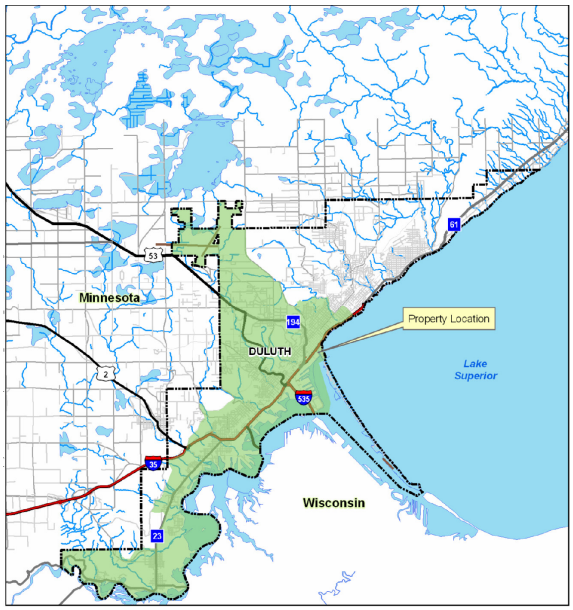
Sample and Analysis Plan
Supplemental Phase II Investigation

Bayfront – Slips 2 and 3
Duluth, MN

Prepared for
The City of Duluth

January, 2007



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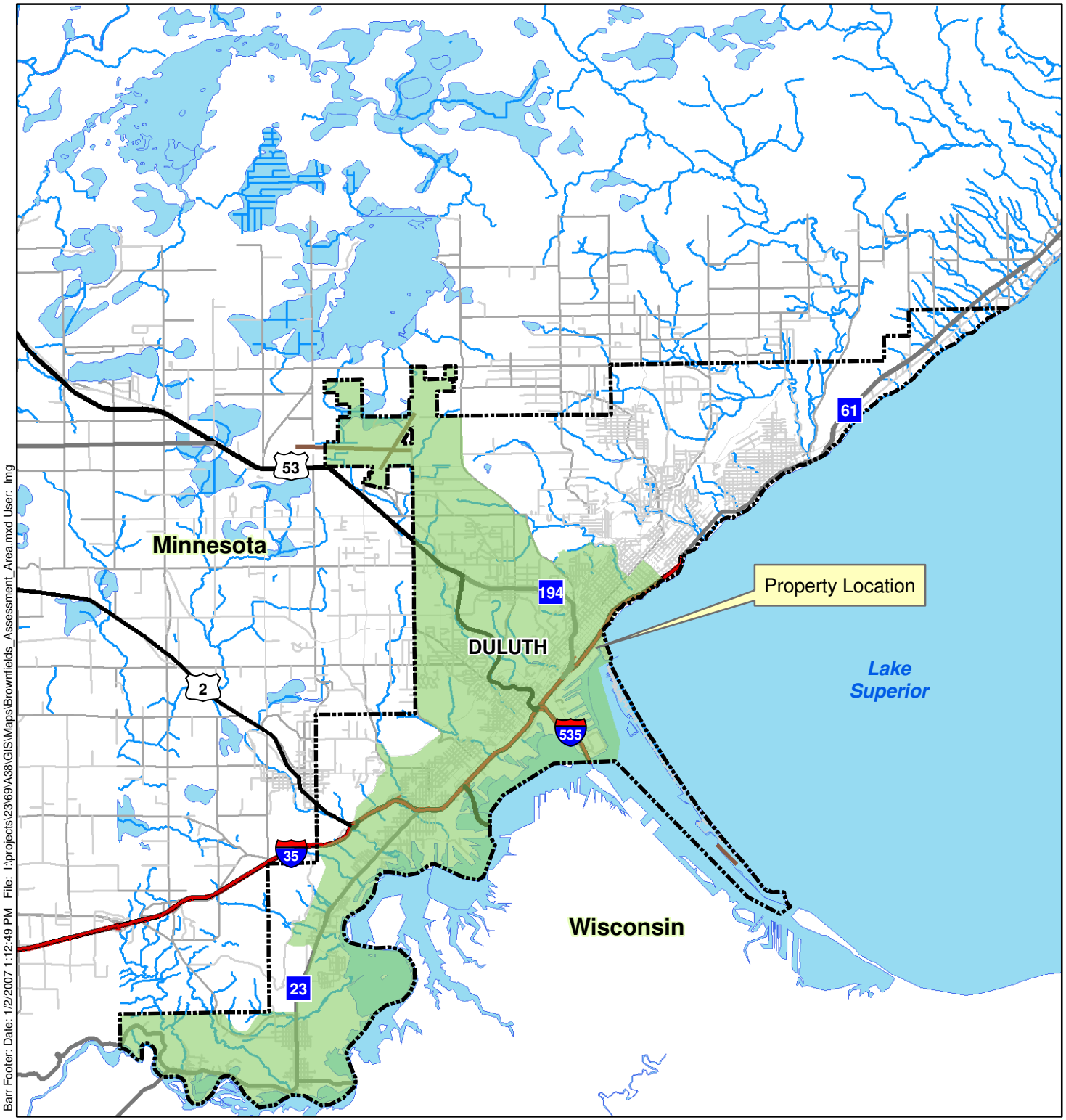

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LEGEND

- Duluth City Boundary
- Airport
- Assessment Area

N

Miles

0.75 0 0.75 1.5 2.25

BARR

Figure 1a

PROPERTY LOCATION AND ASSESSMENT AREA
Bayfront Property Slips 2 and 3
City of Duluth
Duluth, Minnesota

1.0 Introduction

This Sampling and Analysis Plan (SAP) has been prepared for a Supplemental Phase II Investigation (Supplemental Investigation) at the City of Duluth (City), Minnesota Bayfront - Slips 2 and 3 property (Property) located at 700 to 1000 Railroad Street in Duluth, Minnesota. This SAP describes the scope of work and investigative procedures necessary to complete the Supplemental Investigation. This investigation will be conducted as part of the City's Brownfields Assessment grant funded by the US Environmental Protection Agency (EPA). Figures 1a and 1b show the location of the Property.

This SAP was developed based on Barr Engineering Company's (Barr) understanding of the technical and regulatory issues associated with the Property, our understanding of the requirements of the Brownfields Assessment Pilot Program, and our understanding of the City's project objectives.

The investigation work and reporting will occur during the early winter of 2007.

1.1 Project Objectives

Our understanding of the project objectives is as follows:

- Further characterize soil conditions at the Property in the vicinity of two vacant boat slips to help evaluate soil and groundwater quality in areas of interest for public water-related reuse including possible future vessel dockage facilities. The proposed work may not fully delineate the extent of all soil or groundwater contamination (e.g. extent or magnitude of all soil contamination or groundwater plume, if present). If deemed necessary, full delineation of impacts may require the installation of monitoring wells or additional sampling in subsequent phases of inquiry.
- Perform a screening evaluation of risk to human health and the environment using soil and groundwater quality results from the Property.
- Identify whether any additional data are required to completely characterize the extent of significant soil or groundwater contamination identified at the Property and develop recommendations for collecting these data.
- Identify whether remedial actions may be necessary in conjunction with potential redevelopment activities.
- Document the investigation methods and results in a report.

1.2 Site Background Information

1.2.1 Location

The Property is located at 700 to 1000 Railroad Street in Duluth, Minnesota. The Property is located on the northern shore of the St. Louis River harbor area in Downtown Duluth, as shown on Figures 1a and 1b. The Property is owned by the City of Duluth Economic Development Authority (DEDA), and is referred to as the Bayfront – Slips 2 and 3. Former building slabs, asphalt pavement and some surface rubble are present on the surface of the Property. Based on information obtained during previous assessment and investigation activities at the Property, it is anticipated that the groundwater table will be approximately five feet below the ground surface (bgs). Groundwater flow is likely directed southward toward the harbor, and/or eastward toward Slips 2 and 3, at the Property location. Additional information on the Property setting and features is provided in the Phase I Environmental Site Assessment report (Barr, 2004a) and the Phase II Environmental Site Assessment report (Barr, 2004b).

1.2.2 Previous Work

The Phase I Environmental Site Assessment (Phase I ESA) of the Property (noted above) was completed in March 2004 (Barr, 2004a). The assessment was performed in general conformance with the scope, limitations, and methods of the American Society for Testing and Materials (ASTM) Standard Practice E1527-00. The following recognized environmental conditions (RECs) related to the Property were identified (paraphrased from the Phase I ESA report (Barr, 2004a)):

- Shallow soils on the Property are primarily composed of fill material of unknown origin and may contain debris or contamination from off-site sources.

- There was a documented release of petroleum products from the former Food Service of America Leaking Underground Storage Tank (LUST) site located in the area southwest of Slip 2 (the western side of the mouth of Slip 2).

- Activities associated with a scrap materials handling facility (encroaching the northeast corner of Slip 3) may have impacted soil and/or groundwater at the head of Slip 3.

- Petroleum oil, paint and solvent storage and handling may have occurred during past tenancy in an area west and central of Slip 3.

- The potential release of chemicals, hazardous materials or manufacturing waste by-products (including petroleum) may be associated with electrical equipment manufacturing at a facility formerly located on the west side of the head of Slip 3.

Based on the above-listed RECs it was recommended that a Phase II investigation be performed at the Property. The Phase II Environmental Site Assessment (Phase II ESA) of the Property (noted above) was completed in June 2004. The conclusions of the Phase II ESA regarding soil impacts were that (paraphrased from the Phase II ESA report (Barr, 2004b)):

- Soil samples contained trace detectable concentrations of volatile organic hydrocarbons (VOCs) and semivolatile organic hydrocarbons (SVOCs) below Tier I Soil Leaching Value (SLV) and Tier II Industrial Soil Reference Value (SRV) screening criteria.

- Soil samples contained low concentrations of Resource Conservation and Recovery Act (RCRA) metals below Tier II SRV screening criteria.

- Surface and near surface soil samples exceeded the Tier I SLV screening criteria for chromium, indicating a potential chromium impact to groundwater at the Property from these near surface soils.

- Diesel Range Organics (DRO) compounds were detected in soil materials present at the former LUST location. Measured concentrations in the analyzed sample were below typical Minnesota Pollution Control Agency (MPCA) action levels for the soil type.

- Minor amounts of debris material, including building debris presumably from former Property structures are scattered across the Property. No visible Asbestos Containing Material (ACM) was observed during investigation activities. However, it is possible that such ACMs may be present among debris in the subsurface in locations not observed during the field work.

- The Phase II ESA did not include groundwater characterization. Analytical soil samples taken from near or just above the water table, as well as field-screening observations indicated no obvious impacts from VOCs or SVOCs in soil borings at or near the water table.

Subsequent to the Phase I and II ESA activities, City staff have reported that an underground manufactured coal gas pipeline may be present beneath Railroad Street, near the heads of Slips 2 and 3. There is a potential for coal tar impacts to soil at the Property in the vicinity of the reported former coal gas pipeline.

Based on the results of the Phase II ESA, Barr recommended that redevelopment plans for the Property include: 1) preparation of a Construction Contingency Plan (CCP); 2) preparations to manage debris; 3) involvement of a Licensed Asbestos Inspector; and 4) groundwater characterization as needed, particularly in regard to potential chromium impacts.

Only conceptual redevelopment plans have been developed for the Property. General concepts under consideration may include a future vessel dockage facility and other complimentary water-related uses.

1.3 Plan Organization

This SAP is organized into five main sections. These sections include:

- **Section 1** This introduction.
- **Section 2** A discussion of the investigation scope and a description of field investigation tasks.
- **Section 3** A discussion of data quality objectives (DQOs).
- **Section 4** A discussion of the project quality assurance and quality control (QA/QC) process.
- **Section 5** Project schedule and reporting.

2.0 Investigation Approach

Field activities discussed in this section have been designed to provide the necessary data to complete the project objectives defined in Section 1.1 of this SAP. The investigation methods described below are consistent with the EPA-approved Quality Assurance Project Plan, Revision 1.1 (QAPP) prepared for the City's Brownfields Assessment Pilot program (Barr, 2006).

Detailed descriptions of the planned investigation activities are presented below.

2.1 Project Health and Safety Plan

A project health and safety plan (PHASP) will be prepared for the site investigation. A copy of the PHASP will be submitted to the EPA and the City for review or reference. The PHASP will be amended to incorporate any comments prior to the commencement of field investigation activities.

