

Sampling and Analysis Plan

Supplemental Site Inspection (SOC 4) and Remedial Investigation (SOC 5), UMore Mining Area, Dakota County, Minnesota

***Prepared for
University of Minnesota***

August 21, 2009



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**Sampling and Analysis Plan
Supplemental Site Inspection (SOC 4) and Remedial Investigation
(SOC 5), UMore Mining Area, Dakota County, Minnesota**

August 21, 2009

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1.0 Introduction

This Sampling and Analysis Plan (SAP) has been prepared in support of the Work Plan for Supplemental Site Inspection (SOC 4) and Remedial Investigation (SOC 5), UMore Mining Area located in Dakota County, Minnesota (Work Plan), dated June 25, 2009. The SAP includes a Field Sampling Plan (FSP), which is attached as Part 1, and a Quality Assurance Project Plan (QAPP), which is attached as Part 2.

The FSP supplements the Work Plan by providing guidance for fieldwork activities and includes a discussion of site background information and sampling objectives. The QAPP presents the organization, objectives, functional activities and specific quality assurance and quality control activities that are required for implementation of the Work Plan.

Part 1

Field Sampling Plan

Part 1: Field Sampling Plan

***Supplemental Site Investigation (SOC 4) and
Remedial Investigation (SOC 5)***

UMore Mining Area

Dakota County, Minnesota

***Prepared for
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August 21, 2009



Part 1: Field Sampling Plan

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Field Sampling Plan
Work Plan for the Supplemental Site Investigation (SOC 4)/
Remedial Investigation (SOC 5)
UMore Mining Area
Dakota County, Minnesota

August 21, 2009

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1.0 Site Background

This Field Sampling Plan (FSP) has been prepared as a supporting document to be used in conjunction with the Supplemental Site Investigation/Remedial Investigation (SSI/RI) Work Plan for Sites of Concern (SOCs) 4 and 5 (Work Plan) for the UMore Mining Area (UMA) located in the City of Rosemount and Empire Township, Dakota County, Minnesota. This FSP is intended to serve as a comprehensive reference to the standard field sampling procedures to be followed during the implementation of the SSI/RI Work Plan for SOCs 4 and 5 (Barr, 2009). In-depth specific Site background information, investigative approach and rationale, scope of work, and sampling network are detailed in the Work Plan. A brief summary is provided herein. The content included in this FSP is based on Guidance for conducting Remedial Investigations and Feasibility Studies under CERCLA (EPA, 1988).

1.1 Site and Surrounding Area Description

The UMA is located approximately 15 miles southeast of Twin Cities, west of US Highway 52 (Figure 1). The UMA consists of 1,607 acres and comprises roughly the western one-third of the University of Minnesota Outreach, Research, and Experimentation (UMore) Park property located in the City of Rosemount and Empire Township, Dakota County, Minnesota. The address for the UMore Park Administrative Office is 1605 160th Street West, Rosemount, MN 55068.

The majority of the UMA is currently used for agriculture purposes with a small percentage of the area used for administration and support of the University's research at UMore Park. The principal land use activities at the UMA since 1947 have related to agricultural research on crops and livestock associated with the University Agricultural Experiment Station (AES). The University also leases a portion of the cropland within the UMA to the U.S. Department of Agriculture (USDA). The operations related to the agricultural research with potential for releases to the environment include past and current storage of fuels, fertilizers, herbicides, and pesticides.

SOCs 4 and 5 are located in the east central portion of the UMA within Sections 3 and 4 of T114N, R19W (Figure 1). The two SOCs are bounded to the north by Dakota County Road 46 (a.k.a, 160th Street West) and surrounded by agricultural fields to the west, south, and east. The southern reach of SOC 4 abuts to the drainage ditch on the east side of Station Trail (formerly known as West Patrol Road; Figure 2). SOC 5 is currently referred to as the Central Services Station and is used for service

and maintenance activities to support the University's Agricultural Experiment Station (AES; Figure 3).

1.2 Known and Suspected Contamination Sources

UMore Park, including the UMA, was once owned by the U.S. Government and was conveyed to the University in 1947 and 1948. UMore Park includes portions of the former Gopher Ordnance Works (GOW), which was constructed and operated from 1942 to 1945 by E.I DuPont de Nemours for the U.S. Government. The plant was established to manufacture smokeless gunpowder, oleum (an intermediate used in the manufacture of sulfuric acid), and nitric acid. Dinitrotoluene (DNT), aniline, dibutyl phthalate (DBP), and diphenylamine (DPA) were imported for use in the smokeless gunpowder manufacturing process. Other potential constituents related to the former GOW include metals, herbicides, asbestos, and volatile and semivolatile organic compounds. By 1946, GOW had been decommissioned and many of the buildings had been decontaminated and demolished by the federal government.

This investigation will address two subject SOCs, referred to as the Former DNT Loading Platform and Drainage Ditch (SOC 4) and the Central Services Station/Former DNT Storage Bunkers (SOC 5). Past operations at SOC 4 included the unloading of drums of DNT (a dry crystalline product) at the former loading platform. Past operations at SOC 5 included the use of the DNT Storage Bunkers, pesticide handling, and petroleum fueling.

Based on past operations and associated conceptual release models, SOCs 4 and 5 have been divided up into the following Operational Units (OUs) for the purpose of delineating investigation areas:

- SOC4-OU1-Former DNT Loading Platform and Ditch
- SOC4-OU2- Settling Basin and Drainage Ditch South of SOC 5 (AOC 3 DA-1)
- SOC4-OU3-Surficial Debris Area
- SOC5-OU1- DNT Storage Bunkers (Buildings 260a through 260h)
- SOC5-OU2- Pesticide Release Area
- SOC5-OU3- Petroleum Release Area

Additional details of known and suspected contamination sources and OUs can be found in Sections 2.0 and 3.0 of the Work Plan.

1.3 Probable Transport Pathways

The primary conceptual release model for SOC 4 consists of hazardous substance spills to the ground surface at the former loading platform, incorporation of hazardous substances into surface soils and the overland transport of DNT via water runoff, and leaching from demolition debris placed at the ground surface

The conceptual release model for SOC 5 includes spills of hazardous substances or petroleum products to the ground surface and releases from USTs to shallow subsurface soils (generally less than 10 feet). Spills to the ground surface are anticipated to have infiltrated into near surface soils or to have become incorporated into surface soil subject to overland transport with runoff. As a result of the permeable nature of surface and subsurface soils, a release to shallow subsurface soils would be expected to migrate downward from the source and migrate laterally with groundwater flow within the outwash aquifer if sufficient mass is released.

1.4 Data Gaps

The intention of this investigation is to supplement previous investigation data which identified releases (SOC 5) or lacked sufficient data to adequately assess the presence or absence of a release (SOC 4). Current data gaps include:

- Insufficient number of samples to adequately characterize soil and groundwater quality in SOC 4 and 5.
- Insufficient number of sample parameters to adequately characterize soil and groundwater quality in SOCs 4 and 5

2.0 Sampling Objectives

The scope of the SSI/RI includes the advancement of subsurface soil borings, excavation of test trenches, the collection of groundwater samples from direct-push borings and/or temporary wells, and the collection of groundwater samples from existing wells. At SOC 4, the objective of this investigation is to determine if past activities have caused a release of hazardous substances or petroleum products to the environment. If contamination is present, the extent and magnitude of contamination may be assessed during this or future investigations. At SOC 5 where documented releases have been identified, the objective of the investigation is to evaluate the nature and extent of the releases. A summary of the sampling plan and rationale table is provided as Table 1.

The SSI/RI Report will summarize the findings of the investigation and recommendations for follow-up investigation activities, if necessary. It is anticipated that the extent of any environmental impacts within each SOC will be illustrated with a sample location map and a tabular summary of sampling results.

2.1 Sample Location and Frequency

In general, the soil samples exhibiting evidence of significant contamination from an area will be submitted for laboratory analysis. The analytical parameters for each soil sample will be in accordance with the Work Plan (and reproduced in Table 1). Proposed sampling locations for SOC 4 and SOC 5 are shown on Figures 2 and 3, respectively. If unexpected contamination or conditions are encountered during the investigation, the sampling approach, parameters, and number of samples may be reevaluated and adjusted.

In addition to investigative soil samples, QA/QC samples consisting of field blanks, field replicates, field duplicates, methanol blanks, and matrix spikes and matrix spike duplicates will be collected and analyzed at a rate of 1 per every 20 field investigative samples or less, as shown in Table 2.

2.2 Sample Designation

Soil samples will be represented by the SOC the sample is collected from, a letter designator representing the type of investigative method, a unique location number indicated in the Work Plan, and, in the case of soil samples, the sample bottom depth. Standard investigative designators are as follows:

- **SS (Surface Soil):** Surface soil samples will be collected beneath the surface vegetation and the rooting zone, approximately from an interval of 2 to 6 inches below the ground surface. (Example: SOC4_SS1_2-6", etc.)
- **GP (Geoprobe Boring):** Represents any direct-push boring installed for the purpose of collecting information on the stratigraphy or for collecting soil or groundwater samples collected from the drill stem or a temporary well installed in the geoprobe borehole. (Example: SOC4_GP1_0-6", etc.)
- **TT (Test Trench):** Represents any test pit excavated for the purpose of observing subsurface conditions or for collecting soil samples. (Example: SOC4_TT1_2-4', etc)

Groundwater samples collected from wells will be represented by a well type prefix, the well identification number, and the date of sample collection. Well type prefixes include:

- **WSW (Water Supply Well):** Represents groundwater collected from a supply well or stand pipe.

QA/QC samples will be identified with the following prefixes followed by a sequential number:

- **FB (Field Blank):** Represents a sample collected for QA/QC procedures.
- **DUP (Duplicate):** Represents a duplicate soil or groundwater sample collected for QA/QC procedures. (Example: SOC4_DUP1, or for groundwaters: WSW_DUP1)
- **TB (Trip Blank):** Represents a blank container filled by the laboratory with ultra clean test

2.3 Sampling Equipment and Procedures

Field investigation tasks will consist of surface soil sampling, the installation of several direct-push soil borings for the collection of soil and groundwater samples, composite sampling and performing test trenching for the collection of soil samples. Field investigation tasks and documentation will be performed in accordance with the Barr standard operating procedures (SOPs) applicable to the project, which are included in the Quality Assurance Project Plan (QAPP). Soils encountered will be classified in accordance with visual and manual methods described in ASTM D-2488, Standard Practice for Description and Identification of Soils (Visual/Manual Method). A photoionization detector (PID) with a 10.6 eV, or higher, lamp will be used to perform organic vapor headspace screening. Odor and discoloration observations will also be noted. The composite soil samples will be collected using methods consistent with the soil sampling approach described in Minnesota

Department of Agriculture (MDA) Guidance Document 11, *Soil Sampling Guidance (11/05)* as discussed below (MDA, 2005).

All field activities and data will be recorded in a dedicated field notebook or field record forms. Information will be recorded daily and will include date, work time(s), field data (boring or trenching logs, field screening results, sample intervals, field analytical data, QA/QC sample information, etc.), project health and safety information and issues, any scope changes and reasons for scope changes, internal Barr communications, client communications, decision-making processes and rationale, and other observations or activities relevant to the project.

2.4 Sample Handling and Analysis

A Chain of Custody (COC) form will be completed in the field at the time of sampling; two copies will accompany each set of samples (cooler) shipped to any laboratory. A third copy will be retained by the sampling team, and the second copy will be retained by the Barr quality assurance officer. An example of the COC is provided in the QAPP.

Laboratory analysis of selected soil and groundwater samples will include one or more of the following parameter groups: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOC), organochlorine and organophosphorus pesticides, and priority pollutant list metals (i.e., antimony, arsenic, beryllium, cadmium, chromium [not speciated], copper, lead, mercury, nickel, selenium, silver, thallium and zinc), nitrocellulose, polychlorinated biphenyls (PCBs), nitrate and nitrite, total Kjeldahl nitrogen (TKN), and perchlorate. Analytical methods for the various analytical parameters and laboratory reporting limits are presented in Table 3. Table 4 identifies the sample containers, sample preservation methods, and holding times for each analytical parameter class.

3.0 Schedule

Sample collection is scheduled to begin in September 2009 and will take approximately four weeks. Laboratory analyses will be completed and data will be provided within 45 days of sample receipt at the laboratory. A report describing the results of the investigation will be prepared in December 2009.

