NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

AND

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION-2

STATEMENT OF BASIS

WATERVLIET ARSENAL
SIBERIA AREA
WATERVLIET, NEW YORK 12801
EPA I.D. NO.: NY7213820940

SEPTEMBER 2008

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EXECUTIVE SUMMARY

This Statement of Basis was developed by the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency, Region-2 (USEPA) [Regulating Agencies] under the authority of the Solid Waste Disposal Act, as amended, and more commonly referred to as the Resource Conservation and Recovery Act (RCRA). This Statement of Basis addresses the proposed final remedies for both the soils and groundwater in the Watervliet Arsenal Siberia Area. The Watervliet Arsenal consists of two areas, the Main Manufacturing Area and the Siberia Area. Only the Siberia Area is the subject of this Statement of Basis. The Main Manufacturing Area will be addressed in a separate Statement of Basis.

The Siberia Area, impacted by past releases of hazardous constituents from facility operations, is a relatively isolated area of the facility. This Statement of Basis presents a summary of the following pertinent information and data associated with the Siberia Area:

- Background and regulatory history;
- Description of the area;
- Contamination found in the Siberia Area;
- Potential environmental and human health risks;
- Proposed final remedies; and
- Public comment and participation

The Statement of Basis proposes the following final remedies for two Areas of Concern (AOCs), that encompass all of the contaminants at the various Siberia Area Solid Waste Management Units (SWMUs) described in this document. These remedies were implemented as Interim Corrective Measures (ICMs).

AOC 1: Soil Contamination:

- Enhanced bioremediation via land farming;
- Capping;
- Excavation and off-site disposal; and
- Institutional Controls

AOC 2: Groundwater Contamination:

- Source Removal;
- Treatment of volatile organic contamination by a permeable reactive wall; and
- Monitored natural attenuation of low levels of petroleum hydrocarbons in groundwater

The public is encouraged to review and provide comment on this Statement of Basis. These comments can influence the final remedy selection if new substantive information and arguments are presented to the Regulating Agencies. See section 6. below for information on public comment and participation.

BACKGROUND AND REGULATORY HISTORY

A Corrective Action Order (effective October 12, 1993) was issued to the Watervliet Arsenal pursuant to Section 3008(h) of the Resource Conservation and Recovery Act (RCRA,) as amended by the Hazardous and Solid Waste Amendments of 1984, 42 U.S.C. § 6901 et seq. and Section 71-2727 of the New York State Environmental Conservation Law. This order required Watervliet Arsenal to identify and fully investigate the nature, rate or migration, and extent of contamination at its facility; evaluate potential corrective measures and implement these remedies as Interim and Final Corrective Measures. The following reports were issued as part of this process.

RCRA Facility Assessment Report

A RCRA Facility Assessment (RFA) report, prepared by the NYSDEC in December 1986, updated in December 1987 and updated again in March 1992, identified SWMUs in the Siberia area of the Watervliet Arsenal. In addition, several small-scale investigations were conducted in the late 1980s through the early 1990s. Based on the RFA Report and the results of these studies, the Regulatory Agencies determined that additional, detailed sampling was needed.

RCRA Facility Investigation

The required sampling was done as part of a RCRA Facility Investigation (RFI) at the Siberia Area from 1995-1997. The results of the RFI were presented in the Final RCRA Facility Investigation Report, Siberia Area, Watervliet Arsenal, Watervliet, New York, dated December 1997.

Chlorinated volatile organic compounds (VOCs), petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), and metals were detected in the groundwater and soil at the Siberia Area during the RFI. Based on the results of the RFI, the regulatory agencies determined that a Corrective Measures Study was necessary to evaluate and recommend remedial alternatives for the impacted portions of the Siberia Area.

RCRA Corrective Measures Study

Additional investigations were conducted to further define the extent of soil and groundwater contamination. These data are presented in the *Corrective Measures Study Field Data Report, Siberia Area, Watervliet Arsenal, Watervliet, New York, dated October 1998*. Based on the results of the RFI and these investigations, appropriate corrective measure technologies for the Siberia Area were recommended by WVA and presented in the *Draft Corrective Measures Study, Siberia Area, Watervliet Arsenal, Watervliet, New York, July 2002*. This study was approved by the Department on September 15, 2003.

Human Health and Ecological Exposure Assessment / Environmental Indicators

Concurrent with the CMS, a human health and ecological exposure assessment was completed to evaluate and document potential risks resulting from environmental conditions at the Siberia Area. The results of the exposure assessment were presented in the *Final Exposure Assessment, Siberia Area, Watervliet Arsenal, Watervliet, New York dated December 1998.*

The EI 725, *Current Human Health Exposures under Control*, was completed in September 2003. The EI 750, *Migration of Contaminated Groundwater Under Control*, was completed in September 2005.

Focused Corrective Measures Study

Bench scale and pilot scale treatability studies were conducted to evaluate the applicability and efficacy of various technologies for treatment of soil and groundwater, which were identified in the preliminary screening report and the exposure assessment. Because there were positive results in pilot studies for enhanced bioremediation of soils (land farming) and ground water treatment through a permeable reactive wall, they were continued as ICMs. These ICMs, selected as proposed final corrective measures in a Focused Corrective Measures Study dated July, 2003, are being proposed as final remedies for the Siberia Area in this Statement of Basis.

DESCRIPTION OF AREA

The Watervliet Arsenal is a 140-acre government-owned installation under the command of the U.S. Army Tank Automotive and Armaments Command. The Arsenal is located in the City of Watervliet, New York, 3 ½ miles northeast of the City of Albany and adjacent to the Hudson River. A site location map is attached as Figure 1.

Watervliet Arsenal is the nation's oldest cannon factory. The entire facility is a Registered Historic Landmark. Cannon tubes, tube assemblies, cannon components, mortars, and recoilless rifles were manufactured on the site. The Arsenal remains an active U.S. Army facility.

Watervliet Arsenal consists of two areas: (1) Main Manufacturing Area and (2) Siberia Area. The Siberia Area is the subject of this Statement of Basis. A site map delineating the Main Manufacturing Area and Siberia Area is attached as Figure 2.

Siberia Area

The 15-acre Siberia Area was purchased by the Watervliet Arsenal in the early 1940s. The Siberia Area was subsequently filled in with debris consisting of slag, cinders, wood, brick and other available debris of unknown origin. Following completion of the ICMs in 2005 at the Siberia Area, a new building was constructed which covers some of the filled area. The remaining areas were graded, capped, covered with crushed stone and/or covered with grass. In the past, metal chips coated with cutting oils, salvaged scrap metals and scrap lumber were stored directly on the ground surface in the Siberia Area. These practices may have contributed to groundwater and soil contamination in the Siberia Area. In addition, the Watervliet Arsenal has reported that mixtures of oils and solvents removed from underground storage tanks were sprayed on the ground for dust control. Current operational procedures prohibit all of these activities.

In addition to these activities conducted by Arsenal personnel, the Perfection Plating Company manufactured metal plates for brake pads in their facility located hydraulically up-gradient of the Siberia Area. Operations at Perfection Plating are believed to have caused elevated levels of chromium and lead that were detected in the northeastern section of the Siberia Area. This

chromium and lead contamination is currently under remediation by the NYSDEC. This corrective action is not included in the scope of this Statement of Basis.

The Siberia Area is divided into four quadrants as shown on Figure 3. SWMUs in the Siberia Area are shown on Figure 4 and summarized below. The numerical gaps seen in this list exist because the SWMU numbers were assigned for the entire site, which includes the Main Manufacturing Area where most of the SWMUs are found.

- SWMU No. 2: Building 145 Hazardous Waste Storage Area
  This site was an indoor temporary storage area for hazardous waste located within Building 145. The storage area underwent RCRA closure in 1996. Closure activities included the scarification of concrete in the storage area and proper disposal of the resulting concrete waste material. A clean closure letter was issued for SWMU No. 2 by the NYSDEC in April 1997.

- SWMU No. 3: Former Siberia Container Storage Area
  This SWMU is a duplicate of SWMU No. 24, which is summarized below.

- SWMUs Nos, 7 and 7a: Underground Waste Oil Storage Tanks
  SWMU No. 7 was a former 8,000 gallon underground waste oil tank used to collect waste oil resulting from temporary storage of scrap metal materials in the waste recycling area, commonly known as the Chip Handling Facility. The tank was located adjacent to Building 141. This tank was removed in 2000 and replaced with a new, double-walled, underground waste oil tank installed in the same location. An additional underground waste oil storage tank was installed in the new indoor Chip Handling Facility (Building 152) in 1997. This tank was designated as SWMU No. 7a.