2.2 Field Investigation Tasks

Field investigation tasks will include the advancement of direct-push soil borings for the purpose of further characterizing fill deposits, further characterizing soil type and impacts, collecting soil samples, and groundwater quality sampling. These tasks are described in the following paragraphs.

2.2.1 Soil Borings

Conceptual redevelopment plans for the property may include a future vessel dockage facility and other complimentary water-related uses. Borings have been proposed in areas that may be disturbed by future construction activities. Approximately 12 direct-push soil borings will be advanced at the Property at the proposed locations depicted in Figure 2. Depths of the borings will vary from 8 feet to 30 feet bgs as described below. The goal of the soil borings will be to further investigate the depth and character of fill or debris and soil impacts as well as to investigate groundwater quality.

Two of the soil borings will be used to collect groundwater samples at the locations shown on Figure 2. Groundwater grab samples will be collected using either direct-push soil boring groundwater sample procedures or by setting a 1-inch diameter temporary monitoring well. Procedures for groundwater grab sampling through the probes or using a temporary well are described in the Standard Operating Procedures (SOPs) in the QAPP, Revision 1.1 (Barr, 2006) .

Each boring will be sampled using the soil core collection procedures described in the QAPP, Revision 1.1 (Barr, 2006) and Appendix A. The SOP for Soil Sample Collection included in

Appendix A is a revised version and supersedes the related SOPs included in the QAPP, Revision 1.1 (Barr, 2006). Soil samples will be collected and field screened for organic vapors using the soil sample and headspace sample organic vapor screening procedures discussed in Section 2.2.2. Soils collected from all soil borings will be described and a respective soil boring log will be prepared in accordance with the procedures listed in the QAPP, Revision 1.1 (Barr, 2006). Soil boring logs will be created using the boring log form shown in Appendix B. A Minnesota Department of Health (MDH) certified well drilling contractor will be used for the soil borings and any temporary monitoring well installation work. Soil cuttings will be managed on-site as described in Section 2.2.4.

Boring locations may vary from the planned locations depending on utility locations and accessibility in the field. The number, locations and types of soil borings may also vary depending on the resources available to perform the investigation work. Boreholes will be backfilled according to Minnesota Regulations Chapter 4725.3850 and required documentation will be compiled and submitted to the MDH by the certified well drilling contractor.

All drilling and sampling equipment that contacts soil or groundwater will be cleaned and decontaminated using a phosphate-free detergent wash and then a clean water rinse between each boring and sample location. Cleaning fluids will be disposed at the Property by thinspreading on the ground surface.

2.2.1.1 Shallow Soil Boring Locations

Shallow soil borings will be advanced to further characterize the fill material and to obtain supplemental data on soil contamination resulting from past activity and the general filling across the Property. Eight shallow soil borings will be advanced to depths of 4 to 8 feet bgs at the proposed locations shown on Figure 2. The shallow soil borings will be distributed across the Property, omitting locations where previous investigative results are available.

Soil impacts will be evaluated by collecting one soil sample from each of the estimated eight soil borings. Soil samples will be collected at a depth of 4 feet bgs from each of the shallow soil borings. The number of soil samples that will be submitted to a laboratory for analyses will be based on selection criteria described in Section 2.2.2. The specific locations and depths of the shallow soil borings may be adjusted based on field observations, conditions, accessibility, utilities, available budget, or time limitations. These samples will be collected following the methods described in Section 2.2.2.

2.2.1.2 Intermediate Soil Boring Locations

In order to investigate soil conditions at and below the water table, two soil borings will be advanced to 12 feet bgs. The intermediate soil borings will be located at the head of Slip 2 -- north and west of the head of Slip 2 – as shown in Figure 2. At the head of Slip 3 (north of Slip 3), previous investigative results include soil quality data at intermediate depth; therefore, the proposed supplemental investigation will not duplicate an intermediate boring in that area.

Soil impacts will be evaluated by collecting one soil sample from each of the two intermediate borings. Soil samples will be collected at a depth of 5 to 10 feet bgs from each of the intermediate borings above, or at, the water table. The number of soil samples that will be submitted to a laboratory for analyses will be based on selection criteria described in Section 2.2.2. The specific locations and depths of the intermediate soil borings may be adjusted based on field observations, conditions, available budget, or time limitations. The soil samples will be collected following the methods described in Section 2.2.2.

2.2.1.3 Deep Soil Boring Locations

In order to further investigate soil conditions below the water table and to collect groundwater samples, two deep soil borings will be advanced to depths of 30 feet. The proposed locations for the deep soil borings are at the head of each slip – northeast of Slip 2 and northwest of Slip 3 – as shown in Figure 2. Additionally, the deep soil borings may provide supplemental information about the depth and nature of fill materials and/or native soil at the heads of the slips.

Soil impacts will be evaluated by collecting a soil sample from a depth of 5 to 10 feet at each deep soil boring location above, or at, the water table. The number of soil samples that will be submitted to a laboratory for analyses will be based on selection criteria described in Section 2.2.2. Groundwater quality at the heads of the slips will be evaluated by collecting a water sample from each of the two deep borings. One groundwater sample from each of the deep borings will be submitted to a laboratory for analyses as described in Section 2.2.3. The specific locations and depths of the deep soil borings may be adjusted based on field observations, conditions, available budget, or time limitations. The soil samples will be collected following the methods described in

Section 2.2.2. Groundwater samples collected from the borings will be obtained using the procedures discussed in the following Section 2.2.3.

2.2.2 Soil Sample Collection and Analytical Parameters

In each boring, soil will be continuously sampled to the total depth of the boring. As noted above, groundwater is likely to be approximately 5 to 10 feet bgs.

Soil samples will be observed continuously, conditions will be noted, and the soil materials field screened (on a minimum) at every 2-foot interval by the Barr field geologist. The field screening will consist of soil classification, observation of visual evidence of contamination (i.e., incidental odor, discoloration, and sheen), and headspace volatile organic vapor screening (all procedures in accordance with the QAPP, Revision 1.1 (Barr, 2006)). Soils encountered will be described in accordance with ASTM D-2488, Standard Practice for Description and Identification of Soils (Visual/Manual Method). Field screening results will be used to guide the selection of samples that will be sent to the laboratory for analysis. Field screening will be done according to the SOPs presented in the QAPP, Revision 1.1 (Barr, 2006).

It is anticipated that approximately 12 soil samples collected from the soil borings will be submitted for laboratory analysis. The samples selected for analysis will be determined during the course of the fieldwork in accordance with the following criteria: discoloration, odors consistent with solvent or petroleum contamination, the area of interest from which the sample was collected, elevated headspace-volatile organic vapor readings, laboratory hold time requirements, and the types and locations of other samples planned for analysis. Soil samples representative of those exhibiting, or meeting, one or more of these criteria may be submitted to the laboratory for analysis. In addition, it is anticipated that one soil sample exhibiting no evidence of potential contamination may also be submitted to the laboratory for analysis, depending on project resources available. In general, the soil sample exhibiting evidence of the highest level of contamination from each soil boring will be submitted for laboratory analysis. For borings in which no evidence of soil contamination is observed, soil samples may be selected for laboratory analysis such that, if possible, one sample from each soil type (e.g., sand, clay, clayey sand) that is encountered throughout the collective borings may be submitted to the laboratory for analysis (based on time and budgetary constraints). Soil sampling will be done according to the SOPs presented in Appendix A and the QAPP, Revision 1.1 (Barr, 2006).

Up to 2 soil samples will be analyzed for the VOCs listed in Table 1. Up to 12 soil samples will be submitted for analysis of the eight RCRA metals [i.e., arsenic, barium, cadmium, chromium (not speciated), lead, mercury, selenium, and silver] (Table 1). Up to 2 samples will be analyzed for the SVOCs listed in Table 1. Up to 2 samples will be analyzed for DRO as listed in Table 1. Up to 1 sample will be analyzed for polychlorinated biphenyls (PCBs). Analytical methods for the various analytical parameters are listed in the QAPP, Revision 1.1 (Barr, 2006). Table 2 identifies the sample containers, sample preservation methods, and holding times for each analytical parameter class.

If potential asbestos-containing materials are observed in the fill, one soil or debris sample will be submitted for analysis of bulk asbestos content following the methods described in the QAPP, Revision 1.1 (Barr, 2006) (Table 4).

In addition to the native soil samples, QA/QC samples consisting of trip blanks, masked duplicates, methanol blanks, field blanks, and matrix spikes/matrix spike duplicates will be collected and analyzed according to the schedule in Table 3. A sample network summary is presented in Table 4.

Laboratory analyses will be performed by Legend Technical Services in St. Paul, Minnesota. Appropriate sample handling and documentation procedures described in the QAPP, Revision 1.1 (Barr, 2006) will be followed.

2.2.3 Groundwater Sample Collection and Analytical Parameters

Groundwater samples will be collected from up to two soil borings in which groundwater is encountered and sent to the laboratory for analysis.

When groundwater is to be sampled in a boring, a sealed stainless steel screen will be driven below the bottom of the borehole and approximately two to four feet below the water table. The screen will then be deployed, and a water sample collected for laboratory analysis. A Barr geologist will observe the boring advancement and collection of groundwater samples. All drilling and sampling equipment that contacts soil or groundwater will be cleaned/decontaminated using a phosphate-free detergent wash between each boring and sample location. Cleaning fluids will be disposed onsite unless non-aqueous phase liquids (NAPLs) are observed on the equipment prior to cleaning. If this should occur the cleaning fluids will be containerized and properly stored until they can be characterized and properly disposed.

The groundwater sampler will consist of a 4-foot-long, 1.5-inch-outside-diameter, stainless steel sheath, a 4-foot-long, 1.5-inch-outside-diameter stainless steel screen, and an expendable drive point,

or equivalent. The sampling sheath protects the screen and will be sealed at the bottom with an O-ring and the expendable drive point. The top of the sampler will be threaded into the leading edge of the direct-push drive rods, which will be sealed at each joint with O-rings. At the desired sampling depth, the sampling sheath will be retracted and the screen exposed. A groundwater sample will be collected with ½-inch-inside-diameter polyethylene tubing fitted with a check valve or with a peristaltic pump. Additional information on groundwater sampling procedures is presented in the SOPs found in the QAPP, Revision 1.1 (Barr, 2006).

Water levels in each temporary well or probe will be recorded prior to sampling following the procedures outlined in the SOPs (QAPP, Revision 1.1 (Barr, 2006)). Monitoring wells will be purged and sampled with a peristaltic pump using minimal drawdown methods or with disposable polyethylene bailers. Dedicated tubing (or a dedicated bailer) would be utilized at each well. During purging, field analytical data including temperature, pH, Eh, specific conductivity, and dissolved oxygen (DO) will be collected.

Groundwater samples will be collected after the field parameters have stabilized. Purge water would be disposed on the ground adjacent to each well. Groundwater sampling shall be conducted according to the SOPs provided in the QAPP, Revision 1.1 (Barr, 2006).

Up to two groundwater samples will be analyzed from the probes or from temporary wells. The samples will be analyzed for the VOCs, SVOCs and dissolved RCRA metals listed in Table 1. Groundwater samples to be analyzed for metals will be filtered in the field using 0.45 µm filters in either an in-line filter cartridge (if samples are collected with a peristaltic pump) or a manual filtering apparatus (if samples are collected with polyethylene tubing fitted with a check valve). A new filter cartridge or manual filtering apparatus will be used for each sample. Table 2 identifies the sample containers, sample preservation methods, and holding times for each analytical parameter class.

In addition to the native groundwater samples, QA/QC samples consisting of trip blanks, masked duplicates, field blanks, and matrix spikes/matrix spike duplicates will be collected and analyzed according to the schedule in Table 3. A sample network summary is presented in Table 4.

Laboratory analyses will be performed by Legend Technical Services in St. Paul, Minnesota. Appropriate sample handling and documentation procedures described in the QAPP, Revision 1.1 (Barr, 2006) will be followed.

2.2.4 Soil Cuttings

Soil cuttings will be thin spread on the Property in the vicinity of each soil boring unless significant contamination is noted.

2.2.5 Surveying

Final locations of all soil borings will be surveyed using global positioning system (GPS) methods. Elevation data will be approximated from available topographic data.