4.0 References

- ASTM, 2006. Standard Practice for Description and Identification of Soils (Visual/Manual Method), D-2488.
- Barr Engineering, 2009. Supplemental Site Inspection/Remedial Investigation, Sites of Concern 4 and 5, UMore Mining Area, Dakota County, Minnesota.
- Bay West, 2009. *Final – Focused Site Inspection Report, Former Gopher Ordnance Works, Rosemount, Minnesota.*
- Environmental Protection Agency (EPA), 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, EPA/540/G-89/004, October 1988.
- EPA, 2001. EPA Requirements for Quality Assurance Project Plans, EPA/240/B-01/003, March, 2001.
- Minnesota Department of Agriculture (MDA), 2005. *Soil Sampling Guidance, Guidance Document 11, November 2005.*
- Minnesota Pollution Control Agency (MPCA), 2005. Risk-Based Guidance for the Soil-Human Health Pathway User's Guide, Tier 2 SRV table, November 2005.
- US Army Corps of Engineers (USACE), 2006. *Preliminary Assessment Report Final 1947 Quitclaim Property, Former Gopher Ordnance Works, Rosemount, Minnesota.*

Tables

TABLE 1
SOIL AND GROUNDWATER SAMPLING PLAN
 Field Sampling Plan, SSI/RI Work Plan
 SOCs 4 and 5
 UMore Mining Area
 Dakota County, Minnesota

Site of Concern and OU (Preliminary)	Sampling Location ID	Target Depth ¹ (feet bgs)	Soil Sampling Plan ³									Groundwater Sampling Plan ³								Comment			
			Sample Interval ² (feet bgs)	Parameters (Number of samples)								Depth ⁷ (feet bgs)	Parameters (Number of samples)										
				VOCs ⁴	SVOCs	PPL Metals	Nitrocellulose	List 1&2 - Pest ⁵	OC-Pest ⁶	Asbestos	PCBs		VOCs ⁴	SVOCs	PPL Metals	Nitrocellulose	List 1&2 - Pest ⁵	OC-Pest ⁶	Nitrogen ⁸		Perchlorate		
SOC#4 DNT Loading Platform and Drainage Ditch (Includes AOC3A-D1)																							
OU1 - Frm. DNT Loading Platform and Ditch	TT1	6																					
	TT2	6																					
	TT3	6																					
	TT4	6																					
	TT5	6																					
	TT6	6	0-4		1			1														Samples will be collected for SOC #2 parameters if evidence of soil impacts are observed during test trench excavation.	
	TT7	6																					
	TT8	6																					
TT9	6																						
TT10	6																						
TT11	6	0-4	1	1	1	1	1	1	1		1												
TT12	6																						
TT13	6																						
OU3 - Surficial Debris Area	TT14	6																					
	TT15	6																					
	TT16	6																					
OU1 - Frm. DNT Loading Platform and Ditch	GP1	55	0-4		1	1	1					50		1	1	1				1	1	Continuous soil sample to groundwater	
	GP2	20	0-4			1	1																
	GP3	20	0-4		1	1	1																
OU2 - Settling Basing and Ditch	GP4	55	0-4	1	1	1	1	1	1			50		1	1	1				1		Continuous soil sample to groundwater	
	GP5	20	0-4		1	1	1	1			50		1	1	1					1		Soil sample to 20'; blind advance to WT	
	GP6	20	0-4		1	1	1	1															
	GP7	20	0-4		1	1	1	1														Previously shown on SOC#5 map	
SOC#5 Central Services Station and Offices																							
OU1 (260-E)	TT1	6																					
	TT2	6	0-4	1	1	1	1	1	1	*												A minimum of one sample will be collected from test trenches	
OU1 (260-A)	TT3	6																					
	TT4	6																					
	TT5	6	0-4	1	1	1	1	1	1	*												A minimum of one sample will be collected from test trenches	
OU1 (260-F)	TT6	6																					
	TT7	6	0-4	1	1	1	1	1	1	*												A minimum of one sample will be collected from test trenches	
OU1 (260-B)	TT8	6																					
	TT9	6																					
	TT10	6	0-4	1	1	1	1	1	1	*												A minimum of one sample will be collected from test trenches	
OU1 (260-G)	TT11	6																					
	TT12	6																					
	TT13	6	0-4	1	1	1	1	1	1	*												A minimum of one sample will be collected from test trenches	
OU1 (260-C)	TT14	6																					
	TT15	6																					
	TT16	6	0-4	1	1	1	1	1	1	*												A minimum of one sample will be collected from test trenches	
OU1 (260-H)	TT17	6																					
	TT18	6																					
	TT19	6	0-4	1	1	1	1	1	1	*												A minimum of one sample will be collected from test trenches	
OU1 (260-D)	TT20	6																					
	TT21	6	0-4	1	1	1	1	1	1	*												A minimum of one sample will be collected from test trenches	
	TT22	6																					
OU2-Pest. Release Area	TT23	6																					
	TT24	6	0-4	1	1	1	1	1	1	*												A minimum of one sample will be collected from test trenches	
	TT25	6																					
OU1,2&3 - Groundwater	TT26	12																					
	TT27	12																					
	TT28	12	0-4			1			1	*												A minimum of one sample will be collected from test trenches	
	TT29	12																					
OU3 - Petroleum Release Area	GP1	20	0-0.5		1	1						45	1	1	1	1	1	1	1	1	1	Continuous soil sample to groundwater	
	GP2	50	0-0.5		1	1						45	1	1	1	1	1	1	1	1	1	Soil sample to 20'; blind advance to WT	
	GP3	50	0-0.5		1	1						45	1	1	1	1	1	1	1	1	1	Continuous soil sample to groundwater	
	GP4	20	0-0.5		1	1						45	1	1	1	1	1	1	1	1	1	Soil sample to 20'; blind advance to WT	
OU3 - Petroleum Release Area	GP5	20	0-0.5	1	1	1	1																
		2-4	1	1	1	1																Hold	
	GP6	20	0-0.5	1	1	1	1																
		2-4	1	1	1	1																	Hold
	GP7	20	0-0.5	1	1	1	1																
		2-4	1	1	1	1																	Hold
GP8	20	0-0.5	1	1	1	1																	
	2-4	1	1	1	1																	Hold	

TABLE 1
SOIL AND GROUNDWATER SAMPLING PLAN
 Field Sampling Plan, SSI/RI Work Plan
 SOCs 4 and 5
 UMore Mining Area
 Dakota County, Minnesota

Site of Concern and OU (Preliminary)	Sampling Location ID	Target Depth ¹ (feet bgs)	Soil Sampling Plan ³								Groundwater Sampling Plan ³								Comment	
			Sample Interval ² (feet bgs)	Parameters (Number of samples)						Depth ⁷ (feet bgs)	Parameters (Number of samples)									
				VOCs ⁴	SVOCs	PPL Metals	Nitrocellulose	List 1&2 - Pest ⁵	OC-Pest ⁶		Asbestos	PCBs	VOCs ⁴	SVOCs	PPL Metals	Nitrocellulose	List 1&2 - Pest ⁵	OC-Pest ⁶		Nitrogen ⁸
OU1 - Groundwater	GP9	50	0-0.5								45	1	1	1	1	1	1	1		Soil sample to 20'; blind advance to WT
	GP10	50	0-0.5								45	1	1	1	1	1	1	1	1	Continuous soil sample to groundwater
	GP11	50	0-0.5								45	1	1	1	1	1	1	1	1	Continuous soil sample to groundwater
OU2 - Pesticide Release Area (bld 608)	GP12 (A-D)	12	0-0.5					1	1										Sample Per MDA Guidance: A, B, C, D subsamples- Hold 0-0.5' (composite) and 4.5-5' (discrete); analyze 2-2.5' (composite)	
			2-2.5					1	1											
			5					1	1											
	GP13 (A-D)	12	0-0.5					1	1										Sample Per MDA Guidance: A, B, C, D subsamples- Hold 0-0.5' (composite) and 4.5-5' (discrete); analyze 2-2.5' (composite)	
			2-2.5					1	1											
			5					1	1											
GP14 (A-D)	12	0-0.5					1	1										Sample Per MDA Guidance: A, B, C, D subsamples- Hold 0-0.5' (composite) and 4.5-5' (discrete); analyze 2-2.5' (composite)		
		2-2.5					1	1												
		5					1	1												
OU1 - DNT- Storage Bunkers (Tar wall coating)	GP15	4	0-4		1														Characterize berm soils	
	GP16	4	0-4		1															
	GP17	4	0-4		1															
	GP18	4	0-4		1															
	GP19	4	0-4		1															
	GP20	4	0-4		1															
	GP21	4	0-4		1															
	GP22	4	0-4		1															
	GP23	4	0-4		1															
	GP24	4	0-4		1															
OU2- Pesticide Release Area (bld 608)	GP27 (A-D)	12	0-0.5					1	1										Sample Per MDA Guidance: A, B, C, D subsamples- Hold 0-0.5' (composite) and 4.5-5' (discrete); analyze 2-2.5' (composite)	
			2-2.5					1	1											
			5					1	1											
Other - Surface soil characterization	SS1	0.5	0-0.5		1	1	1	1											Characterize site soils not in vicinity of bunkers or suspected releases	
	SS2	0.5	0-0.5		1	1	1	1												
	SS3	0.5	0-0.5		1	1	1	1												
	SS4	0.5	0-0.5		1	1	1	1												
	SS5	0.5	0-0.5		1	1	1	1												
	SS6	0.5	0-0.5		1	1	1	1												
	SS7	0.5	0-0.5		1	1	1	1												
	SS8	0.5	0-0.5		1	1	1	1												
	SS9	0.5	0-0.5		1	1	1	1												
	SS10	0.5	0-0.5		1	1	1	1												
	SS11	0.5	0-0.5		1	1	1	1												
OU1- DNT bunker exterior walls	SS12	0.5	0-0.5		1														Hold	
	SS13	0.5	0-0.5		1														Hold	
	SS14	0.5	0-0.5		1														Hold	
	SS15	0.5	0-0.5		1														Hold	
	SS16	0.5	0-0.5		1														Hold	
	SS17	0.5	0-0.5		1														Hold	
	SS18	0.5	0-0.5		1														Hold	
	SS19	0.5	0-0.5		1														Hold	
	SS20	0.5	0-0.5		1														Hold	
	SS21	0.5	0-0.5		1														Hold	
	SS22	0.5	0-0.5		1														Hold	
	SS23	0.5	0-0.5		1														Hold	
	SS24	0.5	0-0.5		1														Hold	
	SS25	0.5	0-0.5		1														Hold	
	SS26	0.5	0-0.5		1														Hold	
	SS27	0.5	0-0.5		1														Hold	
	SS28	0.5	0-0.5		1														Hold	
	SS29	0.5	0-0.5		1														Hold	
	SS30	0.5	0-0.5		1														Hold	
	SS31	0.5	0-0.5		1														Hold	
	SS32	0.5	0-0.5		1														Hold	
	SS33	0.5	0-0.5		1														Hold	
SS34	0.5	0-0.5		1														Hold		
SS35	0.5	0-0.5		1														Hold		
SS36	0.5	0-0.5		1														Hold		
SS37	0.5	0-0.5		1														Hold		
SS38	0.5	0-0.5		1														Hold		

TABLE 1
SOIL AND GROUNDWATER SAMPLING PLAN
 Field Sampling Plan, SSI/RI Work Plan
 SOCs 4 and 5
 UMore Mining Area
 Dakota County, Minnesota

Site of Concern and OU (Preliminary)	Sampling Location ID	Target Depth ¹ (feet bgs)	Soil Sampling Plan ³									Groundwater Sampling Plan ³									Comment		
			Sample Interval ² (feet bgs)	Parameters (Number of samples)								Depth ⁷ (feet bgs)	Parameters (Number of samples)										
				VOCs ⁴	SVOCs	PPL Metals	Nitrocellulose	List 1&2 - Pest ⁵	OC-Pest ⁶	Asbestos	PCBs		VOCs ⁴	SVOCs	PPL Metals	Nitrocellulose	List 1&2 - Pest ⁵	OC-Pest ⁶	Nitrogen ⁸	Perchlorate			
	SS39	0.5	0-0.5		1																	Hold	
	SS40	0.5	0-0.5		1																		Hold
	SS41	0.5	0-0.5		1																		Hold
	SS42	0.5	0-0.5		1																		Hold
	SS43	0.5	0-0.5		1																		Hold
	SS44	0.5	0-0.5		1																		Hold
	SS45	0.5	0-0.5		1																		Hold
	SS46	0.5	0-0.5																				
Other - Dirt Road	SS47	0.5	0-0.5																				
	SS48	0.5	0-0.5																				
	SS49	0.5	0-0.5																				
Groundwater Quality	WSW-207607												1	1	1	1	1	1	1	1	1	1	
	WSW-208402												1	1	1	1	1	1	1	1	1	1	
	WSW-208405												1	1	1	1	1	1	1	1	1	1	
	WSW-207605												1	1	1	1	1	1	1	1	1	1	Use data from SOC investigation; sample remaining params

- Notes:
- 1- Continuous soil sampling conducted in borings to target depth for soil description and screening purposes. Test trenches to extend 2 feet into unimpacted geologic deposit below modern soil or filled material, if possible.
 - 2- Default soil sample collection depths for chemical analysis. Metals sample default will be from 2 to 6 inches below ground surface. If impacted soils are encountered an additional metals sample will be collected.
 - 3 - Individual compounds and analytical methods for each parameter list are included in the Sampling and Analysis Plan (SAP)
 - 4 - VOC samples will be collected where soil exhibits evidence that VOCs are present. For example, elevated headspace, staining and strong odor.
 - 5 - List1&2-Pest - includes Minnesota Department of Agriculture Pesticides List 1 (neutral) and List 2 (acid) pesticides
 - 6 - OC-Pest - includes organochlorine pesticides listed in EPA method # 8081A
 - 7 - Approximate depth to groundwater. Actual depth to be determined in the field.
 - 8 - Nitrogen analysis include Nitrate+Nitrite (As N) and Total Kjeldahl Nitrogen (TKN)
- VOCs - Volatile organic compounds
 SVOCs - Semi-volatile organic compounds
 PPL Metals - Priority Pollutant List metals
 WT - Water table
 * indicates that a sample will be collected if potential Asbestos Containing Material is observed during test trenching

Table 2
Frequency of Quality Assurance Samples
Field Sampling Plan, SSI/RI, SOCs 4 and 5
UMore Mining Area
Dakota County, Minnesota

Parameter	Frequency	Comments
Field Blanks	1 collected every 20 samples	
Field Replicates	1 collected every 20 samples	Analyzed with field equipment only (i.e., replicate temp, pH or headspace readings to confirm instrument precision)
Field Duplicates	1 collected every 20 samples	Blind laboratory sample submittal
Trip Blanks- Soil (Methanol)	1 placed in every shipping container containing VOC soil samples.	Made up in the laboratory, only analyzed with associated VOCs soil samples. (a soil trip blank)
Trip Blanks-Water (HCl)	1 placed in every shipping container containing VOC water samples.	, only analyzed with associated VOCs water samples.
Matrix Spike, Matrix Spike Duplicates	1 collected every 20 samples to provide the laboratory with necessary QA/QC volume.	Batch MS/MSD samples are required for this project and will performed on each matrix sampled. Since these batches should be representative of each matrix, project specific MS/MSD samples are not required for this project. Extra volume will be provided to the laboratory so that project samples may be used as MS/MSD samples.

