Appendix 1
Historical Documents
Former Gopher Ordnance Works
Sampling and Analysis Plan

Selected historical information included in this Appendix was obtained from:

- United States Army Corps of Engineers (USACE) *Preliminary Assessment Report Final 1947 Quitclaim Property* (PA Report), dated March 2006 (USACE 2006a).

- USACE *History of Site & Sampling, Former Gopher Ordnance Works, MN, Steam Plant and Associated 26.7 Acres*, November 2006 (USACE 2006b).

- Historical Figures provided by the Dakota County Environmental Management, Minnesota Pollution Control Agency, and/or the University of Minnesota.

The property boundary description of AOC 7, Steam Plant and Associated 26.7 Acres (USACE, 2006b):

> Commencing at a point on the West line of Section Thirty-Six (36); twenty three hundred six and sixty-seven one hundredths (2306.67) feet North of the Southwest corner of Section Thirty-Six (36), Township One Hundred and Fifteen (115) North, Range Nineteen (19) West, Dakota Co., Minnesota, thence due East a distance of one hundred twenty (120) feet to a point which is the starting point of the property to be conveyed; thence Northerly parallel to the West line of said Section Thirty-Six (36) a distance of twelve hundred (1200) feet; thence due East a distance of nine hundred sixty-three and twenty-four one hundredths (963.24) feet; thence due South a distance of twelve hundred (1200) feet to a point lying nine hundred seventy-four and twenty-five one hundredths (974.25) feet Easterly from the starting point; thence Westerly along said line nine hundred seventy-four and twenty-five one hundredths (974.25) feet to the starting point; and comprising in all approximately twenty-six and seventy one hundredths (26.70) acres in said Section Thirty-Six (36); otherwise identified as that parcel of land bounded on the North by coordinate S-5200, on the East by coordinate E-19600, on the South by coordinate S-6400 and West by a line parallel to the West line of said Section Thirty-Six (36) which passes through coordinate E-18628.68 at coordinate S-6080.31, said coordinates being as shown on Plot Plan Sheet 1 of two sheets of the Gopher Ordnance Works, dated April 1, 1945, Project 8953, No. 1869. The boundaries of AOC 7 are delineated in Reference 1.

Appendix 3
Photographs
Former Gopher Ordnance Works
Sampling and Analysis Plan

Source: Selected photographs of each AOC are from Bay West Site visits conducted on October 10, 2006[(1)] and February 21, 2007[(2)], and from the PA Report[(3)].

Photo 1. **AOC 1.** Remnants of gated weir/dam structure at the Southeastern end of the Secondary Settling Basin. [(1)]

Photo 2. AOC 1. Looking generally south. Walking down drainage ditch towards primary settling basin. [(1)]

Photo 3. AOC 1. Looking Southeast. Entering Primary Settling Basin from drainage ditch. [(1)]

Photo 4. AOC 1. Looking north at remnants of the dam/weir at toe of primary settling basin.[(2)]

Photo 5. **AOC 1.** Looking South along the drainage ditch/low area where the drainage enters into the secondary settling basin (darker color vegetation). [(1)]

HTRW DRILLING LOG

DISTRICT: Seattle		HOLE NUMBER: B-1
1. COMPANY NAME: ABC Consultants	2. DRILLING CONTRACTOR: AAAAA Drilling	SHEET 1 OF 2 SHEETS
3. PROJECT: gINT Example	4. LOCATION: Ft. Somewhere, USA	
5. NAME OF DRILLER: I. Core	6. MANUFACTURER'S DESIGNATION OF DRILL: ACME Z-99	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4-1/4 Inch I.D. HSA; 2" I.D. split spoon; 8" Dia. Nominal borehole diameter.; Augers, spoons & drilling equipment decontaminated before use.	8. HOLE LOCATION: 160.0 North 265.0 East 123+45, 30' Lt	
	9. SURFACE ELEVATION: 123.4' MSL	
	10. DATE STARTED: 12/11/2000	11. DATE COMPLETED: 12/12/2000
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: 8	
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A	
14. TOTAL DEPTH OF HOLE: 9.0 Well Borehole	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 7.5' BGS (12/13/00)	

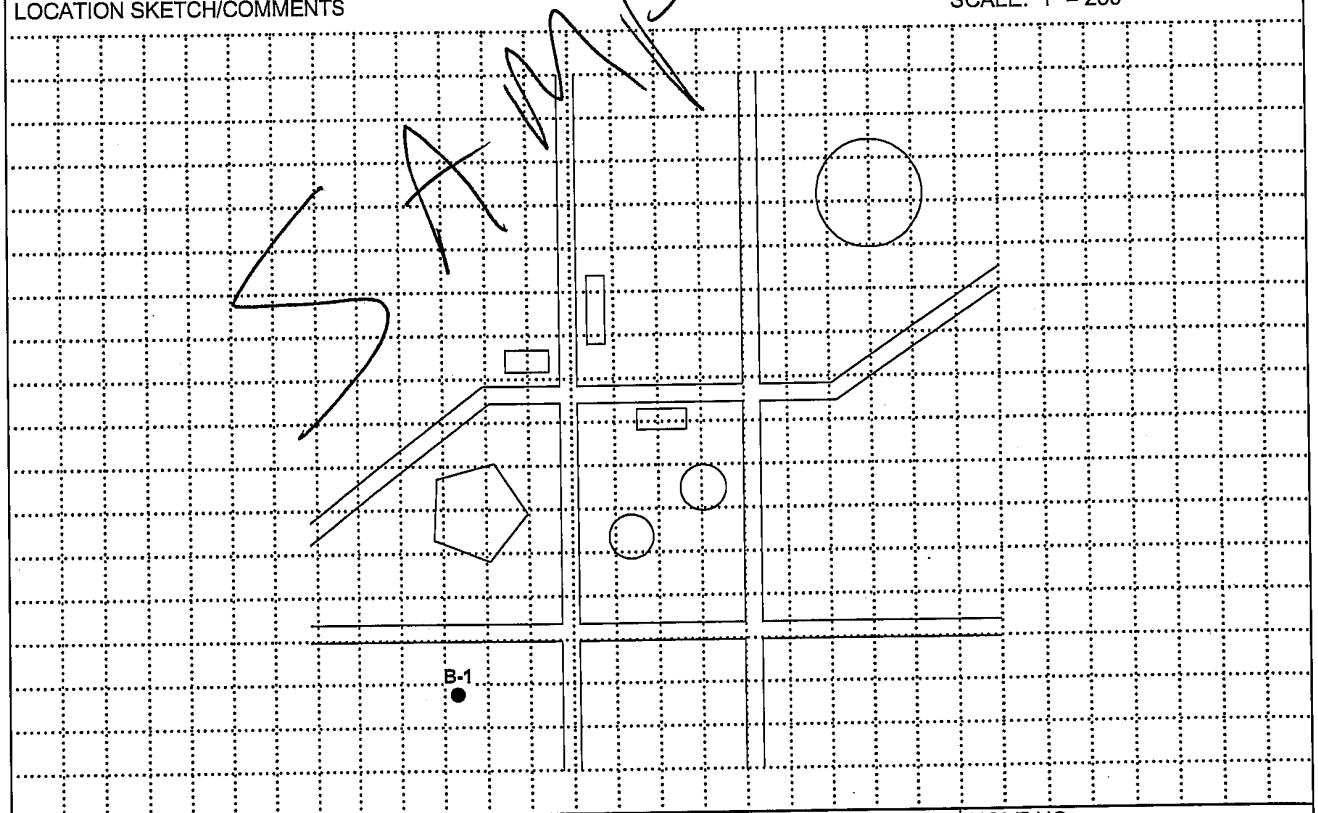
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
2	2	---	---

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
---	---	---	---	---	---	N/A %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Cuttings Drummed	see next	X	---	

LOCATION SKETCH/COMMENTS

SCALE: 1" = 250'



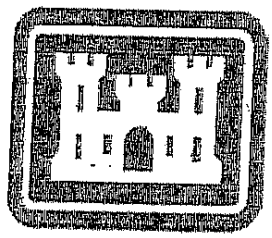
PROJECT	HOLE NO
gINT Example Ft. Somewhere, USA	B-1

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

GEOLOGY SUPPLEMENT TO THE

SCOPE OF SERVICES



REVISED: 26 MARCH 2004

DATE _____

DAY

S	M	T	W	T	F	S

DAILY QUALITY CONTROL REPORT

WEATHER	Bright Sun	Clear	Overcast	Rain	Snow
TEMP	To 32	32-30	30-70	70-85 85 up	
WIND	Still	Moder.	High	Report No.	
HUMIDITY	Dry	Moder.	Humid		

USACE PROJECT MANAGER: Taunya Howe
BAY WEST PROJECT MANAGER: Brenda Winkler
PROJECT: Gopher Ordnance Site Inspection
JOB NO: J060361
CONTRACT NO. W9128F-04-D-0004, TO 21

SUB-CONTRACTORS ON SITE:
EQUIPMENT ON SITE:
WORK PERFORMED (INCLUDING SAMPLING):

NTS GEOPROBE

STANDARD OPERATING PROCEDURES

GEOPROBE DESCRIPTION

NTS collects samples from various earth materials with a Geoprobe Systems® (geoprobe) Model 5400 mounted in a Ford F350 4x4 Pickup and 6610 DT Track Mounted direct push sampling technology. The sampling system is capable of collecting soil, soil gas, and groundwater samples at depths exceeding 100 feet.

The geoprobe consists of a percussion probe driven by a hydraulic pump powered by the carrier vehicle engine. The belt driven hydraulic pump supplies 10 gpm at 2000 rpm, 2250 psi operating pressure. Remote vehicle ignition allows the operator to start the vehicle engine from the rear geoprobe control panel. The probe unit folds for transportation and can be set up again in seconds. The geoprobe utilizes the static force (weight of vehicle) and hydraulic percussion to advance small diameter probing tools (1.0" O.D. to 1.6" O.D.) to depths that are limited only by soil type and depth to bedrock, usually over 30 feet. An eight horsepower hydraulic hammer issues over 1800 blows per minute. The hammer features a 0-300 rpm LH directional rotary function for drilling surface pavements. The unit has more than 12,000 lb. of pulling capability for tool removal.

PROBE DRIVE SYSTEM OPERATIONS

GENERAL PROBING:

1. Attach assembled sampler (see macro-core or large bore sampler below) onto leading Geoprobe probe rod. (A 12" probe rod is recommended to initially drive the Standard 24" and the Large Bore samplers. Replace the 12" rod with a 24" or 36" probe rod as soon as the sampler is driven below the surface.)

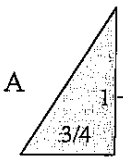
BAY WEST
EXCAVATION INSPECTION FORM

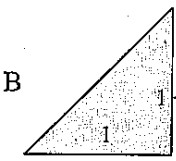
Complete this form at the beginning of each shift or after an event which may have impacted the safety of an excavation.

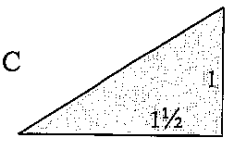
Job No.:	Competent Person:
Date of Inspection:	Time of Inspection: a.m./p.m.
Description of Excavation:	
Excavation activities performed/planned:	

Soil type and protective system:

____ Sloping or Benching

____ Stable Rock _____ Type A 

_____ Type B 

___ Type C 

(Vertical)

____ Shoring/shielding Utilized?

INSPECTION CHECKLIST	N/A	YES	NO
All Excavations:			
Is a barrier provided to identify and guard the excavation boundary?			
Have underground utilities been identified and marked?			
Is clearance (10 feet minimum) or guarding provided to overhead power lines?			
Is excavated material and equipment placed at least 2' from the excavation?			
Do ground workers wear safety vests when working near heavy equipment?			
Are adjacent structures properly stabilized if impacted by the excavation?			
Is there evidence of water that may impact the safety of the excavation?			
Excavations >4 feet deep			
Is a means of egress provided no more than 25' from the work?			
Is there a potential for a hazardous atmosphere in the excavation?			
If yes, is the atmosphere monitored and emergency equipment provided?			
Excavations >5 feet deep			
Is a cave-in protective system employed?			
Is sloping at the proper angle?			
Is shoring or shielding properly designed, constructed, installed and maintained?			
Excavation >20 feet deep			
Has a Registered Professional Engineer designed the protective system?			
Are the designs followed?			

Competent Person Signature: _____

File this completed checklist with the project file.

Standard Operating Procedure

Field Equipment Decontamination At Nonradioactive Sites

CORP-ENV-002-65422V1

Revised: January 27, 2003

Review and Approval:

Developed by: _____ Date: _____
Signature
Manager, Environmental Division
Title

Reviewed by: _____ Date: _____
Signature
QA/QC Manager
Title

Approved by: _____ Date: _____
Signature
Vice President of Operations
Title

Questions and requests for information regarding this SOP should be directed to the Vice President of Operations or the QA/QC Manager. This SOP cannot be edited, changed, or revised without the approval of the individuals listed above, and all edits, changes, and revisions must be routed through the Document Management Coordinator.

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Purpose

This Standard Operating Procedure (SOP) sets forth the procedures required for decontamination of field equipment. Decontamination of field equipment is necessary to ensure the quality of samples by preventing cross contamination. Further, decontamination reduces health hazards and prevents the spread of contaminants off-site.

2.0 DEFINITIONS

Clean - Free of visible contamination and when decontamination has been completed in accordance with this SOP.

Cross-Contamination - The transfer of contaminants through equipment or personnel from the contamination source to less contaminated or uncontaminated samples or areas.

Decontamination - The process of rinsing or otherwise cleaning the surfaces of equipment to rid them of contaminants and to minimize the potential for cross contamination of samples or exposure of personnel.

Field Blank - A field blank (also known as an Equipment Blank) tests the field crew techniques and sampling equipment for contamination. After the sampling equipment has been cleaned with DI water at the last sampling site, the field blank is prepared by pouring DI water into the sample collection equipment and wetting all internal surfaces. The field blank water is then collected in the appropriate sample bottles for analysis. A field blank has the abbreviation of “FB”.

3.0 RESPONSIBILITIES

Site Supervisor - The site supervisor ensures that field personnel are trained in the performance of this procedure and that decontamination is conducted in accordance with this procedure. The site supervisor may also be required to collect and document rinsate samples to provide quantitative verification that these procedures have been correctly implemented.

Project Manager - The Project Manager is responsible for; maintaining logbooks and forms, and, ensuring that site–specific decontamination and waste disposal procedures are detailed in site plans or referenced by this SOP. If laboratory results for an Equipment Blank exceed the laboratory Reporting Limits the Project Manager must document and initiate a corrective action investigation.

4.0 REQUIRED EQUIPMENT

This section provides a list of equipment to be used but does not include equipment such as drill rigs, PID/FID, and all personal protection equipment. The following is a general list of equipment that may be used:

- High-pressure pump with soap dispenser or steam-spray unit (for large equipment only)
- Stiff-bristle scrub brushes
- 55-gallon drums (sample container size dependent on equipment being decontaminated)
- Metal buckets
- Plastic buckets and troughs
- Nalgene or Teflon Sprayers or wash bottles or two-to-five gallon, manual-pump sprayer (pump sprayer material must be compatible with the solution used)
- Plastic sheeting
- Disposable wipes or rags
- Water, American society for Testing and Materials (ASTM) type II or better, as defined by ASTM Standard Specification for Reagent Water, Standard Decontamination 1193-77 (reapproved 1983).
- Detergent (low phosphate such as Alconox or Dawn)
- Appropriate decontamination solutions pesticide grade or better and traceable to a source (e.g. 10% and/or 1% nitric acid (HNO3), acetone, methanol, isopropyl alcohol, hexane)
- Gloves, safety glasses, and other protective clothing as specified in the site-specific health and safety plan

5.0 PROCEDURES

All reusable equipment (non-dedicated) used to collect, handle, or measure samples will be decontaminated before coming into contact with any sample. Decontamination of equipment will occur either at the central decontamination station or at portable decontamination stations set up at the sampling location, drill sites, or monitoring well locations. The centrally located decontamination station will include a pad on which the drill rigs and other large drilling equipment, such as auger flights, can be steam cleaned.

The decontamination pad will be constructed so that contaminated water drains into a collection system. Collected water will be pumped into 55-gallon drums or portable tanks for storage, and if necessary, treated before discharge to an onsite industrial wastewater treatment plant (IWTP) or manifested off site by a waste hauler if required. The water will be collected and the appropriate method of disposal will be determined. Also, decontamination fluids, such as solvents may need to be segregated from other investigation derived wastes. Disposal

alternatives will be specified in the site-specific plans. The need for a specially constructed decontamination pad will be assessed at each site.

All items that will come into contact with potentially contaminated media will be decontaminated before use and between sampling and/or drilling locations. If decontaminated items are not immediately used, they will be covered either with plastic or aluminum foil depending on the sized of the item. Decontamination procedures for specific types of equipment are presented in the following sections.

The following lists general guidelines to be used for all decontamination procedures.

General Guidelines

- Decontamination water will meet specifications listed in Section 4.0.
- Soap used will be a low phosphate detergent.
- Sampling equipment that has come into contact with oil and grease will be cleaned with methanol or other approved alternative to remove the oily material. This may be followed by a hexane rinse and then another methanol rinse. Specific regional or client requirements shall be followed, if available.
- All solvents will be pesticide grade or better and traceable to a source. The corresponding lot numbers will be recorded in the appropriate logbook.
- Decontaminated equipment will be thoroughly rinsed with water.
- Decontaminated equipment will be allowed to air dry, if time allows, before being used.
- Decontamination for all cleaning will be recorded in the appropriate logbook.
- Gloves, boots, safety glasses, and any other personnel protective clothing and equipment will be used as specified in the site-specific health and safety plan.

5.1 Heavy Equipment Decontamination

1. Heavy equipment includes drilling rigs and backhoes. Follow these steps when decontaminating this equipment.
2. Set up a decontamination pad that is large enough to fully contain the equipment to be cleaned. Use one or more layers of heavy plastic sheeting to cover the ground surface. All decontamination pads should be upwind of the area to be investigated (pad requirements will be site specific)
3. With the rig in place, spray areas (rear of rig or backhoe) exposed to contaminated soils using a steam or a high-pressure sprayer. Be sure to spray down all surfaces, including the undercarriage. It is also a good practice to clean the motor, hydraulic lift, oil fill, and fuel tank areas to avoid introducing contaminants to the work site

4. Use brushes, and low phosphate detergent and potable water to remove dirt whenever necessary
5. If using soapy water, rinse the equipment using clean, potable water. If using steam, the rinse step is not necessary if the steam does not contain a detergent. If the steam contains a detergent, this final clean water rinse is required
6. Remove equipment from the decontamination pad and allow it to air dry, if time allows, before returning it to the work site
7. Record equipment type, date, time, and method of decontamination in the appropriate logbook
8. After decontamination activities are completed, collect all contaminated waste waters, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles (as required). All receptacles containing contaminated items must be properly labeled for disposal. Liquids and solids must be drummed separately.

5.2 Downhole Equipment Decontamination

Downhole equipment decontamination includes hollow-stem augers, drill pipes, casings, screens, etc. Follow these steps when decontaminating this equipment:

1. Set up a centralized decontamination area, if possible. This area should be set up to contain contaminated rinse waters and to minimize the spread of airborne spray. The decontamination area/pad requirements will be site-specific.
2. Set up a "clean" area upwind of the decontamination area to receive cleaned equipment for air drying. At a minimum, clean plastic sheeting must be used to cover the ground, tables, or other surfaces on which decontaminated equipment is to be placed. All decontamination pads should be upwind of the area to be investigated, if possible.
3. Place the object to be cleaned on aluminum foil or plastic-covered wooden sawhorses or other supports.
4. Using low phosphate detergent and potable water in the high-pressure sprayer (or steam unit), spray the contaminated equipment. Aim downward to avoid spraying outside the decontamination area. Be sure to spray inside corners and gaps especially well. Use a brush, if necessary, to dislodge dirt.
5. If using soapy water, rinse the equipment using clean, potable water, If using steam, the rinse step is not necessary if the steam does not contain a detergent. If the steam contains a detergent, this final clean water rinse is required.
6. Using the manual-pump sprayer, rinse the equipment thoroughly with water (ASTM Type II or better).
7. Remove the equipment from the decontamination area and place in the clean area to air dry.
8. Record equipment type, date, time, and method of decontamination in the appropriate logbook.

9. After decontamination activities are completed, collect all contaminated waste waters, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal. Liquids and solids must be drummed separately.

5.3 Sampling Equipment Decontamination

Sampling equipment includes split spoons, spatulas, and bowls used for sample homogenization that directly contact sample media. Follow these steps when decontaminating this equipment:

1. Set up a decontamination line on plastic sheeting. The decontamination line should progress from "dirty" to "clean" and end with an area for drying decontaminated equipment. The washbasin will be steel or other inert material, not plastic. At a minimum, clean plastic sheeting must be used to cover the ground, tables, or the surfaces on which decontaminated equipment is to be placed.
2. Before washing, disassemble any items that might trap contaminants internally. Do not reassemble these items until decontamination is complete. Wash items thoroughly in a bucket of low phosphate detergent and potable water. Use a stiff-bristle brush to dislodge any clinging dirt.
3. Rinse the item in potable water. Rinse water should be replaced as needed, generally when cloudy.
4. Using a hand sprayer, wash bottles, or manual-pump sprayer, rinse the item with water (ASTM Type II or better).
5. If required by the site-specific plans, rinse the item with isopropyl alcohol, 10% nitric acid (for stainless steel, glass, plastic, and Teflon), or 1% nitric acid (for items made of low-carbon steel) followed by a water (ASTM Type II or better) rinse.
   a. **NOTE**: Care should be taken not to get nitric acid on skin or clothing. This step should not be used unless required by sampling needs.
   b. **CAUTION**: Do not allow nitric acid to contact methanol or hexane. Contain nitric acid waste separate from organic solvents.
6. If sampling for organic analytes, rinse the item with methanol or approved organic solvent.
7. Triple rinse the item with water (ASTM Type II or better).
8. If polar organic compounds such as pesticides, polychlorinated biphenyls (PCBs), and fuels are to be sampled, rinse the item with hexane or approved alternatives, followed by a second methanol rinse. This step should not be used unless required by sampling needs.
9. Shake off remaining water and allow the item to air dry completely, if time allows.
10. After drying, wrap the clean item in plastic wrap or in aluminum foil, shiny side out.
11. Record equipment type, date, time, and method of decontamination in the appropriate logbook.

12. After decontamination activities are completed, collect all contaminated waters, used solvents and acids, plastic sheeting, and disposable gloves, boots, and clothing. Place contaminated items in properly labeled drums for disposal. Liquids and solids must be drummed separately. (Refer to site-specific plans for waste management requirements).

5.4 Pump Decontamination

Follow these steps when decontaminating pumps:

1. Set up the decontamination area and separate "clean" storage area plastic sheeting to cover the ground, tables, and other porous surfaces. Set up three 55-gallon drums in a triangle. The two drums at the base of the triangle will be used to contain dilute (nonfoaming) soapy water and potable water. The drum at the apex will receive waste water. Place containers of water (ASTM Type II or better) adjacent to the waste drum on the same side as the potable water drum.
2. The pump should be set up in the same configuration as for sampling. Submerge the pump intake (or the pump, if submersible) and all downhole-wetted parts (tubing, piping, foot valve) in the soapy water of the first drum. Place the discharge outlet in the waste drum above the level of the waste water. Pump soapy water through the pump assembly until it discharges to the waste drum.
3. Move the pump assembly to the potable water drum while leaving discharge outlet in the waste drum. All downhole-wetted parts must be immersed in the potable water rinse. Pump potable water through the pump assembly until it runs clear.
4. Move the pump intake to the distilled water can. Pump distilled water through the pump assembly. Usually, three pump-and-line-assembly volumes will be required.
5. Decontaminate the discharge outlet by hand following the steps outlined in Section 5.3.
6. Remove the decontaminated pump assembly to the "clean" area and allow it to air dry, if time allows. Intake and outlet orifices should be covered with aluminum foil to prevent the entry of airborne contaminants and particles.

5.5 Waste Disposal

Refer to site-specific plans for waste disposal requirements. The following are guidelines for disposing of wastes:

- All wash water, rinse water, and decontamination solutions that have come in contact with contaminated equipment are to be handled, packaged, labeled, marked, stored, and disposed of a hazardous waste unless other arrangements are approved in advance.
- Small quantities of decontamination solutions may be allowed to evaporate to dryness.
- If large quantities of used decontamination solutions will be generated, it may be best to separate each type of waste in a separate container. This may permit the disposal of wash water and rinse water in a sanitary sewage treatment plant rather than as a hazardous waste.

If an industrial waste water treatment plant is available on-site, the disposal of acid solutions and solvent-water solutions may be permitted.

- Unless required, plastic sheeting and disposable protective clothing may be treated as a solid, nonhazardous waste.

6.0 DOCUMENTATION

All notes/comments associated with the decontamination of field equipment will be recorded in a project specific field notebook in accordance with the Bay West SOP for Field Documentation.

7.0 PROCEDURE PERFORMANCE EXPECTATIONS

When possible and in general, sampling is performed in a clean to dirty progression. Equipment decontamination is performed between each sampling. Depending on project requirements, a Field Blank (also known as Equipment Blank) may be taken. When possible and in general, field blanks are taken after "dirty" samples to assess the worst case decontamination effectiveness. Successful decontamination will result in a field blank with no detections above laboratory Reporting Limits (RL). If laboratory results for a field blank exceed the RLs the Project Manager must document and initiate a corrective action investigation.

7.1 Restrictions/Limitations

Nitric acid and polar solvent rinses are necessary only when sampling for metals or organics respectively. These steps should not be used unless required because of acid burn and ignitability hazards.

If the field equipment is not allowed to air dry properly before use, volatile organic residue which interferes with the analysis may be detected in the samples. The occurrence of residual organic solvents is often dependent on the time of year sampling is conducted; in the summer, volatilization is rapid and in the winter, volatilization is slow. Check with your EPA region, state and client for approved decontamination solvents.

8.0 REFERENCES

Department of Energy, Hazardous Waste Remedial Actions Program, *Standard Operating Procedures for Site Characterization*, DOE/HWP-100, July 1990.

Department of Energy, Hazardous Waste Remedial Actions Program, *Quality Control Requirements For Field Methods*, DOE/HWP-69/RI.

American Society for Testing and Materials, *Standard Practice for Decontamination of Field Equipment at Nonradioactive Waste Sites*, ASTM D5088-90, June 29, 1990.

U.S. Environmental Protection Agency, Region II, *CERCLA Quality Assurance Manual*, Revision 1, 1989.

U.S. Environmental Protection Agency, Region IV, *Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual*, 1986.

U.S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods*, EPA/540/Procedures-87/001.1, 1987.

2. Drive the sampler into the ground. Stop when the drive head is just above the surface and re-tighten the stop-pin using a 3/8" wrench for the pin and a 1" adjustable wrench for the drive head. Most vibration that could loosen the stop-pin occurs with the initial driving. Failure to tighten the stop-pin could result in damage.
3. Drive the sampler to the top of the desired sampling interval. Attach additional probe rods as necessary to reach depth.
4. Some soil conditions may warrant using a large-bore pre-probe (AT-146B) or solid drive point to pre-probe the hole to the desired depth. Damage may occur as the sampler is driven into rock or other impenetrable layer.

STOP-PIN REMOVAL

1. With the extension function move the geoprobe hammer away from the top of the probe rods to allow room to work.
2. Remove the drive cap and lower extension rods down the inside diameter of the probe rods using couplers to join rods together.
3. Attach the extension rod handle to the top extension rod and rotate the handle clockwise. Some resistance is felt when the stop-pin disengages. Continue rotating the handle until the resistance ends. Check if the threads are completely disengaged by lifting up on the handle.
4. Remove the extension rods from the probe rods. The stop-pin is attached to the end extension rod upon removal.

SAMPLE COLLECTION (Variable Depending On Sampling Tools)

1. Replace drivecap onto the top probe rod. If the top of the probe rod is already in the lowest driving position, it is necessary to attach another probe rod before driving.
2. Mark the top probe rod with a marker or tape at the appropriate distance above ground surface.
3. Drive the sampler an additional 24". Be careful not to over-drive the sampler, which could compact the soil sample, making it difficult to extrude.

SOIL SAMPLING SYSTEMS

The geoprobe system allows for soil sample collection either continuously or from discrete depth intervals. Two separate tool systems (Large-Bore and Macro-Core) are dedicated for soil sample collection.

LARGE BORE (LB) SAMPLING SYSTEM

The Large Bore Sampling System allows for collection of discrete two (2) foot soil samples at any desired depth intervals. The soil samples are retained in PETG plastic liners that may be sealed

with color-coded plastic end caps. Parts that encounter soils are minimized, greatly decreasing time required for decontamination.

LARGE BORE (LB) SAMPLING EQUIPMENT:

- Geoprobe Model 5400
- 12" and 24" Probe Rods (AT-106B, AT-104B)
- Drive Cap (AT-11B)
- Pull Cap (AT-12B)
- Assembled LB Sampler (AT-660, At-661, AT-664)
- LB PETG Liners (AT-665K)
- LB Vinyl End Caps (AT-641K)

LARGE BORE (LB) SAMPLING OPERATION

1. Geoprobe patented Large-Bore Probe-Drive Samplers are tools for collection of 22" long x 1-1/16" diameter samples.
2. The samples are collected in PETG, brass, stainless steel or Teflon liners depending on analytical requirements.
3. The large-bore samplers provide a closed barrel system that allows driving to any discrete depth interval while remaining completely sealed.
4. Upon reaching the desired sampling depth, the piston stop-pin at the trailing edge of the sampler is removed.
5. As the sample barrel advances downward, the internal piston retracts allowing displacement by the soil sample.

EXTRUSION OF SOIL SAMPLES

1. Manual extrusion from the Large Bore Sampler is accomplished as follows:
2. Large Bore liners are removed from the sample tube by unscrewing the cutting shoe and pulling out the liner.
3. Occasionally it is necessary to remove the drive head and push the liner and sample from the barrel of the sampler.
4. Plastic liners are usually cut lengthwise with a utility knife to remove the sample.
5. Brass and stainless steel liners come with a plastic cladding on the outside of the liner to keep four six-inch sections aligned. Removal of the cladding on the outside of the liner allows cutting of the sections with a knife.

MACRO CORE (MC) SAMPLING SYSTEM

Macro-Core Samplers provide continuous sample collection downward from the ground surface using 45' long x 1-1/2" diameter tool, which retains the sample in PETG (clear plastic) liner tubes. If deeper sampling is needed, the soil above the desired sampling interval must be removed. Lowering the sampler down the previously sampled hole and connecting additional probe rods until the sampler reaches the top of the new sampling interval allows collection of additional sample intervals. Continuous sampling depends on the hole staying open. After collection, the sample tubes are removed from the macro-core barrel, and the ends are sealed using color-coded plastic end caps to identify the top and bottom of the sample. Any additional notes (probe-hole number, date, sample interval, and location) can be written directly on the tubes to assist later logging of the soil characteristics or laboratory sample preparation.