- SWMU No. 18: Siberia Area
  Due to the widespread nature of contamination in the soil and groundwater in the Siberia Area, the entire area was identified as a SWMU. Specific sites and/or operations within the Siberia were identified as separate SWMUs.

- SWMU No. 22: Waste Recycling Operations
  Scrap metal materials from MMA operations are processed in the Chip Handling Area, which is in the northwest portion of the site (Buildings 141 and 152), prior to being sent off site for recycling. Any waste lubricating oils present with the scrap metals are removed at the Chip Handling Area and temporarily stored in underground waste oil tanks. A new indoor facility (Building 152) was constructed in this area from 1996-2002. This facility began operations in 2003. The new facility will allow for materials storage and waste oil collection to take place indoors, thereby preventing potential surface runoff of waste oils.

- SWMU No, 23: Former Burn Pit
  The Former Burn Pit was used to burn combustible waste materials from operations at the Watervliet Arsenal from the 1940s to 1967. The pit is located in the Northeast Quadrant of the Siberia Area.

- SWMU No. 24: Trash/Scrap Dumpster Area

The Trash/Scrap Dumpster area located at the concrete ramp in the Northeast Quadrant has historically been and continues to be used for temporary storage of industrial waste (in "roll-off' containers) prior to disposal off site. Clean wood scrap (i.e., pallets or brush) is also periodically stored in this area prior to being disposed off site. A new underground storage tank and drainage system was installed in 1996 to collect any runoff from the industrial waste roll-off containers.

Corrective measures related to the SWMUs listed above were identified in the 2002 Corrective Measures Study. Their disposition is described in the summary. Any contaminants that may have remained from these SWMUs are addressed in the one of the two AOCs included in this Statement of Basis:

- AOC 1: Soil Contamination (SWMU 18: Siberia Area); and
- AOC 2: Groundwater Contamination (SWMU 23: Former Burn Pit.)

CONTAMINATION FOUND IN THE SIBERIA AREA

AOC 1: Soil Contamination

Organic Contamination

The only significant concentrations of VOCs found in Siberia Area soils were in the source area of the Former Burn Pit. These were removed as an ICM.

Organic soil contamination is primarily petroleum hydrocarbons and associated polycyclic aromatic hydrocarbons (PAHs). Areas impacted by petroleum hydrocarbons and associated PAHs were:

- The Main Substation area in the Southwest Quadrant;
- The Chip Handling Facility in the Northwest Quadrant;
- The Former Burn Pit in the Northeast Quadrant; and
- The PCB area in the Southeast Quadrant near the former lumber yard (currently the National Guard vehicle storage area).

The location of these areas is shown on Figure 3.

The highest PAH concentrations detected in the soil were found in the Main Substation area, and include the following as listed in Table 1.

Table 1 - Highest PAH Concentrations in Soil at Main Substation Area

PAH (Main Substation Area)	Maximum Concentration (μg/kg) [PPB]	Average Concentration (μg/kg) [PPB]
Pyrene	180,000	25,822
Fluoranthene	150,000	25,457

Table 1 - Highest PAH Concentrations in Soil at Main Substation Area		
PAH (Main Substation Area)	**Maximum Concentration (μg/kg) [PPB]**	**Average Concentration (μg/kg) [PPB]**
Phenanthrene	89,000	16,962
2-Methylnaphthalene	82,000	23,062
Benzo(b)fluoranthene	79,000	11,787
Chrysene	63,000	9,258
Benzo(a)pyrene	58,000	9,056
Benzo(a)anthracene	51,000	7,902
Benzo(k)fluoranthene	51,000	8,707
Indeno(1,2,3-cd)pyrene	41,000	10,431
Naphthalene	36,000	9,307
Fluorene	26,000	10,474
Benzo(g,h,i)perylene	17,000	4,339
Acenaphthene	16,000	10,100
Dibenzo(a,h)anthracene	15,000	5,023
Anthracene	13,000	3,638

PPB: part per billion

Inorganic Contamination

Inorganic contamination in the soil was the most prevalent in the Northeast and Southwest Quadrants of the Siberia Area. Inorganic contaminants were primarily chromium, lead, and arsenic in the soil. Chromium was the most extensive and widespread inorganic contaminant, with the maximum concentrations detected in the Northeast and Southwest (Main Substation area) Quadrants. The locations of the maximum detected inorganic concentrations in the Siberia Area soil are listed below in Table 2.

Table 2 - Maximum Inorganic Concentrations in Siberia Area Soil			
Metal	**Maximum Concentration (mg/kg) [PPM]**	**Average Concentration (mg/kg) [PPM]**	**Location Of Maximum Concentration**
Arsenic	42.1	11.9	NE Quadrant
Barium	439	155.8	NE Quadrant
Cadmium	23.8	2.0	NW Quadrant
Chromium	2490	105.4	NE Quadrant

Table 2 - Maximum Inorganic Concentrations in Siberia Area Soil			
Metal	**Maximum Concentration (mg/kg) [PPM]**	**Average Concentration (mg/kg) [PPM]**	**Location Of Maximum Concentration**
Lead	2530	196.8	SW Quadrant
Mercury	4	0.4	SW Quadrant
Selenium	30.1	2.5	NE Quadrant
Silver	10.5	1.3	NW Quadrant

PPM: part per million

Lead contamination in the soil was the most extensive along the eastern fence line and in the Main Substation area. Arsenic contamination was widespread, though the maximum concentrations in the surface and shallow soil were almost exclusively located along the eastern, northern, and western fence lines. Chromium, lead, and arsenic concentrations in the soil generally decreased with increasing depth.

Soil and sediment samples (in a drainage ditch) were collected off of the Watervliet Arsenal property adjacent to the Northeast and Northwest Quadrants during the RFI and Corrective Measures Study field activities to assess the impacts of the Siberia Area contamination on the surrounding area. Consistent with the nature of the contamination in the Siberia Area, elevated concentrations of PAHs and inorganic contaminants were detected in the off-site surface soil and sediment samples. However, these concentrations were significantly lower than the maximum concentrations detected within the Siberia Area.

AOC 2: Groundwater Contamination

Petroleum hydrocarbons were detected in groundwater samples collected throughout the Siberia Area, but predominantly in the area of the Main Substation, Chip Handling Area, the Former Burn Pit, and the former lumber yard. A sheen and petroleum odors were noted during monitoring well development and groundwater sampling activities within these areas. However, analytical results for these samples showed relatively few contaminants present at concentrations greater than groundwater standards, per *6 NYCRR Part 703, Surface Water and Groundwater Quality Standards*.

Those PAHs exceeding the NYSDEC Class GA groundwater standards were benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, indeno(1,2,3-cd)pyrene, naphthalene, and phenol. The greatest concentrations of benzo(a)anthracene, chrysene, indeno(1,2,3-cd)pyrene, and naphthalene were detected in groundwater samples from monitoring well MW-32, which was located in the Former Burn Pit area of the Northeast Quadrant. The highest concentrations of benzo(b)fluoranthene, benzo(b)fluoranthene, and bis(2-ethylhexyl)phthalate were detected in monitoring wells located on the southern border of the Northeast Quadrant. (See Table 3 below).

Table 3 - SVOCs in Groundwater Summary of Maximum SVOC Detections in Groundwater Siberia Area (May 2000 - October 2007)	
Parameter	**Maximum Concentration (ug/L)**
1 2 4-Trichlorobenzene	0.6 J
1 4-Dichlorobenzene	1 J
1,2-Dichlorobenzene	1 J
2 4-Dimethylphenol	0.8 J
2-Methylnaphthalene	13
4-Chloro-3-methylphenol	2 J B
Acenaphthene	5 J
Acenaphthylene	0.4 J
Anthracene	2 J B
Benzo(a)anthracene	2
Benzo(a)pyrene	0.3 J
Benzo(b)fluoranthene	0.3 J
Benzo(g,h,i)perylene	0.2 J
Benzo(k)fluoranthene	0.3 J
Bis(2-ethylhexyl) phthalate	210 B D
Butyl benzyl phthalate	9.5 J
Chrysene	3
Diethyl phthalate	9 J
Dimethyl phthalate	0.8 J
Di-n-butyl phthalate	2 J
Di-n-octyl phthalate	2 J M
Fluoranthene	8 J
Fluorene	7 J
Indeno(1 2 3-cd)pyrene	0.1 J
Naphthalene	19
n-Nitrosodiethylamine	3 J B
N-Nitrosodi-n-propylamine	0.3 J
Phenanthrene	3 J

Table 3 - SVOCs in Groundwater	
Summary of Maximum SVOC Detections in Groundwater Siberia Area (May 2000 - October 2007)	
Parameter	**Maximum Concentration (ug/L)**
Phenol	34
Pyrene	25

J: estimated result; analyte detected below quantitation limits
B: constituent detected at concentration ≥ instrumentation detection limit but at < contract required detection limit
D: duplicate sample
M: manually integrated compound to improve data quality

VOCs detected at concentrations greater than the NYSDEC Class GA Standards are contained in both overburden and bedrock groundwater within the Northeast Quadrant of the Siberia Area (see Figure 3). As shown in monitoring well SA-MW-41, adjacent to the burn pit (see Table 4 below) some contaminants were primarily found in the shallow weathered bedrock groundwater. Tetrachloroethene (PCE), trichoroethene (TCE) cis-1,2 dichloroethene (DCE), and vinyl chloride (VC) appeared to be migrating northward from their source, at the Former Burn Pit, towards the property line.

