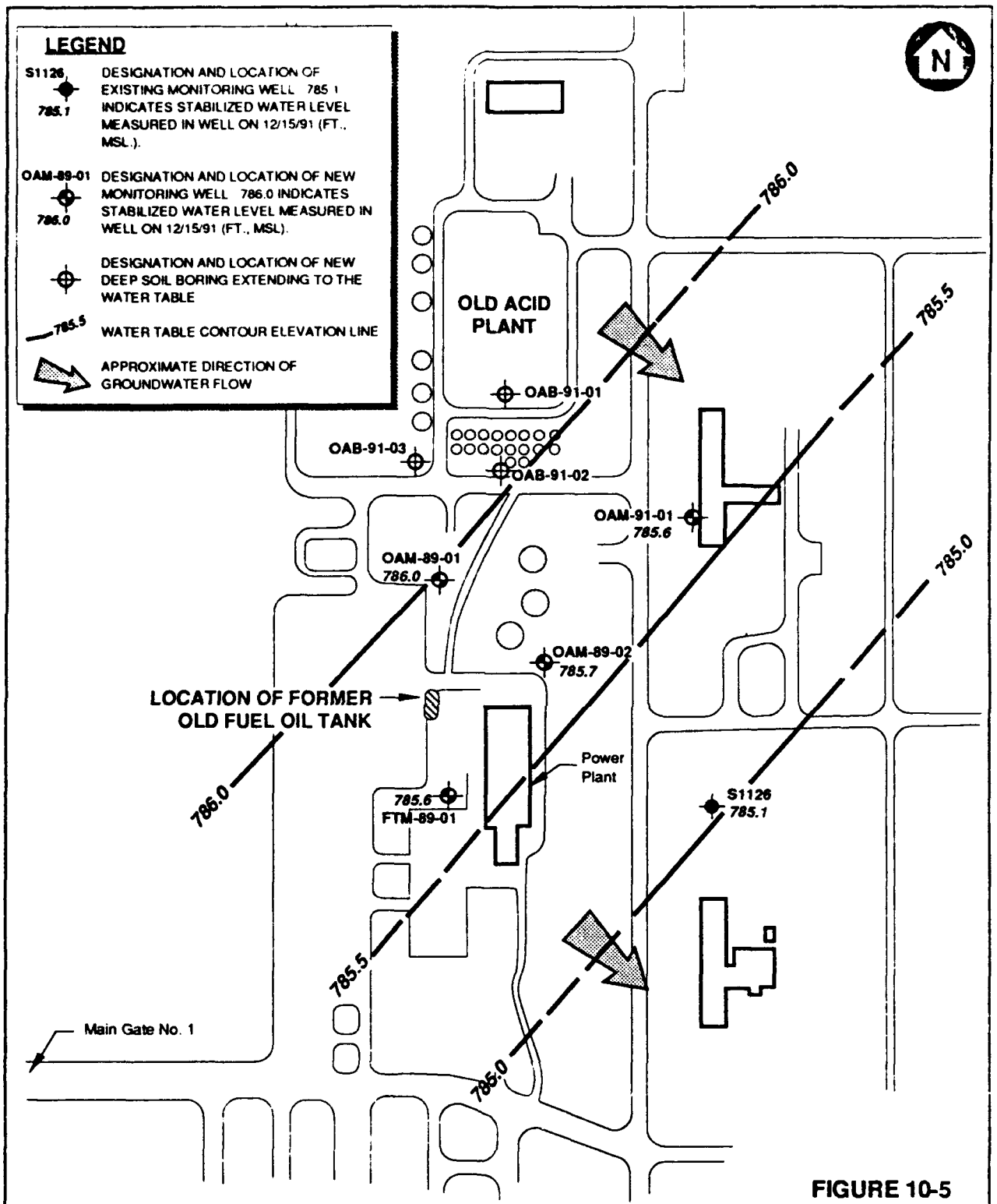


FIGURE 10-5
WATER TABLE CONTOUR PLAN
OLD ACID AREA AND OLD FUEL OIL TANK AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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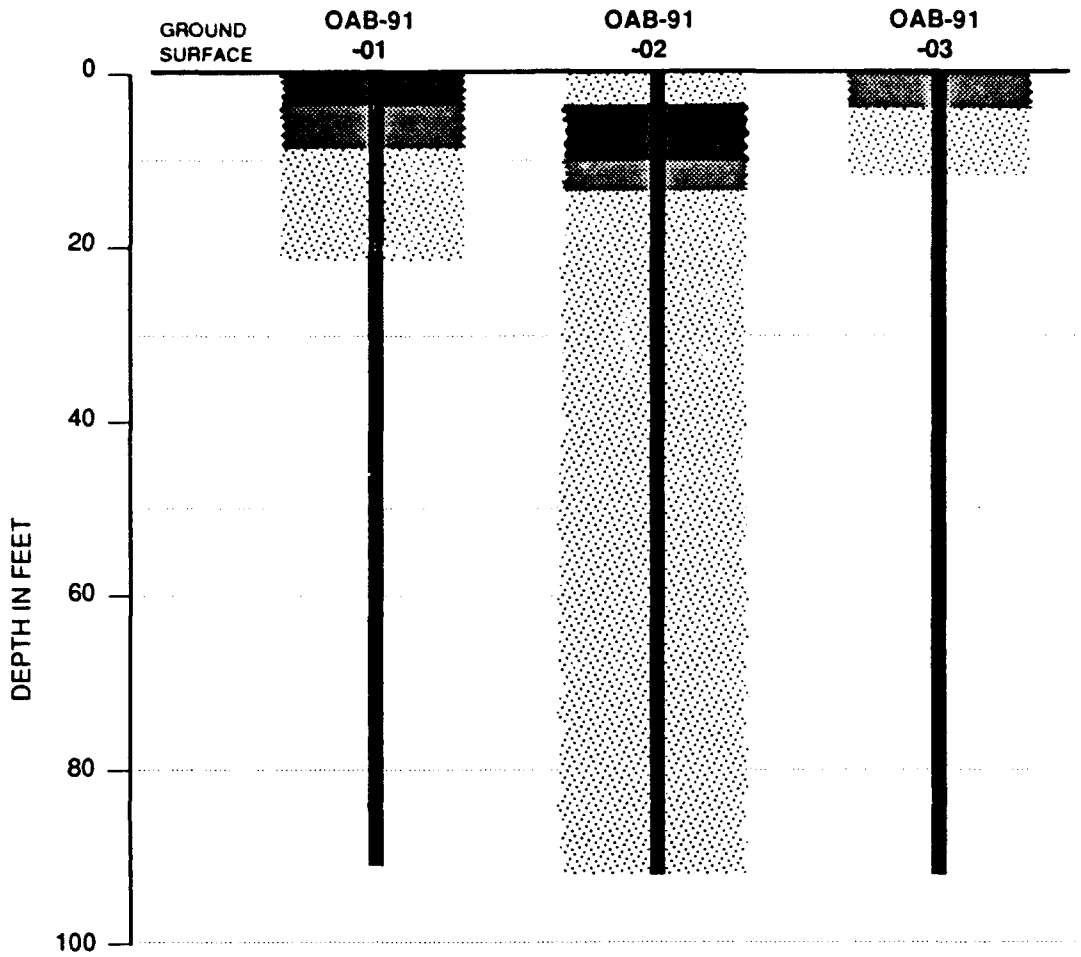

SO4 CONCENTRATION

- > 1,000 mg/kg
- 100 to 999.9 mg/kg
- ND to 99.9 mg/kg

NOTE:

1. SEE TABLE 10-9 AND APPENDIX K FOR CHEMICAL DATA SUMMARY.

FIGURE 10-6
SO4 CONCENTRATIONS IN SUBSURFACE SOILS
OLD ACID AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

9208043Dd

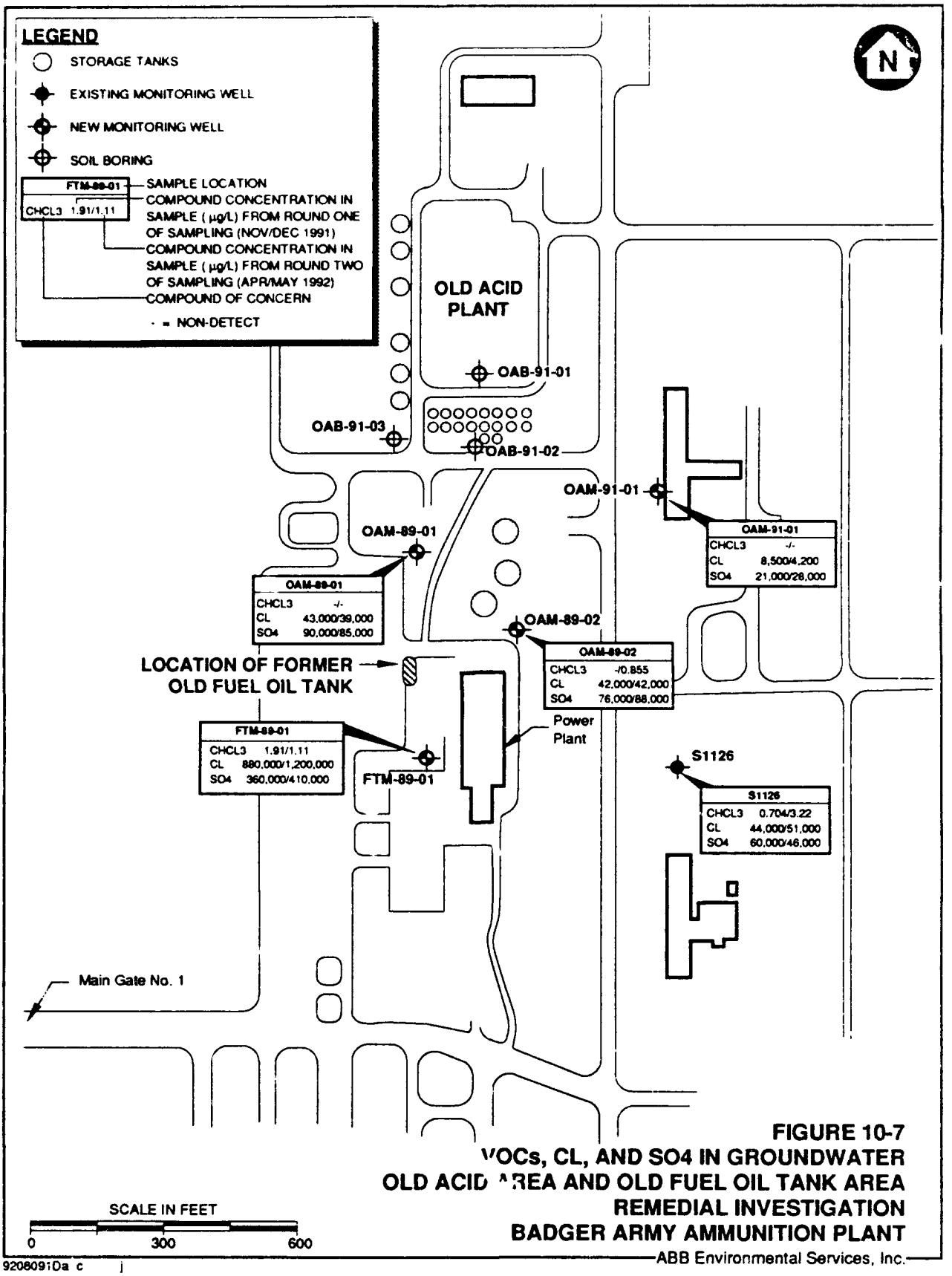

FIGURE 10-7
VOCs, CL, AND SO4 IN GROUNDWATER
OLD ACID AREA AND OLD FUEL OIL TANK AREA
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

9208091Da c j

TABLE 11-1
SUMMARY OF THE REMEDIAL INVESTIGATION FIELD PROGRAM -
OFF-POST AREA SOUTH OF BAAP

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITES	PROGRAM ELEMENTS			
	SOIL VAPOR SURVEY	REMOTE SENSING GEOPHYSICS	MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING*	SOIL BORINGS AND SOIL SAMPLING
Off-Post Area South of BAAP	--	--	24 new wells; 48 samples from 24 new wells	--

Notes:

* Includes 2 rounds of groundwater sampling

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TABLE 11-2
SUMMARY OF MONITORING WELLS INSTALLED -
OFF-POST AREA SOUTH OF BAAP

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE AND WELL IDENTIFIER	DRILLING METHOD	BORING DEPTH FROM GROUND SURFACE (ft.)	BOTTOM ELEVATION OF SCREENS (ft. MSL)	LENGTH OF WELL SCREEN (ft.)	LOCATION	PURPOSE
PBM-90-01 D	Dual-wall driven casing	217.0	618.5	10	Downgradient and off-post of BAAP	To provide horizontal definition to the plume.
PBM-90-02 D	Dual-wall driven casing	214.0	614.2	10	Downgradient and off-post of BAAP	To provide horizontal definition of the plume.
PBM-90-03	Dual-wall driven casing	205.0	613.4	10	Downgradient and off-post of BAAP	To provide horizontal definition of the plume.
PBN-90-04 B -04 D	Dual-wall driven casing Dual-wall driven casing	B - 130.0 D - 237.0	B - 708 D - 627.5	10 10	Downgradient and off-post of BAAP adjacent to water tank	To provide horizontal and vertical definition of the plume.
PBN-91-01 C	Dual-wall driven casing	160.0	675.5	10	Downgradient and off-post of BAAP	In association with existing well PBM-90-01D, to provide horizontal and vertical plume definition.
PBN-91-02 B -02 C	Dual-wall driven casing Dual-wall driven casing	B - 115.0 C - 161.3	B - 704.0 C - 658.6	10 10	Downgradient and off-post of BAAP	In association with existing well PBM-90-02D, to provide horizontal and vertical plume definition.

continued

TABLE 11-2
SUMMARY OF MONITORING WELLS INSTALLED -
OFF-POST AREA SOUTH OF BAAP

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE AND WELL IDENTIFIER	DRILLING METHOD	BORING DEPTH FROM GROUND SURFACE (ft.)	BOTTOM ELEVATION OF SCREENS (ft. MSL)	LENGTH OF WELL SCREEN (ft.)	LOCATION	PURPOSE
PBN-91-03 B -03 C	Dual-wall driven casing Dual-wall driven casing	B - 106.1 C - 152.3	B - 706.7 C - 660.0	10 10	Downgradient and off-post of BAAP	In association with existing well PBM-90-03D, to provide horizontal and vertical plume definition.
SWN-91-01 B -01 C -01 D	Dual-wall driven casing Dual-wall driven casing Dual-wall driven casing	B - 113.1 C - 160.1 D - 200.2	B - 717.1 C - 672.8 D - 633.4	10 10 10	Downgradient and off-post of BAAP along County HWY Z	To provide horizontal and vertical definition of the plume.
SWN-91-02 C -02 D	Dual-wall driven casing Dual-wall driven casing	C - 155.0 D - 190.2	C - 681.9 D - 649.5	10 10	Downgradient and off-post of BAAP along County HWY Z	To provide horizontal and vertical definition of the plume.
SWN-91-03 B -03 C -03 D -03 E	Dual-wall driven casing Dual-wall driven casing Dual-wall driven casing Dual-wall driven casing	B - 113.4 C - 162.8 D - 209.1 E - 258.0	B - 721.3 C - 671.8 D - 625.9 E - 597.1	10 10 10 10	Downgradient and off-post of BAAP along County HWY Z	To provide horizontal and vertical definition of the plume and to assess vertical gradient between bedrock and overburden
SWN-91-04 C -04 D	Dual-wall driven casing Dual-wall driven casing	C - 164.0 D - 197.0	C - 668.8 D - 636.5	10 10	Downgradient and off-post of BAAP along County HWY Z	To provide horizontal and vertical definition of the plume.

continued

TABLE 11-2
SUMMARY OF MONITORING WELLS INSTALLED -
OFF-POST AREA SOUTH OF BAAP

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITE AND WELL IDENTIFIER	DRILLING METHOD	BORING DEPTH FROM GROUND SURFACE (ft.)	BOTTOM ELEVATION OF SCREENS (ft. MSL)	LENGTH OF WELL SCREEN (ft.)	LOCATION	PURPOSE
SWN-91-05 B -05 C -05 D	Dual-wall driven casing Dual-wall driven casing Dual-wall driven casing	B - 112.5 C - 147.0 D - 202.4	B - 718.0 C - 683.8 D - 630.7	10 10 10	Downgradient and off-post of BAAP along County HWY Z	To provide horizontal and vertical definition of the plume.