MACRO CORE (MC) SAMPLING EQUIPMENT:

- Geoprobe Model 5400
- 12" and 24" Probe Rods (AT-106B, AT-104B)
- Drive Cap (AT-11B)
- Pull Cap (AT-12B)
- Assembled MC Sampler (AT-720, AT-722)
- MC PETG Liners (AT-725)
- MC Vinyl End Caps (AT-727)
- 45" Extension Rods
- Extension Rod Couplers

MACRO CORE (MC) SAMPLING OPERATIONS

1. Connect a drive cap to the drive head at the top end of the sampler.
2. Raise the probe shell to its highest position. Next, raise the foot off the ground surface to allow room for placement of the sampler below the hammer. Be sure to plumb the probe-hammer, sampler and rod assembly.
3. Insert an anvil into the hammer and place the sampler and probe rod in the driving position.
4. Raise the hammer latch into the up position while initially driving the sampler to avoid contact with the drive head.
5. Use the FOOT control to apply down pressure and activate the hammer as necessary to advance the sampling assembly. When the foot reaches the ground surface, begin using the probe control to apply down pressure as in normal operation.
6. Add a probe rod and drive the sampler (48") until the drive head reaches the ground surface, being careful not to over-drive the sampler.
7. For sampling consecutive intervals, lower the sampler down the previously made hole by connecting probe rods together until the bottom end of the sampler stops at the next sampling interval.

MACRO CORE (MC) SAMPLE REMOVAL

1. If sampling below the four-foot surficial interval, pull out all of the probe rods until the sampler is exposed just above the ground surface.
2. When the sampler is visible above the ground surface, attach a pull cap to the top of the drive head.
3. Continue to pull the sampler out of the hole using the PROBE control.
4. When the limit of the 40" probe stroke is reached, continue to pull the sampler up using the FOOT control.

MACRO CORE (MC) SAMPLE RECOVERY

1. After the sampler has been removed from the hole, the soil sample is easily recovered by unscrewing the cutting shoe and pulling the liner out.
2. The exterior of the cutting shoe features a notch for attaching the Shoe Wrench (part # AT-727) to loosen tight threads.
3. Applying a sharp blow to the notch with a flat screwdriver and a hammer is also useful for loosening the cutting shoe.

GROUNDWATER SAMPLING SYSTEMS

The geoprobe system provides several alternative methods for sampling groundwater. Three systems are commonly utilized depending upon the sample requirements. Expendable drive point probes allow depth to groundwater measurement, or sample collection if the aquifer is composed of coarse enough material to prevent blow back of solid sediment into the probe rods. For finer grained aquifers, either a Screen Point Sampler or a Mill Slot Screen Sampler is utilized.

EXPENDABLE POINT GROUNDWATER SAMPLING EQUIPMENT:

- Geoprobe Model 5400
- 12” and 24” Probe Rods (AT-106B, AT-104B)
- Drive Cap (AT-11B)
- Pull Cap (AT-12B)
- Expendable Drive Point (AT-14)

EXPENDABLE POINT GROUNDWATER PROBING OPERATIONS

1. Place a drive cap on the assembled sampler and drive it into the subsurface.
2. Continue driving by adding probe rods until the sampler tip has been driven about one foot below the target sampling depth.
3. After reaching the groundwater depth, disengage the expendable drive point by pulling the rods back a distance of about 2 feet.
4. Lower the sensor of an electric water level indicator until the audio signal sounds and record the depth to groundwater. The measurement tape scale (0.01 ft intervals) on the water level indicator wire is read at the top of the probe rod after pulling the tape out and extending it to the ground surface.
5. After the recording the water level depth measurement, the indicator sensor is removed from the geoprobe rods.
6. If required, tubing or smaller diameter bailer is inserted into the probe rods to collect a water sample.

SCREEN POINT SAMPLER EQUIPMENT:

- Assembled Screen Point (GW-440K)
- Geoprobe Model 5400
- 12" and 24" Probe Rods (AT-106B, AT-104B)
- Drive Cap (AT-11B)
- Pull Cap (AT-12B)
- 3/8" O.D. x 1/4" I.D. Polyethylene Post-Run Tubing (PRT)
- GW Expendable Drive Point (GW-445)
- Bottom Check Valve (GW-42)

SCREEN POINT SAMPLER OPERATIONS

Stable Formations:

1. The screen assembly may be pushed out into the open borehole by lowering 3/8" tubing affixed with a PRT adapter (TB-25L, PR-25S) to the top end of the screen assembly.
2. The threads on the PRT adapter are engaged with the threads on the screen connector by pushing gently downward on the tubing and rotating it counter-clockwise.
3. When properly connected, pushing down on the tubing can push the screen assembly out of the sampler sheath exposing the screen to the saturated zone.
4. The water sample is collected through the tubing.

Unstable Formations:

1. The screen assembly may have to be pushed out of the sampler sheath by means of extension rods inserted down the inside of the probe rods.
2. The end of the rods should be equipped with an extension rod coupler (AT-68) to protect the threads of the screen connector.
3. A steady push is sufficient, avoid excessive hammering on the rods.
4. After pushing the screen into the saturated formation, remove the extension rods and begin sample collection.

GROUNDWATER SAMPLING

1. Groundwater sample collection may be accomplished by using 3/8" tubing and a stainless steel PRT adapter as previously described.
2. Once the PRT adapter and screen connector are connected, a vacuum may be applied to the top of the tubing for sample collection utilizing a peristaltic or vacuum pump, with an in-line trap.
3. Another water sampling option is tubing with a bottom check valve (AT-42).
4. Oscillating the tubing up and down causes repeated lifting and seating of the ball check valve, which moves the water column upward into the tubing.

5. The tubing will begin to feel heavier as it fills with several feet of water.
6. The tubing can then be lifted out of the probe rods, cut, and the water poured into a vial for transport to either an on-site or fixed laboratory for analysis.
7. Collection of multi-liter samples are possible using the tubing/check valve assembly technique.

GROUNDWATER SAMPLE REMOVAL

1. The groundwater sampling assembly is extracted from the probe rods after the sampling procedure is finished.
2. If the PRT system is used, remove the tubing by pulling up firmly on it until it disconnects from the PRT adapter down-hole.
3. The PRT adapter will remain attached to the screen connector.
4. After recovery of the sampler, examine all parts for wear, damage, or contamination.
5. Clean all parts thoroughly, replace the O-rings, and prepare for the next sample.

MILL SLOTTED WELL POINT EQUIPMENT:

- Assembled Mill Slot Sampler (GW-40)
- Geoprobe Model 5400
- 12” and 24” Probe Rods (AT-106B, AT-104B)
- Drive Cap (AT-11B)
- Pull Cap (AT-12B)
- 3/8” x 1/4” I.D. Polyethylene Tubing
- GW Expendable Drive Point (GW-445)
- Bottom Check Valve (GW-42)

MILL SLOTTED WELL POINT SAMPLING OPERATIONS

1. The mill-slotted well point sampler threads directly onto the leading probe rod. The mill-slotted well point is 36” long x 1.0” O.D. with a slotted section 24” long x 0.76 I.D. Each mill-cut slot is 2.0” long x .020” wide.
2. This open slotted tool is driven or lowered from the ground surface into the saturated zone.
3. Inserting an inner tubing or smaller diameter bailer down the inside diameter of the probe rods allows collection of a water sample.
4. Connecting the 24” long slotted section (GW-44) together with mill-slotted rod coupler (GW-45) increases the surface area exposed to the slots.
5. This tool works best in sandy aquifers and is not recommended for use in silty, clay-rich soils.
6. Driving a larger diameter pre-probe (AT-146B) ahead of the slotted section is often used with this tool to minimize clogging of the mill slots.

HARD SURFACE OPERATIONS

ASPHALT AND/OR SEMI-HARD SURFACE OPERATIONS

Asphalt surfaces less than 6 inches thick, or other semi hard surfaces such as gravel roads are easily penetrated using a large bore or macro-core pre-probe.

PRE-PROBE EQUIPMENT

- Geoprobe Model 5400
- 12” and 24” Probe Rods (AT-106B, AT-104B)
- Drive Cap (AT-11B)
- Pull Cap (AT-12B)
- Large Bore (AT-150B) or Macro Core (AT-147B) Pre-Probe.

PRE-PROBE OPERATION

1. Attach a 12” probe rod to the desired pre-probe with a drive cap and center the assembly beneath the probe hammer.
2. Drive the assembly like any other sampling tool, paying particular attention to the alignment with the hammer.
3. **NOTE:** Hearing and eye protection are especially important during pre-probing!
4. After the hard surface or obstruction is penetrated remove the assembly with the pull cap and proceed as usual.

MONITORING WELL INSTALLATIONS

Monitoring wells are required at many investigation sites. The geoprobe direct push system is capable of installing small-diameter (3/4 – 1 inch) monitoring wells. As with other geoprobe operations, the monitoring well installation by direct push methods does not produce drill cuttings. While GEOPROBE manufactures Prepacked Screen Monitoring Wells, NTS has found that installation of standard small-diameter PVC screens can provide more options for varying screen lengths. The larger inside diameter of standard PVC screens also allows more options for water level measurement and/or sampling tools. Standard PVC well screens and threaded riser pipe is also less expensive than the GEOPROBE Prepacked Screen Monitoring Wells. NTS will install either standard PVC or GEOPROBE Prepacked Screen Monitoring Wells as required by clients.

MONITORING WELL EQUIPMENT

- GEOPROBE Model 5400
- GEOPROBE GS1000 Series Grout Pump
- 3/8-in. polyethylene tubing for pressure grouting
- 2.125-in.O.D. X 1.5-in. I.D. Probe Rods (AT-2148)
- O-rings for probe rods (AT2100R)
- Expendable Anchor Points or Expendable Drive Points (GW2040/AT2015)
- Drive Cap (AT-2101)
- Pull Cap (AT-2104)
- 60-100 Mesh Glass Beads or 20/40 Environmental Silica Sand or (AT93/AT95 or other non-GEOPROBE supplier) for screen filter pack
- Bentonite for well seal and grouting well annulus (manufacturers vary)
- Schedule 80 PVC Well Screen and Riser Pipe (manufacturers vary)

SMALL DIAMETER MONITORING WELL INSTALLATIONS

1. Place a drive cap on the first section of 2.125-in. probe rod with an expendable drive point installed and begin advancing the rod into the ground.
2. Continue driving by adding probe rods, with O-ring seals between each rod, until the sampler tip reaches approximately one foot below the screen installation depth.
3. After reaching the installation depth, the PVC well screen is lowered into the probe rods while adding threaded lengths of PVC riser pipe as needed. Care must be taken to tighten the threaded sections to prevent leakage at the joints. New, clean, rubber gloves are worn while handling all well screen and riser pipe materials to provide the highest quality samples from the well after installation.

4. After the screen and riser are set at the installation depth, the probe rods are retracted slightly while holding down pressure on the riser pipe. This disengages the expendable point from the bottom section of drive rod.
5. After disengaging the drive point, the screen is exposed to the aquifer. Before proceeding with the well installation, it is prudent to measure the static water level in the well. This allows for adjustment of the proper screen depth if required.
6. After assuring the proper installation depth, filter-pack sand (60-100 Mesh Glass Beads or 20/40 Environmental Silica Sand) is placed within the annular space between the well screen and probe rods. The sand is poured slowly to prevent bridging. The spherical shape of the 60-100 Mesh Glass Beads minimizes the potential for bridging.
7. Filter sand is added, while retracting the probe rods, until the sand reaches approximately two feet above the screen length.
8. If the native formation is well-sorted sand, coarse enough to filter and not pass through the well screen filter sand may be unnecessary. Retracting the probe rods to approximately two feet above the top of the screen will allow collapse of the native formation around the screen.
9. Above the filter pack, a minimum two-foot thick bentonite seal is installed to prevent any infiltration from above reaching the sand pack and/or well screen. The bentonite seal is tremied from the bottom (top of the filter pack), with the GEOPROBE high-pressure grout pump while retracting the probe rods.
10. A bentonite slurry can be used to grout the entire well annulus, or alternatively above the required minimum two-foot thick bentonite seal, the annulus can be grouted with neat cement.
11. Following two days, as required by the Minnesota Department of Health (MDH), development and sampling of the well can proceed as for typical larger diameter wells.

SOIL-GAS INVESTIGATIONS

The Geoprobe System has a long history of use on soil-gas sampling projects. In fact, soil gas sampling was the first application of the system before any specific soil and groundwater sample collection tools were designed for the geoprobe. Soil-gas surveys can provide useful data regarding areal extents of subsurface contamination or other analytes of interest.

Three active soil-gas sampling options are available depending on clients needs. The options include:

1. Direct sampling through the probe rods using an expendable drive point.
2. Sampling through the probe rods using a retractable sampling point.
3. Sampling through post run tubing (PRT) inserted into the probe rods.
4. Permanent soil-gas implants.

The first two options can be used for less demanding investigations, since collection of the soil-gas directly through the probe rods requires sealing the probe rod joints (Teflon® tape) and thorough decontamination of the probe rods. NTS recommends the PRT soil-gas sampling technique since it eliminates the potential problems with the other options. The PRT soil-gas sampling also:

- Increases the speed and accuracy of the soil-gas sampling.
- Eliminates probe rod leakage and sample carryover problems.
- Utilizes a simple design for easy use and verifiable vacuum-tight sample collection.
- Since the PRT methods are used after driving the probe rods to the target depth, standard probing techniques are used prior to sample collection.

COMPONENTS FOR PRT SOIL-GAS SAMPLING

- Tubing, either polyethylene, Teflon®, or stainless steel
- Probe rods, lengths and number of sections as required to reach target depth
- PRT adapter
- Expendable point holder
- Expendable points
- Silicone tubing with adapters to connect the down-hole tubing to the vacuum pump suction tubing
- O-rings for PRT adapter and expendable point holder
- GEOPROBE Vacuum/Volume System (installed in probe truck)

PRT SOIL-GAS SAMPLING OPERATIONS

1. Clean/decontaminate all sampling components prior to use, and check inside diameter of probe rods for obstructions.
2. Test fit treads of PRT adapter and PRT expendable point holder for smooth coupling. **NOTE**: PRT fittings are left-hand threaded.
3. Push adapter into the end of the selected tubing. Securing the tubing to the adapter with tape will not influence sample integrity.
4. After assembling the PRT expendable point holder to the expendable drive point insert into the end of the first probe rod and proceed driving and adding rod sections until reaching the target depth.
5. After reaching the target sampling depth, disengage the expendable drive point by pulling up on the probe rods.
6. Remove the pull cap and retract the probe hammer assembly away from the rods for additional working room.
7. Insert the adapter fitted end of the sample tubing into the probe rods. Continue feeding the tubing into the rods until reaching the bottom (expendable point holder).
8. Allow at least two feet of excess to extend beyond the top of the probe rods before cutting the tubing.

9. Apply downward pressure on the tubing while turning it (counterclockwise) to engage the threads of the expendable point holder. Pull up tightly on the tubing to test the thread engagement.
10. Connect the upper end of the down-hole tubing to the silicone tubing to the vacuum-system suction line with the appropriate adapters.
11. Follow appropriate purging and sampling procedures for the planned analytical method for the investigation.
12. Following sample collection, disconnect the tubing from the vacuum system and pull the down-hole tubing up firmly until it releases from the adapter at the bottom of the hole.
13. Remove all the tubing from the probe rods and dispose polyethylene tubing and/or decontaminate Teflon® tubing following the investigation protocol.
14. Retrieve the probe rods and recover the expendable point holder with the attached PRT adapter.
15. Inspect the O-rings on the expendable point holder/PRT adapter assemblies, and move to the next probe location.

PERMANENT SOIL-GAS IMPLANTS

Installation of permanent soil-gas implants with the Geoprobe System and are also performed using "post-run" methods. Essentially, installation of permanent soil-gas implants is a hybrid between the methods used for installing small-diameter monitoring wells and PRT soil-gas sampling. The only significant difference is the stainless steel vapor sampling implants, which are available in varying sizes and lengths.

Implants are installed post-run and connected to the implant anchor connected to the bottom probe rod after reaching the target depth as described for PRT soil-gas sampling. After the implant and tubing are connected to the anchor, the tubing becomes the "riser pipe" for the permanent installation. A filter pack of silica beads is placed around the implant and the annulus between the tubing and the probe rods is grouted using the same methods as described for monitoring well installations.

ROTARY DRILLING FOR CONCRETE AND/OR FROST

The Model 5400 Geoprobe includes a rotary drilling function that simultaneously operates when needed with the hammer. Carbide tipped drill steels are available in 18, 24, 30 and 36 inch lengths.

CONCRETE ROTARY DRILLING EQUIPMENT

- Geoprobe Model 5400
- Drill Steel (AT-31 through 42 depending on length)
- Carbide Tipped Bit (AT-36 through 44 depending on diameter)
- Hex Drive Adapter (AT- 46)

ROTARY DRILLING OPERATION

1. Remove the anvil from the geoprobe hammer by pulling down on the retainer cap.
2. Install the drill steel in the hammer with the appropriate retainer cap.
3. Lower the probe until the drill steel contacts the concrete surface and lifts the foot approximately 2 inches. Do not lift the foot of the probe more than 3 inches above the ground surface since the drill assembly could bend during drilling.
4. Balance hydraulic power between the hammer function and the rotary function with the ROTARY LEVER located near the top of the hammer.
5. Begin drilling by pressing down on the HAMMER LEVER.
6. As the carbide tip begins to penetrate the surface, flush the hole liberally with water to cool the bit.
7. Minimizing the hammer function while drilling produces a clean hole and avoids seizing the bit. Also raising and lowering the drill steel frequently helps clear cuttings from the hole.
8. After the concrete is penetrated, proceed as usual.

FROST AUGERING EQUIPMENT

- Carbide-Tipped Frost Bit, 2.5 in. (AT5005)
- Frost Auger Section Assembly, 4 ft. (AT5010)
- Frost Auger Connecting Pins (AT5011)
- Hex Drive Adapter (AT5015)
- Anvil Retainer Cap Assembly (AT4200)

FROST DRILLING OPERATION

1. Remove the anvil from the geoprobe hammer by pulling down on the retainer cap.
2. Install the frost auger section assembly in the hammer with the appropriate retainer cap.
3. Lower the probe until the frost auger bit contacts the concrete surface and lifts the foot approximately 2 inches. Do not lift the foot of the probe more than 3 inches above the ground surface since the drill assembly could bend during drilling.
4. Balance hydraulic power between the hammer function and the rotary function with the ROTARY LEVER located near the top of the hammer.
5. Minimize use of the percussion hammer of the rig, since the frost bit is specifically designed for rotary drilling only.
6. Raising and lowering the frost auger assembly helps clear cuttings from the hole.
7. After the frost is penetrated, the auger advances easily.
8. Change back to the appropriate geoprobe tooling and proceed as usual.

PROJECT: Gopher Ordnance Site Inspection **JOB NO: J060361**
DATE:_____

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):
HEALTH AND SAFETY LEVELS AND ACTIVITIES:
PROBLEMS ENCOUNTERED/CORRECTION ACTION TAKEN:
SPECIAL NOTES:
TOMORROW'S EXPECTATONS:

By:_____ QA Check by:_____
(Signature and date) (Signature and date)

TABLE OF CONTENTS

1.0 INTRODUCTION

This supplement serves as the specifications for accomplishing the geology related tasks identified in the Scope of Services, to which this supplement is attached. All work shall be performed in accordance with this supplement unless otherwise specified in the Site Specific Section of the Scope of Services. If there are any differences between this supplement and the Site Specific Section of the Scope of Services, the Contractor shall implement the Site Specific instructions.

- The *Contractor shall disregard* all sections of this supplement that do not apply to the tasks as outlined in the Site Specific Scope of Services. For example, if no new monitoring wells are to be installed, then the Contractor has no reason to refer to the sections on monitoring well installation, construction diagrams, etc.

- The Draft Project Report and Final Project Report referenced in this document shall be defined in the Site Specific Section of the Scope of Services. If there are any questions regarding this supplement, the Contractor shall contact the U.S. Army Corps of Engineers (USACE) Project Geologist for clarification.

- **Regulatory Requirements.** Field investigation procedures shall be conducted in accordance with all federal, state, and local requirements. If the specifications as set forth in this Scope of Services do not meet regulatory requirements, contact the USACE-Contracting Officer's Representative (USACE-COR) for resolution of differences. The Contractor is responsible for determining applicable federal, state, and local requirements.

2.0 QUALITY ASSURANCE/QUALITY CONTROL

2.1 Work Plans

A plan shall be submitted by the Contractor for approval before any field work for the project is begun which addresses all quality assurance/quality control (QA/QC) procedures to be implemented in the field. This plan shall comply with the appropriate regulatory requirements as referenced in the Scope of Services (SOS) for this project. This plan shall include, at a minimum, the Contractor's methods, equipment, and procedures for carrying out all field work including drilling, (sampling soil, sediment, ground water, soil vapor and surface water, etc.) monitoring well installation, well development, decontamination procedures, aquifer testing, geophysics, and surveying. This plan is not a separate document. This information shall be incorporated into the Contractor work plans, which address overall project QA/QC.

2.2 Qualified Personnel

The Contractor shall provide a qualified geologist or geotechnical engineer who shall be on site and responsible for all logging and sampling during all soil/rock sampling activities. A qualified geologist/geotechnical engineer shall be on site and responsible for all monitoring well drilling, installation, development and testing activities. A qualified geologist/geotechnical engineer is defined as having a baccalaureate degree in a geological science or geological/geotechnical engineering from an accredited university and a minimum of one (1) year experience in logging

and/or analysis of subsurface conditions. The qualifications of the on-site geologist and/or geotechnical engineer shall be included in the Contractor work plans. A person meeting these requirements shall be dedicated to each activity. The Contractor shall notify the U.S. Army Corps of Engineers (USACE) representative at least 1 week prior to the initiation of any field investigations so that a USACE representative can plan to be present for field oversight. The Contractor shall notify USACE of any changes in personnel from that specified in the work plan.

3.0 SOIL BORINGS AND MONITORING WELL BORINGS

Soil borings and monitoring wells may be required to investigate the vertical and horizontal extent of site-specific contaminants. Soil samples for chemical analysis may also be required from borings drilled for monitoring well installations, as directed in the Site Specific Section of the Scope of Services. Guidance for field activities may be obtained from USACE EM 1110-1-4000 (Nov. 98): **"Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites"**. All borings for soil sampling and monitoring well installations shall be drilled and sampled according requirements discussed in the following sections.

3.1 Utility Clearances and Permits

The Contractor shall be responsible for obtaining and coordinating all utility clearances and drilling/monitoring well permits. A copy of all monitoring well permits required by state or local regulations shall be included as an appendix in the final report. If it is necessary to move a boring in order to avoid utilities, the Contractor shall be responsible for relocating the boring to a suitable location that accomplishes the intent of the original location. The new location shall be as close as possible to the original location. Both locations shall be shown on the boring log. The Contractor shall take all reasonable precautions to protect persons and property near the drill site.

3.2 Drilling Methods

All borings shall be drilled by a method of the Contractor's choosing unless otherwise specified under the Site Specific Section of the Scope of Service. The method(s) shall be proposed by the Contractor and approved by the USACE Project Geologist (PG) prior to use. The method(s) shall be discussed in the Contractor work plans. The drilling method must allow, or provisions must be made for, accurate determination of the depth to ground-water surface. If a well is to be installed in a boring, the boring shall be of sufficient diameter to permit at least two inches of annular space between the boring wall and the sides of the centered riser and screen. The boring diameter shall be of sufficient size to allow for the accurate placement of the screen, riser, centralizers, filter pack, bentonite and grout. The Contractor's drilling method shall maintain the integrity of the borehole (i.e. prevent collapse) during backfilling or well installation. No grease shall be used on drill pipe joints. The use of any lubricants shall be submitted for approval in the Contractor work plans and shall be noted on the boring logs. The Contractor shall provide documentation (brand name, chemical analysis of product composition, etc.) for all materials introduced into the boring during drilling, for approval prior to use.

3.3 Aquifer Protection

If other than the uppermost water yielding zone is penetrated during drilling, precautions shall be taken to prevent the downward (or upward) movement of any contaminants. The drilling method and procedure to be employed shall be described in detail in the work plans for USACE review and approval prior to field deployment.

3.4 Decontamination

All sampling equipment shall be decontaminated according to the requirements stated in the Chemistry supplement to this Scope of Services. All drill pipe, drilling tools, bits, etc. shall be free of potentially contaminating materials (i.e. grease, oil, paint, etc.) and shall be steam cleaned prior to use at each well boring. Drilling equipment that is used down hole or may potentially cross contaminate samples, such as augers, auger center plugs, core barrels, clean out bits, down hole geophysical equipment, etc. shall be decontaminated between each boring location. The drill rig shall be steam cleaned prior to use at each site if the project consists of more than one site. The rig shall be free of leaks and debris, which could contaminate the holes (i.e. hydraulic fluid, oil, gas, loose paint, etc.).

3.5 Geotechnical Sample Requirements

During drilling of all borings, soil sampling shall be performed at regular intervals to allow for accurate logging of the soil lithology and to obtain material for geotechnical testing. Sampling may be performed using a split spoon sampler or thin wall (Shelby tube) sampler using the techniques given in ASTM D 1586 "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils" and ASTM D 1587 "Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils", respectively. Other type samplers (California split tube, hollow stem auger continuous sampler, etc.) may also be used if included in the Contractor work plans for approval. All samplers used to collect samples for chemical analysis shall be stainless steel. Samples to be used only for logging and geotechnical testing may be taken with sampling devices that are not stainless steel.

3.5.1 Sampling Intervals

Unless otherwise indicated in the Site Specific Section of the Scope of Services, soil samples for lithologic logging shall be collected continuously for the first ten feet and every five feet for the remaining depth of each boring. Material recovered from geotechnical sample intervals may also be utilized to meet the requirements for chemical sampling, i.e. a sample for geotechnical testing and a sample for chemical analysis may be taken from the same split spoon. Where the material quantity is insufficient to meet all needs, samples for chemical analysis shall be collected first.

3.5.2 Soil Classification and Testing

All soil samples shall be visually classified in the field using the Unified Soil Classification System (ASTM D 2488 "Standard Practice for Description and Identification of Soils"). In order to verify the field classifications and to obtain additional data on the composition of the subsurface materials, the Contractor shall retain samples for laboratory geotechnical testing. Refer to the site-specific section of the SOS for specific sampling and testing requirements. This testing shall consist of Grain Size Distribution (ASTM D 421 "Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants" & 422 "Standard Test Method for Particle-Size Analysis of Soils"), Atterberg Limits (ASTM D

4318 "Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils"), and moisture content (ASTM D 2216 "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock"). If multiple borings are performed at a site, the Contractor shall attempt to select samples for geotechnical analysis that are representative of all materials on site. In monitoring well borings, one sample from the screened portion of the aquifer shall be tested to confirm validity of the screen design.

3.6 Logs

All drill logs shall subscribe to the following requirements:

3.6.1 Logs shall be prepared in the field, as borings are drilled, by a qualified geologist or geotechnical engineer. The preparer shall sign each log.

3.6.2 All log entries shall be printed. Photo reproductions shall be clear and legible. **Illegible or incomplete logs shall not be accepted.** One legible copy of each field log shall be completed and sent to the USACE within five days of completion of each boring. The boring shall not be accepted by the USACE before the drilling logs are received and approved.

3.6.3 Borehole depth information shall be from direct measurements accurate to one-tenth of a foot.

3.6.4 Logs shall be prepared on the HTRW Drilling Log Form (Attachment A) that accompanies this supplement. The Contractor may use their company drilling log form if the form is functionally similar to the HTRW Drilling Log Form provided **and** is approved by the USACE Project Geologist.

3.6.5 All relevant information blanks in the log heading and log body shall be completed. If surveyed horizontal control is not available at the time of drilling, location sketches referenced by measured distances from prominent surface features, shall be shown on, or attached to the log. If vertical control is not available, the depth measurement shall be recorded as feet (meters) below ground (grade) surface. The surveyed coordinates and elevations shall be recorded on the final log.

3.6.6 **Log scale shall be 1-inch = 1-foot,** unless otherwise specified in the Site Specific Section of the Scope of Services.

3.6.7 Each and every material type encountered shall be described in column c of the log form. (Material types are to be logged directly from samples and indirectly interpolated using professional judgment, drill cuttings, drill action, etc., between sampling intervals.

3.6.8 Unconsolidated materials shall be described as outlined below and in the following sequence:

3.6.8.1 Descriptive USCS classification in accordance with ASTM D 2488;

3.6.8.2 Consistency of cohesive materials or apparent density of non-cohesive materials;

3.6.8.3 Moisture content assessment, e.g., moist, wet, saturated, etc.;

3.6.8.4 Color;

3.6.8.5 Other descriptive feature (bedding characteristics, organic materials, macrostructure of fine-grained soils e.g., root holes, fractures, etc.);

3.6.8.6 Depositional type (alluvium, till, loess, etc.,)

3.6.9 Rock materials shall be described in the sequence outlined below and in accordance with ASTM C 294 and other standard geologic nomenclature including:

3.6.9.1 Rock type;

3.6.9.2 Relative hardness;

3.6.9.3 Density;

3.6.9.4 Texture;

3.6.9.5 Color;

3.6.9.6 Weathering;

3.6.9.7 Bedding;

3.6.9.8 Fractures, joints, bedding planes, and cavities, including any filling material and whether open or closed;

3.6.9.9 Rock Quality Designation (RQD);

3.6.9.10 Other descriptive features (fossils, pits, crystals, etc.).

3.6.10 Stratigraphic/lithologic changes shall be identified in column c by a solid horizontal line at the appropriate scale depth on the log, which corresponds to measured borehole depths at which changes occur, measured and recorded to the nearest one-tenth of a foot. Gradational transitions, changes identified from cuttings or methods other than direct observation and measurement shall be identified by a horizontal dashed line at the appropriate scale depth based on the best judgment of the logger. All lines shall be drawn with a straight edge and not by free hand.

3.6.11 Logs shall clearly show in columns e and f, the depth intervals from which all samples are retained, complete with sample number.

3.6.12 Logs shall identify the depth at which water is first encountered, the depth to water at the completion of drilling and the stabilized depth to water. The absence of water in borings shall also be indicated. Stabilized water level data shall include time allowed for levels to stabilize and amount of bore hole collapse.

3.6.13 Logs shall show borehole and sample diameters and depths at which drilling or sampling methods or equipment change.

