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FINAL WORKPLAN

Sonoco Products Company

Workplan for Remedial Investigation *2122 Colvin Boulevard Tonawanda, New York*

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ERM Project Number D6713.00.01

Environmental Resources Management
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LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
bgs	Below ground surface
DNAPL	Dense non-aqueous phase liquid
ERM	Environmental Resources Management
ft msl	Feet above mean sea level
GC/MS	Gas chromatograph/mass spectrometer
H&S	Health and Safety
H&S Plan	Health and Safety Plan
MDLs	Method detection limits
µg/kg	Micrograms per kilogram
µg/L	Microgram per liter
PCBs	Polychlorinated biphenyls
PID	Photoionization detector
PVC	Polyvinyl chloride
QA/QC	Quality assurance/quality control
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
SOPs	Standard Operating Procedures
SVOCs	Semivolatile organic compounds
1,1,1-TCA	1,1,1-trichloroethane
TCE	Trichloroethene
TPH	Total petroleum hydrocarbons
USEPA	United States Environmental Protection Agency
USCS	Unified Soil Classification System
VOCs	Volatile organic compounds

1.0 INTRODUCTION

Environmental Resources Management, Inc. (ERM), on behalf of Sonoco Products Company (Sonoco), has prepared this Remedial Investigation (RI) Workplan to describe investigation activities to be conducted at the Greif Bros. Corporation (Greif) property at 2122 Colvin Boulevard Tonawanda, New York (Figure 1).

The purpose of the RI is to address comments contained in the New York State Department of Environmental Conservation (NYSDEC) letter to ERM dated 3 September 1999. NYSDEC requested additional site data to further characterize the geology, hydrogeology, and extent of contamination previously detected at the site. This additional data will be combined with existing information to develop a Remedial Action Plan for the site.

This Workplan was prepared to:

- Summarize the results of previous investigations conducted at the site;
- Identify data gaps related to NYSDEC's comments; and
- Develop a field investigation and sampling program that will address identified data gaps.

1.1 DOCUMENT ORGANIZATION

This Workplan is divided into the following sections:

- Section 1 — General site and project background, and project objectives;
- Section 2 — Previous investigation results;
- Section 3 — Strategy and sampling rationale for the soil and ground water investigation;
- Section 4 — Field investigation and sampling plan;
- Section 5 — Overall project schedule; and
- Section 6 — References used in this document.

Attached to this Workplan are the following appendices:

- Appendix A — Utility clearance procedures;
- Appendix B — Six standard operating procedures (SOPs) for specific field methods that may be used during this investigation;
- Appendix C — Quality Assurance Project Plan (QAPP); and
- Appendix D — Health and Safety Plan (HSP).

1.2 *SITE LOCATION*

The site is located at 2122 Colvin Boulevard in the City of Tonawanda, Erie County, New York. The facility is in a mixed industrial and residential area approximately one-quarter mile south of Highway I-290 (Figure 1). In general, surrounding properties are residential in addition to various commercial operations.

1.3 *PROJECT BACKGROUND*

Sonoco retained ERM to conduct a subsurface investigation at the Greif facility located at 2122 Colvin Boulevard in Tonawanda, New York. The overall objective of the investigation was to evaluate the nature and extent of potential soil and ground water contamination at the subject facility. Greif purchased the facility from the Sonoco in the spring of 1998. In connection with the purchase of the facility, limited environmental investigations were conducted which identified potential soil and/or ground water impacts from historic site activities.

The scope of work associated with the subsurface investigation included:

- Completing 27 soil borings to depths ranging from approximately 7 to 40 feet below ground surface;
- Installing permanent ground water monitoring wells in five soil borings and temporary piezometers in three soil borings;
- Collecting soil samples from the borings completed during the investigation;

- Collecting one round of ground water samples from the monitoring wells and temporary piezometers;

- Analyzing selected soil samples for volatile organic compounds (VOCs) and polynuclear aromatic (PNA) compounds; and

- Analyzing water samples for VOCs.

The investigation was conducted during two phases of fieldwork performed during the summer and late fall 1998.

1.4 *SITE HISTORY*

Based on information provided by Grief and ERM's review of onsite diagrams, the building at the subject facility was originally constructed in approximately 1948. From 1948 to approximately 1985 the facility was owned and operated by Continental Fiber Drum and Continental Can Corporation. Historical manufacturing operations at this time consisted of the production of fiber drums but also included production of the metal lids and rims used in the fiber drums.

Sonoco Industrial Container Division acquired the facility in 1985. The major existing manufacturing operations continued generally unchanged until the early 1990s. In 1995, production of the metal lids and rims used in the fiber drums was discontinued. Greif subsequently acquired the facility in May 1998. The site continues to be used for the manufacture of fiber drums. Secondary operations include equipment maintenance and administrative activities.

1.5 *REMEDIAL INVESTIGATION OBJECTIVES*

The primary goal of the RI is to further characterize the geology, hydrogeology, and distribution of hazardous substances in soil and ground water to determine the necessity and scope of potential remedial actions. To accomplish this goal, the objectives of the RI are to:

- Identify the extent of hazardous substances in shallow soils to aid in the preparation of remedial alternatives for the site;
- Determine the gradient of ground water, the gradient of the clay confining layer, and the depth and gradient of bedrock at the site; and

- Characterize the lateral and vertical distribution of hazardous substances in ground water to the extent necessary to evaluate potential source area remedial alternatives.

This RI will build upon the data from previous investigations.