Table 4 - VOCs Detected in Well SA-MW-41				
Summary of VOCs detected in Bedrock Monitoring Well SA-MW-41				
VOC (μg/l) [PPB]	Depth Below Ground Surface			
	14 - 34 feet	34 - 54 feet	54 - 74 feet	74 - 94 feet
1,1-Dichloroethene	5	ND	ND	ND
1,2,4-Trimethylbenzene	3.5	ND	ND	ND
1,2-Dichloroethene	ND	ND	ND	9
1,3,5-Trimethylbenzene	1.7	ND	ND	ND
Acetone	ND	ND	ND	10
Benzene	11	ND	ND	ND
Chloroform	88	ND	ND	ND
cis-1,2-Dichloroethene	950	1300	50	ND
Methylene Chloride	ND	ND	ND	13
Tetrachloroethene	1100	170	1.7	ND
trans-1,2-Dichloroethene	4.9	ND	ND	ND
Trichloroethene	140	900	1.1	ND
Vinyl Chloride	2400	340	ND	19

ND: Not detected

POTENTIAL ENVIRONMENTAL AND HUMAN HEALTH RISKS

Older buildings at the Siberia Area are slab-on-grade construction and are not located above identified AOCs for soil and/or groundwater. A new building was constructed in 2005 with a sub-slab depressurization system to prevent indoor air impacts from VOC contaminated groundwater known to be in the area.

EI 725 concluded that current human exposures are under control. EI 750 concluded that migration of contaminated groundwater is under control and monitoring will be conducted to confirm that it remains within the existing are of contaminated groundwater. These conclusions will be reevaluated if NYSDEC becomes aware of significant changes at the facility.

As part of long term monitoring (LTM), water in four storm water and sanitary sewer catch basins is sampled on an annual basis. The most recent results in May 2007 show that TCE, PCE and vinyl chloride are present at low concentrations in three samples. These three sample locations are along the northern border of the Siberia Area in close proximity to residences. In February 2008, three on-site soil gas samples were collected from the Siberia Area adjacent to the residences. Very low levels of VOCs were detected, ranging from non-detect to 3.9 $\mu g/m^3$ for PCE.

AOC 1: Soil Contamination

The majority of the surface soil contaminated with petroleum hydrocarbons and/or metals were removed or treated as part of the ICMs conducted at the Siberia Area in 2002 and 2003. This includes removal of contaminated soils in off-site areas. Areas of surface soil that could not be treated or removed were covered with clean fill, crushed stone and/or capped with asphalt. As such, there is no exposure pathway for any of the remaining contaminants in the surface soil other than the potential for occasional contact exposure by construction personnel working in or around subsurface excavations in the capped areas.

Additional protection from exposure will be provided by a Site-Wide Soils Management Plan that outlines procedures for disposal of excavated soils from areas where contamination remains on the site at levels above Corrective Action Objectives (CAOs). In addition, Land Use Controls (LUCs) are in place at the Siberia Area to protect human health, the environment, and the integrity of an engineering remedy by limiting the activities that may occur at a particular contaminated site. LUCs include any type of physical, legal, or administrative mechanism that restricts the use of, or limits access to, real property. The Department of Defense (DoD) promulgated the memorandum entitled *Policy on Land Use Controls Associated with Environmental Restoration Activities (January 2001)* to provide a DoD framework for implementing, documenting, and managing LUCs for real property being transferred out of Federal control and for active installations. The LUC for the Siberia Area was prepared in accordance with this DoD policy.

AOC 2: Groundwater Contamination

Groundwater contamination at the Siberia Area is predominately in the Northeast Quadrant where concentrations of VOCs, presumed to be associated with the Former Burn Pit, are found at

concentrations greater than NYSDEC Class GA standards. While groundwater in other portions of the Siberia Area also contains visual evidence of petroleum contamination, concentrations of regulated compounds are, in general, less than Class GA Standards.

The material in the Burn Pit was excavated in 2000 as a source removal ICM. In addition a two part, in-situ permeable iron reactive wall system was constructed to intercept and treat residual VOCs from the formal burn pit area. Subsequent monitoring has demonstrated that the reactive wall system is successfully preventing the discharge of VOCs from the Siberia Area and there is no pathway for offsite exposure to VOCs from the site.

The long term groundwater monitoring program has shown that contaminant concentrations in the Siberia Area are stable or decreasing, presumably because there are no remaining sources of groundwater contamination. Watervliet Arsenal and all surrounding properties are serviced by public potable water supplies provided by the City of Watervliet and the Town of Colonie. Therefore, there is no pathway for ingestion or contact with contaminated groundwater for all receptors except for the potential for occasional contact exposure by construction workers in or around subsurface excavations.

PROPOSED FINAL REMEDIES

The Regulating Agencies approved the following ICMs, which were implemented and are recommended to become the final remedies.

AOC 1: Soil Contamination

For Siberia Area soils, the following remedial technologies are proposed as final remedies. Some of these technologies were implemented and completed as ICMs.

- Enhanced bioremediation (land farming);
- Capping;
- Excavation and off-site disposal; and
- Institutional Controls.

The locations where these activities were completed are shown on Figure 5. A Construction Certification Report detailing the Siberia Area soil remedy activities was approved by NYSDEC on August 31, 2007.

Enhanced Bioremediation (Landfarming)

Enhanced bioremediation uses microorganisms to degrade organic contaminants in excavated soil, sludge, and solids. The microorganisms break down contaminants by using them as a food source.

This technology was chosen because of: (1) its low cost ($20 to $80 per cubic yard); (2) its destruction of petroleum hydrocarbons and PAH's; and (3) because pilot studies demonstrated a reasonable expectation that it could achieve the CAOs.

Bio-treatability studies indicated that naturally occurring bio-degrading organisms exist onsite and are using the total petroleum hydrocarbons and PAH's as a source of carbon (food). To assure removal of recalcitrant PAH's down to the CAOs, bio-enhancement was used. This entailed the addition of fertilizer, moisture, a bulking agent (wood chips) and mixing of the soil on a routine basis.

The CAOs for the soils, which were developed with the concurrence of the New York State Department of Health, are shown in Table 5 below.

Table 5 - Corrective Action Objectives for Soils

Corrective Action Objectives For The Siberia Area Soils

PAH*	CAO (mg/kg) [PPM]	PAH	CAO (mg/kg) [PPM]	Inorganic	CAO (mg/kg) [PPM]
Naphthalene	50	Fluoranthene	50	Arsenic	23
Acenaphthene	50	Pyrene	50	Chromium	390
Acenapthylene	50	Benzo(a)pyrene	1.0	Lead	500
Anthracene	50	Benzo(b)fluoranthene	8.8		
Fluorene	50	Benzo(k)fluoranthene	8.8		
Phenantherene	50	Dibenzo(a,h)anthracene	1.0		
Benzo(a)anthracene	1.0	Benzo(g,h,i)perylene	50		
Chrysene	3.2	Indeno(1,2,3)pyrene	25.6		

* Polycyclic Aromatic Hydrocarbon
PPM: part per million

The plans and specifications to implement bioremediation (land farming) as an ICM were approved on February 28, 2003. However, due to possible loss of funding, the facility started preliminary site work prior to this approval. During September 2002, the following was accomplished: site surveys, utility relocation, preparation of on-site facilities, erosion control measures and asphalt pavement removal. During the winter of 2002, the following field work was conducted: soil excavation and screening, post-excavation sampling, off-site disposal of soil that could not be treated, and construction of land farming treatment cells and placement of contaminated soils in the cells.

During the summer of 2003 and 2004 approximately 13,300 cubic yards of soil were actively treated through landfarming in a number of treatment cells. When the soils reached levels below CAOs or when monitoring showed a continuing reduction in concentrations due to natural attenuation, these areas (approximately 2.9 acres) were graded and covered with a geotextile and gravel. This work was completed in January 2006.