3.6.14 Logs shall show total depth of penetration and sampling. The bottom of the hole shall be clearly identified on the log with a double line across all columns at the bottom depth of drilling and with the notation "Bottom of Hole."

3.6.15 Logs shall identify any drilling fluid losses including the depths, at which they occur, rate of loss and total volume lost.

3.6.16 Logs shall show drilling fluids used including, as appropriate:

3.6.16.1 Source and volume of make-up water;

3.6.16.2 Drill fluid additives by brand and product name, and mixture proportions; and

3.6.16.3 Type of filter for compressed air.

3.6.17 Logs shall show depths and types of any temporary casing used.

3.6.18 Logs shall identify any intervals of hole instability.

3.6.19 Intervals of lost bedrock core shall be shown in column e. Intervals of intact soil sampling attempts shall also be shown in column e, including depths from which attempts were made and length of sample recovered from each attempt. Bedrock coring information shall be recorded in consecutively numbered runs in column h and shall include the following:

3.6.19.1 Start and stop time of each core run;

3.6.19.2 Depth to top and bottom of each core run;

3.6.19.3 Length of core recovered from each run;

3.6.19.4 Size and type of coring bit and barrel; and

3.6.19.5 Measured depth to the bottom of the hole after core is removed from each run.

3.6.20 Any special drilling or sampling problems shall be recorded on logs, including descriptions of problem resolutions.

3.6.21 Logs shall include all other information relevant to a particular investigation, including but not limited to;

3.6.21.1 Odors;

3.6.21.2 PID/FID measurements or other field screening or test results; and

3.6.21.3 Any observed evidence of contamination in samples, cuttings, or drilling fluids.

3.6.22 Copies of the field logs shall be included in the Draft Project Report and drafted boring logs shall be submitted in the Final Project Report unless specified otherwise in the Site Specific Section of the Scope of Services.

3.7 Backfilling

All borings shall be backfilled with a bentonite-cement grout or a high-solids bentonite grout in accordance with the Site Specific Section of the Scope of Services. Grout backfill shall be placed consistent with paragraph 4.6 of this supplement. Tamped cuttings may be used to backfill the borehole only if specified in the Site Specific Section of the Scope of Services. The borings shall be backfilled immediately after the sampling is completed unless saturated conditions have been encountered or a monitoring well is installed. In borings encountering saturated conditions, a 24-hour ground-water level shall be measured before backfilling. Borings left open overnight shall be covered to lessen the potential for injury to personnel and to minimize the potential for any surface drainage entering the boring.

3.8 Site Restoration

The site shall be restored to the condition prior to fieldwork that is acceptable to the owner/base/facility within 5 days of the completion of the site investigation. **High visibility areas or high traffic areas shall be immediately restored upon completion of the site investigation.** Drums (if used) shall be staged to a pre-designated drum staging area specified by the owner as part of this site restoration. The drum staging area shall be identified in the work plans. The drums shall be placed on wooden pallets for temporary storage. The USACE shall provide the final approval of the site restoration.

4.0 WELL DESIGN AND INSTALLATION

The wells shall be constructed according to all applicable federal, state, and local requirements. If the specifications as set forth in the Scope of Services do not meet regulatory guidance or requirements, contact the USACE-Contracting Officer's Representative (USACE-COR) for resolution of differences. The Contractor is responsible for determining all applicable regulatory

agency requirements and for obtaining all state and local well permits required for wells with the yields anticipated during development and sampling.

All well materials shall be steam cleaned immediately before installation and shall remain clean until installed in the boring or the material shall be steam cleaned again. Factory sealed well materials (screen and riser) do not require decontamination if the plastic wrap is intact, without holes or rips, and the materials are not removed until immediately before installation. The following specifications shall be followed except when site specific requirements may be different where noted in the Site Specific Section of the Scope of Services. The Contractor shall provide documentation (brand name, sizes, etc.) for all well and seal materials that shall be used for well installation. This data shall be presented in the work plan.

4.1 Well Riser

Well riser shall consist of poly-vinyl chloride (PVC) or stainless steel, unless stated otherwise in the Site Specific Section of the Scope of Services. PVC pipe (if used) shall be new, threaded, flush joint, and as a minimum, conform to the requirements of ASTM F 480 "Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in standard Dimension Ratios, e.g. schedule 40 or schedule 80. It shall bear markings that shall identify the materials and shall carry the seal of the National Sanitation Foundation. Stainless steel pipe (if used) shall consist of new, flush-jointed and threaded, type 304, corrosion resistant steel, unless otherwise stated in the Site Specific Section of the Scope of Services. Threaded flush-joint couplings with chemically inert O-rings, to form watertight unions, shall join riser sections. Adhesives or solvents shall not be used to join the casing sections. The use of Teflon tape on threaded joints is acceptable and shall be noted on the well construction log. No lead shot or lead wool is to be employed in producing seals at any point in the well.

4.2 Well Screen

The Contractor shall have the responsibility of selecting the screened area of the borehole so that the completed monitoring well provides data that meets the project data quality objectives. Well screen shall be constructed of the same size and strength material as the well riser, unless specified otherwise in the Site Specific Section of the Scope of Services. The screen material shall be non-contaminating, non-clogging, *continuous slot, wire wrap design.* All screen sections shall be threaded, flush joint design. **Field slotted or factory slotted screen** is **not** *permitted,* unless otherwise specified in the site-specific requirements. The slot size shall be determined by the Contractor based upon available subsurface data and designed to be compatible with aquifer and gravel pack material. For water table wells, normal, seasonal fluctuations in the water table elevation shall be taken into consideration when placing the well screen so that monitoring shall be possible throughout an average year. Normal fluctuations shall be determined through a review of local well records and available literature. Sediment traps (sumps, tailpipe) shall not be used below the screened portion in monitoring wells unless directed by the USACE-Omaha District Project Geologist. The procedure to be used in the field for determining the screen placement shall be presented in the Contractor work plans.

4.3 Filter Pack

The annular space around the well screen shall be backfilled with clean, washed, well-rounded silica sand sized to perform as a filter between the formation material and the well screen. The

grain size of the filter pack that is used shall be included in the Contractor work plans (with selection rationale) and shall be shown on the well construction log. A grain-size distribution curve for all filter pack material shall be submitted by the Contractor in the work plan and in the Final Project Report along with the well construction diagrams. Unless otherwise specified in the site specific SOS, the Contractor shall collect and test for grain size distribution a minimum of one representative sample of the filter pack material to assure compliance with the work plan. This sample shall be collected at the site. The filter pack material shall be tremied into place to avoid bridging and ensure a continuous filter pack throughout the screened interval of the well. The filter pack shall extend approximately 1 foot below, and 3 to 5 feet above the well screen. If the boring extends more than 1 foot below the bottom of the screen, the Contractor shall propose backfilling methods and materials in the Contractor work plan.

4.4 Well Plumbness and Alignment

All riser and screen shall be set round, plumb, and true to line. A 10-foot long section of pipe, ½ to ¾ inch less in diameter than the inner diameter of the well riser pipe (or screen), shall be run through the entire length of the well to check the alignment. The result of such test shall be recorded on the Daily Quality Control Reports and the installation diagram. If the pipe does not pass freely for the entire depth of the well, the Contractor shall replace or repair the well at no additional cost to the Government, if so directed by the Contracting Officer. The pipe section shall be decontaminated with steam prior to the test. Adequate precautions shall be taken to prevent cross-contamination of wells by changing the rope attached to the pipe or decontaminating the cable prior to each alignment test.

4.5 Bentonite Seal

A 3-5 foot thick bentonite seal shall be placed in the annular space above the well screen and filter pack sand. The seal shall be composed of commercially manufactured, solvent-free, sodium-bentonite pellets. "Coated" bentonite pellets shall not be used without prior approval from the USACE Project Geologist. Bentonite pellets shall not exceed one-half inch diameter. If the bentonite seal is positioned above the water table, the bentonite shall be installed in 1-foot lifts with each hydrated a minimum of 30 minutes between lifts before proceeding. Clean, potable water shall be added to hydrate the bentonite. After the placement of the final lift, the bentonite seal shall be allowed to hydrate an additional two hours before grouting begins.

The bentonite seal shall be placed immediately after installing the filter pack, unless the well is going to be developed prior to placement of the seals, in which case, the seal shall be placed immediately upon completion of development.

4.6 Annular Seal

Grout shall be placed by pumping through a side discharging tremie pipe with the lower end of the tremie pipe located within 3 feet of the top of the bentonite seal. Pumping shall continue until undiluted grout flows from the boring at the ground surface. The annular seal shall be placed within 48 hours, but no sooner than two hours after the final lift of the bentonite seal installation.

4.6.1 Cement grout

Cement grout shall be placed above the bentonite seal to the ground surface. The cement grout shall consist of a mixture of Portland cement (ASTM C 150) and water in the proportion of not more than 7 gallons of approved water per bag of cement (94 pounds). Additionally, 3 percent by weight of sodium bentonite powder shall be added unless prohibited by state or local regulations.

4.6.2 High-Solids Bentonite Grout

Commercially available high-solids bentonite grout may be substituted for cement grout with USACE approval or specified in the site-specific section of the Scope of Services. If approved or specified, the grout shall be mixed in accordance with the manufacturer's instructions. The slurry shall consist of a mixture of bentonite and the manufacturer's recommended volume of water to achieve an optimal seal. The slurry shall contain at least 20 – 30 percent solids by weight and have a density of at least 9.4 pounds/gallon. The slurry weight shall be tested periodically with a mud scale to assure proper mixing.

4.7 Protection of Well

At all times during the progress of the work, precautions shall be taken to prevent tampering with the well or the entrance of foreign material into it. Run-off shall be prevented from entering the well during construction. Upon completion of the well, a suitable vented or loose fitting cap shall be installed to prevent material from entering the well. A vent hole of 1/8inch diameter shall be drilled into the cap. The well riser shall be surrounded by a larger diameter protective non-corrosive steel or aluminum casing rising 2 to 3 feet above ground level and set an equal distance below the ground surface into the cement grout backfill. The casing shall be installed in a manner that does not hinder access to the monitoring well for purposes of cap removal, taking samples, or water level measurements. The outside of all protective casings shall be painted a color specified by the USACE-COR. Refer to Site Specific Section for color requirements (the default color-blaze orange). The protective casing shall be provided with a locking cap and lock. The cap shall be designed to prevent water from entering the protective casing. All locks shall be brass (non-rusting) and keyed alike. Three (3) duplicate keys shall be provided: two to the USACE-COR and one to the owner unless otherwise specified. A minimum 2 feet by 2 feet square by 4 inches thick concrete (cement, aggregate, water) pad, sloped away from the well, shall be constructed around the well casing with the top outer edge at the final ground level elevation. A weep hole of 1/8-inch diameter shall be drilled into the outer protective casing within three inches above the pad to permit drainage of fluids that may accumulate. Three 2-inch diameter or larger concrete filled steel posts shall be equally spaced around the well and cemented in place 2 to 3 feet below ground, outside the concrete pad. The posts shall be a minimum of 3 feet above ground. The ground immediately surrounding the top of the well pad shall be sloped away from the well.

4.7.1 Flush Finish Completion

Some wells may be required to be finished flush with the ground or pavement if they are in areas of heavy traffic. This requirement shall be stipulated in the Site Specific Section of the Scope of Services or determined by the site owner. If this is required, the Contractor shall submit the proposed locations and flush mounted well designs in the Contractor work plan for approval. Flush finished wells shall also be equipped with a lock and shall be protected from the

entry of surface fluids into the well. Protective posts shall not be required on flush-finished wells.

4.7.2 Cold Climate Completion

In climates with alternating freezing and thawing conditions, the well must be designed to minimize the potential for damage caused by frost heaving. The Contractor shall determine the frost heave potential and include damage minimizing surface completion design details, such as a gravel blanket in lieu of the concrete pad or constructing a joint separating the concrete pad from the protective casing, in the Contractor work plan.

4.8 Monitoring Well Installation Diagrams

Suitable diagrams detailing the as-built configuration of each monitoring well shall be prepared for inclusion in the Project Report. A qualified geologist/geotechnical engineer present during all drilling operations shall prepare the diagrams. A legible field copy of each well installation diagram shall be completed and sent to the USACE Project Geologist within five days of completion of the well. The USACE Project Geologist shall not accept the well before the drill logs and installation diagrams are received and approved. Information provided on all diagrams shall include, but not be limited to the following:

4.8.1 Project and site names, well number, and the total depth of completed well;

4.8.2 Depth of any grouting or sealing, and the amount of cement and/or bentonite used, and the total boring depth;

4.8.3 Depth, diameter, type of well casing, and location of any blank pipe installed in the well;

4.8.4 Static water level upon completion of the well and after well development;

4.8.5 Installation date or dates, and name of the driller and the geologist/geotechnical engineer installing the well. The preparer shall sign each installation diagram;

4.8.6 All pertinent construction details of monitoring wells, such as depth, volume and description of all backfill materials installed (such as gravel pack, bentonite, and grout); gradation of gravel pack; length, location, diameter, slot size, material (PVC, etc.), and manufacturer of well screen(s), position of centralizers, etc.;.

4.8.7 Source and volume of water added during drilling and well installation;

4.8.8 Descriptions of surface completion, including protective steel casing, protective pipes, and concrete surface seal;

4.8.9 A description of any difficulties encountered during well installation; and

4.8.10 Surveyed coordinates and elevation of top of ground and top of well riser where ground water is measured. A notch or mark on the casing where ground water is

measured should be noted. (Generally, a mark or notch should be made on the north side of the casing.)

4.9 Temporary Capping

Any well that is to be temporarily removed from service or left incomplete due to delay in construction shall be capped with a watertight cap and equipped with a "vandal proof" cover satisfying applicable state or local regulations or recommendations.

4.10 Identification of Wells

The Contractor shall securely affix a permanent corrosion resistant tag to the outer steel protective casing of each well which clearly identifies the well number, depth, date of installation, the Contractor's company name and the top of riser measuring/point elevation. The well shall also be clearly identified as a ground-water monitoring well, (or other type of well as applicable) either on the tag or by other means which must be approved by the USACE. On flush finished wells, the tag shall be fixed to the inside of the cover. The outside shall be labeled as a monitoring well, with the well number clearly identified.

4.11 Contractor Responsibility for Monitoring Wells

It is the responsibility of the Contractor to properly plan, design, install, develop, and test monitoring wells so that they are suitable to produce representative ground-water samples in sufficient quantity and quality for geochemical testing. The Contractor shall ensure that the intentions of this Scope of Services and best construction practices are carried out.

4.11.1 Well Replacement

If the Contractor, due to his inadequate design or construction, installs monitoring wells that are not suitable for their intended use or not in accordance with specifications, the Contracting Officer shall disapprove the well and direct the Contractor to repair or replace it at the Contracting Officer's discretion. This work shall be done at no additional cost to the Government.

4.11.2 Abandoned Wells

If a monitoring well is disapproved by the USACE or is abandoned by the Contractor for any reason, the well (or borehole) shall be abandoned in accordance with paragraph: **7.0 Well Abandonment**. Such work shall be done at no additional cost to the Government.

4.12 Well Development

4.12.1 Procedures

Within one week after each well has been constructed, but no sooner than 48 hours after grouting is completed, the Contractor shall direct a program for the development of the well without the use of dispersing agents, acids, or explosives. The Contractor has the option of developing the well prior to placing the annular seal providing borehole stability can be maintained throughout the development and seal placement activities. This should be considered if significant settlement of the filter pack during development is anticipated. The objectives of well development are to: (a) assure that ground water enters the well screen freely, thus yielding a representative ground-water sample and an accurate water level measurement, b) remove all

water that may have been introduced during drilling and well installation, c) remove very fine-grained sediment in the filter pack and nearby formation so that ground-water samples are not highly turbid and so that silting of the well does not occur. Development shall consist of mechanical surging and bailing until little or no sediment enters the well. If not specified in the Site Specific Section of the Scope of Services, well development shall continue for a minimum of two (2) hours. Sediment that enters the well during this process shall be removed. At the end of that time, the well shall be continuously pumped using an electric submersible, or pneumatic drive positive displacement or bladder pump. Temperature, pH, specific conductivity, and turbidity shall be monitored during pumping (one reading per well volume). Pumping shall continue until these parameters have stabilized (less than 0.2 pH units or a 10 percent change for the other parameters between four consecutive readings) and the water is clear and free of fines. If these parameters have not stabilized after four (4) hours of continuous pumping, then the USACE shall be contacted for further direction.

If the addition of water is required to facilitate surging and bailing only formation water from that well shall be used. If this is not practical due to tightness of the formation then only bailing shall be done. In all cases, the utmost care shall be taken not to collapse well screens during development activities and at least as much water as was introduced during drilling shall be removed from each well. The Contractor shall collect approximately one liter of the last water withdrawn from the well during development in a clear glass jar, label and immediately photograph it with a 35 mm or digital color photo, and submit the photo as part of the well development form or appropriate project report. The photograph shall be a suitably back-lit, close-up that shows the clarity of the water. Fines remaining in the water shall not be allowed to settle out prior to taking the photograph. The depth of any sediment that collects in the bottom of the jar after the sample is allowed to settle shall be noted on the Well Development Form. The nephelometric turbidity of the water shall be determined in accordance with ASTM D-1889 "Standard Test Method for Turbidity of Water" and shown on the final Well Development Form. Part of well development should be the washing of the entire well cap and interior of the well casing above the water table using only water from that well. The result of this operation should be a well casing free of extraneous materials (grout, bentonite, sand, etc.). This washing should be conducted during development, not after development is completed. This washing should not be performed where free phase contaminants (i.e. petroleum products) are present.

4.12.2 Well Development Records

A legible well development form shall be prepared and completed for each monitoring well installed. The geologist/geotechnical engineer present during the well development operations shall prepare the form. A copy of the well development records, complete with original photos, shall be submitted to the USACE Project Geologist within five (5) days of completion of well development activities. A sample form shall be submitted in the Contractor work plan. Copies of the completed well development records shall be included in the Draft Project Report and Final Project Report. Information provided on the well development record shall include, but not be limited to the following:

4.12.2.1 Name of project and site, well identification number, and date(s).

4.12.2.2 Date, time, and elevation of the static water level and bottom of well before development.

4.12.2.3 Method used for development, to include equipment, size, type and make of bailer and/or pump used during development.

4.12.2.4 Time spent developing the well by each method, to include the typical pumping rate if a pump was used in development.

4.12.2.5 Volume and physical character of water removed, to include changes during development in clarity, color, particulates, and odor.

4.12.2.6 Volume and source of any water added to the well, and chemical analysis of the added water.

4.12.2.7 Volume and physical character of sediment removed, to include changes during development in color and odor.

4.12.2.8 Clarity of water before, during, and after development, including a backlit photo, and depth of any sediment which settles to the bottom of the jar containing the last one liter of water withdrawn from the well during development.

4.12.2.9 Total depth of well and the static water level immediately after, and no sooner than the following day after development.

4.12.2.10 Readings of pH, specific conductance, temperature, and turbidity taken before, during, and after development.

4.12.2.11 Name(s) and job title of individual(s) developing well.

4.12.2.12 Name and/or description of the disposal facility/area for the waters removed during development.

4.12.2.13 Photograph.

4.13 In-situ Permeability Testing (Slug Testing)

Slug tests shall be performed for all new wells at each site **only if specified** in site specific SOS. After development and sampling of monitoring wells, the Contractor shall determine for each new well at each site the in-situ permeability of the screened formation using an appropriate method. The Contractor shall propose the methods expected to be used and references for those methods in the Contractor work plans. No water or other liquid may be introduced into the well. Both rising and falling head slug tests shall be performed, however, only the rising head portion of slug tests shall be analyzed in a well screened partially in the unsaturated zone. All instrumentation and materials placed into the well shall be decontaminated according to the requirements given for sampling equipment. If for any reason in-situ tests can not be completed at any well, the Contractor shall contact the USACE-COR immediately for instructions.

4.14 Water Source

Water for drilling, steam cleaning, and other necessary field activities shall be arranged by the Contractor and approved by the USACE-COR. Chlorine-free water shall be used if a suitable source is available. The Contractor shall be responsible for collecting and transporting all water to the drilling areas for required uses. The Contractor shall sample the water at each source and test it for the same parameters specified for ground-water samples under the Site Specific Section of the Scope of Services. In addition, a sample shall be obtained at the site from the delivery/transport vehicle and tested for the same parameters as the source sample. This information and documentation of the source of the water (i.e. fire hydrant location, etc.) which was used and any impact it may have on any of the analytical results performed under this Scope of Services shall be included in both the Draft and Final Project reports. The Contractor shall be responsible for providing any deionized water required to perform this work.

5.0 SAMPLING TECHNIQUES-EQUIPMENT AND METHODS

5.1 Soil Sampling

The number and type of samples for chemical analysis is specified in the Site Specific Section of the Scope of Services. The sampling procedures and analytical methods are specified in the Site Specific Section of the Scope of Services and the General Chemistry Supplement to the Scope of Services.

Sampling for chemical analysis shall be performed using a stainless steel split-spoon sampler. Alternate sampling methods may be proposed for approval by the USACE Project Geologist in the Contractor work plans. Soil grab samples for volatile organic compounds (VOCs) or semi-volatile compounds (SVOCs) analyses shall be obtained by sub-sampling the material retrieved in the split spoon. The portion of the split-spoon sample that represents slough shall not be sub-sampled. Sub-sampling shall be done immediately upon opening the split spoon and shall be done as soon as possible once the split-spoon sample is taken from the boring. When collecting samples with a hand auger, the VOC and SVOC sub-samples shall be collected immediately upon retrieval of the sample at the surface. The Contractor is responsible to recover adequate soil volume for all analytical requirements. If the sample volume of the first sample is not adequate, another sample shall be attempted from immediately below the previous sample or from the same depth in a boring drilled immediately adjacent to the boring in which the sample failed. This shall be done at no additional cost to the Government. The Contractor shall include in the Contractor work plans methods to be used to recover additional samples that are consistent with the project data quality objectives. Shallow soil samples for chemical analysis may be obtained with a stainless steel hand auger or a similar device if approved by the USACE Project Geologist in the Contractor work plans.

Homogenizing (mixing) of soil samples shall be performed in a stainless steel bowl using stainless steel stirring devices that have been decontaminated prior to each homogenizing procedure. Samples for VOCs or SVOCs shall not be homogenized unless specified in the Site Specific Section of the Scope of Services. Sampling equipment, sampling methods, and decontamination procedures shall be clearly indicated in the Contractor work plans.

5.2 Headspace Screening Method

The Contractor shall screen all soil samples collected above the water table for volatile organic compounds in the field at the time of sample collection. Field screening shall utilize either an organic vapor analyzer equipped with a photo-ionization detector (PID) or a flame-ionization detector (FID). If a high humidity condition exists during the time period when field activity is to be performed, the FID is recommended since a PID is not reliable screening instrument under these conditions. The ionization potential of lamp for the PID shall be optimized for the contaminants of concern. The Contractor shall perform field screening in accordance with the following procedures unless alternate procedures are submitted and approved in the Contractor work plans.

5.2.1 Immediately upon opening the split-spoon (or other sample retrieval device) and after collecting the volatile organic sample (if required), a representative portion of the sample shall be collected and placed in a clean, contaminate-free jar. (The sample may be placed in a new, clean, plastic sandwich bag inside a jar to minimize the number of new jars required. **If the plastic bag method is utilized, readings shall be taken inside empty bags to ensure no external contamination is being introduced.)**

5.2.2 If the volume of sample recovered is insufficient for all analytical requirements, then the material used in the headspace readings could be utilized for any non-volatile sampling requirements (i.e. the headspace material could be used to fulfill the geotechnical requirements). NOTE: A headspace reading is not required from the additional sample that was retrieved immediately below the initial attempt due to insufficient sample volume.

5.2.3 Seal each jar with at least one continuous sheet of aluminum foil, using the jar lid to secure the foil.

5.2.4 Vigorously agitate the sample jar for at least fifteen seconds and then allow a minimum of ten minutes (or as the environmental conditions dictate) for the sample to adequately volatilize.

5.2.5 During cold weather, the samples shall be warmed to near room temperature prior to taking the headspace measurement.

5.2.6 Re-shake the jar and then remove the jar lid. Quickly insert the vapor sampling probe through the aluminum foil and record the maximum meter response (which should be within the first two to five seconds). Erratic responses should be evaluated in terms of high organic vapor concentrations or conditions of elevated headspace moisture.

5.2.7 Record headspace screening data on the boring log and any other appropriate documentation (e.g. sample transmittals, field notebooks, etc.) as appropriate.

5.2.8 The screening instrument shall be calibrated according to the appropriate standard span gas and shall be calibrated a minimum of twice daily and before use after a long shut down period (i.e. lunch breaks, equipment breakdowns, weather caused breaks, etc.).

5.2.9 If sample jars are to be re-used in the field, jars must be cleaned according to field decontamination procedures for cleaning of sampling equipment. In addition, headspace readings must be taken to ensure no residual organic vapors exist in the cleaned sample jars.

5.2.10 Any deviation(s) from the approved procedures must be noted on the drill logs and the Daily Quality Control Report (DQCR), with the basis for the deviation(s) stated.

5.3 Low-Stress Ground-Water Sampling

The primary objective of low-stress purging and sampling is to consistently collect representative ground-water samples without altering water chemistry. Low-stress purging and sampling techniques help to reduce high turbidity levels that may adversely affect sample quality, which commonly occurs with conventional techniques that use bailers or high-speed pumps. The Contractor shall provide all purging and sampling details, including equipment specifications, in the work plan. After development, all wells shall be allowed to stabilize for a minimum of 2 weeks prior to sampling. For all wells, the Contractor shall determine (measure and record) depth to water and the total well depth using an electronic water level probe to determine the water volume to be purged. Prior to purging, determine the presence of Non-Aqueous Phase Liquids (NAPLs) at the top and bottom of the water column. If NAPLs are present, contact the USACE-COR for further instructions. Note: when turbidity is a concern and DNAPLs are not suspected, do not measure the depth of the well prior to purging and sampling. Calculate well volume using the as-build depth and measure the actual well depth upon completion of sampling activities.

5.3.1 Well Purging Procedure

A well must be purged with a pump prior to sampling to assure that true formation water is sampled instead of stagnant casing water. Suitable pumps for low-flow (minimal drawdown) purging and sampling include bladder pumps, positive displacement pumps, peristaltic pumps, electrical submersible pumps, and gas driven pumps. Bladder pumps and other positive displacement pumps are preferred by the USACE when VOCs are to be sampled.

Well purging devices (bladders, pumps, bailers, and tubing) should be constructed of stainless steel, Teflon®, and other inert materials to reduce the chance of these materials altering the ground water in areas were concentrations of the site contaminants are expected near detection limits. Teflon® tubing is preferred for sampling VOCs, but polyethylene tubing is acceptable for single use provided if it is demonstrated to not contribute contaminants to the samples. Disposable polyethylene tubing, which is discarded after its initial use, also decreases the possibility of cross contamination between wells.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (bladder, peristaltic), and/or the use of dedicated equipment. If the recharge rate of the well is lower than extraction rate capabilities of currently manufactured pumps and the

well is essentially dewatered during purging, then the well should be sampled as soon as the water level has recovered sufficiently to collect the appropriate volume needed for all anticipated samples (ideally the intake should not be moved during this recovery period). Samples may then be collected even though the indicator field parameters have not stabilized.

Water quality indicator parameters will be measured every three to five minutes by instruments contained in an in-line flow-through cell attached to the pump. Purging will be considered complete when parameters stabilize for at least three consecutive readings within the following limits: 1°C for temperature, ± 0.1 for pH, ± 0.01 mS/cm or ± 3% (which ever is less) for conductivity, ± 10 mV or 10% (which ever is less) for redox potential, ± 10% for turbidity, and ± 0.3 mg/L or ± 10% (which ever is less) for dissolved oxygen. Ideally, an attempt will be made to purge until turbidity drops below 10 NTU, but this is not a requirement. Removal of a specific volume of water is also not required, provided all water quality parameters are stable as noted above.

Wells will not be dewatered or purged dry, which can cause aeration as ground water cascades back into the well. Water table wells with slow recharge that results in significant drawdown (greater than 0.33 feet) while purging at the lowest possible rate will be pumped at a rate between 100 mL/min to 200 mL/min (0.03 to 0.05 gpm) for a minimum of 1 hour, unless drawdown exceeds 2 ft. If a drawdown of >2 ft occurs in a water table well, purging will be stopped to allow the well to recover before sampling. For wells screened below the water table, a greater drawdown during purging may be acceptable, at the discretion of the USACE Project Geologist. The USACE-COR will be notified if any wells produce less than 100 mL/min to discuss alternate sampling strategies.

Pertinent sampling measurements- intake depth and drawdown information from sampling event(s) for each well, etc., shall be recorded. During subsequent sampling events, these relevant measurements and instrument settings (e.g. the intake depth, extraction rate, final pump dial setting information from previous event(s), drawdown levels, etc.) shall be duplicated, to the extent practicable.

5.3.2 Sample Collection

Sampling devices such as bailers and lift foot-valve samplers that cause repeated sediment disturbance and mixing of stagnant water in the casing with dynamic water in the screened interval are unacceptable.

All samples will be collected from the pump system unless federal, state, or local regulations or guidance stipulate other methodology. After water quality indicator parameters stabilize, ground-water samples will be collected immediately. However, in-line monitoring equipment must be removed prior to sample collection. During sample collection, the pumping rate will remain the same or lower than the purging rate to minimize aeration, bubble formation, or turbulent filling of sample bottles.

During purging and sampling, the tubing should remain filled with water so as to minimize possible changes in water chemistry upon contact with the atmosphere. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help insure that the sample tubing

remains water filled. If the pump tubing is not completely filled to the sampling point, use one of the following procedures to collect samples: (1) add clamp, connector (Teflon or stainless steel) or valve to constrict sampling end of tubing; (2) insert small diameter Teflon tubing into water filled portion of pump tubing allowing the end to protrude beyond the end of the pump tubing, collect sample from small diameter tubing; (3) collect non-VOC samples first, then increase flow rate slightly until the water completely fills the tubing, collect sample and record new drawdown, flow rate and new indicator field parameter values.

In general, sample collection sequence for various analytes shall begin with volatile organic compounds (VOCs). If required, filtered samples for inorganics shall be collected utilizing in-line filters and obtained last from the pump stream. Samples shall be drawn and placed in the appropriate sample bottles immediately upon receipt of water at the surface. The samples shall then be immediately placed in a cooler and maintained at a temperature of 4 degrees Centigrade until received at the laboratory. Sample collection, packaging, and shipping requirements shall be specified in the Contractor's Quality Assurance Project Plan (QAPP). Data generated during purging and sampling shall be presented in the project report, including flow rate, drawdown, water volumes, water quality parameter values, purge times, field instrument calibration data, sampling forms, and chain of custody forms.