2.0 PREVIOUS INVESTIGATION RESULTS

Several previous investigations have been conducted at the site. This section summarizes the physical site characteristics and previous investigation results.

Detailed information on the results of these investigations is provided in ERM's report "*Subsurface Investigation, Greif Bros. Corporation Facility, 2122 Colvin Boulevard, Tonawanda, New York*" dated April 1999. This report was submitted to NYSDEC on 7 April 1999.

2.1 SITE PHYSICAL CHARACTERISTICS

The following subsections describe the physical characteristics of the site, including topographic and surface features, geology, hydrogeology, hydrology, and land uses adjacent to the site.

2.1.1 *Topographic and Surface Features*

Site topography is relatively flat with an average elevation of approximately 585 feet above mean sea level (ft msl). The subject facility consists of a single one-story industrial building located on approximately 25 acres of urban land. Unpaved parking, storage areas, and landscaped areas are generally present around the building.

A former railroad siding is located on the north side of the facility. The area surrounding the building consists of paved parking areas at the northeastern corner and the western end of the facility. A wooded area extends along the northern property boundary to the western end of the site. Colvin Boulevard is adjacent to the facility at the eastern side of the property, and an open field exists along the entire southern property boundary. A site diagram is provided in Figure 2 behind the Figures Tab.

2.1.2 *Regional and Site Geology*

The site is situated approximately three and one half miles east of the Niagara River and approximately twenty-four miles south of Lake Ontario in the Erie-Ontario Lowlands physiographic province of western New York State. Topographic relief within one-half mile of the site is approximately 15 feet.

Surficial geology in the vicinity of the site is mapped as Quaternary lacustrine deposits. These deposits are generally composed of laminated silt and clays with variable thickness up to 300 feet. Bedrock in the vicinity of the site consists predominantly of shale and dolostone of the Upper Silurian Syracuse, Camillus and Vernon formations.

Based on evaluation of the subsurface soil samples collected during the previous investigations, the unconsolidated deposits in the areas investigated by ERM consist primarily of silt in the first 4 to 10 feet of onsite soils. Exceptions to this finding include the soils beneath the main building, the former varnish underground storage tank (UST) area, and former drum storage area. In these locations, sand and other fill material are present to a depth ranging from 1 to 10 feet below ground surface (bgs).

The silt (and in selected areas fill material) is generally underlain by a silty clay or soft clay to a depth of 18 to 20 feet bgs. The silty clay or soft clay layers also contain what appear to be discontinuous sand and gravel lenses. The clay layer appears to be continuous beneath the facility.

Beneath the silty clay or soft clay layer is a medium-grained sand with some silt. This sand was encountered at depths as shallow as approximately 18 feet bgs at monitoring well MW-5 and as deep as 24 feet bgs at monitoring well MW-3. The sand layer continued to a depth of at least 40 feet bgs beneath the facility.

2.1.3 *Regional and Site Hydrogeology*

Shallow ground water was not encountered outside the area immediately surrounding the main building. However, shallow ground water was encountered in all the soil borings (soil borings GP-20, 21, and 22) completed inside the building. This shallow ground water appears to be consistent with "perched" water that is located in the sand and fill material on top of the silty clay underlying the building. The depth to the shallow ground water ranged from 4 to 6 feet.

Shallow ground water was also encountered at the former varnish UST area and former drum storage area. This shallow ground water also appeared to be "perched" water in replacement fill located on top of the silty clay underlying these areas. During the previous investigation, ERM confirmed the presence of an intermediate ground water aquifer located beneath the upper clay layer at the facility. This intermediate ground water is present in the lower overburden sand unit. Based on the ground

water elevation data, the intermediate ground water zone appears to be a confined aquifer.

ERM calculated ground water elevations using measured depths to ground water prior to sampling and the results of a survey prepared by Krehbiel Associates, Professional Engineers and Land Surveyors, P.C. in Tonawanda, New York. These elevations are provided in Table 1.

Table 1 *Ground Water Elevations*

Monitoring Well	Top of Casing	Depth to Ground water*	Ground water Elevation
MW-1	585.96	15.08	570.88
MW-2	583.85	20.85	563.00
MW-3	586.41	17.24	569.17
MW-4	583.50	14.98	568.52
MW-5	585.19	15.32	569.87

* feet below top of casing

Based on ERM's evaluation of the water elevations, ground water flow in the intermediate sand zone located beneath the subject facility appears to generally flow in west/southwest direction.

2.1.4 *Adjacent Land Use*

In general, surrounding properties include residential properties and vacant lands. Adjoining properties are as follows:

- North: Vacant land and residential apartments;
- South: Local playground and single family residential;
- East: Colvin Avenue. Further east are single family homes; and
- West: Vacant undeveloped land.

Based on ERM's observations during the site inspection, exterior activities on adjacent properties do not appear to have the potential to have impacted the subject facility.

2.2 *PREVIOUS INVESTIGATIONS*

The initial subsurface investigation of the facility was conducted by ERM in April 1998 and included:

- Completing seven Geoprobe® soil borings to depths ranging from 8 to 26 feet below ground surface;
- Collecting soil samples from the borings installed during this investigation;
- Collecting water samples from temporary wells installed in three soil borings at a former varnish UST excavation pit and drum storage area;
- Collecting three soil samples with a hand auger from 0 to 1 foot below ground surface; and
- Analyzing selected soil and water samples for VOCs, semivolatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), and PCBs.

