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Long-Term Monitoring 2008 Data Summary Report

**Watervliet Arsenal
Watervliet, New York**

February 2009



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Report Prepared For:

U.S. Army Corps of Engineers

Baltimore District
Baltimore, Maryland
Contract No. W912DR-05-D-0004

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**MALCOLM
PIRNIE**

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1. Introduction

1.1. Purpose

Malcolm Pirnie, Inc. (Malcolm Pirnie) has been retained by the Baltimore District of the US Army Corps of Engineers (USACE) to implement the Long-Term Monitoring Plan (LTM Plan) for the Watervliet Arsenal (WVA) in Watervliet, New York. Long-term monitoring is being conducted at the WVA in support of investigations and corrective measures that have been conducted at the WVA under a United States Environmental Protection Agency (USEPA) Administrative Order on Consent (Docket No. II RCRA-3008(h)-93-0210). In accordance with the LTM Plan and its subsequent approved modifications, the purpose of this report is to summarize the data collected during the May and October 2008 monitoring events at the WVA.

1.2. Facility Description

The WVA encompasses approximately 140 acres in and around the City of Watervliet, New York, approximately 3.5 miles northeast of the City of Albany (Figure 1-1). To the east of the WVA, Broadway Street and a six-lane interstate highway (I-787) separate the WVA from the Hudson River. To the west, the WVA extends beyond the limits of the City of Watervliet into the Town of Colonie. Residential areas border the WVA to the north and south.

The WVA consists of two primary areas: (1) The "Main Manufacturing Area" (MMA), where manufacturing and administrative operations occur, comprises about 125 acres, and, (2) The "Siberia Area" (SA), which is chiefly used for the storage of raw and hazardous materials, comprises about 15 acres. These areas are shown on Figure 1-2.

1.3. Previous and Ongoing Studies

1.3.1. Main Manufacturing Area

Several environmental studies have been conducted at the MMA of the WVA. The most comprehensive investigation, an RFI, was conducted by MPI and Louis Berger & Associates, Inc. from 1995 to 1998. Previous investigations are summarized in the RFI. Two ICM studies involving in-situ groundwater remedial techniques were conducted at the MMA in the area of Buildings 25 and 40 between 2001 and 2003. Final corrective measures, in the form of in-situ chemical oxidation, were conducted at Building 40 from 2004 through 2007 in accordance with the Corrective Measures Work Plan – Building 40 Groundwater, dated July 2004 (Malcolm Pirnie, 2004). Monitoring of the wells in the Building 40 area was conducted separately under the Corrective Measures Monitoring

Plan, Building 40 Groundwater, dated August 2004 (Malcolm Pirnie, 2004a) (CMMP) during that time.

1.3.2. Siberia Area

An RFI was conducted by Malcolm Pirnie at the Siberia Area from 1994 to 1995. Additional investigations and ICMs were completed by Malcolm Pirnie from 1996 to 2002. The CMS Report for Siberia was approved in August 2003. The CMS Certification Report was approved by the NYSDEC and USEPA in 2007. The ICMs are summarized in the CMS report.

1.4. Generalized Site Geology and Hydrogeology

1.4.1. Main Manufacturing Area

The major overburden unit identified in the MMA is fill, consisting of brown or dark gray silty sand with angular gravel. The fill material is the only unit consistently found throughout the site, with the thickest amount of fill being in the eastern portion of the MMA. Underlying the fill are the following native overburden units: a fine-grained alluvium, a coarser alluvium, and glacial till. These units are not present in all areas of the site.

The bedrock underlying the site is a black, medium-hard laminated shale, showing some characteristics of minor metamorphism. This shale is part of the Snake Hill Formation. The bedrock can be described in three ways based on the degree of weathering observed. The first is an extremely weathered zone approximately four feet thick. This extremely weathered bedrock unit was encountered at depths ranging from near ground surface to approximately 20 feet below ground surface (bgs). Beneath this extremely weathered bedrock is a zone of less weathered shale showing minimal competency. Competent bedrock is generally encountered at depths ranging from approximately 1.5 feet bgs to 18 feet bgs.

The majority of the MMA is relatively impervious to rainfall except at the residential and recreational areas of the northeastern portion of the WVA. Due to the shallow depth of bedrock and the limited amount of overburden in several areas of the WVA, groundwater is encountered within different geologic units (overburden, weathered bedrock, or bedrock) depending on the location. For instance, groundwater is encountered in the bedrock at the western end of WVA (topographic high and local recharge area); progressing eastward toward the Hudson River, groundwater is encountered in the weathered bedrock and then in the overburden deposits.

Groundwater flow in bedrock in the MMA is primarily controlled by the degree of fracturing within the bedrock itself and in the local recharge area, which is coincident with a topographic high along a bedrock ridge in the central portion of the facility. The most prominent feature on the potentiometric surface is a groundwater divide trending

approximately north to south through Buildings 135 and 125. This feature appears to mirror the bedrock ridge. The primary discharge area for groundwater from the Main Manufacturing Area is the Hudson River, which is located to the east of WVA. For the area surrounding Building 25, groundwater in each of the hydrostratigraphic units flows from west to east towards the Hudson River, with a component of flow to the northeast. In the Building 40 area, groundwater in the bedrock unit flows to the east-southeast. West of the groundwater divide, shallow groundwater flow discharges toward the Kromma Kill.

1.4.2. Siberia Area

According to the "Surficial Geologic Map of New York - Hudson-Mohawk Sheet, 1987", a majority of the SA is underlain by recent alluvial deposits. These are defined as fine sand and gravel deposits overlain by silt. The SA, which is at a lower elevation than the MMA of the WVA located to the east, is generally underlain by a layer of fill (sand, shale fragments, slag, cinders, brick, wire, wood and concrete). Alluvium, lenses of peat, and lacustrine clay deposits were encountered beneath the layer of fill material. Bedrock beneath the SA is also the Snake Hill shale. During the SA investigation, highly weathered shale was encountered from approximately 3.5 feet bgs to 31 feet bgs. In general, competent bedrock was encountered at approximately 12 feet bgs. The upper portion of the competent bedrock was found to be fissile and highly fractured with 45 to 60 degree bedding planes.

Groundwater flows generally to the north-northwest in the NE Quadrant of the SA, and generally to the west across the remainder of the SA. The water table responds quickly to recharge events, and during times of low precipitation the water table may be present in the shale bedrock over portions of the SA. However, on the average, the water table is encountered in the overburden. Surface water in the SA that does not infiltrate is generally directed into the existing storm sewers. The WVA storm sewers are connected to the City of Watervliet storm sewer network.

2. Field Sampling

2.1. Sampling Dates and Methods

Monitoring of all wells included in the LTM Plan was conducted at the WVA from May 12 through May 16, May 19 through May 23, May 27 through May 28, and October 28 through 31, 2008. Monitoring wells currently sampled as part of the LTM are listed in Tables 2-1 and 2-2 and shown on Figures 2-1 and 2-2. With the exception of the reactive wall monitoring wells, groundwater sampling was conducted according to the USEPA protocol for Low Stress (Low Flow) Purging and Sampling (USEPA, 1998) using dedicated, permanent, bladder pumps installed in each of the wells included in the LTM Plan. In accordance with the USEPA letter dated September 20, 2002 (USEPA, 2002), the reactive wall monitoring wells were sampled using Passive Diffusion Bag (PDB) samplers. Water levels were measured in all wells (including those not included in the LTM Plan) at the site prior to groundwater sampling.

In accordance with the LTM Plan and LTM Plan Update (Malcolm Pirnie, 2008), and with the exception of the above mentioned reactive wall wells, groundwater samples were analyzed by Alpha Woods Hole Labs, a New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP)-certified laboratory, for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), dissolved sulfide, dissolved organic carbon (DOC), and dissolved gases. Samples collected from reactive wall wells were analyzed for VOCs only. Additional laboratory analyses, including RCRA-listed metals, were also performed at select locations listed in the LTM Plan Update. Beginning with the May 2008 monitoring event, ASP Category B deliverables and data validation were no longer required for samples collected as part of the LTM program. Field parameters, consisting of temperature, pH, specific conductivity, dissolved oxygen, oxidation-reduction potential, and turbidity were measured during purging using a Horiba U-22 water quality meter equipped with a flow-through cell. Additional field parameters, consisting of ferrous iron, nitrate, nitrite, sulfate, chloride, and alkalinity, were measured at each location in SA area wells (excluding the reactive wall wells) and select wells in the MMA area using Hach®-brand field analysis kits. Sampling methods, specific analytical methods, and sampling locations are discussed in detail in the LTM Plan. Purge logs for the May and October 2008 monitoring events are presented in Appendix A. Analytical laboratory reporting forms for the May and October 2008 monitoring events are presented in Appendix B.

2.2. Sampling Summary

In accordance with the LTM Plan, a total of 35 MMA wells and 32 SA wells (including four sewer monitoring points) were scheduled for sampling during the May 2008 monitoring event. During the October 2008 monitoring event, a total of eight MMA wells were scheduled for sampling. However, some wells either were not sampled or were sampled for limited analytical parameters during the monitoring event. Table 2-3 summarizes the monitoring wells that were not sampled for all or some parameters during the May and October 2008 monitoring events. As shown in Table 2-3, one monitoring well in the MMA and three monitoring wells in the SA were not sampled during the May 2008 monitoring event. All wells scheduled for sampling during the October 2008 monitoring event were sampled.

Seven SA wells (WVA-SA-MW-78 through WVA-SA-MW-84) were added to the LTM Plan in 2005 and are sampled annually as part of the May monitoring event to monitor the bedrock groundwater quality in the vicinity of the former burn pit. Monitoring well WVA-SA-MW-78, which is located in the vicinity of the former burn pit, contained potassium permanganate (KMnO₄) (remaining from the bedrock chemical oxidation pilot that was conducted in 2002) at the time of sampling and was not sampled.

3. Sampling Results

3.1. Groundwater Flow

Groundwater elevations measured prior to sampling in May and October 2008 are presented in Table 3-1. Groundwater elevations measured during previous LTM events are also summarized in Table 3-1.

3.1.1. Main Manufacturing Area

Potentiometric contour maps for the first water bearing unit at the MMA in May and October 2008 are presented in Appendix C. As shown in Appendix C, groundwater flow patterns at the MMA in May and October 2008 are similar to those documented during the MMA RFI and previous LTM events, as groundwater levels at the MMA do not vary significantly from season to season.

3.1.2. Siberia Area

Potentiometric contour maps for the overburden and bedrock units at the SA in May and October 2008 are also presented in Appendix C. As shown on the maps, with the exception of overburden flow in the southeastern portion of the SA, groundwater flow patterns in both the overburden and bedrock were similar to those observed during previous monitoring events. Though the reactive walls cause local anomalies, the groundwater flow paths in the overburden indicate that groundwater from the former burn pit area (the VOC source area) is being directed through the reactive walls.

3.2. Main Manufacturing Area Analytical Results

Analytical results for MMA long-term monitoring groundwater samples are summarized on Figures 3-1A and 3-2A (May 2008) and Figures 3-1B and 3-2B (October 2008). Summary tables presenting results for each MMA well sampled during LTM are presented in Appendix D.

3.2.1. VOCs and SVOCs

Figures 3-1A and 3-1B summarize exceedences of NYSDEC Class GA standards for groundwater samples collected from the MMA LTM monitoring wells in the May and October 2008 LTM sampling events, respectively. Figures 3-2A and 3-2B summarize exceedences of NYSDEC Class GA standards for May and October 2008 samples, respectively, collected in the Building 25 area of the MMA. As shown on Figures 3-1A and 3-2A, NYSDEC Class GA standards for VOCs were exceeded in samples collected from 10 of the 35 MMA LTM monitoring wells sampled during the May monitoring

event. Figures 3-1B and 3-2B show that NYSDEC Class GA standards for VOCs were exceeded in samples collected from seven of the eight MMA LTM monitoring wells sampled during the October monitoring event. NYSDEC Class GA standards for SVOCs were not exceeded in any samples collected from the MMA long-term monitoring wells during the May 2008 monitoring event, with the exception of the sample from WVA-B35-PW-1, for which the NYSDEC Class GA guidance value for chrysene (0.002 micrograms per liter [$\mu\text{g/L}$]) was exceeded (0.44 $\mu\text{g/L}$). Consistent with results from previous monitoring events, VOC concentrations in MMA groundwater samples exceeded Class GA standards in three general areas:

- East of Building 25;
- In the area of Buildings 121/116; and
- East of Building 20.

3.2.2. Data Trends

Due to the spatial and geological separation between the areas of concern in the MMA long-term monitoring program, analysis of trends in concentrations of parameters over the entire MMA is not feasible. However, trends in total contaminant concentrations in samples collected from representative monitoring wells in the areas of concern discussed above have been utilized to evaluate variations in groundwater conditions.

3.2.2.1. VOCs

Figures 3-3 and 3-4 present trends in total chlorinated VOC concentrations in groundwater samples collected from the following representative LTM wells located in the listed areas of concern.

- 86EM-SP-1A, 25-MW-2, 25-MW-3, and 25-MW-7: Building 25 Area.
- MW-121S: Building 121 Area.
- AW-MW-35: Building 20 Area.