5.4 Passive and Other Ground-Water Sampling Methods

5.4.1 Passive Ground-Water Sampling Methods

Passive sampling technology is new and evolving. Passive ground-water sampling methods shall be utilized only if specified in the site-specific section of the SOS- otherwise the Contractor must propose to the USACE-COR and the procedure approved before employing passive sampling. Generally, passive sampling generates no purge water because the sample is obtained by diffusion or natural flow of ground water. A sampling device is lowered into a well and allowed to equilibrate within the well water for a specific period of time. The device is then removed from the well and a sample is sent to the laboratory for analysis of target analytes. It should be noted that air sensitive field parameters (e.g. redox potential and dissolved oxygen) cannot be considered accurate when measured in open air since no flow-through cell is used during passive sampling. If these parameters are to be collect for natural attenuation scoring, then alternative data collection must be considered.

5.4.2 Other Ground-Water Sampling Methods

Innovative sampling technology is continuously evolving. Innovative ground-water sampling methods shall be utilized only if specified in the site-specific section of the SOS- otherwise the Contractor must propose to the USACE-COR and the procedure approved before employing innovative sampling.

5.5 Additional References for Ground-Water Sampling

At a minimum, the Contractor should consult the following references prior to developing sampling procedures for wells.

- EPA, Region 1; "SOP GW 0001, Low Stress (Low Flow) SOP" Revision Number 2. July 30, 1996

- Puls, W.P. and M. J. Barcelona, April 1996, U.S. EPA Ground-Water Issue Paper: Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, EPA/540/S-95/504, Washington, DC.

- USACE, 2001 Requirements for Preparation of Sampling and Analysis Plans. EM-200-3-1, 1 Feb. 2001.

- Yeskis, Douglas, and Zavala, Bernard, May 2003, U.S. EPA Ground-Water Issue Paper: Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers, EPA/542/S-02/001, Washington, DC.

6.0 INVESTIGATION DERIVED WASTES (IDW)

Drill cuttings, excess sample materials, drilling fluids, and water removed from a well during installation, development, and aquifer testing shall be disposed of in a manner prescribed in the Contractor work plan. Disposal shall be consistent with applicable federal, state, and local regulations or guidance. (Reference EPA/540/G-91/009 Management of Investigation Derived Wastes During Site Inspection) The Contractor shall develop field protocols to minimize the amount of waste generated and to segregate clean materials from potentially contaminated materials. These protocols shall be described in the Contractor work plans. Site specific disposal options should be discussed with the appropriate regulatory agencies prior to their inclusion in the Contractor work plans.

All materials generated during field activities that are segregated as potentially contaminated shall be placed in water-tight containers supplied by the Contractor. If drums are utilized, they shall be new, DOT and EPA approved for transport of hazardous materials. The use of reconditioned/recycled drums may be proposed for approval by the USACE Project Geologist in the Contractor work plans. Any drum used shall be sealed, labeled, and recorded so that its contents can be identified as to material and source. At a minimum, drums shall be labeled as to type of material contained, site number and location, boring number (and depths for soils), Contractor firm, point of contact and telephone, and date. All materials shall be segregated in separate drums (i.e. soil, water, PPE, etc.). Labeling shall be of a permanent nature, unaffected by exposure to outdoor elements for an extended period of time. Labels shall be placed on the side of the drum and positioned to be easily viewed when drums are staged.

All potentially contaminated IDW shall be transported to a secured centralized location, on site, at the completion of each boring, well development, purging event, or daily unless otherwise specified in the Site Specific Section of the SOS. Drums shall be secured on wooden pallets and shall not be stacked. The Contractor shall include disposal methods for uncontaminated materials in the Contractor work plans.

Results from laboratory analysis of soil and ground-water samples collected during the field investigation shall be utilized to further segregate contaminated and uncontaminated drummed materials. Drummed materials identified as clean shall be disposed of in the manner stated in the Contractor work plans for uncontaminated materials. Drums containing potentially hazardous materials shall be sampled to characterize the material for off-site disposal. These analysis shall

identify the potentially hazardous characteristics of the material, including flammability, corrosivity, reactivity, and TCLP. The Contractor shall utilize the analyses to prepare a waste manifest for ultimate shipment of the material to a TSD facility. The Contractor is responsible for off-site disposal of any contaminated material. The Contractor shall determine the most cost-effective method of disposal and furnish an estimated cost to the USACE-COR.

7.0 WELL ABANDONMENT

All well abandonment procedures shall be in accordance with this SOS and/or all federal, state, and local requirements. If the specifications as set forth in the Scope of Services do not meet state or local requirements, contact the USACE-COR for resolution of differences. The Contractor is responsible for determining applicable federal, state, and local requirements. For each well abandonment, the documents outlined below shall be completed. The Contractor shall be responsible for submittal of all required documentation to the respective state agency and copies shall be provided to the USACE Project Geologist.

7.1 Well Abandonment Methods

A description of the methods and procedures to be used for well abandonment shall be submitted with the Contractor work plans. The plans shall include, but not be limited to the following:

- Applicable regulations (include copy of regulation in the work plan).
- Description of well abandonment procedures including drilling and placement of grout.
- Description of drilling equipment.
- Description of well abandonment material.
- Description of quality control procedures including depth measurements, placement of grout. Include also example forms for well abandonment logs and diagrams.

7.2 Well Abandonment Records

Well abandonment records summarizing the field performance of the items listed in paragraph 7.1 shall be prepared by a qualified geologist/geotechnical engineer present on-site during all well abandonment activities. Copies of these records, as well as any state/locally required submittals/approvals, shall be submitted in the draft and final reports.

7.3 Abandonment Procedures

If there are no state or local regulations governing well abandonment, the following procedures shall be followed:

7.3.1 Grout

Grout for well abandonment shall consist of the same mixture specified under paragraph: **4.6 Annular Seal**, of this supplement.

7.3.2 Grout Placement

The grout shall be placed by tremie pipe, submerged in the grout at all times. The tremie pipe may be raised as the grout is placed as long as the discharge end remains submerged in the grout. The grout shall be placed from the bottom to the top of the hole in one continuous operation.

7.3.3 Casing Removal

Well casing, protective casing, etc. shall be cut off a minimum of two feet below ground surface and the borehole backfilled with appropriate material (native soil, concrete, asphalt, etc.).

8.0 SURVEYS (GENERAL).

All sampling locations shall be staked to facilitate subsequent surveying. The Contractor shall perform all surveys required for this project and shall supply this office with the original or a legible reproducible copy of the surveys and field books. The surveys shall at least conform to the requirements stated in the following paragraphs.

8.1 Monitoring Wells.

Coordinates and elevations shall be established for each monitoring well. The coordinates shall be to the closest one foot and referenced to the State Plane Coordinate System. If the State Plane Coordinate System is not available, an existing local grid system shall be used. A ground elevation to the closest 0.1- foot and an elevation for the top of the well riser to the closest 0.01-foot shall be obtained at each well. These elevations shall be referenced to Mean Sea Level, specifically to the North American Vertical Datum (NAVD) of 1988. If the 1988 Datum is not available, the National Geodetic Vertical Datum (NGVD) of 1929 shall be used. All positions and coordinates of all permanent points within the control traverse shall be shown. If not stated in the Site Specific Scope of Services, the Contractor shall coordinate with the USACE COR to determine what datum shall be used for the project. The Contractor shall state what datum was used upon the product delivery.

8.2 Soil Borings/Sampling Points

All soil sampling locations shall be located horizontally following procedures outlined in paragraph: **8.1 Monitoring Wells.**

8.3 Physical Features.

At each site, all above ground and, where possible, underground physical features shall be either verified with previous mapping or be determined if required. All above ground physical features shall be located/verified to the nearest foot. Permanent control monuments shall be placed in accessible locations within the limits of the work if existing permanent monuments are not located within 1000 feet of a site. One set of monuments is allowable for adjacent sites. These monuments shall be set no closer than 500 feet to each other.

8.4 Documentation.

The location, identification, coordinates, and elevations of the wells and monuments shall be plotted on maps with a scale large enough to show their locations with reference to other structures at the individual sites. A tabulated list of the monitoring wells and monuments, copies

of all field books, and all computations sheets shall be prepared and submitted to the USACE-COR. The tabulations shall consist of the designated number of the well or monument, the X and Y coordinates, and all the required elevations. These items shall be submitted to Omaha District no later than the Draft Project Report.

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: B-1

SHEET 2 OF 2 SHEETS

PROJECT: gINT Example
Ft. Somewhere, USA

INSPECTOR: A. Bore

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
123.4	0	Very loose, orange, fine sand, some silt, moist (SM).					
122.4	1				0123456 0123457		
121.4	2		RAD:0 Oxy:21.0 LEL:0				@09:58
120.4	3	Loose, orange to light brown, clayey sand, wet to saturated (SC).					
				(3.5'-5.0')		5	Rec = 100%
119.4	4					6	
						7	
118.4	5						
117.4	6						
116.4	7			(7.0'-9.0')	0123458 0123459	7	Rec = 90%
						8	
115.4	8					9	
						10	
114.4	9	Bottom of hole at 9'					
113.4	10						

SAMPLE

PROJECT: gINT Example Ft. Somewhere, USA

HOLE NO: B-1

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

Photo 6. AOC 2. Looking East. Crops: Soybeans, wheat, corn fields and rows of trees.[(1)]

Photo 7. AOC 2. Soybean fields. Foreground possible former building location. [(1)]

Photo 8. AOC 3, Drainage Area DA1. South and adjacent to AOC 5. [(3)]

Photo 9. AOC 4. Looking south from 170th Street.[(1)]

Photo 10. **AOC 5.** Looking east.DNT storage bunker with trash inside. [(1)]

Photo 11. AOC 5. Looking north at a drainage area south of the DNT storage bunkers and north of AOC 3 Drainage Area DA1. [(1)]

Photo 12. **AOC 5**. Looking East. DNT storage bunker. (1)

Photo 13. AOC 6. Looking northeast, standing at Bottom of 154th Street Disturbed Area (3)

Photo 14. AOC 7A. Possible Transformer storage pad on the south side of Pump House.(2)

Photo 15. AOC 7A. Looking east. Water Chemical Inlet house attached to the North side of Building 402-A. (2)

Photo 16. AOC 7B. Looking northeast.(2)

Photo 17. AOC 7C. Looking south at the location of the former Coal Storage Area. (2)

Photo 18. AOC 7C. Looking northeast at a culvert located in the northeast corner of AOC 7C.(2)

Photo 19. AOC 7D. Looking southeast at stockpiled soil. The toe end of the stockpile on the left side of the photograph is in AOC 7C. (2)

Photo 20. AOC 7D. Looking northeast at the former location of Building 401-A. (2)

Photo 21. AOC 7D. Looking northeast at the former Fuel Oil Tank location east of Building 401-A.(2)

Photo 22. AOC 7D. Looking east at the former Ash Disposal Pit, south and adjacent to the Fuel Oil Tanks located east of Building 401-A.(2)

Photo 23. AOC 7D. Two of four of the possible transformer storage pads on the southwest side of Building 401-A. (2)

FEDERAL SECURITY AGENCY
WASHINGTON

Office of
The Administrater

July 6, 1951

Director, National Industrial
Reserve Division
General Services Administration
Washington 25, D. C.

Gentlemen:

We are transmitting herewith for your custody and necessary title clearance with the Attorney General of the United States, a quitclaim deed granted by the Regents of the University of Minnesota reverting title to the Steam Plant at the Gopher Ordnance Plant, Rosemont, Minnesota to the United States.

Also transmitted is a copy of a letter addressed to the Regional Director, General Services Administration, Kansas City, Missouri assigning jurisdiction and custody of the reverted property to the General Services Administration.

This office would appreciate being advised when the opinion of the Attorney General is received in order that we may issue a release deed modifying the real property transferred to the University of Minnesota at the Gopher Ordnance Plant for educational utilization.

Sincerely,

/s/
W. T. Frazier, Acting
Property Utilization Coordinator
Health and Education

Attachments 2

C
O
P
Y

T. O. File

QUITCLAIM DEED

WHEREAS, the property hereinafter described was surplus to the needs of the United States of America pursuant to the provisions of the Surplus Property Act of 1944 (58 Stat. 764) as amended, and WAA Regulation No. 1, as amended (11 Fed. Reg. 408); and Whereas the War Assets Administration, under and pursuant to Reorganization Plan One of 1947 (12 F. R. 4534), and pursuant to the powers and authority contained in the Surplus Property Act of 1944 (58 Stat. 764) as amended, as Grantor did, on the 17th day of March, 1948, deed the following described land, together with other lands, to the Regents of the University of Minnesota, a public educational corporation, which deed was filed for record in the office of the Register of Deeds, for Dakota County, Minnesota on the 19th day of March, 1948, at 11 o'clock a.m. in Book 224 of Deeds, Pages 598-600.

WHEREAS, the United States of America has requested that an area of land together with certain buildings, structures, and equipment thereon located, containing and surrounding the central steam plant be reconveyed by the Regents of the University of Minnesota back to the United States of America for facilitating use by it, pursuant to the Federal Property and Administrative Services Act of 1949, as amended P.L. 152, 81st Congress and P.L. 754, 81st Congress.

NOW THEREFORE, This Indenture, made this 27th day of June, 1951, between the REGENTS OF THE UNIVERSITY OF MINNESOTA, a Minnesota Educational Corporation, created by the Territorial Government of Minnesota, and perpetuated by the Constitution of the State of Minnesota, with post office address in Minneapolis, Minnesota, Grantor, and the UNITED STATES OF AMERICA, Grantee,

WITNESSETH, THAT the Grantor, in consideration of the covenants, conditions, restrictions and reservations hereafter contained, and other good and valuable consideration, the receipt of which is hereby acknowledged, does hereby grant, bargain, quitclaim and convey unto the said Grantee, its successors and assigns, forever, the following described property in the County of Dakota, State of Minnesota, to-wit:

Commencing at a point on the West line of Section Thirty-six (36), twenty three hundred six and sixty-seven one hundredths (2306.67) feet North of the Southwest corner of Section Thirty-six (36), Township One Hundred and Fifteen (115) North, Range Nineteen (19) West, Dakota County, Minnesota thence due East a distance

of one hundred twenty (120) feet to a point which is the starting point of the property to be conveyed; thence Northerly parallel to the West line of said Section Thirty-six (36) a distance of twelve hundred (1200) feet; thence due East a distance of nine hundred sixty-three and twenty-four one hundredths (963.24) feet; thence due South a distance of twelve hundred (1200) feet to a point lying nine hundred seventy-four and twenty-five one hundredths (974.25) feet Easterly from the starting point; thence Westerly along said line nine hundred seventy-four and twenty-five one hundredths (974.25) feet to the starting point; and comprising in all approximately Twenty-six and seventy one-hundredths (26.70) acres in said Section Thirty-six (36); otherwise identified as that parcel of land bounded on the North by coordinate S-5200, on the East by coordinate E-19600, on the South by coordinate S-6400 and West by a line parallel to the West line of said Section Thirty-six (36) which passes through coordinate E-18628.68 at coordinate S-6080.31, said coordinates being as shown on Plot Plan Sheet 1 of two sheets of the Gopher Ordnance Works, dated April 1, 1945, Project 8953, No. 1869.

Title to said land, consisting of approximately twenty-six and seventy one-hundredths (26.70) acres more or less, having been acquired from the United States of America as part of that installation formerly known as the Gopher Ordnance Works, Rosemount, Dakota County, Minnesota; together with the improvements and betterments on said lands, including but not limited to, buildings and structures and customary building installations and railway trackage and equipment. The buildings, structures, and all equipment or personal property presently installed or located therein are included in this deed. The buildings included are the steam plant described as Building "401-A", the Water Reservoir Building described as Building "402-A", the Transformer Stockade Building described as Building "405-A", the Ash Disposal Basin Building described as Building "410-A", the Water Pumping Equipment Building described as Building "412-A", the so-called South Water Tower adjacent to the above steam plant, salt dissolving pit described as "406-A" and the coal conveying equipment running from the steam plant to the coal storage area which is not a building but an open storage area for stockpiling coal.

There is specifically included in the above conveyance and guaranteed to the Grantee the right of ingress to and egress from the conveyed area for the use-in-place and/or dismantling and removal of the above buildings, structures, and

functional units or any part thereof, together with the right to the use and utilization of the surrounding land not conveyed by this deed for the dismantling and removal of the said functional units. Grantee shall also have the right to reactivate and operate said functional units or any part thereof, with the consent of the Grantor, in view of the Grantor's use of the premises known as Rosemount Research Center. Grantee shall have the right to dismantle, sell and remove said functional units or any part thereof from the premises conveyed. Grantee shall have the right to utilize jointly with the Grantor all utilities now on said conveyed premises in connection with the maintaining, preserving, protecting, dismantling, selling or removing of said functional units or any part thereof from the premises conveyed, which right of joint use shall not inure to the Grantee's assignees or successors. Said easement rights shall be free of any and all cost or charge, other than the utility charges entailed, and other items included in the supplemental agreement dated June 27th, 1951, between the Grantor and the United States of America acting by and through the Administrator of General Services, and shall continue for so long as the said functional units, or any part thereof, may remain in place. The above rights of ingress and egress shall include the right to the United States of America, with the consent of the Grantor as to location, to install any and all pipe and wiring across, under or through any of the property not conveyed by this deed but which is a part of the Rosemount Research Center, formerly known as the Gopher Ordnance Works, as well as a right of ingress and egress at times agreeable to the Grantor and the Grantee for the purposes of maintaining any and all such pipe or wiring the United States of America may install. This right of ingress and egress shall include the use of railroad tracks and lines and highways outside of but serving the conveyed area.

The Grantor at times agreeable to the Grantee shall have the right of ingress to and egress from the conveyed area for the purpose of maintenance, repair, or replacement of equipment relating to water supply, fire protection, sewage disposal, and power and telephone supply now installed and in use in said conveyed area; provided, however that such equipment may be removed upon joint consent of the parties hereto.

There is hereby reserved the right of joint use, by the Grantor and the Grantee, of switches, transformers and other electrical gear, and water and sewage

pumping equipment now in the Steam Plant Building or area now in use and necessary to the electrical, water, and sewer distribution systems of the entire area formerly known as Gopher Ordnance Works, provided, however, that the requirements of the Grantor shall take precedence over the requirements of the Grantee under said joint use.

The aforesaid premises are hereby conveyed subject, however, to the following easements and encumbrances:

(1) Easements to the Northern States Power Company for electrical transmission and distribution lines.

(2) Easements for the public roads and highways and public utilities.

(3) Easement to the present location of any sewer, water or other public utilities now located on said premises granted in this deed.

(4) Any other easements in open and notorious use by the owner thereof, not specifically mentioned herein.

TO HAVE AND TO HOLD all and singular said premises together with the appurtenances, unto the said Grantee and its successors and assigns forever.

In consideration hereof it is mutually agreed that the fair value of the property conveyed is determined to be $1,823,500.00 as of March 17, 1948; which is a part of the consideration for this deed; that a credit of this amount is to be allowed the Regents of the University of Minnesota, the Grantor herein, against the full value, as of March 17, 1948, of $3,936,213.00, which would indicate that the total fair value of the remainder of the installation, as of March 17, 1948, would be reduced to $2,112,713.00 as the basis for all future business, pursuant to the original deed of March 17, 1948.

IN WITNESS WHEREOF, the Grantor has caused these presents to be executed in its corporate name by its President and its Secretary and its corporate seal to be hereunto affixed the day and year first above written.

In the presence of:

In the presence of:

Arthur H. Bernatin

Frank H. Tilmer

REGENTS OF THE UNIVERSITY OF MINNESOTA

By _____ President

By _____ Secretary

Seal

UNITED STATES OF AMERICA, acting by and through the Federal Security Agency

By _____

DR. ARTHUR B. PRICE, REGIONAL DIRECTOR
FEDERAL SECURITY AGENCY
REGION V, CHICAGO, ILLINOIS

STATE OF MINNESOTA)
) ss
COUNTY OF HENNEPIN)

I, Evelyn G. Nelson a Notary Public in and for the State and County aforesaid, do certify that on this 28 day of June, 1951 before me appeared J. L. Morrill and W. T. Middlebrook ~~~ President and ~~~ Secretary of the Regents of the University of Minnesota, respectively, to me personally known, and known to me to be such ~~~ President and ~~~ Secretary of the Regents of the University of Minnesota, who being by me duly sworn did say that they were such ~~~ President and ~~~ Secretary of the Regents of the University of Minnesota, and that they signed the attested said deed in pursuance of proper authority, that said deed was signed and attested by them, as such ~~~ President and ~~~ Secretary of the Regents of the University of Minnesota, respectively, on behalf of the Regents of the University of Minnesota; and that said J. L. Morrill and W. T. Middlebrook acknowledged the execution and attestation of said deed to be their free act and deed as such ~~~ President and ~~~ Secretary of the Regents of the University of Minnesota and the free act and deed of the said Regents of the University of Minnesota and the seal affixed thereto to be the corporate seal of said University of Minnesota.

IN WITNESS WHEREOF, I hereunto set my hand at Minneapolis, Minnesota, in the County and State aforesaid, on the date last above written.

Evelyn G. Nelson
Notary Public, Hennepin County, Minn.

My Commission Expires: July 6, 1951

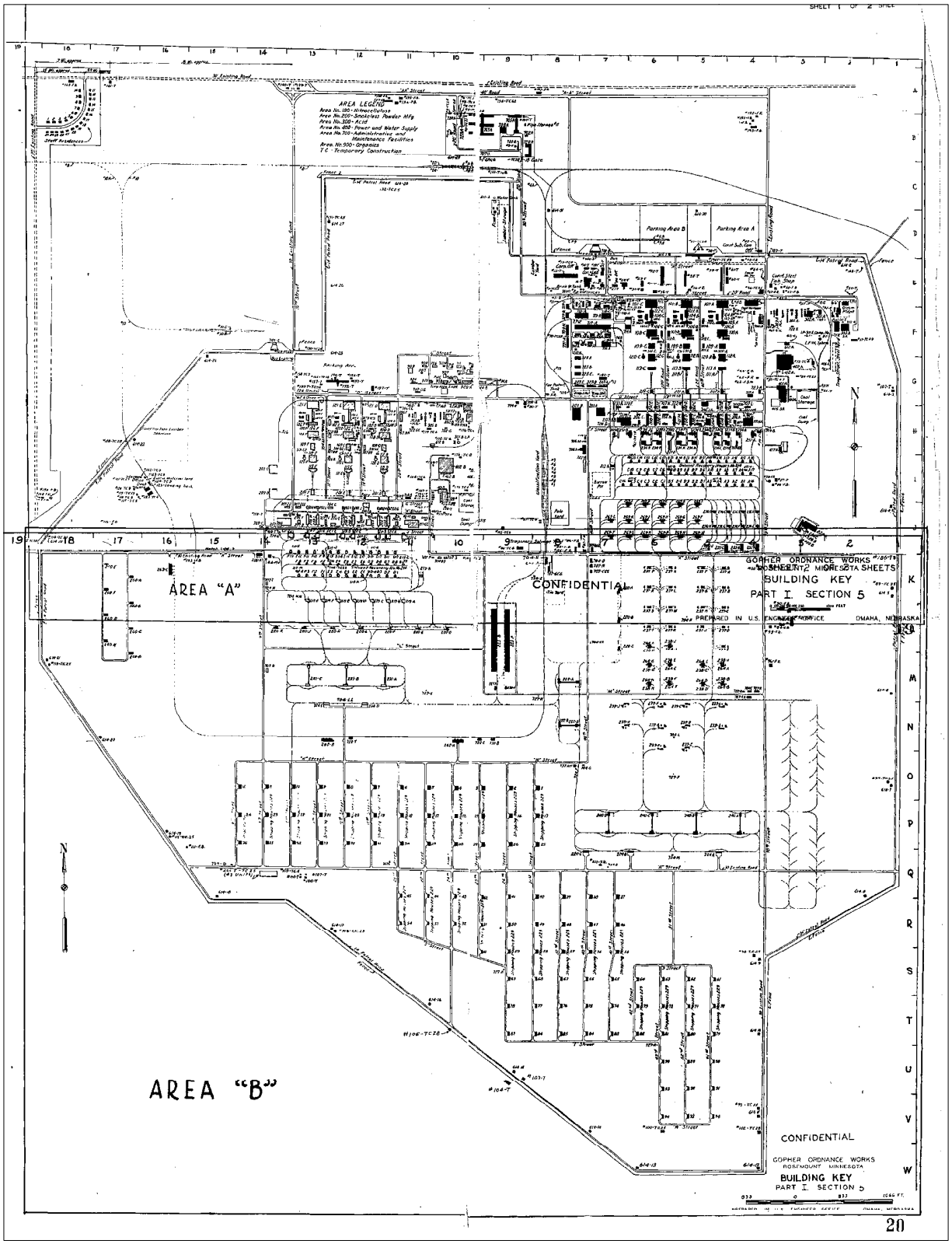
STATE OF ILLINOIS)
) ss
COUNTY OF COOK)

I, [illegible] a Notary Public in and for said State and County aforesaid, do certify that on this 27th day of June, 1951, before me appeared Dr. Arthur B. Price, Regional Director, Federal Security Agency, Region V, Chicago, Illinois, to me personally known, and known to me to be such Regional Director, Region V of the Federal Security Agency, who being by me duly sworn did say that he was such Regional Director, and that he signed his name to said deed in pursuance of proper authority, that said deed was signed by him, as such Regional Director, Region V, Federal Security Agency, on behalf of the United States of America; and that said Dr. Arthur B. Price acknowledged, the execution of said deed to be his free act and deed as such Regional Director, the free act and deed of the United States of American by the Federal Security Agency, and the free act and deed of the Federal Security Agency, acting for the United States of America, and that said Agency has no official seal.

IN WITNESS WHEREOF, I hereunto set my hand at Chicago, Illinois, in the County and State aforesaid, on the date last above written.

[signature]
Notary Public

My Commission Expires 5/25/54



BUILDING KEY
MAP 1

FORMER GOPHER ORDNANCE WORKS
ROSEMONT, MINNESOTA

1:8,000

1,000 0 1,000 2,000 3,000 4,000 Feet

UMP002014

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Building Number	Title	Page Number of Building Plan
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42 F.R.	Farm Residence	None
43 T	Sub-contractors' Facilities	459
44 T	Truck Scale House	None
45 T	Re-steel Shop	None
46 T	Lead Burner Shop	None
47 F.R.	Farm Residence	None
48 F.B.	Farm Garage	None
49 F.B.	Machine Shed	None
50 T	Field Office	None
51 T	Material Storage	None
52 T	Material Storage	None
53 T	Boiler House	460
54 T	Toilet	439
55 T	Field Office	None
56 F. B.	Farm Shed	None
57 F. B.	Farm Barn	None
58 F. R.	Farm Residence	None
59	Farm Residence	None
60 T	Guard House	None
61 T	Guard House	None
62 T	Guard House	None
63 T	Guard House	None
64 F.B.	Farm Barn	None
65 F.R.	Farm Residence	None
66 F. B.	Farm Building	None
67 S.H.	School House	None
68 T	Toilet	439
69 T	Fire Station	None
70 T	Store Room	None
71 T	Store Room	None
72 T	Store Room	None
73 T	Cement Shed	None
74 T	Tool Shed	None
75 T	Guard House	None
76 T	Toilet	439
77 T	Boiler House	461
78 T	Guard House	None
79 F. R.	Farm Residence	None
80 T	Boiler House	460
81 T	Field Office	None
82 T	Storage Shed	462
83 T	Store Room	None

INDEX OF BUILDING PLANS

Building Number	Title	Page Number of Building Plan
84 F. B.	Farm Milk Barn	None
85 F.B.	Farm Machine Shed	None
86 F.B.	Farm Barn	None
87 F.R.	Farm Residence	None
88 F.R.	Farm Residence	None
89 T	Guard House	None
90 F.B.	Farm Granary	None
91 F.B.	Farm Barn	None
92 F.B.	Farm Barn	None
93 F.B.	Farm Milk House	None
94 F B	Farm Garage	None
95 F R	Farm Residence	None
96 F R	Farm Residence	None
97 T	Guard House	None
98 T	Guard House	None
99 T	Toilet	439
100 T	Toilet	439
101-SH	Rural School	None
102 T	Guard House	None
103 T	Toilet	439
104 T	Pistol Range Shed	None
105 T	Guard House	None
106 T	Toilet	None
107 T	Time Office	None
108 T	Sanitary Building	None
109 T	Sanitary House	None
110 T	Boiler House	463
111 F B	Farm Silo	None
112 T	Toilet	None
113 T	Toilet	None
114 T	Toilet	None
115 T	Guard House	None
116 F B	Farm Silo	None
117 T	Cement Shed	None
118 T	Field Office	None
119 T	Paint Shop	None
120 T	Field Office	None
121 T	Toilet	None
122 T	Field Office	None
123 T	Field Office	None
124 T	Field Office	None
125 T	Loading Dock	None
126 T	Store Room	None
127 T	Store Room	None