In addition, as an ICM for the Burn Pit area, all contaminated soils and other materials disposed in the area of the pit were excavated and treated by enhanced bioremediation during the landfarming pilot study.

Capping

An asphalt cap was placed on approximately 90,000 square feet (2.1 acres) of the site where landfarming was not feasible. Capping of these areas was completed during July 2004.

Excavation and Disposal

Approximately 3,500 cubic yards of soil that was not amenable to bioremediation or capping were excavated and disposed of off-site.

Institutional Controls

Institutional controls through land use restrictions will be imposed to limit future use of the site. A Site-Wide Soils Management Plan outlines procedures for disposal of excavated soils from areas where contamination remains on the site at levels above CAOs. In addition, Land Use Controls (LUCs) in place at the Siberia Area prevent exposure to contaminants above CAOs. LUCs include any type of physical, legal, or administrative mechanism that restricts the use of, or limits access to, real property.

AOC 2: Groundwater Contamination

For Siberia Area Groundwater, the following technologies are proposed to become final remedies.

- Source removal at the Former Burn Pit;
- In-situ groundwater treatment through a reactive iron wall; and
- Monitored Natural Attenuation (MNA) that will incorporate the existing, long term monitoring program.

Source removal and in-situ groundwater treatment have already been implemented and have succeeded in removing the contaminant source, and preventing dissolved VOCs from migrating off-site. Monitored natural attenuation is also occurring as demonstrated through ongoing long term monitoring. Thus, these remedies are considered appropriate to become final remedies because they are effective and they do not incur ongoing costs other than monitoring and periodically refreshing the iron wall to extend its effective life as long as it is needed.

Remedies Not Selected as Final Corrective Measures

Before selecting the proposed remedies, Watervliet Arsenal conducted three in-situ treatment pilot studies to evaluate other potential options to treat contaminated groundwater. These studies included Biosparging and Oxygen Release Compound ® (ORC) injections to destroy petroleum related organics and permanganate injection to address VOC contamination.

The Biosparging Pilot Study was conducted on the border of the northeast and southeast quadrants of the Siberia Area, on the south side of Building 148, to address petroleum hydrocarbon contamination in groundwater within the overburden. The maximum radius of influence achieved under typical biosparge flow rates was approximately 2.5 feet. Because of

this limited distribution, elevated dissolved oxygen concentrations were not sustained in any of the nearby groundwater monitoring points and no significant reductions in SVOC and TPH-DRO concentrations were observed during the pilot study. Based on these data, biosparging is not considered a feasible remedy for the petroleum hydrocarbons in the saturated soil or groundwater at the site.

The ORC Pilot Study was conducted to address the same contaminants as the biosparge study. For similar reasons the ORC was not shown to be effective: ORC or increased dissolved oxygen levels were not detected in any of the nearby monitoring points, and SVOC and TPH-DRO concentration reductions were not observed in either the soil or the groundwater during the pilot study. Based on these data, ORC is not considered a feasible remedy for the petroleum hydrocarbons in the saturated soil and or groundwater at the site.

The Permanganate Injection Pilot Study was conducted to address the residual VOC contamination hotspot in bedrock beneath the Former Burn Pit. Preliminary results did show that potassium permanganate can reduce VOC concentrations in the bedrock groundwater in the hotspot area. Based on the hydraulic response in the surrounding bedrock monitoring wells during the first injection, it appeared that WVA would be able to successfully distribute the potassium permanganate to the affected areas of the bedrock VOC hotspot if additional injections were conducted at multiple locations. However, there is a strong possibility that the injected potassium permanganate could migrate into the reactive walls and render them useless by oxidizing the reactive iron in them. Given the evidence that the permeable reactive walls are successfully treating VOCs migrating from this area, the permanganate injection remedy is not selected as a final remedy for groundwater in the Siberia area.

Selected Remedies

The reasons these three options were selected as final remedies are discussed further below.

Source Removal

Debris and soil beneath the Former Burn Pit area was identified as the source of soil and groundwater petroleum hydrocarbons and VOC contamination in the NE quadrant of the Siberia Area. An ICM was conducted in June and July, 2000 to remove approximately 1,500 cubic yards of contaminated soil and debris from this area. The extent of the contaminated materials was identified in a February, 2000 field investigation, supplemented by visual inspection during the excavation itself. Soil material was treated on site as part of the landfarming program. Oversized material, including wood block flooring, C&D debris, stabilization fabric, and other materials were sent off-site for disposal. A low-permeability clay layer was used as the first lift of backfill material in the excavation. This restricts groundwater infiltration through materials that may contain residual VOC contaminants leached from the Burn Pit. Groundwater monitoring downgradient of the Former Burn Pit area have shown a dramatic decrease in contaminant concentrations since the contaminant source was removed. Current levels are being effectively treated by the iron wall system.

Reactive Iron Wall

In November and December of 1998 Watervliet Arsenal installed a system to treat VOC contaminated groundwater in overburden using a system of two permeable reactive walls, as shown in Figure 6. The treated water includes groundwater in weathered bedrock that migrates into the overburden before it leaves the site. The permeable reactive wall is made up of zero-valent iron that degrades chlorinated contaminants such as trichloroethylene (TCE) and perchloroethylene (PCE) into non-toxic byproducts using oxidation-reduction reactions. As the iron is oxidized, a chlorine atom is removed from the compound using electrons supplied by the oxidation of iron. This technology was implemented as an ICM and is proposed to become the final remedy.

Groundwater monitoring of wells up and downgradient of the walls has shown this system to be highly effective in reducing VOC contaminants to levels that are consistently below groundwater standards.

Monitored Natural Attenuation

The long term monitoring program for the Siberia area includes annual samples from 19 monitoring wells in overburden, weathered bedrock, and bedrock. The program also includes three samples from storm sewer lines and one from the bedding material beneath a sanitary sewer line. These monitoring points are selected to monitor the Former Burn Pit area, the reactive wall, the storm sewers (large collection areas), and on the perimeter of the facility to ensure that contaminants are not migrating off-site. These wells are identified in Table 6 below and shown on Figure 7.

Table 6 - Siberia Area Monitoring Summary

Well	Area Monitored	Geologic Unit	Sampling Frequency
MW-EA-6	WVA boundary	Weathered Bedrock	Annual
MW-ESE-6	WVA boundary	Overburden	Annual
SNS-6	Sewer	Sanitary Sewer	Annual
STS-3	Sewer	Storm Sewer	Annual
STS-5	Sewer	Storm Sewer	Annual
STS-6	Sewer	Storm Sewer	Annual
WVA-SA-MW-	WVA boundary	Overburden	Annual
WVA-SA-MW-20	WVA boundary	Overburden	Annual
WVA-SA-MW-23	WVA boundary	Bedrock	Annual
WVA-SA-MW-32	Burn Pit	Overburden	Annual
WVA-SA-MW-33	WVA boundary	Overburden	Annual
WVA-SA-MW-34	WVA boundary	Bedrock	Annual
WVA-SA-MW-38	WVA boundary	Weathered Bedrock	Annual
WVA-SA-MW-39	Burn Pit	Weathered Bedrock	Annual
WVA-SA-MW-41	Burn Pit	Bedrock	Annual
WVA-SA-MW-49	Reactive Wall -	Weathered Bedrock	Annual
WVA-SA-MW-54	Reactive Wall -	Weathered Bedrock	Annual
WVA-SA-MW-59	Reactive Wall -	Weathered Bedrock	Annual
WVA-SA-MW-60	Reactive Wall -	Weathered Bedrock	Annual

Table 6 - Siberia Area Monitoring Summary			
Well	**Area Monitored**	**Geologic Unit**	**Sampling Frequency**
WVA-SA-MW-66	Reactive Wall -	Weathered Bedrock	Annual
WVA-SA-MW-70	Reactive Wall -	Overburden	Annual
WVA-SA-MW-76	Reactive Wall -	Weathered Bedrock	Annual
WVA-SA-MW-85	Reactive Wall - Side	Hybrid	Annual

Notes: Annual monitoring is conducted during the month of May.
The hybrid well monitors the weathered bedrock and overburden.

Monitored natural attenuation is considered appropriate for this site because:

- Contaminants from the burn pit source area were removed;
- Contaminants in bedrock have reached a stable distribution where the contaminant front does not appear to be migrating due to natural attenuation;
- VOC contaminants in overburden are being destroyed by passing through the reactive iron walls;
- Monitoring shows that no contaminants are migrating off site; and
- Watervliet Arsenal and the surrounding properties are all serviced by public potable water supplies provided by the City of Watervliet and the Town of Colonie. There is no likely pathway for ingestion or contact with contaminated groundwater.