2.2.6 Temporary Wells

If groundwater grab samples cannot be collected using the probe rods then (as a contingency) temporary monitoring wells will be installed to allow collection of groundwater samples. If used, temporary wells will be constructed of 1-inch diameter PVC screens and risers. Top of casing elevation for these wells will be surveyed relative to a site datum. These temporary wells will be properly sealed upon completion of the investigation. If installed, groundwater elevations will be measured in these temporary wells to estimate groundwater flow direction beneath the Property (by comparison with nearby reference elevations such as the current lake level elevation).

2.3 Sample Labeling and Numbering

Well locations and/or sample type will be represented by one- or two-letter designators, followed by a unique location number. Standard designators are as follow:

- **MW** (Monitoring Well): Represents any well installed for the purpose of collecting groundwater samples and water levels.
- **GP** (Direct-push Boring): Represents any boring installed for the purpose of collecting information on the stratigraphy or for collecting soil or groundwater samples.
- **FB** (Field Blank): Represents a sample collected for QA/QC procedures.
- **DUP** (Duplicate): Represents a duplicate soil or groundwater sample collected for QA/QC procedures.
- **TB** (Trip Blank): Represents a blank container filled by the laboratory with ultra clean test water.

Samples will be labeled according to the location (boring or well) from which they are collected.

2.4 Field Records

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

3.0 Data Quality Objectives

As stated in the QAPP, Revision 1.1 (Barr, 2006), data quality objectives (DQOs) are qualitative and quantitative statements that specify the quality of the analytical data needed to support decisions made during project investigations. DQOs are established to ensure that the data collected are sufficient and are of adequate level of quality for their intended uses.

3.1 Site Problem

As stated above in Section 1.2.2., the Phase I ESA identified several RECs related to the previous uses or current observations at the Property. The Phase II ESA of the Property indicated chromium in surface and near-surface soil samples at concentrations exceeding Tier I SLV screening criteria. There is a potential for chromium impact to groundwater at the Property from the near-surface soils. In addition, the Phase II ESA results indicated trace to relatively low concentrations of VOCs, SVOCs, RCRA metals, and DRO. Fill and debris are present in the subsurface across the Property indicating that there is a potential for asbestos and PCBs to be present. Previous investigations have not included groundwater characterization at the Property.

The objective of this investigation will be to evaluate the nature and potential risks of RECs and contaminants of concern to human health or the environment.

3.2 Decision Statements

The decision statements will be: Do any of the RECs identified in the Phase I ESA, or contaminants of concern identified in the Phase II ESA, pose a potential impact or threat to human health or the environment? Does the soil and groundwater at the Property meet applicable State or Federal criteria? Is remediation necessary? And if so, can existing or proposed land use be modified to make remediation economically viable? Can exposure pathways be eliminated through engineering/institutional controls?

3.3 Decision Inputs

Decision inputs include the field observations, the field screening results, and the data collected from the soil and groundwater sample analyses as described in Section 2.0 of this SAP. Legend Technical Services, Inc. in St. Paul, Minnesota will analyze these samples for the parameters listed in Table 1. Based on available information, these parameters have been determined to be the compounds most

representative of previous Property uses. Data generated during this investigation and other available information (e.g., the Phase I and Phase II ESA reports) will be used to evaluate compliance with the project objectives.

3.4 Study Boundaries

The boundaries of the Property are shown on Figure 2. Investigation timing (temporal boundaries) will be determined after approval of this SAP by the City and the EPA.

3.5 Decision Rule

The decision for any actions at the Property will be based on the analytical results of the soil and groundwater samples along with field information as to how they meet the project objectives. The decision rule for the Property is: Do the RECs or contaminants of concern present any potential risks to human health or the environment and can redevelopment proceed as conceptually planned or is additional investigation or remediation necessary?

3.6 Decision Errors

3.6.1 Sampling Design Errors

Sample design error is defined as the inability of a sampling design process to capture the complete extent of natural variability that exists in the true state of the environment. As detailed in Section 2.0 of this SAP, this design error is countered by the knowledge of the Phase I ESA performed in March 2004, the Phase II ESA performed in June 2004, and the total numbers of sample collected.

3.6.2 Measurement Errors

Measurement errors are defined as the combination of random and systematic errors that inevitably arise during the various steps of the measurement procedure. This type of error is minimized through systematic uniform management of each of the steps in the measurement process as detailed in this SAP and within the approved QAPP, Revision 1.1 (Barr, 2006), which will be followed during all aspects of this investigation.

3.7 Optimum Design

The overall sampling network addresses each of the previously identified RECs and contaminants of concern. With proper implementation of all field and laboratory procedures it will provide

representative information for the evaluation of their potential impacts to human health and/or the environment, thus meeting the DQOs.

3.8 Project Data Quality Objectives

The data and investigative information generated will be used to determine the impacts on the soil and groundwater in the vicinity of the previously identified RECs and contaminants of concern and to determine the overall nature and extent of any potential impacts to human health and environment at the Property. The data will satisfy the Property DQOs presented below:

- Analytical results must accurately reflect the soil and groundwater quality.
- Field collection of samples for risk-based evaluations will require a high level of data quality since the sampling will be used to determine the potential impacts associated with the RECs and contaminants of concern.
- Laboratory results must be of sufficient quality to demonstrate that the identified RECs or contaminants of concern either do or do not present impacts to human health or the environment. Detection limits must be lower than the appropriate risked-based values and applicable State or Federal criteria. Risk criteria and standards are discussed in Section A8.1.1.5, and are presented in Table 1 of the QAPP, Revision 1.1 (Barr, 2006).
- Analytical results must satisfy quality control requirements for accuracy, precision, representativeness, completeness and comparability.
- The laboratory analyses will require a high level of data quality and will be used for the determination of overall compliance with project objectives. The analyses are characterized by rigorous QA/QC protocols and documentation and provide qualitative and quantitative data. Analytical and data review procedures must be in accordance with State recognized protocol as detailed in the QAPP, Revision 1.1 (Barr, 2006).
- The field screening procedures will have an intermediate level of data quality, but will follow all SOPs, ensuring consistency and accuracy, as detailed in the QAPP, Revision 1.1 (Barr, 2006).

4.0 Quality Assurance/Quality Control

Quality assurance objectives (QAOs) have been established to ensure accuracy, precision, sensitivity, completeness, and comparability of laboratory analytical data and to meet the Quality Control (QC) acceptance criteria of analytical protocols in support of project needs. Overall, QAO procedures for field sampling, chain-of-custody, laboratory analysis, and reporting will provide the level of data required for determining the concentration of potential contaminants in surface water, sediment and groundwater samples.

As detailed in the QAPP, Revision 1.1 (Barr, 2006), 4 individual QAOs, including precision, accuracy, sensitivity, and completeness will be used to meet the QAOs for this investigation. Precision measures the reproducibility of measurements at the laboratory by comparing analytical results between matrix spike/matrix spike duplicates (MS/MSD) and also between masked duplicates and the native samples collected in the field. In addition, the laboratory routinely analyzes lab duplicates for inorganic parameters during sample runs. The relative percent difference will be calculated for each pair of duplicate analyses and the result will be used to assess precision. Accuracy is measured by the agreement of results with a known value. Accuracy of results will be assessed using the analytical results of method blanks, field blanks, reagent/preparation blanks, MS/MSD samples, and laboratory control samples. Completeness is defined as the number of valid measurements obtained compared to the planned number of measurements, and is expressed as a percentage. Barr expects that the contracted laboratory will provide useable and acceptable data for at least 95 percent of all samples tested using the specified analytical methods. Sensitivity (reporting limits) is dependent upon instrument sensitivity, sample matrix, and composition effects, and will be monitored by the laboratory. Final laboratory reporting limits are listed in Table 1. Actual reporting limits achieved may depend on sample size available, sample matrix interferences, and parameter concentrations.

5.0 Reporting and Schedule

5.1 Reporting

Investigation results will be summarized and evaluated in a Supplemental Phase II environmental site investigation report. This report will summarize the data collected during the investigation and compare analytical results to State of Minnesota and Federal risk-screening criteria or standards relevant to the contaminant type, media, and Property setting. Risk criteria and standards are discussed in Section A8.1.1.5, and are presented in Table 1, of the QAPP, Revision 1.1 (Barr, 2006). The report will include the following elements: Introduction, Property setting, previous investigations summary, Supplemental Phase II investigation results, QA/QC procedures and results, a preliminary risk evaluation, conclusions, and recommendations. A map showing all sampling locations, soil conditions, and groundwater conditions will be developed.

A draft report will be prepared and submitted to City staff for review. Review comments will be incorporated into the final report.

5.2 Schedule

The project (including report preparation) will take approximately eight weeks (with laboratory analysis) to complete. Project start date is dependent on timing of the SAP review by the EPA and by the State Historic Preservation Office, coordination with the City, and Property access.

6.0 References

Barr Engineering Company (Barr), 2004a. "Phase I Environmental Site Assessment: City of Duluth Waterfront Properties, 500-1000 Railroad Street, Duluth, Minnesota," prepared for the City of Duluth, Minnesota, March 2004.

Barr, 2004b. "Phase II Environmental Site Assessment: Duluth Waterfront Property, Duluth, Minnesota," prepared for the City of Duluth, Minnesota, August 2004.

Barr, 2006. "Quality Assurance Project Plan – U.S. EPA Brownfield Development, Hazardous Substance and Petroleum Assessment Grant," Revision 1.1, prepared for the City of Duluth, Minnesota, July 2006.

Tables

Table 1

Analytical Parameters, Methods, Detection Limits, and Reporting Limits
Bayfront – Slips 2 and 3
Supplemental Phase II Investigation
Duluth, Minnesota

Parameter	Matrix[1]	Method	MDL	RL	Test Unit
Metals					
Arsenic	Soil	EPA 6010B	0.036	0.5	mg/kg
Barium	Soil	EPA 6010B	0.12	1.0	mg/kg
Cadmium	Soil	EPA 6010B	0.0065	0.25	mg/kg
Chromium	Soil	EPA 6010B	0.0055	0.5	mg/kg
Lead	Soil	EPA 6010B	0.027	1.0	mg/kg
Mercury	Soil	EPA 7471A	0.0042	0.10	mg/kg
Selenium	Soil	EPA 6010B	0.13	1.0	mg/kg
Silver	Soil	EPA 6010B	0.016	0.25	mg/kg
Arsenic	Water	EPA 6010B	0.72	10	µg/L
Barium	Water	EPA 6010B	2.3	20	µg/L
Cadmium	Water	EPA 6010B	0.13	1	µg/L
Chromium	Water	EPA 6010B	0.11	10	µg/L
Lead	Water	EPA 6010B	0.54	3	µg/L
Mercury	Water	EPA 7470A	.042	0.2	µg/L
Selenium	Water	EPA 6010B	2.5	20	µg/L
Silver	Water	EPA 6010B	0.31	5	µg/L
Petroleum					
Diesel Range Organics (DRO)	Soil	WDNR Mod	1.8	10	mg/kg
Diesel Range Organics (DRO)	Water	WDNR Mod	25	100	µg/L
Semivolatile Organic Compounds					
1,2,4-Trichlorobenzene	Soil	EPA 8270C	0.049	0.33	mg/kg
1,2-Dichlorobenzene	Soil	EPA 8270C	0.044	0.33	mg/kg
1,3-Dichlorobenzene	Soil	EPA 8270C	0.045	0.33	mg/kg
1,4-Dichlorobenzene	Soil	EPA 8270C	0.045	0.33	mg/kg
2,3,4,6-Tetrachlorophenol	Soil	EPA 8270C	0.15	0.67	mg/kg
2,4,5-Trichlorophenol	Soil	EPA 8270C	0.099	0.67	mg/kg
2,4,6-Trichlorophenol	Soil	EPA 8270C	0.12	0.67	mg/kg
2,4-Dichlorophenol	Soil	EPA 8270C	0.1	0.67	mg/kg
2,4-Dimethyl phenol	Soil	EPA 8270C	0.1	0.67	mg/kg
2,4-Dinitrophenol	Soil	EPA 8270C	0.081	0.67	mg/kg
2,4-Dinitrotoluene	Soil	EPA 8270C	0.057	0.33	mg/kg
2,6-Dichlorophenol	Soil	EPA 8270C	0.15	0.67	mg/kg
2,6-Dinitrotoluene	Soil	EPA 8270C	0.073	0.33	mg/kg
2-Chloronaphthalene	Soil	EPA 8270C	0.052	0.33	mg/kg
2-Chlorophenol	Soil	EPA 8270C	0.091	0.67	mg/kg
2-Methylnaphthalene	Soil	EPA 8270C	0.1	0.34	mg/kg
2-Methylphenol	Soil	EPA 8270C	0.1	0.67	mg/kg
2-Nitroaniline	Soil	EPA 8270C	0.069	0.33	mg/kg

Table 1 (cont.)