INDEX OF BUILDING PLANS

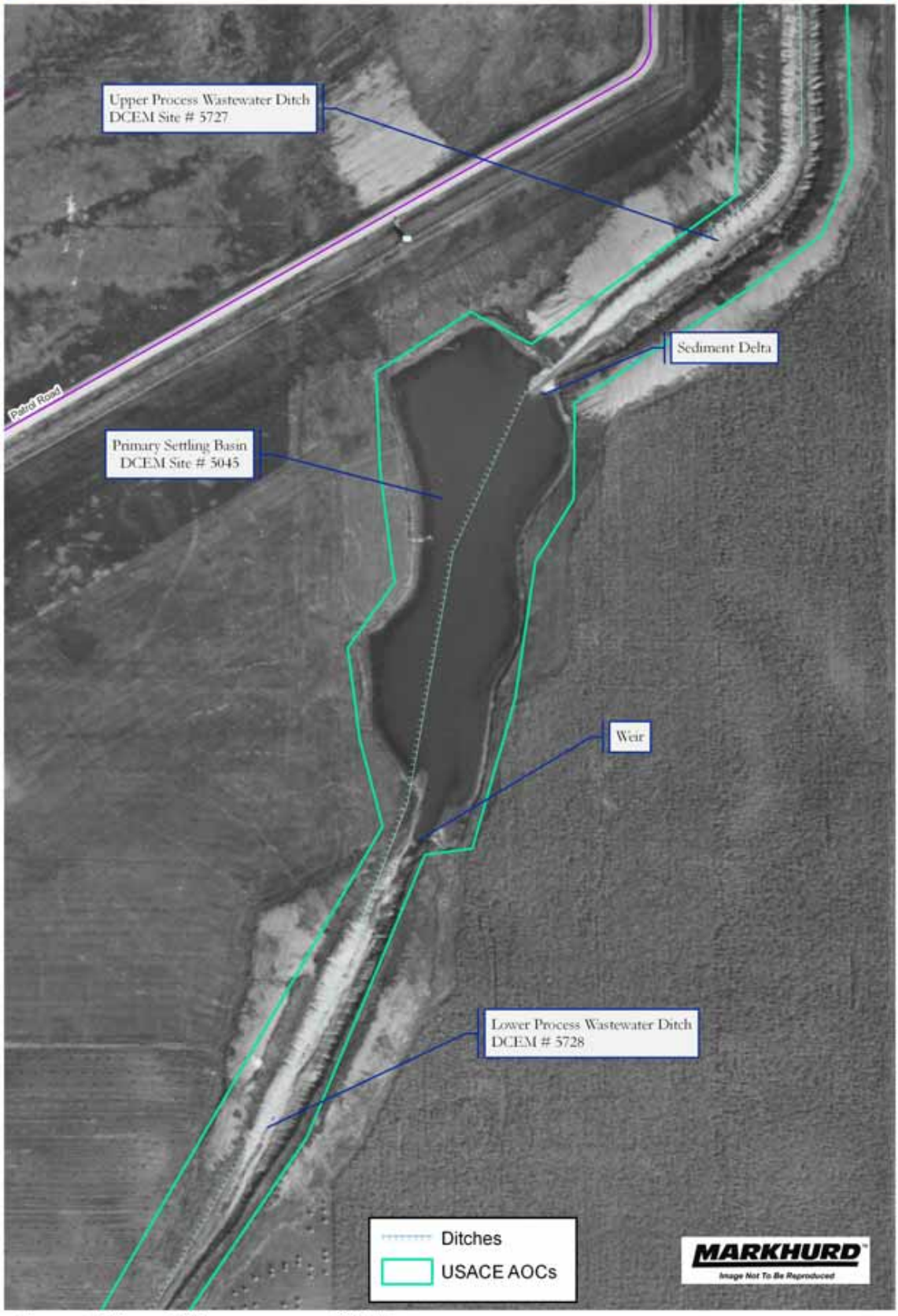
Building Number	Title	Page Number of Building Plan
128 T	Guard House	None
129 T	Guard House	None
130 T	Toilet	439
131 T	Toilet	439
132 T	Toilet	439
133 T	Guard House	None
134 T	Warning Shelter	None
135 F B	Farm Barn	None
136 F B	Farm Granary	None
137 F B	Farm Shed	None
138 F B	Farm Barn	None
139 T	Warning Shelter	None
140 T	Warning Shelter	None
141 T	Garage Shop	464
142 F B	Farm Barn	None
143 F. B.	Farm Silo	None
144 T	Pipe Shop	465
145 T	Field Office	None
146 T	Guard House	None
148 F R	Farm Residence	None
149 F B	Farm Barn	None
150 F B	Farm Silo	None
151 T	Field Office	None
152 T	Boiler Office	460
153 T	Clock Alley	456
154 T	Canteen	None
155 T	Guard House	None
156 T	Canteen	None
157 T	Field Office	None
158 T	Field Office	None
159 T	Machine Shop	None
160 T	Electric Shop	None
161 T	Pipe Shop	465
162 T	Boiler House	None
163 T	Field Office	None
164 T	Riggers Shed	466
165 T	Pipe Shop	465
166 T	Machine Shop	None
167 T	Electric Shop	None
168 T	Storage Shed	None
169 T	Storage Shed	None
170 T	Storage Shed	None
171 T	Tool Shed	None
172 T	Tool Shed	None

INDEX OF BUILDING PLANS

INDEX OF BUILDING PLANS

AOC 1: Primary Settling Basin & Upper Process Wastewater Ditch

Gopher Ordnance Works



0 150 300 600 Feet

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N W E S

Dakota

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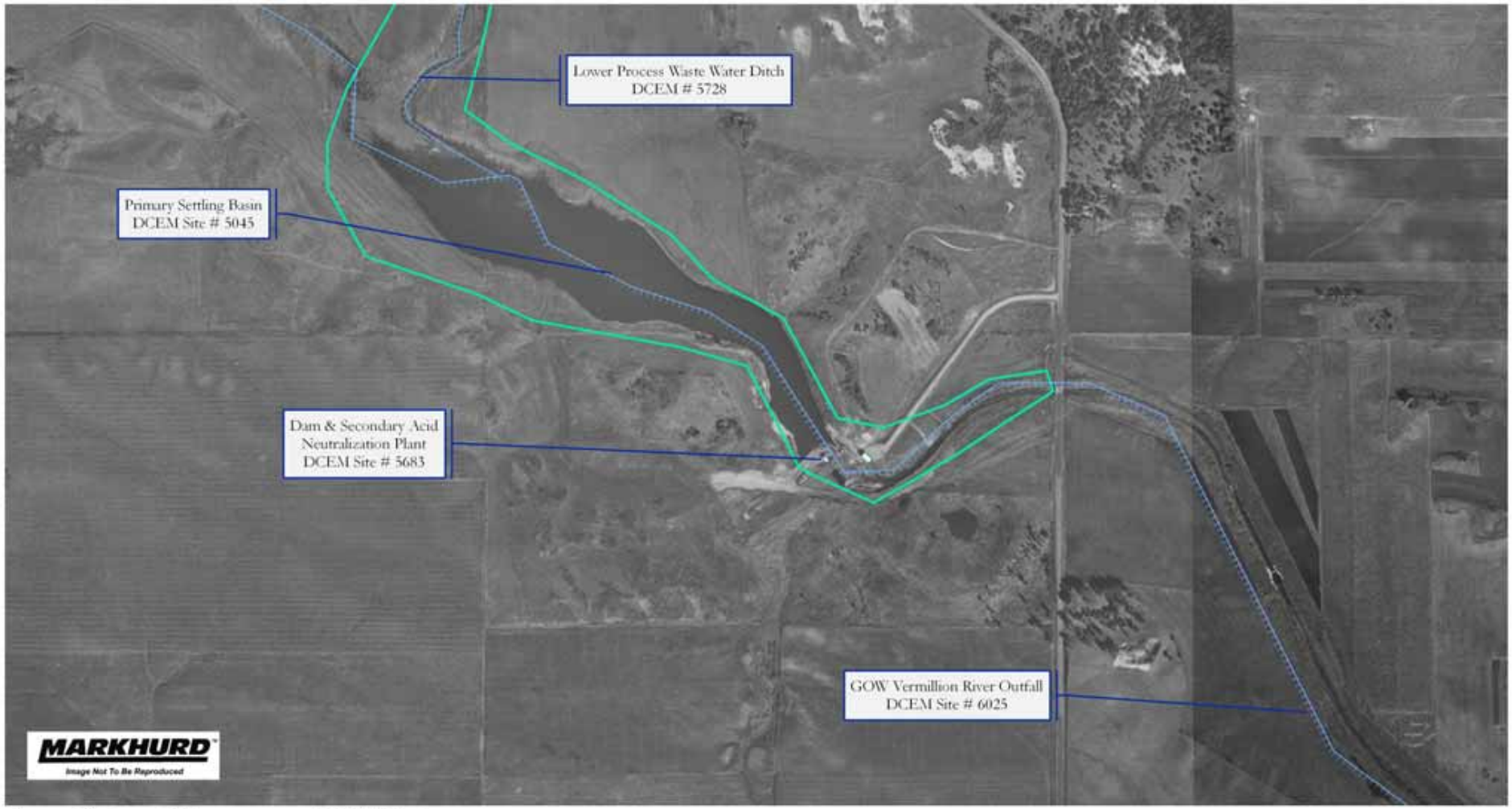
Dakota County Environmental Management
14955 Galaxie Avenue, Apple Valley, MN 55124-8597
(952) 891-7557
environ@co.dakota.mn.us

AOC 1: Secondary Settling Basin & GOW Vermillion River Outfall

Gopher Ordnance Works



0 375 750 1,500 Feet

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N W E S

Ditches
USACE AOCs

Dakota County

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Dakota County Environmental Management
14955 Galaxie Avenue, Apple Valley, MN 55124-8597
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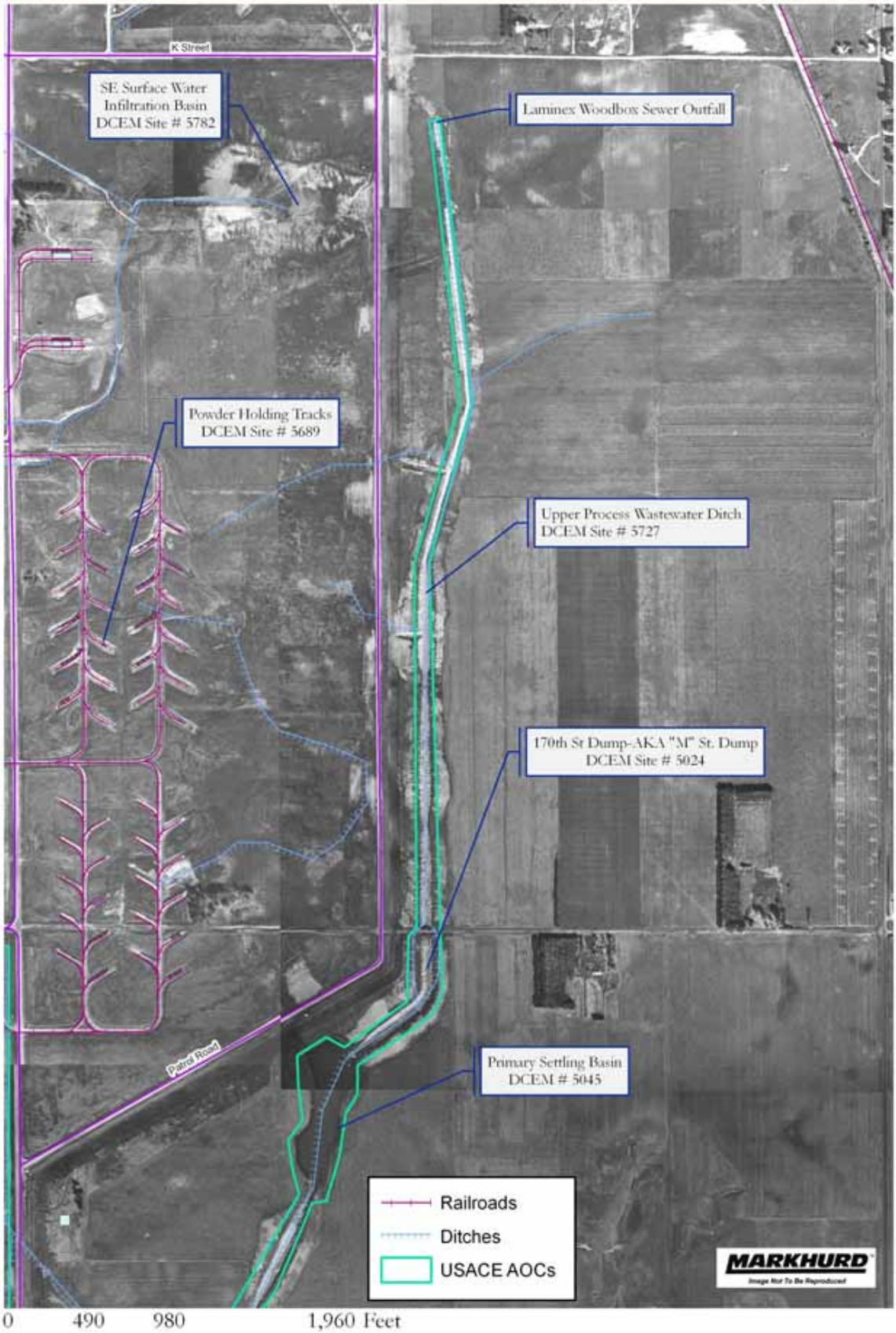
environ@co.dakota.mn.us

UMP002026

AOC 1: Laminex Woodbox Sewer Outfall & Upper Process Wastewater Ditch

Gopher Ordnance Works



0 490 980 1,960 Feet

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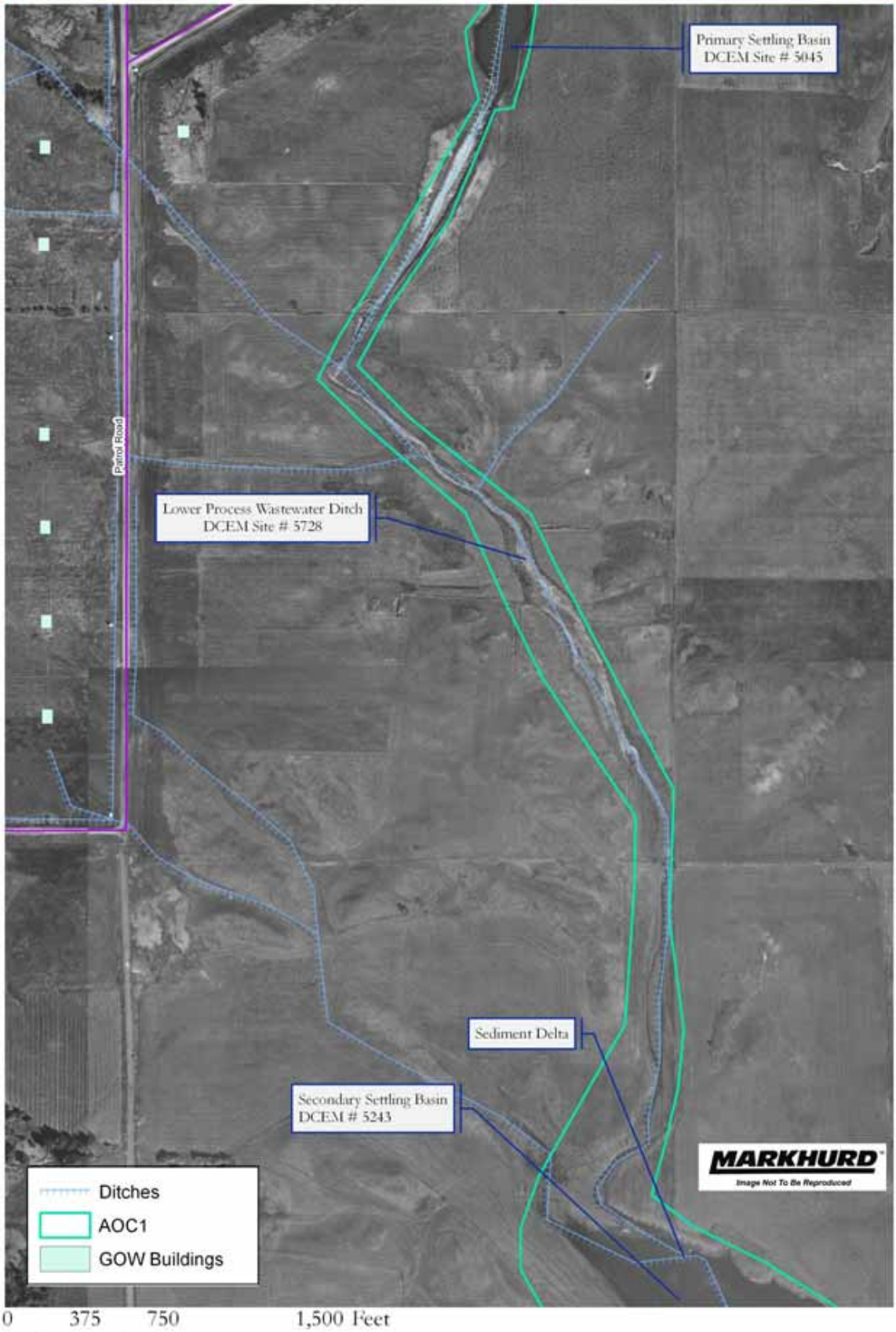
environ@co.dakota.mn.us

AOC 1: Primary Settling Basin & Lower Process Wastewater Ditch

Gopher Ordnance Works



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N
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S

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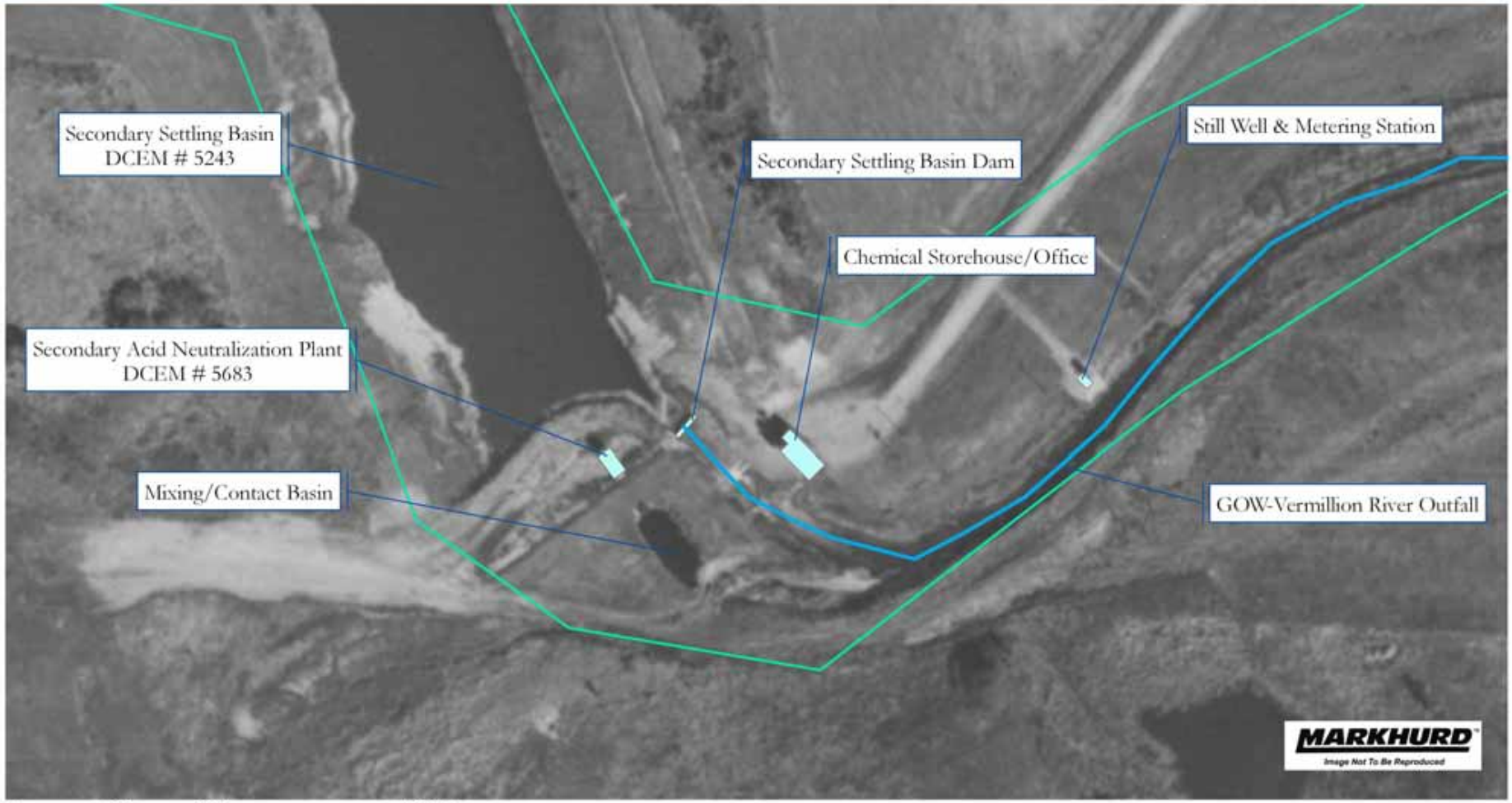
AOC 1: Secondary Acid Neutralization Plant & Vermillion River Outfall Ditch

Gopher Ordnance Works



0 100 200 400 Feet

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Outfall Ditch
AOC 1

Dakota County

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(952) 891-7557
environ@co.dakota.mn.us

AOC 2: Shipping Houses & Surface Water Drainage-2005 Photo

Gopher Ordnance Works

0 0.125 0.25 0.5 Miles

N

Ditches
AOC 2
GOW Buildings
GOW Roads

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Photography Date 2005

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(952) 891-7557
environ@co.dakota.mn.us

AOC 2: Shipping Houses & Surface Water Drainage-1945 Photo

Gopher Ordnance Works

0 0.125 0.25 0.5 Miles

N

Ditches
AOC 2
GOW Buildings
GOW Roads

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environ@co.dakota.mn.us

AOC 4: Sanitation Buildings & Surface Water Drainage-Current

Gopher Ordnance Works

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(952) 891-7557
environ@co.dakota.mn.us

UMP002032

AOC 4: Sanitation Buildings & Surface Water Drainage-Historic

Gopher Ordnance Works

0 75 150 300 Feet

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Dakota County Environmental Management Department staff.
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N

- GOW Roads
- Ditches
- GOW Buildings
- AOC:4

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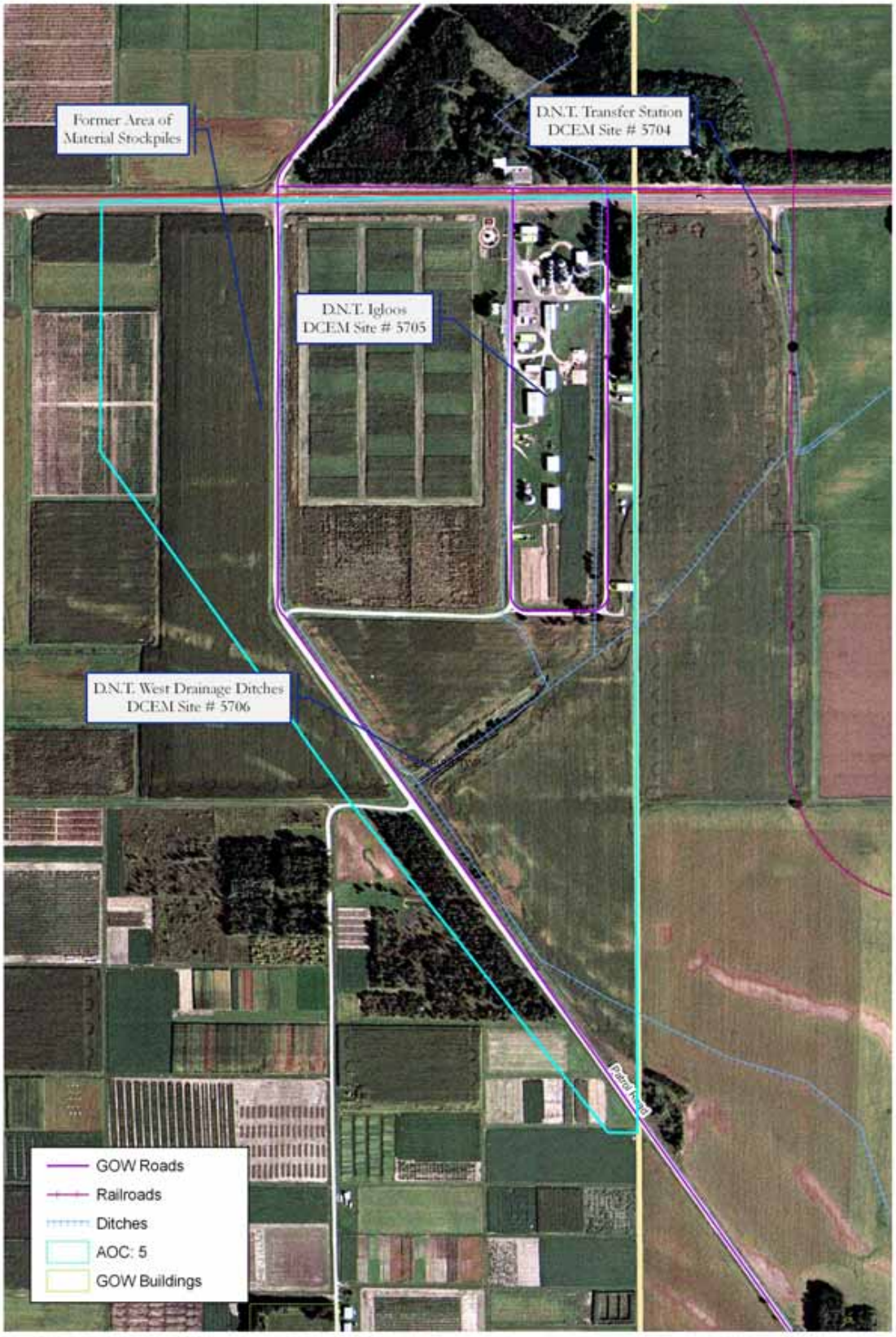
(952) 891-7557
environ@co.dakota.mn.us

AOC 5: D.N.T. Igloos , Transfer Station & Drainage Ditch

Gopher Ordnance Works



0 375 750 1,500 Feet

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Photography Date: 2002

N
W E
S

Dakota County

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(952) 891-7557
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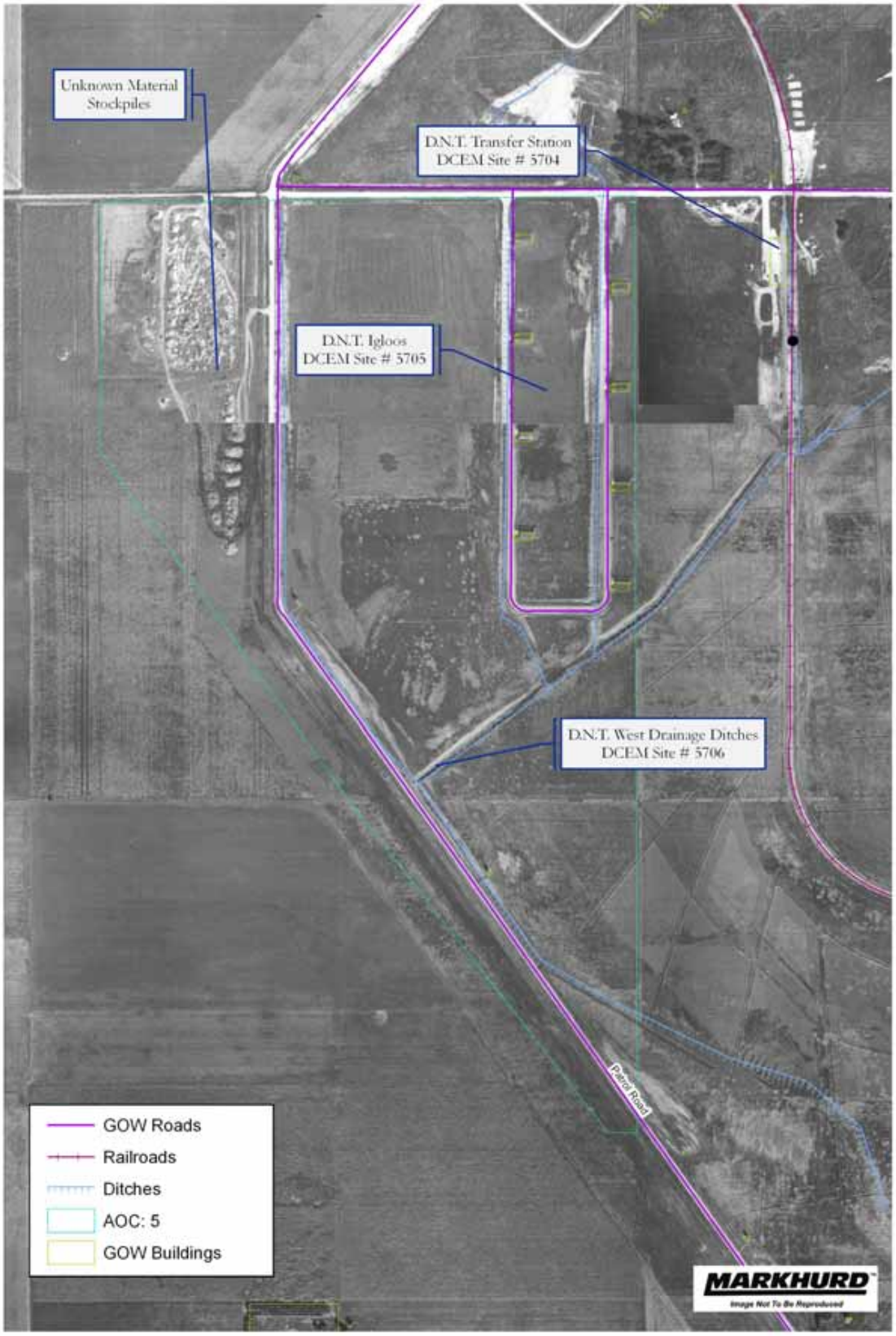
AOC 5: D.N.T. Igloos , Transfer Station & Drainage Ditch

Gopher Ordnance Works



0 375 750 1,500 Feet

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N W E S

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environ@co.dakota.mn.us

AOC 6: 154th Street Disturbed Areas-Current

Gopher Ordnance Works

0 250 500 1,000 Feet

N

AOC 6
GOW Buildings
GOW Roads

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Dakota County Environmental Management Department staff
Photography Date 2005

Presented by:
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(952) 891-7557
environ@co.dakota.mn.us