Table 3
Analytical Parameters, Methods and Quantitation Limits
Field Sampling Plan, SSI/RI, SOCs 4 and 5
UMore Mining Area
Dakota County, Minnesota

Parameter	CAS Number	Matrix	Method (EPA unless noted otherwise)	Method Detection Limit	Reporting Limit	Test Unit	MDH Health Risk Limits ³	Minnesota Tier SLV ⁴	Minnesota SRV ⁵	Minnesota Tier II Industrial SRV ⁶
Metals										
Antimony	7440-36-0	Soil/Solid	6010B	0.0055	0.50	mg/kg	--	2.7	12	100
Arsenic	7440-38-2	Soil/Solid	6010B	0.10	0.50	mg/kg	--	15.1	9	20
Beryllium	7440-41-7	Soil/Solid	6010B	0.011	0.25	mg/kg	--	1.4	55	230
Cadmium	7440-43-9	Soil/Solid	6010B	0.025	0.25	mg/kg	--	4.4	25	200
Chromium	7440-47-3	Soil/Solid	6010B	0.012	0.50	mg/kg	--	1000000 (8)	44000 (8)	100000 (8)
Copper	7440-50-8	Soil/Solid	6010B	0.070	1.0	mg/kg	--	400	100	9000
Lead	7439-92-1	Soil/Solid	6010B	0.034	1.0	mg/kg	--	525	300	700
Nickel	7440-02-0	Soil/Solid	6010B	0.014	0.25	mg/kg	--	88	560	2500
Selenium	7782-49-2	Soil/Solid	6010B	0.11	1.0	mg/kg	--	1.5	160	1300
Silver	7440-22-4	Soil/Solid	6010B	0.0090	0.25	mg/kg	--	3.9	160	1300
Thallium	7440-28-0	Soil/Solid	6010B	0.13	2.0	mg/kg	--	--	3	21
Zinc	7440-66-6	Soil/Solid	6010B	0.22	1.0	mg/kg	--	1500	8700	75000
Metals										
Antimony	7440-36-0	Water/Liquid	6020	0.046	0.500	ug/L	6	--	--	--
Arsenic	7440-38-2	Water/Liquid	6010B	2	10.000	ug/L	--	--	--	--
Beryllium	7440-41-7	Water/Liquid	6020	0.027	0.5000	ug/L	0.08	--	--	--
Cadmium	7440-43-9	Water/Liquid	6010B	0.099	1.0000	ug/L	4	--	--	--
Chromium	7440-47-3	Water/Liquid	6010B	0.24	10.000	ug/L	100 (5)	--	--	--
Copper	7440-50-8	Water/Liquid	6010B	1.4	20.000	ug/L	--	--	--	--
Lead	7439-92-1	Water/Liquid	6010B	0.68	3.0000	ug/L	--	--	--	--
Nickel	7440-02-0	Water/Liquid	6010B	0.28	5.0000	ug/L	100	--	--	--
Selenium	7782-49-2	Water/Liquid	6010B	2.2	20.000	ug/L	30	--	--	--
Silver	7440-22-4	Water/Liquid	6010B	0.18	5.0000	ug/L	30	--	--	--
Thallium	7440-28-0	Water/Liquid	6020	0.0081	0.500	ug/L	0.6	--	--	--
Zinc	7440-66-6	Water/Liquid	6010B	4.4	20.000	ug/L	2000	--	--	--
Mercury										
Mercury	7439-97-6	Soil/Solid	7471A	0.0031	0.10	mg/kg	--	1.6 C	0.5	1.5
Mercury	7439-97-6	Water/Liquid	7470A	0.000031	0.00020	mg/L	--	--	--	--
Nitrate+Nitrite Nitrogen as N (Braun)										
N+N Nitrogen as N	NA	Water/Liquid	SM4500-NO3-F	0.007	0.02	mg/L	10 (3)	--	--	--
Total Kjeldahl Nitrogen (Braun)										
TKN as N	NA	Water/Liquid	SM4500-NH3-C	0.17	0.5	mg/L	--	--	--	--
Perchlorate (TA)										
Perchlorate	NA	Water/Liquid	314	0.36	4	ug/L	--	--	--	--
Nitrocellulose (TA)										
Nitrocellulose	NA	Soil/Solid	353.2Mod	0.78	0.5	mg/kg	--	--	--	--
Nitrocellulose (TA)										
Nitrocellulose	NA	Water/Liquid	353.2Mod	0.124	0.5	mg/L	--	--	--	--
Organochlorine Pesticides										
4,4'-DDD	72-54-8	Soil/Solid	8081A	0.0015	0.040	mg/kg	--	--	56	125
4,4'-DDE	72-55-9	Soil/Solid	8081A	0.0014	0.040	mg/kg	--	--	40	80
4,4'-DDT	50-29-3	Soil/Solid	8081A	0.0020	0.040	mg/kg	--	--	15	88
a-Chlordane	5103-71-9	Soil/Solid	8081A	0.0015	0.040	mg/kg	--	--	--	--
Aldrin	309-00-2	Soil/Solid	8081A	0.0012	0.040	mg/kg	--	--	1	2
alpha-BHC	319-84-6	Soil/Solid	8081A	0.0011	0.040	mg/kg	--	--	2	3.5
beta-BHC	319-85-7	Soil/Solid	8081A	0.0015	0.040	mg/kg	--	--	7	15
delta-BHC	319-86-8	Soil/Solid	8081A	0.0015	0.040	mg/kg	--	--	--	--
Dieldrin	60-57-1	Soil/Solid	8081A	0.0014	0.040	mg/kg	--	--	0.8	2
Endosulfan I	959-98-8	Soil/Solid	8081A	0.0013	0.040	mg/kg	--	--	--	--
Endosulfan II	891-86-1	Soil/Solid	8081A	0.0016	0.040	mg/kg	--	--	--	--
Endosulfan sulfate	1031-07-8	Soil/Solid	8081A	0.0016	0.040	mg/kg	--	--	--	--
Endrin	72-20-8	Soil/Solid	8081A	0.0014	0.040	mg/kg	--	--	8	56
Endrin aldehyde	7421-93-4	Soil/Solid	8081A	0.0041	0.040	mg/kg	--	--	--	--
Endrin ketone	53494-70-5	Soil/Solid	8081A	0.0016	0.040	mg/kg	--	--	--	--
gamma-BHC (Lindane)	58-89-9	Soil/Solid	8081A	0.0012	0.040	mg/kg	--	--	9	15
gamma-Chlordane	5566-34-7	Soil/Solid	8081A	0.0017	0.040	mg/kg	--	--	--	--
Heptachlor	76-44-8	Soil/Solid	8081A	0.0014	0.040	mg/kg	--	--	2	3.5
Heptachlor epoxide	1024-57-3	Soil/Solid	8081A	0.0012	0.040	mg/kg	--	--	0.4	3
Methoxychlor	72-43-5	Soil/Solid	8081A	0.0019	0.040	mg/kg	--	--	11	50
Toxaphene	8001-35-2	Soil/Solid	8081A	0.015	0.080	mg/kg	--	--	13	28
Organochlorine Pesticides										
4,4'-DDD	72-54-8	Water/Liquid	8081A	0.026	0.40	ug/L	1	--	--	--
4,4'-DDE	72-55-9	Water/Liquid	8081A	0.037	0.40	ug/L	1	--	--	--
4,4'-DDT	50-29-3	Water/Liquid	8081A	0.031	0.40	ug/L	1	--	--	--
a-Chlordane	5103-71-9	Water/Liquid	8081A	0.030	0.40	ug/L	--	--	--	--
Aldrin	309-00-2	Water/Liquid	8081A	0.036	0.40	ug/L	--	--	--	--
alpha-BHC	319-84-6	Water/Liquid	8081A	0.028	0.40	ug/L	--	--	--	--
beta-BHC	319-85-7	Water/Liquid	8081A	0.026	0.40	ug/L	--	--	--	--
delta-BHC	319-86-8	Water/Liquid	8081A	0.023	0.40	ug/L	--	--	--	--
Dieldrin	60-57-1	Water/Liquid	8081A	0.031	0.40	ug/L	0.006 (4)	--	--	--

Table 3
Analytical Parameters, Methods and Quantitation Limits
Field Sampling Plan, SSI/RI, SOCs 4 and 5
UMore Mining Area
Dakota County, Minnesota