PUBLIC COMMENT AND PARTICIPATION

The NYSDEC is soliciting public comments on the proposed final remedies discussed in this Statement of Basis. The NYSDEC is accepting public comments until September 26, 2008.

Based on a review by the Regulating Agencies, the proposed final remedies are believed to be protective of human health and the environment. The NYSDEC will select the Final Remedies after the public comment period has ended and all comments have been reviewed and considered. Changes may be made to the final remedies, or alternative measures may be selected, if public comments or additional data indicate that such changes will result in more appropriate remedies.

All comments submitted in accordance with the instructions below will be considered in making the decision for selection of the final remedies for the Watervliet Arsenal Siberia Area. Based on these considerations, and other pertinent information, the NYSDEC will issue a decision on the final remedies. The final decision will identify any changes from the proposed final remedies and include a responsiveness summary of comments.

A copy of the final decision will be sent to each person who submits written comments or who requests such notice.

Document Availability

The Statement of Basis summarizes information that is documented in greater detail in the administrative record for the site. The administrative record contains reports, including

investigations and sampling results, which the NYSDEC used to select the proposed final remedies. A list of key reports which are available for review is referenced in the "List of Supporting Documents" below. Review of these documents provides a more comprehensive understanding of the nature and extent of environmental impacts at the site and the remedial measures that are being proposed.

Copies of the documents in the "List of Supporting Documents" are available for review at the following location.

Watervliet Public Library
1501 Broadway
Watervliet, NY 12189-2895
Telephone: (518) 274-4471

How to Provide Comments

Comments must be sent to the NYSDEC Central Office in Albany, NY to the attention of Alicia Barraza (see contact information above). In lieu of, or in addition to submission of written comments, any interested person may request a public hearing. A request for a public hearing must be made in writing and must state the nature of the issues to be raised in the hearing. All written comments and/or requests for a hearing must be submitted no later than September 26, 2008.

List of Supporting Documents

Malcolm Pirnie (1997), Final RCRA Facility Investigation Report, Siberia Area, Watervliet Arsenal, Watervliet, New York, December 1997.

Malcolm Pirnie (1998a), Corrective Measures Study Field Data Report, Siberia Area, Watervliet Arsenal, Watervliet, New York, October 1998.

Malcolm Pirnie (1998b), Exposure Assessment, Siberia Area, Watervliet Arsenal, Watervliet, New York, April 1998.

Malcolm Pirnie (1998c), Final Work Plan and Addenda, Permeable Reaction Wall Pilot Treatment System, Watervliet Arsenal, Siberia Area NE Quadrant, Watervliet, New York, September 1998.

Malcolm Pirnie (1999a), Draft Corrective Measures Study (CMS) Preliminary Screening Report, Watervliet Arsenal, Siberia Area, Watervliet, New York, August 1999.

Malcolm Pirnie (1999b), Construction Certification Report, Permeable Reaction Wall Pilot Treatment System, Watervliet Arsenal, Siberia Area NE Quadrant, Watervliet, New York, February 1999.

Malcolm Pirnie (1999c), Final Long-Term Monitoring Plan, Watervliet Arsenal, Watervliet, New York, May 1999.

Malcolm Pirnie (2000a), Draft Final Biological Treatability Studies of Siberia Area, Watervliet Arsenal, Watervliet, New York, April 2000.

Malcolm Pirnie (2000), Work Plan for the Landfarming Pilot Treatment System, Watervliet, Arsenal, Siberia Area, NE Quadrant, Watervliet, New York, June 2000.

Malcolm Pirnie (2001), Certification Report, Former Burn Pit Removal, Watervliet Arsenal Siberia Area, Watervliet, New York, April 2001.

Malcolm Pirnie (2002), Landfarming Pilot Treatment System Report, Siberia Area, Watervliet Arsenal, Watervliet, New York, July 2002.

Malcolm Pirnie (2002), Long-Term Monitoring Data Summary Report (1999-2001), Watervliet Arsenal, Watervliet, New York, June 2002.

Malcolm Pirnie (2002), Plans and Specifications, Interim Corrective Measures Work Plan, Siberia Area Soil Bioremediation, Watervliet Arsenal, Watervliet, New York, October 2002

Malcolm Pirnie (2003) Draft Corrective Measures Study, Siberia Area, Watervliet Arsenal, Watervliet, New York (approved September 15, 2003)

Malcolm Pirnie (2006), Construction Certification Report, Siberia Area Soil Corrective Measures, Watervliet Arsenal, Watervliet, New York, May 2006

Definition of Technical Terms Used in This Statement of Basis

Containment: Containment is a remediation strategy that is selected when treatment is impractical. It is often used, or in combination with in-situ treatment. The most common containment measures are capping landfills and placing barriers in the subsurface to impede migration.

Corrective Action Objectives (CAOs): Cleanup levels for soils developed by NYSDEC with the concurrence from the New York State Department of Health.

In-situ Treatment: After it is determined that contamination is present, one of the first questions that is asked is whether the contaminants can be treated in place (i.e., in-situ). Treatment could include destruction or reduction in mobility or mass. Typical in-situ methods range from phytoremediation (absorption and metabolism by plants) to permeable barrier walls (walls of material that react with an agent to render it harmless).

Metals: This category includes metals such as lead, chromium and arsenic.

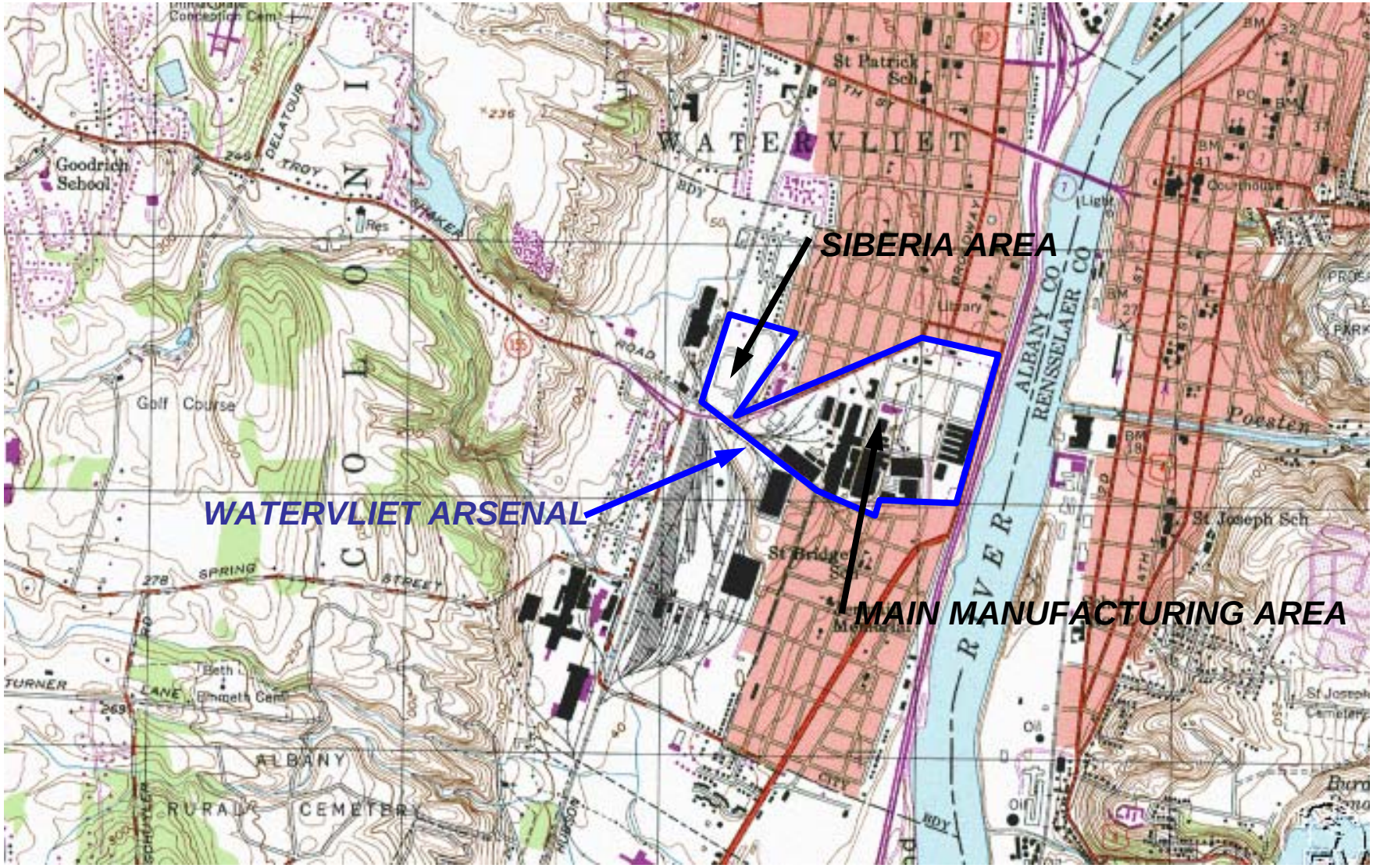
Removal: If contaminants cannot be successfully treated or destroyed in place, they have to be removed and treated, contained, or disposed of.