Soil sampling locations are shown on Figure 3 behind the Figures Tab. The locations were based on the (1) results of ERM's site inspection regarding recognized environmental conditions and (2) site features such as the location of former USTs, the hazardous substance storage areas, exterior doors, and the former rail spur.

To further evaluate the nature and extent of soil and ground water contamination detected during the initial phase, ERM conducted a follow-up investigation at the facility. This investigation focused on the areas of previous soil and ground water contamination detected at the western end of the manufacturing building. The follow-up subsurface investigation was conducted during three rounds of fieldwork performed in November and December 1998. The follow-up investigation included:

- Completing 20 soil borings to depths ranging from approximately 7 to 40 feet below ground surface;
- Installing permanent ground water monitoring wells in five soil borings and a temporary piezometer in one soil boring;
- Collecting soil samples from the borings completed during the investigation;

- Collecting one round of ground water samples from the monitoring wells and a temporary piezometer inside the building;

- Analyzing selected soil samples for VOCs and PNA compounds; and

- Analyzing the water samples for VOCs.

The follow-up investigation sampling locations are also shown on Figure 3 behind the *Figures Tab*. The Phase III sampling locations were based on the (1) initial subsurface investigation results and (2) site features such as the former drum storage area and varnish pit.

2.2.1 *Soil Investigations*

A total of 27 soil borings have been completed during previous investigations at the site. In addition to the soil borings, three soil samples were collected utilizing a hand auger. A total of 15 Geoprobe soil borings were completed to depths ranging from 7 to 16 feet bgs. These soil borings included the following:

- Three soil borings (GB-20, GB-21, GB-22) surrounding the former varnish pit inside the manufacturing building;

- Two soil borings (GB-13 and GB-17) inside the truck dock on the south side of the former varnish pit inside the manufacturing building;

- Five soil borings (GB-14, GB-15, GB-16, GB-18, GB-19) surrounding the former varnish UST area on the west side of the building; and

- Five soil borings (GB-8, GB-9, GB-10, GB-11, GB-12) surrounding the former drum storage area at the southwest corner of the building.

Soil samples were continuously collected from the Geoprobe soil borings at four-foot intervals from the ground surface until the final depth was reached.

Five hollow stem auger soil borings were completed to a final depth ranging from 28 to 40 feet bgs. These soil borings included the following:

- One soil boring/monitoring well (MW-1) at the northwest corner of the "former drum storage area" on the southwest side of the facility;

- One soil boring/monitoring well (MW-2) on the west side of the "trailer parking area" at the rear (west side) of the facility;

- One soil boring/monitoring well (MW-3) on the north side of the west end of the manufacturing building;

- One soil boring/monitoring well (MW-4) at the northwest corner "trailer parking area" at the rear (northwest side) of the facility; and

- One soil boring/monitoring well (MW-5) across the roadway south of the former drum storage area on the south side of the facility.

Soil samples were collected continuously from the hollow stem auger soil borings at two-foot intervals from the ground surface until the final depth was reached. The soil samples were collected from the borings using a stainless steel split spoon.

ERM observed evidence of potential contamination in the soil samples collected at Soil Borings GB-1, GB-2, GB-3, and GB-4. At the soil borings GB-1 and GB-2, ERM noted a "sweet" solvent odor and elevated photoionization detector (PID) readings in the soil samples collected at varying depth. At the soil borings GB-3 and GB-4, ERM noted a strong petroleum odor and elevate PID reading in the soil samples collected at varying depths. ERM also noted petroleum hydrocarbon or solvent-like odors in the soil samples collected from soil borings GB-10, GB-13, GB-15, GB-17, GB-20, GB-21, and GB-22. The odors noted at these soil borings continued to be present in the deepest soil sample collected from the borings.

ERM did not observe evidence of potential contamination in the remainder of soil borings advanced during the above mentioned investigations.

2.2.2 *Shallow Ground Water Monitoring*

To further evaluate potential ground water contamination at the facility the five hollow-stem auger soil borings (soil borings MW-1 through MW-5) were converted to permanent monitoring wells. ERM also collected a water sample from a temporary piezometer installed in soil boring GB-20 located adjacent to the eastern end of the varnish pit inside the building.

During the completion of soil borings MW-1 through MW-5, the shallow "perched" ground water previously identified at the manufacturing building was not encountered. Therefore, these monitoring wells were installed in an intermediate overburden water bearing zone located at a depth of approximately 18 to 24 feet bgs.

In addition, ERM collected water samples from a perched saturated zone encountered at borings GB-2 through GB-4. The samples were collected after extending a stainless steel screen from the collector rod and using disposable teflon tubing and a vacuum pump.

2.2.3 *Chemical Distribution*

The current understanding of chemical impact to site soil and ground water is discussed below.

2.2.3.1 *Chemical Distribution in Soil*

Elevated concentrations of selected organic compounds were detected in soil samples collected from selected soil borings completed at the facility during the April 1998 investigation. First, VOCs were detected in soil samples analyzed from four of the five soil boring locations evaluated for VOCs. The highest concentration of total VOCs (greater than 4,000 mg/kg) were detected in the soil sample collected at 12 to 16 feet bgs from soil boring SB-2. This soil boring was completed at the former varnish UST pit area.

Second, low concentrations of selected PNA compounds (sub-family of BNA compounds) were detected in soil samples analyzed from four of the six soil boring locations. The highest concentration of total PNAs (greater than 3,700 mg/kg) were detected in the soil sample collected at 14 to 16 feet bgs from soil boring SB-1. This soil boring was completed at the location where the former varnish UST piping enters beneath the western side of the building.