3.2.2.2. Building 25

As shown on Figure 3-3, generally decreasing trends in total chlorinated VOC concentrations are evident in samples collected from monitoring wells WVA-25-MW-2 and WVA 25 MW-7. These trends are likely associated with the Hydrogen-Release Compound (HRC©) ICM pilot study at Building 25. Trends in total chlorinated VOC concentrations in samples collected from monitoring well 86EM-SP-1A (stable) do not appear to have been affected by the HRC ICM pilot study, while data from the last two years from monitoring well WVA-25-MW-3 suggest a potential downward trend in total chlorinated VOC concentrations.

3.2.2.3. Building 121 and 20

As shown on Figure 3-4, the generally decreasing trends in total chlorinated VOC concentrations evident in samples collected from monitoring wells WVA-AW-MW-35, and WVA-MW-121S continued in 2008 and are likely the result of ongoing natural attenuation processes. The increase in total chlorinated VOCs in WVA-MW-121S observed in 2007 appears to be anomalous based on 2008 data.

3.3. Siberia Area Analytical Results

3.3.1. VOCs and SVOCs

Figure 3-5 summarizes exceedances of NYSDEC Class GA standards for groundwater samples collected from SA monitoring wells during the May 2008 LTM event. In accordance the NYSDEC letter dated December 6, 2006, SA monitoring wells are no longer sampled in October. As shown on Figure 3-5, NYSDEC Class GA standards for VOCs were exceeded in groundwater samples from nine of the 32 SA LTM wells sampled during the May 2008 monitoring event. NYSDEC Class GA standards for SVOCs were not exceeded in any of the groundwater samples collected from SA long-term monitoring wells during the May 2008 event. The number of samples containing VOCs and SVOCs at concentrations that exceed NYSDEC Class GA standards in the SA have been generally decreasing since the April 2000 sampling event.

Consistent with results from previous monitoring events, VOC concentrations in SA groundwater samples generally exceeded Class GA standards only in the area of the former burn pit and in monitoring wells up-gradient of the reactive walls.

3.3.2. Reactive Wall Sampling

In accordance with the NYSDEC letter dated December 6, 2006, the 14 wells between Siberia Reactive Walls A and B and the six wells within the walls were removed from the LTM Plan in 2007. As discussed in Section 2.1, the reactive wall monitoring wells (SA-MW-49, 54, 59, 60, 66, 70, 76, and 85) were sampled using PDB samplers in accordance with the USEPA letter dated September 20, 2002 and analyzed for VOCs only.

3.3.3. Data Trends

Figure 3-6 presents total chlorinated VOC concentrations in wells up-gradient of reactive wall A and down-gradient of reactive wall B. As shown on Figure 3-6, total chlorinated VOC concentrations in both up-gradient and down-gradient reactive wall monitoring wells have decreased since the beginning of long-term monitoring. These trends indicate that the ICMs at the former burn pit and the reactive wall are successfully reducing total chlorinated VOC concentrations up-gradient and down-gradient of the reactive wall, respectively. Chlorinated VOCs were not detected in the groundwater sample collected in May 2008 from monitoring well SA-MW-85, which was installed at the western end of

reactive wall A (southern wall) to evaluate groundwater conditions between the reactive wall and the sewer.

4. Conclusions and Recommendations

4.1. Conclusions

The following conclusions can be drawn based on the data generated during the 2008 LTM events.

1. Groundwater flow in the MMA and SA is consistent with that documented during previous monitoring events.
2. In general, VOC concentrations in groundwater in the MMA are stable or decreasing.
3. VOC concentrations in groundwater in the area of the former burn pit and current permeable reactive walls in the SA are decreasing.

4.2. LTM Modifications and Recommendations

The following modifications to the LTM program are recommended.

1. As recommended in the 2007 LTM Report, the Building 40 Bedrock Groundwater Corrective Measures Performance Evaluation Report (submitted December 2008), and per discussions with the NYSDEC, it is recommended that the following Building 40 monitoring wells be added to the LTM program and be sampled annually:
 - WVA-MW-79
 - WVA-MW-82R (3-zones)
 - WVA-MW-83 (3-zones)
 - WVA-MW-84R (3-zones)
 - WVA-MW-85R (3-zones)
 - WVA-MW-86 (3-zones)
2. Based on groundwater data collected to date and the observed trends, it is recommended that, beginning with the May 2009 monitoring event, the monitoring frequency be reduced to annual for the eight MMA wells currently monitored semi-annually.

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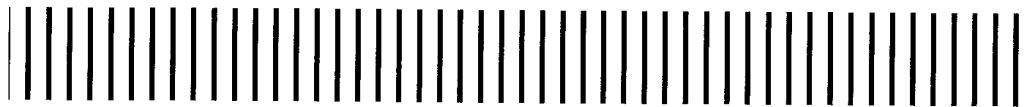
INDEPENDENT ENVIRONMENTAL
ENGINEERS, SCIENTISTS
AND CONSULTANTS

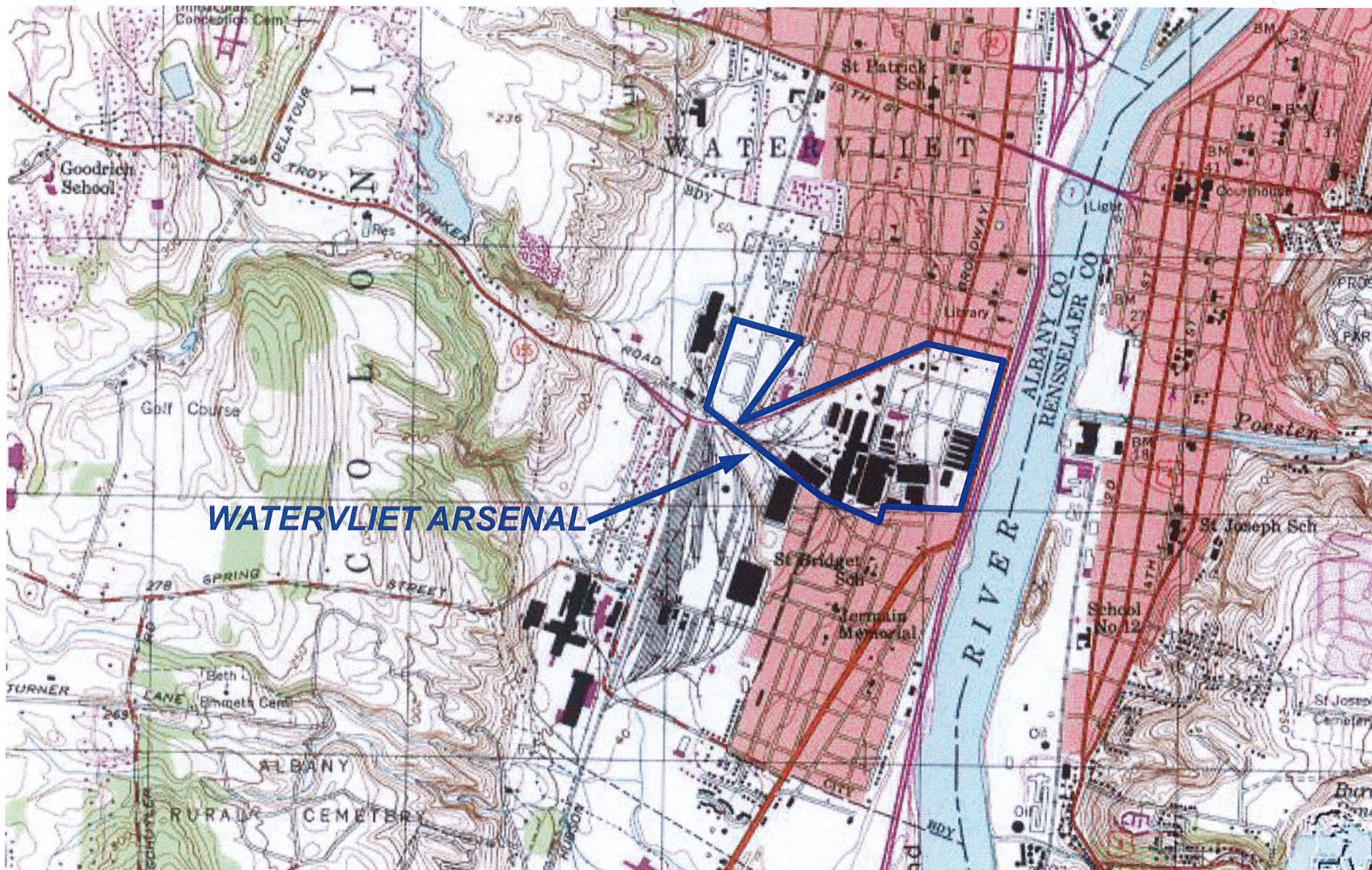
Figures



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Figures





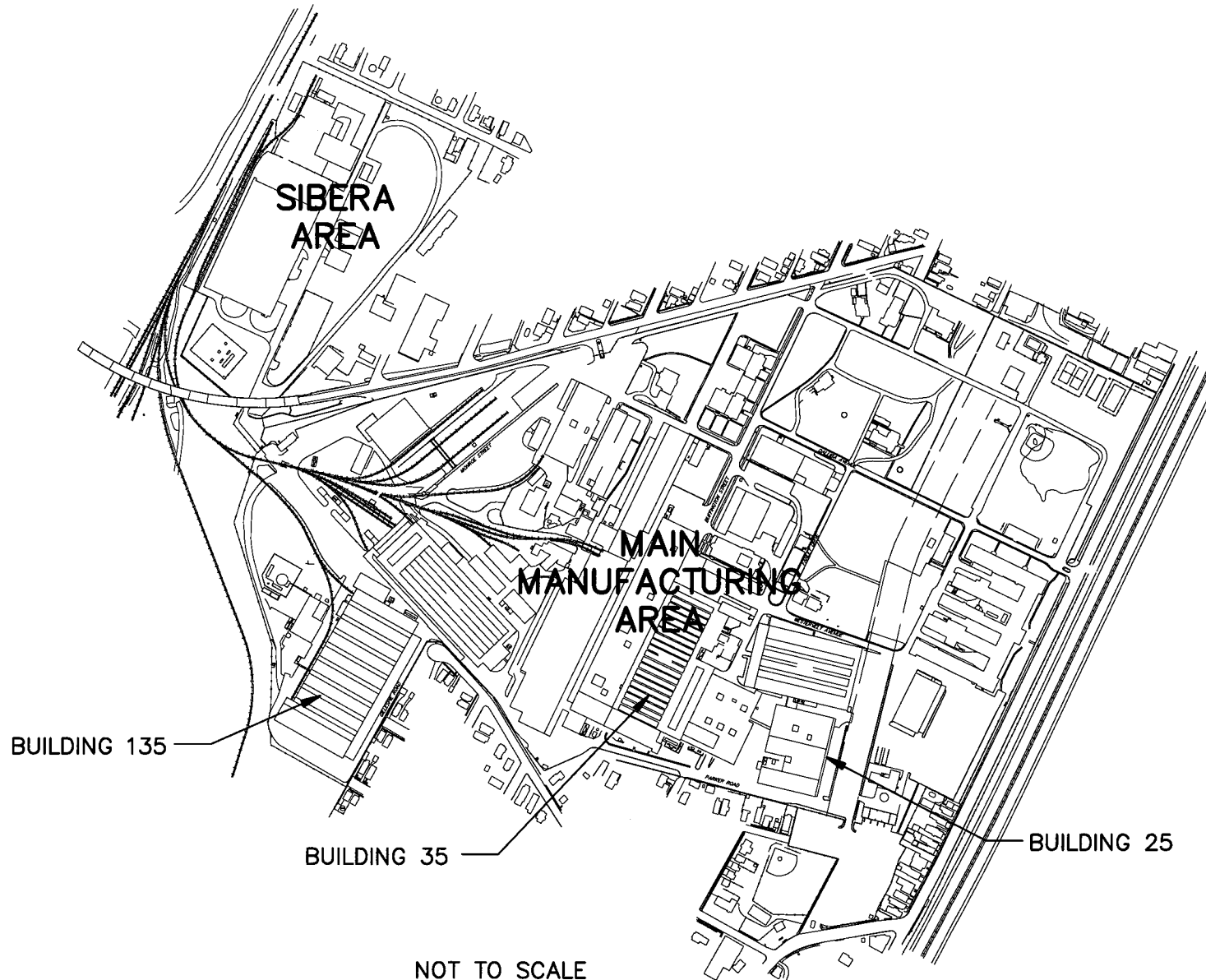
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US Army Corps
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Baltimore District

WATERVLIET ARSENAL
WATERVLIET, NEW YORK
SITE LOCATION

FIGURE 1-1



US Army Corps
of Engineers

MAIN MANUFACTURING AREA
SITE PLAN
WATERVLIET ARSENAL
USACE CONTRACT NO. DACA31-94-D-0017

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FIGURE 1-2

Figure 3-3
Trends in Total Chlorinated VOC Concentrations
Building 25 Area
Watervliet Arsenal, Watervliet, New York