Analytical Parameters, Methods, Detection Limits, and Reporting Limits
Bayfront – Slips 2 and 3
Supplemental Phase II Investigation
Duluth, Minnesota

Parameter	Matrix[1]	Method	MDL	RL	Test Unit
2-Nitrophenol	Soil	EPA 8270C	0.12	0.67	mg/kg
3,3'-Dichlorobenzidine	Soil	EPA 8270C	0.55	1.9	mg/kg
3-Nitroaniline	Soil	EPA 8270C	0.056	0.33	mg/kg
4,6-Dinitro-2-methyl phenol	Soil	EPA 8270C	0.11	0.67	mg/kg
4-Bromophenyl-phenylether	Soil	EPA 8270C	0.073	0.33	mg/kg
4-Chloro-3-methyl phenol	Soil	EPA 8270C	0.11	0.67	mg/kg
4-Chloroaniline	Soil	EPA 8270C	0.041	0.67	mg/kg
4-Chlorophenyl-phenylether	Soil	EPA 8270C	0.06	0.33	mg/kg
4-Methylphenol	Soil	EPA 8270C	0.082	0.33	mg/kg
4-Nitroaniline	Soil	EPA 8270C	0.059	0.33	mg/kg
4-Nitrophenol	Soil	EPA 8270C	0.35	1.2	mg/kg
Acenaphthene	Soil	EPA 8270C	0.05	0.33	mg/kg
Acenaphthylene	Soil	EPA 8270C	0.052	0.33	mg/kg
Aniline	Soil	EPA 8270C	0.11	0.67	mg/kg
Anthracene	Soil	EPA 8270C	0.048	0.33	mg/kg
Azobenzene	Soil	EPA 8270C	0.054	0.33	mg/kg
Benzidine	Soil	EPA 8270C	0.97	3.7	mg/kg
Benzo(a)anthracene	Soil	EPA 8270C	0.067	0.33	mg/kg
Benzo(a)pyrene	Soil	EPA 8270C	0.076	0.33	mg/kg
Benzo(b)fluoranthene	Soil	EPA 8270C	0.064	0.33	mg/kg
Benzo(g,h,i)perylene	Soil	EPA 8270C	0.076	0.33	mg/kg
Benzo(k)fluoranthene	Soil	EPA 8270C	0.01	0.33	mg/kg
Benzoic acid	Soil	EPA 8270C	0.15	0.51	mg/kg
Benzyl alcohol	Soil	EPA 8270C	0.26	0.89	mg/kg
bis(2-Chloroethoxy)methane	Soil	EPA 8270C	0.065	0.33	mg/kg
bis(2-Chloroethyl)ether	Soil	EPA 8270C	0.055	0.33	mg/kg
bis(2-Chloroisopropyl)ether	Soil	EPA 8270C	0.071	0.33	mg/kg
bis(2-Ethyl hexyl)phthalate	Soil	EPA 8270C	0.096	0.33	mg/kg
Butylbenzylphthalate	Soil	EPA 8270C	0.096	0.67	mg/kg
Carbazole	Soil	EPA 8270C	0.075	0.33	mg/kg
Chrysene	Soil	EPA 8270C	0.055	0.33	mg/kg
Dibenz(a,h)anthracene	Soil	EPA 8270C	0.074	0.33	mg/kg
Dibenzofuran	Soil	EPA 8270C	0.056	0.33	mg/kg
Diethylphthalate	Soil	EPA 8270C	0.069	0.33	mg/kg
Dimethylphthalate	Soil	EPA 8270C	0.078	0.33	mg/kg
Di-n-butylphthalate	Soil	EPA 8270C	0.10	0.35	mg/kg
Di-n-octylphthalate	Soil	EPA 8270C	0.084	0.33	mg/kg
Fluoranthene	Soil	EPA 8270C	0.073	0.33	mg/kg
Fluorene	Soil	EPA 8270C	0.046	0.33	mg/kg
Hexachlorobenzene	Soil	EPA 8270C	0.052	0.33	mg/kg
Hexachlorobutadiene	Soil	EPA 8270C	0.055	0.33	mg/kg
Hexachlorocyclopentadiene	Soil	EPA 8270C	0.041	0.33	mg/kg
Hexachloroethane	Soil	EPA 8270C	0.067	0.33	mg/kg
Indeno(1,2,3-cd)pyrene	Soil	EPA 8270C	0.071	0.33	mg/kg

Table 1 (cont.)

Analytical Parameters, Methods, Detection Limits, and Reporting Limits
Bayfront – Slips 2 and 3
Supplemental Phase II Investigation
Duluth, Minnesota

Parameter	Matrix[1]	Method	MDL	RL	Test Unit
Isophorone	Soil	EPA 8270C	0.06	0.33	mg/kg
Naphthalene	Soil	EPA 8270C	0.042	0.33	mg/kg
Nitrobenzene	Soil	EPA 8270C	0.058	0.33	mg/kg
n-Nitrosodimethylamine	Soil	EPA 8270C	0.043	0.33	mg/kg
n-Nitroso-di-n-propylamine	Soil	EPA 8270C	0.086	0.33	mg/kg
n-Nitrosodiphenylamine	Soil	EPA 8270C	0.059	0.33	mg/kg
Pentachlorophenol	Soil	EPA 8270C	0.14	0.67	mg/kg
Phenanthrene	Soil	EPA 8270C	0.061	0.33	mg/kg
Phenol	Soil	EPA 8270C	0.082	0.67	mg/kg
Pyrene	Soil	EPA 8270C	0.065	0.33	mg/kg
1,2,4-Trichlorobenzene	Water	EPA 8270C	1.2	10	µg/L
1,2-Dichlorobenzene	Water	EPA 8270C	1.1	10	µg/L
1,3-Dichlorobenzene	Water	EPA 8270C	1.2	10	µg/L
1,4-Dichlorobenzene	Water	EPA 8270C	1.0	10	µg/L
2,3,4,6-Tetrachlorophenol	Water	EPA 8270C	1.7	10	µg/L
2,4,5-Trichlorophenol	Water	EPA 8270C	1.9	10	µg/L
2,4,6-Trichlorophenol	Water	EPA 8270C	1.9	10	µg/L
2,4-Dichlorophenol	Water	EPA 8270C	1.8	10	µg/L
2,4-Dimethyl phenol	Water	EPA 8270C	1.1	10	µg/L
2,4-Dinitrophenol	Water	EPA 8270C	2.5	10	µg/L
2,4-Dinitrotoluene	Water	EPA 8270C	0.92	10	µg/L
2,6-Dichlorophenol	Water	EPA 8270C	1.7	10	µg/L
2,6-Dinitrotoluene	Water	EPA 8270C	1.1	10	µg/L
2-Chloronaphthalene	Water	EPA 8270C	0.83	10	µg/L
2-Chlorophenol	Water	EPA 8270C	1.5	10	µg/L
2-Methylnaphthalene	Water	EPA 8270C	1.9	10	µg/L
2-Methylphenol	Water	EPA 8270C	1.5	10	µg/L
2-Nitroaniline	Water	EPA 8270C	1.9	10	µg/L
2-Nitrophenol	Water	EPA 8270C	1.9	10	µg/L
3,3'-Dichlorobenzidine	Water	EPA 8270C	17	100	µg/L
3-Nitroaniline	Water	EPA 8270C	3	10	µg/L
4-6-Dinitro-2-methylphenol	Water	EPA 8270C	2.7	10	µg/L
4-Bromophenyl-phenylether	Water	EPA 8270C	1.3	10	µg/L
4-Chloro-3-methyl phenol	Water	EPA 8270C	2.0	10	µg/L
4-Chloroaniline	Water	EPA 8270C	3.0	10	µg/L
4-Chlorophenyl-phenyl ether	Water	EPA 8270C	1.1	10	µg/L
4-Methylphenol	Water	EPA 8270C	2.3	10	µg/L
4-Nitroaniline	Water	EPA 8270C	1.8	10	µg/L
4-Nitrophenol	Water	EPA 8270C	1.7	10	µg/L
Acenaphthene	Water	EPA 8270C	0.8	10	µg/L
Acenaphthylene	Water	EPA 8270C	0.81	10	µg/L
Aniline	Water	EPA 8270C	3.2	10	µg/L
Anthracene	Water	EPA 8270C	1.1	10	µg/L
Azobenzene	Water	EPA 8270C	0.94	10	µg/L

Table 1 (cont.)

Analytical Parameters, Methods, Detection Limits, and Reporting Limits
Bayfront – Slips 2 and 3
Supplemental Phase II Investigation
Duluth, Minnesota

Parameter	Matrix[1]	Method	MDL	RL	Test Unit
Benzidine	Water	EPA 8270C	23	100	µg/L
Benzo(a)anthracene	Water	EPA 8270C	0.88	10	µg/L
Benzo(a)pyrene	Water	EPA 8270C	0.94	10	µg/L
Benzo(b)fluoranthene	Water	EPA 8270C	0.83	10	µg/L
Benzo(g,h,i)perylene	Water	EPA 8270C	1.2	10	µg/L
Benzo(k)fluoranthene	Water	EPA 8270C	0.96	10	µg/L
Benzoic acid	Water	EPA 8270C	2.8	10	µg/L
Benzyl alcohol	Water	EPA 8270C	1.5	10	µg/L
bis(2-Chloroethoxy)methane	Water	EPA 8270C	0.83	10	µg/L
bis(2-Chloroethyl)ether	Water	EPA 8270C	0.86	10	µg/L
bis(2-Chloroisopropyl)ether	Water	EPA 8270C	0.83	10	µg/L
bis(2-Ethylhexyl)phthalate	Water	EPA 8270C	1.2	10	µg/L
Butylbenzylphthalate	Water	EPA 8270C	1.2	10	µg/L
Carbazole	Water	EPA 8270C	1.2	10	µg/L
Chrysene	Water	EPA 8270C	0.94	10	µg/L
Dibenz(a,h)anthracene	Water	EPA 8270C	1.1	10	µg/L
Dibenzofuran	Water	EPA 8270C	1.7	10	µg/L
Diethylphthalate	Water	EPA 8270C	1.1	10	µg/L
Dimethylphthalate	Water	EPA 8270C	1.0	10	µg/L
Di-n-butyl phthalate	Water	EPA 8270C	1.4	10	µg/L
Di-n-octylphthalate	Water	EPA 8270C	1.0	10	µg/L
Fluoranthene	Water	EPA 8270C	1.1	10	µg/L
Fluorene	Water	EPA 8270C	0.96	10	µg/L
Hexachlorobenzene	Water	EPA 8270C	1.3	10	µg/L
Hexachlorobutadiene	Water	EPA 8270C	1.5	10	µg/L
Hexachlorocyclopentadiene	Water	EPA 8270C	1.2	10	µg/L
Hexachloroethane	Water	EPA 8270C	1.1	10	µg/L
Indeno(1,2,3-cd)pyrene	Water	EPA 8270C	0.96	10	µg/L
Isophorone	Water	EPA 8270C	0.80	10	µg/L
Naphthalene	Water	EPA 8270C	1.1	10	µg/L
Nitrobenzene	Water	EPA 8270C	0.80	10	µg/L
n-Nitrosodimethylamine	Water	EPA 8270C	0.95	10	µg/L
N-Nitroso-di-n-propylamine	Water	EPA 8270C	0.89	10	µg/L
n-Nitrosodiphenylamine	Water	EPA 8270C	1.5	10	µg/L
Pentachlorophenol	Water	EPA 8270C	2.6	10	µg/L
Phenanthrene	Water	EPA 8270C	1.4	10	µg/L
Phenol	Water	EPA 8270C	1.4	10	µg/L
Pyrene	Water	EPA 8270C	0.91	10	µg/L
Volatile Organic Compounds					
1,1,1,2-Tetrachloroethane	Soil	EPA 8260B	0.018	0.25	mg/kg
1,1,1-Trichloroethane	Soil	EPA 8260B	0.022	0.25	mg/kg
1,1,2,2-Tetrachloroethane	Soil	EPA 8260B	0.0095	0.25	mg/kg
1,1,2-Trichloroethane	Soil	EPA 8260B	0.026	0.25	mg/kg

Table 1 (cont.)