UMP002036

AOC 6: 154th Street Disturbed Areas

Gopher Ordnance Works

0 250 500 1,000 Feet

N

AOC 6
GOW Buildings
GOW Roads

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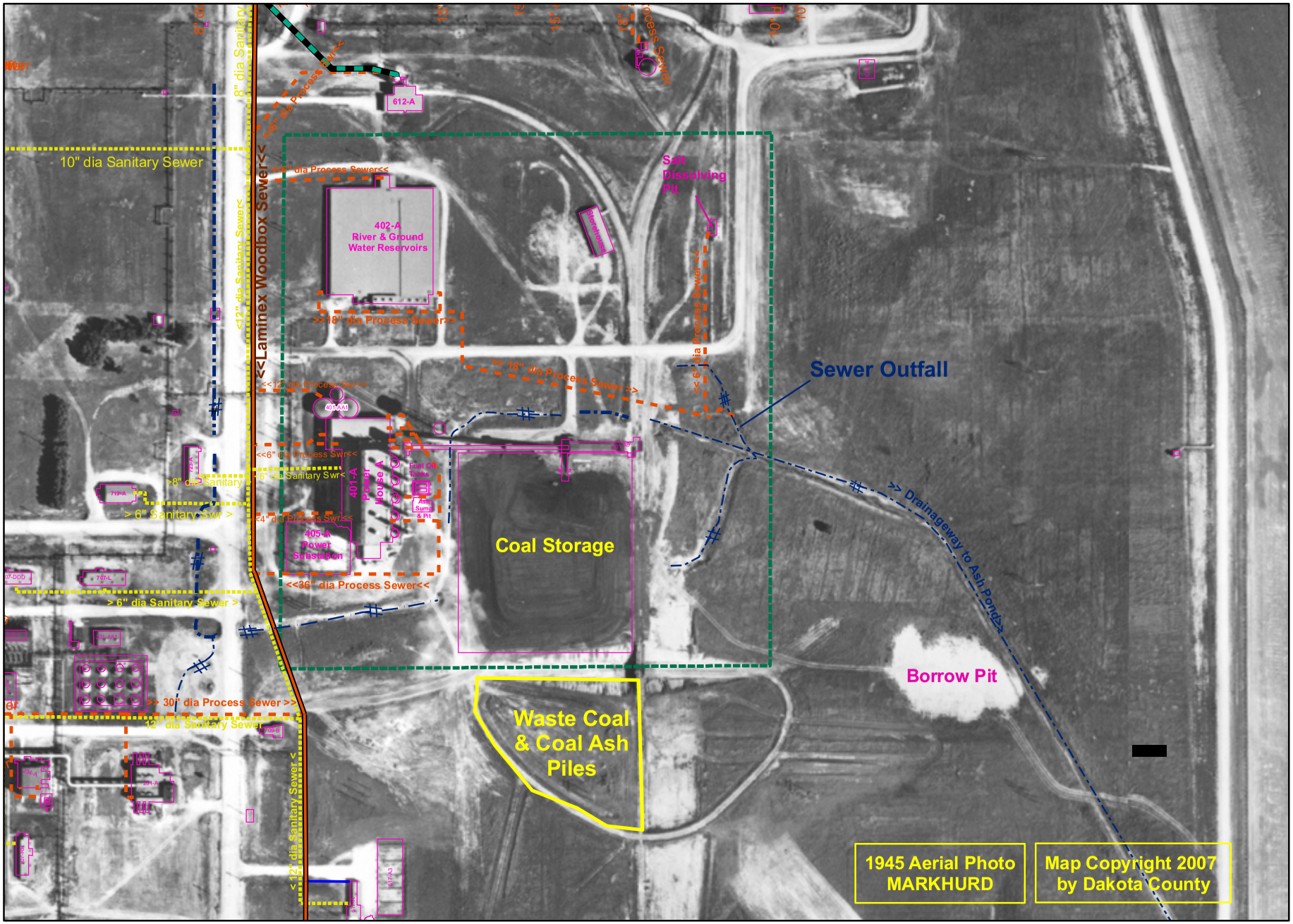
environ@co.dakota.mn.us

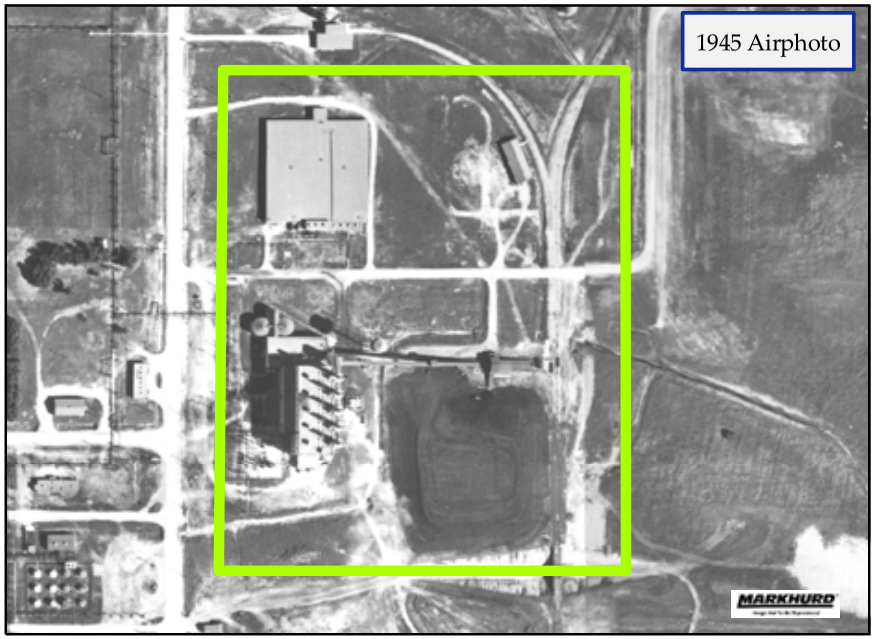
GOW Power Plant A, Water Reservoirs & Surrounding Infrastructure

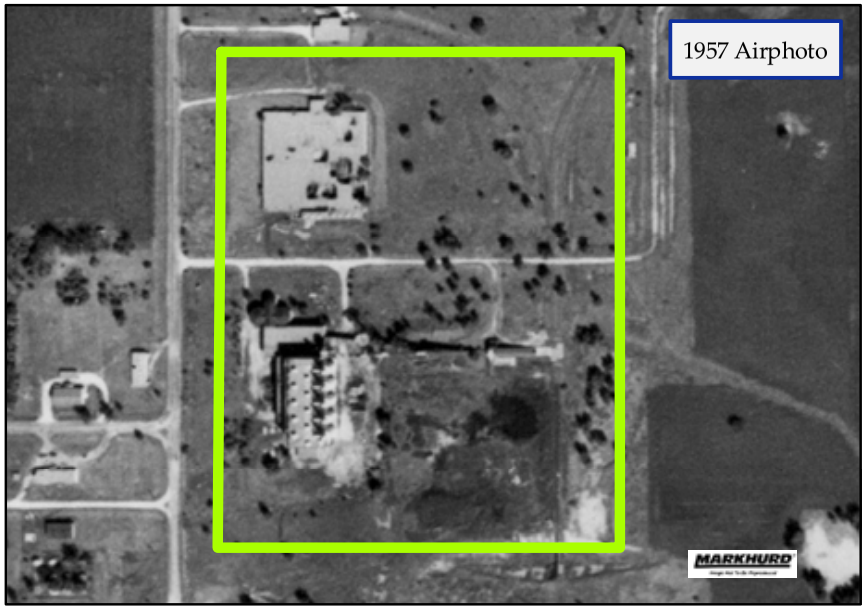


UMP002038

Powerplant A 1945, 1957 and Current Conditions

Gopher Ordnance Works





UMP002039

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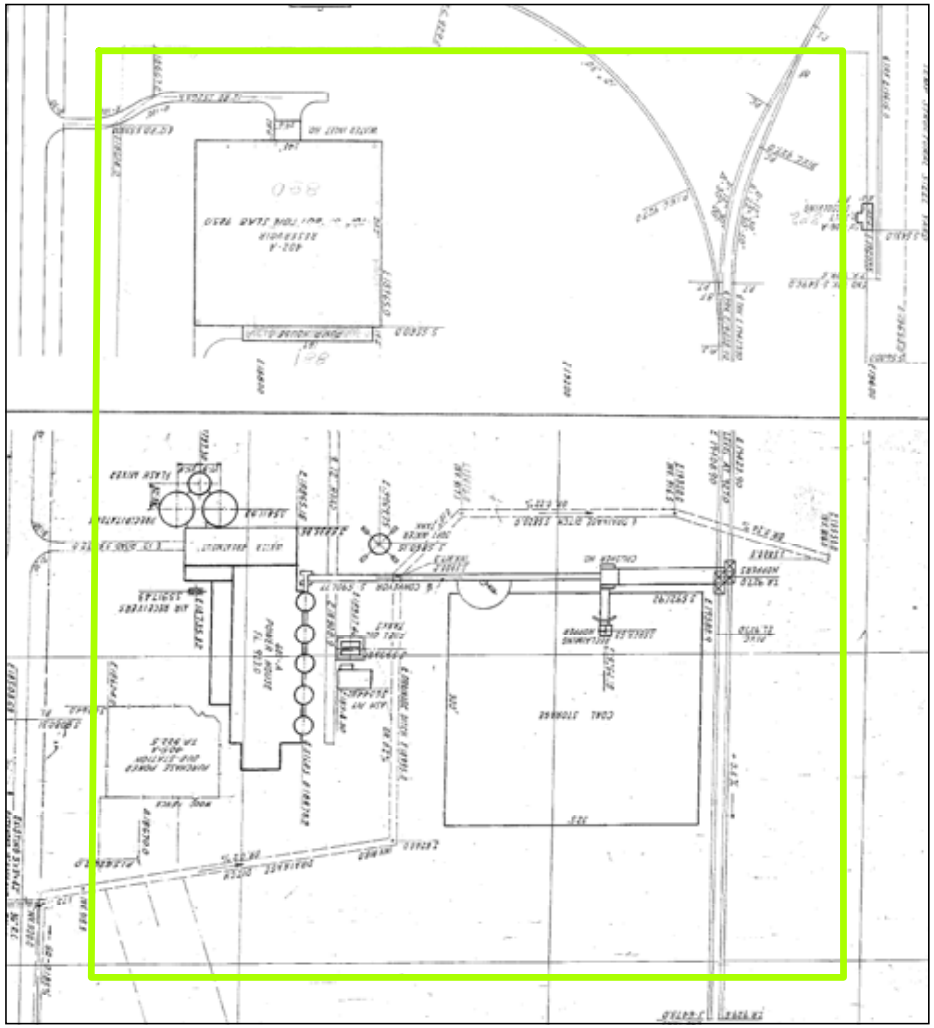
(952) 891-7557
environ@co.dakota.mn.us

AOC 9: Powerplant A - 1945

Gopher Ordnance Works



0 150 300 600 Feet

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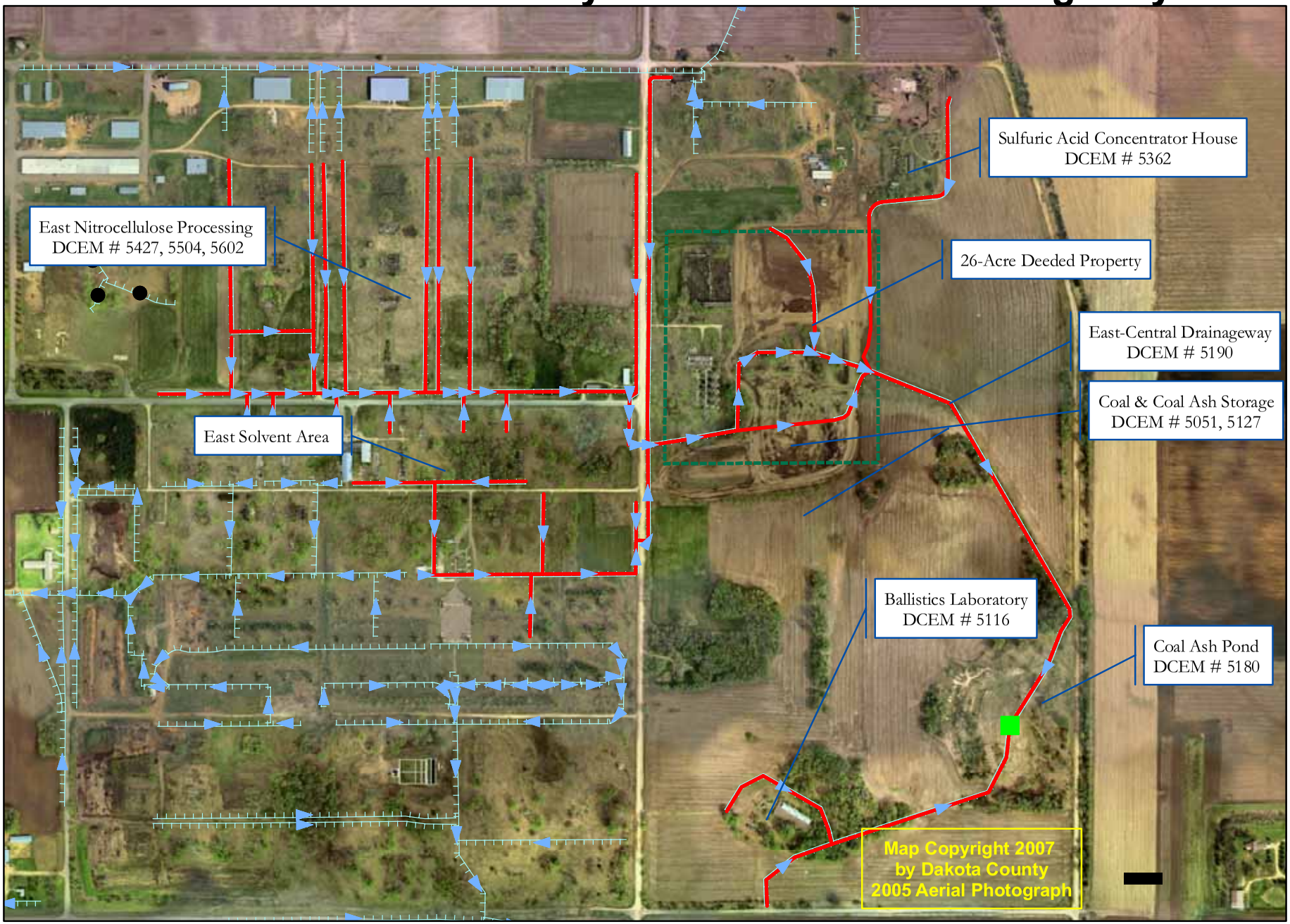
(952) 891-7557
environ@co.dakota.mn.us

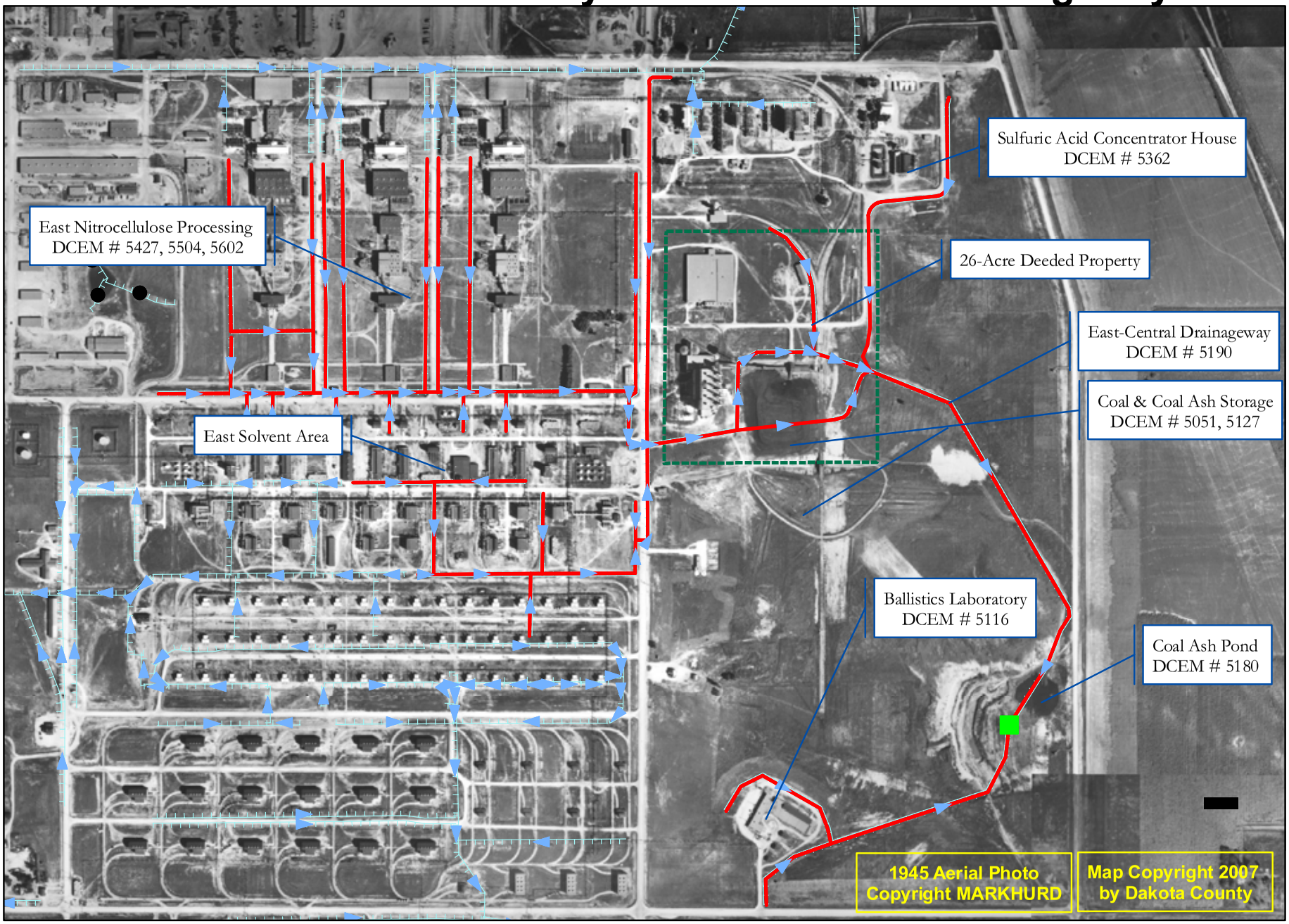
UMP002040

Surface Water Flow Analysis: East-Central Drainageway



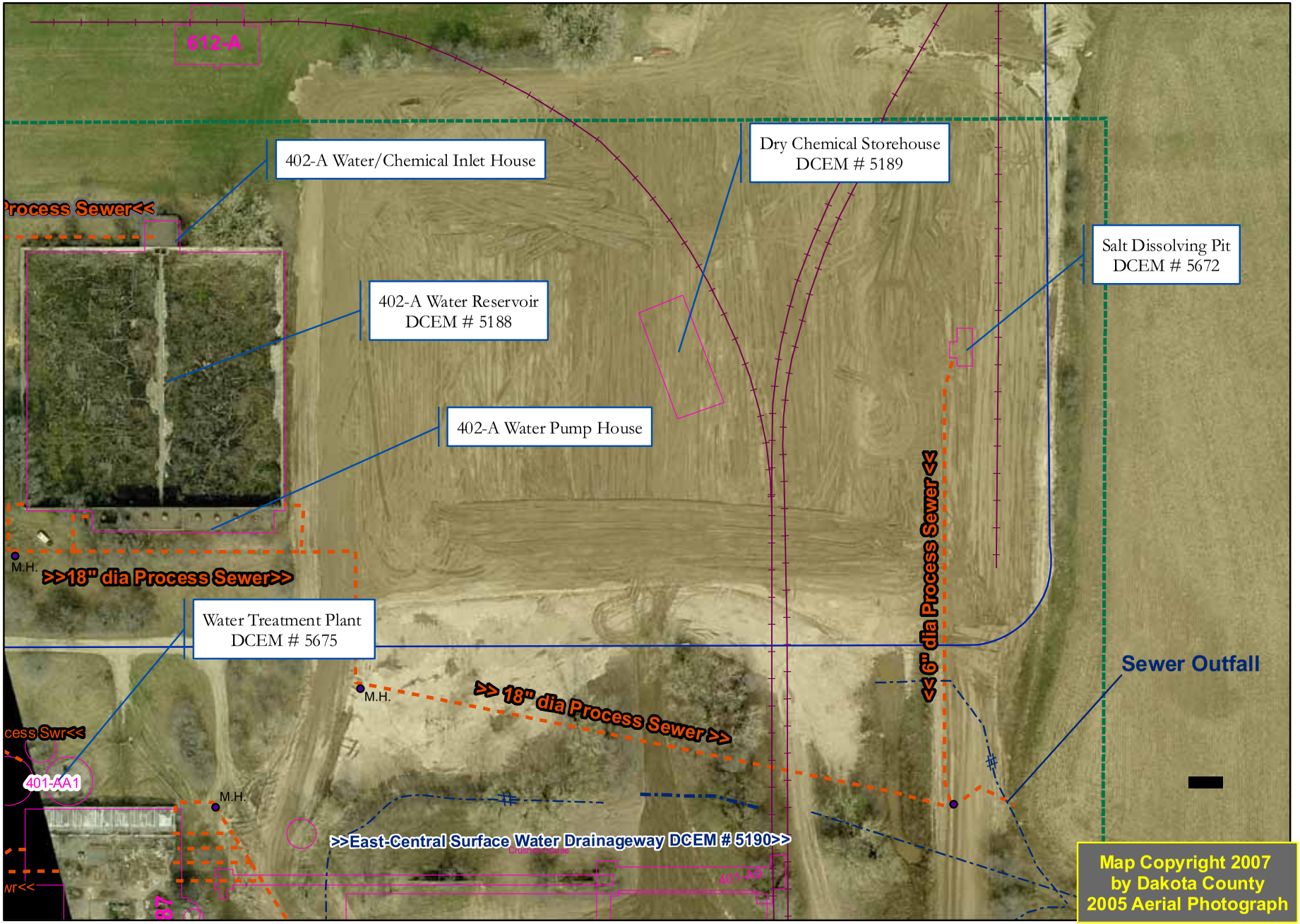
UMP002041

Surface Water Flow Analysis: East-Central Drainageway



UMP002042

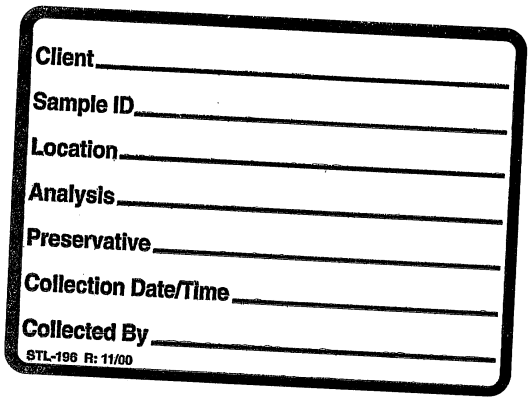
GOW Reservoir, Chemical Storehouse & Salt Dissolving Pit



UMP002043

GOW Reservoir, Chemical Storehouse & Salt Dissolving Pit

UMP002044


Client
Sample ID
Location
Analysis
Preservative
Collection Date/Time
Collected By
STL-196 R: 11/00

APPENDIX D

SCOPE OF WORK FOR SCREENING-LEVEL RISK ASSESSMENT

1. Introduction.

a. A section of the *Site Inspection* (SI) Report for the site needs to be entitled *Screening-Level Risk Assessment.* Subdivide this section into *Human Health Risk Assessment* (HHRA) and *Ecological Risk Assessment* (ERA) subsections. The Screening-Level Risk Assessment is used to evaluate the site to see if it can be eliminated from further concern.

b. Use the Technical Project Planning (TPP) Process (EM 200-1-2) to assist in planning data collection required to prepare the screening-level risk assessment. The work plan shall document Data Quality Objectives (DQOs) for all data collection activities. The Contractor shall ensure that quantitation limits for all dual-purpose samples (i.e., those required for both the HHRA and ERA) are low enough that site concentrations can be evaluated against levels that are known to affect potentially exposed receptors.

c. The Contractor shall evaluate a site's location, history, and possible contaminants present, and make recommendations to the U.S. Army Corps of Engineers (USACE) regarding locations for collection of background samples. The screening-level risk assessment portion of the work plan shall discuss proposed uses of background data, including any statistics to be performed on the background data set, comparisons/screening with site data, and evaluation of essential human nutrients. The screening-level risk assessment in the SI report shall follow through with procedures described in the approved work plan.

2. Human Health Risk Assessment (HHRA). The work plan for the HHRA shall include recommendations regarding the receptor populations, and which exposure pathways and routes are to be evaluated. Recommendations regarding selection of health-based screening levels shall also be discussed in the plan. The HHRA shall conservatively evaluate the potential for adverse human health effects attributable to site contamination. This evaluation will be based on comparing site media concentrations with health-based screening levels, [see *Risk Assessment Guidance for Superfund* (RAGS) *Volume I: Human Health Evaluation Manual (Part A)* (EPA/540/1-89/002)]. Again, use conservative exposure assumptions.

a. Exposure Assessment. Two primary elements of the screening-level risk assessment are identifying the appropriate receptor group or groups and selecting appropriate exposure point concentrations.

(1) The Contractor shall select the population group with the highest reasonable exposure. The Contractor shall prepare a preliminary Conceptual Site Model (CSM) to help identify this

STL Denver
4955 Yarrow Street

Arvada, CO 80002
phone 303-736-0100 fax 303-431-7171

Chain of Custody Record

SEVERN TRENT STL

Severn Trent Laboratories, Inc.

Client Contact	**Project Manager:**	**Site Contact:**	**Date:**	COC No:
Your Company Name here	**Tel/Fax:**	**Lab Contact:**	**Carrier:**	_____ of _____ COCs
Address	**Analysis Turnaround Time**			Job No.
City/State/Zip	Calendar (C) or Work Days (W) _____			
(xxx) xxx-xxxx Phone	TAT if different from Below _____			SDG No.
(xxx) xxx-xxxx FAX	☐ 2 weeks			
Project Name:	☐ 1 week			
Site:	☐ 2 days			
P O #	☐ 1 day			

Sample Identification	**Sample Date**	**Sample Time**	**Sample Type**	**Matrix**	**# of Cont.**	**Filtered Sample**	Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H_2SO_4; 4=HNO_3; 5=NaOH; 6= Other _____

Possible Hazard Identification

☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For _____ Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

Non-Conformance Report **Bay West, Inc.**	**NCR No.**
	ISSUE DATE
	PAGE OF

CONDITION DESCRIPTION (1)

IDENTIFIED ❒ INTERNAL BY: _____ LOC: _____ DATE: _____

❒ EXTERNAL BY: _____ LOC: _____ DATE: _____

REVIEW AND EVALUATION
(COMMENTS)

BRIEF DESCRIPTION OF:
CAUSE, CORRECTIVE ACTION, AND PREVENTIVE ACTION (*as required*)

CORRECTIVE/PREVENTAIVE ACTION AGREED COMPLETION DATE _____ BY _____

VERIFICATION REQUIREMENTS:

❒ CORRECTIVE ACTION: BY _____ PROJ./OFFICE _____ DATE _____

❒ PREVENTAIVE ATCION: BY _____ PROJ./OFFICE _____ DATE _____

INITIAL DISTRIBUTION:	FINAL DISTRIBTUTION (AFTER CLOSEOUT)

CLOSEOUT (3) BY _____ DATE _____

DOCs 91084

STL Denver
Laboratory Quality Manual

MINNESOTA MDH DEPARTMENT OF HEALTH

Minnesota Department Of Health
Environmental Laboratory Certification Program

In accordance with Minnesota Law and Rules

State Laboratory ID: 008-999-405

STL DENVER
4955 Yarrow Street
Arvada, CO 80002

has been certified for the examination of environmental samples for fields of testing listed on the laboratory's Scope of Certification.

Continued certification is contigent upon successful on-going compliance with Minnesota Rules 4740.2010 through 4740.2040. Specific methods and analytes certified are cited on the laboratory's Scope of Certification. **This certificate is valid proof of certification only when associated with its accompanying Scope of Certification.**

The Scope of Certification and reports of on-site inspections are on file at the Minnesota Department of Health, P.O. Box 9441, Minneapolis, Minnesota, 55440-9441. Clients and customers should verify with this agency the laboratory's certification status in Minnesota for particular methods and analytes.

ISSUED: April 22, 2004

EXPIRES: March 4, 2006

Dianne Mandernach

Dianne M. Mandernach, Commissioner of Health

/S/

Suzanne Skonich, Certification Officer

Certificate Number: 10230AA

SEVERN TRENT STL

Date: 11/2/2005

Introductory Statement for STL STL Denver Self Declaration Submittal

DoD Quality Systems Manual
Final Version 3, dated March 2005

Legal Name of Laboratory:	STL Denver
Laboratory Director:	Robert C. Hanisch
Quality Assurance Manager:	Michael L. Schmitt
Street Address:	4955 Yarrow St.
City / State / Zip Code:	Arvada, CO 80002
Phone Number:	303-736-0100
Fax Number:	303-421-7171
Web Site:	http://www.stl-inc.com

STL Denver has a well developed and mature Quality System. This system meets the requirements of the NELAC Standards as applicable to environmental laboratories. The STL Denver Quality System is detailed in the Laboratory Quality Manual, STL Policies and in the laboratory standard operating procedures. STL Denver is accredited for the methods that it will perform in support of the USACE as referenced in the QSM.

STL Denver routinely assesses compliance with its quality system and is also subject to numerous assessments by external agencies and programs. We consider our overall level of compliance with the NELAC standard and the Appendix requirements to be excellent. While our Quality System has been determined to be compliant with NELAC, there are instances of non-compliance that occur which are documented and corrected as part of the assessment process. With this in mind, it is not possible for any lab to claim full compliance, meaning they meet all requirements all of the time. A good quality system recognizes the need for corrective action and continuous improvement.

STL Denver has reviewed the Department of Defense Quality Systems Manual (DoD QSM) as compared with its quality system. We have documented our level of compliance with the QSM and identified specific variances between the current laboratory Quality System and the QSM. The results of this review are presented in the following document.

STL Denver will work with our DoD clients to develop Quality Assurance Project Plans with appropriate data quality objectives that reflect the laboratory Quality System in light of the QSM requirements. Specific objectives found in the QSM that may not be supported by the laboratory quality system should be discussed in detail prior to completion of the QAPjP.

WI-STL-019/A-05/05

Performance Testing Summary for Month

PT Program	Report Date	#Accept	Total Reported	Score (%)
PT - Micro. Make-up from Lab Proficiency	12/27/2005	9	10	90.0
NSI Turbidity Make-up	1/11/2006	1	1	100.0
ERA 8081A Soil PT	1/24/2006	20	20	100.0
APG PT STAT- WP	3/2/2006	3	3	100.0
APG PT STAT - WP	2/27/2006	1	1	100.0
APG PT STAT - WS	3/2/2006	6	6	100.0
APG - March WP	4/27/2006	565	579	97.6

MINNESOTA
MDH
DEPARTMENT OF HEALTH

Protecting, maintaining and improving the health of all Minnesotans

February 27, 2006

Dorothy Leeson
STL North Canton
4101 Shuffel Drive Nw
North Canton, Ohio 44720

RE: Laboratory Number 039-999-348

Dear Ms. Leeson:

We received your laboratory's Application for Environmental Laboratory Certification, performance evaluation sample results and fees on January 13, 2006. Our staff has not fully reviewed your file for compliance with all parts of the Minnesota Rules 4740.2010 through 4740.2040 pertaining to certification of laboratories.

However, based on your laboratory's past compliance and response to requests for information, I am granting your laboratory a 30-day extension of certification during which time your file will be reviewed. This certification will expire on April 16, 2006. By this date, you should either receive a new certificate with an expiration date of March 16, 2008, a letter denying certification or a written request for additional information.

If you have questions, please contact me at the address and phone number below or call the Environmental Laboratory Certification Program at (651) 201-5200.