Third, TPH concentrations were detected in soil samples collected from two of the three soil boring locations (soil borings GB-1 and GB-3). The elevated TPH concentrations were detected at soil borings that also had elevated VOC results. Finally, PCBs were not detected at the soil sample locations at the electrical substation or former rail spur at the facility.

Laboratory analytical data from the 18 and 19 November 1998 investigation detected concentrations of VOCs above the MDL in soil samples collected from 11 of the 18 soil borings locations evaluated for these compounds. The highest concentration of total VOCs (approximately 4,200,000 ug/kg) were detected in the sample collected at 1 to 2 feet bgs from soil boring GB-10. Soil boring GB-10 is at the location of a former suspected UST fill pipe area adjacent to the roadway on the south side of the main building. The VOCs detected at soil boring GB-10 included trichloroethene (TCE) at a concentration of 4,000,000 ug/kg.

Elevated concentrations (i.e., greater than 100,000 ug/kg) of selected VOCs were also detected in the soils located beneath the west end of the main building at the facility. These VOCs included TCE and 1,1,1-trichloroethane (1,1,1-TCA) at respective concentrations as high as 84,000 and 55,000 ug/kg.

Low concentrations of selected PNA compounds were detected in soil samples analyzed at four of the seven soil boring locations evaluated for these compounds. The highest concentration of total PNAs (greater than 10,500 ug/kg) were detected in the sample collected from 7 to 8 feet bgs at soil boring GB-10.

PNA compounds were not detected in the soil samples collected from beneath the western end of the main building. In addition, PNAs were not detected on the north or far western sides of the main building.

2.2.3.2 *Chemical Distribution in Ground Water*

Elevated concentrations of 11 VOCs were detected in the shallow perched ground water samples collected from two soil borings during the April 1998 investigation. The VOCs included both chlorinated and non-chlorinated solvents. Concentrations of total xylene were detected in all water samples.

A review of the laboratory analytical results of the water samples collected during the November 1998 subsurface investigation indicates that VOCs were not detected above the MDL in the water samples collected from the five permanent monitoring wells installed in the intermediate overburden sand zone. However, elevated VOC concentrations were detected in the water sample collected from the shallow perched ground water at soil boring GB-20.

The VOCs detected in the shallow perched ground water at soil boring GB-20 included both chlorinated and non-chlorinated compounds. The concentration of total VOCs in the water sample was 472,879 ug/L. These VOCs included TCE and 1,1,1-TCA at respective concentrations of 220,000 and 210,000 ug/L.

3.0 INVESTIGATION STRATEGY AND SAMPLING RATIONALE

This RI builds upon the previous investigations and will be conducted in stages to maximize the efficiency of the sampling program. Soil and ground water sampling locations identified in this Workplan may be adjusted based on the results of previous investigation stages. Significant changes to the proposed sample locations described herein will be communicated to Sonoco and NYSDEC in memoranda prior to the initiation of fieldwork for that stage. The scope and methods for each investigation stage are described in Section 4. The overall rationale and sampling strategy for the soil and ground water investigation are described below.

3.1 SOIL INVESTIGATION

The preliminary investigations performed at the Greif facility indicate that the varnish pit, former varnish UST, and soil boring GB-10 areas are potential sources of soil contamination. In addition, underground utilities at the site may be acting as a conduit for contaminant migration. It is important to identify and characterize impacted soils because they represent potential ongoing sources to ground water contamination.

Given the clayey nature of the vadose zone soils at soil boring GB-10, it is likely that excavation of these impacted soils will ultimately be the most feasible removal action alternative. Full characterization of vadose zone soils surrounding the varnish pit during this phase of investigation is also necessary for the design of any remedial actions at this location.

The proposed soil investigation will focus on the varnish pit area located inside the main building onsite; the area proximal to soil boring GB-10, located at the southwestern corner of the site; and underground utilities located at the southern and western areas of the site.

3.1.1 *Varnish Pit Area*

Soil samples collected adjacent to the varnish pit area contain concentrations of chlorinated solvents above NYSDEC recommended generic soil cleanup guidance levels. The lateral characterization of the impacted soil is currently incomplete to the north and east.

Elevated concentrations of chlorinated compounds have also been observed in ground water samples collected from a temporary well installed at soil boring GB-20, which is adjacent to the varnish pit area. The elevated ground water concentrations at GB-20 may be the result of dispersive chemical migration from the actual varnish pit.

To further identify the lateral and horizontal extent of VOC impacts to soils, nine additional shallow soil borings (to 16 feet bgs) will be advanced in the area of the Varnish Pit. These soil borings will be placed on a 50-foot grid centered at soil boring GB-20. The borings will also be used to provide for the collection of geochemical information that can be used in the evaluation of remedial alternations.

3.1.2 *Soil Boring GB-10 Area*

To estimate the lateral extent of VOC impacts to soils at soil boring GB-10, a passive soil vapor survey will be completed in this area. The soil vapor survey will be used to focus subsequent soil and (and potential) ground water sampling by identifying elevated vapor concentrations that are indicative of VOC sources. Soil vapor investigations, used in conjunction with actual soil and ground water sampling, can provide a more thorough and cost-effective site investigation than boring and well samples alone. This shifts the primary role of soil and ground water sampling to confirmation rather than investigation.