TABLE 11-3
WELLS INCLUDED IN GROUNDWATER SAMPLING PROGRAM -
OFF-POST AREA SOUTH OF BAAP

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

SITES	NEW WELLS	EXISTING WELLS	RESIDENTIAL WELLS
Off-Post Area South of BAAP	PBM-90-01D PBM-90-02D PBM-90-03D PBN-90-04B,D PBN-91-01C PBN-91-02B,C PBN-91-03B,C SWN-91-01B,C,D SWN-91-02C,D SWN-91-03B,C,D,E SWN-91-04C,D SWN-91-05B,C,D	None	Graf Premo Shaefer Spear
TOTAL WELLS	24	0	4

Notes:

B,C,D,E - Shallowest to deepest: B indicates shallowest; E indicates deepest well in a well nest.

TABLE 11-4
CHEMICAL ANALYSES PERFORMED ON GROUNDWATER SAMPLES -
OFF-POST AREA SOUTH OF BAAP/PRIVATE WELLS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS																	ORGANICS					TPH
	METALS									ANIONS			OTHER										
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	NI	NIT	CL	SO4	HARD	ALK	TDS	TOC	NH3N2	VOC	BNA	NG	NAM	DNT	
OFF-POST WELLS SOUTH OF BAAP																							
PBM-90-01 D*	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	1	—	—	—	—
PBN-91-01 C	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
PBM-90-02 D*	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
PBN-91-02 B	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
PBN-91-02 C	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
PBM-90-03 D*	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
PBN-91-03 C	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
PBN-91-03 B	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
PBN-90-04 B*	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
PBN-90-04 D*	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
SWN-91-01 B	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
SWN-91-01 C	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
SWN-91-01 D	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
SWN-91-02 C	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
SWN-91-02 D	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
SWN-91-03 B	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
SWN-91-03 C	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
SWN-91-03 D	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
SWN-91-03 E	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
SWN-91-04 C	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
SWN-91-04 D	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
SWN-91-05 B	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
SWN-91-05 C	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
SWN-91-05 D	—	—	—	—	B	B	B	B	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—

TABLE 11-4
CHEMICAL ANALYSES PERFORMED ON GROUNDWATER SAMPLES -
OFF-POST AREA SOUTH OF BAAP/PRIVATE WELLS

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

	INORGANICS																	ORGANICS					TPH
	METALS									ANIONS			OTHER										
SAMPLE LOCATION	PP	TAL	CA	NA	CD	CR	HG	PB	NI	NIT	CL	SO4	HARD	ALK	TDS	TOC	NH3N2	VOC	BN/A	NG	NAM	DNT	
PRIVATE WELLS																							
PREMO	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
SCHAEFER	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	B	B	B	—
SPEAR	—	B	—	—	—	—	—	—	—	B	B	B	B	B	B	—	—	B	B	—	—	—	—
GRAF	—	2	—	—	—	—	—	—	—	2	2	2	2	2	2	—	—	2	B	—	—	—	—

NOTES:

PP = Priority Pollutant Metals (13) (AG, AS, BE, CD, CR, CU, PB, HG, NI, SB, SE, TL, ZN)
TAL = Toxic Analyte List (23) (AL, SB, AS, BA, BE, CD, CA, CR, CO, CU, FE, PB, MG, MN, HG, NI, K, SE, AG, NA, TL, V, ZN)
VOC = volatile organic compounds by GC/MS
GC/MS = Gas Chromatography/Mass Spectrometry
BN/A = base-neutral and acid-extractable organics by GC/MS
NAM = nitrosamines by GC
DNT = 2,4- and 2,6-dinitrotoluene by HPLC
HPLC = High Performance Liquid Chromatrography
* = Wells were analyzed for select VOCs during Round I (September 1990) and Round II (October 1990).
B = Analyzed in both Rounds (One and Two).
1 = Analyzed in Round Round One Only.
2 = Analyzed in Round Two Only.

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TABLE 11-5
FIELD HYDRAULIC CONDUCTIVITY TEST RESULTS -
OFF-POST AREA SOUTH OF BAAP

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

WELL DESIGNATION	MAXIMUM WATER LEVEL DEPRESSION (FEET)	HYDRAULIC CONDUCTIVITY (CM/SEC)	GEOLOGIC CONDITIONS
SWN-91-03B	5.8	2.6×10^{-2} [a]	Coarse sand and gravel (SP-GP)
SWN-91-03C	8.0	1.8×10^{-2} [a]	Medium to coarse sand (SP)
SWN-91-03D	4.9	1.5×10^{-2} [a]	Coarse sand (SP)
SWN-91-03E	7.8	1.0×10^{-3}	Sandstone and dolomite bedrock

Notes:

Field data and calculations are presented in Appendix I. Hydraulic conductivities were calculated using the HVORSLEV method.

Hydraulic Conductivity Tests were completed during March and November, 1989, and November and December 1991.

Values for hydraulic conductivities represent an averaged value of multiple tests performed on each well.

a Water level recovery at this well was impacted by inertial effects, resulting in water level recovery above static water levels. Hydraulic conductivity measurements may be greater than the calculated values at this well.

cm/sec = centimeters per second

TABLE 11-6
SUMMARY OF GROUNDWATER CHEMICAL DATA-
OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBM-90-01D		PBM-90-01D		PBM-90-02D		PBM-90-02D		PBM-90-03D	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		09/24/90	10/22/90	12/15/91	04/24/92	09/25/90	10/23/90	12/08/91	04/28/92	09/25/90	10/23/90
ROUND:		I	II	ONE	TWO	I	II	ONE	TWO	I	II
VOCs	ACET			-	-			-	-		
	CCL4	-	-	-	-	-	1.68	2.16 P	3.53 P	-	-
	CH2CL2			4.8 P	6.67 B			4.02 P	7.25 B		
	CHCL3	-	-	-	-	-	-	0.553 P	0.594 P	-	-
	MEK			-	-			-	-		
	TRCLE	-	-	-	-	-	-	-	-	-	-
SVOCs	2E1HXL										
	B2EHP			-				-	-		
Metals	BA										
	CA										
	CD			2.78	-			-	-		
	CR			8.47	-			-	-		
	FE										
	HG			-	-			-	-		
	K										
	MG										
	MN										
	NA										
	PB			-	-			-	-		
Anions	NIT			6700	5600			5200	3200		
	CL			31000 P	29000 P			6800	8100		
	SO4			59000	52000			38000	39000		
Indicator parameter	ALK			231000	262000			269000	200000		
	HARD			256000	338000			370000	284000		
	TDS			479000	404000			272000	303000		
	pH(1)	7.5	7.7	7.7	7.8	7.5	7.6	7.5	8.0	7.6	7.6
	Sp.Cond.(2)	586	522	543	642	453	398	534	482	463	395

Notes and flagging codes are presented at the end of this table.

TABLE 11-6
SUMMARY OF GROUNDWATER CHEMICAL DATA-
OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBM-90-03D		PBM-90-04B		PBN-90-04B		PBN-90-04D		PBN-90-04D	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		12/14/91	04/28/92	09/25/90	10/23/90	12/15/91	04/24/92	09/25/90	10/23/90	12/15/91	04/24/92
ROUND:		ONE	TWO	I	II	ONE	TWO	I	II	ONE	TWO
VOCs	ACET	-	-			-	-			-	-
	CCL4	-	-	-	-	-	-	-	-	-	-
	CH2CL2	4.9 P	7.25 B			4.41 P	7.45 B			4.31 P	7.45 B
	CHCL3	-	-	-	-	-	-	-	-	-	-
	MEK	36.0 S	-			-	60.0 S			-	-
	TRCLE	-	-	-	-	-	-	-	-	-	-
SVOCs	2E1HXL					20.0 S					
	B2EHP	-	-			-	-			90.8	71.8
Metals	BA										
	CA										
	CD	-	-			-	-			-	-
	CR	13.8	-			4.63	-			5.72	-
	FE										
	HG	-				-	-			-	-
	K										
	MG										
	MN										
	NA										
	PB	-	-			-	-			-	-
Anions	NIT	5300	5200			8500	7500			6500	6100
	CL	7300	8700			6300	7300			5000	5200
	SO4	18000	19000			18000	19000			15000	16000
Indicator parameter	ALK	220000	228000			242000	218000			210000	218000
	HARD	278000	282000			346000	274000			244000	274000
	TDS	335000	303000			340000	288000			388000	288000
	pH(1)	7.8	7.9	7.6	7.5	7.7	7.9	7.6	7.7	7.7	8.0
	Sp.Cond.(2)	414	477	453	573	310	462	440	400	302	446

Notes and flagging codes are presented at the end of this table.

TABLE 11-6
SUMMARY OF GROUNDWATER CHEMICAL DATA-
OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		PBN-91-01C		PBN-91-02B		PBN-91-02C		PBN-91-03B		PBN-91-03C	
Sample Type:		WELL		WELL		WELL		WELL		WELL	
UNITS:		UGL		UGL		UGL		UGL		UGL	
DATE SAMPLED:		12/15/91	04/24/92	12/07/91	04/28/92	12/07/91	04/28/92	12/14/91	04/28/92	12/14/91	04/28/92
ROUND:		ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO	ONE	TWO
VOCs	ACET	-	-	-	-	-	7.4 S	-	-	-	-
	CCL4	-	-	-	2.94 P	-	-	-	-	-	-
	CH2CL2	4.8 P	6.76 B	4.9 P	7.25 B	4.9 P	7.65 B	4.71 P	7.45 B	4.41 P	7.84 B
	CHCL3	-	-	-	0.493 P	-	-	-	-	-	-
	MEK	-	-	-	-	39 S	9.7 S	-	-	40 S	120 S
	TRCLE	-	-	-	-	-	-	-	-	-	-
SVOCs	2E1HXL										
	B2EHP	30.3 P	39.8 P	25.5 P	31.5 P	79.6	-	-	-	255	29.8 P
Metals	BA										
	CA										
	CD	-	-	-	-	-	-	-	-	-	-
	CR	5.55	-	[illegible]	-	6.67	-	6.06	-	4.61	-
	FE										
	HG	-	-	-	-	-	-	-	-	-	-
	K										
	MG										
	MN										
	NA										
	PB	-	-	-	-	-	-	-	-	-	-
Anions	NIT	10000	9000	27000	25000	19000	14000	19000	19000	7000	7900
	CL	37000	37000	27000 P	29000 P	24000	26000 X	29000 P	27000 P	25000 P	25000 P
	SO4	63000	59000	50000	45000	49000	51000	28000	28000	21000	21000
Indicator parameter	ALK	284000	222000	266000	268000	520000	202000	227000	250000	228000	244000
	HARD	330000	366000	372000	406000	370000	350000	368000	360000	314000	310000
	TDS	543000	272000	449000	460000	369000	268000	463000	383000	419000	323000
	pH(1)	7.6	7.7	8.1	7.8	8.4	7.8	7.6	7.7	7.8	7.8
	Sp.Cond.(2)	592	716	783	701	691	620	577	658	487	562

Notes and flagging codes are presented at the end of this table.

TABLE 11-6
SUMMARY OF GROUNDWATER CHEMICAL DATA-
OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		SWN-91-01B			SWN-91-01C			SWN-91-01D			SWN-91-02C			SWN-91-02D		
Sample Type:		WELL			WELL			WELL			WELL			WELL		
UNITS:		UGL			UGL			UGL			UGL			UGL		
DATE SAMPLED:		12/14/91		04/25/92	12/14/91		04/25/92	12/14/91		04/25/92	12/14/91		04/26/92	12/14/91		04/26/92
ROUND:		ONE		TWO	ONE		TWO	ONE		TWO	ONE		TWO	ONE		TWO
VOCs	ACET	-		-	13	S	-	-		-	-		-	-		-
	CCL4	-		-	-		-	-		-	-		-	-		-
	CH2CL2	4.71	P	6.76 B	4.8	P	5.98	B	4.51 P	6.18 B	4.51 P		5.69 B	4.9 P		6.47 B
	CHCL3	-		-	-		-		-	-	-		0.433 P	-		-
	MEK	-		-	64	S	79	S	-	-	-		-	-		-
	TRCLE	-		-	-		-		-	-	-		-	-		-
SVOCs	2EHXL	10	S		30	S										
	B2EHP	62.1		-	105		-		127	-	110		50.8 P	104		104
Metals	BA															
	CA															
	CD	-		-	-		-		-	-	-		-	-		-
	CR	4.82		-	14.5		-		7.18	-	5.96		-	-		-
	FE															
	HG	-		-			-		-	-	-		-	-		-
	K															
	MG															
	MN															
	NA															
	PB	-		-	-		-		-	-	-		-	-		5.6
Anions	NIT	13000		11000 X	10000		9200		7900	8800	14000		16000	5300		5500
	CL	33000		36000	26000	P	27000	P	30000 P	30000 P	31000 P		31000 P	14000		17000
	SO4	37000		37000	35000		36000		36000	36000	48000		49000	36000		39000
Indicator parameter	ALK	246000		260000	220000		258000		256000	278000	316000		200000	208000		196000
	HARD	354000		358000	316000		378000		340000	338000	354000		374000	278000		294000
	TDS	504000		405000	391000		401000		545000	401000	512000		263000	359000		251000
	pH(1)	7.5		7.7	7.6		7.7		7.5	7.7	7.4		7.7	7.7		7.9
	Sp.Cond.(2)	422		611	389		564		394	568	424		673	328		519

Notes and flagging codes are presented at the end of this table.