Analytical Parameters, Methods, Detection Limits, and Reporting Limits
Bayfront – Slips 2 and 3
Supplemental Phase II Investigation
Duluth, Minnesota

Parameter	Matrix[1]	Method	MDL	RL	Test Unit
1,1,2-Trichlorotrifluoroethane	Soil	EPA 8260B	0.013	0.25	mg/kg
1,1-Dichloroethane	Soil	EPA 8260B	0.011	0.25	mg/kg
1,1-Dichloroethene	Soil	EPA 8260B	0.015	0.25	mg/kg
1,1-Dichloropropene	Soil	EPA 8260B	0.021	0.25	mg/kg
1,2,3-Trichlorobenzene	Soil	EPA 8260B	0.023	0.5	mg/kg
1,2,3-Trichloropropane	Soil	EPA 8260B	0.014	0.25	mg/kg
1,2,4-Trichlorobenzene	Soil	EPA 8260B	0.023	0.5	mg/kg
1,2,4-Trimethylbenzene	Soil	EPA 8260B	0.0049	0.25	mg/kg
1,2-Dibromo-3-chloropropane	Soil	EPA 8260B	0.021	0.5	mg/kg
1,2-Dibromoethane	Soil	EPA 8260B	0.023	0.25	mg/kg
1,2-Dichlorobenzene	Soil	EPA 8260B	0.014	0.25	mg/kg
1,2-Dichloroethane	Soil	EPA 8260B	0.009	0.25	mg/kg
1,2-Dichloropropane	Soil	EPA 8260B	0.023	0.25	mg/kg
1,3,5-Trimethyl benzene	Soil	EPA 8260B	0.016	0.25	mg/kg
1,3-Dichlorobenzene	Soil	EPA 8260B	0.018	0.25	mg/kg
1,3-Dichloropropane	Soil	EPA 8260B	0.0092	0.25	mg/kg
1,4-Dichlorobenzene	Soil	EPA 8260B	0.018	0.25	mg/kg
2,2-Dichloropropane	Soil	EPA 8260B	0.05	0.25	mg/kg
2-Butanone	Soil	EPA 8260B	0.039	2.0	mg/kg
2-Chlorotoluene	Soil	EPA 8260B	0.011	0.25	mg/kg
4-Chlorotoluene	Soil	EPA 8260B	0.013	0.25	mg/kg
Acetone	Soil	EPA 8260B	0.067	2.0	mg/kg
Allyl chloride	Soil	EPA 8260B	0.091	0.5	mg/kg
Benzene	Soil	EPA 8260B	0.011	0.25	mg/kg
Bromobenzene	Soil	EPA 8260B	0.011	0.25	mg/kg
Bromochloromethane	Soil	EPA 8260B	0.026	0.25	mg/kg
Bromodichloromethane	Soil	EPA 8260B	0.021	0.25	mg/kg
Bromoform	Soil	EPA 8260B	0.047	0.25	mg/kg
Bromomethane	Soil	EPA 8260B	0.07	0.25	mg/kg
Carbon tetrachloride	Soil	EPA 8260B	0.011	0.25	mg/kg
Chlorobenzene	Soil	EPA 8260B	0.012	0.25	mg/kg
Chloroethane	Soil	EPA 8260B	0.0085	0.25	mg/kg
Chloroform	Soil	EPA 8260B	0.01	0.25	mg/kg
Chloromethane	Soil	EPA 8260B	0.035	0.25	mg/kg
cis- 1,2-Dichloroethene	Soil	EPA 8260B	0.017	0.25	mg/kg
cis-1,3-Dichloropropene	Soil	EPA 8260B	0.017	0.25	mg/kg
Dibromochloromethane	Soil	EPA 8260B	0.042	0.25	mg/kg
Dibromomethane	Soil	EPA 8260B	0.013	0.25	mg/kg
Dichlorodifluoromethane	Soil	EPA 8260B	0.038	0.5	mg/kg
Dichlorofluoromethane	Soil	EPA 8260B	0.027	0.25	mg/kg
Ethyl benzene	Soil	EPA 8260B	0.013	0.25	mg/kg
Ethyl ether	Soil	EPA 8260B	0.01	0.25	mg/kg
Hexachlorobutadiene	Soil	EPA 8260B	0.071	0.5	mg/kg
Isopropyl benzene	Soil	EPA 8260B	0.025	0.25	mg/kg

Table 1 (cont.)

Analytical Parameters, Methods, Detection Limits, and Reporting Limits
Bayfront – Slips 2 and 3
Supplemental Phase II Investigation
Duluth, Minnesota

Parameter	Matrix[1]	Method	MDL	RL	Test Unit
Methyl isobutyl ketone	Soil	EPA 8260B	0.067	0.5	mg/kg
Methylene chloride	Soil	EPA 8260B	0.029	1.5	mg/kg
Methyl-tert-butyl ether	Soil	EPA 8260B	0.018	0.25	mg/kg
Naphthalene	Soil	EPA 8260B	0.012	0.5	mg/kg
n-Butyl benzene	Soil	EPA 8260B	0.0064	0.25	mg/kg
n-Propyl benzene	Soil	EPA 8260B	0.013	0.25	mg/kg
o-Xylene	Soil	EPA 8260B	0.019	0.25	mg/kg
p/m-Xylene	Soil	EPA 8260B	0.028	0.50	mg/kg
p-Isopropyltoluene	Soil	EPA 8260B	0.014	0.25	mg/kg
sec-butyl benzene	Soil	EPA 8260B	0.011	0.25	mg/kg
Styrene	Soil	EPA 8260B	0.017	0.25	mg/kg
tert-Butyl benzene	Soil	EPA 8260B	0.047	0.25	mg/kg
Tetrachloroethene	Soil	EPA 8260B	0.04	0.25	mg/kg
Tetrahydrofuran	Soil	EPA 8260B	0.029	2.0	mg/kg
Toluene	Soil	EPA 8260B	0.0093	0.25	mg/kg
trans-1,2-Dichloroethene	Soil	EPA 8260B	0.021	0.25	mg/kg
trans-1,3-Dichloropropene	Soil	EPA 8260B	0.019	0.25	mg/kg
Trichloroethene	Soil	EPA 8260B	0.017	0.25	mg/kg
Trichlorofluoromethane	Soil	EPA 8260B	0.023	0.25	mg/kg
Vinyl chloride	Soil	EPA 8260B	0.021	0.25	mg/kg
1,1,1,2-Tetrachloroethane	Water	EPA 8260B	0.2	1.0	µg/L
1,1,1-Trichloroethane	Water	EPA 8260B	0.098	1.0	µg/L
1,1,2,2-Tetrachloroethane	Water	EPA 8260B	0.19	1.0	µg/L
1,1,2-Trichloroethane	Water	EPA 8260B	0.22	1.0	µg/L
1,1,2-Trichlorotrifluoroethane	Water	EPA 8260B	0.3	1.0	µg/L
1,1-Dichloroethane	Water	EPA 8260B	0.11	1.0	µg/L
1,1-Dichloroethene	Water	EPA 8260B	0.14	1.0	µg/L
1,1-Dichloropropene	Water	EPA 8260B	0.083	1.0	µg/L
1,2,3-Trichlorobenzene	Water	EPA 8260B	0.17	5.0	µg/L
1,2,3-Trichloropropane	Water	EPA 8260B	0.095	2.5	µg/L
1,2,4-Trichlorobenzene	Water	EPA 8260B	0.13	5.0	µg/L
1,2,4-Trimethylbenzene	Water	EPA 8260B	0.037	1.0	µg/L
1,2-Dibromo-3-chloropropane	Water	EPA 8260B	0.85	5.0	µg/L
1,2-Dibromoethane	Water	EPA 8260B	0.15	2.5	µg/L
1,2-Dichlorobenzene	Water	EPA 8260B	0.079	1.0	µg/L
1,2-Dichloroethane	Water	EPA 8260B	0.11	1.0	µg/L
1,2-Dichloropropane	Water	EPA 8260B	0.12	1.0	µg/L
1,3,5-Trimethylbenzene	Water	EPA 8260B	0.046	1.0	µg/L
1,3-Dichlorobenzene	Water	EPA 8260B	0.08	1.0	µg/L
1,3-Dichloropropane	Water	EPA 8260B	0.11	1.0	µg/L
1,4-Dichlorobenzene	Water	EPA 8260B	0.08	1.0	µg/L
1,4-Dioxane	Water	EPA 8260B	12	100	µg/L
2,2-Dichloropropane	Water	EPA 8260B	0.23	5.0	µg/L
2-Butanone	Water	EPA 8260B	0.32	20	µg/L

Table 1 (cont.)

Analytical Parameters, Methods, Detection Limits, and Reporting Limits
Bayfront – Slips 2 and 3
Supplemental Phase II Investigation
Duluth, Minnesota

Parameter	Matrix[1]	Method	MDL	RL	Test Unit
2-Chlorotoluene	Water	EPA 8260B	0.047	1.0	µg/L
4-Chlorotoluene	Water	EPA 8260B	0.071	1.0	µg/L
4-Isopropyltoluene	Water	EPA 8260B	0.033	2.5	µg/L
Acetone	Water	EPA 8260B	2.4	20	µg/L
Allyl chloride	Water	EPA 8260B	0.34	5.0	µg/L
Benzene	Water	EPA 8260B	0.056	1.0	µg/L
Bromobenzene	Water	EPA 8260B	0.15	1.0	µg/L
Bromochloromethane	Water	EPA 8260B	0.12	1.0	µg/L
Bromodichloromethane	Water	EPA 8260B	0.14	1.0	µg/L
Bromoform	Water	EPA 8260B	0.54	5.0	µg/L
Bromomethane	Water	EPA 8260B	0.48	5.0	µg/L
Carbon tetrachloride	Water	EPA 8260B	0.11	1.0	µg/L
Chlorobenzene	Water	EPA 8260B	0.064	1.0	µg/L
Chloroethane	Water	EPA 8260B	0.33	2.5	µg/L
Chloroform	Water	EPA 8260B	0.047	1.0	µg/L
Chloromethane	Water	EPA 8260B	0.13	2.5	µg/L
cis-1,2-Dichloroethene	Water	EPA 8260B	0.13	1.0	µg/L
cis-1,3-Dichloropropene	Water	EPA 8260B	0.088	1.0	µg/L
Dibromochloromethane	Water	EPA 8260B	0.43	2.5	µg/L
Dibromomethane	Water	EPA 8260B	0.24	2.5	µg/L
Dichlorodifluoromethane	Water	EPA 8260B	0.085	5.0	µg/L
Dichlorofluoromethane	Water	EPA 8260B	0.11	1.0	µg/L
Ethyl benzene	Water	EPA 8260B	0.038	1.0	µg/L
Ethyl ether	Water	EPA 8260B	0.14	5.0	µg/L
Hexachlorobutadiene	Water	EPA 8260B	0.31	10	µg/L
Isopropyl benzene	Water	EPA 8260B	0.066	1.0	µg/L
Methyl isobutyl ketone	Water	EPA 8260B	0.7	5.0	µg/L
Methylene chloride	Water	EPA 8260B	0.4	10	µg/L
Methyl-tert-butyl ether	Water	EPA 8260B	0.1	1.0	µg/L
Naphthalene	Water	EPA 8260B	0.13	5.0	µg/L
n-Butyl benzene	Water	EPA 8260B	0.056	2.5	µg/L
n-Propyl benzene	Water	EPA 8260B	0.052	1.0	µg/L
o-Xylene	Water	EPA 8260B	0.023	1.0	µg/L
p,m-Xylene	Water	EPA 8260B	0.2	2.0	µg/L
sec-Butyl benzene	Water	EPA 8260B	0.045	1.0	µg/L
Styrene	Water	EPA 8260B	0.077	1.0	µg/L
tert-Butyl benzene	Water	EPA 8260B	0.051	1.0	µg/L
Tetrachloroethene	Water	EPA 8260B	0.11	1.0	µg/L
Tetrahydrofuran	Water	EPA 8260B	0.65	20	µg/L
Toluene	Water	EPA 8260B	0.12	1.0	µg/L
trans-1,2-Dichloroethene	Water	EPA 8260B	0.14	1.0	µg/L
trans-1,3-Dichloropropene	Water	EPA 8260B	0.1	1.0	µg/L
Trichloroethene	Water	EPA 8260B	0.2	1.0	µg/L
Trichlorofluormethane	Water	EPA 8260B	0.12	1.0	µg/L

Table 1 (cont.)