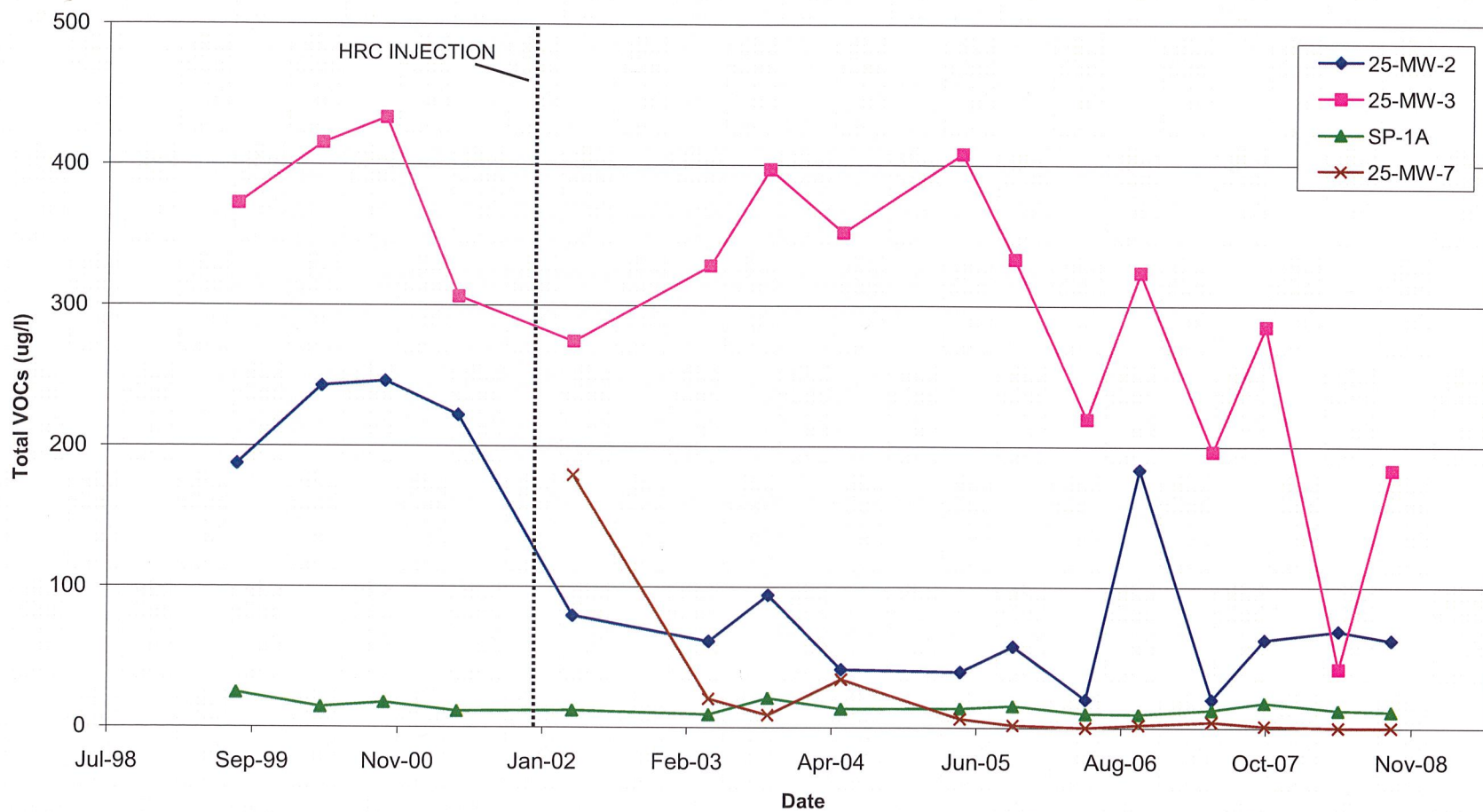
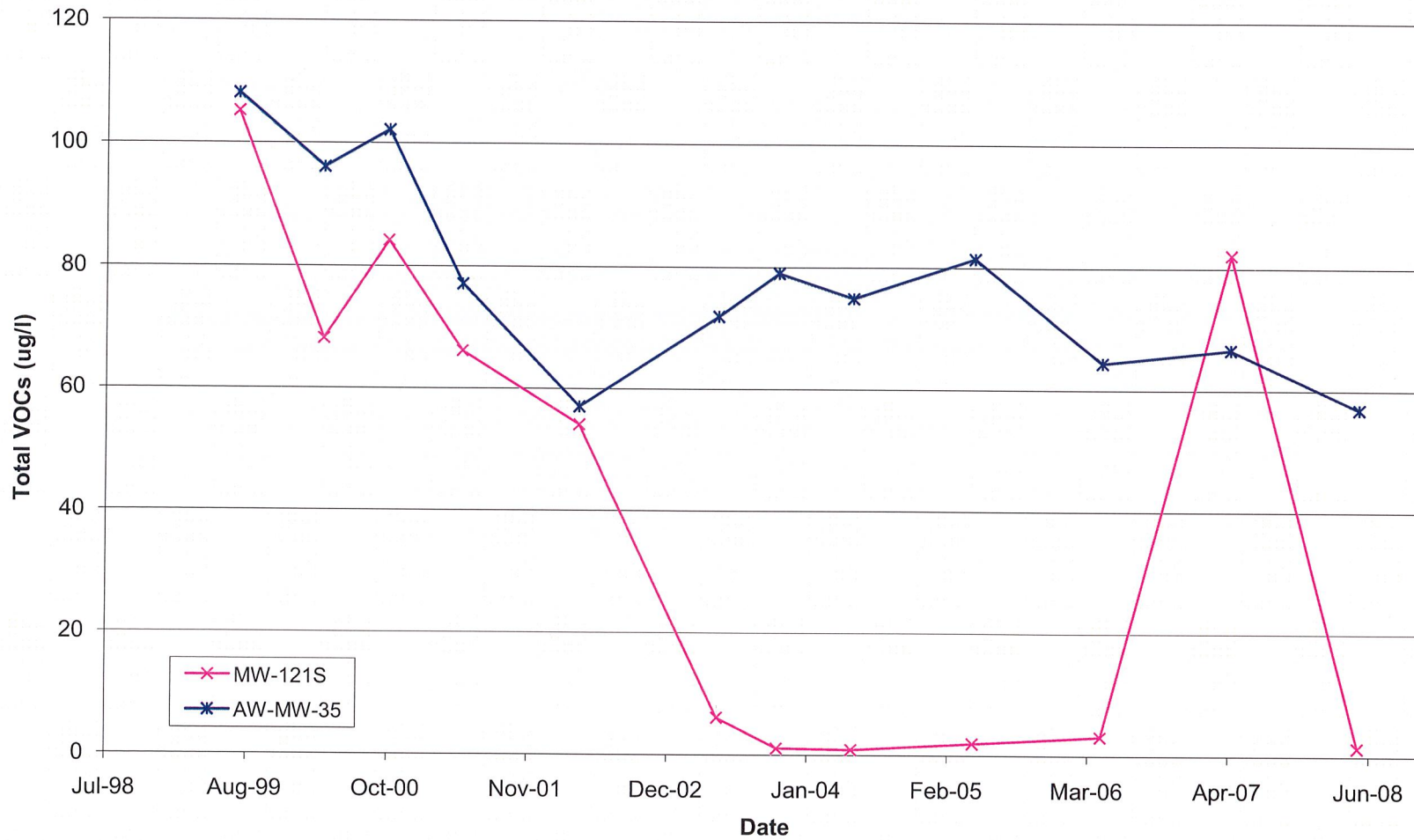
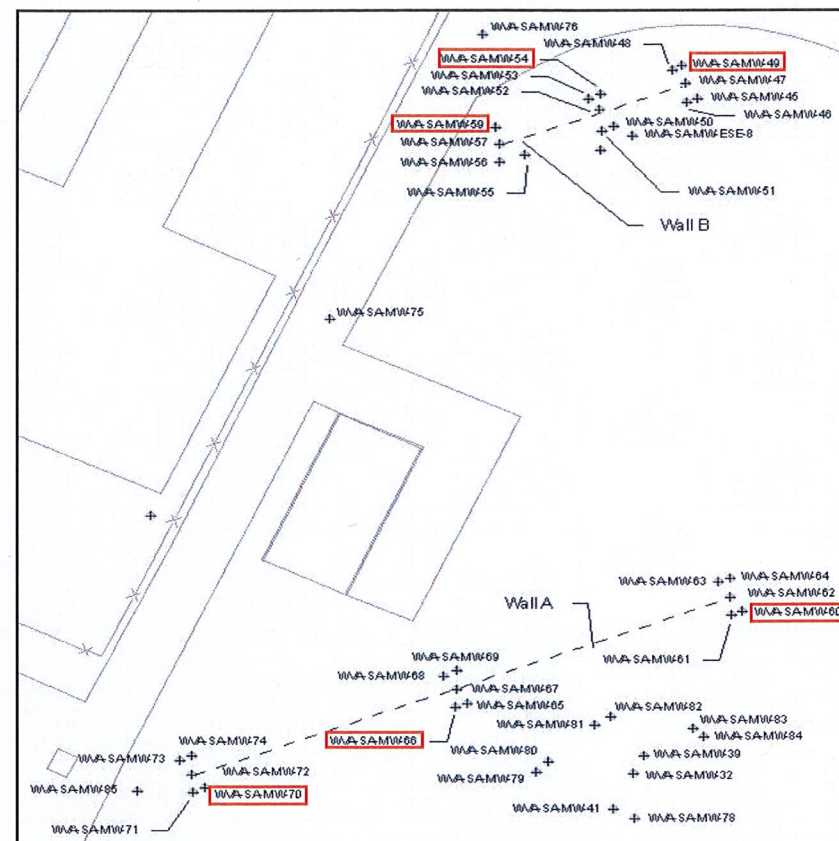
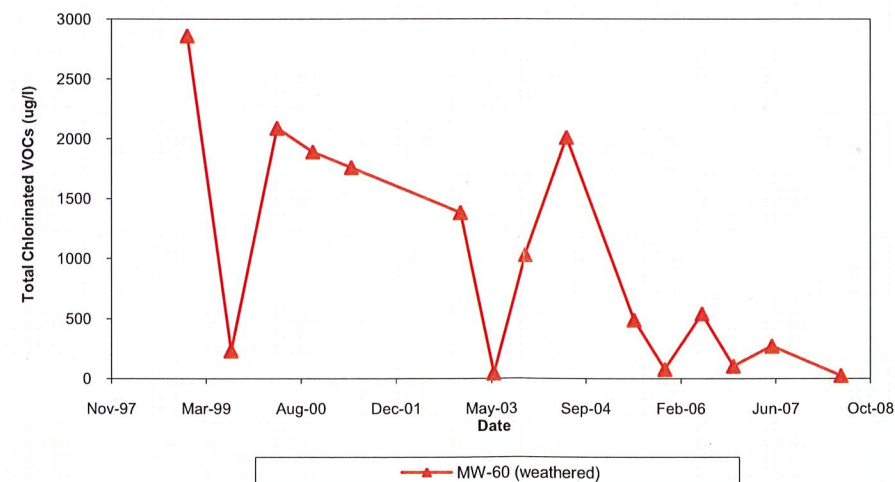
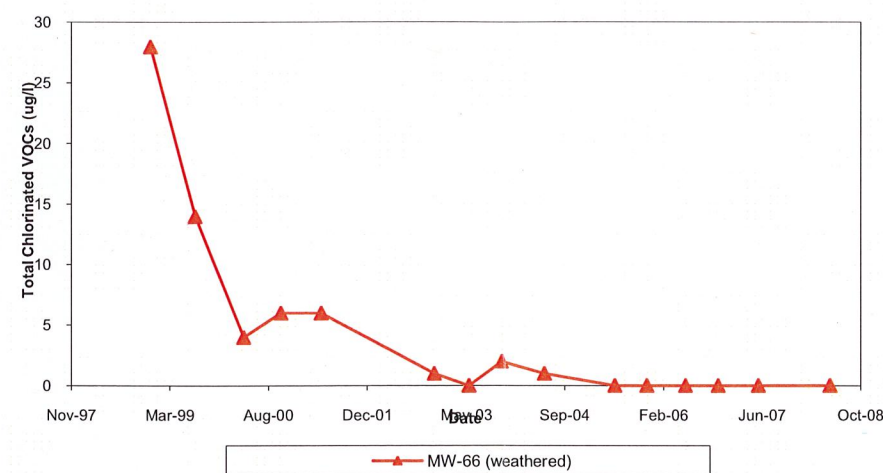
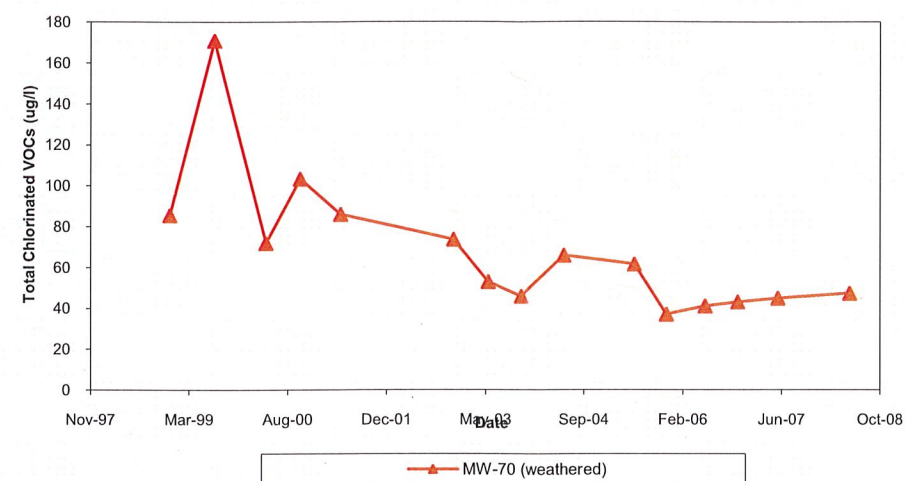