Passive soil vapor surveys provide information on soil and ground water constituents by measuring the concentration of organic compounds in the vadose zone. Passive methods generally involve integrated sampling over time and collection of the sample on an adsorbent material. This method provides high sensitivity to volatile organics, allows for success on sites with low soil permeability, and minimizes fluctuations in soil vapor availability due to changing ambient and subsurface conditions. Passive soil vapor sampling does not disrupt the natural equilibrium of vapors in the subsurface, as in the case with active soil vapor sampling methods.

Fifteen soil vapor samples will be collected in an approximate 60-foot by 80-foot area centered at soil boring GB-10 at south-southwest side of the building. The results of this survey will be used to guide the placement of subsequent soil sampling locations that will confirm the lateral boundaries of soil contamination. Details on the soil vapor sampling field methodologies are provided in Section 4 of this Workplan.

3.1.3 *Underground Utilities*

NYSDEC expressed concern regarding the potential for site utilities to act as potential pathways for contaminant migration. Previous investigations have not indicated that affected soil is immediately proximal to site utilities. However, to investigate whether site utilities are providing a migration pathway, passive soil vapor samples will be place along the exterior fire loop and a natural gas line located to the south and north of the building. The passive soil vapor samples will be placed at 100-foot intervals extending to the front (eastern side) of the building.

Passive soil vapor samples will also be placed along interior below ground utility lines at approximate 100-foot intervals. These intervals will begin outside of the area of additional soil borings proposed around the varnish pit and continue for a maximum of 400 feet (four sampling points) laterally along each separate line that is located in close proximity to the varnish pit inside the building.

3.2 *GROUND WATER INVESTIGATION*

Water samples have been collected from five intermediate monitoring wells and four temporary well locations at the site. VOCs were detected in perched shallow ground water samples collected from temporary wells installed at the drum storage area, the former varnish UST area, and the varnish pit area. There were no VOCs detected in the five permanent ground water monitoring wells at the site.

During the RI, additional ground water sampling will be performed to characterize the on-site impacts of these chemicals. NYSDEC has requested that additional intermediate overburden wells be installed to further define the extent of affected ground water. In addition, NYSDEC requested that three bedrock ground water wells be installed at the site. This work plan includes the installation of the two additional shallow intermediate overburden wells and three deeper intermediate overburden monitoring wells.

The deeper intermediate overburden wells will be installed to the top of the bedrock beneath the site to assess ground water quality at the overburden bedrock interface. In addition, these deeper intermediate overburden wells will be located within 50 feet of the varnish pit which has been identified as the primary chlorinated VOC source area. This close proximity will ensure potential dense non-aqueous phase liquid

(DNAPL) at the overburden / bedrock interface is evaluated during as part of the RI.

Based on this information, bedrock ground water monitoring wells do not appear to be warranted at this time based on the results of the previous investigations.

3.2.1 *Shallow Perched Ground Water Sampling*

Three additional ground water monitoring wells will be installed to further delineate the extent of affected shallow perched ground water beneath the building. These wells will be installed in the immediate area of the varnish pit inside the building. These shallow perched ground water wells will be installed within the building in the area of the varnish pit. The objective of this sampling effort is to provide accurate water quality results for VOCs and evaluate if DNAPL is present on the clay confining layer beneath the building.

The installation of shallow perched ground water monitoring wells surrounding the varnish pit will also provide for the collection of geotechnical information on the soils and hydraulic information on this perched water-bearing zone. These shallow wells may also be utilized as part of any remedial activities for the perched water beneath the building.

Installation of monitoring wells around the varnish pit that are screened in the intermediate overburden ground water have not been proposed in this work plan. Installation of these intermediate monitoring wells would greatly increase the potential for contamination of this unit by the shallow perched water surrounding the pit. In ERM's opinion, the contaminated shallow perched water is present on a clay confining layer that should not be penetrated in the source area.

3.2.2 *Shallow Intermediate Ground Water Sampling*

Three shallow intermediate overburden wells will be installed during this investigation. One shallow intermediate overburden well will be installed immediately downgradient of soil boring GB-10 area. One well will be installed at the southwest corner of the building. The third will be installed to the east of the plant building. The objective of this sampling effort is to confirm the absence of the VOC plume in the upper-most portion of the intermediate overburden aquifer at the site.

The installation of shallow intermediate ground water monitoring wells will also provide for the collection of geotechnical information on the soils

and hydraulic information on this water bearing zone. These wells will also be incorporated in the confirmation of ground water flow direction for this unit.

3.2.3 *Deep Ground Water Sampling*

Previous investigations at the site have been limited to the shallow perched ground water and uppermost extent of the intermediate overburden aquifer approximately 20 to 26 feet bgs. This intermediate zone is believed to be located on top of the bedrock. However, the continuity of this unit with lower water-bearing zones has not been determined. In addition, the water quality in the deeper zone of the intermediate overburden ground water is unknown. Furthermore, the potential for DNAPL to be present on the top of the bedrock beneath the varnish pit has not been fully evaluated.

To resolve these issues, three additional intermediate overburden ground water monitoring wells will be installed to evaluate the extent of affected deeper ground water at the site. These deeper overburden wells will be screened at the top of the bedrock to allow for an assessment of vertical flow patterns at the interface of the overburden with the bedrock and potential for DNAPL.

The deep intermediate overburden monitoring wells will be installed immediately downgradient of the varnish pit. Potential DNAPL migrating vertically beneath the varnish pit would be expected to flow southwest towards the proposed deeper ground water monitoring wells base on existing water elevation data.