Parameter	CAS Number	Matrix	Method (EPA unless noted otherwise)	Method Detection Limit	Reporting Limit	Test Unit	MDH Health Risk Limits ³	Minnesota Tier SLV ⁴	Minnesota SRV ⁵	Minnesota Tier II Industrial SRV ⁶
Endosulfan I	959-98-8	Water/Liquid	8081A	0.032	0.40	ug/L	--	--	--	--
Endosulfan II	891-86-1	Water/Liquid	8081A	0.035	0.40	ug/L	--	--	--	--
Endosulfan sulfate	1031-07-8	Water/Liquid	8081A	0.034	0.40	ug/L	--	--	--	--
Endrin	72-20-8	Water/Liquid	8081A	0.029	0.40	ug/L	--	--	--	--
Endrin aldehyde	7421-93-4	Water/Liquid	8081A	0.044	0.40	ug/L	--	--	--	--
Endrin ketone	53494-70-5	Water/Liquid	8081A	0.031	0.40	ug/L	--	--	--	--
gamma-BHC (Lindane)	58-89-9	Water/Liquid	8081A	0.024	0.40	ug/L	--	--	--	--
gamma-Chlordane	5566-34-7	Water/Liquid	8081A	0.030	0.40	ug/L	--	--	--	--
Heptachlor	76-44-8	Water/Liquid	8081A	0.028	0.40	ug/L	0.08	--	--	--
Heptachlor epoxide	1024-57-3	Water/Liquid	8081A	0.030	0.40	ug/L	0.04	--	--	--
Methoxychlor	72-43-5	Water/Liquid	8081A	0.032	0.40	ug/L	--	--	--	--
Toxaphene	8001-35-2	Water/Liquid	8081A	0.069	1.00	ug/L	0.3	--	--	--
MDA List 1 Pesticides (Braun)										
EPTC	759-94-4	Soil/Solid	8270C	0.0060	0.04	mg/kg	--	--	--	--
Propachlor	1918-16-7	Soil/Solid	8270C	0.0090	0.04	mg/kg	--	--	--	--
Ethalfuralin	55283-68-6	Soil/Solid	8270C	0.014	0.04	mg/kg	--	--	--	--
Deisopropylatrazine	1007-28-9	Soil/Solid	8270C	0.0080	0.04	mg/kg	--	--	--	--
Trifluralin	1582-09-8	Soil/Solid	8270C	0.014	0.04	mg/kg	--	--	--	--
Desethylatrazine	6190-65-4	Soil/Solid	8270C	0.011	0.04	mg/kg	--	--	--	--
Phorate	298-02-2	Soil/Solid	8270C	0.0060	0.04	mg/kg	--	--	--	--
Prometon	1610-18-0	Soil/Solid	8270C	0.0060	0.04	mg/kg	--	--	--	--
Simazine	122-34-9	Soil/Solid	8270C	0.0090	0.04	mg/kg	--	--	--	--
Atrazine	1912-24-9	Soil/Solid	8270C	0.0100	0.04	mg/kg	--	--	--	--
Propazine	139-40-2	Soil/Solid	8270C	0.0070	0.04	mg/kg	--	--	--	--
Terbufos	13071-79-9	Soil/Solid	8270C	0.0090	0.04	mg/kg	--	--	0.6	3.5
Fonofos	944-22-9	Soil/Solid	8270C	0.0040	0.04	mg/kg	--	--	--	--
Triallate	2303-17-5	Soil/Solid	8270C	0.0050	0.04	mg/kg	--	--	--	--
Metribuzin	21087-64-9	Soil/Solid	8270C	0.0090	0.04	mg/kg	--	--	--	--
Dimethenamid	87674-68-8	Soil/Solid	8270C	0.0060	0.04	mg/kg	--	--	--	--
Acetochlor	34256-82-1	Soil/Solid	8270C	0.010	0.04	mg/kg	--	--	--	--
Alachlor	15972-60-8	Soil/Solid	8270C	0.0070	0.04	mg/kg	--	--	--	--
Cyanazine	21725-46-2	Soil/Solid	8270C	0.0080	0.04	mg/kg	--	--	--	--
Metolachlor	51218-45-2	Soil/Solid	8270C	0.0030	0.04	mg/kg	--	--	435	3300
Chlorpyrifos	2921-88-2	Soil/Solid	8270C	0.0070	0.04	mg/kg	--	--	--	--
Pendimethalin	40487-42-1	Soil/Solid	8270C	0.016	0.04	mg/kg	--	--	--	--
MDA List 1 Pesticides (Braun)										
EPTC	759-94-4	Water/Liquid	8270C	0.22	0.50	ug/L	200	--	--	--
Propachlor	1918-16-7	Water/Liquid	8270C	0.14	0.50	ug/L	--	--	--	--
Ethalfuralin	55283-68-6	Water/Liquid	8270C	0.47	0.50	ug/L	300 (1)	--	--	--
Deisopropylatrazine	1007-28-9	Water/Liquid	8270C	0.26	0.50	ug/L	--	--	--	--
Trifluralin	1582-09-8	Water/Liquid	8270C	0.21	0.50	ug/L	5 (1)	--	--	--
Desethylatrazine	6190-65-4	Water/Liquid	8270C	0.29	0.50	ug/L	--	--	--	--
Phorate	298-02-2	Water/Liquid	8270C	0.58	1.00	ug/L	1 (1)	--	--	--
Prometon	1610-18-0	Water/Liquid	8270C	0.29	0.50	ug/L	100	--	--	--
Simazine	122-34-9	Water/Liquid	8270C	0.32	0.50	ug/L	4 (3)	--	--	--
Atrazine	1912-24-9	Water/Liquid	8270C	0.24	0.50	ug/L	3 (3)	--	--	--
Propazine	139-40-2	Water/Liquid	8270C	0.21	0.50	ug/L	10 (1)	--	--	--
Terbufos	13071-79-9	Water/Liquid	8270C	0.54	1.00	ug/L	0.2 (1)	--	--	--
Fonofos	944-22-9	Water/Liquid	8270C	0.30	0.50	ug/L	10 (1)	--	--	--
Triallate	2303-17-5	Water/Liquid	8270C	0.34	0.50	ug/L	9 (1)	--	--	--
Metribuzin	21087-64-9	Water/Liquid	8270C	0.35	0.50	ug/L	200	--	--	--
Dimethenamid	87674-68-8	Water/Liquid	8270C	0.24	0.50	ug/L	40 (1)	--	--	--
Acetochlor	34256-82-1	Water/Liquid	8270C	0.25	0.50	ug/L	9 (4)	--	--	--
Alachlor	15972-60-8	Water/Liquid	8270C	0.19	0.50	ug/L	5 (4)	--	--	--
Cyanazine	21725-46-2	Water/Liquid	8270C	0.48	0.50	ug/L	1	--	--	--
Metolachlor	51218-45-2	Water/Liquid	8270C	0.28	0.50	ug/L	300 (4)	--	--	--
Chlorpyrifos	2921-88-2	Water/Liquid	8270C	0.34	0.50	ug/L	20 (1)	--	--	--
Pendimethalin	40487-42-1	Water/Liquid	8270C	0.25	0.50	ug/L	--	--	--	--
MDA List 2 Pesticides (Braun)										
Dicamba	1918-00-9	Soil/Solid	8270C	0.008	0.50	mg/kg	--	--	--	--
MCPA	94-74-6	Soil/Solid	8270C	0.014	0.50	mg/kg	--	--	16	110
2,4-D	94-75-7	Soil/Solid	8270C	0.012	0.50	mg/kg	--	--	285	2200
Trichlopyr	55336-06-3	Soil/Solid	8270C	0.006	0.50	mg/kg	--	--	--	--
Pentachlorophenol	87-86-5	Soil/Solid	8270C	0.007	0.50	mg/kg	--	--	80	120
2,4,5-T.P.	93-72-1	Soil/Solid	8270C	0.007	0.50	mg/kg	--	--	--	--
2,4,5-T	93-76-5	Soil/Solid	8270C	0.009	0.50	mg/kg	--	--	290	2150
Dinoseb	88-85-7	Soil/Solid	8270C	0.005	0.50	mg/kg	--	--	--	--
2,4-D.B.	94-82-6	Soil/Solid	8270C	0.011	0.50	mg/kg	--	--	226	1750

Table 3
Analytical Parameters, Methods and Quantitation Limits
Field Sampling Plan, SSI/RI, SOCs 4 and 5
UMore Mining Area
Dakota County, Minnesota

Parameter	CAS Number	Matrix	Method (EPA unless noted otherwise)	Method Detection Limit	Reporting Limit	Test Unit	MDH Health Risk Limits ³	Minnesota Tier SLV ⁴	Minnesota SRV ⁵	Minnesota Tier II Industrial SRV ⁶
Bentazone	25057-89-0	Soil/Solid	8270C	0.009	0.50	mg/kg	--	--	--	--
Picloram	1918-02-1	Soil/Solid	8270C	0.011	0.50	mg/kg	--	--	2000	15000
MDA List 2 Pesticides (Braun)										
Dicamba	1918-00-9	Water/Liquid	8270C	0.38	0.50	ug/L	200	--	--	--
MCPA	94-74-6	Water/Liquid	8270C	0.29	0.30	ug/L	--	--	--	--
2,4-D	94-75-7	Water/Liquid	8270C	0.26	0.50	ug/L	70	--	--	--
Trichlopyr	55336-06-3	Water/Liquid	8270C	0.41	0.50	ug/L	300 (1)	--	--	--
Pentachlorophenol	87-86-5	Water/Liquid	8270C	0.39	0.50	ug/L	1	--	--	--
2,4,5-T.P.	93-72-1	Water/Liquid	8270C	0.28	0.50	ug/L	50 (3)	--	--	--
2,4,5-T	93-76-5	Water/Liquid	8270C	0.31	0.50	ug/L	--	--	--	--
Dinoseb	88-85-7	Water/Liquid	8270C	0.34	0.50	ug/L	7 (1)	--	--	--
2,4-D.B.	94-82-6	Water/Liquid	8270C	0.15	0.50	ug/L	60 (1)	--	--	--
Bentazone	25057-89-0	Water/Liquid	8270C	0.22	0.50	ug/L	200 (1)	--	--	--
Picloram	1918-02-1	Water/Liquid	8270C	0.25	0.50	ug/L	500	--	--	--
PCBs -										
Aroclor 1016	12674-11-2	Soil/Solid	8082	0.017	0.20	mg/kg	--	--	--	--
Aroclor 1221	11104-28-2	Soil/Solid	8082	0.039	0.20	mg/kg	--	--	--	--
Aroclor 1232	11141-16-5	Soil/Solid	8082	0.010	0.20	mg/kg	--	--	--	--
Aroclor 1242	53469-21-9	Soil/Solid	8082	0.016	0.20	mg/kg	--	--	--	--
Aroclor 1248	12672-29-6	Soil/Solid	8082	0.0078	0.20	mg/kg	--	--	--	--
Aroclor 1254	11097-69-1	Soil/Solid	8082	0.0071	0.20	mg/kg	--	--	--	--
Aroclor 1260	11096-82-5	Soil/Solid	8082	0.015	0.20	mg/kg	--	--	--	--
PCBs -										
Aroclor 1016	12674-11-2	Water/Liquid	8082	0.41	2.0	ug/L	--	--	--	--
Aroclor 1221	11104-28-2	Water/Liquid	8082	0.36	2.0	ug/L	--	--	--	--
Aroclor 1232	11141-16-5	Water/Liquid	8082	0.25	2.0	ug/L	--	--	--	--
Aroclor 1242	53469-21-9	Water/Liquid	8082	0.58	2.0	ug/L	--	--	--	--
Aroclor 1248	12672-29-6	Water/Liquid	8082	0.25	2.0	ug/L	--	--	--	--
Aroclor 1254	11097-69-1	Water/Liquid	8082	0.25	2.0	ug/L	--	--	--	--
Aroclor 1260	11096-82-5	Water/Liquid	8082	0.32	2.0	ug/L	--	--	--	--
VOCs - Soil/Solid										
1,1,1,2-Tetrachloroethane	630-20-6	Soil/Solid	8260B	0.019	0.25	mg/kg	--	1.4	31	51
1,1,1-Trichloroethane	71-55-6	Soil/Solid	8260B	0.0098	0.25	mg/kg	--	3.5	140	472
1,1,2,2-Tetrachloroethane	79-34-5	Soil/Solid	8260B	0.012	0.25	mg/kg	--	0.005	3.5	6.5
1,1,2-Trichloroethane	79-00-5	Soil/Solid	8260B	0.022	0.25	mg/kg	--	0.010	9	14
1,1,2-Trichlorotrifluoroethane	76-13-1	Soil/Solid	8260B	0.052	0.25	mg/kg	--	2580	3745	5430
1,1-Dichloroethane	75-34-3	Soil/Solid	8260B	0.013	0.25	mg/kg	--	0.18	34	55
1,1-Dichloroethene	75-35-4	Soil/Solid	8260B	0.016	0.25	mg/kg	--	0.025	20	60
1,1-Dichloropropene	563-58-6	Soil/Solid	8260B	0.021	0.25	mg/kg	--	--	--	--
1,2,3-Trichlorobenzene	87-61-6	Soil/Solid	8260B	0.063	0.50	mg/kg	--	--	--	--
1,2,3-Trichloropropane	96-18-4	Soil/Solid	8260B	0.017	0.25	mg/kg	--	0.35	--	--
1,2,4-Trichlorobenzene	120-82-1	Soil/Solid	8260B	0.052	0.50	mg/kg	--	0.31	200	985
1,2,4-Trimethylbenzene	95-63-6	Soil/Solid	8260B	0.013	0.25	mg/kg	--	--	8	25
1,2-Dibromo-3-chloropropane	96-12-8	Soil/Solid	8260B	0.079	0.50	mg/kg	--	0.001	--	--
1,2-Dibromoethane (EDB)	106-93-4	Soil/Solid	8260B	0.0056	0.25	mg/kg	--	0.00001	0.3	0.5
1,2-Dichlorobenzene	95-50-1	Soil/Solid	8260B	0.0055	0.25	mg/kg	--	8.1	26	75
1,2-Dichloroethane	107-06-2	Soil/Solid	8260B	0.030	0.25	mg/kg	--	0.010	4	6
1,2-Dichloropropane	78-87-5	Soil/Solid	8260B	0.016	0.25	mg/kg	--	0.011	4	6
1,3,5-Trimethylbenzene	108-67-8	Soil/Solid	8260B	0.0077	0.25	mg/kg	--	--	3	10
1,3-Dichlorobenzene	541-73-1	Soil/Solid	8260B	0.015	0.25	mg/kg	--	4.2	26	200
1,3-Dichloropropane	142-28-9	Soil/Solid	8260B	0.017	0.25	mg/kg	--	--	--	--
1,4-Dichlorobenzene	106-46-7	Soil/Solid	8260B	0.017	0.25	mg/kg	--	0.13	30	50
2,2-Dichloropropane	594-20-7	Soil/Solid	8260B	0.034	0.50	mg/kg	--	--	--	--
2-Butanone	78-93-3	Soil/Solid	8260B	0.069	2.0	mg/kg	--	--	5500	19000
2-Chlorotoluene	95-49-8	Soil/Solid	8260B	0.015	0.25	mg/kg	--	--	436	436
4-Chlorotoluene	106-43-4	Soil/Solid	8260B	0.015	0.25	mg/kg	--	--	--	--
Acetone	67-64-1	Soil/Solid	8260B	0.16	2.0	mg/kg	--	0.7	340	1000
Allyl chloride	107-05-1	Soil/Solid	8260B	0.016	0.50	mg/kg	--	0.032	--	--
Benzene	71-43-2	Soil/Solid	8260B	0.0070	0.25	mg/kg	--	0.034	6	10
Bromobenzene	108-86-1	Soil/Solid	8260B	0.017	0.25	mg/kg	--	--	--	--
Bromochloromethane	74-97-5	Soil/Solid	8260B	0.021	0.25	mg/kg	--	0.15	--	--
Bromodichloromethane	75-27-4	Soil/Solid	8260B	0.020	0.25	mg/kg	--	0.013	10	17
Bromoform	75-25-2	Soil/Solid	8260B	0.015	0.50	mg/kg	--	0.14	370	650
Bromomethane	74-83-9	Soil/Solid	8260B	0.012	0.50	mg/kg	--	0.5	0.7	2
Carbon tetrachloride	56-23-5	Soil/Solid	8260B	0.018	0.25	mg/kg	--	0.023	0.3	0.9
Chlorobenzene	108-90-7	Soil/Solid	8260B	0.011	0.25	mg/kg	--	1.1	11	32
Chloroethane	75-00-3	Soil/Solid	8260B	0.045	0.25	mg/kg	--	--	1000	3000
Chloroform	67-66-3	Soil/Solid	8260B	0.017	0.25	mg/kg	--	0.17	2.5	4
Chloromethane	74-87-3	Soil/Solid	8260B	0.017	0.25	mg/kg	--	0.006	8	23
cis-1,2-Dichloroethene	156-59-2	Soil/Solid	8260B	0.016	0.25	mg/kg	--	0.14	8	22
cis-1,3-Dichloropropene	10061-01-5	Soil/Solid	8260B	0.0098	0.25	mg/kg	--	0.005 M	--	--
Dibromochloromethane	124-48-1	Soil/Solid	8260B	0.014	0.25	mg/kg	--	0.03	12	20
Dibromomethane	74-95-3	Soil/Solid	8260B	0.021	0.25	mg/kg	--	--	260	1860
Dichlorodifluoromethane	75-71-8	Soil/Solid	8260B	0.035	0.50	mg/kg	--	38	16	50