Figure 3-4
Trends in Total Chlorinated VOC Concentrations
Main Manufacturing Area
Watervliet Arsenal, Watervliet, New York

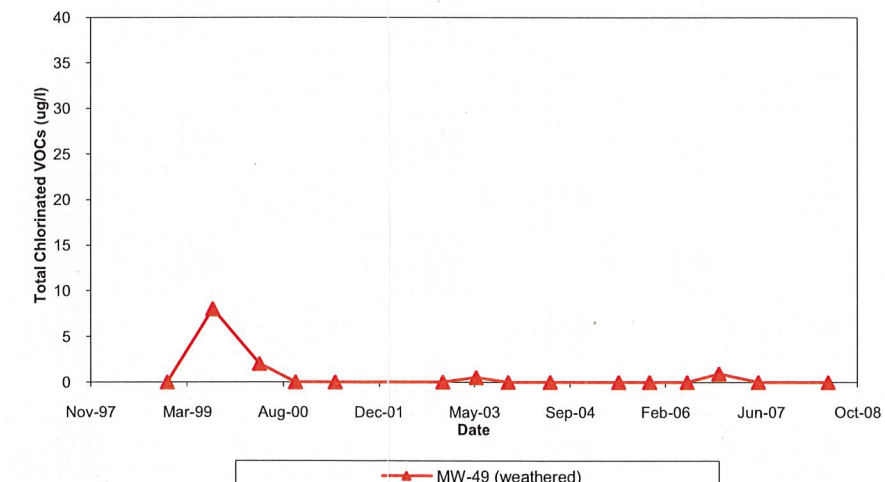
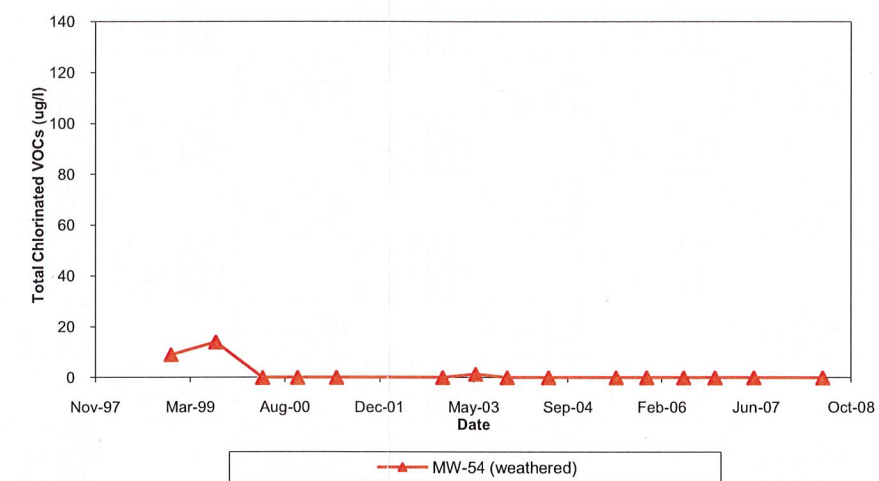
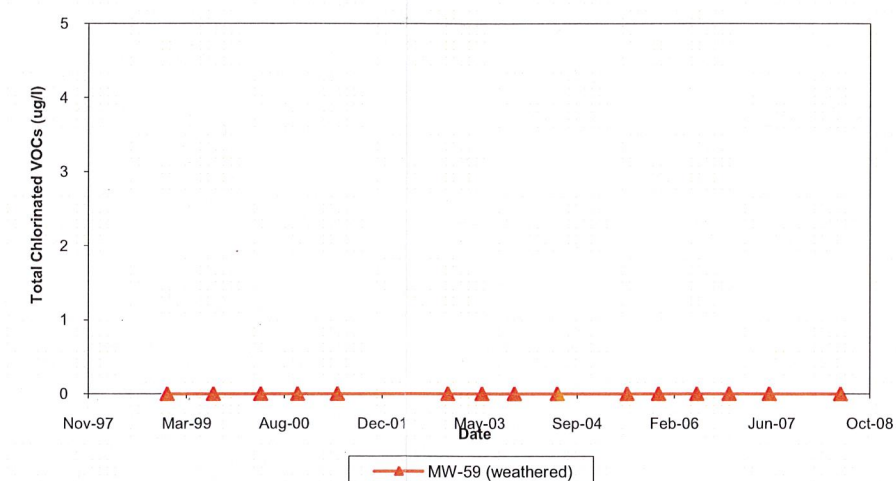




UP-GRADIENT



DOWN-GRADIENT



LONG-TERM MONITORING
SIBERIA AREA, WATERVLIET ARSENAL, WATERVLIET, NEW YORK

TOTAL CHLORINATED ORGANIC COMPOUNDS UP- AND DOWN-GRADIENT OF PERMEABLE REACTIVE WALLS

FIGURE 3-6

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Tables



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Tables



Table 2-1
Long Term Monitoring Wells (Updated December 2007)
Main Manufacturing Area
Watervliet Arsenal, Watervliet, New York

Well	Area Monitored	Geologic Unit	Water Level	Sample in LTM	VOCs	SVOCs	Metals	NAP	Sampling Frequency
87GTI-MW-1BP	PBS	Hybrid (a)	X						
87GTI-MW-2BP	PBS	Hybrid (a)	X						
87GTI-MW-3BP	PBS	Hybrid (a)	X						
87GTI-MW-4BP	PBS	Hybrid (a)	X						
83DM-SP-1	Building 25	Hybrid (a)	X	X	X			X	Semi-annual
83DM-SP-2	WVA boundary	Bedrock	X						
83DM-SP-3	WWTP	Bedrock	X	X	X		X (d)	X	Annual
83DM-SP-4	WWTP	Bedrock	X	X	X				Annual
86EM-SP-1A	Building 25	Overburden	X	X	X				Semi-annual
86EM-SP-1B	Building 25	Overburden	X	X	X				Annual
86EM-SP-5	Building 25	Overburden	X	X	X	X		X	Annual
86EM-SP-6	WWTP	Overburden	X	X	X		X	X	Annual
92EM-SP-7	WWTP	Overburden	X	X	X			X	Annual
92EM-SP-8	WWTP	Overburden	X	X	X	X		X	Annual
93EM-SP-9	WVA boundary	Overburden	X	X	X				Annual
93EM-SP-10	WVA boundary	Hybrid (a)	X						
93EM-SP-11	Building 25	Overburden	X	X	X				Annual
93EM-SP-12	Building 35	Overburden	X						
93EM-SP-13	Building 135	Bedrock	X	X	X	X			Annual
93EM-SP-14	Building 135	Bedrock	X						
93EM-SP-15	Building 114	Bedrock	X						
93EM-SP-16	Building 114	Bedrock	X						
94EM-MW-19	Building 15	Bedrock	X	X	X		X		Annual
94EM-MW-20	Building 15	Bedrock	X	X	X		X		Annual
94EM-MW-21	Building 15	Bedrock	X	X	X		X		Annual
93EM-RW-2	Building 114	Bedrock	X	X	X			X	Annual
WVA-AW-25-MW-2	Building 25	Bedrock	X	X	X			X	Semi-annual
WVA-AW-25-MW-3	Building 25	Overburden	X	X	X			X	Semi-annual
WVA-AW-25-MW-4	Building 25	Weathered	X						
WVA-AW-25-MW-5	Building 25	Hybrid (a)	X	X	X	X			Annual
WVA-AW-25-MW-6	Building 25	Overburden	X	X	X				Semi-annual
WVA-AW-25-MW-7	Building 25	Bedrock	X	X	X			X	Semi-annual
WVA-AW-35-MW-5	Building 35	Bedrock	X	X	X				Pent-annual
WVA-AW-35-MW-6	Building 35	Overburden	X						
WVA-AW-35-MW-7	Building 35	Bedrock	X						
WVA-AW-35-MW-8	Building 35	Bedrock	X	X	X	X			Annual
WVA-AW-135-MW-2	Building 135	Bedrock	X	X	X				Pent-annual
WVA-AW-135-MW-3	Building 135	Bedrock	X						
WVA-AW-135-MW-4	Building 135	Bedrock	X	X	X	X		X	Pent-annual
WVA-AW-MW-20	WVA boundary	Overburden	X						
WVA-AW-MW-21	WVA boundary	Overburden	X						
WVA-AW-MW-22	WVA boundary	Bedrock	X	X	X				Pent-annual
WVA-AW-MW-25	WVA boundary	Weathered	X						
WVA-AW-MW-26	WVA boundary	Bedrock	X	X	X				Pent-annual
WVA-AW-MW-27	WVA boundary	Overburden	X	X	X				Annual
WVA-AW-MW-28	WVA boundary	Bedrock	X						
WVA-AW-MW-29	Building 125	Bedrock	X						
WVA-AW-MW-31	Building 20	Overburden	X						
WVA-AW-MW-32	WVA boundary	Weathered	X	X	X				Annual
WVA-AW-MW-33	Building 40	Bedrock	X						
WVA-AW-MW-34	Building 40	Bedrock	X						
WVA-AW-MW-35	Building 20	Bedrock	X	X	X				Annual
WVA-AW-MW-36	Building 20	Overburden	X	X	X				Annual
WVA-AW-MW-37	WVA boundary	Bedrock	X						
WVA-AW-MW-38	WVA boundary	Bedrock	X	X	X				Pent-annual
WVA-AW-MW-39	Building 125	Bedrock	X						

Notes:

PBS - Petroleum bulk storage area.
WWTP - Wastewater treatment plant.
(a) Overburden and weathered bedrock.
(b) Equipped with Westbay multilevel device.
(c) Inaccessible.
(d) Chromium only.

Table 2-1
Long Term Monitoring Wells (Updated December 2007)
Main Manufacturing Area
Watervliet Arsenal, Watervliet, New York

Well	Area Monitored	Geologic Unit	Water Level	Sample in LTM	VOCs	SVOCs	Metals	NAP	Sampling Frequency
WVA-AW-MW-40	Building 125	Bedrock	X						
WVA-AW-MW-41	WVA boundary	Bedrock	X	X	X				Pent-annual
WVA-AW-MW-42	Building 120	Weathered	X						
WVA-AW-MW-43	Building 25	Overburden	X	X	X	X			Annual
WVA-AW-MW-44	Building 25	Overburden	X	X	X	X			Annual
WVA-AW-MW-45	WVA boundary	Bedrock	X						
WVA-AW-MW-46	WWTP	Bedrock	X						
WVA-AW-MW-47	WVA boundary	Weathered	X	X	X			X	Annual
WVA-AW-MW-48	Building 20	Bedrock	X						
WVA-AW-MW-49	Building 25	Weathered	X						
WVA-AW-MW-50	Building 125	Bedrock	X						
WVA-AW-MW-51	Building 40	Bedrock	X						
WVA-AW-MW-52	Building 114	Bedrock	X	X	X			X	Semi-annual
WVA-AW-MW-53	Building 25	Bedrock	X						
WVA-AW-MW-54	Building 35	Bedrock	X						
WVA-AW-MW-55	WVA boundary	Bedrock	X						
WVA-AW-MW-56	WVA boundary	Overburden	X						
WVA-AW-MW-57	WWTP	Overburden	X						
WVA-AW-MW-58	Building 40	Bedrock	X						
WVA-AW-MW-59	Building 40	Bedrock	X						
WVA-AW-MW-60	Building 40	Bedrock	X						
WVA-AW-MW-61	Building 40	Bedrock	X						
WVA-AW-MW-62	Building 40	Bedrock	X						
WVA-AW-MW-63	WVA boundary	Bedrock	X						
WVA-AW-MW-64	Building 114	Bedrock	X	X	X			X	Semi-annual
WVA-AW-MW-65	Building 40	Bedrock	X						
WVA-AW-MW-66	Building 40	Overburden	X						
WVA-AW-MW-67	Building 40	Overburden	X						
WVA-AW-MW-68	Building 40	Bedrock	(b)						
WVA-AW-MW-70	Building 40	Overburden	X						
WVA-AW-MW-71	Building 40	Bedrock	(b)						
WVA-AW-MW-72	Building 40	Bedrock	(c)						
WVA-AW-MW-73	Building 40	Overburden	(c)						
WVA-AW-MW-74	Building 40	Bedrock	X						
WVA-AW-MW-75	Building 40	Bedrock	X						
WVA-AW-MW-76	Building 40	Bedrock	(b)						
WVA-AW-MW-77	Building 40	Bedrock	X						
WVA-AW-MW-78	Building 40	Bedrock	(b)						
WVA-P-1	Building 110	Bedrock	X						
WVA-P-2	Building 110	Bedrock	X						
WVA-P-3	Building 110	Bedrock	X						
WVA-P-4	Building 110	Bedrock	X						
B121N	Building 121	Hybrid (a)	X	X	X			X	Annual
B121S	Building 121	Hybrid (a)	X	X	X			X	Annual
WVA-AW-MW-BLD-110	Building 110	Bedrock	X	X	X	X			Annual
WVA-AW-RW-1	WVA Boundary	Bedrock	X						
WVA-B35-PW-1	Building 110	Bedrock	X	X	X	X			Annual

Notes:

PBS - Petroleum bulk storage area.