TABLE 11-6
SUMMARY OF GROUNDWATER CHEMICAL DATA-
OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		SWN-91-03B			SWN-91-03C			SWN-91-03D			SWN-91-03E			SWN-91-04C		
Sample Type:		WELL			WELL			WELL			WELL			WELL		
UNITS:		UGL			UGL			UGL			UGL			UGL		
DATE SAMPLED:		12/11/91		04/28/92	12/11/91		04/27/92	12/11/91		04/27/92	12/11/91		04/27/92	12/14/91		04/25/92
ROUND:		ONE		TWO	ONE		TWO	ONE		TWO	ONE		TWO	ONE		TWO
VOCs	ACET	-		-	5.9	S	7.1	-		-	-		-	47	S	-
	CCL4	7.25		10.8	-		2.75	-		3.33	P	-		-	-	-
	CH2CL2	4.71	P	7.16 B	4.71	P	7.55	4.71	P	7.84	B	4.9	P	7.75	B	4.51	P	7.06 B
	CHCL3	1.31		1.21	-		-	-		-		-		-		-		-
	MEK	68	S	130 S	16	S	38	5.5	S	-		54	S	150	S	42	S	51 S
	TRCLE	-		0.287 P	-		-	0.425	P	-		-		-		-		-
SVOCs	2E1HXL							30	S			10.0	S					
	B2EHP	50.8	P	62.1	49.4	P	28.7	73.2		139		97.1		74.8		66.9		-
Metals	BA											24.8		624.3				
	CA											74000		68000				
	CD	-		-	-		-	-		-		-		-		-		-
	CR	5.42		-	-		-	5.16		-		5.0		-		7.14		-
	FE											27.4		-				
	HG	-		-	-		-	-		-		-		-		-		-
	K											968	T	1520	T			
	MG											32000		29000				
	MN											54.1		29.7				
	NA						-					25000	T	27000	T			
	PB	-		-	-		-	-		-		-		-		-		-
Anions	NIT	18000		14000	1800		1800	5300		1300		5000		4400		7200		6000
	CL	23000		23000	3100	P	4400	8000		10000		20000	P	20000		14000		15000
	SO4	41000		42000	18000		19000	33000		22000		57000		54000	X	39000		42000
Indicator parameter	ALK	314000		274000	224000		224000	238000		232000		250000		230000		242000		260000
	HARD	348000		396000	260000		264000	212000		256000		294000		402000		298000		330000
	TDS	443000		419000	269000		281000	319000		297000		376000		251000		525000		377000
	pH(1)	8.2		7.5	8.1		7.9	8.3		7.9		8.7		7.8		7.7		7.7
	Sp.Cond.(2)	714		572	445		431	568		523		629		566		492		542

Notes and flagging codes are presented at the end of this table.

TABLE 11-6
SUMMARY OF GROUNDWATER CHEMICAL DATA-
OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		SWN-91-04D				SWN-91-05B				SWN-91-05C				SWN-91-05D			
Sample Type:		WELL				WELL				WELL				WELL			
UNITS:		UGL				UGL				UGL				UGL			
DATE SAMPLED:		12/14/91		04/25/92		12/14/91		04/26/92		12/14/91		04/26/92		12/14/91		04/26/92	
ROUND:		ONE		TWO		ONE		TWO		ONE		TWO		ONE		TWO	
VOCs	ACET	11	S	–		–		–		–		–		18	S	–	
	CCL4	–		–		–		–		–		–		–		–	
	CH2CL2	4.41	P	6.86	B	4.51	P	6.57	B	4.31	P	7.45	B	4.31	P	7.84	B
	CHCL3	–		–		–		–		–		–		–		–	
	MEK	–		8.8	S	–		63	S	35	S	16	S	–		–	
	TRCLE	–		–		–		–		–		–		–		–	
SVOCs	2E1HXL																
	B2EHP	55.7		–		31.8	P	41.4	P	31.8	P	45.5	P	39.8	P	70.1	
Metals	BA																
	CA																
	CD	–		–		–		–		–		–		–		–	
	CR	6.42		–		–		–		–		–		5.94		–	
	FE																
	HG	–		–		–		–		–		–		–		–	
	K																
	MG																
	MN																
	NA																
	PB	–		–		–		–		–		–		–		–	
Anions	NIT	3100		4100		10000		6200		7900		6300		5200		3900	
	CL	3800		4900		37000		37000		39000		49000		33000		29000	P
	SO4	19000		[illegible]		53000		59000		59000		64000		63000		54000	
Indicator parameter	ALK	266000		234000		256000		278000		248000		226000		224000		222000	
	HARD	244000		290000		356000		334000		314000		348000		305000		330000	
	TDS	323000		[illegible]		428000		401000		435000		363000		463000		297000	
	pH(1)	7.8		7.8		7.6		7.7		7.6		7.7		7.6		7.7	
	Sp.Cond.(2)	400		438		584		646		568		658		555		602	

Notes and flagging codes are presented at the end of this table.

TABLE 11-6
SUMMARY OF GROUNDWATER CHEMICAL DATA-
OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

Appendix K contains complete analytical results

USATHAMA chemical codes are defined in the RI Report Glossary

TABLE 11-7
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PRIVATE WELLS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Site ID:		GRAF		PREMO				SCHAEFER				SPEAR			
Sample Type:		WELL		WELL				WELL				WELL			
UNITS:		UGL		UGL				UGL				UGL			
DATE SAMPLED:		04/09/92		12/04/91		04/09/92		12/04/91		04/09/92		12/04/91		04/09/92	
ROUND:		TWO		ONE		TWO		ONE		TWO		ONE		TWO	
VOCs	CH2CL2	5.88	B	5.29	P	5.69	B	3.82	P	5.88	B	4.31	P	6.08	B
	CHCL3	-		-		0.584	P	-		-		-		-	
Metals	AS	-		-		-		3.28		-					
	BA	60		31.4		28.5		95		98		31.9		33.3	
	BE	0.358		-		-		-		-		-		-	
	CA	130000		82000		76000		64000		72000		74000		74000	
	CR	-		23.8		-		28.6		-		19.6		-	
	CU	6.31		-		7.66		-		-		-		4.63	
	FE	-		1200		78.9		2600		2400		110		-	
	HG	-		-		-		-		3.25					
	K	2850	T	968	T	1540	T	915	T	1650	T	1660	T	2510	T
	MG	12000		43000		39000		34000		37000		39000		39000	
	MN	193		8.93		-		234	X	320		-		-	
	NA	16000	T	22000	T	20000	T	3060	T	3270	T	-		14000	T
	NI	-		-		-		10		-		-		-	
	ZN	330		190		178		224	X	320		167		117	
Anions	NIT	570	X	8000		8800		1800		-		9300		8100	
	CL	17000		49000		51000		9500		9500		13000		13000	
	SO4	60000	X	36000		35000		23000		23000		44000		42000	
Indicator parameter	ALK	292000		220000		270000		270000		286000		256000		302000	
	HARD	346000		330000		360000		292000		306000		350000		354000	
	TDS	412000		444000		413000		336000		311000		412000		388000	
	pH(1)	7.8		8.4		7.8		8.3		8.1		7.8		7.8	
	Sp.Cond.(2)	637		92		746		432		520		516		650	

Notes and flagging codes are presented at the end of this table.

TABLE 11-7
SUMMARY OF GROUNDWATER CHEMICAL DATA-
PRIVATE WELLS
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

Notes and flagging codes:

(1)	=	unitless
(2)	=	Specific conductivity, umhos/cm
UGL	=	Micrograms per liter (parts per billion)
VOCs	=	Volatile organic compounds
SVOCs	=	Semi-volatile organic compounds
Blank cell	=	No analysis performed
-	=	Less than the Certified Reporting Limit (CRL)
GT	=	Greater than the reported value
B	=	Analyte found in blank as well as sample
G	=	Reported results affected by interferences or high background
P	=	Results less than CRL, but greater than Criteria of Detection
R	=	Analyte required for reporting purposes, but not currently certified
S	=	Results based on internal standard
T	=	Uncertified analyte in a certified method
X	=	Analyte recovery outside of certified range, but within acceptable limits

USATHAMA chemical codes are defined in the RI Report Glossary

TABLE 11-8
CHEMICAL AND PHYSICAL PROPERTIES OF VOCS DETECTED IN GROUNDWATER
OFF-POST AREA SOUTH OF BAAP

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

CHEMICALS	CAS#	MOLECULAR WEIGHT (g/mole)	DENSITY (mℓ/g)	WATER SOLUBILITY (mg/ℓ)	VAPOR PRESSURE (mmHg)	HENRY'S LAW CONSTANT (atm-m³/mole)	K_{oc}[b] (mℓ/g)	K_{ow}[c] (mℓ/mℓ)
Volatile Organic Compounds								
CCL4	56-23-5	154	1.594	7.57×10^{2}	90	2.41×10^{-2}	110	437
CHCL3	67-66-3	119	1.483	8.2×10^{3}	150.5	2.88×10^{-3}	44	91
TRCLE	79-01-6	132	1.45	1.1×10^{3}	57.9	9.1×10^{-3}	126	240

Notes:

[A] All data from the Risk Assessment Guidance for Superfund (USEPA, 1989a).

[B] K_{oc} = partition coefficient between the organic chemical and carbon.

[C] K_{ow} = partition coefficient of the chemical between octanol and water.

See the List of USATHAMA Chemical Codes in the Glossary for definitions of chemical abbreviations.

TABLE 11-9
ESTIMATE OF DISTANCE TRAVELED BY CCL4 IN GROUNDWATER - OFF-POST AREA SOUTH OF BAAP

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

$$V_c = V/[1 + K_d\,(b/n)] \quad K_d = K_{oc} * f_{oc}$$

Assume: Fraction of organic carbon (f_{oc}) = 0.003
Soil density (b) = 2 g/mℓ
Soil porosity (n) = 0.3

A weighted-average groundwater flow velocity (V) along a flow line from the Propellant Burning Ground to the Wisconsin River:

$$V = (0.55)*(330\ ft/yr) + (0.45)*(440\ ft/yr)$$
$$\cong 440\ ft/yr$$

VOC	CONTAMINANT VELOCITY V_c, (FT/YR.)	PARTITION COEFFICIENT K_d, (mℓ/g)	K_{oc}	YEARS	DISTANCE TRAVELED (FT.)
CCL4	137.5	0.33	110	50	6.875

The approximate minimum distance that TRCLE has been transported in groundwater is 13,000 ft., in approximately 26 years.

The velocity of TRCLE (V_c) in groundwater is:

V_c = 13,000 ft/26 yrs.
= 500 ft/yr (slightly greater than groundwater flow rate)

Assume CCL4 moves at rate of groundwater flow (440 ft/yr):

Estimated distance CCL4 has traveled = (440 ft/yr)*(50 yrs)
= 22,000 feet
or 4.2 miles

TABLE 11-10
COMPARISON OF GROUNDWATER TO STANDARDS -
UNITS: μG/ℓ
OFF-POST AREA SOUTH OF BAAP

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

COMPOUNDS OF POTENTIAL CONCERN	FREQUENCY OF DETECTION	MAXIMUM DETECTED CONCENTRATION	MINIMUM DETECTED CONCENTRATION	SDWA (1)		WI GROUNDWATER STANDARDS (2)		CALCULATED CONCENTRATION (3)
				MCL	MCLG	ES	PAL	
BA	2:2	24.8	24.3	2,000	2,000	1,000(c)	200(c)	-
CCL4	8:52	10.8	1.68	5	0	5	0.5	-
CD	1:42	2.78	-	5	5	10(d)	1(d)	-
CHCL3	6:52	1.31	0.433	-	-	6	0.6	-
CL	42:42	49,000	3,100	250,000(a)	-	-	-	-
CR	16:42	14.5	4.61	100	100	50(e)	5(e)	-
MN	2:2	54.1	29.7	50(a)	-	50(f)	25(f)	-
NA	2:2	27,000	25,000	20,000(b)	-	-	-	-
NIT	42:42	27,000	1,300	10,000	10,000	10,000	2,000	-
PB	1:42	5.6	-	TT	0	50(g)	5(g)	-
SO4	42:42	64,000	18,000	250,000(a)	-	250,000(f)	125,000(f)	-
TRCLE	2:52	0.425	0.287	5	0	5	0.18	-

Sources:

(1) U.S. Environmental Protection Agency (EPA), 1991, "Fact Sheet: National Primary Drinking Water Standards." Office of Water, Washington, D.C., August 1991; EPA, 1991, "Fact Sheet: National Secondary Drinking Water Standards," Office of Water, Washington, D.C., September 1991; and EPA, 1990, "National Primary and Secondary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals, Final Rule," 57FR31776, July 17, 1992 (see Subsection 3.6 for details).

(2) Wisconsin Administrative Code, Chapter NR 140.10, Table 1 (see Subsection 3.6 for details).

(3) Calculated to be protective at risk of 10^{-6} or HI of 1 (see Subsection 4.5 for details).

Notes:

(a) Secondary drinking water standard, suggested level.

(b) Reporting level. Monitoring is required and data is reported to health officials to protect individuals on restricted sodium diet.

(c) WI proposing change to ES = 2,000 μg/ℓ and PAL = 400 μg/ℓ

(d) WI proposing change to ES = 5 μg/ℓ and PAL = 0.5 μg/ℓ

(e) WI proposing change to ES = 100 μg/ℓ and PAL = 10 μg/ℓ

(f) Values for protection of public welfare (usually aesthetic concerns) rather than for protection of public health.

(g) WI proposing change to ES = 15 μg/ℓ and PAL = 1.5 μg/ℓ.