Table 3
Analytical Parameters, Methods and Quantitation Limits
Field Sampling Plan, SSI/RI, SOCs 4 and 5
UMore Mining Area
Dakota County, Minnesota

Parameter	CAS Number	Matrix	Method (EPA unless noted otherwise)	Method Detection Limit	Reporting Limit	Test Unit	MDH Health Risk Limits ³	Minnesota Tier SLV ⁴	Minnesota SRV ⁵	Minnesota Tier II Industrial SRV ⁶
Dichlorofluoromethane	75-43-4	Soil/Solid	8260B	0.014	0.25	mg/kg	--	--	--	--
Ethyl ether	60-29-7	Soil/Solid	8260B	0.017	0.50	mg/kg	--	1.2	--	--
Ethylbenzene	100-41-4	Soil/Solid	8260B	0.011	0.25	mg/kg	--	4.7	200	200
Hexachlorobutadiene	87-68-3	Soil/Solid	8260B	0.11	1.0	mg/kg	--	25	6	37
Isopropylbenzene	98-82-8	Soil/Solid	8260B	0.019	0.25	mg/kg	--	18	30	87
m,p-Xylene	108-38-3/ 106-42-3	Soil/Solid	8260B	0.024	0.50	mg/kg	--	45 M	45 M	130 M
Methyl isobutyl ketone	108-10-1	Soil/Solid	8260B	0.031	0.50	mg/kg	--	0.42	1700	9000
Methyl tert-butyl ether	1634-04-4	Soil/Solid	8260B	0.018	0.25	mg/kg	--	0.027	--	--
Methylene chloride	75-09-2	Soil/Solid	8260B	0.043	1.0	mg/kg	--	0.068	97	158
Naphthalene	91-20-3	Soil/Solid	8260B	0.060	0.50	mg/kg	--	7.5	10	28
n-Butylbenzene	104-51-8	Soil/Solid	8260B	0.012	0.25	mg/kg	--	--	30	92
n-Propylbenzene	103-65-1	Soil/Solid	8260B	0.013	0.25	mg/kg	--	--	30	93
o-Xylene	95-47-6	Soil/Solid	8260B	0.015	0.25	mg/kg	--	45 M	45 M	130 M
p-Isopropyltoluene	99-87-6	Soil/Solid	8260B	0.014	0.25	mg/kg	--	--	--	--
sec-Butylbenzene	135-98-8	Soil/Solid	8260B	0.012	0.25	mg/kg	--	--	25	70
Styrene	100-42-5	Soil/Solid	8260B	0.012	0.25	mg/kg	--	1.9	210	600
tert-Butylbenzene	98-06-6	Soil/Solid	8260B	0.0073	0.25	mg/kg	--	--	30	90
Tetrachloroethene	127-18-4	Soil/Solid	8260B	0.016	0.25	mg/kg	--	0.068	72	131
Tetrahydrofuran	109-99-9	Soil/Solid	8260B	0.068	2.0	mg/kg	--	0.16	--	--
Toluene	108-88-3	Soil/Solid	8260B	0.0063	0.25	mg/kg	--	6.4	107	305
trans-1,2-Dichloroethene	156-60-5	Soil/Solid	8260B	0.016	0.25	mg/kg	--	0.27	11	33
trans-1,3-Dichloropropene	10061-02-6	Soil/Solid	8260B	0.013	0.25	mg/kg	--	0.005 M	--	--
Trichloroethene	79-01-6	Soil/Solid	8260B	0.013	0.25	mg/kg	--	0.14	29	46
Trichlorofluoromethane	75-69-4	Soil/Solid	8260B	0.035	0.25	mg/kg	--	22	67	195
Vinyl chloride	75-01-4	Soil/Solid	8260B	0.031	0.25	mg/kg	--	0.001	0.8	2.2
VOCs - Water/Liquid										
1,1,1,2-Tetrachloroethane	630-20-6	Water/Liquid	8260B	0.083	1.0	ug/L	70	--	--	--
1,1,1-Trichloroethane	71-55-6	Water/Liquid	8260B	0.098	1.0	ug/L	9000 (4)	--	--	--
1,1,2,2-Tetrachloroethane	79-34-5	Water/Liquid	8260B	0.084	1.0	ug/L	2	--	--	--
1,1,2-Trichloroethane	79-00-5	Water/Liquid	8260B	0.15	1.0	ug/L	3	--	--	--
1,1,2-Trichlorotrifluoroethane	76-13-1	Water/Liquid	8260B	0.10	1.0	ug/L	200000	--	--	--
1,1-Dichloroethane	75-34-3	Water/Liquid	8260B	0.094	1.0	ug/L	100 (7)	--	--	--
1,1-Dichloroethene	75-35-4	Water/Liquid	8260B	0.10	1.0	ug/L	200	--	--	--
1,1-Dichloropropene	563-58-6	Water/Liquid	8260B	0.099	1.0	ug/L	--	--	--	--
1,2,3-Trichlorobenzene	87-61-6	Water/Liquid	8260B	0.40	5.0	ug/L	--	--	--	--
1,2,3-Trichloropropane	96-18-4	Water/Liquid	8260B	0.13	2.5	ug/L	40	--	--	--
1,2,4-Trichlorobenzene	120-82-1	Water/Liquid	8260B	0.52	5.0	ug/L	--	--	--	--
1,2,4-Trimethylbenzene	95-63-6	Water/Liquid	8260B	0.052	1.0	ug/L	--	--	--	--
1,2-Dibromo-3-chloropropane	96-12-8	Water/Liquid	8260B	1.2	5.0	ug/L	--	--	--	--
1,2-Dibromoethane (EDB)	106-93-4	Water/Liquid	8260B	0.10	2.5	ug/L	0.004	--	--	--
1,2-Dichlorobenzene	95-50-1	Water/Liquid	8260B	0.12	1.0	ug/L	600	--	--	--
1,2-Dichloroethane	107-06-2	Water/Liquid	8260B	0.084	1.0	ug/L	4	--	--	--
1,2-Dichloropropane	78-87-5	Water/Liquid	8260B	0.13	1.0	ug/L	5	--	--	--
1,3,5-Trimethylbenzene	108-67-8	Water/Liquid	8260B	0.066	1.0	ug/L	100 (4) (6)	--	--	--
1,3-Dichlorobenzene	541-73-1	Water/Liquid	8260B	0.094	1.0	ug/L	--	--	--	--
1,3-Dichloropropane	142-28-9	Water/Liquid	8260B	0.074	1.0	ug/L	--	--	--	--
1,4-Dichlorobenzene	106-46-7	Water/Liquid	8260B	0.053	1.0	ug/L	10	--	--	--
2,2-Dichloropropane	594-20-7	Water/Liquid	8260B	0.23	5.0	ug/L	--	--	--	--
2-Butanone	78-93-3	Water/Liquid	8260B	0.58	20	ug/L	4000	--	--	--
2-Chlorotoluene	95-49-8	Water/Liquid	8260B	0.077	1.0	ug/L	--	--	--	--
4-Chlorotoluene	106-43-4	Water/Liquid	8260B	0.059	1.0	ug/L	--	--	--	--
Acetone	67-64-1	Water/Liquid	8260B	0.89	20	ug/L	700	--	--	--
Allyl chloride	107-05-1	Water/Liquid	8260B	0.28	5.0	ug/L	30	--	--	--
Benzene	71-43-2	Water/Liquid	8260B	0.047	1.0	ug/L	2 (4)	--	--	--
Bromobenzene	108-86-1	Water/Liquid	8260B	0.084	1.0	ug/L	--	--	--	--
Bromochloromethane	74-97-5	Water/Liquid	8260B	0.075	1.0	ug/L	--	--	--	--
Bromodichloromethane	75-27-4	Water/Liquid	8260B	0.13	1.0	ug/L	6	--	--	--
Bromoform	75-25-2	Water/Liquid	8260B	0.074	5.0	ug/L	40	--	--	--
Bromomethane	74-83-9	Water/Liquid	8260B	0.26	5.0	ug/L	10	--	--	--
Carbon tetrachloride	56-23-5	Water/Liquid	8260B	0.074	1.0	ug/L	3	--	--	--
Chlorobenzene	108-90-7	Water/Liquid	8260B	0.025	1.0	ug/L	100	--	--	--
Chloroethane	75-00-3	Water/Liquid	8260B	0.26	2.5	ug/L	--	--	--	--
Chloroform	67-66-3	Water/Liquid	8260B	0.098	1.0	ug/L	30 (4) (6)	--	--	--
Chloromethane	74-87-3	Water/Liquid	8260B	0.098	2.5	ug/L	--	--	--	--
cis-1,2-Dichloroethene	156-59-2	Water/Liquid	8260B	0.12	1.0	ug/L	50 (4)	--	--	--
cis-1,3-Dichloropropene	10061-01-5	Water/Liquid	8260B	0.11	1.0	ug/L	--	--	--	--
Dibromochloromethane	124-48-1	Water/Liquid	8260B	0.084	2.5	ug/L	10	--	--	--
Dibromomethane	74-95-3	Water/Liquid	8260B	0.14	2.5	ug/L	--	--	--	--
Dichlorodifluoromethane	75-71-8	Water/Liquid	8260B	0.39	5.0	ug/L	700 (4)	--	--	--
Dichlorofluoromethane	75-43-4	Water/Liquid	8260B	0.070	1.0	ug/L	--	--	--	--
Ethyl ether	60-29-7	Water/Liquid	8260B	0.10	5.0	ug/L	1000	--	--	--
Ethylbenzene	100-41-4	Water/Liquid	8260B	0.055	1.0	ug/L	700	--	--	--

Table 3
Analytical Parameters, Methods and Quantitation Limits
Field Sampling Plan, SSI/RI, SOCs 4 and 5
UMore Mining Area
Dakota County, Minnesota