WWTP - Wastewater treatment plant.

(a) Overburden and weathered bedrock.

(b) Equipped with Westbay multilevel device.

(c) Inaccessible.

(d) Chromium only.

Table 2-2
Long Term Monitoring Wells (Updated December 2007)
Siberia Area
Watervliet Arsenal, Watervliet, New York

Well	Area Monitored	Geologic Unit	Water Level	Sample in LTM	VOCs	SVOCs	Metals	NAP	Sampling Frequency
WVA-SA-MW-19R	WVA boundary	Overburden	X	X	X	X		X	Annual
WVA-SA-MW-20	WVA boundary	Overburden	X	X	X	X		X	Annual
WVA-SA-MW-21	Chip Handling	Overburden	X						
WVA-SA-MW-22	Chip Handling	Bedrock	X						
WVA-SA-MW-23	WVA boundary	Bedrock	X	X	X	X		X	Annual
WVA-SA-MW-24	WVA boundary	Overburden	X						
WVA-SA-MW-25	SE Quadrant	Overburden	X						
WVA-SA-MW-26	WVA boundary	Overburden	X						
WVA-SA-MW-27R	Transformer	Overburden	X						
WVA-SA-MW-28	Transformer	Bedrock	X						
WVA-SA-MW-29	Transformer	Overburden	X						
WVA-SA-MW-30	NE Quadrant	Bedrock	X						
WVA-SA-MW-31	Transformer	Overburden	X						
WVA-SA-MW-32	Burn Pit	Overburden	X	X	X	X		X	Annual
WVA-SA-MW-33	WVA boundary	Overburden	X	X	X	X		X	Annual
WVA-SA-MW-34	WVA boundary	Bedrock	X	X	X	X		X	Annual
WVA-SA-MW-35	SE Quadrant	Overburden	X						
WVA-SA-MW-36	WVA boundary	Overburden	X						
WVA-SA-MW-37	WVA boundary	Overburden	X						
WVA-SA-MW-38	WVA boundary	Weathered	X	X	X	X		X	Annual
WVA-SA-MW-39	Burn Pit	Weathered	X	X	X	X		X	Annual
WVA-SA-MW-40	WVA boundary	Bedrock	X						
WVA-SA-MW-41	Burn Pit	Bedrock	X	X	X	X		X	Annual
WVA-SA-MW-45	Reactive Wall	Weathered	X						
WVA-SA-MW-46	Reactive Wall	Overburden	X						
WVA-SA-MW-47	Reactive Wall	Reac. Wall	X						
WVA-SA-MW-48	Reactive Wall	Overburden	X						
WVA-SA-MW-49	Reactive Wall	Weathered	X	X (b)	X				Annual
WVA-SA-MW-50	Reactive Wall	Weathered	X						
WVA-SA-MW-51	Reactive Wall	Overburden	X						
WVA-SA-MW-52	Reactive Wall	Reac. Wall	X						
WVA-SA-MW-53	Reactive Wall	Overburden	X						
WVA-SA-MW-54	Reactive Wall	Weathered	X	X (b)	X				Annual
WVA-SA-MW-55	Reactive Wall	Weathered	X						
WVA-SA-MW-56	Reactive Wall	Hybrid (a)	X						
WVA-SA-MW-57	Reactive Wall	Reac. Wall	X						
WVA-SA-MW-59	Reactive Wall	Weathered	X	X (b)	X				Annual
WVA-SA-MW-60	Reactive Wall	Weathered	X	X (b)	X				Annual
WVA-SA-MW-61	Reactive Wall	Overburden	X						
WVA-SA-MW-62	Reactive Wall	Reac. Wall	X						
WVA-SA-MW-63	Reactive Wall	Overburden	X						
WVA-SA-MW-64	Reactive Wall	Weathered	X						
WVA-SA-MW-65	Reactive Wall	Overburden	X						
WVA-SA-MW-66	Reactive Wall	Weathered	X	X (b)	X				Annual
WVA-SA-MW-67	Reactive Wall	Reac. Wall	X						
WVA-SA-MW-68	Reactive Wall	Weathered	X						
WVA-SA-MW-69	Reactive Wall	Overburden	X						

Notes:

- (a) Overburden and weathered bedrock.
(b) Sampled using passive diffusion bags.

Table 2-2
Long Term Monitoring Wells (Updated December 2007)
Siberia Area
Watervliet Arsenal, Watervliet, New York

Well	Area Monitored	Geologic Unit	Water Level	Sample in LTM	VOCs	SVOCs	Metals	NAP	Sampling Frequency
WVA-SA-MW-70	Reactive Wall	Overburden	X	X (b)	X				Annual
WVA-SA-MW-71	Reactive Wall	Weathered	X						
WVA-SA-MW-72	Reactive Wall	Reac. Wall	X						
WVA-SA-MW-73	Reactive Wall	Weathered	X						
WVA-SA-MW-74	Reactive Wall	Overburden	X						
WVA-SA-MW-75	Reactive Wall	Weathered	X	X (b)	X				Annual
WVA-SA-MW-76	Reactive Wall	Weathered	X	X (b)	X				Annual
WVA-SA-MW-77	Reactive Wall	Weathered	X	X (b)	X				Annual
WVA-SA-MW-78	Burn Pit	Bedrock	X	X	X			X	Annual
WVA-SA-MW-79	Burn Pit	Bedrock	X	X	X			X	Annual
WVA-SA-MW-80	Burn Pit	Bedrock	X	X	X			X	Annual
WVA-SA-MW-81	Burn Pit	Bedrock	X	X	X			X	Annual
WVA-SA-MW-82	Burn Pit	Bedrock	X	X	X			X	Annual
WVA-SA-MW-83	Burn Pit	Bedrock	X	X	X			X	Annual
WVA-SA-MW-84	Burn Pit	Bedrock	X	X	X			X	Annual
WVA-SA-MW-85	Reactive Wall	Hybrid (a)	X	X (b)	X				Annual
MW-DEC-1	Perfec. Plating	Bedrock	X						
MW-DEC-2	Perfec. Plating	Weathered	X						
MW-EA-5	WVA boundary	Overburden	X						
MW-EA-6	WVA boundary	Weathered	X	X	X	X		X	Annual
MW-EA-7	WVA boundary	Weathered	X						
MW-EA-8	WVA boundary	Overburden	X						
MW-ESE-1	WVA boundary	Bedrock	X						
MW-ESE-2	WVA boundary	Bedrock	X						
MW-ESE-3	WVA boundary	Bedrock	X						
MW-ESE-4	WVA boundary	Overburden	X						
MW-ESE-5	WVA boundary	Bedrock	X						
MW-ESE-6	WVA boundary	Overburden	X	X	X	X		X	Annual
MW-ESE-7	SE Quadrant	Bedrock	X						
MW-ESE-8	NE Quadrant	Weathered	X						
MW-ESE-9	WVA boundary	Bedrock	X						
MW-GTI-1	SE Quadrant	Overburden	X						
MW-GTI-2	SE Quadrant	Overburden	X						
MW-GTI-3	SE Quadrant	Bedrock	X						
MW-GTI-4	SE Quadrant	Bedrock	X						
STS-3	Sewer	Storm Sewer		X	X	X			Annual
STS-5	Sewer	Storm Sewer		X	X	X			Annual
STS-6	Sewer	Storm Sewer		X	X	X			Annual
SNS-6	Sewer	Sanitary Sewer		X	X	X		X	Annual

Notes:
(a) Overburden and weathered bedrock.
(b) Sampled using passive diffusion bags.

Table 2-3
Summary of Incomplete Sampling Locations
2008 Long Term Monitoring
Watervliet Arsenal
Watervliet, New York

Monitoring Well	May 2008	October 2008
<i>Main Manufacturing Area</i>		
86EM-SP-6	Well damaged and filled with debris from WWTP construction. No sampled collected	-
<i>Siberia Area</i>		
MPI-SA-MW-84	Well damaged likely by snow plow and filled with debris. No sampled collected	-
MPI-SA-MW-78	Water contained MnO4-, no sample collected.	-
MPI-SA-MW-33	Well dry. No sample collected.	-

Table 3-1
Summary of Groundwater Elevations
Long Term Monitoring
Watervliet Arsenal
Watervliet, New York

Well	Groundwater Elevation (feet AMSL)								
	5/25/2004	5/16/2005	10/24/2005	5/10/2006	10/23/2006	5/22/2007	10/23/2007	5/12/2008	10/28/2008
<i>Main Manufacturing Area</i>									
83DM-SP-1	24.56	24.07	25.03	24.62	24.74	24.73	24.90	26.27	25.03
83DM-SP-2	16.42	16.14	17.07	16.31	16.77	16.68	16.30	16.37	17.00
83DM-SP-3	17.81	17.66	18.69	18.15	18.36	18.20	18.19	17.91	18.82
83DM-SP-4	18.35	18.18	18.96	18.36	18.58	18.48	18.56	18.28	18.97
86-EM-SP-1A	25.48	25.49	25.61	25.43	25.53	25.56	25.61	26.16	25.66
86-EM-SP-1B	21.82	20.70	22.94	21.88	22.29	21.86	21.27	21.12	22.77
86EM-SP-5	20.83	20.48	21.50	21.29	20.86	20.56	20.69	20.51	20.74
86EM-SP-6	20.70	20.54	20.85	23.63	24.21	30.50	obstructed	well filled in	23.30
87GTI-MW-1BP	64.13	63.11	63.89	62.27	63.35	63.13	64.13	62.86	64.31
87GTI-MW-2BP	64.27	62.34	63.92	61.93	63.33	62.88	64.25	62.25	64.25
87GTI-MW-3BP	62.34	61.79	63.05	61.67	62.40	62.20	63.07	61.92	63.41
87GTI-MW-4BP	61.73	61.03	63.65	61.23	62.53	62.31	64.05	61.72	64.31
92EM-SP-7	20.08	19.85	19.46	19.02	19.12	18.96	19.00	18.76	19.10
92EM-SP-8	20.50	20.38	20.90	20.35	20.33	18.92	19.80	19.68	20.14
93-EM-RW-2	59.31	70.32	62.50	61.90	60.86	59.21	62.08	61.93	70.32
93-EM-SP-11	26.69	26.55		26.60	26.84	26.98	27.40	26.57	27.86
93-EM-SP-12	29.35	29.14	30.46	29.11	29.30	29.27	29.43	29.25	29.93
93-EM-SP-13	62.79	62.55	62.28	62.17	62.88	63.07	63.48	62.13	61.32
93-EM-SP-14	63.16	63.07	63.27	62.95		63.08	obstructed	63.16	63.56
93-EM-SP-15	59.86	59.71	60.04	59.60	59.75	59.83	59.88	59.66	59.92
93-EM-SP-9					34.66	36.78	37.03	dry	37.23
94EM-MW-19	47.84	47.36	48.96	47.47	47.95	47.92	48.11	47.88	48.37
94EM-MW-20	45.44	44.25	45.91	43.62	44.24	44.16	45.15	44.34	44.93
94EM-MW-21	47.05	46.08	48.89	46.35	46.79	46.64	47.43	46.83	47.39
WVA-135-MW-1	20.07	19.52	abandoned	abandoned	abandoned	abandoned	abandoned	abandoned	abandoned
WVA-135-MW-2	66.23	66.13	66.96	64.87	66.34	66.22	66.72	66.07	67.34
WVA-135-MW-3	62.67	62.32	63.33	62.20	62.94	58.51	obstructed	62.16	63.39
WVA-135-MW-4	58.19	58.02	58.55	58.15	58.35	66.31	58.38	58.14	58.28
WVA-25-MW-1	32.00	29.76	26.07	abandoned	abandoned	abandoned	abandoned	abandoned	abandoned
WVA-25-MW-2	23.31	23.65		23.71	22.76	23.24	22.75	23.35	23.91
WVA-25-MW-3	23.95	23.89	24.29	23.94	24.08	24.08	24.13	23.95	24.56
WVA-25-MW-4	20.76	20.65	21.12		22.78	22.84	21.01	19.38	22.42
WVA-25-MW-5	19.52	19.19	19.29	19.41	15.49	19.42	19.48	19.30	NM
WVA-25-MW-6	25.13	25.36	25.61	25.35	25.47	25.48	25.49	22.15	25.64
WVA-35-MW-5	39.96	39.45	40.67	39.89		39.68	40.01	39.65	39.91
WVA-35-MW-6	30.57	30.22	31.13	30.28	30.67	30.58	30.73	30.32	30.06
WVA-35-MW-7	44.11	44.30	44.59	44.42	44.31	44.92	44.13	45.66	45.47
WVA-35-MW-8	49.92	50.32	51.16	49.89	49.95	50.20	49.98	50.50	53.69
WVA-AW-MW-20	12.61	11.41	abandoned	abandoned	abandoned	abandoned	abandoned	abandoned	abandoned
WVA-AW-MW-21	20.97	21.06	21.74	20.99	20.99	21.13	20.83	20.96	21.23
WVA-AW-MW-22	41.16	41.15	41.66	41.28	41.31	41.41	41.59	41.10	41.56
WVA-AW-MW-23	49.82	50.20	abandoned	abandoned	abandoned	abandoned	abandoned	abandoned	abandoned
WVA-AW-MW-24	52.14	52.12	abandoned	abandoned	abandoned	abandoned	abandoned	abandoned	abandoned
WVA-AW-MW-25	55.92	55.96	57.12	55.91	56.51	56.65	56.89	55.94	57.05
WVA-AW-MW-26	59.17	58.88	59.63	58.79	59.03	59.05	59.32	59.79	59.65
WVA-AW-MW-27	53.25	53.02	53.88	52.73	53.41	53.10	54.00	52.54	50.12
WVA-AW-MW-28	60.54	60.14	60.53	60.15	60.48	60.29	60.47	60.14	60.65
WVA-AW-MW-29	60.81	60.23	60.46	60.57	60.67	60.69	60.77	60.61	abandoned
WVA-AW-MW-30	62.88	62.72	abandoned	abandoned	abandoned	abandoned	abandoned	abandoned	abandoned