Analytical Parameters, Methods, Detection Limits, and Reporting Limits
Bayfront – Slips 2 and 3
Supplemental Phase II Investigation
Duluth, Minnesota

Parameter	Matrix[1]	Method	MDL	RL	Test Unit
Vinyl chloride	Water	EPA 8260B	0.13	1.0	µg/L
PCBs					
Aroclor 1016	Soil	EPA 8082	0.029	0.2	mg/kg
Aroclor 1221	Soil	EPA 8082	0.033	0.2	mg/kg
Aroclor 1232	Soil	EPA 8082	0.036	0.2	mg/kg
Aroclor 1242	Soil	EPA 8082	0.032	0.2	mg/kg
Aroclor 1248	Soil	EPA 8082	0.043	0.2	mg/kg
Aroclor 1254	Soil	EPA 8082	0.059	0.2	mg/kg
Aroclor 1260	Soil	EPA 8082	0.023	0.2	mg/kg
Asbestos					
Asbestos	Bulk Material	EPA 600/R-93-116	NA	NA	

[1] Includes optional analyses that may be performed based on field observations (e.g. DRO and PCBs in groundwater).
MDL Method Detection Limit
RL Reporting Limit
Results will be compared to appropriate risk-screening criteria or standards as discussed in the QAPP, Revision 1.1 (Barr, 2004c).
Analyses will be performed by Legend Technical Services, Inc. in St. Paul, Minnesota.

Table 2

Laboratory Sample Containers, Preservation and Holding Times
Bayfront – Slips 2 and 3
Supplemental Phase II Investigation
Duluth, Minnesota

Parameter	Container	Preservative	MPCA/EPA Recommended Holding Time
Diesel Range Organics	Soil -4 oz. Jar filled to 25 grams Water (if analyzed for DRO) – 1 liter amber	Soil- Cool to 4°C Water – HCl , Cool to 4°C	Soil – 14 day extract Water - 7 day extract Both -40 days analysis after extract
Volatile Organic Compounds	Soil -4 oz. Jar filled to 25 grams Water – 40 ml vial	Soil –25 ml MeOH, Cool to 4°C Water – pH <2 HCl, Cool to 4°C	14 days from collection
Metals	Soil -4 oz. Jar Water - 100ml plastic	Soil -Cool to 4°C Water – pH <2 HNO3	6 months except mercury (28 days) from collection
Semivolatile Organic Compounds, PCBs, Pesticide	Soil - 4 oz. Jar Water - 1 liter Amber	Cool to 4°C	Soil – 14 day extract Water -7 day extract Both -40 days analysis after extract
Hexavalent Chromium	Water (if analyzed for hexavalent chromium) – 100 ml plastic	Cool to 4ºC	Water – 24 hours
Bulk Asbestos	Plastic baggie, glass jar	NA	NA

Table 3

Frequency of Quality Assurance Samples
Bayfront – Slips 2 and 3
Supplemental Phase II Investigation
Duluth, Minnesota

Parameter	Frequency	Comments
Field Blanks	1 collected every 20 samples with a minimum of 1per sampling event.	
Field Duplicates	1 collected every 20 samples with a minimum of 1per sampling event.	Analyzed with field equipment only.
Masked Duplicates	1 collected every 20 samples with a minimum of 1per sampling event.	Analyzed by the laboratory only.
Methanol Blanks	1 collected every 20 samples with a minimum of 1per sampling event.	Collected only when soil VOC samples are collected.
Trip Blanks	1 placed in every shipping container containing VOC samples.	Made up in the laboratory, only analyzed when VOCs are contaminants of concern.
Matrix Spikes	2 collected every 20 samples with a minimum of 2 per sampling event.	Extra volume collected in the field, analyzed in each analytical batch.

Table 4

Sample Network Summary
Bayfront – Slips 2 and 3
Supplemental Phase II Investigation
Duluth, Minnesota

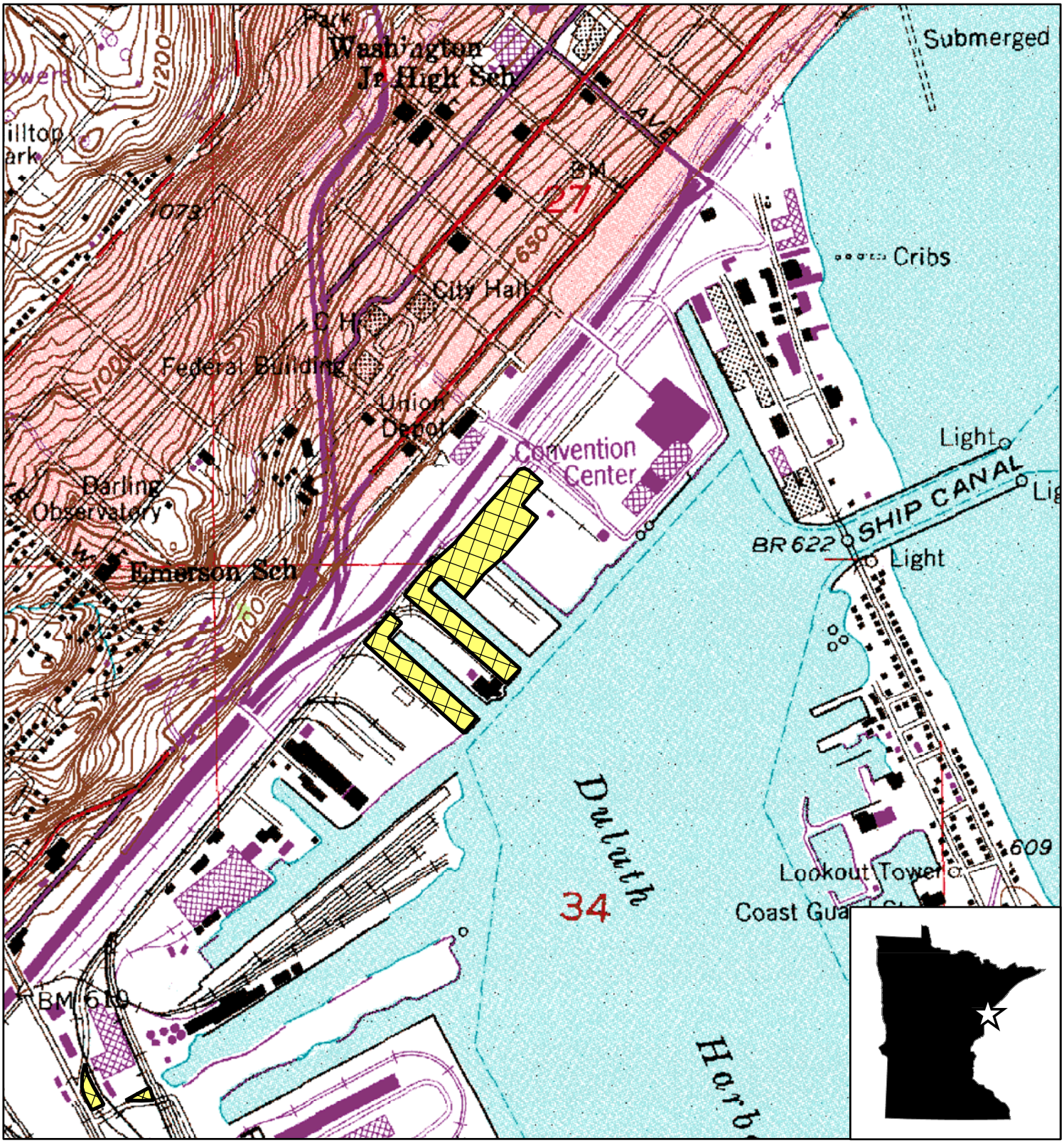
Sample Type	Field Parameters	Laboratory Analytical Parameters[1]	Estimated Maximum Number of Investigative Samples[3]	Quality Control Samples				Total
				FB	FD	TB	MS/MSD	
Soil	Field Screening (visual, odor, headspace)	RCRA Metals	12	1	1	0	2	16
		SVOCs	2	1	1	0	2	6
		PCBs	1	1	1	0	2	5
		VOCs	2	1	1	1	2	7
		DRO	2	1	1	0	2	6
Debris	Visual observation by trained/certified asbestos technician	Bulk Asbestos Content	1	0	0	0	0	1
Groundwater[2]	pH, Conductivity, Temperature, Dissolved Oxygen, Eh	VOCs	2	1	1	1	2	7
		RCRA Metals	2	1	1	0	2	6
		SVOCs	2	1	1	0	2	6

FB Field Blank
FD Field Duplicate
TB Trip Blank
MS Matrix Spike
MSD Matrix Spike Duplicate
RCRA Metals Resource Conservation Recovery Act metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver)
VOCs Volatile Organic Compounds
SVOCs Semivolatile Organic Compounds
PCBs Polychlorinated Biphenols
DRO Diesel-range Organics.

Field Parameters include temperature, specific conductivity, eH, pH, dissolved oxygen, and turbidity.
Methanol blanks will be collected with all VOCs soil samples.

[1] Individual analytical parameters are listed in Table 1.
[2] Includes samples from borings or from temporary monitoring wells.
[3] Actual number of samples will be determined based on field observations and/or locations as listed in Section 2.2.2.

Figures



Barr Footer: Date: 11/17/2006 12:49:33 PM File: I:\projects\23\69\A38\GIS\Maps\location_map.mxd User: mmb

Base Map: USGS 7.5' Quadrangle, Duluth, 1993 revision

Duluth Bayfront
Slip 2 and 3 Property

N

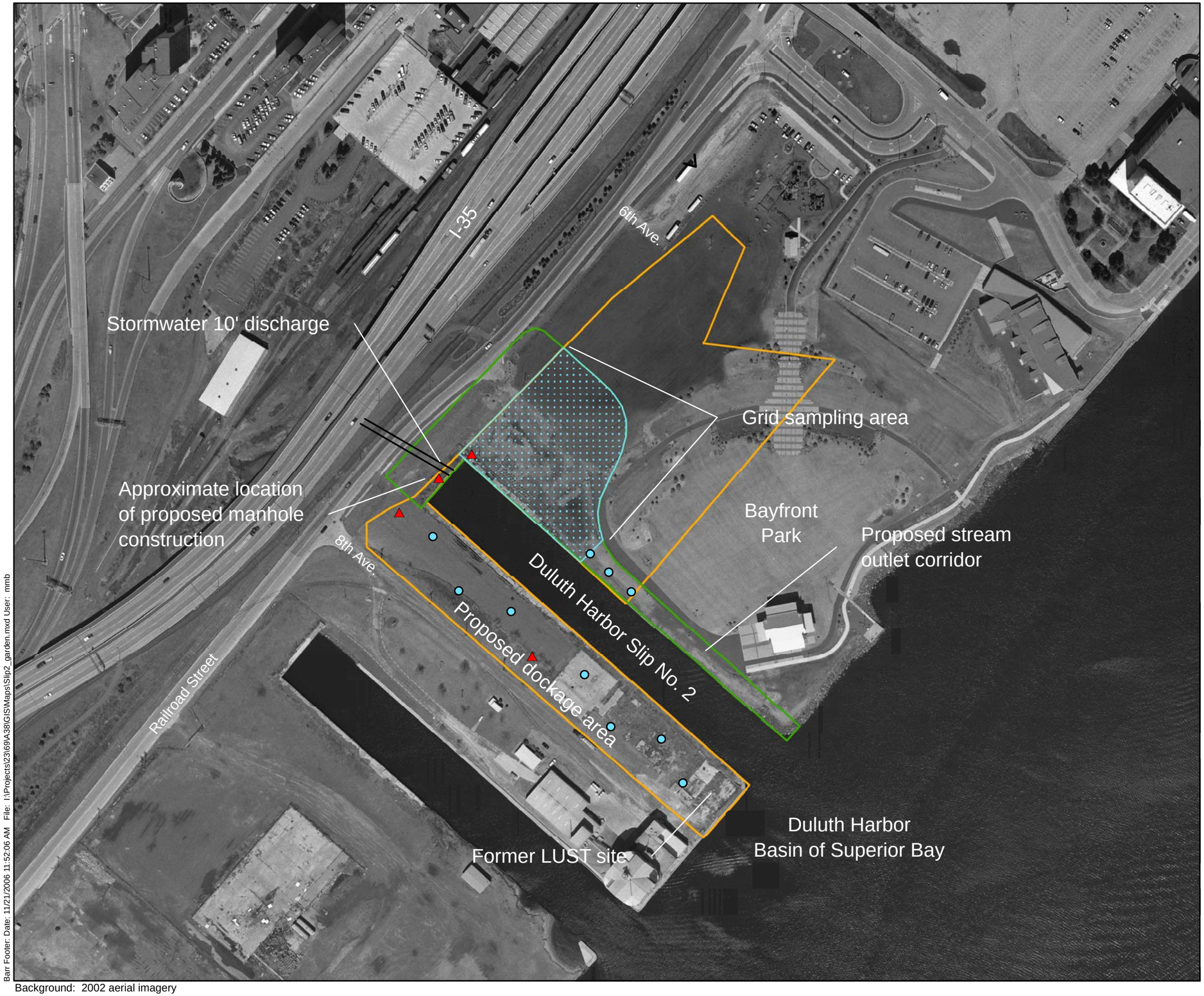
Feet
500 0 500 1,000

Miles
0.25 0 0.25

BARR

Figure 1b

PROPERTY LOCATION MAP
Duluth Bayfront Slips 2 and 3
City of Duluth
Duluth, MN



Background: 2002 aerial imagery

Legend

- Aproximate extent of DEDA property
- Approximate proposed stormwater garden extent