3.3 *VARNISH PIT INSPECTION*

An inspection of the varnish pit will be performed during this investigation. The varnish pit inspection will document the dimensions of the pit; including the total depth of the pit. The depth of the varnish pit will be assessed with respect to the known depth of the confining clay layer to evaluate whether the pit penetrates the confining unit. In addition, a visual inspection of the varnish pit will be conducted to evaluate the current condition of the pit.

4.0 FIELD INVESTIGATION AND SAMPLING PLAN

This section summarizes the field sampling and analytical methodologies for the RI.

4.1 FIELDWORK PLANNING

The RI field activities will be conducted in a specific order and coordinated to maximize the RI efficiency. The rationale for this approach was presented in Section 3.

4.1.1 *Investigation Stages*

The Phase I RI will be sequenced in the following three stages:

- Stage I – Soil vapor survey;
- Stage II – Verification soil sampling; and
- Stage III – Shallow and deep ground water investigation.

The Stage II soil investigation will be based on the source areas defined by the soil vapor survey and previous investigation results. Impacted soils will be defined both laterally and vertically to the extent necessary to support the design of any soil remediation efforts. Stage III represents the ground water characterization.

4.1.2 *Utility Clearance*

Prior to drilling, each location will be reviewed for the presence of aboveground and subsurface utility lines. Adequate steps will be taken to reduce the potential for contact with utility lines according to the steps listed in Appendix A.

4.1.3 *Sample Numbering System*

Each sample location will be identified with prefixes that are representative of the sampling technique. The following prefixes will be used:

- Soil vapor point – "SV-#"
- Soil boring (including samples) – "GB-#"
- Monitoring well – "MW-#"

The number sequence for borings will begin with GB-23 to be consistent and sequential with borings completed previously at the site. The suffix for a boring will be identified with a number either in the sequential order of completion or with a number preassigned prior to implementation of field activities. The suffix for a soil vapor point will be in accordance with the sampling grid presented in Figure 3.

Each soil sample collected from a given location will be assigned the same name as the location where the sample was collected. The depth of the sample will be added as a suffix following the location the sample was collected. For example, a soil sample collected from a depth of 5 feet from boring GB-24 would be identified as GB-24-5.

4.1.4 *Surveying*

All new soil borings, and monitoring wells will be surveyed following the completion of fieldwork. A licensed surveyor will survey the well casing elevation datum to the nearest 0.01 foot and the x and y coordinates to the nearest 0.1 foot. Ground surface elevation will be surveyed to the nearest 0.1 foot. All site surveying will be from a local datum referenced to mean sea level.

4.2 *SOIL INVESTIGATION*

The RI source investigation will be completed in two stages: a shallow soil vapor survey followed by completion of soil borings around the varnish pit and GB-10 verification soil borings.

4.2.1 *Shallow Soil Vapor Survey*

A shallow soil vapor survey will be conducted as a screening tool to identify the approximate limits of soil and ground water contamination within source areas.

4.2.1.1 *Sampling Methodology*

Passive soil vapor sampling devices will be placed at predetermined locations in the area of soil boring GB-10 at the south-southwestern portion of the site and along the identified utility lines (Figure 3). Sample locations around GB-10 are based on an approximate 20-foot grid spacing in an area approximately 60-feet by 80-feet.

This area is adjacent to the main building at the southwestern corner of the site and borders a driveway, which runs east/west along the southern portion of the site. The survey area fully encompasses the area proximal to soil boring GB-10.

Sample locations along below ground utility lines will be completed in 100-foot intervals along the length of the line. The utility line soil vapor survey will encompass the entire length of known interior and exterior below ground lines and will extend to the front (east) side of the building.

At interior locations a concrete saw will be used to prepare a 2-inch hole for soil augering. At interior and exterior locations a slam bar or electric rotary hammer-drill will typically be used to auger a 3/4-to 1-inch-diameter pilot hole for the deployment of the sampling modules to an average depth of 2 to 3 feet below grade. After the pilot hole is completed, sampling modules are tied to a section of nylon cord and inserted into the completed boreholes using a stainless steel insertion rod. The nylon cord is typically fastened to a cork, which is tamped flush with the ground surface to assist in retrieval of the module, and to seal the annulus of the boring. A complete description of the sampling procedures is included in Standard Operating Procedure (SOP) #1 (Appendix B).

4.2.1.2 *Sample Analyses*

Soil vapor samples will be analyzed for VOCs by gas chromatograph/ mass spectrometer (GC/MS) methods. The VOC target compound list will include chlorinated VOCs and aromatic hydrocarbons, and will be consistent with USEPA Method 8260.

4.2.2 *GB-10 Verification and Varnish Pit Soil Borings*

Soil borings will be completed using direct-push methods to verify the lateral and vertical extent of contamination as defined using the soil vapor survey techniques at GB-10. Additional soil boring will also be completed within the building in the varnish pit area.

These borings will be continuously cored to a total depth of approximately 16 feet using direct-push methods with acetate liners. Soil boring locations surrounding GB-10 will be determined based on the results of the soil vapor survey to be completed in Stage I of this RI. Because of the extensive soil vapor data that will be collected prior to this work, we estimate that only four borings in the GB-10 area may be necessary to verify the lateral extent of VOC impacts to soils.

Soil boring locations surrounding the varnish pit are based on a 50-foot grid centered at GB-20. Soil boring GB-20 was the location with the highest concentration of total VOCs in soil and water based on previous investigations.