Semi-volatile Organic Compounds (SVOCs): This category includes contaminants that are more difficult to remove because they do not easily change phases, and often adsorb onto soil particles. Typical contaminants of this type are polychlorinated biphenyls (PCB), and polynuclear aromatic hydrocarbons (PAHs), such as coal tars and creosote.

Soil: This is the zone either at or below the ground surface that is above saturated zones (water table). This is referred to as the unsaturated subsurface or the vadose zone.

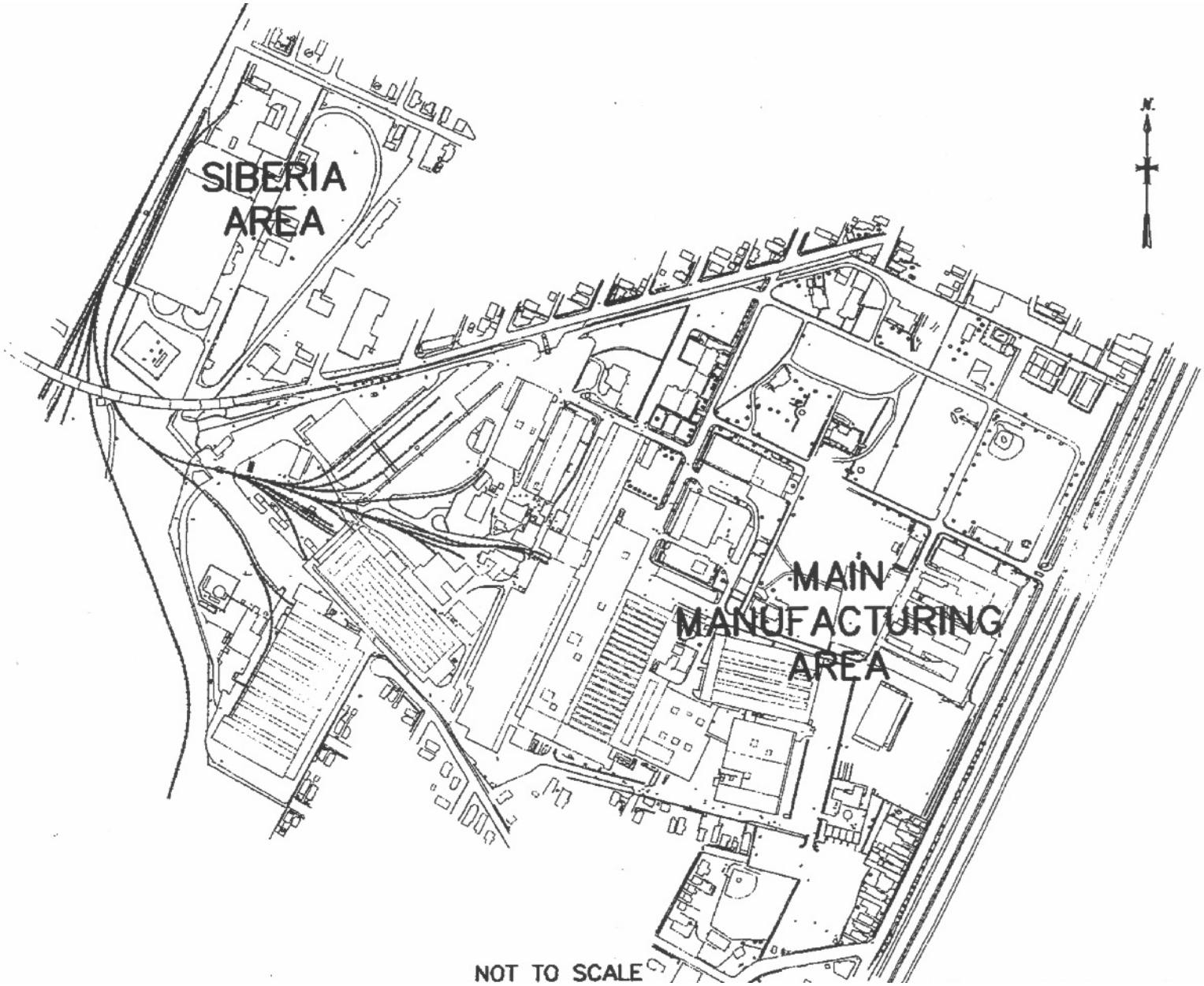
Volatile Organic Compounds (VOCs): This category includes solvents that easily change phases, or evaporate. This attribute often makes the compound easier to detect and remove. Very frequently, these compounds are chlorinated. Typical contaminants of this type are trichloroethene (TCE) and its daughter products such as vinyl chloride.