Proposed Borings

- 8' boring for soil sampling
- 16' boring for soil and groundwater sampling
- 100' grid sampling area
  8' borings for soil sampling
  (Boring locations to be determined in the field)

N

Feet
100 0 100

Miles
0 0.1

BARR

Figure 2

PROPOSED BORING LOCATIONS
Slip 2 Phase II Investigation
City of Duluth
Duluth, MN

Appendix A: Barr Standard Operating Procedures

STANDARD OPERATING PROCEDURE

SOIL SAMPLE COLLECTION

Revision 1

June 28, 2006

Approved By:	Andrea Nord	Andrea Nord	06/28/06	
	Print	QA Manager(s) Signature	Date	
	KEVIN McGILP		06/28/06	
	Print	Field Technician(s) Signature	Date	

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Minneapolis, MN • Hibbing, MN • Duluth, MN • Ann Arbor, MI • Jefferson City, MO

Annual Review of the SOP has been performed
and the SOP still reflects current practice.

Initials:	_____	Date:	_____
Initials:	_____	Date:	_____
Initials:	_____	Date:	_____
Initials:	_____	Date:	_____
Initials:	_____	Date:	_____

Standard Operating Procedure for
Soil Sample Collection

Purpose

To describe the collection of water samples for volatiles, semivolatiles, metals, inorganics, bacteria, and dioxin in soil.

Applicability

This procedure applies to the collection of soil samples by the sampling technician(s). It identifies each container type (volume, construction, preservative) required for each category of analyses, their corresponding holding times and collection procedures from a variety of sources.

Definitions

Holding Time. Period of time between sample collection and when the sample is analyzed.

Sample Preservation. The stability of analytes depends upon how well the samples are preserved.

Equipment

Sampler media
Pre-cleaned-certified Sampling Containers
Stainless Steel Spoons
Balance
Coolers
Ziploc® Baggy
Ice
Water-proof ink pen or pencil
Gloves
Alconox®
Chain of Custody Form
Sample Label
Custody Seal – if applicable

Field Sampling Report
Field Log Cover Sheet
Field Log Data Sheet

Responsibilities

The Field Operations/QA Officer or the environmental technician(s) will order the sample containers prior to the sampling event. The environmental technician(s) is responsible for the proper collection of soil samples, sample identification, quality control procedures, and documentation.

Procedure

Examples of samplers include split-barrel, split-barrel with brass liners, Geoprobe® sleeves, piston samplers, backhoe, or shovels may be used to retrieve soil from sampling locations. Depending upon the analyses to be conducted on the soil sample, the soil sample will either be sealed within the liner or sleeve or the soil sample will be transferred to a certified-laboratory-supplied container. The equipment required to transfer soil from the sampler to the sample container includes: stainless steel spoons, or scoops and the appropriate personal protective equipment necessary for collection and handling of soil. Volatile samples will be collected from representative areas of soil that were least disturbed first, then the remaining soil will be mixed and collected for the remaining analyses.

All soil sampling equipment will be carefully cleaned before and during soil sampling. All sampling tools including split-barrels, stainless steel spoons and scoops will be cleaned before use and between samples in the following manner: (1) clean with tap water and a phosphate–free detergent such as Alconox®, using a brush if necessary to remove particulate matter and films; (2) rinse three times with tap water; and (3) rinse three times with deionized water. To prevent sample cross-contamination, the sampler will discard the outer pair of sample gloves and put on a new pair between each sample event.

Collecting Volatile Organic Samples

Soil samples will be collected for analysis by either a drilling apparatus equipped with a split-barrel, core barrel sampler or by hand excavation. Volatile samples should be collected first. The soil selected for collection should be the most undisturbed sample possible.

The following procedure applies to soil samples retrieved with a drilling apparatus equipped with a split-barrel sampler or core barrel with liners (if Encore® sampler is used skip to next section):

1. Open the split-barrel sampler.

2. Open a representative liner containing soil.

3. Using a stainless-steel spoon, weigh 25 grams of a representative soil sample on a field balance. Once a weight/volume estimate has been established, discard the soil and collect untouched soil, from the same source for step 4.

4. Using a stainless-steel spoon, place 25 ± 5 grams of soil in a laboratory-provided-pre-weighed sample container containing methanol (avoid splashing the methanol).

5. Wipe the container lip and screw threads to remove soil and provide a good sealing surface, and immediately screw on the lid.

6. Cool the sample to approximately 4±2°C immediately after collection.

The following procedure applies to the collection of hand-excavated soil samples:

1. Dig to the desired sampling interval, exposing fresh soil surface to sample.

2. Collect a large sample on a shovel or in a bucket auger and bring it to the surface or collect the sample directly from the fresh soil surface.

3. Using a stainless-steel spoon, weigh 25 ± 5 grams of a representative soil sample on a field balance. Once a weight/volume estimate has been established, discard the soil and collect untouched soil, from the same sample source for step 4.

4. Using a stainless-steel spoon, place 25 C 5 grams of soil in a pre-weighed-laboratory-provided sample container containing methanol (avoid splashing the methanol).

5. Wipe the jar lip and screw threads to remove soil and provide a good sealing surface, and immediately screw on the lid.

6. Cool the sample to 4±2°C immediately after collection

Collecting Volatile Organic Samples with the Encore® Sampler

Soil samples will be collected for analysis by either a drilling apparatus equipped with a split-barrel, core barrel sampler or by hand excavation.

The following procedure applies to soil samples retrieved with a drilling apparatus equipped with a split-barrel sampler, core barrel or hand excavation with the Encore® sampler:

1. Open the split-barrel sampler.

2. Open a representative liner containing soil.

3. Collect a large sample on a shovel or in a bucket auger and bring it to the surface or collect the sample directly from the fresh soil surface. Be sure to collect a representative sample from an area of soil that was most undisturbed.

4. Hold the Encore® coring body and push plunger down until small o-ring rests against tabs to ensure the plunger moves freely.

5. Depress locking lever on T-Handle. Place coring body plunger end first into the open end of the T-Handle, aligning the slots on the coring body with the locking pins in the T-Handle. Twist coring body clockwise to lock pins in slots. Check to insure sampler is locked in place.

6. Turn T-handle with T-up and coring body down. This positions the plunger bottom flush with bottom of coring body. Using T-Handle, push sampler into soil until coring body is completely full.

When full the small o-ring will be centered in the T-Handle viewing hole. Remove excess soil from the coring body exterior.

7. Cap the coring body while it is still on the T-Handle. Push and twist cap over bottom until grooves on locking arms seat over ridge on coring body. Remove from T-Handle, lock plunger by rotating extended plunger rod fully counterclockwise until wings rest firmly against tabs, and attach label.

8. Cool the sample to 4±2°C immediately after collection.

Collecting Semivolatile Organic, Wet Chemistry and Metals Samples– except WI DRO

Soil samples will be collected for analysis by either a drilling rig equipped with a Geoprobe® sleeve, split-barrel, core barrel sampler or by hand excavation.

The following procedure applies to soil samples retrieved with a drilling rig equipped with a split-barrel sampler or core barrel with brass liners:

1. Open the split-barrel sampler.

2. Select a representative brass liner filled completely with soil.

3. Wrap the ends of the brass liners with heavy-duty aluminum foil, taking care to not piece the foil. Tape the foil to the brass liner with duct tape to ensure a seal. Cover the ends of the liner with plastic caps or duct tape to fully protect the foil.

4. Cool the sample to 4±2°C immediately after collection.

The following procedure applies to the collection of hand-excavated soil samples or core barrel samples:

1. Dig to the desired sampling interval, exposing fresh soil surface to sample.

2. Collect a large sample on a shovel or in a bucket auger and bring it to the surface or collect the sample directly from the fresh soil surface.

3. Using a stainless-steel spoon, composite the soil, pack the soil into the sample jars, leaving no headspace.

4. Wipe the container lip and screw threads to remove soil and provide a good sealing surface, and immediately screw on the lid.

5. Cool the sample to 4±2°C immediately after collection.

WI Diesel Range Organic (WIDRO) Samples

Soil samples will be collected for analysis by either a drilling apparatus equipped with a split-barrel, core barrel sampler or by hand excavation. Volatile samples should be collected first. The soil selected for collection should be the most undisturbed sample possible.

The following procedure applies to soil samples retrieved with a drilling apparatus equipped with a split-barrel sampler or core barrel with liners:

1. Open the split-barrel sampler.

2. Open a representative liner containing soil.

3. Using a stainless-steel spoon, weigh 25 ± 5 grams of a representative soil sample on a field balance. Once a weight/volume estimate has been established, discard the soil and collect untouched soil, from the same source for step 4.

4. Using a stainless-steel spoon, place 25 ± 5 grams of soil in a laboratory-provided-pre-weighed sample container.

5. Wipe the container lip and screw threads to remove soil and provide a good sealing surface, and immediately screw on the lid.

6. Cool the sample to 4±2°C immediately after collection.

The following procedure applies to the collection of hand-excavated soil samples:

1. Dig to the desired sampling interval, exposing fresh soil surface to sample.

2. Collect a large sample on a shovel or in a bucket auger and bring it to the surface or collect the sample directly from the fresh soil surface.

3. Using a stainless-steel spoon, weigh 25 ± 5 grams of a representative soil sample on a field balance. Once a weight/volume estimate has been established, discard the soil and collect untouched soil, from the same sample source for step 4.

4. Using a stainless-steel spoon, place 25 ± 5 grams of soil in a pre-weighed-laboratory-provided sample container containing methanol (avoid splashing the methanol).

5. Wipe the container lip and screw threads to remove soil and provide a good sealing surface, and immediately screw on the lid.

6. Cool the sample to 4±2°C immediately after collection

Collecting Soil Quality Control Samples

Trip blanks are only used when sampling for volatile organics. Their purpose is to determine if contamination has occurred as a result of improper sample container cleaning, sample contamination during storage and transport due to exposure to volatile organics, or other environmental conditions during sampling or analysis. Trip blanks are prepared prior to the sampling events by the laboratory providing the sample containers. The certified-pre-weighed methanol (MeOH) containers will be free of contaminants. The trip blanks are prepared by the lab, sealed, labeled appropriately by the lab, and transported to the field in the same containers as the sample containers. These blanks are not opened in the field. They are transferred to the cooler designated for volatile sample storage and transport and accompany the samples to the analytical laboratory.

Field (or Masked) duplicate samples will be collected to measure relative sampling precision. Five percent of all samples collected are collected in duplicate. These samples are collected at the same time using the same procedures, equipment, and types of containers as the required samples. They are also preserved in the same manner and are either co-located or split and submitted for the same analyses as the required samples.