Sincerely,

Teresa Berry

Teresa Berry, Program Representative
Environmental Laboratory Certification Program
Minnesota Department of Health
601 Robert St. N
PO Box 64899
St. Paul, MN 55164-0899
(651) 201-5322

/tb

Minnesota Department Of Health
Environmental Laboratory Certification Program

In accordance with Minnesota Law and Rules

State Laboratory ID: 039-999-348

SEVERN TRENT LABORATORIES - NORTH CANTON
4101 Shuffel Drive Nw
North Canton, OH 44720

has been certified for the examination of environmental samples for fields of testing listed on the laboratory's Scope of Certification.

Continued certification is contigent upon successful on-going compliance with Minnesota Rules 4740.2010 through 4740.2040. Specific methods and analytes certified are cited on the laboratory's Scope of Certification. **This certificate is valid proof of certification only when associated with its accompanying Scope of Certification.**

The Scope of Certification and reports of on-site inspections are on file at the Minnesota Department of Health, P.O. Box 9441, Minneapolis, Minnesota, 55440-9441. Clients and customers should verify with this agency the laboratory's certification status in Minnesota for particular methods and analytes.

ISSUED: March 29, 2004

EXPIRES: March 16, 2006

Dianne M. Mandernach, Commissioner of Health

Sharon Dahl, Certification Officer

Certificate Number: 10823AA

MINNESOTA MDH DEPARTMENT OF HEALTH

Protecting, maintaining and improving the health of all Minnesotans

March 29, 2004

RECEIVED
APR 06 2004

Dorothy Leeson
Severn Trent Laboratories - North Canton
4101 Shuffel Drive Nw
North Canton, Ohio 44720

RE: Laboratory Number 039-999-348

Dear Ms. Leeson:

We have received your laboratory's Application for Certification, appropriate fees and proficiency testing results. After reviewing all the information/documents received, the Minnesota Department of Health (MDH) is issuing certification for the analytes as listed in the enclosed Scope of Certification. **The enclosed certificate (10823AA) is valid proof of certification only when associated with its accompanying Scope of Certification.**

Your laboratory must analyze a proficiency testing sample from an approved provider for each certified method and analyte by March 16, 2005. The laboratory must forward the results of these proficiency testing samples to the MDH within 30 days from the date your laboratory receives them. In addition, it is the laboratory's duty to notify the MDH within 30 days of changes in laboratory location or ownership, major analytical equipment, test methodology or supervisory staff, as detailed in Minnesota Rules, Chapter 4740, part 4740.2030, subpart 10.

If your laboratory wishes to renew its certification, an application, appropriate fees, changes in your quality assurance manual and laboratory procedures must be received by January 15, 2006.

If you have questions, please contact me at the address and phone number below or call the Environmental Laboratory Certification Program at (612) 676-5200.

Sincerely,

Sharon Dahl

Sharon Dahl, Certification Officer
Environmental Laboratory Section
Public Health Laboratory Division
Minnesota Department of Health
P.O. Box 9441
Minneapolis, Minnesota 55440-9441
(612) 676-5243

/th
Enclosure

MINNESOTA MDH DEPARTMENT OF HEALTH

Environmental Laboratory Certification Program
Scope of Certification

THIS LISTING OF CERTIFIED FIELDS OF TESTING MUST BE ACCOMPANIED BY CERTIFICATE NUMBER: 10823AA

State Laboratory ID: 039-999-348 **EPA Lab Code:** OH00048 **Expiration Date:** March 16, 2006

SEVERN TRENT LABORATORIES - NORTH CANTON
4101 Shuffel Drive Nw
North Canton, OH 44720
Phone 330-497-9396

Clean Water Program

Analyte	Method	Matrix
Alkalinity	EPA 310.1	Non-potable Water
Chemical Oxygen Demand	EPA 410.4	Non-potable Water
Cyanide	EPA 335.2	Non-potable Water
Nitrogen, Ammonia	EPA 350.2	Non-potable Water
Nitrogen, Ammonia	EPA 350.3	Non-potable Water
Nitrogen, Total Kjeldahl	EPA 351.2	Non-potable Water
Nitrogen, Total Kjeldahl	EPA 351.3	Non-potable Water
Nitrogen, Nitrate	EPA 353.2/354.1	Non-potable Water
Nitrogen, Nitrate + Nitrite	EPA 353.2	Non-potable Water
Oil and Grease	EPA 1664A (HEM)	Non-potable Water
Organic Carbon, Total	EPA 415.1	Non-potable Water
Phenol, Total Compounds	EPA 420.1	Non-potable Water
Phosphorus, Ortho	EPA 365.2	Non-potable Water
Phosphorus, Total	EPA 365.2	Non-potable Water
Solids, Total	EPA 160.3	Non-potable Water
Solids, Dissolved	EPA 160.1	Non-potable Water
Solids, Nonfilterable (TSS)	EPA 160.2	Non-potable Water
Specific Conductance	EPA 120.1	Non-potable Water
Sulfide	EPA 376.1	Non-potable Water
Aluminum	EPA 200.7	Non-potable Water
Antimony	EPA 200.7	Non-potable Water
Arsenic	EPA 200.7	Non-potable Water
Barium	EPA 200.7	Non-potable Water
Beryllium	EPA 200.7	Non-potable Water
Boron	EPA 200.7	Non-potable Water
Cadmium	EPA 200.7	Non-potable Water
Calcium	EPA 200.7	Non-potable Water
Chromium, Hexavalent	SM 18th ED 3500-Cr D	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

Environmental Laboratory Certification Program
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SEVERN TRENT LABORATORIES - NORTH CANTON
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North Canton, OH 44720
Phone 330-497-9396

Clean Water Program

Analyte	Method	Matrix
Chromium	EPA 200.7	Non-potable Water
Cobalt	EPA 200.7	Non-potable Water
Copper	EPA 200.7	Non-potable Water
Iron	EPA 200.7	Non-potable Water
Lead	EPA 200.7	Non-potable Water
Magnesium	EPA 200.7	Non-potable Water
Manganese	EPA 200.7	Non-potable Water
Mercury	EPA 1631E	Non-potable Water
Mercury	EPA 245.1	Non-potable Water
Molybdenum	EPA 200.7	Non-potable Water
Nickel	EPA 200.7	Non-potable Water
Potassium	EPA 200.7	Non-potable Water
Selenium	EPA 200.7	Non-potable Water
Silver	EPA 200.7	Non-potable Water
Sodium	EPA 200.7	Non-potable Water
Thallium	EPA 200.7	Non-potable Water
Tin	EPA 200.7	Non-potable Water
Vanadium	EPA 200.7	Non-potable Water
Zinc	EPA 200.7	Non-potable Water
Dichlorodifluoromethane	EPA 601	Non-potable Water
Chloromethane	EPA 601	Non-potable Water
Chloromethane	EPA 624	Non-potable Water
Vinyl chloride	EPA 601	Non-potable Water
Bromomethane	EPA 601	Non-potable Water
Chloroethane	EPA 601	Non-potable Water
Trichlorofluoromethane	EPA 601	Non-potable Water
1,1-Dichloroethene	EPA 601	Non-potable Water
Methylene chloride	EPA 601	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

Environmental Laboratory Certification Program
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North Canton, OH 44720
Phone 330-497-9396

Clean Water Program

Analyte	Method	Matrix
trans-1,2-Dichloroethene	EPA 601	Non-potable Water
1,1-Dichloroethane	EPA 601	Non-potable Water
2,2-Dichloropropane	EPA 601	Non-potable Water
cis-1,2-Dichloroethene	EPA 601	Non-potable Water
Chloroform	EPA 601	Non-potable Water
Bromochloromethane	EPA 601	Non-potable Water
1,1,1-Trichloroethane	EPA 601	Non-potable Water
Carbon tetrachloride	EPA 601	Non-potable Water
1,2-Dichloroethane	EPA 601	Non-potable Water
Trichloroethene	EPA 601	Non-potable Water
1,2-Dichloropropane	EPA 601	Non-potable Water
Bromodichloromethane	EPA 601	Non-potable Water
Bromodichloromethane	EPA 624	Non-potable Water
Dibromomethane	EPA 601	Non-potable Water
cis-1,3-Dichloropropene	EPA 601	Non-potable Water
trans-1,3-Dichloropropene	EPA 601	Non-potable Water
1,1,2-Trichloroethane	EPA 601	Non-potable Water
1,3-Dichloropropane	EPA 601	Non-potable Water
Tetrachloroethene	EPA 601	Non-potable Water
Chlorodibromomethane	EPA 601	Non-potable Water
1,2-Dibromoethane	EPA 601	Non-potable Water
Chlorobenzene	EPA 601	Non-potable Water
Chlorobenzene	EPA 602	Non-potable Water
1,1,1,2-Tetrachloroethane	EPA 601	Non-potable Water
Bromoform	EPA 601	Non-potable Water
1,1,2,2-Tetrachloroethane	EPA 601	Non-potable Water
1,2,3-Trichloropropane	EPA 601	Non-potable Water
Bromobenzene	EPA 601	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

Environmental Laboratory Certification Program
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North Canton, OH 44720
Phone 330-497-9396

Clean Water Program

Analyte	Method	Matrix
2-Chlorotoluene	EPA 601	Non-potable Water
4-Chlorotoluene	EPA 601	Non-potable Water
1,3-Dichlorobenzene	EPA 601	Non-potable Water
1,3-Dichlorobenzene	EPA 602	Non-potable Water
1,2-Dibromo-3-Chloropropane	EPA 601	Non-potable Water
Benzene	EPA 601	Non-potable Water
Benzene	EPA 602	Non-potable Water
Toluene	EPA 601	Non-potable Water
Ethyl benzene	EPA 601	Non-potable Water
m+p-Xylene	EPA 601	Non-potable Water
o-Xylene	EPA 601	Non-potable Water
Styrene	EPA 601	Non-potable Water
Isopropylbenzene	EPA 601	Non-potable Water
n-Propylbenzene	EPA 601	Non-potable Water
1,3,5-Trimethylbenzene	EPA 601	Non-potable Water
tert-Butylbenzene	EPA 601	Non-potable Water
1,2,4-Trimethylbenzene	EPA 601	Non-potable Water
sec-Butylbenzene	EPA 601	Non-potable Water
p-Isopropyltoluene	EPA 601	Non-potable Water
n-Butylbenzene	EPA 601	Non-potable Water
Naphthalene	EPA 601	Non-potable Water
Acetone	EPA 601	Non-potable Water
2-Chloroethylvinylether	EPA 601	Non-potable Water
Methyl ethyl ketone	EPA 601	Non-potable Water
Acrolein	EPA 624	Non-potable Water
Acrylonitrile	EPA 624	Non-potable Water
Butyl benzyl phthalate	EPA 625	Non-potable Water
Di-2(ethylhexyl) phthalate	EPA 625	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

Environmental Laboratory Certification Program
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Clean Water Program

Analyte	Method	Matrix
Di-n-butyl phthalate	EPA 625	Non-potable Water
Di-n-octyl phthalate	EPA 625	Non-potable Water
Diethyl phthalate	EPA 625	Non-potable Water
Dimethyl phthalate	EPA 625	Non-potable Water
Aldrin	EPA 608	Non-potable Water
alpha-BHC	EPA 608	Non-potable Water
beta-BHC	EPA 608	Non-potable Water
delta-BHC	EPA 608	Non-potable Water
gamma-BHC (Lindane)	EPA 608	Non-potable Water
4,4'-DDD	EPA 608	Non-potable Water
4,4'-DDE	EPA 608	Non-potable Water
4,4'-DDT	EPA 608	Non-potable Water
Dieldrin	EPA 608	Non-potable Water
Endosulfan I	EPA 608	Non-potable Water
Endosulfan II	EPA 608	Non-potable Water
Endosulfan sulfate	EPA 608	Non-potable Water
Endrin	EPA 608	Non-potable Water
Endrin Aldehyde	EPA 608	Non-potable Water
Heptachlor	EPA 608	Non-potable Water
Heptachlor epoxide	EPA 608	Non-potable Water
PCB-1016	EPA 608	Non-potable Water
PCB-1221	EPA 608	Non-potable Water
PCB-1232	EPA 608	Non-potable Water
PCB-1242	EPA 608	Non-potable Water
PCB-1248	EPA 608	Non-potable Water
PCB-1254	EPA 608	Non-potable Water
PCB-1260	EPA 608	Non-potable Water
Toxaphene	EPA 608	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

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Phone 330-497-9396

Clean Water Program

Analyte	Method	Matrix
4-Chloro-3-methylphenol	EPA 625	Non-potable Water
2-Chlorophenol	EPA 625	Non-potable Water
2,4-Dichlorophenol	EPA 625	Non-potable Water
2,4-Dimethylphenol	EPA 625	Non-potable Water
2-Methyl-4,6-dinitrophenol	EPA 625	Non-potable Water
2-Nitrophenol	EPA 625	Non-potable Water
Pentachlorophenol	EPA 625	Non-potable Water
Phenol	EPA 625	Non-potable Water
2,4,6-Trichlorophenol	EPA 625	Non-potable Water
4-Nitrophenol	EPA 625	Non-potable Water
Bis-(2-chloroethyl) ether	EPA 625	Non-potable Water
Bis-(2-chloroethoxy)methane	EPA 625	Non-potable Water
4-Bromophenylphenyl ether	EPA 625	Non-potable Water
4-Chlorophenylphenyl ether	EPA 625	Non-potable Water
2-Chloronaphthalene	EPA 625	Non-potable Water
Hexachlorobenzene	EPA 625	Non-potable Water
Hexachlorobutadiene	EPA 625	Non-potable Water
Hexachlorocyclopentadiene	EPA 625	Non-potable Water
Hexachloroethane	EPA 625	Non-potable Water
1,2,4-Trichlorobenzene	EPA 625	Non-potable Water
Acenaphthene	EPA 610	Non-potable Water
Acenaphthene	EPA 625	Non-potable Water
Acenaphthylene	EPA 610	Non-potable Water
Acenaphthylene	EPA 625	Non-potable Water
Anthracene	EPA 610	Non-potable Water
Anthracene	EPA 625	Non-potable Water
Benzo(a)anthracene	EPA 610	Non-potable Water
Benzo(a)anthracene	EPA 625	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

Environmental Laboratory Certification Program
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SEVERN TRENT LABORATORIES - NORTH CANTON
4101 Shuffel Drive Nw
North Canton, OH 44720
Phone 330-497-9396

Clean Water Program

Analyte	Method	Matrix
Benzo(a)pyrene	EPA 610	Non-potable Water
Benzo(a)pyrene	EPA 625	Non-potable Water
Benzo(b)fluoranthene	EPA 610	Non-potable Water
Benzo(b)fluoranthene	EPA 625	Non-potable Water
Benzo(g,h,i)perylene	EPA 610	Non-potable Water
Benzo(g,h,i)perylene	EPA 625	Non-potable Water
Benzo(k)fluoranthene	EPA 610	Non-potable Water
Benzo(k)fluoranthene	EPA 625	Non-potable Water
Chrysene	EPA 610	Non-potable Water
Chrysene	EPA 625	Non-potable Water
Dibenz(a,h)anthracene	EPA 610	Non-potable Water
Dibenz(a,h)anthracene	EPA 625	Non-potable Water
Fluoranthene	EPA 610	Non-potable Water
Fluoranthene	EPA 625	Non-potable Water
Fluorene	EPA 610	Non-potable Water
Fluorene	EPA 625	Non-potable Water
Indeno(1,2,3-cd)pyrene	EPA 610	Non-potable Water
Indeno(1,2,3-cd)pyrene	EPA 625	Non-potable Water
Naphthalene	EPA 610	Non-potable Water
Naphthalene	EPA 625	Non-potable Water
Phenanthrene	EPA 610	Non-potable Water
Phenanthrene	EPA 625	Non-potable Water
Pyrene	EPA 610	Non-potable Water
Pyrene	EPA 625	Non-potable Water
2,4-Dinitrotoluene	EPA 625	Non-potable Water
2,6-Dinitrotoluene	EPA 625	Non-potable Water
Isophorone	EPA 625	Non-potable Water
Nitrobenzene	EPA 625	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

Environmental Laboratory Certification Program
Scope of Certification

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SEVERN TRENT LABORATORIES - NORTH CANTON
4101 Shuffel Drive Nw
North Canton, OH 44720
Phone 330-497-9396

Clean Water Program

Analyte	Method	Matrix
Benzidine	EPA 625	Non-potable Water
3,3'-Dichlorobenzidine	EPA 625	Non-potable Water
N-Nitrosodimethylamine	EPA 625	Non-potable Water
N-Nitrosodiphenylamine	EPA 625	Non-potable Water
N-Nitrosodi-n-propylamine	EPA 625	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

Environmental Laboratory Certification Program
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SEVERN TRENT LABORATORIES - NORTH CANTON
4101 Shuffel Drive Nw
North Canton, OH 44720
Phone 330-497-9396

Resource Conservation and Recovery Program

Analyte	Method	Matrix
Arsenic	EPA 6010B	Non-potable Water
Arsenic	EPA 6020	Solid and Chemical Materials
Arsenic	EPA 6010B	Solid and Chemical Materials
Arsenic	EPA 6020	Non-potable Water
Barium	EPA 6010B	Non-potable Water
Barium	EPA 6010B	Solid and Chemical Materials
Barium	EPA 6020	Non-potable Water
Barium	EPA 6020	Solid and Chemical Materials
Cadmium	EPA 6010B	Non-potable Water
Cadmium	EPA 6020	Solid and Chemical Materials
Cadmium	EPA 6010B	Solid and Chemical Materials
Cadmium	EPA 6020	Non-potable Water
Chromium	EPA 6010B	Non-potable Water
Chromium	EPA 6010B	Solid and Chemical Materials
Chromium	EPA 6020	Non-potable Water
Chromium	EPA 6020	Solid and Chemical Materials
Copper	EPA 6010B	Non-potable Water
Copper	EPA 6020	Solid and Chemical Materials
Copper	EPA 6010B	Solid and Chemical Materials
Copper	EPA 6020	Non-potable Water
Lead	EPA 6010B	Non-potable Water
Lead	EPA 6010B	Solid and Chemical Materials
Lead	EPA 6020	Non-potable Water
Lead	EPA 6020	Solid and Chemical Materials
Mercury	EPA 7470A	Non-potable Water
Mercury	EPA 7471A	Solid and Chemical Materials
Molybdenum	EPA 6010B	Non-potable Water
Molybdenum	EPA 6020	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

Environmental Laboratory Certification Program
Scope of Certification

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SEVERN TRENT LABORATORIES - NORTH CANTON
4101 Shuffel Drive Nw
North Canton, OH 44720
Phone 330-497-9396

Resource Conservation and Recovery Program

Analyte	Method	Matrix
Molybdenum	EPA 6020	Solid and Chemical Materials
Molybdenum	EPA 6010B	Solid and Chemical Materials
Nickel	EPA 6010B	Non-potable Water
Nickel	EPA 6020	Non-potable Water
Nickel	EPA 6020	Solid and Chemical Materials
Nickel	EPA 6010B	Solid and Chemical Materials
Selenium	EPA 6010B	Non-potable Water
Selenium	EPA 6020	Non-potable Water
Selenium	EPA 6020	Solid and Chemical Materials
Selenium	EPA 6010B	Solid and Chemical Materials
Silver	EPA 6010B	Non-potable Water
Silver	EPA 6020	Non-potable Water
Silver	EPA 6020	Solid and Chemical Materials
Silver	EPA 6010B	Solid and Chemical Materials
Zinc	EPA 6010B	Non-potable Water
Zinc	EPA 6020	Solid and Chemical Materials
Zinc	EPA 6010B	Solid and Chemical Materials
Zinc	EPA 6020	Non-potable Water
Toxicity Characteristic Leaching Proc	EPA 1311	Non-potable Water
Toxicity Characteristic Leaching Proc	EPA 1311	Solid and Chemical Materials
Acetone	EPA 8021B	Non-potable Water
Acetone	EPA 8260B	Non-potable Water
Acetone	EPA 8260B	Solid and Chemical Materials
Acetone	EPA 8021B	Solid and Chemical Materials
Carbon disulfide	EPA 8021B	Non-potable Water
Carbon disulfide	EPA 8021B	Solid and Chemical Materials
Carbon disulfide	EPA 8260B	Solid and Chemical Materials
Carbon disulfide	EPA 8260B	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

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Resource Conservation and Recovery Program

Analyte	Method	Matrix
Ethyl ether	EPA 8260B	Non-potable Water
Ethyl ether	EPA 8260B	Solid and Chemical Materials
p-Dioxane	EPA 8260B	Non-potable Water
p-Dioxane	EPA 8260B	Solid and Chemical Materials
Methyl ethyl ketone	EPA 8021B	Non-potable Water
Methyl ethyl ketone	EPA 8260B	Solid and Chemical Materials
Methyl ethyl ketone	EPA 8021B	Solid and Chemical Materials
Methyl ethyl ketone	EPA 8260B	Non-potable Water
Methyl isobutyl ketone	EPA 8021B	Non-potable Water
Methyl isobutyl ketone	EPA 8260B	Non-potable Water
Methyl isobutyl ketone	EPA 8260B	Solid and Chemical Materials
Methyl isobutyl ketone	EPA 8021B	Solid and Chemical Materials
Butyl benzyl phthalate	EPA 8270C	Non-potable Water
Butyl benzyl phthalate	EPA 8270C	Solid and Chemical Materials
Di-2(ethylhexyl) phthalate	EPA 8270C	Non-potable Water
Di-2(ethylhexyl) phthalate	EPA 8270C	Solid and Chemical Materials
Di-n-butyl phthalate	EPA 8270C	Non-potable Water
Di-n-butyl phthalate	EPA 8270C	Solid and Chemical Materials
Dimethyl phthalate	EPA 8270C	Non-potable Water
Dimethyl phthalate	EPA 8270C	Solid and Chemical Materials
beta-BHC	EPA 8081A	Non-potable Water
beta-BHC	EPA 8081A	Solid and Chemical Materials
gamma-BHC (Lindane)	EPA 8081A	Non-potable Water
gamma-BHC (Lindane)	EPA 8081A	Solid and Chemical Materials
Chlorpyrifos	EPA 8141A	Non-potable Water
Chlorpyrifos	EPA 8141A	Solid and Chemical Materials
4,4'-DDT	EPA 8081A	Non-potable Water
4,4'-DDT	EPA 8081A	Solid and Chemical Materials

MINNESOTA MDH DEPARTMENT OF HEALTH

Environmental Laboratory Certification Program
Scope of Certification

THIS LISTING OF CERTIFIED FIELDS OF TESTING MUST BE ACCOMPANIED BY CERTIFICATE NUMBER: 10823AA

State Laboratory ID: 039-999-348 **EPA Lab Code:** OH00048 **Expiration Date:** March 16, 2006

SEVERN TRENT LABORATORIES - NORTH CANTON
4101 Shuffel Drive Nw
North Canton, OH 44720
Phone 330-497-9396

Resource Conservation and Recovery Program

Analyte	Method	Matrix
Endrin	EPA 8081A	Non-potable Water
Endrin	EPA 8081A	Solid and Chemical Materials
Methyl parathion	EPA 8141A	Non-potable Water
Methyl parathion	EPA 8141A	Solid and Chemical Materials
PCBs	EPA 8082	Non-potable Water
PCBs	EPA 8082	Solid and Chemical Materials
PCBs in Oil	EPA 8082	Solid and Chemical Materials
Toxaphene	EPA 8081A	Non-potable Water
Toxaphene	EPA 8081A	Solid and Chemical Materials
2-Methylphenol	EPA 8270C	Non-potable Water
2-Methylphenol	EPA 8270C	Solid and Chemical Materials
3-Methylphenol	EPA 8270C	Non-potable Water
3-Methylphenol	EPA 8270C	Solid and Chemical Materials
2,3,4,6-Tetrachlorophenol	EPA 8270C	Non-potable Water
2,3,4,6-Tetrachlorophenol	EPA 8270C	Solid and Chemical Materials
Benzo(a)anthracene	EPA 8270C	Non-potable Water
Benzo(a)anthracene	EPA 8270C	Solid and Chemical Materials
Benzo(a)anthracene	EPA 8310	Non-potable Water
Benzo(a)anthracene	EPA 8310	Solid and Chemical Materials
Benzo(a)pyrene	EPA 8270C	Non-potable Water
Benzo(a)pyrene	EPA 8310	Solid and Chemical Materials
Benzo(a)pyrene	EPA 8310	Non-potable Water
Benzo(a)pyrene	EPA 8270C	Solid and Chemical Materials
Benzo(b)fluoranthene	EPA 8270C	Non-potable Water
Benzo(b)fluoranthene	EPA 8270C	Solid and Chemical Materials
Benzo(b)fluoranthene	EPA 8310	Solid and Chemical Materials
Benzo(b)fluoranthene	EPA 8310	Non-potable Water
Benzo(k)fluoranthene	EPA 8270C	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

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Resource Conservation and Recovery Program

Analyte	Method	Matrix
Benzo(k)fluoranthene	EPA 8270C	Solid and Chemical Materials
Benzo(k)fluoranthene	EPA 8310	Solid and Chemical Materials
Benzo(k)fluoranthene	EPA 8310	Non-potable Water
Dibenz(a,h)anthracene	EPA 8270C	Non-potable Water
Dibenz(a,h)anthracene	EPA 8270C	Solid and Chemical Materials
Dibenz(a,h)anthracene	EPA 8310	Solid and Chemical Materials
Dibenz(a,h)anthracene	EPA 8310	Non-potable Water
Fluoranthene	EPA 8270C	Non-potable Water
Fluoranthene	EPA 8310	Solid and Chemical Materials
Fluoranthene	EPA 8310	Non-potable Water
Fluoranthene	EPA 8270C	Solid and Chemical Materials
Indeno(1,2,3-cd)pyrene	EPA 8270C	Non-potable Water
Indeno(1,2,3-cd)pyrene	EPA 8270C	Solid and Chemical Materials
Indeno(1,2,3-cd)pyrene	EPA 8310	Non-potable Water
Indeno(1,2,3-cd)pyrene	EPA 8310	Solid and Chemical Materials
Pyrene	EPA 8270C	Non-potable Water
Pyrene	EPA 8310	Solid and Chemical Materials
Pyrene	EPA 8310	Non-potable Water
Pyrene	EPA 8270C	Solid and Chemical Materials
Benzidine	EPA 8270C	Non-potable Water
Benzidine	EPA 8270C	Solid and Chemical Materials
1,1-Biphenyl	EPA 8270C	Non-potable Water
1,1-Biphenyl	EPA 8270C	Solid and Chemical Materials
1,2-Diphenylhydrazine	EPA 8270C	Non-potable Water
1,2-Diphenylhydrazine	EPA 8270C	Solid and Chemical Materials
Benzoic acid	EPA 8270C	Non-potable Water
Benzoic acid	EPA 8270C	Solid and Chemical Materials
N-Nitrosodi-n-butylamine	EPA 8270C	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

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Phone 330-497-9396

Resource Conservation and Recovery Program

Analyte	Method	Matrix
N-Nitrosodi-n-butylamine	EPA 8270C	Solid and Chemical Materials
Bis-(2-chloroisopropyl) ether	EPA 8270C	Non-potable Water
Bis-(2-chloroisopropyl) ether	EPA 8270C	Solid and Chemical Materials
Pentachlorobenzene	EPA 8270C	Non-potable Water
Pentachlorobenzene	EPA 8270C	Solid and Chemical Materials
Pronamide	EPA 8270C	Non-potable Water
Pronamide	EPA 8270C	Solid and Chemical Materials
1,2,4,5-Tetrachlorobenzene	EPA 8270C	Non-potable Water
1,2,4,5-Tetrachlorobenzene	EPA 8270C	Solid and Chemical Materials
2,4-D	EPA 8151A	Non-potable Water
2,4-D	EPA 8151A	Solid and Chemical Materials
Dalapon	EPA 8151A	Non-potable Water
Dalapon	EPA 8151A	Solid and Chemical Materials
Dinoseb	EPA 8151A	Non-potable Water
Dinoseb	EPA 8151A	Solid and Chemical Materials
2,4,5-T	EPA 8151A	Non-potable Water
2,4,5-T	EPA 8151A	Solid and Chemical Materials
2,4,5-TP (Silvex)	EPA 8151A	Non-potable Water
2,4,5-TP (Silvex)	EPA 8151A	Solid and Chemical Materials
MCPA	EPA 8151A	Non-potable Water
MCPA	EPA 8151A	Solid and Chemical Materials

MINNESOTA MDH DEPARTMENT OF HEALTH

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SEVERN TRENT LABORATORIES - NORTH CANTON
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North Canton, OH 44720
Phone 330-497-9396

Underground Storage Tank Program

Analyte	Method	Matrix
Diesel Range Organics (DROs)	WI(95) DRO	Non-potable Water
Diesel Range Organics (DROs)	WI(95) DRO	Solid and Chemical Materials
Gasoline Range Organics (GROs)	WI(95) GRO	Non-potable Water
Gasoline Range Organics (GROs)	WI(95) GRO	Solid and Chemical Materials
Petroleum Volatile Organic Compounds	WI(95) GRO	Non-potable Water
Petroleum Volatile Organic Compounds	WI(95) GRO	Solid and Chemical Materials

SEVERN TRENT STL

STL (Location)
Date: 11/2/2005

Self-Declaration Statement for the DoD Quality Systems Manual Final Version 3, dated March 2005

Legal Name of Laboratory:	STL Denver
Street Address:	4955 Yarrow St.
City / State / Zip Code:	Denver, CO 80002
Phone Number:	303-736-0100
Fax Number:	303-421-7171
Web Site:	http://www.stl-inc.com
Name of Owner:	Severn Trent Laboratories, Inc.
Owner Address:	The Founders Building, Suite 300 580 Virginia Drive
City / State / Zip Code:	Ft. Washington, PA 19034-2707
Phone Number:	(215) 646-9201

The undersigned persons understand and acknowledge that:

a. Laboratory operations, which will be utilized for testing in support of environmental analytical testing for USACE, are in full compliance with the DoD QSM (Version 3), including NELAC Standard Chapter 5 and Appendix requirements. All written documentation provided to USACE, accompanying this declaration, accurately reflect policy/practices implemented by laboratory staff.

b. The Laboratory will notify the USACE immediately of change in status of laboratory operations that may affect on-going compliance as declared per item a.

c. The Laboratory acknowledges that USACE may audit the laboratory, relative to policy compliance at any time deemed appropriate; and will allow a designated COR full access to information and facilities to conduct such audit operations.

d. Signatories are authorized to sign this form on behalf of the owner and that there are no misrepresentations in the information provided in the initial laboratory assessment package.

****** DISCLAIMER ******

STL Denver has reviewed the Department of Defense Quality Systems Manual (DoD QSM) as compared with its quality system, as contained in its Laboratory Quality Manuals and associated Standard Operating Procedures. STL documents our level of compliance with the QSM and identifies variances between the current laboratory Quality System and the QSM, and we expect project requirements to be negotiated on a project-specific basis. In addition to identified variances with the DoD QSM, instances of noncompliance may be identified during quality assessments and such instances will be addressed via the laboratory's documented corrective action procedures, and as part of STL's commitment to continuous improvement.