Parameter	CAS Number	Matrix	Method (EPA unless noted otherwise)	Method Detection Limit	Reporting Limit	Test Unit	MDH Health Risk Limits ³	Minnesota Tier SLV ⁴	Minnesota SRV ⁵	Minnesota Tier II Industrial SRV ⁶
Hexachlorobutadiene	87-68-3	Water/Liquid	8260B	0.58	10	ug/L	1	--	--	--
Isopropylbenzene	98-82-8	Water/Liquid	8260B	0.068	1.0	ug/L	300	--	--	--
m,p-Xylene	108-38-3 3	106-42 Water/Liquid	8260B	0.14	2.0	ug/L	10000 M	--	--	--
Methyl isobutyl ketone	108-10-1	Water/Liquid	8260B	0.13	5.0	ug/L	300	--	--	--
Methyl tert-butyl ether	1634-04-4	Water/Liquid	8260B	0.079	1.0	ug/L	--	--	--	--
Methylene chloride	75-09-2	Water/Liquid	8260B	0.29	5.0	ug/L	5 (3)	--	--	--
Naphthalene	91-20-3	Water/Liquid	8260B	0.38	5.0	ug/L	300	--	--	--
n-Butylbenzene	104-51-8	Water/Liquid	8260B	0.094	2.5	ug/L	--	--	--	--
n-Propylbenzene	103-65-1	Water/Liquid	8260B	0.079	1.0	ug/L	--	--	--	--
o-Xylene	95-47-6	Water/Liquid	8260B	0.074	1.0	ug/L	10000 M	--	--	--
p-Isopropyltoluene	99-87-6	Water/Liquid	8260B	0.087	2.5	ug/L	--	--	--	--
sec-Butylbenzene	135-98-8	Water/Liquid	8260B	0.030	1.0	ug/L	--	--	--	--
Styrene	100-42-5	Water/Liquid	8260B	0.072	1.0	ug/L	--	--	--	--
tert-Butylbenzene	98-06-6	Water/Liquid	8260B	0.046	1.0	ug/L	--	--	--	--
Tetrachloroethene	127-18-4	Water/Liquid	8260B	0.10	1.0	ug/L	5 (3)	--	--	--
Tetrahydrofuran	109-99-9	Water/Liquid	8260B	0.76	20	ug/L	--	--	--	--
Toluene	108-88-3	Water/Liquid	8260B	0.036	1.0	ug/L	1000	--	--	--
trans-1,2-Dichloroethene	156-60-5	Water/Liquid	8260B	0.14	1.0	ug/L	100	--	--	--
trans-1,3-Dichloropropene	10061-02-6	Water/Liquid	8260B	0.082	1.0	ug/L	--	--	--	--
Trichloroethene	79-01-6	Water/Liquid	8260B	0.097	1.0	ug/L	5 (3)	--	--	--
Trichlorofluoromethane	75-69-4	Water/Liquid	8260B	0.17	1.0	ug/L	2000	--	--	--
Vinyl chloride	75-01-4	Water/Liquid	8260B	0.10	1.0	ug/L	0.2 (4)	--	--	--
SemiVolatile Organics										
1,2,4-Trichlorobenzene	120-82-1	Soil/Solid	8270C	0.020	0.33	mg/kg	--	0.31	200	985
1,2-Dichlorobenzene	95-50-1	Soil/Solid	8270C	0.012	0.33	mg/kg	--	8.1	26	75
1,2-Diphenylhydrazine as Azobenzene	103-33-3	Soil/Solid	8270C	0.039	0.33	mg/kg	--	--	--	--
1,3-Dichlorobenzene	541-73-1	Soil/Solid	8270C	0.014	0.33	mg/kg	--	4.2	26	200
1,4-Dichlorobenzene	106-46-7	Soil/Solid	8270C	0.013	0.33	mg/kg	--	0.13	30	50
2,3,4,6-Tetrachlorophenol	58-90-2	Soil/Solid	8270C	0.072	0.67	mg/kg	--	--	636	3700
2,4,5-Trichlorophenol	95-95-4	Soil/Solid	8270C	0.039	0.67	mg/kg	--	--	1920	10600
2,4,6-Trichlorophenol	88-06-2	Soil/Solid	8270C	0.081	0.67	mg/kg	--	0.21	595	1060
2,4-Dichlorophenol	120-83-2	Soil/Solid	8270C	0.046	0.67	mg/kg	--	0.076	48	230
2,4-Dimethylphenol	105-67-9	Soil/Solid	8270C	0.079	0.67	mg/kg	--	0.34	390	1925
2,4-Dinitrophenol	51-28-5	Soil/Solid	8270C	0.064	0.67	mg/kg	--	0.014	--	--
2,4-Dinitrotoluene	121-14-2	Soil/Solid	8270C	0.044	0.33	mg/kg	--	0.001	50	355
2,6-Dichlorophenol	87-65-0	Soil/Solid	8270C	0.042	0.67	mg/kg	--	--	--	--
2,6-Dinitrotoluene	606-20-2	Soil/Solid	8270C	0.040	0.33	mg/kg	--	0.001	25	175
2-Chloronaphthalene	91-58-7	Soil/Solid	8270C	0.018	0.33	mg/kg	--	--	--	--
2-Chlorophenol	95-57-8	Soil/Solid	8270C	0.029	0.67	mg/kg	--	0.26	--	--
2-Methylnaphthalene	91-57-6	Soil/Solid	8270C	0.021	0.33	mg/kg	--	--	100	369
2-Methylphenol	95-48-7	Soil/Solid	8270C	0.019	0.67	mg/kg	--	0.064	75	352
2-Nitroaniline	88-74-4	Soil/Solid	8270C	0.041	0.33	mg/kg	--	--	--	--
2-Nitrophenol	88-75-5	Soil/Solid	8270C	0.040	0.67	mg/kg	--	0.60	--	--
3,3'-Dichlorobenzidine	91-94-1	Soil/Solid	8270C	0.21	1.6	mg/kg	--	0.36	25	50
3-Nitroaniline	99-09-2	Soil/Solid	8270C	0.041	0.33	mg/kg	--	--	--	--
4,6-Dinitro-2-methylphenol	534-52-1	Soil/Solid	8270C	0.097	0.67	mg/kg	--	--	--	--
4-Bromophenyl phenyl ether	101-55-3	Soil/Solid	8270C	0.044	0.33	mg/kg	--	--	--	--
4-Chloro-3-methylphenol	59-50-7	Soil/Solid	8270C	0.075	0.67	mg/kg	--	--	--	--
4-Chloroaniline	106-47-8	Soil/Solid	8270C	0.022	0.67	mg/kg	--	--	--	--
4-Chlorophenyl phenyl ether	7005-72-3	Soil/Solid	8270C	0.024	0.33	mg/kg	--	--	--	--
4-Methylphenol	106-44-5	Soil/Solid	8270C	0.017	0.67	mg/kg	--	0.033	10	59
4-Nitroaniline	100-01-6	Soil/Solid	8270C	0.044	0.33	mg/kg	--	--	--	--
4-Nitrophenol	100-02-7	Soil/Solid	8270C	0.081	0.67	mg/kg	--	--	--	--
Acenaphthene	83-32-9	Soil/Solid	8270C	0.020	0.33	mg/kg	--	50	1200	5260
Acenaphthylene	208-96-8	Soil/Solid	8270C	0.031	0.33	mg/kg	--	--	--	--
Aniline	62-53-3	Soil/Solid	8270C	0.034	0.67	mg/kg	--	--	--	--
Anthracene	120-12-7	Soil/Solid	8270C	0.043	0.33	mg/kg	--	942	7880	45400
Benzydine	92-87-5	Soil/Solid	8270C	0.71	2.5	mg/kg	--	--	--	--
Benzo (a) anthracene	56-55-3	Soil/Solid	8270C	0.045	0.33	mg/kg	--	10.2 T	2 T	3 T
Benzo (a) pyrene	50-32-8	Soil/Solid	8270C	0.049	0.33	mg/kg	--	10.2 T	2 T	3 T
Benzo (b) fluoranthene	205-99-2	Soil/Solid	8270C	0.048	0.33	mg/kg	--	10.2 T	2 T	3 T
Benzo (g,h,i) perylene	191-24-2	Soil/Solid	8270C	0.050	0.33	mg/kg	--	--	--	--
Benzo (k) fluoranthene	207-08-9	Soil/Solid	8270C	0.053	0.33	mg/kg	--	10.2 T	2 T	3 T
Benzoic acid	65-85-0	Soil/Solid	8270C	0.036	0.33	mg/kg	--	30	50000	100000
Benzyl alcohol	100-51-6	Soil/Solid	8270C	0.11	0.67	mg/kg	--	--	8700	56000
Bis(2-chloroethoxy)methane	111-91-1	Soil/Solid	8270C	0.021	0.33	mg/kg	--	--	--	--

Table 3
Analytical Parameters, Methods and Quantitation Limits
Field Sampling Plan, SSI/RI, SOCs 4 and 5
UMore Mining Area
Dakota County, Minnesota

Parameter	CAS Number	Matrix	Method (EPA unless noted otherwise)	Method Detection Limit	Reporting Limit	Test Unit	MDH Health Risk Limits ³	Minnesota Tier SLV ⁴	Minnesota SRV ⁵	Minnesota Tier II Industrial SRV ⁶
Bis(2-chloroethyl)ether	111-44-4	Soil/Solid	8270C	0.013	0.33	mg/kg	--	0.001	2.5	5
Bis(2-chloroisopropyl)ether	39638-32-9	Soil/Solid	8270C	0.017	0.33	mg/kg	--	--	--	--
Bis(2-ethylhexyl)phthalate	117-81-7	Soil/Solid	8270C	0.046	0.33	mg/kg	--	40	570	2100
Butyl benzyl phthalate	85-68-7	Soil/Solid	8270C	0.047	0.33	mg/kg	--	28	580	3700
Carbazole	86-74-8	Soil/Solid	8270C	0.044	0.33	mg/kg	--	--	700	1310
Chrysene	218-01-9	Soil/Solid	8270C	0.049	0.33	mg/kg	--	10.2 T	2 T	3 T
Dibenz (a,h) anthracene	53-70-3	Soil/Solid	8270C	0.053	0.33	mg/kg	--	10.2 T	2 T	3 T
Dibenzofuran	132-64-9	Soil/Solid	8270C	0.022	0.33	mg/kg	--	--	104	810
Diethyl phthalate	84-66-2	Soil/Solid	8270C	0.045	0.33	mg/kg	--	18	--	--
Dimethyl phthalate	131-11-3	Soil/Solid	8270C	0.043	0.33	mg/kg	--	172	--	--
Di-n-butyl phthalate	84-74-2	Soil/Solid	8270C	0.054	0.33	mg/kg	--	23	2440	16300
Di-n-octyl phthalate	117-84-0	Soil/Solid	8270C	0.056	0.33	mg/kg	--	--	520	3700
Fluoranthene	206-44-0	Soil/Solid	8270C	0.047	0.33	mg/kg	--	295	1080	6800
Fluorene	86-73-7	Soil/Solid	8270C	0.011	0.33	mg/kg	--	47	850	4120
Hexachlorobenzene	118-74-1	Soil/Solid	8270C	0.041	0.33	mg/kg	--	0.32	5	9
Hexachlorobutadiene	87-68-3	Soil/Solid	8270C	0.035	0.33	mg/kg	--	25	6	37
Hexachlorocyclopentadiene	77-47-4	Soil/Solid	8270C	0.030	0.33	mg/kg	--	4.4	2	6
Hexachloroethane	67-72-1	Soil/Solid	8270C	0.018	0.33	mg/kg	--	0.050	--	--
Indeno (1,2,3-cd) pyrene	193-39-5	Soil/Solid	8270C	0.042	0.33	mg/kg	--	10.2 T	2 T	3 T
Isophorone	78-59-1	Soil/Solid	8270C	0.018	0.33	mg/kg	--	0.16	--	--
Naphthalene	91-20-3	Soil/Solid	8270C	0.015	0.33	mg/kg	--	7.5	10	28
Nitrobenzene	98-95-3	Soil/Solid	8270C	0.014	0.33	mg/kg	--	--	--	--
N-Nitrosodimethylamine	62-75-9	Soil/Solid	8270C	0.028	0.33	mg/kg	--	0.82	--	--
N-Nitrosodi-n-propylamine	621-64-7	Soil/Solid	8270C	0.014	0.33	mg/kg	--	--	0.7	1.2
N-Nitrosodiphenylamine ***	86-30-6	Soil/Solid	8270C	0.045	0.33	mg/kg	--	0.88	1950	3720
Diphenylamine ***	122-39-4	Soil/Solid	8270C	--	--	--	--	--	--	--
Pentachlorophenol	87-86-5	Soil/Solid	8270C	0.081	0.67	mg/kg	--	0.034	80	120
Phenanthrene	85-01-8	Soil/Solid	8270C	0.026	0.33	mg/kg	--	--	--	--
Phenol	108-95-2	Soil/Solid	8270C	0.027	0.67	mg/kg	--	7.8	1500	20203
Pyrene	129-00-0	Soil/Solid	8270C	0.046	0.33	mg/kg	--	272	890	5800
2,4-Dinitrotoluene (DNT)	121-14-2	Soil/Solid	8270C	0.063	3.0	mg/kg	--	0.001	50	355
2,6-Dinitrotoluene (DNT)	606-20-2	Soil/Solid	8270C	0.13	3.0	mg/kg	--	0.001	25	175
SemiVolatile Organics										
1,2,4-Trichlorobenzene	120-82-1	Water/Liquid	8270C	0.28	10	ug/L	--	--	--	--
1,2-Dichlorobenzene	95-50-1	Water/Liquid	8270C	0.21	10	ug/L	600	--	--	--
1,2-Diphenylhydrazine as Azobenzene	103-33-3	Water/Liquid	8270C	0.20	10	ug/L	--	--	--	--
1,3-Dichlorobenzene	541-73-1	Water/Liquid	8270C	0.21	10	ug/L	--	--	--	--
1,4-Dichlorobenzene	106-46-7	Water/Liquid	8270C	0.18	10	ug/L	10	--	--	--
2,3,4,6-Tetrachlorophenol	58-90-2	Water/Liquid	8270C	1.0	10	ug/L	--	--	--	--
2,4,5-Trichlorophenol	95-95-4	Water/Liquid	8270C	0.85	10	ug/L	--	--	--	--
2,4,6-Trichlorophenol	88-06-2	Water/Liquid	8270C	0.89	10	ug/L	30	--	--	--
2,4-Dichlorophenol	120-83-2	Water/Liquid	8270C	0.78	10	ug/L	20	--	--	--
2,4-Dimethylphenol	105-67-9	Water/Liquid	8270C	0.76	10	ug/L	100	--	--	--
2,4-Dinitrophenol	51-28-5	Water/Liquid	8270C	0.50	10	ug/L	10	--	--	--
2,4-Dinitrotoluene	121-14-2	Water/Liquid	8270C	0.49	10	ug/L	0.5 (2)	--	--	--
2,6-Dichlorophenol	87-65-0	Water/Liquid	8270C	0.78	10	ug/L	--	--	--	--
2,6-Dinitrotoluene	606-20-2	Water/Liquid	8270C	0.39	10	ug/L	0.5 (2)	--	--	--
2-Chloronaphthalene	91-58-7	Water/Liquid	8270C	0.20	10	ug/L	--	--	--	--
2-Chlorophenol	95-57-8	Water/Liquid	8270C	0.66	10	ug/L	30	--	--	--
2-Methylnaphthalene	91-57-6	Water/Liquid	8270C	0.32	10	ug/L	--	--	--	--
2-Methylphenol	95-48-7	Water/Liquid	8270C	0.77	10	ug/L	30	--	--	--
2-Nitroaniline	88-74-4	Water/Liquid	8270C	0.92	10	ug/L	--	--	--	--
2-Nitrophenol	88-75-5	Water/Liquid	8270C	1.0	10	ug/L	--	--	--	--
3,3'-Dichlorobenzidine	91-94-1	Water/Liquid	8270C	7.1	25	ug/L	0.8	--	--	--
3-Nitroaniline	99-09-2	Water/Liquid	8270C	0.95	10	ug/L	--	--	--	--
4,6-Dinitro-2-methylphenol	534-52-1	Water/Liquid	8270C	0.90	10	ug/L	--	--	--	--
4-Bromophenyl phenyl ether	101-55-3	Water/Liquid	8270C	0.19	10	ug/L	--	--	--	--
4-Chloro-3-methylphenol	59-50-7	Water/Liquid	8270C	0.79	10	ug/L	--	--	--	--
4-Chloroaniline	106-47-8	Water/Liquid	8270C	1.0	10	ug/L	--	--	--	--
4-Chlorophenol	106-48-9	Water/Liquid	8270C	NA	NA	ug/L	--	--	--	--
4-Chlorophenyl phenyl ether	7005-72-3	Water/Liquid	8270C	0.15	10	ug/L	--	--	--	--
4-Methylphenol	106-44-5	Water/Liquid	8270C	0.82	10	ug/L	3	--	--	--
4-Nitroaniline	100-01-6	Water/Liquid	8270C	0.83	10	ug/L	--	--	--	--
4-Nitrophenol	100-02-7	Water/Liquid	8270C	1.2	10	ug/L	--	--	--	--
Acenaphthene	83-32-9	Water/Liquid	8270C	0.15	10	ug/L	400	--	--	--
Acenaphthylene	208-96-8	Water/Liquid	8270C	0.17	10	ug/L	--	--	--	--
Aniline	62-53-3	Water/Liquid	8270C	0.97	10	ug/L	--	--	--	--