μg/ℓ = micrograms per liter
SDWA = Safe Drinking Water Act
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
WI = Wisconsin
ES = Enforcement Standard
PAL = Preventive Action Limit
TT = Treatment technique requirement in effect
Copper action level = 1,300 μg/ℓ
Lead action level = 15 μg/ℓ

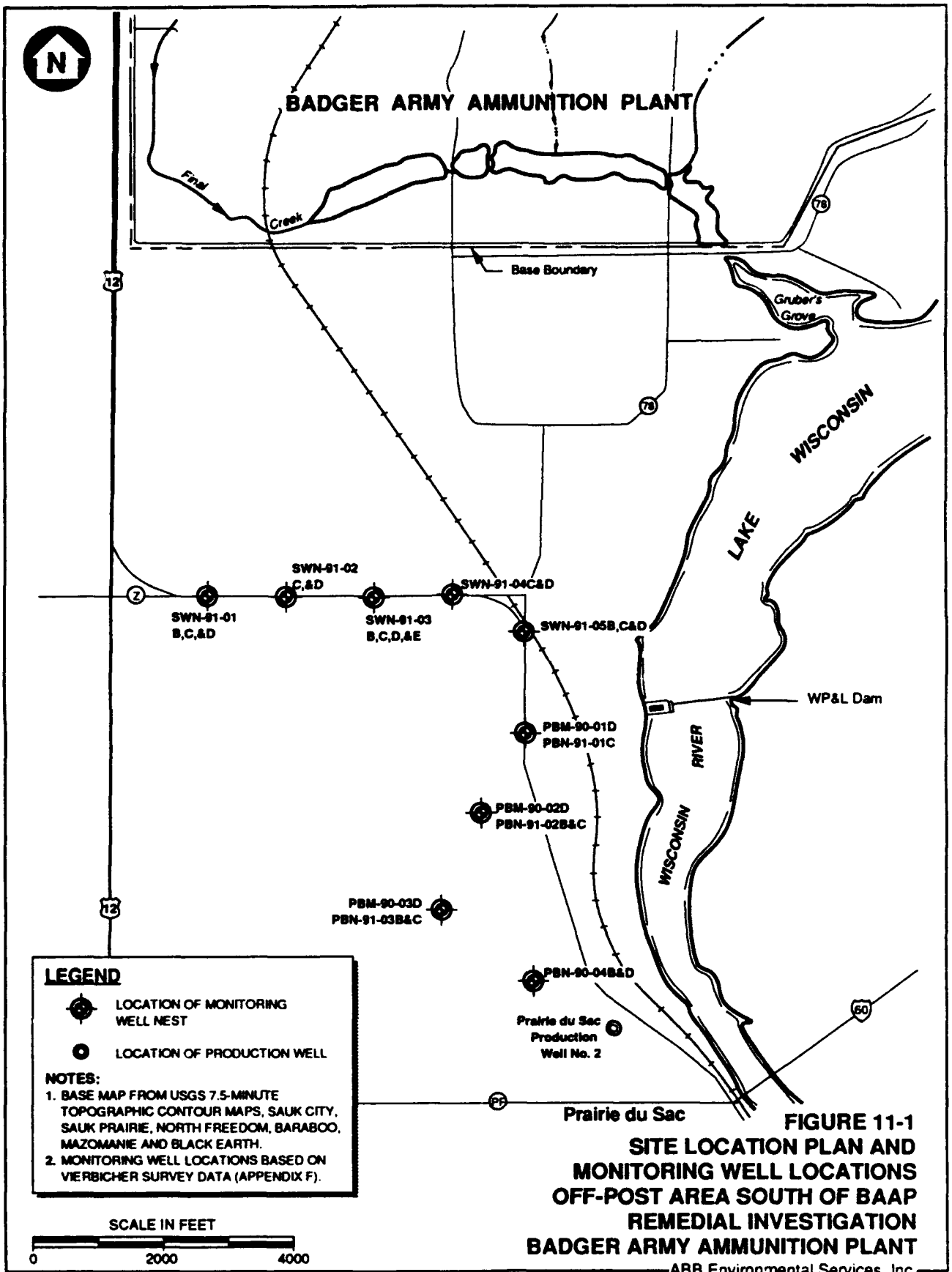

FIGURE 11-1
SITE LOCATION PLAN AND MONITORING WELL LOCATIONS OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

9208095D bc

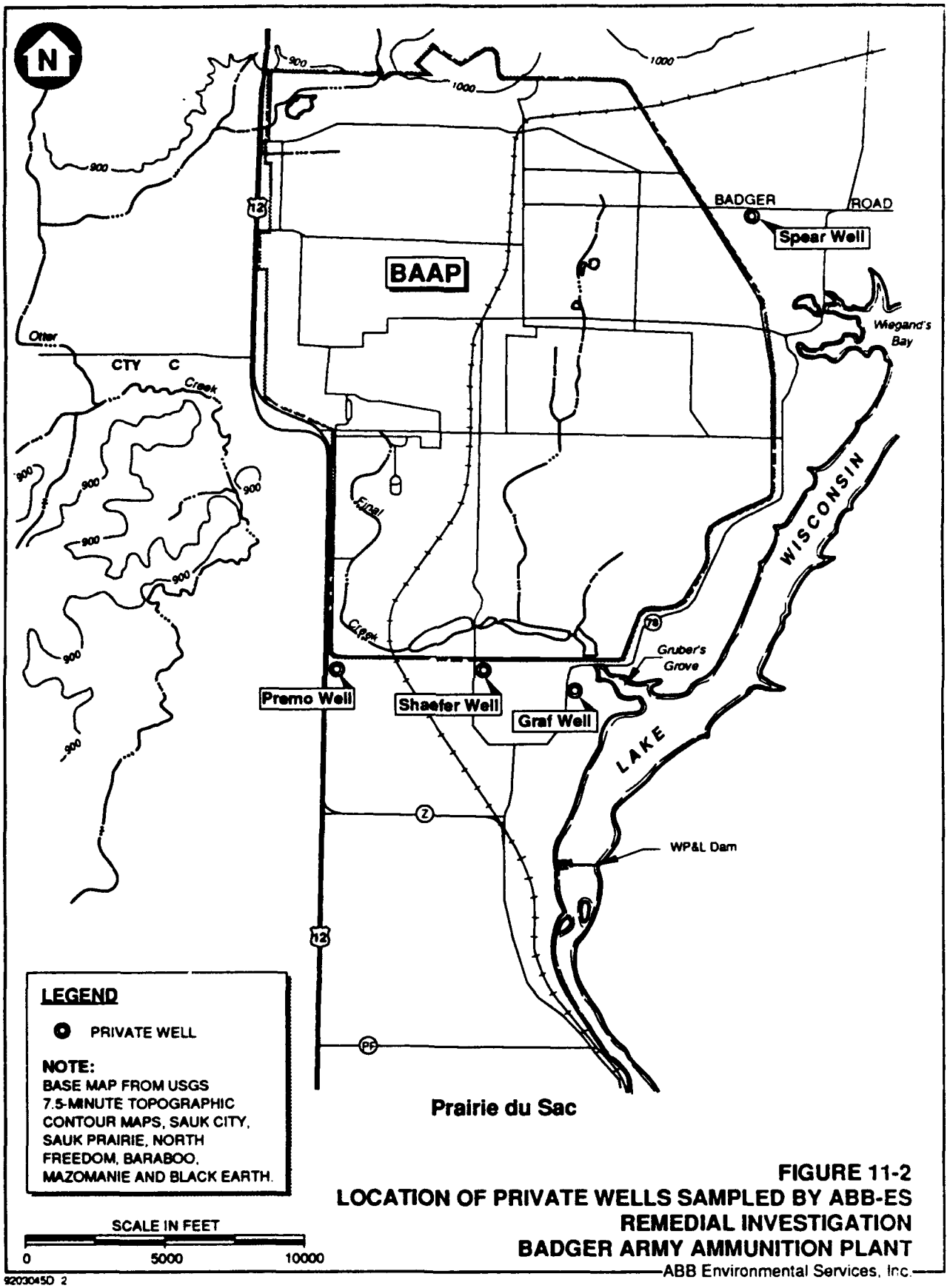

FIGURE 11-2
LOCATION OF PRIVATE WELLS SAMPLED BY ABB-ES
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

92030450 2

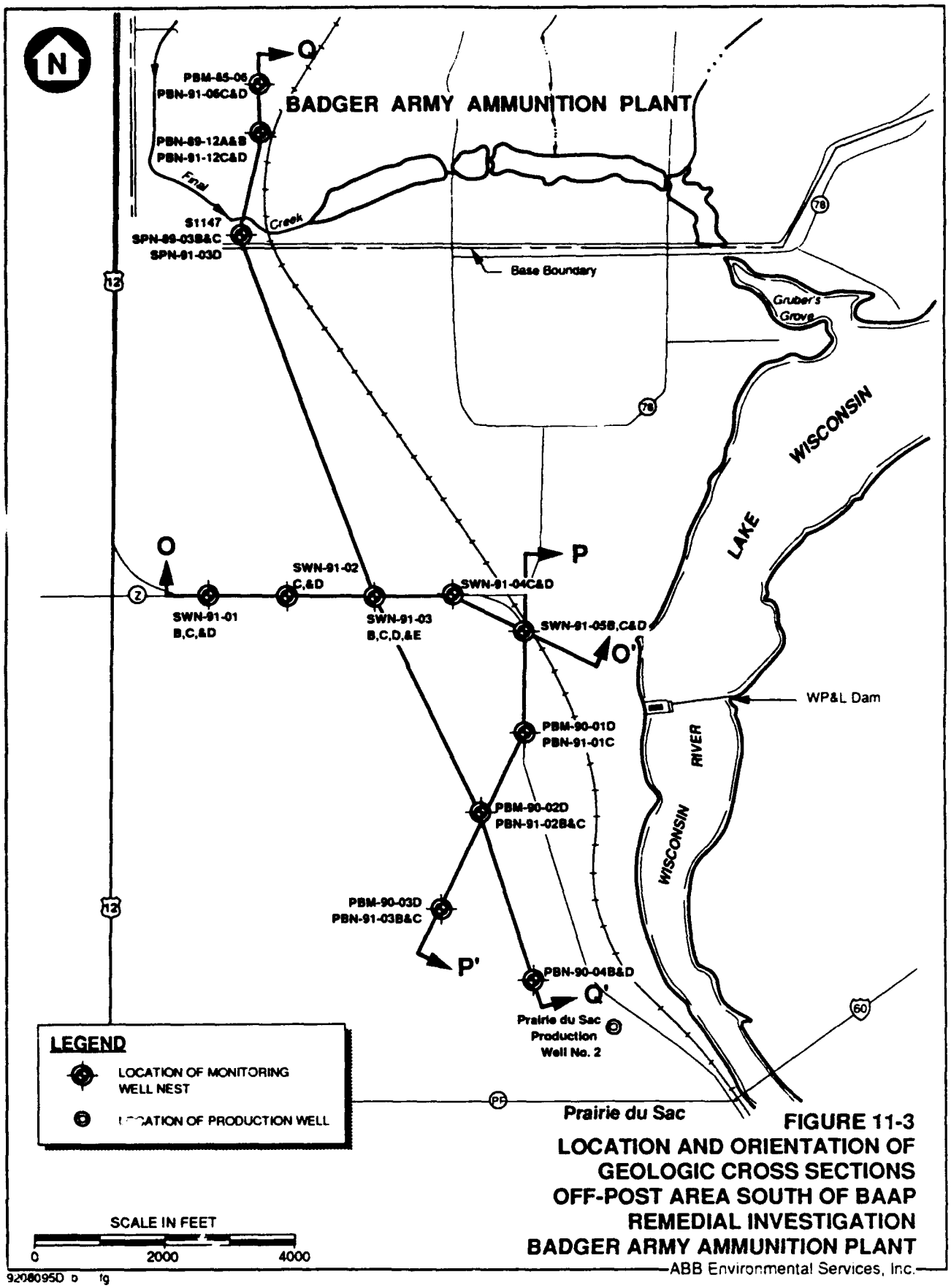

FIGURE 11-3
LOCATION AND ORIENTATION OF GEOLOGIC CROSS SECTIONS OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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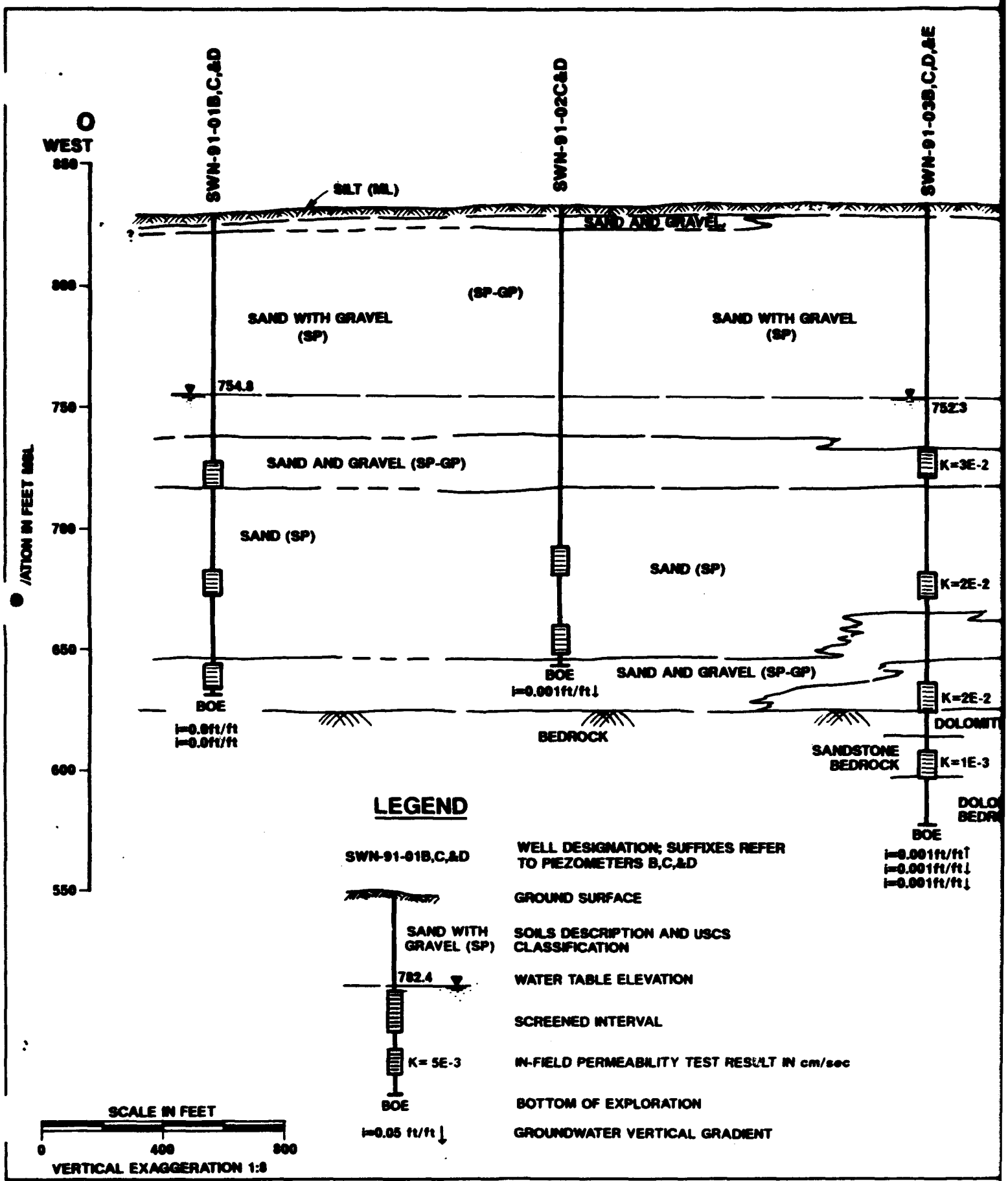