	Robert C Hanisch	11/2/2005
Laboratory Director	Signature	Date
Robert C. Hanisch	***Email Address:***	RHanisch@stl-inc.com
	Michael L. Schmitt	11/2/2005
Quality Assurance Manager	Signature	Date
Michael L. Schmitt	***Email Address:***	MSchmitt@stl-inc.com

WI-STL-020/A-05/05

MINNESOTA MDH DEPARTMENT OF HEALTH

Environmental Laboratory Certification Program
Scope of Certification

THIS LISTING OF CERTIFIED FIELDS OF TESTING MUST BE ACCOMPANIED BY CERTIFICATE NUMBER: 10230AA

State Laboratory ID: 008-999-405 **EPA Lab Code:** **Expiration Date:** March 04, 2006

STL DENVER
4955 Yarrow Street
Arvada, CO 80002
Phone 303-736-0100

Clean Water Program

Analyte	Method	Matrix
Cyanide	EPA 335.3	Non-potable Water
Phenol, Total Compounds	EPA 420.2	Non-potable Water
Solids, Nonfilterable (TSS)	EPA 160.2	Non-potable Water
Aluminum	EPA 200.7	Non-potable Water
Antimony	EPA 200.7	Non-potable Water
Antimony	SM 18th ED 3113B	Non-potable Water
Arsenic	EPA 200.7	Non-potable Water
Arsenic	SM 18th ED 3113B	Non-potable Water
Barium	EPA 200.7	Non-potable Water
Beryllium	EPA 200.7	Non-potable Water
Boron	EPA 200.7	Non-potable Water
Cadmium	EPA 200.7	Non-potable Water
Calcium	EPA 200.7	Non-potable Water
Chromium	EPA 200.7	Non-potable Water
Cobalt	EPA 200.7	Non-potable Water
Copper	EPA 200.7	Non-potable Water
Iron	EPA 200.7	Non-potable Water
Lead	EPA 200.7	Non-potable Water
Lead	SM 18th ED 3113B	Non-potable Water
Magnesium	EPA 200.7	Non-potable Water
Manganese	EPA 200.7	Non-potable Water
Mercury	EPA 245.1	Non-potable Water
Molybdenum	EPA 200.7	Non-potable Water
Selenium	EPA 200.7	Non-potable Water
Selenium	SM 18th ED 3113B	Non-potable Water
Silver	EPA 200.7	Non-potable Water
Sodium	EPA 200.7	Non-potable Water
Thallium	EPA 200.7	Non-potable Water

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Clean Water Program

Analyte	Method	Matrix
Vanadium	EPA 200.7	Non-potable Water
Zinc	EPA 200.7	Non-potable Water
Chloromethane	EPA 624	Non-potable Water
Vinyl chloride	EPA 624	Non-potable Water
Bromomethane	EPA 624	Non-potable Water
Chloroethane	EPA 624	Non-potable Water
Trichlorofluoromethane	EPA 624	Non-potable Water
1,1-Dichloroethene	EPA 624	Non-potable Water
Methylene chloride	EPA 624	Non-potable Water
trans-1,2-Dichloroethene	EPA 624	Non-potable Water
1,1-Dichloroethane	EPA 624	Non-potable Water
cis-1,2-Dichloroethene	EPA 624	Non-potable Water
Chloroform	EPA 624	Non-potable Water
1,1,1-Trichloroethane	EPA 624	Non-potable Water
Carbon tetrachloride	EPA 624	Non-potable Water
1,2-Dichloroethane	EPA 624	Non-potable Water
Trichloroethene	EPA 624	Non-potable Water
1,2-Dichloropropane	EPA 624	Non-potable Water
Bromodichloromethane	EPA 624	Non-potable Water
Dibromomethane	EPA 624	Non-potable Water
cis-1,3-Dichloropropene	EPA 624	Non-potable Water
trans-1,3-Dichloropropene	EPA 624	Non-potable Water
1,1,2-Trichloroethane	EPA 624	Non-potable Water
Tetrachloroethene	EPA 624	Non-potable Water
Chlorodibromomethane	EPA 624	Non-potable Water
Chlorobenzene	EPA 624	Non-potable Water
1,1,1,2-Tetrachloroethane	EPA 624	Non-potable Water
Bromoform	EPA 624	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

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Arvada, CO 80002
Phone 303-736-0100

Clean Water Program

Analyte	Method	Matrix
1,1,2,2-Tetrachloroethane	EPA 624	Non-potable Water
1,2,3-Trichloropropane	EPA 624	Non-potable Water
1,3-Dichlorobenzene	EPA 624	Non-potable Water
1,4-Dichlorobenzene	EPA 624	Non-potable Water
1,2-Dichlorobenzene	EPA 624	Non-potable Water
1,2-Dibromo-3-Chloropropane	EPA 624	Non-potable Water
Benzene	EPA 624	Non-potable Water
Toluene	EPA 624	Non-potable Water
Ethyl benzene	EPA 624	Non-potable Water
m+p-Xylene	EPA 624	Non-potable Water
o-Xylene	EPA 624	Non-potable Water
Styrene	EPA 624	Non-potable Water
Acetone	EPA 624	Non-potable Water
2-Chloroethylvinylether	EPA 624	Non-potable Water
Methyl ethyl ketone	EPA 624	Non-potable Water
Acrolein	EPA 624	Non-potable Water
Acrylonitrile	EPA 624	Non-potable Water
Butyl benzyl phthalate	EPA 625	Non-potable Water
Di-2(ethylhexyl) phthalate	EPA 625	Non-potable Water
Di-n-butyl phthalate	EPA 625	Non-potable Water
Di-n-octyl phthalate	EPA 625	Non-potable Water
Diethyl phthalate	EPA 625	Non-potable Water
Dimethyl phthalate	EPA 625	Non-potable Water
Aldrin	EPA 608	Non-potable Water
alpha-BHC	EPA 608	Non-potable Water
beta-BHC	EPA 608	Non-potable Water
delta-BHC	EPA 608	Non-potable Water
gamma-BHC (Lindane)	EPA 608	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

Environmental Laboratory Certification Program
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Phone 303-736-0100

Clean Water Program

Analyte	Method	Matrix
Chlordane	EPA 608	Non-potable Water
4,4'-DDD	EPA 608	Non-potable Water
4,4'-DDE	EPA 608	Non-potable Water
4,4'-DDT	EPA 608	Non-potable Water
Dieldrin	EPA 608	Non-potable Water
Endosulfan I	EPA 608	Non-potable Water
Endosulfan II	EPA 608	Non-potable Water
Endosulfan sulfate	EPA 608	Non-potable Water
Endrin	EPA 608	Non-potable Water
Endrin Aldehyde	EPA 608	Non-potable Water
Heptachlor	EPA 608	Non-potable Water
Heptachlor epoxide	EPA 608	Non-potable Water
PCB-1016	EPA 608	Non-potable Water
PCB-1221	EPA 608	Non-potable Water
PCB-1232	EPA 608	Non-potable Water
PCB-1242	EPA 608	Non-potable Water
PCB-1248	EPA 608	Non-potable Water
PCB-1254	EPA 608	Non-potable Water
PCB-1260	EPA 608	Non-potable Water
Toxaphene	EPA 608	Non-potable Water
4-Chloro-3-methylphenol	EPA 625	Non-potable Water
2-Chlorophenol	EPA 625	Non-potable Water
2,4-Dichlorophenol	EPA 625	Non-potable Water
2,4-Dimethylphenol	EPA 625	Non-potable Water
2,4-Dinitrophenol	EPA 625	Non-potable Water
2-Methyl-4,6-dinitrophenol	EPA 625	Non-potable Water
2-Nitrophenol	EPA 625	Non-potable Water
Pentachlorophenol	EPA 625	Non-potable Water

MINNESOTA MDH DEPARTMENT OF HEALTH

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Clean Water Program

Analyte	Method	Matrix
Phenol	EPA 625	Non-potable Water
2,4,6-Trichlorophenol	EPA 625	Non-potable Water
4-Nitrophenol	EPA 625	Non-potable Water
Bis-(2-chloroethyl) ether	EPA 625	Non-potable Water
Bis-(2-chloroethoxy)methane	EPA 625	Non-potable Water
4-Bromophenylphenyl ether	EPA 625	Non-potable Water
4-Chlorophenylphenyl ether	EPA 625	Non-potable Water
2-Chloronaphthalene	EPA 625	Non-potable Water
Hexachlorobenzene	EPA 625	Non-potable Water
Hexachlorobutadiene	EPA 625	Non-potable Water
Hexachlorocyclopentadiene	EPA 625	Non-potable Water
Hexachloroethane	EPA 625	Non-potable Water
1,2,4-Trichlorobenzene	EPA 625	Non-potable Water
Acenaphthene	EPA 625	Non-potable Water
Acenaphthylene	EPA 625	Non-potable Water
Anthracene	EPA 625	Non-potable Water
Benzo(a)anthracene	EPA 625	Non-potable Water
Benzo(a)pyrene	EPA 625	Non-potable Water
Benzo(b)fluoranthene	EPA 625	Non-potable Water
Benzo(g,h,i)perylene	EPA 625	Non-potable Water
Benzo(k)fluoranthene	EPA 625	Non-potable Water
Chrysene	EPA 625	Non-potable Water
Dibenz(a,h)anthracene	EPA 625	Non-potable Water
Fluoranthene	EPA 625	Non-potable Water
Fluorene	EPA 625	Non-potable Water
Indeno(1,2,3-cd)pyrene	EPA 625	Non-potable Water
Naphthalene	EPA 625	Non-potable Water
Phenanthrene	EPA 625	Non-potable Water

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Clean Water Program

Analyte	Method	Matrix
Pyrene	EPA 625	Non-potable Water
2,4-Dinitrotoluene	EPA 625	Non-potable Water
2,6-Dinitrotoluene	EPA 625	Non-potable Water
Isophorone	EPA 625	Non-potable Water
Nitrobenzene	EPA 625	Non-potable Water

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Resource Conservation and Recovery Program

Analyte	Method	Matrix
Arsenic	EPA 6010B	Non-potable Water
Arsenic	EPA 6010B	Solid and Chemical Materials
Arsenic	EPA 6020	Solid and Chemical Materials
Arsenic	EPA 6020	Non-potable Water
Barium	EPA 6010B	Non-potable Water
Barium	EPA 6020	Non-potable Water
Barium	EPA 6020	Solid and Chemical Materials
Barium	EPA 6010B	Solid and Chemical Materials
Cadmium	EPA 6010B	Non-potable Water
Cadmium	EPA 6020	Solid and Chemical Materials
Cadmium	EPA 6010B	Solid and Chemical Materials
Cadmium	EPA 6020	Non-potable Water
Chromium	EPA 6010B	Non-potable Water
Chromium	EPA 6020	Non-potable Water
Chromium	EPA 6020	Solid and Chemical Materials
Chromium	EPA 6010B	Solid and Chemical Materials
Copper	EPA 6010B	Non-potable Water
Copper	EPA 6020	Solid and Chemical Materials
Copper	EPA 6010B	Solid and Chemical Materials
Copper	EPA 6020	Non-potable Water
Lead	EPA 6010B	Non-potable Water
Lead	EPA 6010B	Solid and Chemical Materials
Lead	EPA 6020	Non-potable Water
Lead	EPA 6020	Solid and Chemical Materials
Mercury	EPA 7470A	Non-potable Water
Mercury	EPA 7471A	Solid and Chemical Materials
Molybdenum	EPA 6010B	Non-potable Water
Molybdenum	EPA 6020	Solid and Chemical Materials

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Resource Conservation and Recovery Program

Analyte	Method	Matrix
Molybdenum	EPA 6020	Non-potable Water
Molybdenum	EPA 6010B	Solid and Chemical Materials
Nickel	EPA 6010B	Non-potable Water
Nickel	EPA 6010B	Solid and Chemical Materials
Nickel	EPA 6020	Solid and Chemical Materials
Nickel	EPA 6020	Non-potable Water
Selenium	EPA 6010B	Non-potable Water
Selenium	EPA 6020	Solid and Chemical Materials
Selenium	EPA 6020	Non-potable Water
Selenium	EPA 6010B	Solid and Chemical Materials
Silver	EPA 6010B	Non-potable Water
Silver	EPA 6020	Non-potable Water
Silver	EPA 6010B	Solid and Chemical Materials
Silver	EPA 6020	Solid and Chemical Materials
Zinc	EPA 6010B	Non-potable Water
Zinc	EPA 6010B	Solid and Chemical Materials
Zinc	EPA 6020	Non-potable Water
Zinc	EPA 6020	Solid and Chemical Materials
Toxicity Characteristic Leaching Proc	EPA 1311	Non-potable Water
Toxicity Characteristic Leaching Proc	EPA 1311	Solid and Chemical Materials
Acetone	EPA 8260B	Non-potable Water
Acetone	EPA 8260B	Solid and Chemical Materials
Carbon disulfide	EPA 8260B	Non-potable Water
Carbon disulfide	EPA 8260B	Solid and Chemical Materials
Ethyl ether	EPA 8260B	Non-potable Water
Ethyl ether	EPA 8260B	Solid and Chemical Materials
p-Dioxane	EPA 8260B	Non-potable Water
p-Dioxane	EPA 8260B	Solid and Chemical Materials

MINNESOTA MDH DEPARTMENT OF HEALTH

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Arvada, CO 80002
Phone 303-736-0100

Resource Conservation and Recovery Program

Analyte	Method	Matrix
Methyl ethyl ketone	EPA 8260B	Non-potable Water
Methyl ethyl ketone	EPA 8260B	Solid and Chemical Materials
Methyl isobutyl ketone	EPA 8260B	Non-potable Water
Methyl isobutyl ketone	EPA 8260B	Solid and Chemical Materials
Butyl benzyl phthalate	EPA 8270C	Non-potable Water
Butyl benzyl phthalate	EPA 8270C	Solid and Chemical Materials
Di-2(ethylhexyl) phthalate	EPA 8270C	Non-potable Water
Di-2(ethylhexyl) phthalate	EPA 8270C	Solid and Chemical Materials
Di-n-butyl phthalate	EPA 8270C	Non-potable Water
Di-n-butyl phthalate	EPA 8270C	Solid and Chemical Materials
Dimethyl phthalate	EPA 8270C	Non-potable Water
Dimethyl phthalate	EPA 8270C	Solid and Chemical Materials
beta-BHC	EPA 8081A	Non-potable Water
beta-BHC	EPA 8081A	Solid and Chemical Materials
gamma-BHC (Lindane)	EPA 8081A	Non-potable Water
gamma-BHC (Lindane)	EPA 8081A	Solid and Chemical Materials
Chlorpyrifos	EPA 8081A	Non-potable Water
Chlorpyrifos	EPA 8081A	Solid and Chemical Materials
4,4'-DDT	EPA 8081A	Non-potable Water
4,4'-DDT	EPA 8081A	Solid and Chemical Materials
Endrin	EPA 8081A	Non-potable Water
Endrin	EPA 8081A	Solid and Chemical Materials
Methyl parathion	EPA 8141A	Non-potable Water
Methyl parathion	EPA 8141A	Solid and Chemical Materials
PCBs	EPA 8082	Non-potable Water
PCBs	EPA 8082	Solid and Chemical Materials
Toxaphene	EPA 8081A	Non-potable Water
Toxaphene	EPA 8081A	Solid and Chemical Materials

MINNESOTA MDH DEPARTMENT OF HEALTH

Environmental Laboratory Certification Program
Scope of Certification

THIS LISTING OF CERTIFIED FIELDS OF TESTING MUST BE ACCOMPANIED BY CERTIFICATE NUMBER: 10230AA

State Laboratory ID: 008-999-405 **EPA Lab Code:** **Expiration Date:** March 04, 2006

STL DENVER
4955 Yarrow Street
Arvada, CO 80002
Phone 303-736-0100

Resource Conservation and Recovery Program

Analyte	Method	Matrix
2-Methylphenol	EPA 8270C	Non-potable Water
2-Methylphenol	EPA 8270C	Solid and Chemical Materials
3-Methylphenol	EPA 8270C	Non-potable Water
3-Methylphenol	EPA 8270C	Solid and Chemical Materials
2,3,4,6-Tetrachlorophenol	EPA 8270C	Non-potable Water
2,3,4,6-Tetrachlorophenol	EPA 8270C	Solid and Chemical Materials
Benzo(a)anthracene	EPA 8270C	Non-potable Water
Benzo(a)anthracene	EPA 8270C SIM	Solid and Chemical Materials
Benzo(a)anthracene	EPA 8310	Solid and Chemical Materials
Benzo(a)anthracene	EPA 8310	Non-potable Water
Benzo(a)anthracene	EPA 8270C SIM	Non-potable Water
Benzo(a)anthracene	EPA 8270C	Solid and Chemical Materials
Benzo(a)pyrene	EPA 8270C	Non-potable Water
Benzo(a)pyrene	EPA 8270C	Solid and Chemical Materials
Benzo(a)pyrene	EPA 8270C SIM	Solid and Chemical Materials
Benzo(a)pyrene	EPA 8310	Solid and Chemical Materials
Benzo(a)pyrene	EPA 8310	Non-potable Water
Benzo(a)pyrene	EPA 8270C SIM	Non-potable Water
Benzo(b)fluoranthene	EPA 8270C	Non-potable Water
Benzo(b)fluoranthene	EPA 8270C SIM	Non-potable Water
Benzo(b)fluoranthene	EPA 8270C	Solid and Chemical Materials
Benzo(b)fluoranthene	EPA 8270C SIM	Solid and Chemical Materials
Benzo(b)fluoranthene	EPA 8310	Solid and Chemical Materials
Benzo(b)fluoranthene	EPA 8310	Non-potable Water
Benzo(k)fluoranthene	EPA 8270C	Non-potable Water
Benzo(k)fluoranthene	EPA 8310	Solid and Chemical Materials
Benzo(k)fluoranthene	EPA 8310	Non-potable Water
Benzo(k)fluoranthene	EPA 8270C SIM	Solid and Chemical Materials

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Resource Conservation and Recovery Program

Analyte	Method	Matrix
Benzo(k)fluoranthene	EPA 8270C SIM	Non-potable Water
Benzo(k)fluoranthene	EPA 8270C	Solid and Chemical Materials
Dibenz(a,h)anthracene	EPA 8270C	Non-potable Water
Dibenz(a,h)anthracene	EPA 8270C SIM	Non-potable Water
Dibenz(a,h)anthracene	EPA 8270C SIM	Solid and Chemical Materials
Dibenz(a,h)anthracene	EPA 8310	Solid and Chemical Materials
Dibenz(a,h)anthracene	EPA 8310	Non-potable Water
Dibenz(a,h)anthracene	EPA 8270C	Solid and Chemical Materials
Fluoranthene	EPA 8270C	Non-potable Water
Fluoranthene	EPA 8310	Solid and Chemical Materials
Fluoranthene	EPA 8310	Non-potable Water
Fluoranthene	EPA 8270C	Solid and Chemical Materials
Fluoranthene	EPA 8270C SIM	Solid and Chemical Materials
Fluoranthene	EPA 8270C SIM	Non-potable Water
Indeno(1,2,3-cd)pyrene	EPA 8270C	Non-potable Water
Indeno(1,2,3-cd)pyrene	EPA 8270C SIM	Solid and Chemical Materials
Indeno(1,2,3-cd)pyrene	EPA 8310	Solid and Chemical Materials
Indeno(1,2,3-cd)pyrene	EPA 8310	Non-potable Water
Indeno(1,2,3-cd)pyrene	EPA 8270C	Solid and Chemical Materials
Indeno(1,2,3-cd)pyrene	EPA 8270C SIM	Non-potable Water
Pyrene	EPA 8270C	Non-potable Water
Pyrene	EPA 8270C SIM	Solid and Chemical Materials
Pyrene	EPA 8310	Non-potable Water
Pyrene	EPA 8310	Solid and Chemical Materials
Pyrene	EPA 8270C SIM	Non-potable Water
Pyrene	EPA 8270C	Solid and Chemical Materials
Benzidine	EPA 8270C	Non-potable Water
Benzidine	EPA 8270C	Solid and Chemical Materials

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Resource Conservation and Recovery Program

Analyte	Method	Matrix
1,2-Diphenylhydrazine	EPA 8270C	Non-potable Water
1,2-Diphenylhydrazine	EPA 8270C	Solid and Chemical Materials
N-Nitrosodi-n-butylamine	EPA 8270C	Non-potable Water
N-Nitrosodi-n-butylamine	EPA 8270C	Solid and Chemical Materials
Bis-(2-chloroisopropyl) ether	EPA 8270C	Non-potable Water
Bis-(2-chloroisopropyl) ether	EPA 8270C	Solid and Chemical Materials
Pentachlorobenzene	EPA 8270C	Non-potable Water
Pentachlorobenzene	EPA 8270C	Solid and Chemical Materials
Pronamide	EPA 8270C	Non-potable Water
Pronamide	EPA 8270C	Solid and Chemical Materials
1,2,4,5-Tetrachlorobenzene	EPA 8270C	Non-potable Water
1,2,4,5-Tetrachlorobenzene	EPA 8270C	Solid and Chemical Materials
2,4-D	EPA 8151A	Non-potable Water
2,4-D	EPA 8151A	Solid and Chemical Materials
Dalapon	EPA 8151A	Non-potable Water
Dalapon	EPA 8151A	Solid and Chemical Materials
Dinoseb	EPA 8151A	Non-potable Water
Dinoseb	EPA 8151A	Solid and Chemical Materials
2,4,5-T	EPA 8151A	Non-potable Water
2,4,5-T	EPA 8151A	Solid and Chemical Materials
2,4,5-TP (Silvex)	EPA 8151A	Non-potable Water
2,4,5-TP (Silvex)	EPA 8151A	Solid and Chemical Materials
MCPA	EPA 8151A	Non-potable Water
MCPA	EPA 8151A	Solid and Chemical Materials

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Safe Drinking Water Program

Analyte	Method	Matrix
Cyanide	SM 18th ED 4500-CN E	Drinking Water
Fluoride	EPA 300.0	Drinking Water
Nitrogen, Nitrate	EPA 300.0	Drinking Water
Nitrogen, Nitrite	EPA 300.0	Drinking Water
Sulfate	EPA 300.0	Drinking Water

Close Report

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Laboratory Quality Manual

STL Denver

4955 Yarrow Street
Arvada, Colorado 80002
Phone: 303-736-0100
FAX: 303-431-7171
www.stl-inc.com

Revision 1
April 2005

CONTROLLED COPY #	

Leaders in Environmental Testing

SEVERN TRENT STL

Laboratory Quality Manual

STL Denver

Revision 1
April 2005

Approval Signatures

Robert Hanisch, Laboratory Director — Date: 4-14-05

Michael Schmitt, Quality Assurance Manager (Acting) — Date: 04/14/05

Karen Kuoppala, Organic Operations Manager — Date: 4-14-05

Sherry Scaggiari, Inorganic Operations Manager (Acting) — Date: 4/14/05

Purpose and Scope

The purpose of this Laboratory Quality Manual (LQM) is to describe the implementation the Severn Trent Laboratories (STL) Quality System at the STL Denver laboratory. The LQM is written within the guidelines of the STL Quality Management Plan (QMP), which applies to all STL laboratories. The LQM outlines specific policies, organization, responsibilities, and activities required to ensure high quality laboratory services. The LQM also fulfills the requirements of our clients and government agencies for laboratory quality manuals. Particular emphasis is given to the requirements of the National Environmental Laboratory Accreditation Conference (NELAC) standards, and the Utah Rule R444-14 implementing the NELAC guidelines.

This LQM contains references to other essential STL quality documents. The company-wide QMP, STL Denver LQM, and referenced policies and SOPs are interrelated. Together they provide an integrated quality foundation that meets the objectives of the STL Quality Assurance Policy, as stated in Section 1.2 of this document.

The requirements set forth in this document are applicable to all employees at the STL Denver laboratory. The policies and practices described herein are presented as minimum guidelines only. Based on good scientific judgment, more rigorous requirements may be applied by laboratory employees. Specific requirements delineated in project plans may supersede general quality requirements described in this manual.

This LQM is organized in sections and each section is a stand alone document with its own revision date. When any part of a section(s) is revised, that section(s) will be reviewed by the Laboratory Director, Quality Assurance Manager, and Operations Managers, as a minimum. The LQM cover and signature pages will be updated with the new revision number and date of the section(s) that was revised.

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group, using current and reasonable future land uses. The Contractor shall clearly justify all assumptions used.

(2) The highest detected chemical concentration in a medium shall be used as the exposure point concentration unless the range of concentrations detected, as well as the number of samples collected, allows a 95% Upper Confidence Limit (UCL) to be calculated. The Contractor shall clearly justify all assumptions used.

b. Health-Based Screening Levels. The Contractor shall evaluate the CSM for appropriate exposure pathways and exposure factors, and select or calculate the health-based screening levels that most accurately reflect site conditions. The health-based screening levels shall be selected on the basis of state and regional requirements. One potential set of health-based screening levels to use are the United States Environmental Protection Agency (USEPA) Region 9 Preliminary Remediation Goals (PRG) Tables. The risk screening portion of the work plan shall identify proposed values to be used in the risk screen and shall provide justification for choosing these values.

c. Risk Screening. The risk screening portion of the work plan shall describe the proposed method of evaluating site detections with approved screening levels. Include a description of the procedures to be used to account for the effects of multiple chemicals, if present. Procedures to account for both carcinogenic and non-carcinogenic chemical effects shall be proposed in the work plan. The screening level risk assessment in the SI report shall comply with procedures in the approved work plan.

d. Characterization of Uncertainty. The uncertainties associated with the HHRA shall be clearly presented as part of the screening-level risk assessment. The potential effect of the following factors should be discussed:

(1) Uncertainties associated with the limited chemical data base for the site.

(2) Use of maximum chemical concentrations for exposure point concentrations.

(3) Use of highest exposure receptors.

(4) The application of the health-based screening value and the inherent assumptions used in its derivation.

d. Results of the Screening-Level HHRA. The Contractor shall summarize the Screening-Level HHRA, indicating the strengths and weaknesses of the screening-level assessment. The Contractor shall discuss the range of chemical concentrations detected, how far the health-based screening level or levels have been exceeded, the effects of multiple chemicals, and the appropriateness of the values themselves. This information will assist in the process of deciding

whether the site should be eliminated from further concern.

3. Ecological Risk Assessment (ERA). The ERA shall conservatively evaluate the potential for adverse ecological effects ascribable to site contamination. The screening-level ERA shall be consistent with Steps 1 and 2 of the USEPA guidance, *Ecological Risk Assessment Guidance for Superfund (ERAGS): Process for Designing and Conducting Ecological Risk Assessments* (USEPA 1997) and consistent with state and regional guidance.

b. Planning. Before beginning the screening-level problem formulation, the Contractor shall propose clearly articulated Site-Specific Management Objectives (SSMOs) and characterize the decisions to be made within the context of those objectives in the screening-level risk assessment portion of the work plan.

c. Step 1: Screening-Level Problem Formulation and Ecological Effects Evaluation.

(1) *Screening-Level Problem Formulation.* For the screening-level problem formulation, the Contractor shall develop a preliminary Ecological Conceptual Site Model (ECSM) for the site. Based on the site history and an initial site reconnaissance, the ESCM shall address the following five issues:

(*a*) Characterization of the environmental setting and known or suspected contaminants.

(*b*) Fate and transport mechanisms that might exist at the site.

(*c*) Mechanisms of ecotoxicity associated with chemicals and likely categories of receptors that could be affected.

(*d*) Complete exposure pathways.

(*e*) Selection of appropriate endpoints supporting the SSMOs to screen for ecological risks.

(2) *Screening-Level Ecological Effects Evaluation.* The next part of the ERA is to evaluate preliminary ecological effects and establish chemical exposure levels that represent conservative thresholds for adverse ecological effects. The conservative thresholds are called screening ecotoxicity values. The Contractor shall locate and use an adequate benchmark as the screening ecotoxicity value. The Contractor shall evaluate the ECSM for appropriate exposure pathways, exposure factors, and the assessment endpoints (tied to the SSMOs), then select the benchmark values that most accurately reflect site conditions. The Contractor shall propose benchmark values to be used in the screening-level risk assessment portion of the work plan and shall provide justification for criteria selection.

(*a*) State and Federal Ambient Water Quality Criteria (AWQC).

(*b*) USEPA, National Oceanic and Atmospheric Administration (NOAA) and Ontario sediment criteria.

(*c*) USEPA online databases (ECOTOX, AQUIRE, etc.).

(*d*) Oak Ridge National Laboratory (ORNL) benchmarks.

(*e*) U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) (military unique compounds [MUCs]).

(*f*) USEPA Region or state benchmark or guidance values.

(3) *Uncertainty Assessment.* After the screening-level problem formulation, the Contractor shall briefly evaluate the uncertainties associated with the benchmarks used as the screening ecotoxicity values, the study design, and the selected endpoints.

c. Step 2: Screening-Level Exposure Estimate and Risk Calculation.

(1) *Screening-Level Exposure Estimate.* In this step, the Contractor shall estimate chemical exposure levels to screen for potential ecological risks. For all complete exposure pathways, the Contractor shall use the maximum detected site-related chemical concentration as the exposure point concentration. For wildlife, exposure parameters used shall be the conservative assumptions listed below:

(*a*) Area use factor of 100%.

(*b*) 100% bioavailability.

(*c*) Most sensitive life stage present.

(*d*) Average body weight—normalized ingestion rate.

(*e*) 100% of the diet consists of the most contaminated dietary component.

(2) *Screening-Level Risk Calculation.* For the screening-level risk calculation, the HQ approach shall be used, comparing the dose (estimated contaminant intake) with the screening ecotoxicity value. The Contractor shall determine if the chemicals present have similar toxic mechanisms, requiring summing of the HQs to produce an HI. Justification for calculating an HI shall be clearly documented within the text of the assessment.

(3) *Scientific/Management Decision Point (SMDP).* The Contractor shall write a summary of the screening-level ERA, including the range of chemical concentrations detected, the number of chemicals exceeding their benchmarks, the degree of the exceedance of the benchmark (or benchmarks), and the appropriateness of the benchmarks themselves. In addition, the Contractor shall relate the results back to the SSMOs, and ensure that the information provided assists the risk manager in making one of the following decisions:

(*a*) That there is adequate information to conclude that ecological risks are negligible and, therefore, no need for remediation on the basis of ecological risk.

(*b*) That the information is not adequate to make a decision at this point.

(*c*) That the information points to a potential for adverse ecological effects.