Note:

Blank space - well dry or water level below top of pump

NI - Not Installed

NM - Not Measured

TOC- Water level at top of well casing

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Table 3-1
Summary of Groundwater Elevations
Long Term Monitoring
Watervliet Arsenal
Watervliet, New York

Well	Groundwater Elevation (feet AMSL)								
	5/25/2004	5/16/2005	10/24/2005	5/10/2006	10/23/2006	5/22/2007	10/23/2007	5/12/2008	10/28/2008
WVA-AW-MW-31	22.73	22.45	23.68	22.62	22.70	22.70	22.63	22.71	22.94
WVA-AW-MW-32	14.99	14.69	15.23	14.72	14.75	14.77	14.16	14.52	14.62
WVA-AW-MW-33	8.65	9.15	9.03	9.14	8.33	9.90	DRY	dry	10.51
WVA-AW-MW-34	9.94	8.83	9.36	8.90	8.97	8.77	8.85	8.65	9.36
WVA-AW-MW-35	21.14	20.81	21.54	20.83	20.97	21.05	20.85	21.18	21.27
WVA-AW-MW-36		21.11	22.02	22.22	21.02	-	-	20.98	21.09
WVA-AW-MW-37	48.00	47.63	49.98	47.51	48.58	48.18	49.55	48.14	49.49
WVA-AW-MW-38	46.05	45.85	48.22	46.07	47.57	46.82	47.84	47.41	47.69
WVA-AW-MW-39	65.01	64.30	65.16	63.91	64.56	64.51	65.12	NM	71.76
WVA-AW-MW-40	65.77	64.62	65.57	64.38	65.15	65.07	65.37	64.61	65.55
WVA-AW-MW-41	58.63	54.31	59.61	58.44	58.83	58.76	58.98	58.47	59.31
WVA-AW-MW-42	59.76	59.56	60.50	60.06	60.18	-	60.24	60.05	60.40
WVA-AW-MW-43		20.53	25.51	20.58	20.59	20.57	20.61	20.23	20.60
WVA-AW-MW-44	20.58	20.13	21.09	20.49	20.36	20.43	20.53	19.94	20.27
WVA-AW-MW-45	53.59	58.31	55.79	53.92	54.83	54.46	55.31	54.73	54.80
WVA-AW-MW-46	20.80	20.68	22.62	20.48	22.35	21.52	21.32	NM	21.05
WVA-AW-MW-47	21.20	21.01	22.01	21.30	21.63	21.36	21.46	NM	22.07
WVA-AW-MW-49	22.77	22.43	23.02	22.54	22.80	22.69	22.63	21.23	23.04
WVA-AW-MW-50	54.08	53.95	54.08	54.17	54.23	54.46	54.03	54.49	54.15
WVA-AW-MW-51	9.05	6.84	7.08	5.33	4.26	-	7.53	9.59	9.58
WVA-AW-MW-55	66.83	66.65	66.69	66.79	66.81	66.96	66.92	66.66	68.18
WVA-AW-MW-56	20.28	20.12	20.65	20.16	20.07	20.28	20.16	19.86	20.09
WVA-AW-MW-57	20.32	20.03	20.60	20.29	20.20	20.48	20.24	19.82	20.15
WVA-AW-MW-58	10.19	16.24	15.47	10.97	11.62	10.20	18.00	10.38	12.46
WVA-AW-MW-59	9.15	9.04	10.03	9.19	9.32	9.25	9.33	9.09	10.33
WVA-AW-MW-60	17.52	17.63	17.85	17.25	17.41	16.89	17.25	16.64	16.82
WVA-AW-MW-62	14.13	13.92	14.56	14.11	14.38	14.26	14.55	14.09	14.77
WVA-AW-MW-63	63.04	63.00	63.96	63.16	63.79	63.55	63.92	64.39	64.34
WVA-AW-MW-64	59.60	59.23	60.11	59.29	59.71	34.32	59.90	59.32	59.90
WVA-AW-MW-66	8.47	8.27			8.35	18.43	8.64	8.31	9.28
WVA-AW-MW-67	11.92	11.82			12.21	12.14	21.23	12.21	12.77
WVA-AW-MW-70	8.61	8.41			8.46	8.50	8.65	8.42	9.02
WVA-AW-25-IW-1	21.32	27.93			obstructed	22.46	obstructed	obstructed	obstructed
WVA-AW-25-IW-2	20.01	19.70	19.87		obstructed	19.41	19.75	19.87	21.11
WVA-AW-25-IW-3	22.08	20.93	21.17		20.81	20.93	20.47	20.74	19.80
WVA-AW-25-IW-4	24.30	T.O.C	T.O.C		28.68		28.68	28.68	28.68
WVA-AW-25-IW-5	20.05	20.79			obstructed	23.58	obstructed	NM	21.47
WVA-AW-25-IW-6	25.36	28.03	29.78		27.37		26.87	25.29	25.77
WVA-P-1	54.63	54.53	55.21	55.15	55.75	55.55	55.08	55.61	55.56
WVA-P-2	46.87	46.80	47.18	47.30	47.58	47.55	47.46	50.90	47.55
WVA-P-3	43.85	44.26	44.74	42.64	42.93	43.25	43.21	43.25	43.05
WVA-P-4	45.29	44.96	45.21	45.09	45.34	45.31	45.23	45.26	45.26
WVA-B35-PW-1	48.62	48.08	48.23	48.79	49.28	49.06	49.88	49.11	54.88
WVA-AW-RW-1	27.21	25.41	27.21	25.35	25.49	25.58	26.92	27.30	26.82
Bldg 110	51.14	obstructed	51.10	obstructed	51.07	obstructed	51.20	51.07	51.08
Bldg 121-North Well	58.69	58.09	59.25	56.62	58.27	51.05	53.63	58.67	59.15
Bldg 121-South Well	59.06	58.51	59.65	56.97	55.65	51.91	54.82	59.03	59.56
<i>Siberia Area</i>									
WVA-SA-MW-19(R)	-	-	39.44	-	-	-	-	39.38	NM
WVA-SA-MW-20	41.53	40.91	40.89	39.00	39.89	40.84	40.72	40.50	40.91
WVA-SA-MW-21	33.46	34.72	34.36	32.26	33.70	33.51	33.54	33.34	34.72
WVA-SA-MW-22	38.45	38.77	38.70	38.40	38.48	38.51	38.43	29.34	38.77
WVA-SA-MW-23		41.39	41.19	39.92	40.54	40.15	40.40	39.37	41.39

Note:

Blank space - well dry or water level below top of pump

NI - Not Installed

NM - Not Measured

TOC- Water level at top of well casing

H:\PROJECT\2118147\FILE\LT M 2008 Report\done\LT M water levels 2008

Table 3-1
Summary of Groundwater Elevations
Long Term Monitoring
Watervliet Arsenal
Watervliet, New York

Well	Groundwater Elevation (feet AMSL)								
	5/25/2004	5/16/2005	10/24/2005	5/10/2006	10/23/2006	5/22/2007	10/23/2007	5/12/2008	10/28/2008
WVA-SA-MW-24	36.58	37.74	-	36.14	36.60	36.25	36.43	36.05	37.74
WVA-SA-MW-25	39.64	41.28	39.99	39.20	39.74	39.57	39.69	38.89	41.28
WVA-SA-MW-26	NM	flooded	-	41.93	-	-	flooded	41.79	flooded
WVA-SA-MW-27(R)	39.99	0.00	40.22	38.99	39.70	-	39.80	39.25	40.58
WVA-SA-MW-28	37.97	40.58	38.68	38.38	38.29	37.98	41.82	37.9	38.46
WVA-SA-MW-29	38.95	38.46	39.78	38.92	39.64	39.85	39.63	38.91	41.41
WVA-SA-MW-30	35.02	41.41	35.67	34.67	35.22	36.00	34.66	35.91	35.03
WVA-SA-MW-31	36.77	35.03	36.94	36.59	36.75	36.61	36.88	36.76	37.09
WVA-SA-MW-32	TOC	41.64	40.16	37.84	39.53	-	39.34	37.36	41.64
WVA-SA-MW-33	-	-	36.01	34.22	35.84	34.35	dry	33.95	35.13
WVA-SA-MW-34	32.28	35.13	32.55	32.10	32.24	32.14	32.26	32.19	32.58
WVA-SA-MW-35	38.22	32.58	38.63	38.03	dry	37.92	38.05	37.39	obstructed
WVA-SA-MW-36	32.32	obstructed	34.32	32.76	33.25	32.97	33.01	37.09	35.02
WVA-SA-MW-37	39.54	35.02	39.85	39.16	39.58	39.56	39.60	39.21	41.11
WVA-SA-MW-38	33.10	41.11	33.61	32.99	33.27	33.06	33.16	32.80	33.64
WVA-SA-MW-39	37.95	38.73	38.85	38.03	38.50	3.68	38.07	37.49	38.73
WVA-SA-MW-45	34.82	38.05	36.98	35.53	36.56	3.92	36.19	35.76	38.05
WVA-SA-MW-46	37.76	38.24	37.78	37.00	37.22	2.81	37.08	36.94	38.24
WVA-SA-MW-47	34.89	38.23	37.19	35.70	36.72	3.12	36.36	35.88	38.23
WVA-SA-MW-48	35.06	39.58	37.27	35.96	36.81	3.76	36.7	36.31	39.58
WVA-SA-MW-49	34.79	37.92	37.09	35.65	36.68	3.6	36.29	35.77	37.92
WVA-SA-MW-50	35.25	38.49	37.61	36.13	37.09	3.19	36.3	36.20	38.49
WVA-SA-MW-51	36.83	38.15	38.28	37.52	37.05	2.34	37.34	37.20	38.15
WVA-SA-MW-52	34.77	39.32	38.41	35.86	37.43	2.53	37.1	36.11	39.32
WVA-SA-MW-53	35.57	35.82	36.16	36.09	35.75	3.10	35.37	36.38	35.82
WVA-SA-MW-54	34.68	38.15	37.45	35.72	36.87	3.17	36.49	35.82	38.15
WVA-SA-MW-55	34.93	37.64	38.14	35.86	36.64	3.10	36.51	36.53	37.64
WVA-SA-MW-56	35.78	39.61	36.95	36.68	37.63	2.41	37.33	36.22	39.61
WVA-SA-MW-57	34.56	39.07	37.28	36.76	38.57	1.11	37.56	36.45	39.07
WVA-SA-MW-59	35.34	38.03	37.02	35.47	36.57	2.96	36.27	35.85	38.03
WVA-SA-MW-60	38.06	38.96	38.89	38.30	38.59	4.05	38.19	38.02	38.96
WVA-SA-MW-61	38.03	39.01	38.81	38.35	38.64	4.10	38.24	37.98	39.01
WVA-SA-MW-62	38.06	38.94	38.88	38.59	38.58	3.95	38.17	38.00	38.94
WVA-SA-MW-63	38.05	39.18	38.58	38.33	38.32	3.85	37.74	38.12	39.18
WVA-SA-MW-64	38.00	38.89	38.91	35.27	38.55	3.89	38.15	37.99	38.89
WVA-SA-MW-65	39.50	41.03	40.39	39.16	39.71	2.24	39.49	39.18	41.03
WVA-SA-MW-66	37.43	38.49	38.58	37.80	38.05	4.12	37.68	37.70	38.49
WVA-SA-MW-67	37.52	38.31	38.36	37.90	38.02	3.70	37.65	37.82	38.31
WVA-SA-MW-68	37.19	37.69	38.05	37.59	37.65	4.11	37.3	37.42	37.69
WVA-SA-MW-69	38.13	38.22	37.57	37.91	37.55	3.47	36.89	38.29	38.22
WVA-SA-MW-70	38.5	40.73	39.91	38.53	38.89	1.89	38.63	38.56	40.73
WVA-SA-MW-71	36.91	37.78	37.80	37.23	37.40	3.48	36.86	37.30	37.78
WVA-SA-MW-72	36.99	39.18	37.89	37.31	37.49	3.27	37.22	37.42	39.18
WVA-SA-MW-73	37.12	38.21	37.93	37.64	37.62	3.24	36.91	37.51	38.21
WVA-SA-MW-74	36.81	37.75	37.74	37.12	37.30	3.55	36.96	37.09	37.75
WVA-SA-MW-75	33.19	33.29	33.36	33.17	33.15	6.46	33.02	33.16	33.29
WVA-SA-MW-76	32.65	32.58	32.18	32.55	32.54	6.34	32.54	32.58	32.58
WVA-SA-MW-77	34.46	37.19	35.96	35.02	35.65	4.42	35.69	35.07	37.19
WVA-SA-MW-78	36.91	38.32	37.85	37.24	37.54	37.43	37.3	36.85	38.32
WVA-SA-MW-79	36.79	38.40	37.88	37.28	37.27	37.28	37.16	36.96	38.4
WVA-SA-MW-80	37.10	38.18	38.03	37.32	37.63	37.58	37.38	36.98	38.18
WVA-SA-MW-81	34.47	34.03	37.38	34.09	34.04	33.95	33.85	33.61	34.03
WVA-SA-MW-82	34.23	34.00	34.44	34.61	34.06	34.03	34.17	33.65	34
WVA-SA-MW-83	34.47	34.00	34.43	33.92	33.02	33.94	33.98	33.63	34
WVA-SA-MW-84	37.98	38.82	38.63	38.06	38.40	38.06	38.06	---	38.82
WVA-SA-MW-85	34.91	34.27	34.58	34.63	34.31	34.66	34.28	34.53	34.45
WVA-SA-MW-40	NM	-	-	-	-	-	paved over	paved over	paved over
WVA-SA-MW-41	TOC	42.02	41.97	41.77	41.62	42.02	42.02	36.07	42.02