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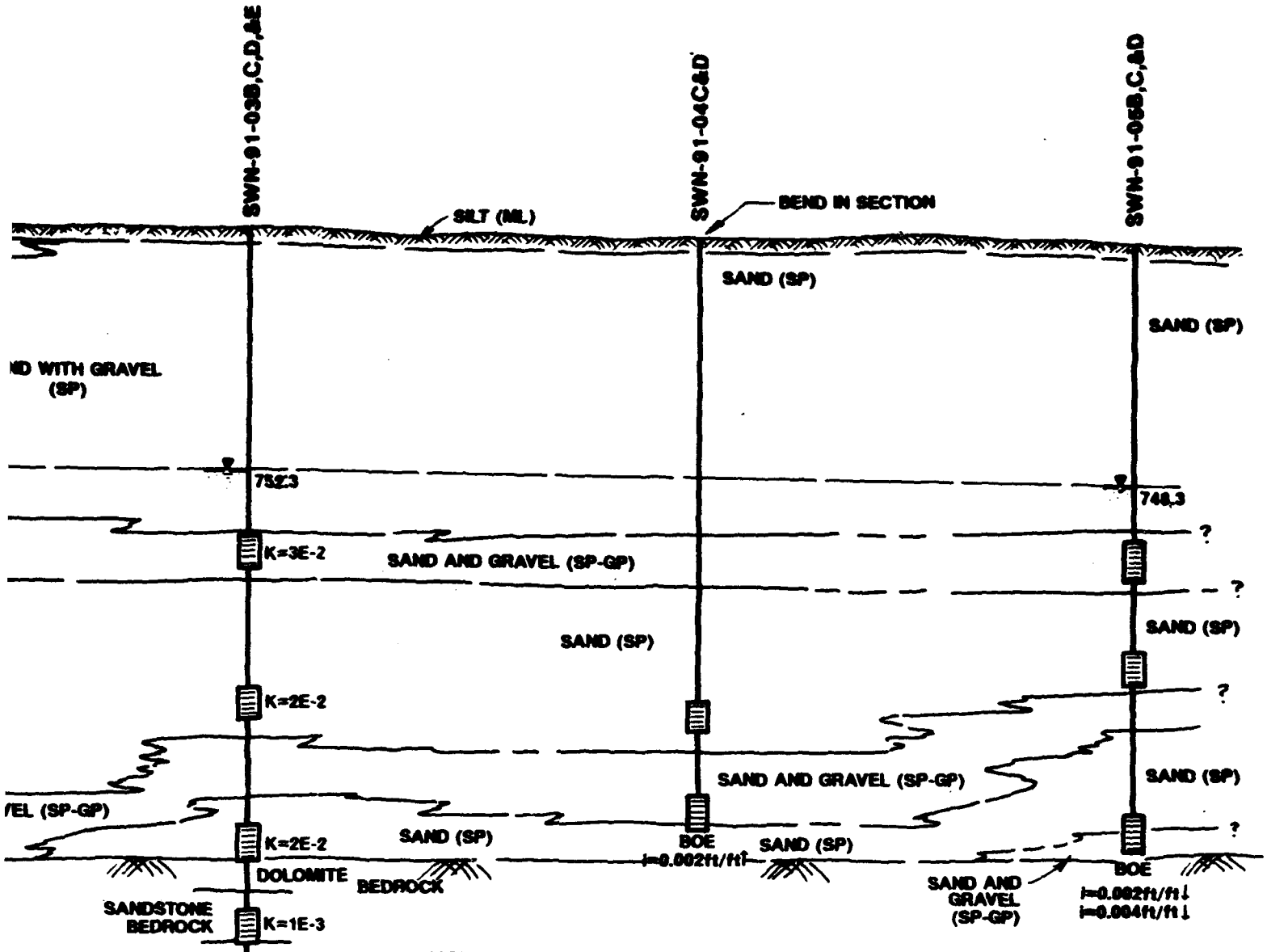


REFER

NOTES:

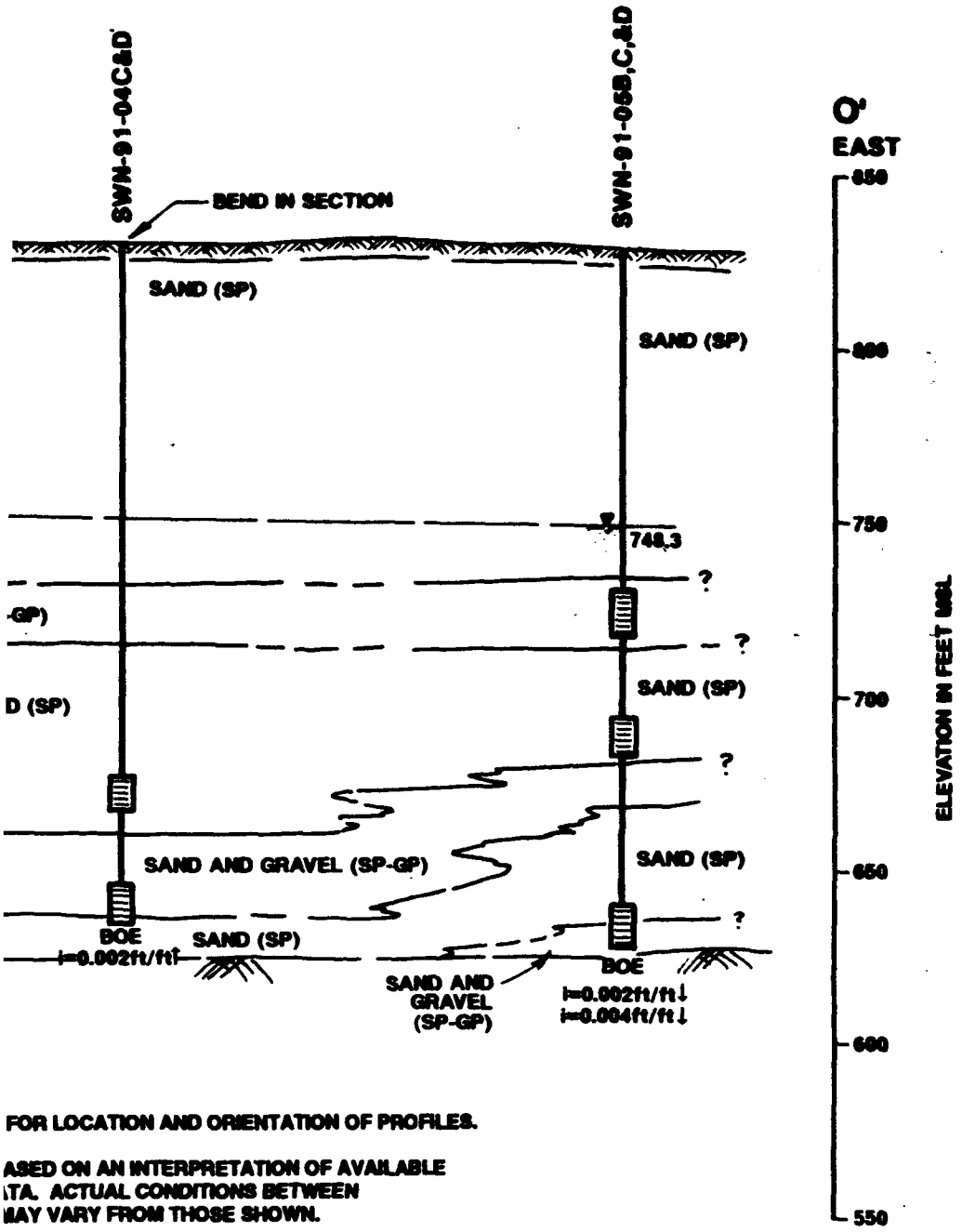
1. SEE FIGURE 11-3 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. ON MULTIPLE WELL NESTS, GRADIENTS ARE LISTED IN ORDER OF SHALLOW TO DEEP WELLS; B TO C, C TO D, AND D TO E.
4. WATER LEVELS MEASURED IN B-SERIES PIEZOMETERS ON 12/15/91 ARE LISTED.
5. BEDROCK SURFACE ELEVATION ESTIMATED FROM SWN-91-03D&E.

ESULT IN cm/sec

DIENT

FIGURE
GEOLOGIC CROSS SECTION
OFF-POST AREA SOUTH OF
REMEDIAL INVESTIGA
BADGER ARMY AMMUNITION P

ABB Environmental Servic



FOR LOCATION AND ORIENTATION OF PROFILES.

ASED ON AN INTERPRETATION OF AVAILABLE
ATA. ACTUAL CONDITIONS BETWEEN
MAY VARY FROM THOSE SHOWN.

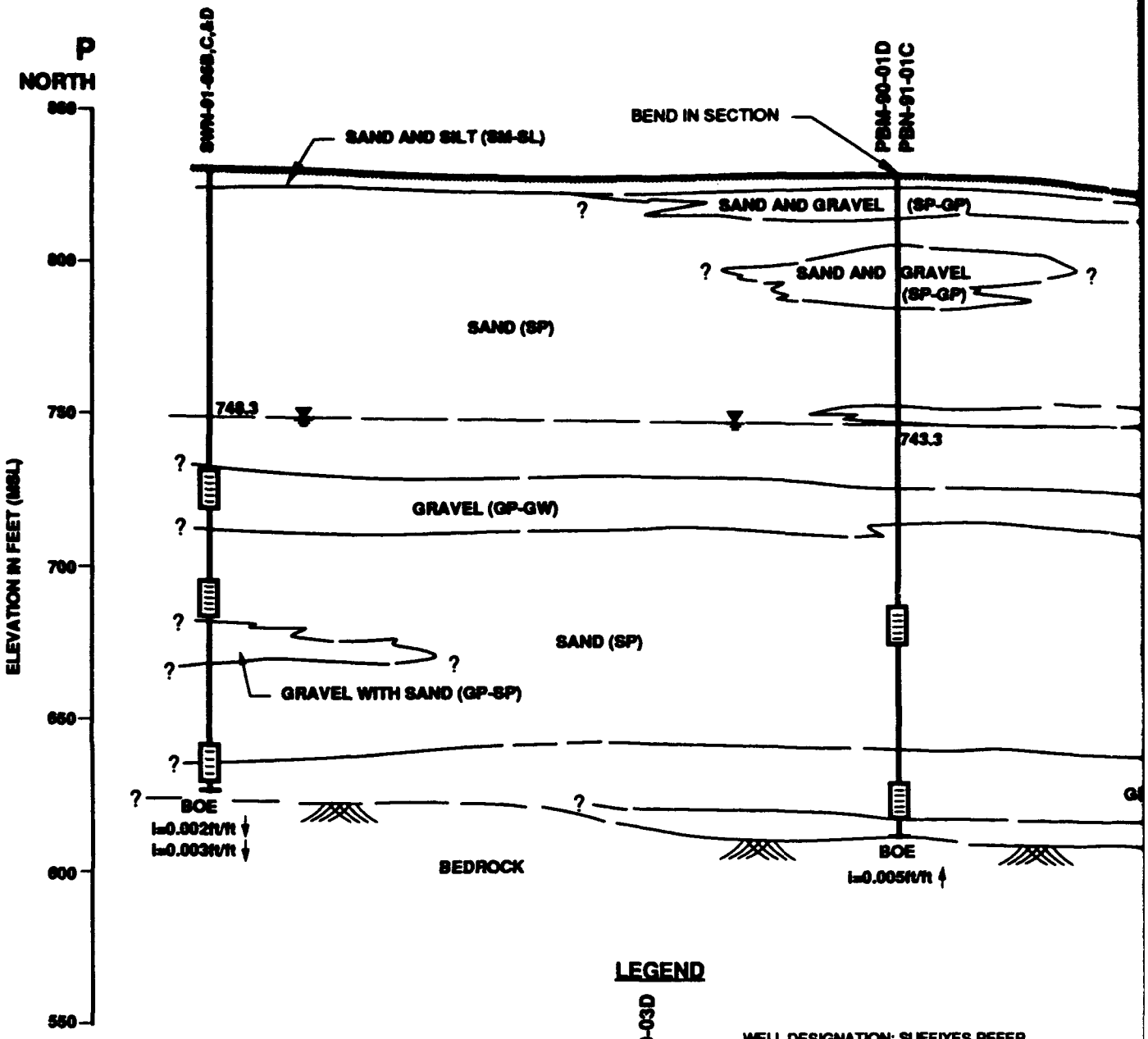
ELL NESTS, GRADIENTS ARE LISTED IN ORDER OF
EP WELLS; B TO C, C TO D, AND D TO E.

MEASURED IN B-SERIES PIEZOMETERS ON 12/15/91

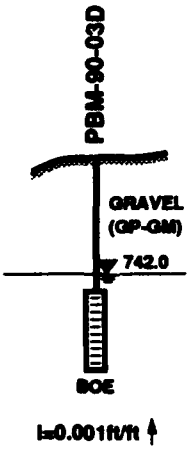
ACE ELEVATION ESTIMATED FROM SWN-91-03D&E.