Table 3
Analytical Parameters, Methods and Quantitation Limits
Field Sampling Plan, SSI/RI, SOCs 4 and 5
UMore Mining Area
Dakota County, Minnesota

Parameter	CAS Number	Matrix	Method (EPA unless noted otherwise)	Method Detection Limit	Reporting Limit	Test Unit	MDH Health Risk Limits ³	Minnesota Tier SLV ⁴	Minnesota SRV ⁵	Minnesota Tier II Industrial SRV ⁶
Anthracene	120-12-7	Water/Liquid	8270C	0.18	10	ug/L	2000	--	--	--
Benztidine	92-87-5	Water/Liquid	8270C	23	100	ug/L	--	--	--	--
Benzo (a) anthracene	56-55-3	Water/Liquid	8270C	0.18	10	ug/L	--	--	--	--
Benzo (a) pyrene	50-32-8	Water/Liquid	8270C	0.22	10	ug/L	--	--	--	--
Benzo (b) fluoranthene	205-99-2	Water/Liquid	8270C	0.18	10	ug/L	--	--	--	--
Benzo (g,h,i) perylene	191-24-2	Water/Liquid	8270C	0.24	10	ug/L	--	--	--	--
Benzo (k) fluoranthene	207-08-9	Water/Liquid	8270C	0.21	10	ug/L	--	--	--	--
Benzoic acid	65-85-0	Water/Liquid	8270C	0.75	10	ug/L	30000	--	--	--
Benzyl alcohol	100-51-6	Water/Liquid	8270C	0.66	10	ug/L	--	--	--	--
Bis(2-chloroethoxy)methane	111-91-1	Water/Liquid	8270C	0.21	10	ug/L	--	--	--	--
Bis(2-chloroethyl)ether	111-44-4	Water/Liquid	8270C	0.21	10	ug/L	0.3	--	--	--
Bis(2-chloroisopropyl)ether	39638-32-9	Water/Liquid	8270C	0.14	10	ug/L	--	--	--	--
Bis(2-ethylhexyl)phthalate	117-81-7	Water/Liquid	8270C	0.45	10	ug/L	20 (1)	--	--	--
Butyl benzyl phthalate	85-68-7	Water/Liquid	8270C	0.33	10	ug/L	100	--	--	--
Carbazole	86-74-8	Water/Liquid	8270C	0.24	10	ug/L	--	--	--	--
Chrysene	218-01-9	Water/Liquid	8270C	0.15	10	ug/L	--	--	--	--
Dibenz (a,h) anthracene	53-70-3	Water/Liquid	8270C	0.25	10	ug/L	--	--	--	--
Dibenzofuran	132-64-9	Water/Liquid	8270C	0.27	10	ug/L	--	--	--	--
Diethyl phthalate	84-66-2	Water/Liquid	8270C	0.32	10	ug/L	6000	--	--	--
Dimethyl phthalate	131-11-3	Water/Liquid	8270C	0.26	10	ug/L	70000	--	--	--
Di-n-butyl phthalate	84-74-2	Water/Liquid	8270C	0.33	10	ug/L	700	--	--	--
Di-n-octyl phthalate	117-84-0	Water/Liquid	8270C	0.42	10	ug/L	--	--	--	--
Fluoranthene	206-44-0	Water/Liquid	8270C	0.23	10	ug/L	300	--	--	--
Fluorene	86-73-7	Water/Liquid	8270C	0.16	10	ug/L	300	--	--	--
Hexachlorobenzene	118-74-1	Water/Liquid	8270C	0.15	10	ug/L	0.2	--	--	--
Hexachlorobutadiene	87-68-3	Water/Liquid	8270C	0.34	10	ug/L	1	--	--	--
Hexachlorocyclopentadiene	77-47-4	Water/Liquid	8270C	0.22	10	ug/L	--	--	--	--
Hexachloroethane	67-72-1	Water/Liquid	8270C	0.30	10	ug/L	--	--	--	--
Indeno (1,2,3-cd) pyrene	193-39-5	Water/Liquid	8270C	0.19	10	ug/L	--	--	--	--
Isophorone	78-59-1	Water/Liquid	8270C	0.23	10	ug/L	100	--	--	--
Naphthalene	91-20-3	Water/Liquid	8270C	0.19	10	ug/L	300	--	--	--
Nitrobenzene	98-95-3	Water/Liquid	8270C	0.26	10	ug/L	--	--	--	--
N-Nitrosodimethylamine	62-75-9	Water/Liquid	8270C	0.30	10	ug/L	--	--	--	--
N-Nitrosodi-n-propylamine	621-64-7	Water/Liquid	8270C	0.28	10	ug/L	--	--	--	--
N-Nitrosodiphenylamine ***	86-30-6	Water/Liquid	8270C	0.27	10	ug/L	70	--	--	--
Diphenylamine ***	122-39-4	Water/Liquid	8270C	--	--	--	--	--	--	--
Pentachlorophenol	87-86-5	Water/Liquid	8270C	0.99	10	ug/L	1 (3)	--	--	--
Phenanthrene	85-01-8	Water/Liquid	8270C	0.13	10	ug/L	--	--	--	--
Phenol	108-95-2	Water/Liquid	8270C	0.59	10	ug/L	4000	--	--	--
Pyrene	129-00-0	Water/Liquid	8270C	0.24	10	ug/L	200	--	--	--

Notes:

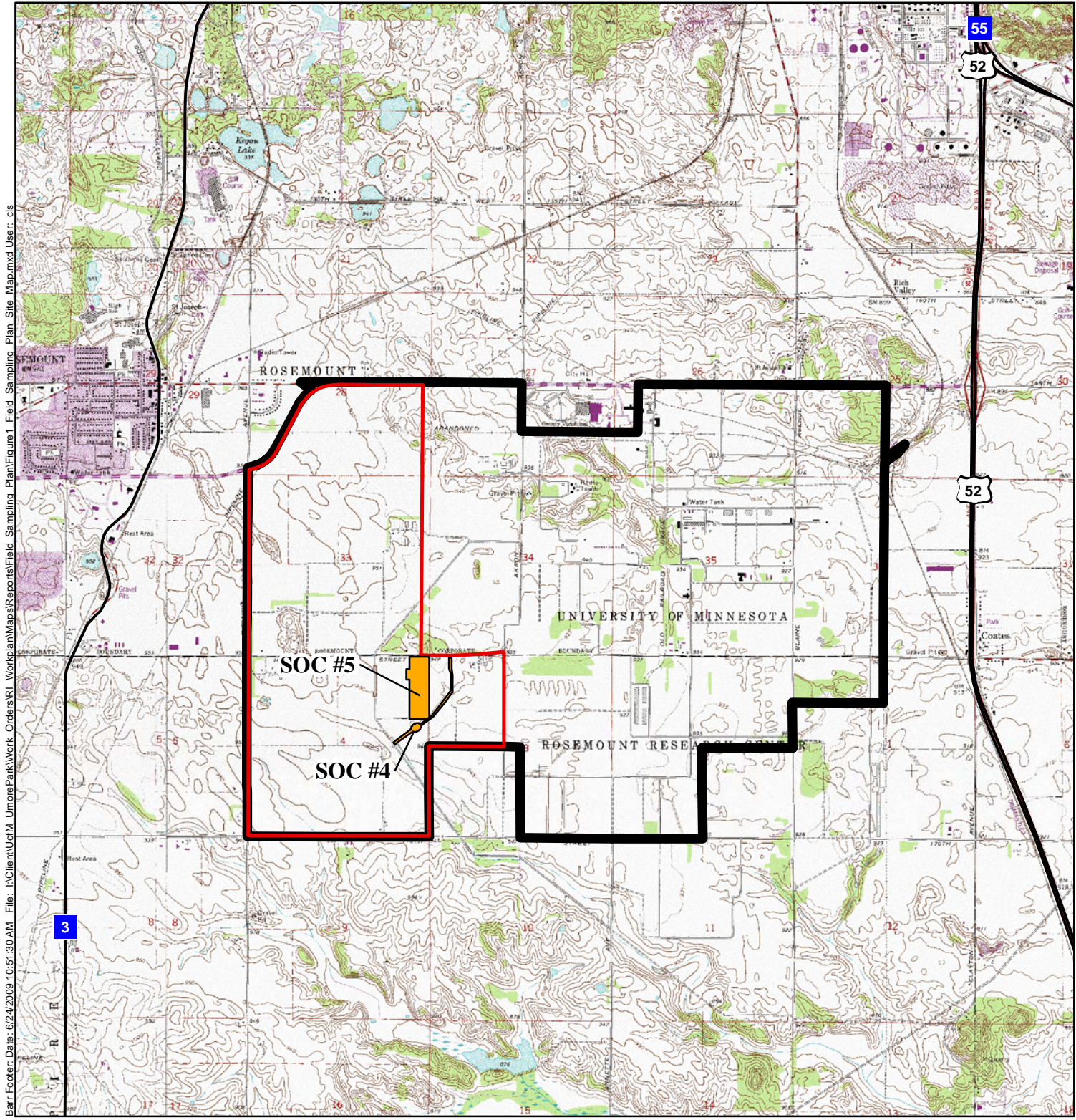
- M - the values with this notation indicate the limit is for all combined isomers of this compound
- T - the values with this notation represent the limit for the total carcinogenic PAHs as BaP
- C - Mercury as mercuric chloride
- (TA) - Legend Technical Services, Inc. will subcontract this analysis to Test America, West Sacramento, California.
- (Braun) - Legend Technical Services, Inc. will subcontract this analysis to Braun Intertec, Minneapolis, MN.
- (1) Not a HRL but a Health Based Value (HBV)
- (2) (SRL)-Specific Risk Level (water concentration which corresponds to a riskof 1E-5.
- (3) Not a HRL but an EPA Maximum Contaminant Level (MCL).
- (4) Value is representative of the lowest exposure duration published in the 2008 Health Risk Limits.
- (5) Value represents the criteria for Chromium, hexavalent.
- (6) Set at short-term HRL.
- (7) Not a HRL, but a Risk Assessment Advice (RAA).
- (8) Value represents the criteria for Chromium, Trivalent.
- ³ - Minnesota Department of Health, Health Risk Limit (HRL) unless noted otherwise.
- ⁴ - Minnesota Pollution Control Agency's Risk-based guidance for Soil - Soil Leaching Value (SLV)
- ⁵ - Minnesota Pollution Control Agency's Risk-based guidance for Soil - Soil Reference Value (SRV)
- ⁶ - Minnesota Pollution Control Agency's Risk-based guidance for Soil - Tier II Industrial SRV.