Note:
Blank space - well dry or water level below top of pump
NI - Not Installed
NM - Not Measured
TOC - Water level at top of well casing
H:\PROJECT\2118147\FILE\LT.M 2008 Report\done\LT.M waterlevels2008

Table 3-1
Summary of Groundwater Elevations
Long Term Monitoring
Watervliet Arsenal
Watervliet, New York

Well	Groundwater Elevation (feet AMSL)								
	5/25/2004	5/16/2005	10/24/2005	5/10/2006	10/23/2006	5/22/2007	10/23/2007	5/12/2008	10/28/2008
DEC-1							dry		
DEC-2	36.31	36.86	36.80	36.30	36.44	33.38	36.4	36.03	36.86
DEC-3	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned
MW-EA-5	41.16	42.25	42.07	41.00	41.69	41.22	41.54	40.58	42.25
MW-EA-6	39.93	41.66	41.35	39.31	39.90	39.32	dry	38.88	41.66
MW-EA-7	38.03	41.74	41.66	41.17	41.14	40.79	41.37	40.91	41.74
MW-EA-8	37.31	40.62	38.08	37.65	37.93	37.38	37.49	37.09	40.62
MW-ESE-1	38.70	39.24	39.24	38.57	39.04	38.80	39.18	38.51	39.24
MW-ESE-2	39.84	41.63	41.09	39.28	40.84	40.22	40.94	39.33	41.63
MW-ESE-3	34.39	37.57		34.37	34.78	34.55	34.71	34.30	37.57
MW-ESE-4	31.26	34.04	33.40	31.72	32.24	31.92	32.04	31.58	34.04
MW-ESE-5	40.81	41.18	41.11	40.43	40.82	40.81	40.90	40.27	41.18
MW-ESE-6	31.87	34.68	33.99	32.33	32.90	35.88	32.62	32.18	34.68
MW-ESE-7	33.06	32.98	32.96	33.01	32.98	32.92	33.09	33.03	32.98
MW-ESE-8	35.32	34.90	37.01	35.90	36.42	36.04	36.18	35.12	34.90
MW-ESE-9				obstructed	dry		damaged	damaged	36.32
MW-GTI-1	39.34	-	-	-	-		not found	not found	not found
MW-GTI-2	38.14	38.57	38.78	38.23	38.21	38.48	38.18	34.78	38.57
MW-GTI-3	33.96	34.58	34.41	34.17	34.20	34.38	34.31	34.13	34.58
MW-GTI-4	39.61	40.72	40.41	38.57	39.18	39.50	39.14	45.14	45.14

Note:

Blank space - well dry or water level below top of pump

NI - Not Installed

NM - Not Measured

TOC- Water level at top of well casing

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US Army Corps of Engineers
Long-Term Monitoring 2008 Data Summary Report

Appendices



**MALCOLM
PIRNIE**

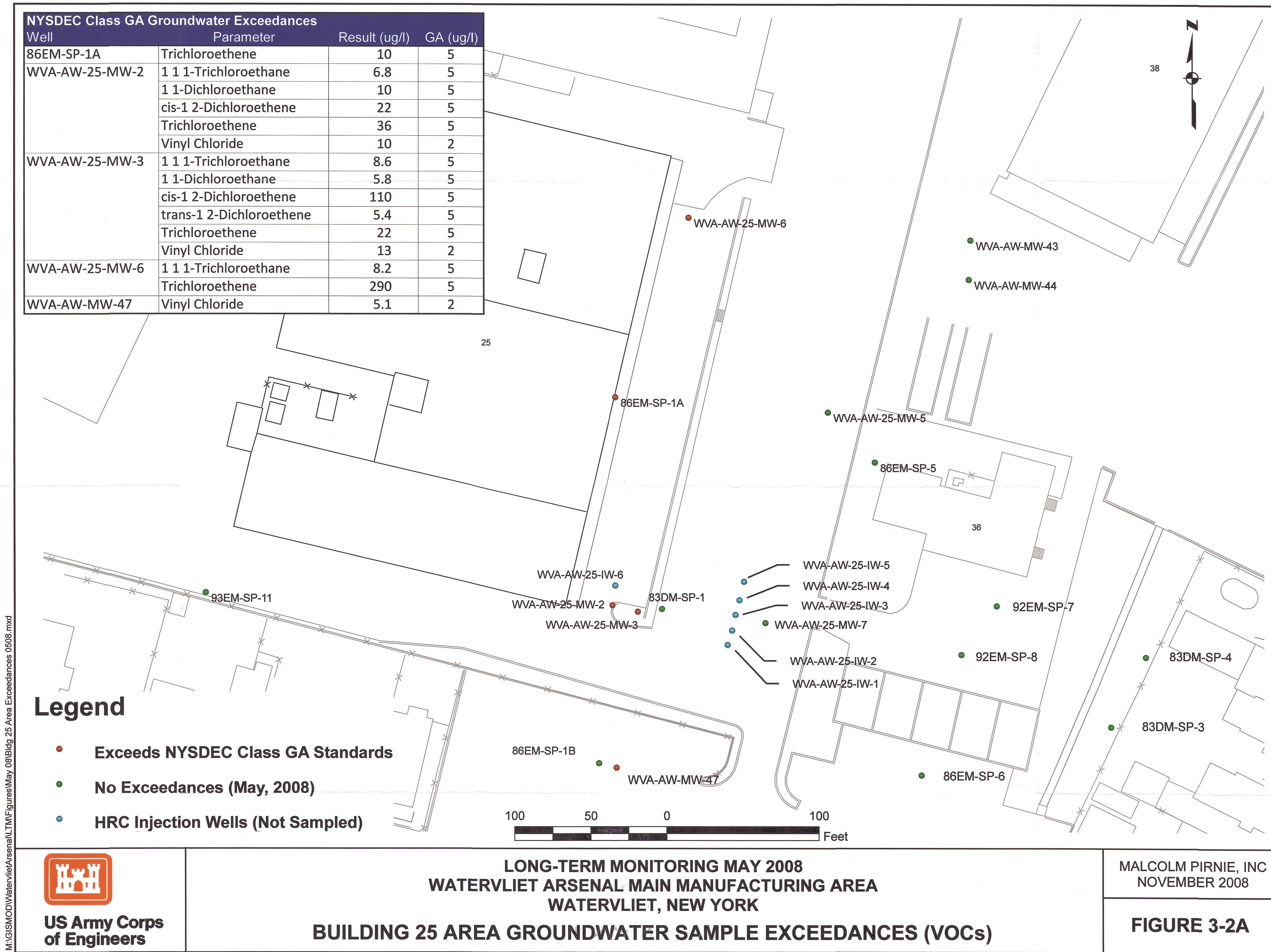
INDEPENDENT ENVIRONMENTAL
ENGINEERS, SCIENTISTS
AND CONSULTANTS

A
APPENDIX

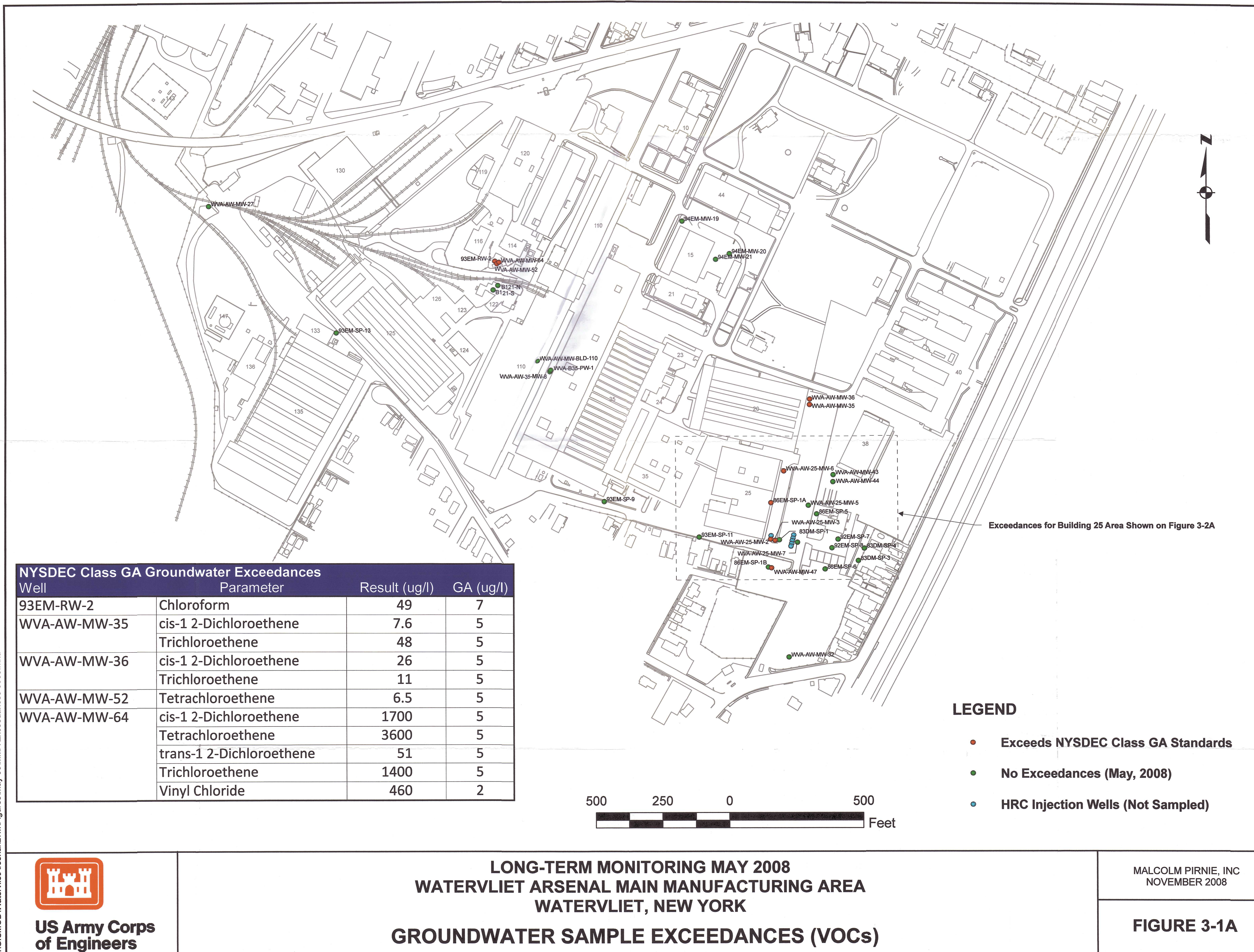
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APPENDIX