FIGURE 11-4
GEOLOGIC CROSS SECTION O-O'
OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



LEGEND



WELL DESIGNATION; SUFFIXES REFER TO WATER TABLE WELL (A) AND PIEZOMETER (B&C)

GROUND SURFACE

SOILS DESCRIPTION AND USCS CLASSIFICATION

WATER TABLE ELEVATION

SCREENED INTERVAL

BOTTOM OF EXPLORATION

GROUNDWATER VERTICAL GRADIENT

NOTES:

1. SEE FIGURE 11-3 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91.

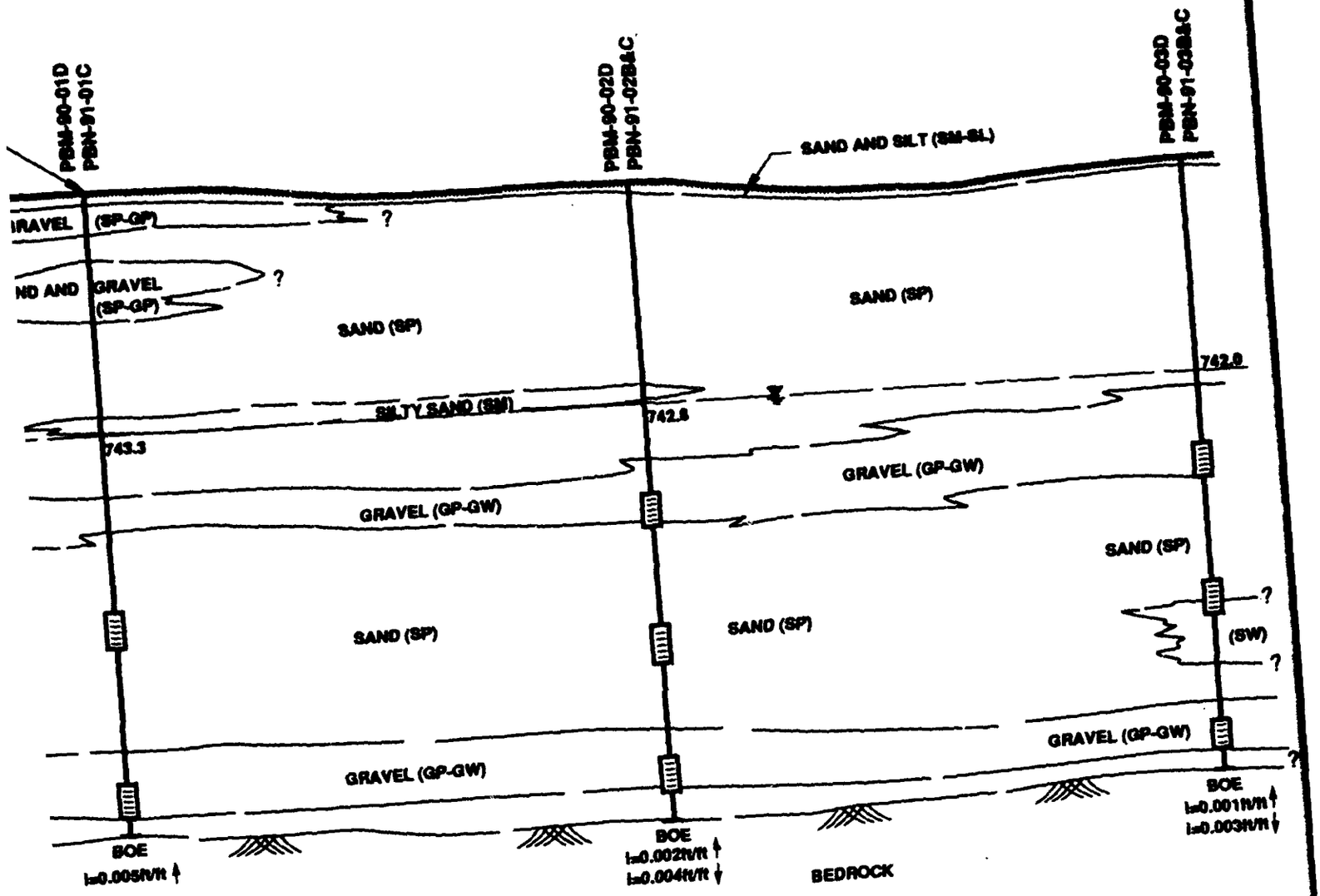
SCALE IN FEET

0 400 800

VERTICAL EXAGGERATON 1:8

9212021D

2



IGNATION: SUFFIXES REFER
I TABLE WELL (A) AND
ER (B&C)

SURFACE

ICRIPTION AND USCS
ATION

BLE ELEVATION

D INTERVAL

F EXPLORATION

WATER VERTICAL GRADIENT

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REMEDIAL INVE
BADGER ARMY AMMUNIT
ABB Environmenta

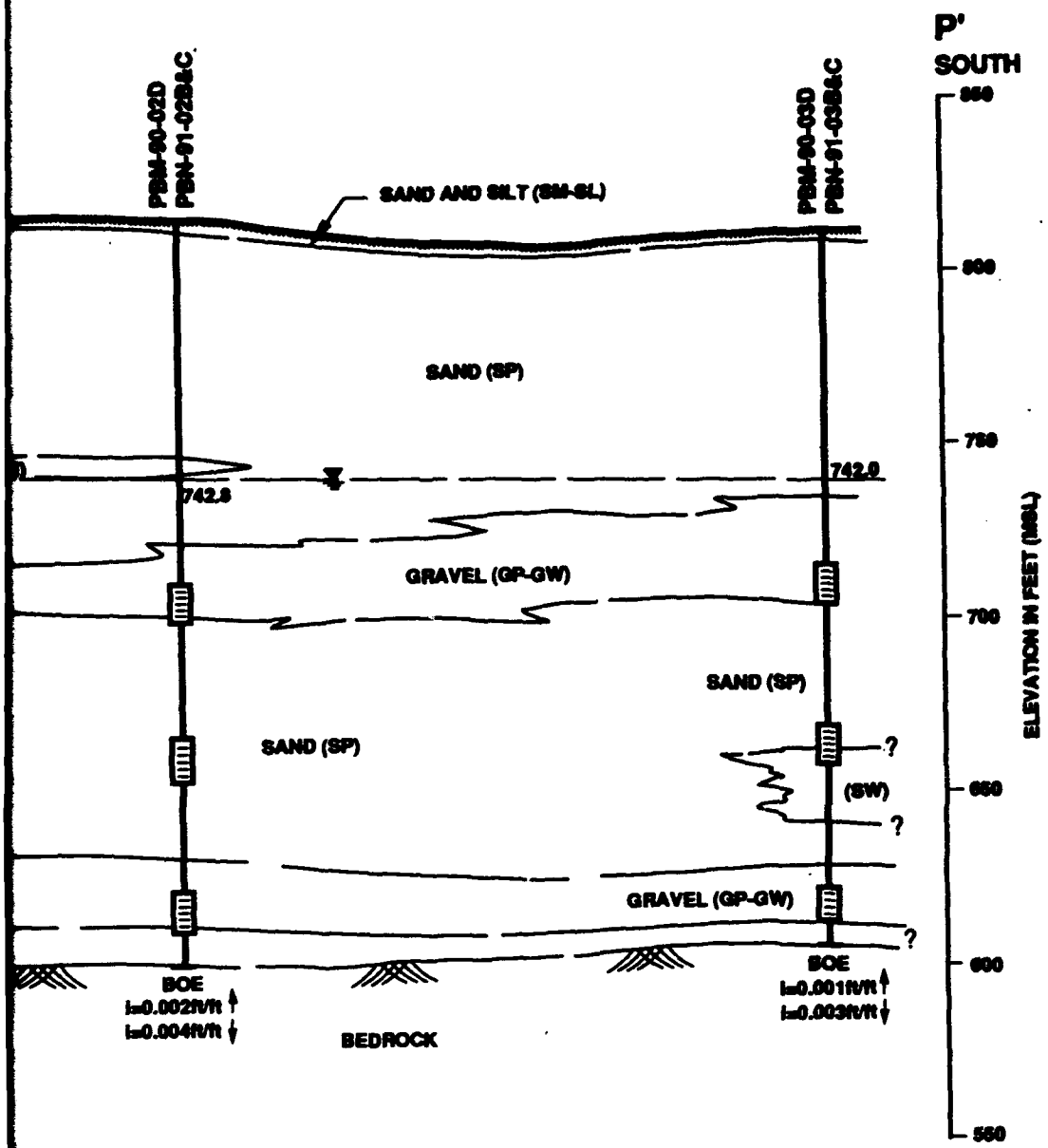
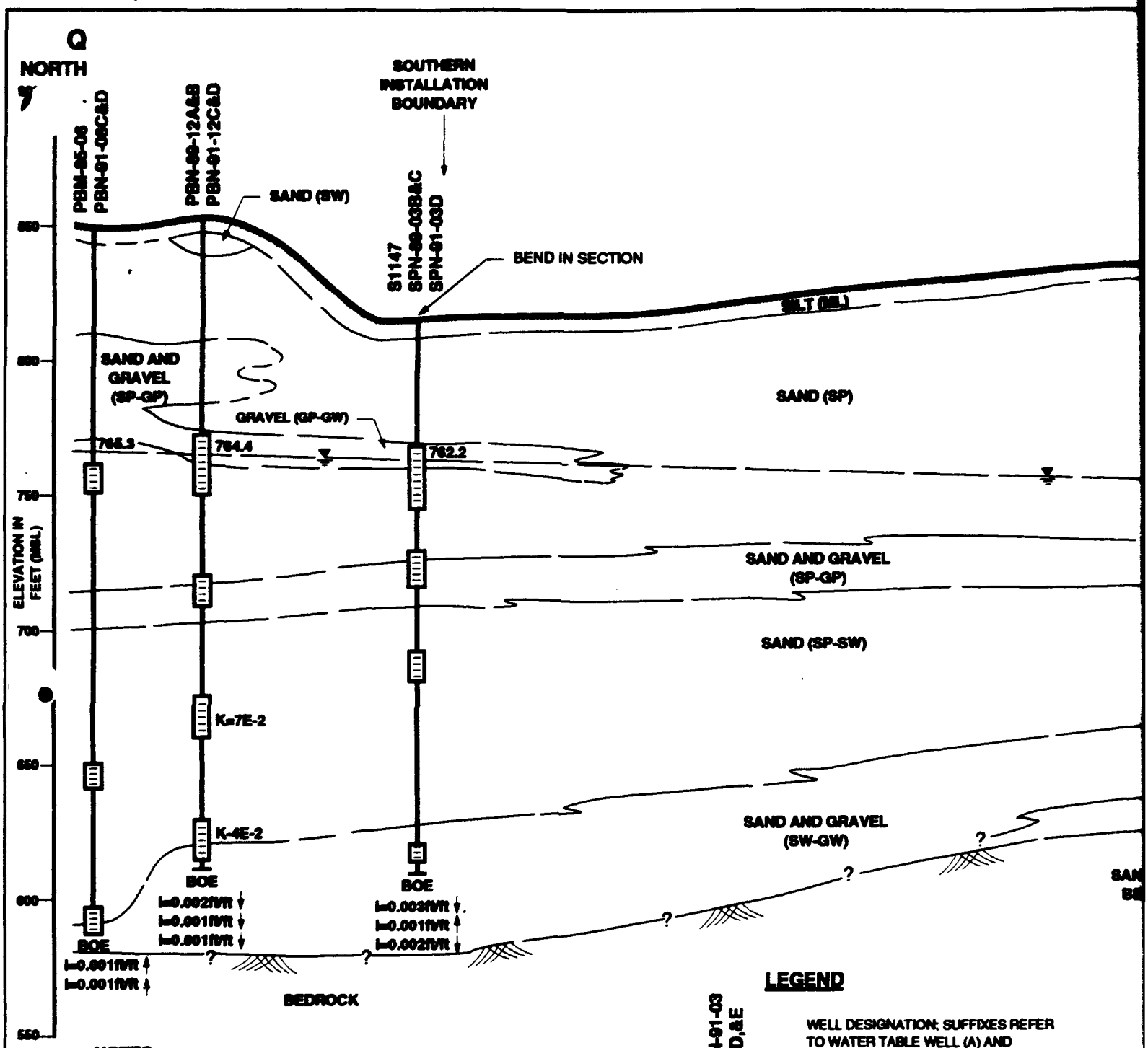


FIGURE 11-5
GEOLOGIC CROSS SECTION P-P'
OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.



NOTES:

1. SEE FIGURE 11-3 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. WATER LEVELS MEASURED IN WATER TABLE WELLS ON 12/15/91.

LEGEND

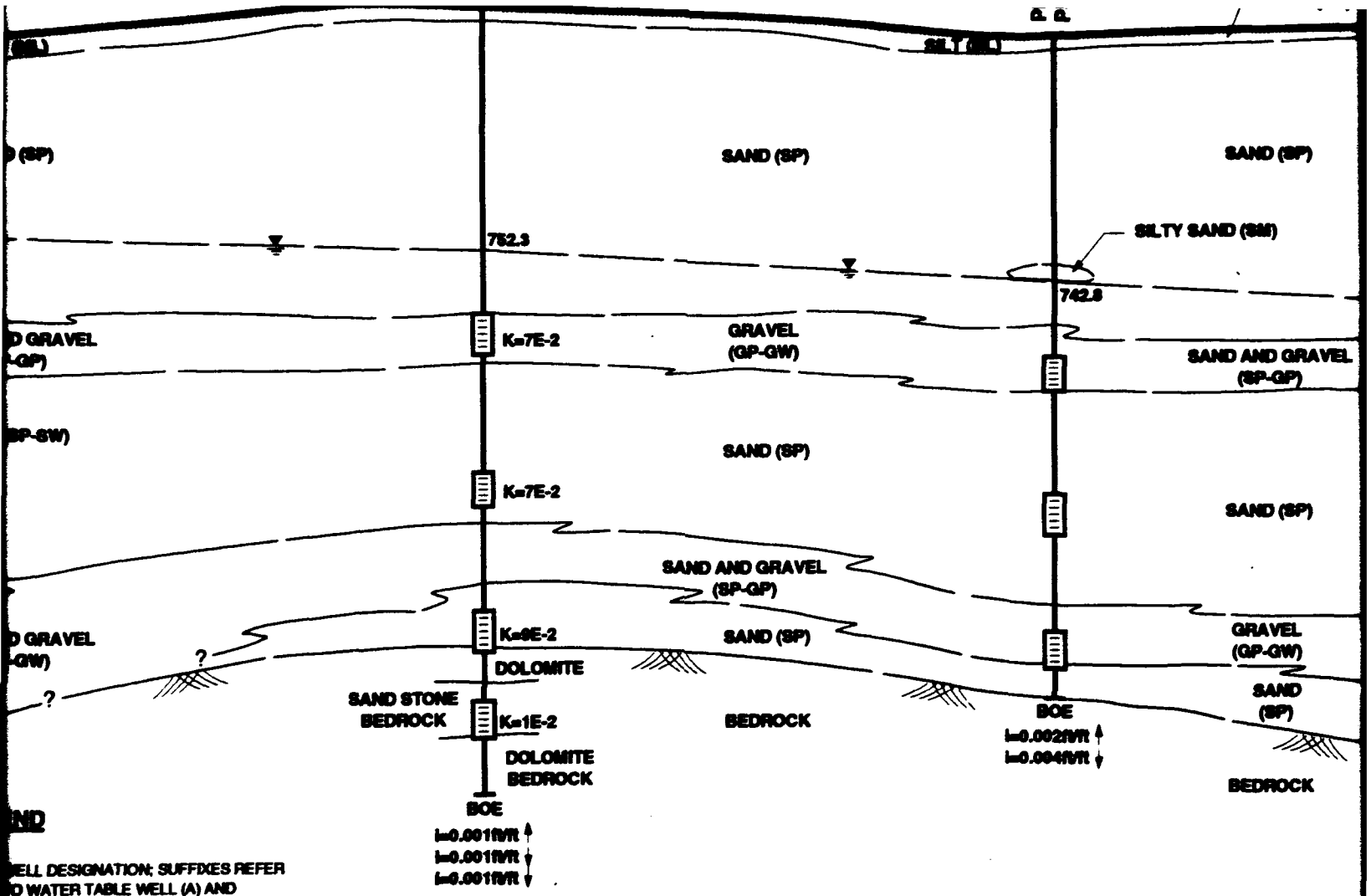
SWN-91-03 B,C,D,&E	WELL DESIGNATION; SUFFIXES REFER TO WATER TABLE WELL (A) AND PIEZOMETER (B&C)
	GROUND SURFACE
SAND (SP)	SOILS DESCRIPTION AND USCS CLASSIFICATION
752.3	WATER TABLE ELEVATION
	SCREENED INTERVAL
K=7E-2	IN-FIELD PERMEABILITY TEST RESULT IN cm/sec
BOE	BOTTOM OF EXPLORATION
I=0.001ft/ft	GROUNDWATER VERTICAL GRADIENT