Soil samples from this investigation will be retained from the surface (within the top 4 feet), and the sample with the highest field PID. The exact sampling depths will be determined in the field based on observation. However, the soil borings surrounding the varnish pit will not exceed a final depth of 16 feet bgs to ensure that the confining clay layer beneath the building is not breached.

A field geologist will log all soil borings. Soils will be classified in accordance with the Unified Soil Classification System (USCS), and field notes will be prepared to document evidence of soil and/or ground water impact (e.g., solvent-like odor, chemical staining). A PID will be used to screen soil samples for potential volatile constituents. Soil samples will be collected using sampling procedures consistent with SOP #2.

Soil samples will be submitted to a New York State Department of Health-certified laboratory. At least one soil sample from each boring will be analyzed for VOCs. Selected soil samples may also be analyzed for SVOCs. In addition, 20 percent of the soil samples collected will be analyzed for Target Analyte List (TAL) metals. Samples for laboratory analyses for VOC, will be collected from the sample with the highest PID reading or from the bottom of the boring in the event that elevated PID readings are not observed. Soil samples selected for VOC analyses that appear to be visually affected with petroleum like compounds will also be analyzed for SVOCs. All analyses will be conducted according to the methods described in Section 4.5.

4.3 *GROUND WATER INVESTIGATION*

Ground water investigation activities will be completed in Stage III of this investigation. The investigation involves the collection of perched water and intermediate overburden ground water samples to characterize the lateral and vertical extent of chemical impact to ground water. This will be accomplished through the installation and sampling of new monitoring wells. The following subsections present these techniques.

4.3.1 *Shallow Perched Ground Water Investigation*

Three ground water monitoring wells will be installed in the shallow perched ground beneath the building to obtain water levels and collect ground water samples for laboratory analyses. These shallow wells will be placed in the immediate area surrounding the varnish pit area. The shallow perched water monitoring wells will be screened from approximately 5 to 15 feet bgs.

4.3.2 *Shallow Intermediate Overburden Ground Water Investigation*

Three ground water monitoring wells will be installed in the shallow intermediate overburden in order to obtain water levels and collect ground water samples for laboratory analyses. The first shallow well will be placed in an immediate downgradient location from the varnish pit area. The second shallow well will be placed in a downgradient location proximal to soil boring GB-10 area. The third shallow well will be installed to the east of the plant building.

Based on previous investigations at the site and the construction of nearby monitoring wells, the uppermost overburden water-bearing zone occurs at approximately 20 feet bgs. Therefore, the additional shallow intermediate overburden monitoring wells will be screened from approximately 19 to 29 feet bgs. A screen length of 10 feet has been selected to provide greater coverage of the upper water zone of the intermediate overburden unit. The soil boring for the well at the east side of the plant building will be advanced to bedrock and a core sample will be obtained a maximum of 5 feet into bedrock.

4.3.3 *Deep Overburden Ground Water Investigation*

Three deep intermediate overburden ground water monitoring wells will be installed within 50 feet of the suspected chlorinated VOC source area at the varnish pit. These monitoring wells will be used in order to obtain water levels and collect ground water samples for laboratory analyses from the interface of the intermediate overburden aquifer with the bedrock beneath the site.

Based on regional geology and neighboring wells, bedrock is expected to be encountered at approximately 50 feet bgs. The three deep intermediate overburden monitoring wells will be screened into the top of the bedrock. A screen length of 5 feet has been selected to ensure proper evaluation of potential DNAPL on top of the bedrock. Soil borings for each of these three wells will be drilled approximately six inches beyond

the overburden/bedrock interface and a five foot long core sample of bedrock will be obtained. The bedrock core hole will be backfilled with bentonite prior to installing the wells.

4.3.4 *Monitoring Well Installation*

Soil borings for ground water monitoring well construction will be advanced with hollow stem augers having a minimum inside diameter of 4.25 inches. Monitoring well material will consist of a 5-foot or 10-foot long two-inch inside diameter (ID) polyvinyl-chloride (PVC) 10 slot (0.010 inch) screens and a two-inch ID PVC riser. Sand pack will consist of clean medium-grained silica sand. The final zone to be screened will be based on project objectives discussed above, physical characteristics of the soil sample, PID field screening of soil samples, and the judgment of the on-site geologist.

Any open borehole below the desired well bottom ("overdrill") will be plugged with bentonite chips overlain by six inches of very fine silica sand. Direct measurement with a decontaminated fiberglass weighted tape will be made to assure proper downhole placement of bentonite chips. The well screen and sand pack will then be installed above the plugged borehole. Well installation procedures are discussed in SOP#3.

4.3.4.1 *Drilling Methodology*

Monitoring wells will be drilled and installed using conventional hollow-stem auger. Hollow-stem drilling is cost-effective for well installation; however, additional efforts (e.g., placement of conductor casing) must be taken to minimize cross-contamination between aquifer zones. Based on the location of the intermediate overburden monitoring wells, cross contamination concerns with the shallow perched ground water zone beneath the building is not expected. If perched water is present in the area of the intermediate aquifer monitoring wells, the overburden soil borings will be double cased.

The field geologist will log all monitoring well boreholes. All monitoring wells will be continuously cored for lithological logging purposes.

Selected soil core samples will be analyzed for the following geotechnical parameters:

- Grain size distribution;
- Moisture content;
- Saturated hydraulic conductivity;

- Porosity;
- Bulk density; and
- Total organic carbon content.