Table 4
Sample Containers, Preservation and Holding Times
Field Sampling Plan, SSI/RI, SOCs 4 and 5
UMore Mining Area
Dakota County, Minnesota

Parameter	Preservative/Container Type & Volume	EPA Recommended Hold Time
Soil		
Metals	Cool to $\leq 6^{\circ}\text{C}$, plastic or glass (4-oz and additional volume for moisture analysis)	180 days Mercury = 28 days
SVOCs	Cool to $\leq 6^{\circ}\text{C}$, glass (4-oz and additional volume for moisture analysis)	14 days to extraction; 40 days to analysis
VOCs	Cool to $\leq 6^{\circ}\text{C}$, 1:1 ratio soil:methanol (MeOH), glass (10 g to 10 ml solvent and additional volume for moisture analysis) 40 ml vial	14 days
Pesticides (All lists)	Cool to $\leq 6^{\circ}\text{C}$, glass (one, 4oz container or two, 2-oz containers and additional volume for moisture analysis)	14 days to extraction; 40 days to analysis
Nitrocellulose	Cool to $\leq 6^{\circ}\text{C}$, glass (two, 4-oz containers)	28 days
PCBs	Cool to $\leq 6^{\circ}\text{C}$, glass (4-oz and additional volume for moisture analysis)	none
Water		
Metals	HNO_3 to pH<2; Cool to $\leq 6^{\circ}\text{C}$, plastic (250 ml) ¹	Six months Mercury = 28 days
SVOCs	Cool to $\leq 6^{\circ}\text{C}$, amber glass (1-liter)	7 days to extraction; 40 days to analysis
VOCs	Cool to $\leq 6^{\circ}\text{C}$, HCl to pH <2, glass (set of 3-40 ml vials)	14 days
Total Kjeldahl Nitrogen	H_2SO_4 to pH<2; Cool to $\leq 6^{\circ}\text{C}$, plastic (500 ml)	28 days
Nitrate + Nitrite as N	H_2SO_4 to pH<2; Cool to $\leq 6^{\circ}\text{C}$, plastic (500 ml)	28 days
Pesticides	Cool to $\leq 6^{\circ}\text{C}$, glass (1-liter)	7 days to extraction; 40 days to analysis
Nitrocellulose	Cool to $\leq 6^{\circ}\text{C}$, glass (250 mL)	28 days
Perchlorate	Cool to $\leq 6^{\circ}\text{C}$, plastic (250 mL)	28 days

¹ All water samples collected for metals analysis from temporary wells or monitoring wells will be filtered in the field. All water samples collected for metals analysis from supply wells will not be filtered.

Figures



Barr Footer: Date: 6/24/2009 10:51:30 AM File: I:\Client\UofM_UmorePark\Work_Orders\SI_Workplan\Maps\Reports\Field_Sampling_Plan\Figure 1_Field_Sampling_Plan_Site_Map.mxd User: cjs

- UMore Mining Area (UMA)
- UMore Park Boundary
- Site of Concern (SOC) Boundary



Figure 1

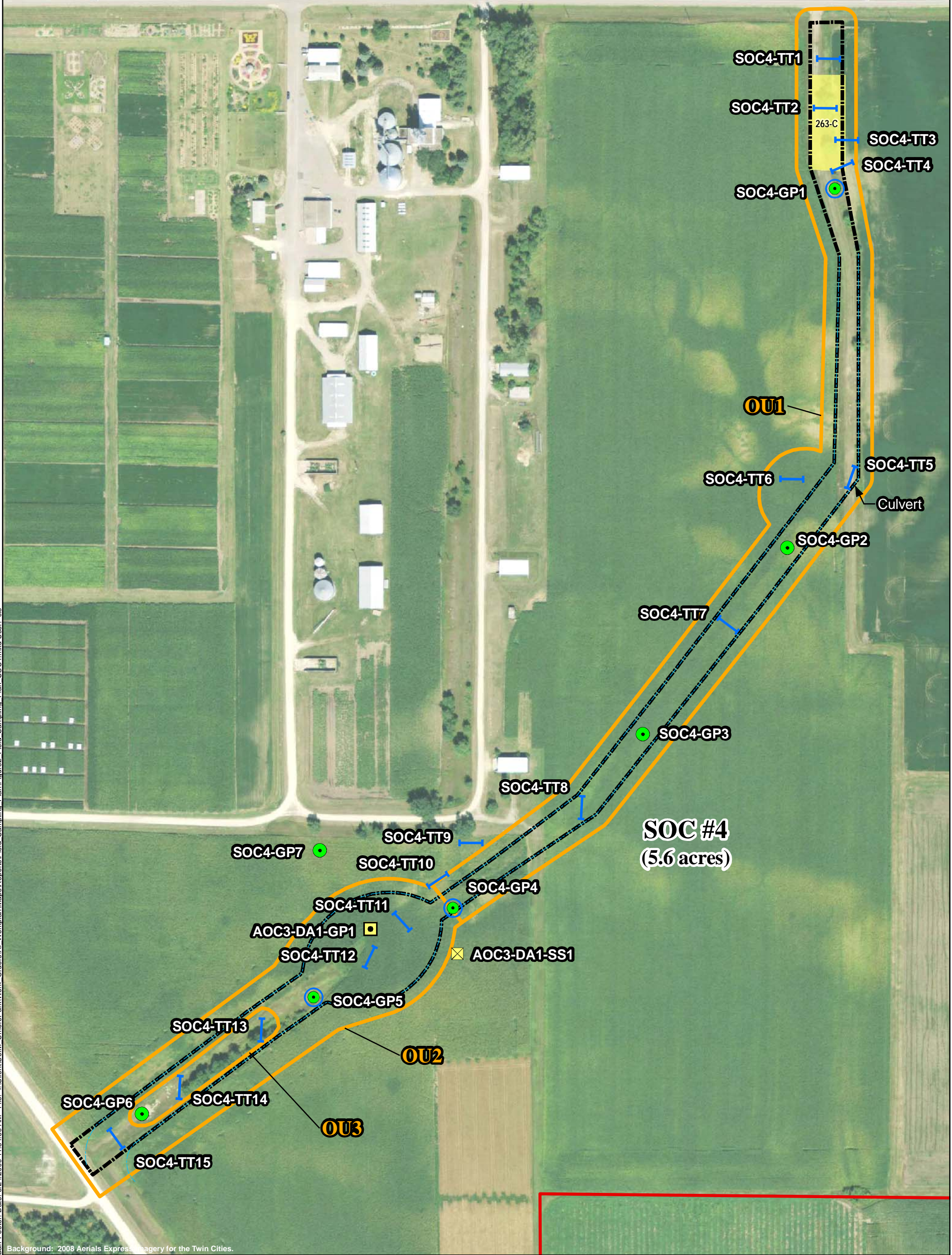
SITE LOCATION

FIELD SAMPLING PLAN
 SSI/RI Work Plan
 Sites of Concern 4 and 5
 UMore Mining Area
 Dakota County, MN

Source: MnDOT, MN DNR, Dakota County, Barr, SEH, HKGI.
 USGS topographic map background downloaded from the U.S.
 Department of Agriculture, Natural Resources Conservation Service.



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Background: 2008 Aerials Express Imagery for the Twin Cities.

- | | |
|--|--|
| Umore Mining Area Boundary (UMA) | USACE Geoprobe (Approximate Location from Bay West, 2009) |
| Site of Concern (SOC) Boundary | USACE Surface Soil Sample (Approximate Location from Bay West, 2009) |
| Operational Unit | Trace of Former Ditch Alignment (Approximate) |
| Former GOW Building (location from Dakota Co.) | |
| Direct Push Boring for Soil Sampling | |
| Direct Push Boring for Soil and Groundwater Sampling | |
| Test Trench | |

Notes:
 1. Based on field observation, test trenches may consist of discontinuous test pits excavated throughout the planned trench limits.
 2. Sample locations are approximate and may vary depending on site conditions.
 3. Operational Unit boundaries are offset from SOC boundaries for the purpose of graphical presentation.

Source: Dakota County, Barr, SEH, HKGI.

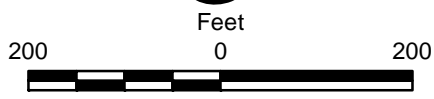
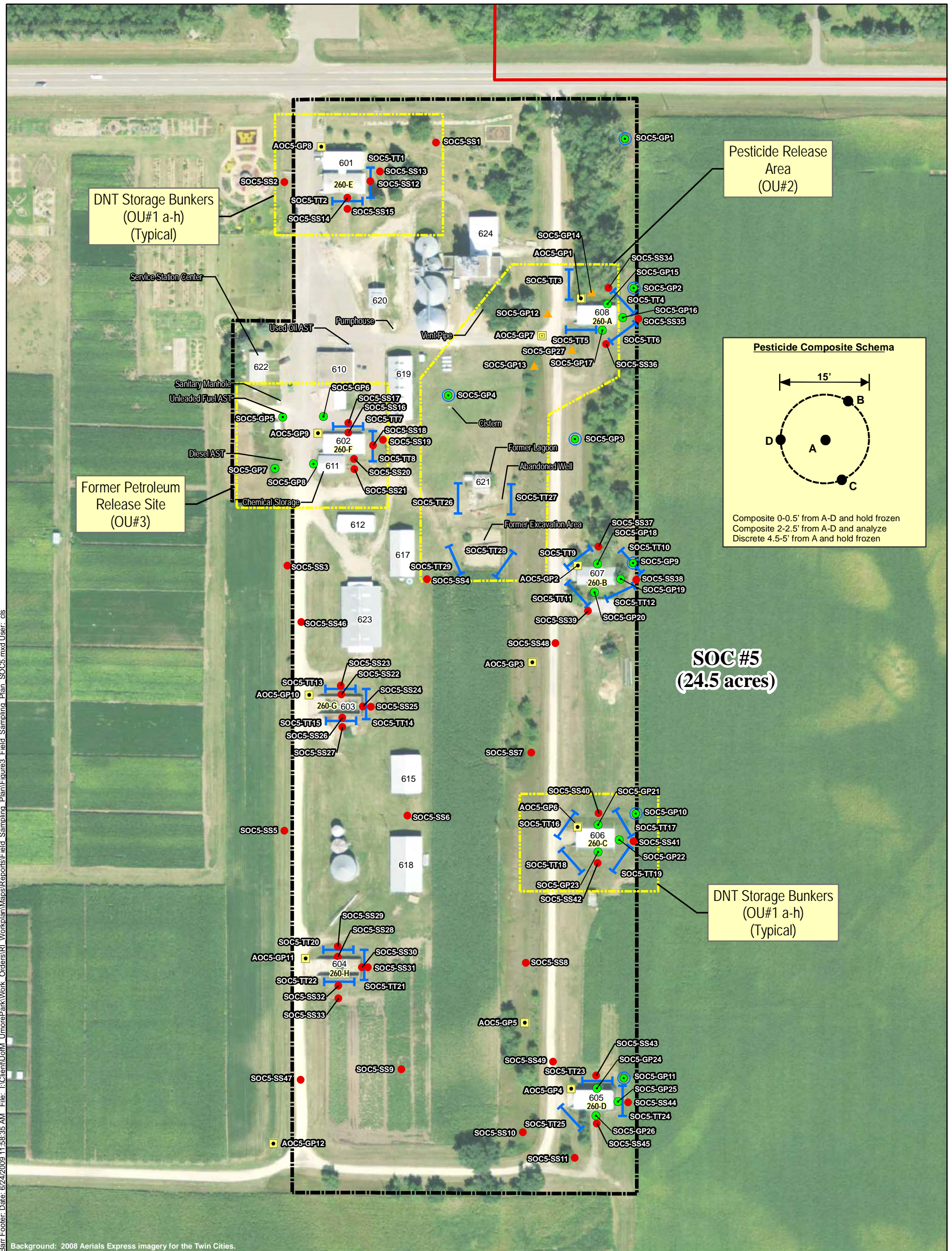


Figure 2
 FORMER DNT LOADING PLATFORM
 AND DRAINAGE DITCH 9 (SOC #4)
 SAMPLING LOCATIONS

FIELD SAMPLING PLAN
 SSI/RI Work Plan
 Sites of Concern 4 and 5
 Umore Mining Area
 Dakota County, MN





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- UMore Mining Area Boundary (UMA)
- Site of Concern (SOC) Boundary
- ▲ Direct Push Boring for Ag. Chem. Soil Sampling
- Direct Push Boring for Soil Sampling
- Direct Push Boring for Soil and/or Groundwater Sampling
- Test Trench
- Surface Soil Sampling
- USACE Geoprobe (Approximate Location from Bay West, 2009)
- USACE Soil & Water Geoprobe (Approximate Location from Bay West, 2009)

Notes:
 1. Based on field observation, test trenches may consist of discontinuous test pits excavated throughout the planned trench limits.
 2. Sample locations are approximate and may vary depending on site conditions.
 Source: Dakota County, Barr, SEH, HKGi, Bay West (2008).

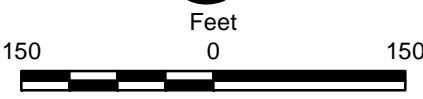


Figure 3

CENTRAL SERVICES STATION
/FORMER DNT BUNKERS (SOC #5)
SAMPLING LOCATIONS

FIELD SAMPLING PLAN
SSI/RI Work Plan
Sites of Concern 4 and 5
UMore Mining Area
Dakota County, MN