SCALE IN FEET

0 1000 2000

VERTICAL EXAGGERATON 1:20

9212026D



IND

ELL DESIGNATION; SUFFIXES REFER
D WATER TABLE WELL (A) AND
IEZOMETER (B&C)

ROUND SURFACE

OILS DESCRIPTION AND USCS
LASSIFICATION

ATER TABLE ELEVATION

CREENED INTERVAL

N-FIELD PERMEABILITY TEST RESULT IN
m/sec

OTTOM OF EXPLORATION

ROUNDWATER VERTICAL GRADIENT

FIGUR
GEOLOGIC CROSS SECTIO
OFF-POST AREA SOUTH OF
REMEDIAL INVESTIG
BADGER ARMY AMMUNITION

ABB Environmental Serv

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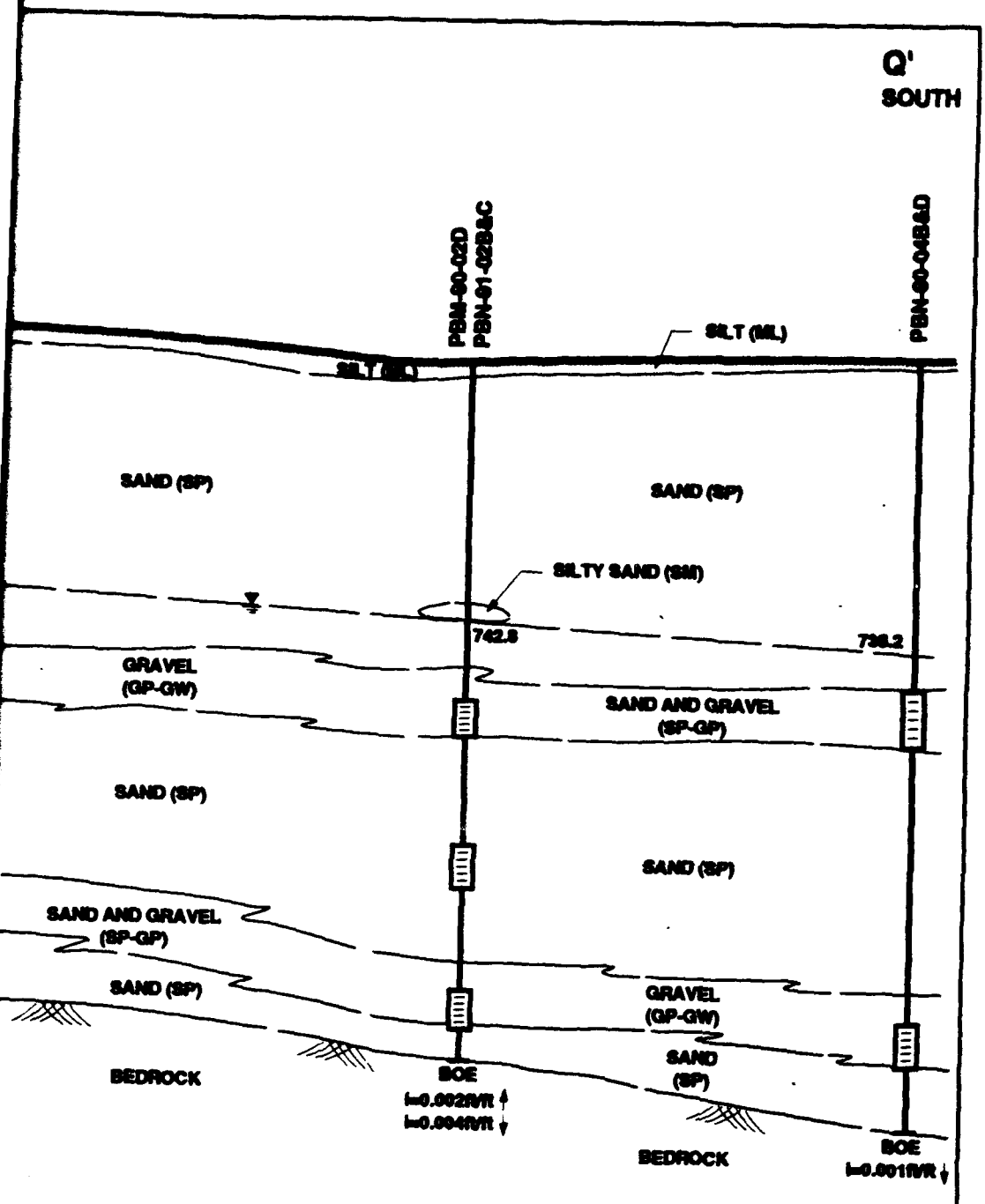

FIGURE 11-6
GEOLOGIC CROSS SECTION Q-Q'
OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

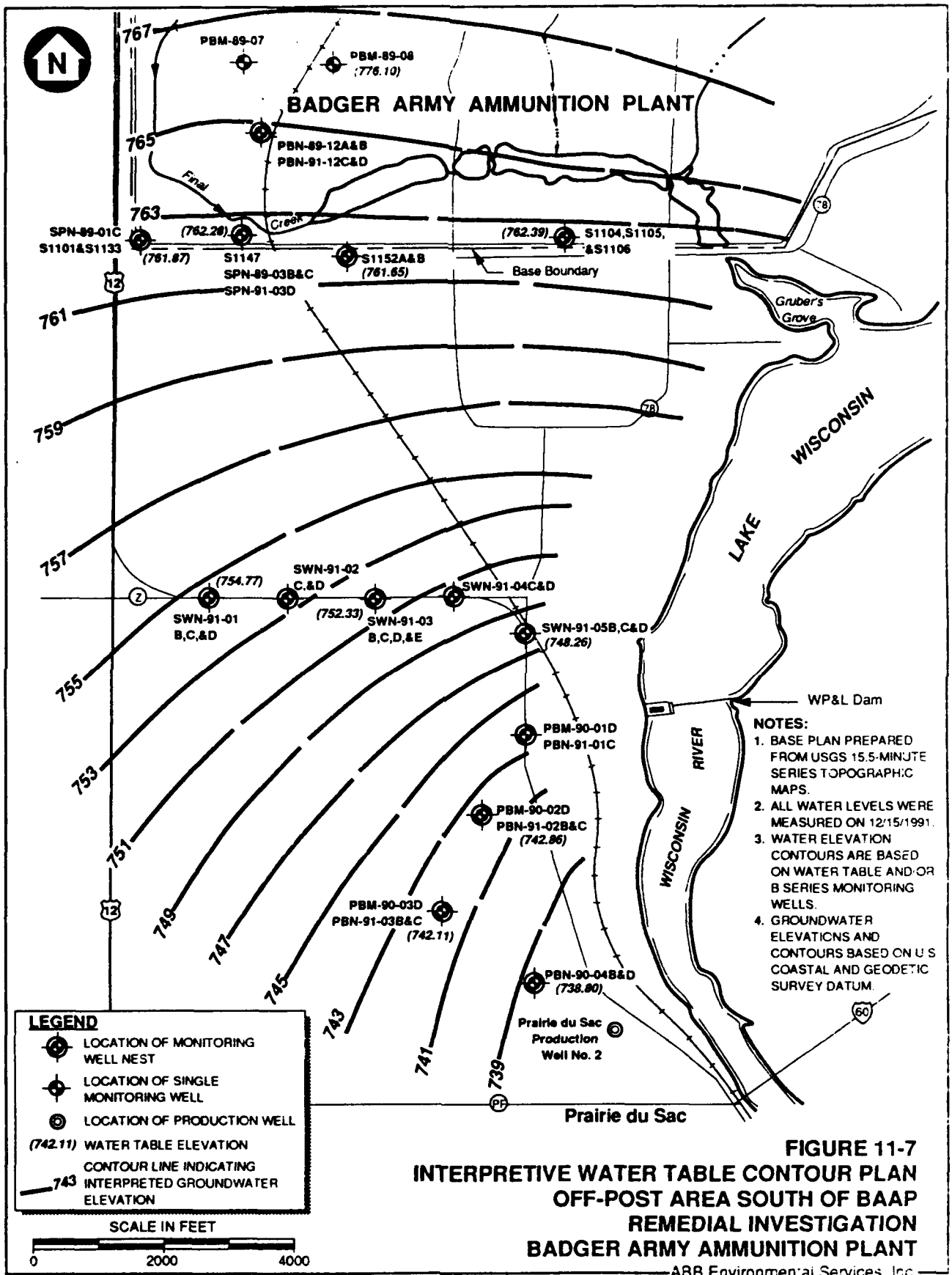

FIGURE 11-7
INTERPRETIVE WATER TABLE CONTOUR PLAN
OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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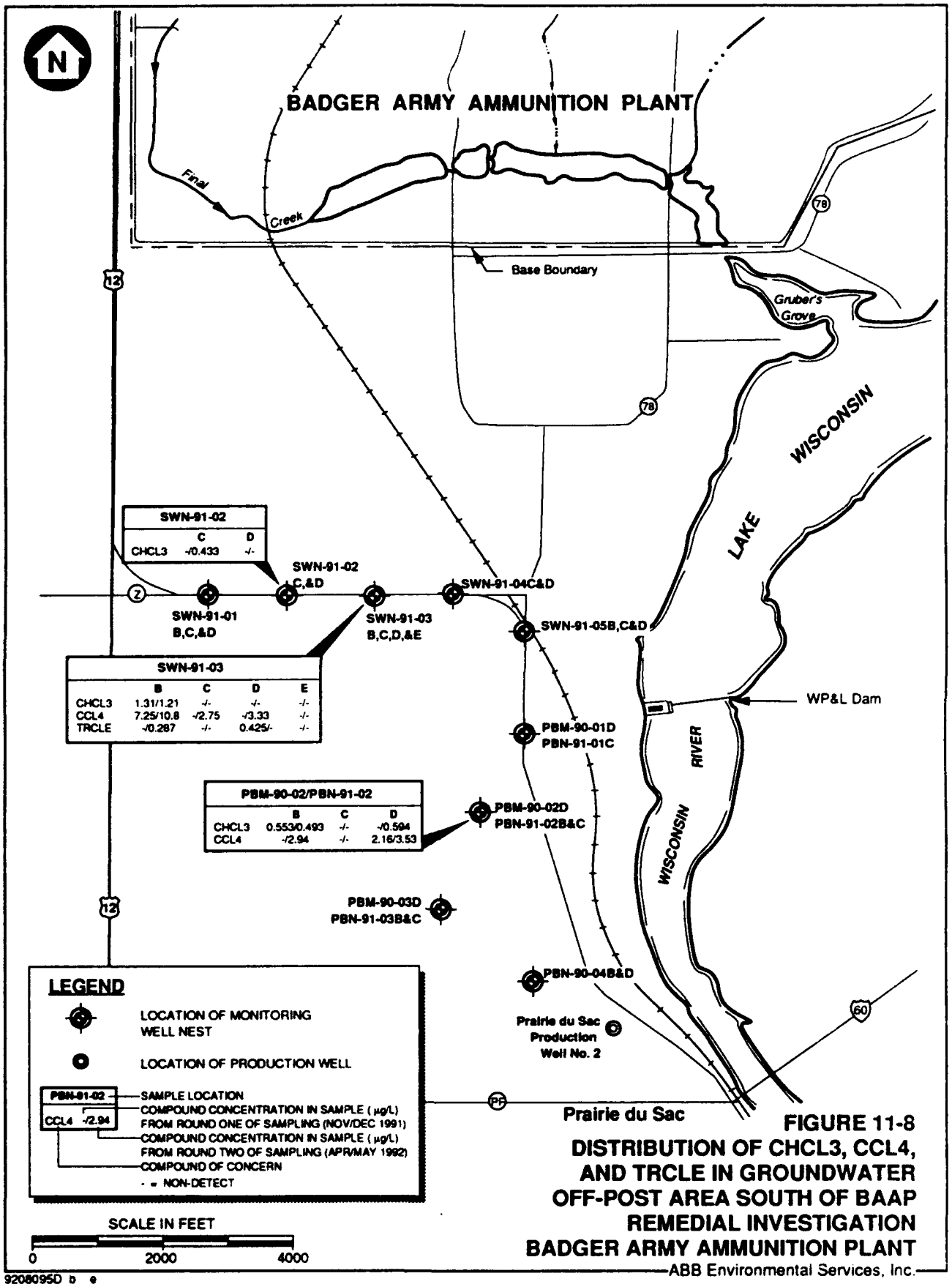
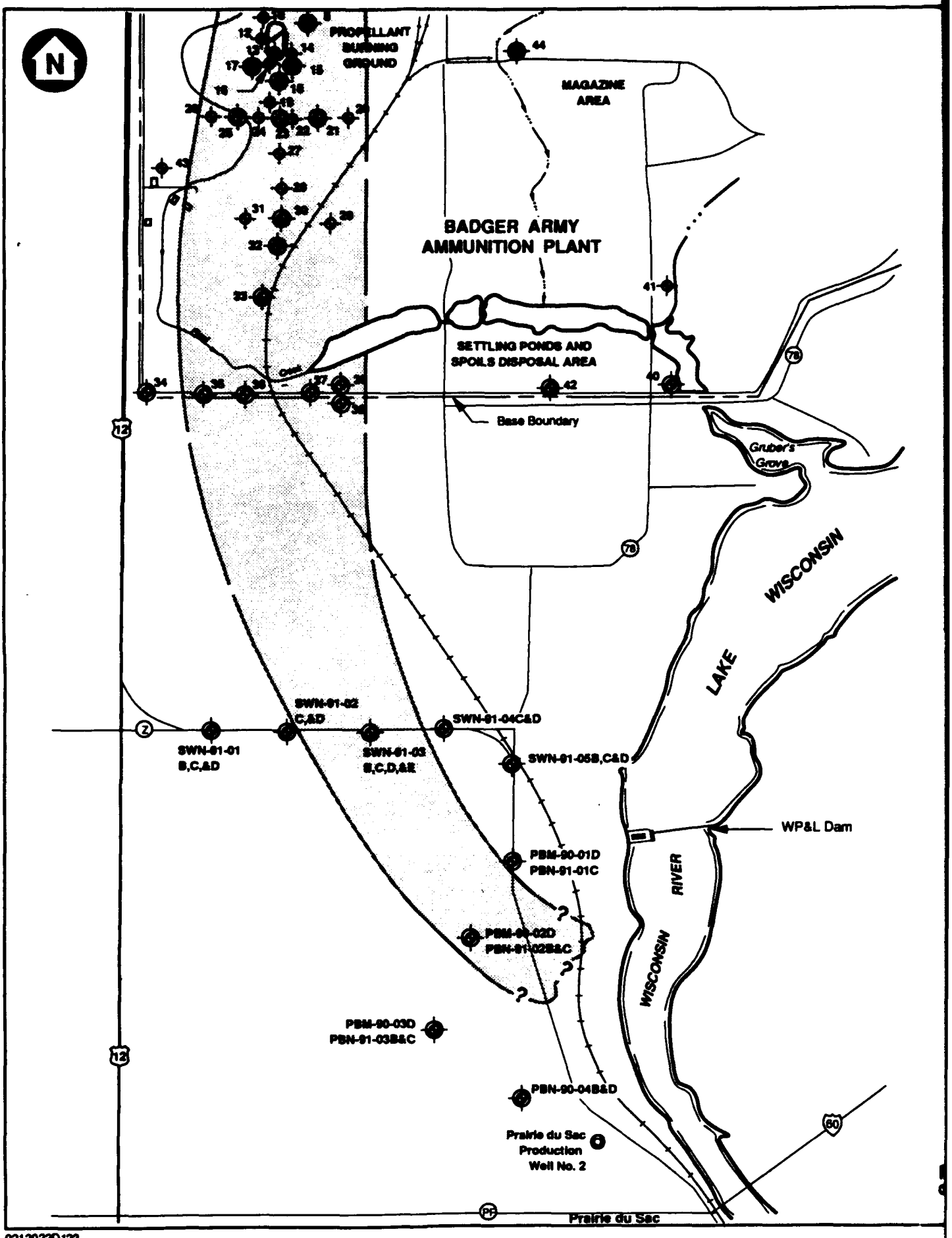