Some general considerations will be taken into account when planning and conducting sampling operations. The sampler will take into consideration the required sample volumes, sample holding times, sample handling, and special precautions for trace contaminant sampling.

The volume of the sample obtained should be sufficient to perform all required analyses with an additional amount collected to satisfy the needs for quality control, split samples, or repeat examinations. The Laboratory Coordinator should be consulted for any specific volume requirements.

The elapsed time between sample collection and initiation of each laboratory analysis will fall within a prescribed time frame. Holding times for samples required by this project are prescribed by EPA: Title 40 of the Code of Federal Regulations.

After collection, all samples should be handled as few times as possible. Samplers should use extreme care to ensure that samples are not contaminated. If samples are placed in a cooler, samplers should ensure that melted ice cannot cause sample containers to become submerged, as this may result in cross-contamination. Plastic bags, such as Ziplock® bags, should be used when small sample containers are placed in coolers to prevent cross-contamination.

Some compounds can be detected in the parts per billion and/or parts per trillion range. Extreme care will be taken to prevent cross-contamination of these samples. A clean pair of new, disposable gloves will be worn for each sample location. Sample containers for source samples or samples suspected of containing high concentrations of contaminants are placed in separate plastic bags and coolers immediately after collecting, preserving and tagging. Sample collection activities will proceed progressively from the least contaminated area to the most contaminated area (when known).

Sample Storage

Immediately after samples are collected, they will be placed in a cooler containing bagged ice. Samples will be kept cold (approximately 4±2°C) until receipt at the laboratory, where they are to be stored in a refrigerated area. Custody seals may be present, but at minimum, the coolers must be taped shut with three straps of tape. All samples will be kept secured to prevent tampering. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured. The coolers must be delivered to the laboratory via hand or over night delivery courier in accordance with all Federal, State and Local shipping regulations.

Note: Samples may have to be stored indoors in winter to prevent freezing.

Disposal

All waste generated by this process will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for environmental pollution.

Documentation

The technician(s) will document the soil sampling events in a project dedicated field logbook or on field log data sheets. They will also document the type and number of bottles the field log data sheets and chain-of-custody record. The analysis for each bottle and the laboratory used will be documented on the chain-of-custody record. The sampling request form will document which sampling containers are used for which soil samples.

Attachments

Attachment 1: Chain of Custody Form

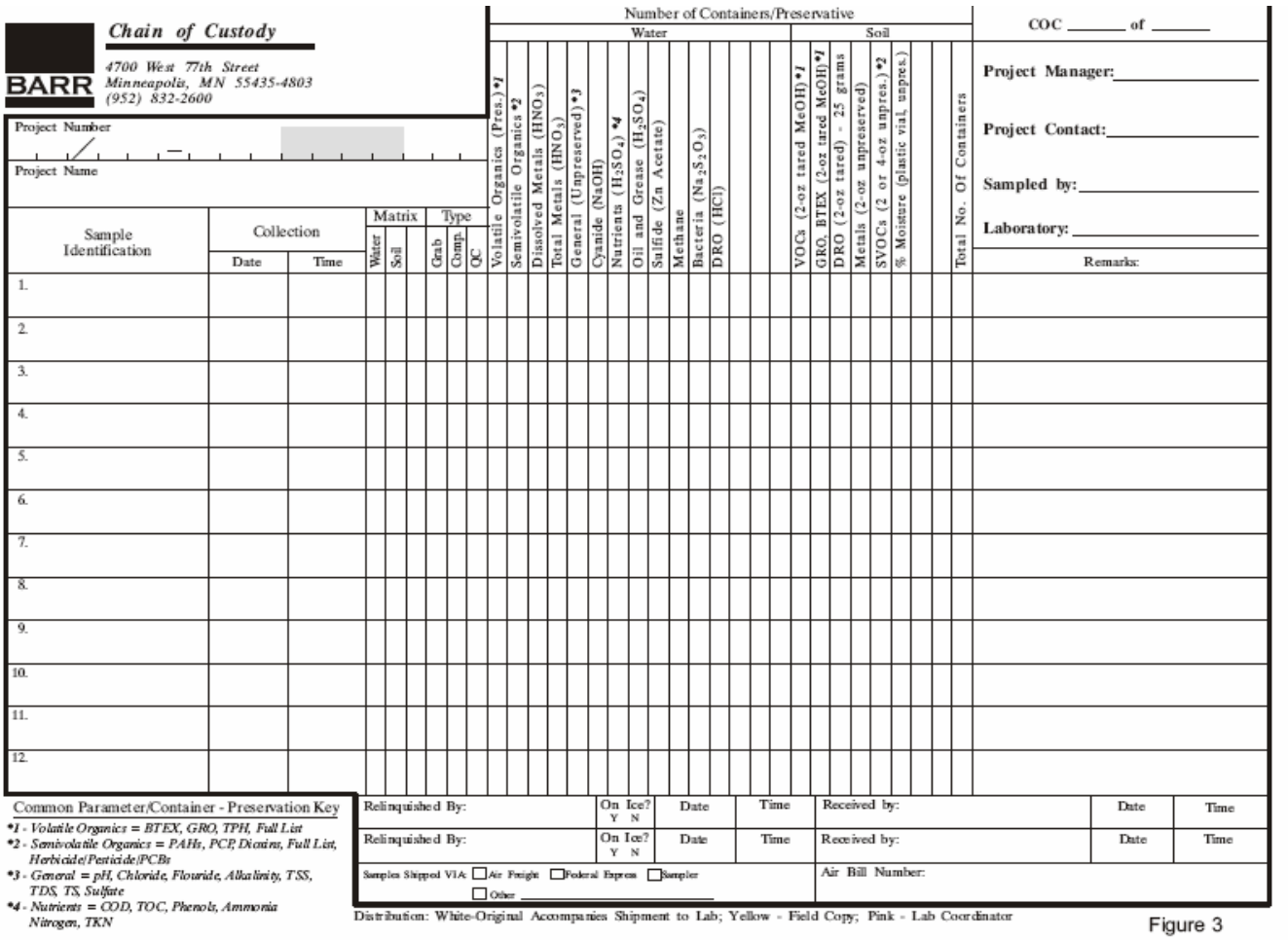
Attachment 2: Sample Label

Attachment 3: Custody Seal – if applicable

Attachment 4: Field Log Data Sheet

Attachment 1

Chain of Custody Form



Chain of Custody

BARR
4700 West 77th Street
Minneapolis, MN 55435-4803
(952) 832-2600

Project Number
Project Name

Number of Containers/Preservative
Water | Soil

COC _____ of _____

Project Manager:
Project Contact:
Sampled by:
Laboratory:

Sample Identification	Collection Date	Collection Time	Matrix: Water	Matrix: Soil	Type: Grab	Type: Comp.	Type: QC	Water: Volatile Organics (Pres.) *1	Water: Semivolatile Organics *2	Water: Dissolved Metals (HNO_3)	Water: Total Metals (HNO_3)	Water: General (Unpreserved) *3	Water: Cyanide (NaOH)	Water: Nutrients (H_2SO_4) *4	Water: Oil and Grease (H_2SO_4)	Water: Sulfide (Zn Acetate)	Water: Methane	Water: Bacteria ($Na_2S_2O_3$)	Water: DRO (HCl)	Soil: VOCs (2-oz tared MeOH) *1	Soil: GRO, BTEX (2-oz tared MeOH) *1	Soil: DRO (2-oz tared) - 25 grams	Soil: Metals (2-oz unpreserved)	Soil: SVOCs (2 or 4-oz unpres.) *2	Soil: % Moisture (plastic vial, unpres.)	Total No. Of Containers	Remarks
1.																										
2.																										
3.																										
4.																										
5.																										
6.																										
7.																										
8.																										
9.																										
10.																										
11.																										
12.																										

Common Parameter/Container - Preservation Key
*1 - Volatile Organics = BTEX, GRO, TPH, Full List
*2 - Semivolatile Organics = PAHs, PCP, Dioxins, Full List, Herbicide/Pesticide/PCBs
*3 - General = pH, Chloride, Flouride, Alkalinity, TSS, TDS, TS, Sulfate
*4 - Nutrients = COD, TOC, Phenols, Ammonia Nitrogen, TKN

Relinquished By:	On Ice? Y N	Date	Time	Received by:	Date	Time
Relinquished By:	On Ice? Y N	Date	Time	Received by:	Date	Time

Samples Shipped VIA: ☐ Air Freight ☐ Federal Express ☐ Sampler ☐ Other _____
Air Bill Number:

Distribution: White-Original Accompanies Shipment to Lab; Yellow - Field Copy; Pink - Lab Coordinator

Figure 3

CHAIN OF CUSTODY

Attachment 2

Example - Sample label

Client _____

Project Number _____

Date: _____ Time _____

Preservative: _____

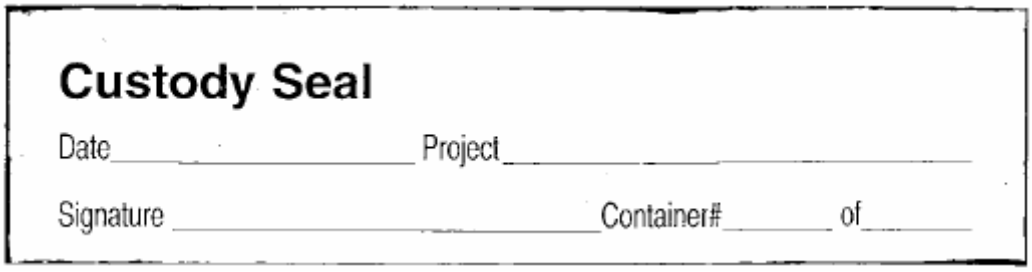
Sampled By: _____

Sample Location: _____

_____

Attachment 3

Custody Seal



Attachment 4

Field Log Data Sheet

Barr Engineering Company
Field Log Data Sheet
Soil Samples

Client:									Number of Containers/ Analysis																
Location:																									
Project #:																									
Project Name:																									
Sample Identification	Collection		Matrix			Type			2 oz. Pres.	2 oz. Unpres.	4 oz. Unpres.	8 oz. Unpres.	Moisture-plastic vial etc.	Other:	SVOC	PAH	VOC	WIGRO	WIDRO	PCB	RCRA Metals	Moisture	Other:	Other:	
	Date	Time	Soil	Sludge		Grab	Comp.	O/C																	
1.																									
2.																									
3.																									
4.																									
5.																									
6.																									
7.																									
8.																									
9.																									
10.																									
11.																									
12.																									
13.																									
14.																									
15.																									
16.																									
17.																									
18																									
19.																									
20.																									

Appendix B: Forms

Barr Engineering Company

Boring #

Project:

Project Number:
Boring Location:
Drilling Contractor:
Drilling Method:
Driller:
Geologist:

Total Drilled Depth (ft bgs):
Depth to Groundwater (ft bgs):
Date Started:
Date Completed:

Depth (ft. bgs)	Sample Interval\ Recovery (ft)	Moisture	Odor\Sheen\ Discoloration	Headspace (ppm)	ASTM	Lithologic Unit	Material Descriptions and Remarks
0							
2							
4							
6							
8							
10							
12							
14							
16							
18							
20							
22							
24							
26							

Barr Engineering Company
Field Log Data Sheet

Client:	**Monitoring Point:**
Location:	**Date:**
Project #:	**Sample Time:**

GENERAL DATA		**STABILIZATION TEST**						
Barr lock:								
Casing diameter:		Time/ Volume	Temp. ºC	Cond. @ 25	pH	Eh	D.O.	Turbidity Appearance
Total well depth:*								
Static water level:*								
Water depth:*								
Well volume: (gal)								
Purge method:								
Sample method:								
Start time:		Odor:						
Stop time:		Purge Appearance:						
Duration: (minutes)		Sample Appearance:						
Rate, gpm:		Comments:						
Volume, purged:								
Duplicate collected?								
Sample collection by:		CO2- Mn2- Fe(T)- Fe2-						
Others present:		Well Condition:						

MW: groundwater monitoring well WS: water supply well SW: surface water SE: sediment other:

VOC- semi-volatile- general- nutrient- cyanide-

DRO- Sulfide-

oil, grease- bacteria- total metal- filtered metal-

methane- filter-

Others:

*Measurements are referenced from top of riser pipe, unless otherwise indicated.