F I G U R E S



SOURCE: U.S.G.S 7.5 MIN. TROY SOUTH QUADRANGLE

MALCOLM PIRNIE	WATERVLIET ARSENAL WATERVLIET, NEW YORK	**WATERVLIET ARSENAL SITE LOCATION**	Page 23 FIGURE 1

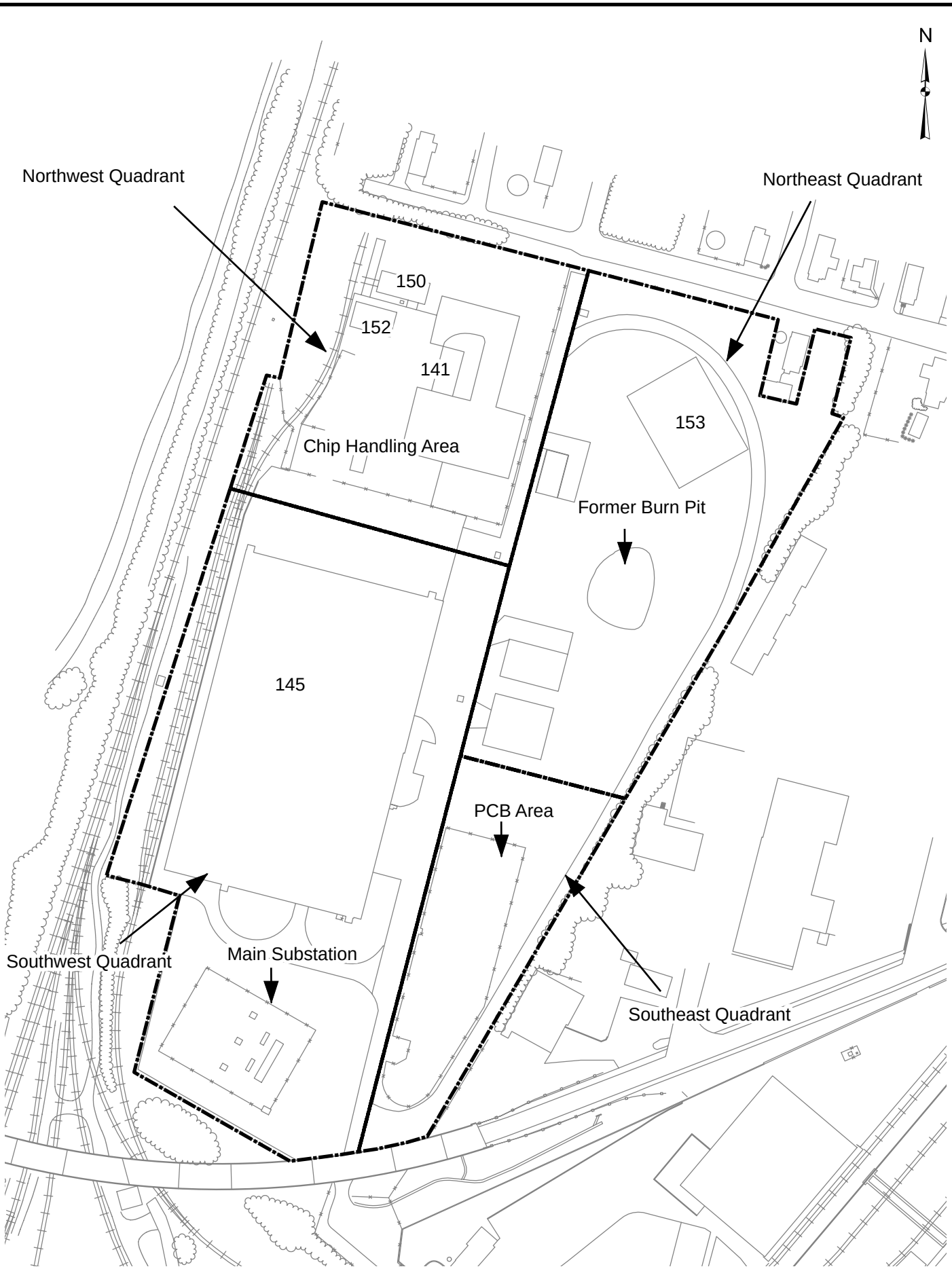


MALCOLM PIRNIE

WATERVLIET ARSENAL
WATERVLIET, NEW YORK

WATERVLIET ARSENAL SIBERIA AREA LOCATION

FIGURE 2



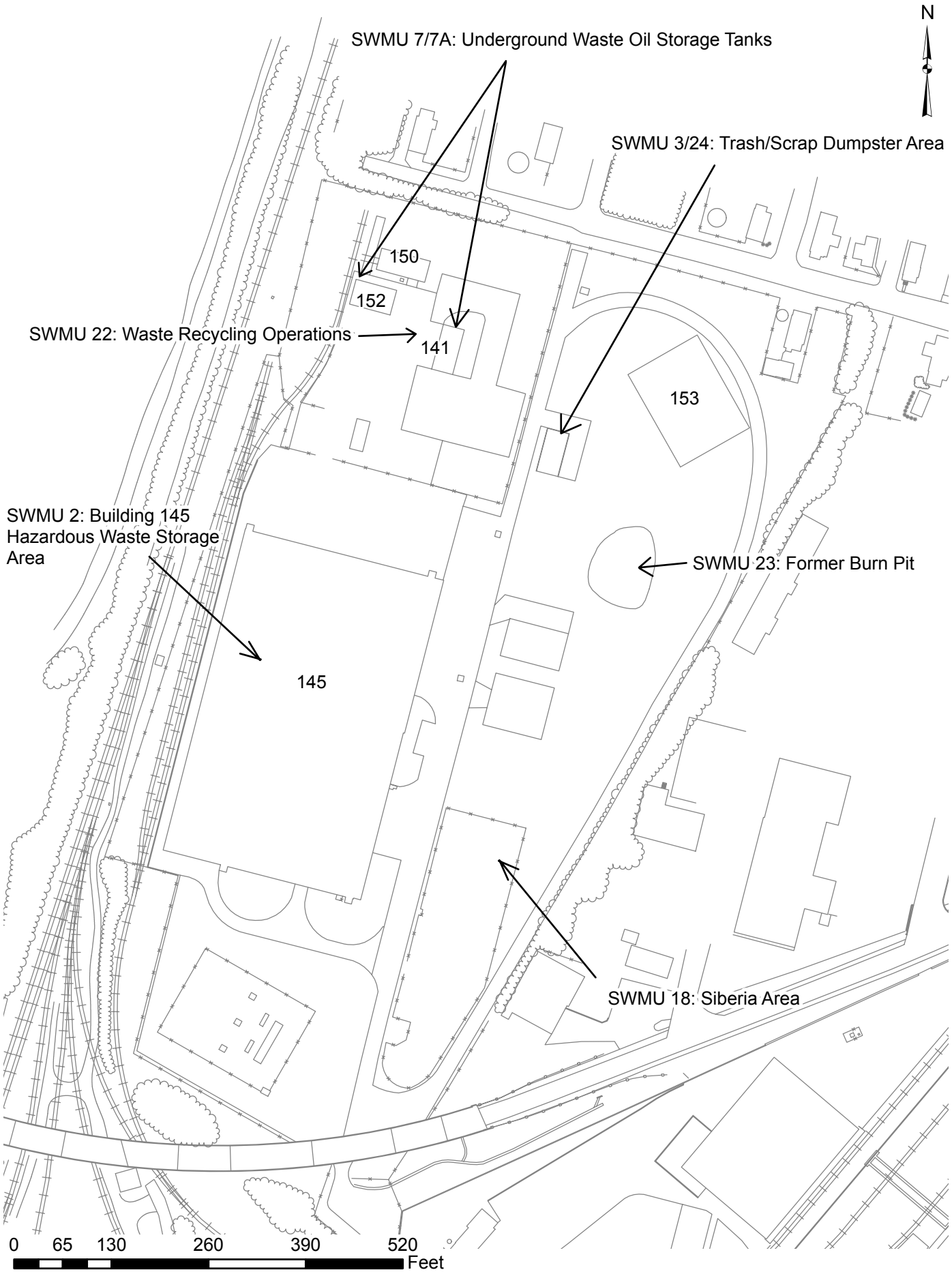
MALCOLM PIRNIE

WATERVLIET ARSENAL
WATERVLIET, NEW YORK

SIBERIA SITE FEATURES - QUADRANT LOCATIONS

MALCOLM PIRNIE, INC.

FIGURE 3



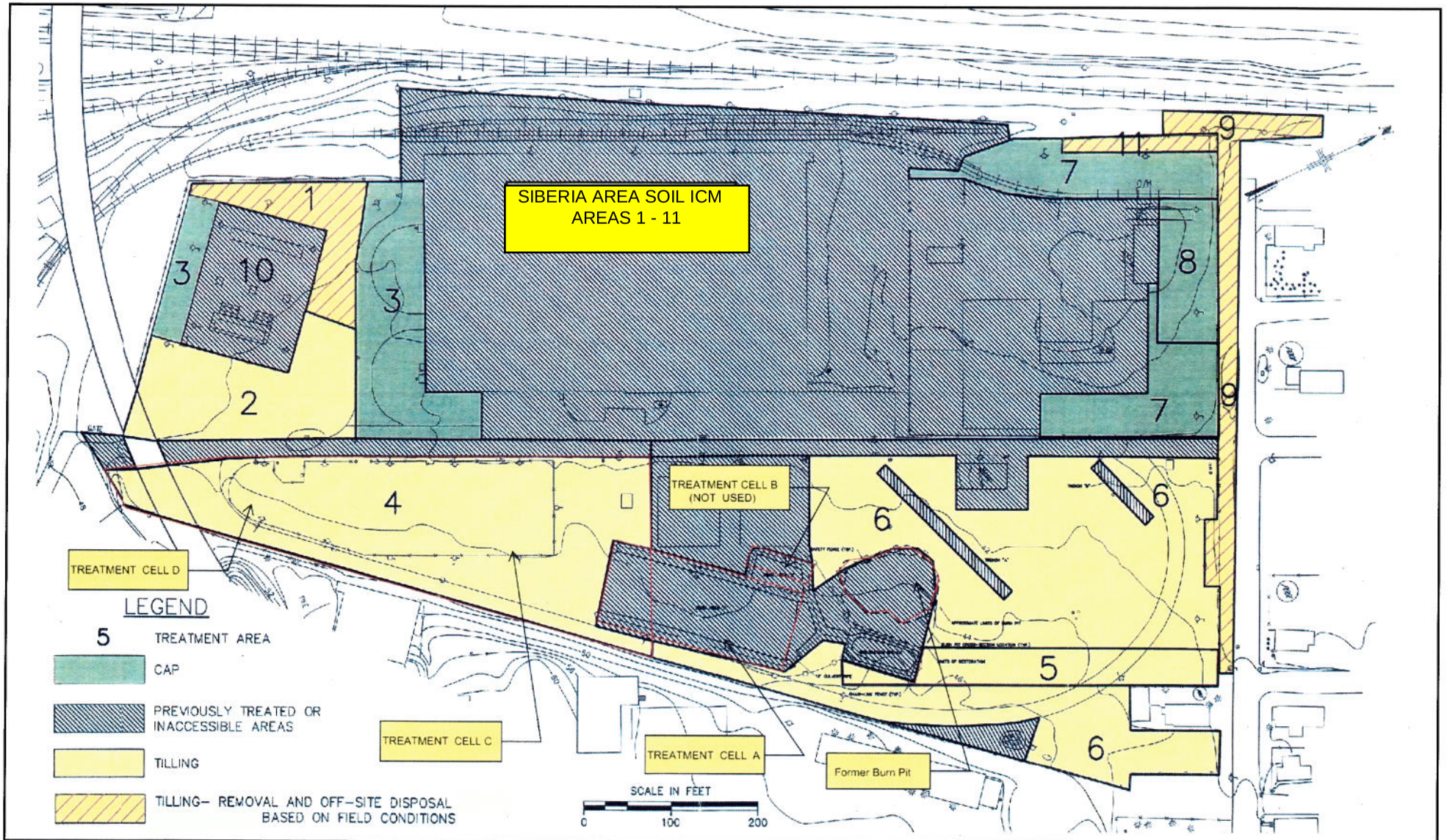
MALCOLM PIRNIE

WATERVLIET ARSENAL
WATERVLIET, NEW YORK

SIBERIA AREA SWMUs

MALCOLM PIRNIE, INC.