FIGURE 11-8
DISTRIBUTION OF CHCL3, CCL4, AND TRCLE IN GROUNDWATER OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

92080950 b



9212022D123

2

MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER
8	PBN-89-10A,B,C,&D	24	PBM-95-02	36	SPN-89-03A,B,&C
10	S1144	25	PBN-89-03B&C		SPN-91-03D
12	PBM-92-03		PBN-95-03A	38	SPN-89-03B&C
13	PBM-92-04	26	PBM-89-05		SPN-91-03D
14	PBM-92-05	27	PBM-95-04		S1147
15	PBN-92-05A,B,&C	28	PBM-95-05	37	SPN-89-04B&C
16	S1117	29	PBM-89-06		S1146, SPN-91-0
17	PBN-92-03A,B,&C	30	PBN-89-04B&C	38	S1102, S1103, S1
	S1145		PBN-95-04A	39	S1139A&B
18	PBN-92-04A,B,&C	31	PBM-89-07	40	SPN-89-05A&B
19	PBM-95-01	32	PBN-91-09C&D	41	S1110
20	PBM-89-08		PBM-95-06	42	S1104, S1105, S1
21	PBN-89-02B&C	33	PBN-89-12A&B	43	S1109
	PBN-95-02A		PBN-91-12C&D	44	S1115, S1116
22	PBM-95-03	34	SPN-89-01C		
23	PBN-89-01B,C,&D		S1101 & S1133		
	PBN-95-01A				

LEGEND

- LOCATION OF MONITORING WELL NEST
- LOCATION OF SINGLE MONITORING WELL
- LOCATION OF PRODUCTION WELL
- INTERPRETIVE EXTENT OF VOC PLUME

NOTE:

1. EXTENT OF VOC PLUME IS BASED ON DETECTI OF CHCL3, CCL4 AND TRCLE IN AT LEAST ONE ROUND OF SAMPLING.
2. SEE FIGURES 6-33 AND 6-34 FOR INTERPRETIVE PLAN VIEW OF PROPELLANT BURNING GROUNI LANDFILL 1, SETTLING PONDS AND SPOILS DISPOSAL AREA VOC PLUMES.
3. MONITORING WELL LOCATIONS BASED ON VIERBICHER SURVEY DATA (APPENDIX F).

SCALE IN FEET

0 1000 2000

INTERPRETIVE PLAN VIEW OF
PROPELLANT BURNIN
SETTLING PONDS, SPOILS DISP
AND OFF-POST AREA SOU
REMEDIAL INV
BADGER ARMY AMMUNI

ABB Environment

MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER	MAP CODE	WELL NUMBER
8	PBN-89-10A,B,C,&D	24	PBM-85-02	35	SPN-89-02A,B,&C
10	S1144	25	PBN-89-03B&C		SPN-91-02D
12	PBM-82-03		PBN-85-03A	36	SPN-89-03B&C
13	PBM-82-04	26	PBM-89-05		SPN-91-03D
14	PBM-82-05	27	PBM-85-04		S1147
15	PBN-82-05A,B,&C	28	PBM-85-05	37	SPN-89-04B&C
16	S1117	29	PBM-89-06		S1148, SPN-91-04D
17	PBN-82-03A,B,&C	30	PBN-89-04B&C	38	S1102, S1103, S1149
	S1146		PBN-85-04A	39	S1152A&B
18	PBN-82-04A,B,&C	31	PBM-89-07	40	SPN-89-05A&B
19	PBM-85-01	32	PBN-91-09C&D	41	S1110
20	PBM-89-06		PBM-85-06	42	S1104, S1105, S1106
21	PBN-89-02B&C	33	PBN-89-12A&B	43	S1109
	PBN-85-02A		PBN-91-12C&D	44	S1115, S1116
22	PBM-85-03	34	SPN-89-01C		
23	PBN-89-01B,C,&D		S1101 & S1133		
	PBN-85-01A				

LEGEND

LOCATION OF MONITORING WELL NEST

LOCATION OF SINGLE MONITORING WELL

LOCATION OF PRODUCTION WELL

INTERPRETIVE EXTENT OF VOC PLUME

NOTE:

1. EXTENT OF VOC PLUME IS BASED ON DETECTION OF CHCL3, CCL4 AND TRCLE IN AT LEAST ONE ROUND OF SAMPLING.
2. SEE FIGURES 6-33 AND 6-34 FOR INTERPRETIVE PLAN VIEW OF PROPELLANT BURNING GROUND, LANDFILL 1, SETTLING PONDS AND SPOILS DISPOSAL AREA VOC PLUMES.
3. MONITORING WELL LOCATIONS BASED ON VIERBICHER SURVEY DATA (APPENDIX F).

FIGURE 11-9
INTERPRETIVE PLAN VIEW OF VOC PLUME PROPELLANT BURNING GROUND, SETTLING PONDS, SPOILS DISPOSAL AREA AND OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

2000

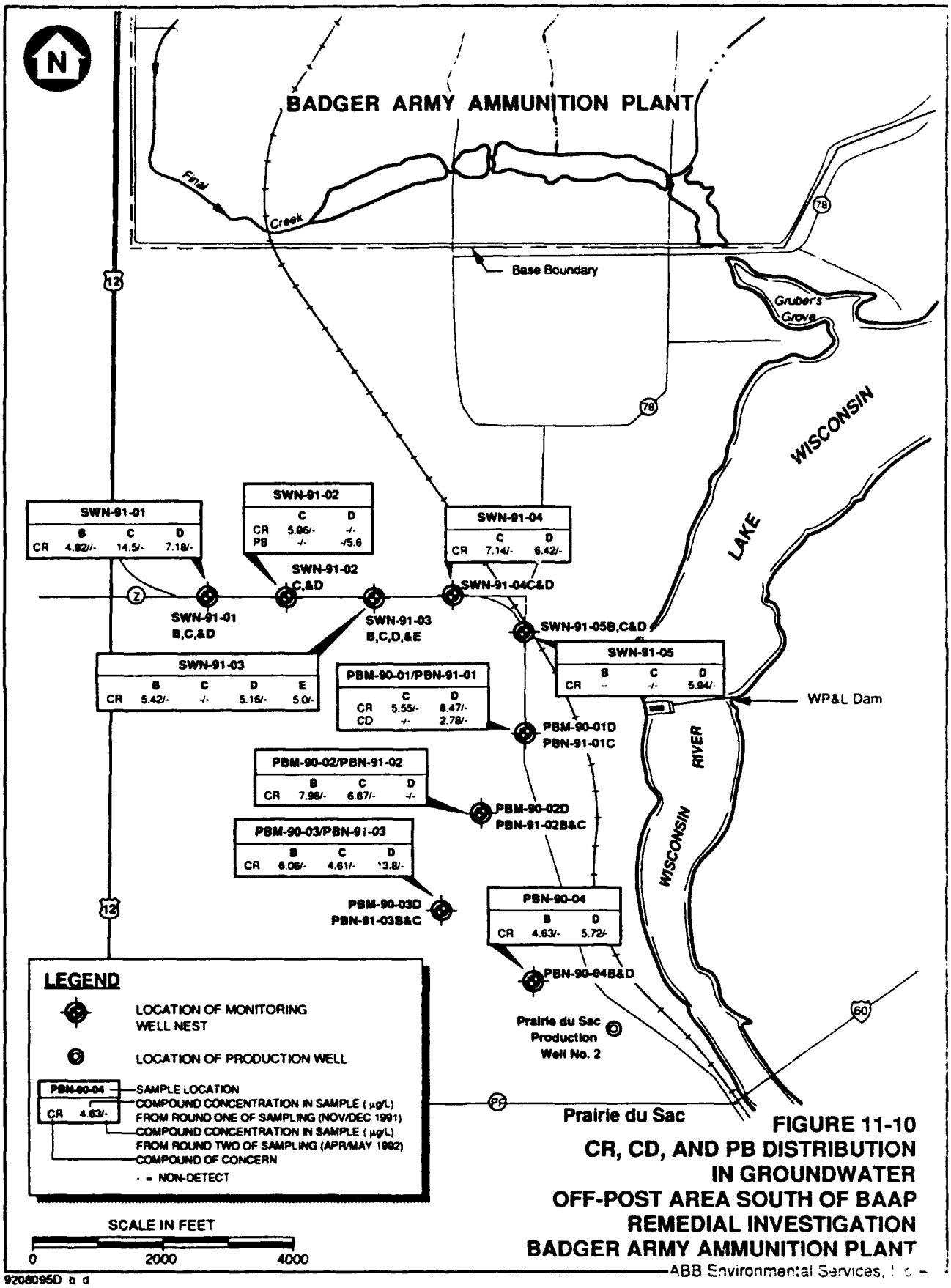


FIGURE 11-10
CR, CD, AND PB DISTRIBUTION IN GROUNDWATER
OFF-POST AREA SOUTH OF BAAP
REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

ABB Environmental Services, Inc.

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TABLE 12-1

SUMMARY OF AREAS FOR WHICH
REMEDIAL ACTION OBJECTIVES[1] ARE RECOMMENDED

REMEDIAL INVESTIGATION
BADGER ARMY AMMUNITION PLANT

AREA	MEDIUM (RECEPTOR)	COMPOUNDS
Propellant Burning Ground	Surface Soil (Human)	PB
	Surface Soil (Ecological)	PB[2], CU[2], HG[2], SE[2], ZN[2]
	Subsurface Soil (Human)	PB, 24DNT
Final Creek	Surface Soil (Ecological)	PB[2], SN, 24DNT, SO4, DPA
Settling Pond 1	Surface Soil (Ecological)	PB[2], SN, 24DNT, SO4, DEP
Settling Pond 2	Surface Soil (Ecological)	PB[2], SN, DEP
Settling Pond 3	Surface Soil (Ecological)	PB[2], SN
Settling Pond 4	Surface Soil (Ecological)	PB[2], SN, AL[2]
Spoils Disposal Area 1	Surface soil (Ecological)	PB[2], DPA, SN, NG, ZN[2]
Spoils Disposal Area 2	Surface Soil (Ecological)	PB[2], SN, ZN[2]
Spoils Disposal Area 3	Surface Soil (Ecological)	PB[2], SN, ZN[2]
Spoils Disposal Area 4	Surface Soil (Ecological)	PB[2], SN[2], ZN[2]
Spoils Disposal Area 5	Surface Soil (Ecological)	PB[2], SN[2], ZN[2]
Propellant Burning Ground/Settling Ponds	Groundwater (Human)	26DNT, CHCL3, BE, CCL4, TRCLE, NNDPA
Deterrent Burning Ground	Subsurface Soil (Human)	24DNT
Deterrent Burning Ground/Existing Landfill	Groundwater (Human)	26DNT, BE, 112TCE

continued

TABLE 12-1

SUMMARY OF AREAS FOR WHICH REMEDIAL ACTION OBJECTIVES[1] ARE RECOMMENDED

REMEDIAL INVESTIGATION BADGER ARMY AMMUNITION PLANT

AREA	MEDIUM (RECEPTOR)	COMPOUNDS
Nitroglycerine Pond	Surface Soil (Human)	PB
	Surface Soil (Ecological)	PB[2], HG[2], NG
	Sediment (Ecological)	PB, HG
	Surface Water (Ecological)	AL, FE, HG, MN, PB
Rocket Paste Area	Surface Soil (Human)	PB,NG
	Surface Soil (Ecological)	24DNT, 26DNT, NNDPA, PB[2], CR[2], HG[2], NG
	Sediment (Ecological)	PB
	Surface Water (Ecological)	AL, CR, CU, FE, MN, PB, ZN
Off-Post Wells South of BAAP	Groundwater (Human)	CCL4

Notes:

1 The aim of the Remedial Action Objective should be to reduce contact with or concentrations of the compounds listed for a specific media at a site.

2 Compounds whose risk-based PRGs are within naturally-occurring mean surface soil background concentrations.