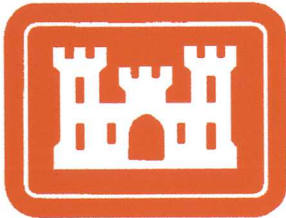




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NYSDEC Class GA Groundwater Exceedances			
Well	Parameter	Result (ug/l)	GA (ug/l)
WVA-SA-MW-32	cis-1 2-Dichloroethene	18	5
WVA-SA-MW-39	1 1-Dichloroethene	13	5
	Benzene	24	1
	Vinyl Chloride	1100	2
	cis-1 2-Dichloroethene	4800	5
	Tetrachloroethene	470	5
	trans-1 2-Dichloroethene	200	5
	Trichloroethene	900	5
WVA-SA-MW-60	Vinyl Chloride	2000	2
	cis-1 2-Dichloroethene	22	5
WVA-SA-MW-70	cis-1 2-Dichloroethene	42	5
	Vinyl Chloride	3.6	2
WVA-SA-MW-79	Benzene	4.8	1
WVA-SA-MW-81	cis-1 2-Dichloroethene	11	5
	Vinyl Chloride	150	2
WVA-SA-MW-83	cis-1 2-Dichloroethene	41	5
	Vinyl Chloride	700	2
WVA-SA-SNS-6	Vinyl Chloride	4.2	2
WVA-SA-STS-6	cis-1 2-Dichloroethene	10	5
	Tetrachloroethene	8.5	5



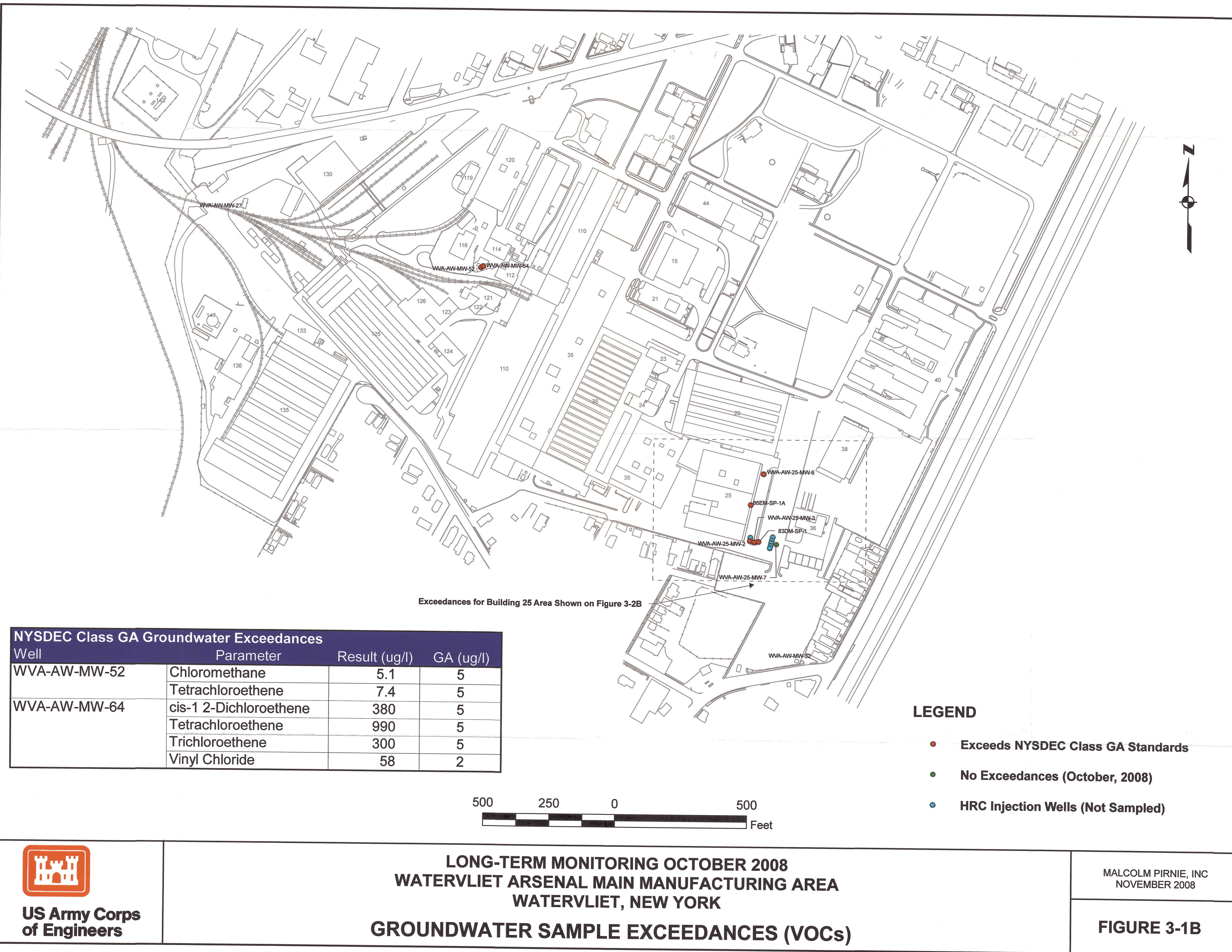
US Army Corps
of Engineers

LONG-TERM MONITORING MAY 2008
WATERVLIET ARSENAL SIBERIA AREA
WATERVLIET, NEW YORK
GROUNDWATER SAMPLE EXCEEDANCES (VOCs)

MALCOLM PIRNIE, INC
NOVEMBER 2008

FIGURE 3-5

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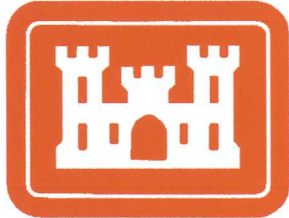
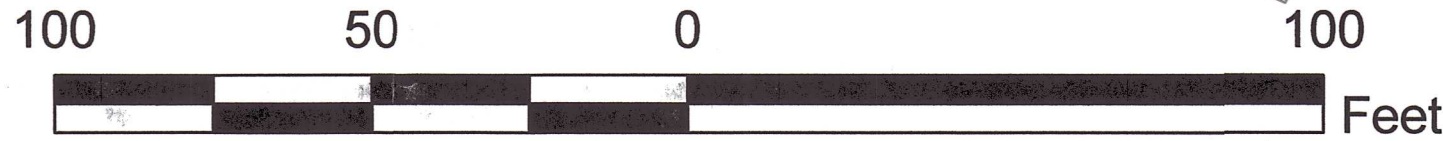


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NYSDEC Class GA Groundwater Exceedances			
Well	Parameter	Result (ug/l)	GA (ug/l)
83DM-SP-1	cis-1 2-Dichloroethene	18	5
	Trichloroethene	15	5
86EM-SP-1A	Trichloroethene	10	5
WVA-AW-25-MW-2	1 1 1-Trichloroethane	6.9	5
	1 1-Dichloroethane	13	5
	cis-1 2-Dichloroethene	31	5
	Trichloroethene	20	5
	Vinyl Chloride	10	2
WVA-AW-25-MW-3	1 1 1-Trichloroethane	10	5
	1 1-Dichloroethane	8.2	5
	cis-1 2-Dichloroethene	150	5
	Trichloroethene	16	5
	Vinyl Chloride	13	2
WVA-AW-25-MW-6	1 1 1-Trichloroethane	8.4	5
	Trichloroethene	290	5

Legend

- Exceeds NYSDEC Class GA Standards
- No Exceedances (October, 2008)
- HRC Injection Wells (Not Sampled)



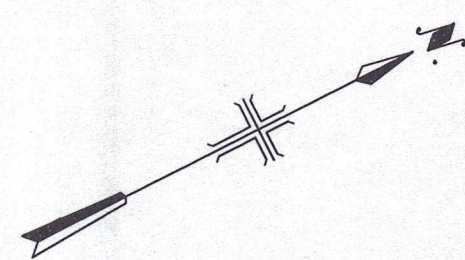
US Army Corps
of Engineers

LONG-TERM MONITORING OCTOBER 2008
WATERVLIET ARSENAL MAIN MANUFACTURING AREA
WATERVLIET, NEW YORK

BUILDING 25 AREA GROUNDWATER SAMPLE EXCEEDANCES (VOCs)

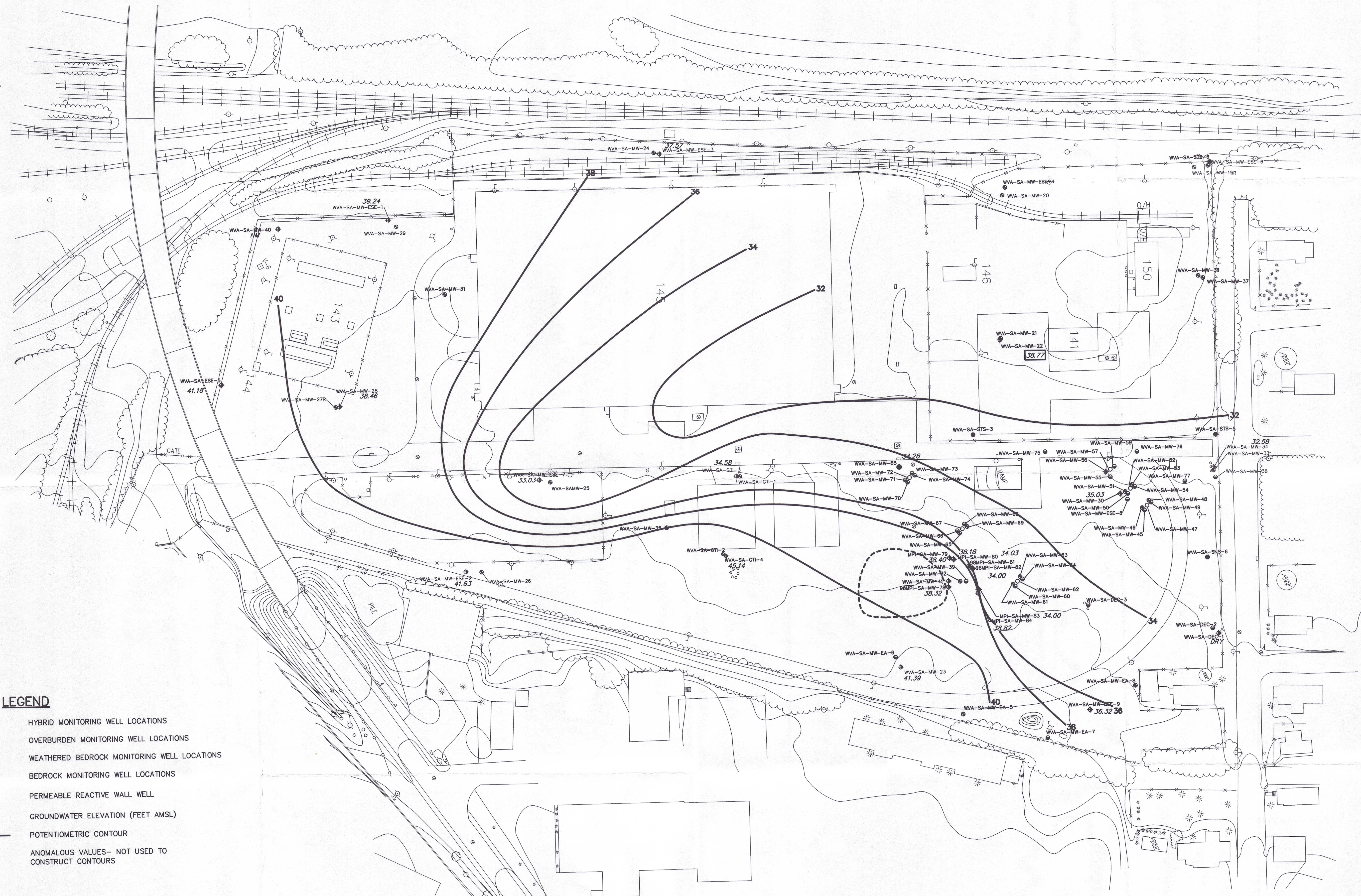
MALCOLM PIRNIE, INC
NOVEMBER 2008

FIGURE 3-2B

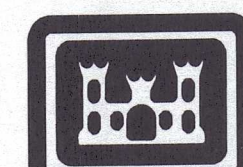


LEGEND

- ◆ HYBRID MONITORING WELL LOCATIONS
- OVERBURDEN MONITORING WELL LOCATIONS
- WEATHERED BEDROCK MONITORING WELL LOCATIONS
- ◆ BEDROCK MONITORING WELL LOCATIONS
- PERMEABLE REACTIVE WALL WELL
- 32.84 GROUNDWATER ELEVATION (FEET AMSL)
- POTENTIOMETRIC CONTOUR
- 38.65 ANOMALOUS VALUES- NOT USED TO CONSTRUCT CONTOURS



30 0 30 60
SCALE: 1" = 60'



US Army Corps
of Engineers

**MALCOLM
PIRNIE**

REVISIONS			
NO.	BY	DATE	REMARKS

DES ARV
DWN MDM
CKD BRN

WATERVLIET ARSENAL
SIBERIA AREA
USACE CONTRACT NO. DACA31-94-D-0017

BEDROCK
POTENTIOMETRIC CONTOUR MAP
(OCTOBER 28, 2008)
1"=60'

MALCOLM PIRNIE, INC.
DATE DECEMBER 2008
SHEET 1 OF 1
DWG. NO. FIGURE 2-3