FIGURE 4

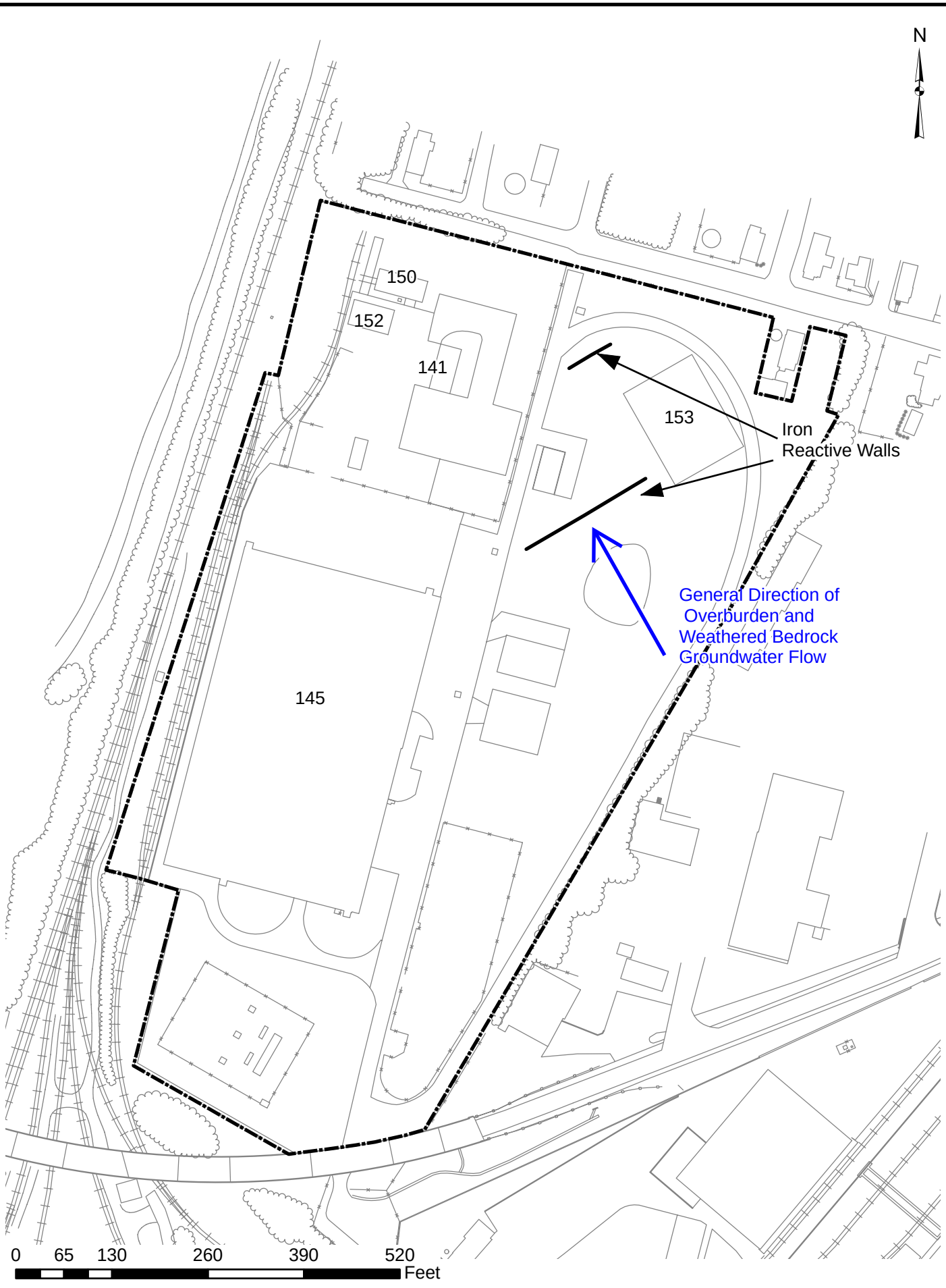


MALCOLM PIRNIE

WATERVLIET ARSENAL
WATERVLIET, NEW YORK

SIBERIA AREA REMEDIAL METHOD LOCATIONS

FIGURE 5



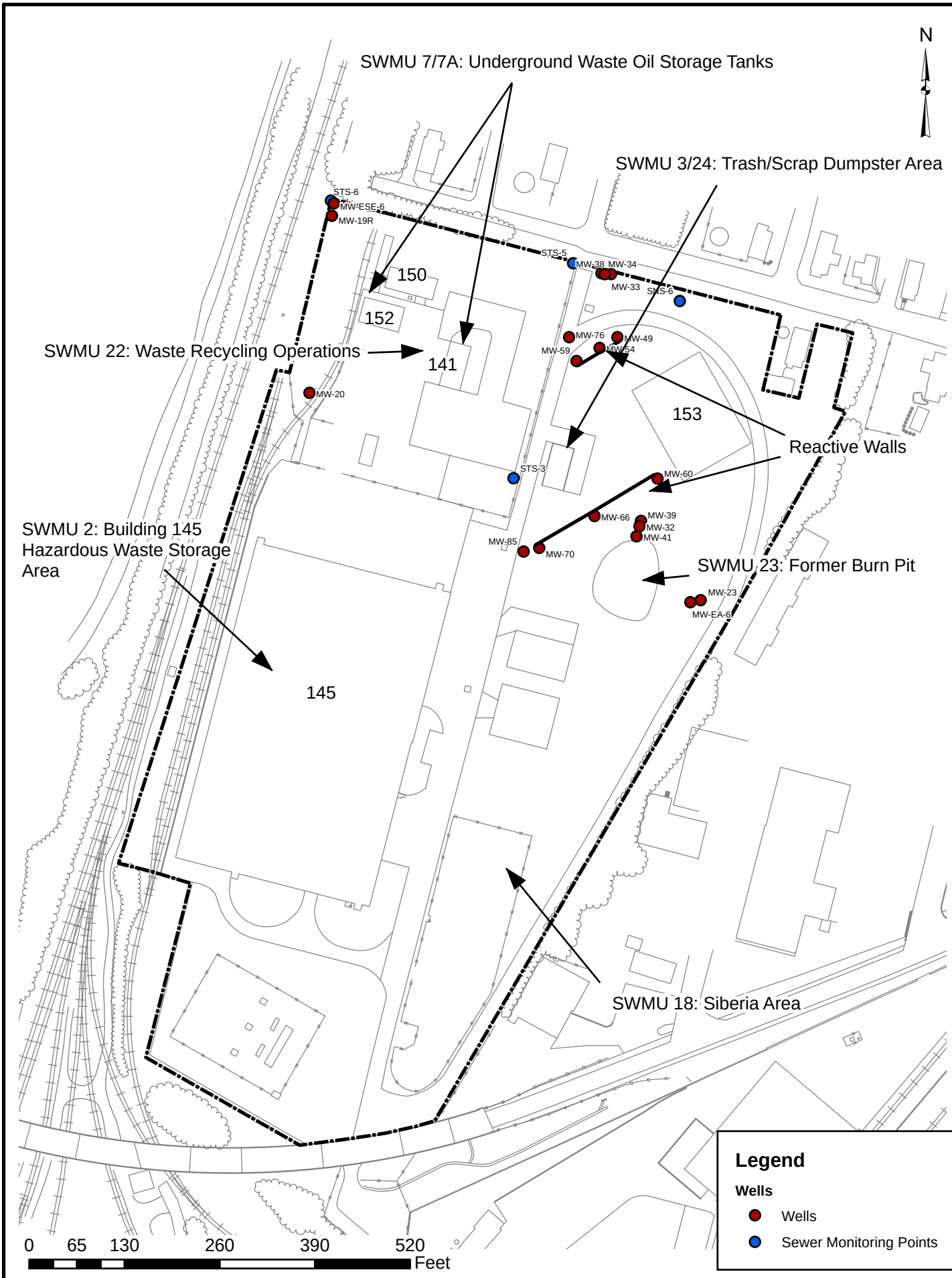
MALCOLM PIRNIE

WATERVLIET ARSENAL
WATERVLIET, NEW YORK

SIBERIA AREA IRON
REACTIVE WALLS

MALCOLM PIRNIE, INC.

FIGURE 6



MALCOLM PIRNIE

WATERVLIET ARSENAL
WATERVLIET, NEW YORK

SIBERIA AREA LONG TERM MONITORING POINTS

MALCOLM PIRNIE, INC.

FIGURE 7