Hydraulic conductivity and porosity data can be utilized to estimate ground water flow rates for the soil, and organic carbon data can be used to evaluate partitioning coefficients to calculate rates of VOC migration. Grain size analyses will be reviewed to select screen size and filter pack size for any future monitoring or extraction wells. American Society for Testing and Materials (ASTM) methods will be followed for all of these analyses, where appropriate.

4.3.5 *Well Development*

All new wells will be developed prior to sampling to ensure high quality monitoring well data. Wells will be developed according to the procedures outlined in SOP #4. All well development information will be recorded on appropriate well development forms.

4.3.6 *Water Level Measurements*

Ground water levels will be measured in all wells before sampling according to the procedures outlined in SOP #5. Water level measurements will be taken using an electronic water level meter and recorded to the nearest 0.01 foot. Ground water levels will be appropriately recorded in a dedicated field notebook.

4.3.7 *Water Sampling - New and Existing Monitoring Wells*

Approximately one week after all new wells have been developed, ground water levels will be measured and samples will be collected from each new and the existing wells at the site. Water sampling of the new and existing monitoring wells will be conducted according to the procedures detailed in SOP#4. Dissolved oxygen will be measured during the collection of all water samples from the monitoring wells.

The water samples collected from the new monitoring wells will be analyzed for VOCs and SVOCs. Water samples collected from the existing monitoring wells will be analyzed for VOCs to provide a second round of data for these wells. One upgradient and two downgradient ground water samples will be collected and analyzed for TAL metals.

4.4 *INVESTIGATION-DERIVED WASTE*

Wastes generated during the RI will be handled according to the type of waste generated. All soil, ground water, and decontamination water will be temporarily stored on site, tested, and disposed of as discussed below.

4.4.1 *Waste Soil*

Waste soil is expected to be minimal because of the direct-push methods used for the majority of the soil borings during this RI. All waste soil will be stored in 55-gallon drums in a secured area of the site. Drums will be labeled to indicate the sources (individual sample locations) of the soil in the drum.

The waste soil in each drum will be profiled based on the analytical results for the soil samples collected from each boring. If necessary, a composite soil sample of the waste soil will be collected and analyzed for appropriate compounds. The recommendation for soil disposal will then be based on the results of the composite sample.

4.4.2 *Wastewater*

Wastewater generated from drilling, sampling, or other activity (e.g., well development or purging) will be temporarily stored on site in water storage tanks or 55-gallon drums and tested for appropriate compounds. The recommendation for water disposal will be based on the analytical results for each drum.

4.5 *ANALYTICAL METHODS*

Samples will be analyzed for a variety of compounds and by a variety of methods. To ensure continuity and comparability among the data collected during this RI, the following analytical methods have been selected. These methods will provide the necessary compounds and detection limits to allow for comparison to applicable regulatory criteria and adequate data for designing interim remediation measures.

- VOCs by USEPA Method 8260; and
- SVOCs by USEPA Method 8270.

4.6 *QUALITY ASSURANCE/QUALITY CONTROL*

The site-wide quality assurance/quality control (QA/QC) program is included as Appendix C. Specific QA/QC requirements for the RI will be consistent with the following field and sampling QA/QC procedures.

4.6.1 *Field QA/QC Procedures*

Field QA/QC activities will be summarized daily. Daily logs will note the instruments used, a description of the work performed, health and safety monitoring conducted, problems encountered, deviations from the approved Workplan, events that may impact the quality of data collected, and a listing of original and QA/QC samples collected.

4.6.2 *Sampling QA/QC*

QA/QC samples will be collected during all stages of sampling during the RI. QA/QC samples include duplicates, trip blanks, and sampling equipment rinsates. Collection procedures of QA/QC samples are presented in the individual SOPs. Laboratory QA/QC samples include laboratory control samples, method blanks, and matrix spike/matrix spike duplicate samples. Laboratory QA/QC procedures are provided in the laboratory quality assurance plan for each laboratory utilized.

4.7 *HEALTH AND SAFETY MONITORING*

This discussion of Health and Safety (H&S) monitoring addresses scheduled field activities for the RI. All fieldwork will be conducted according to the *Health and Safety Plan* included in Appendix D.

Field work will be conducted under level D protection unless information becomes available before or as a result of drilling indicating a need to upgrade to another level based on the requirements of the H&S Plan. Action levels have been established for the RI activities based on potential site compounds. Chlorinated solvents (primarily TCE) are the main compounds of potential concern. TCE has an OSHA permissible exposure limit of 50 ppm. The action levels and personal protective equipment have been established based on the conservative potential for exposure to total organic vapors.

Action levels have been established for activity cessation, site evacuation, emergency response, and upgrading or downgrading the level of personal protective equipment. These action levels are provided in the site H&S

Plan. During RI activities, monitoring for total organics using a PID and/or flame ionization detector (FID) will be conducted. Measurements will be taken every 30 minutes in both the work area and breathing zone.

If a total organic reading is observed greater than 5 ppm above the established background level, protection will be increased to Level C with half- or full-facepiece air-purifying respirators with organic vapor/high efficiency particulate air (HEPA) cartridges; however, only those personnel in direct contact (i.e., samplers) will need to don gloves, boot covers, and Tyvek® coveralls. PID measurements will be repeated every 15 minutes until the observed reading drops to below 5 ppm over background.

If observed levels increase to greater than 10 ppm, respiratory protection will be increased to a full-facepiece air-purifying respirator equipped with organic vapor/HEPA cartridges. Measurements will be repeated every 15 minutes until the level drops to below 5 ppm.

If the observed concentration exceeds 50 ppm, operations will cease, and the on-site safety officer will halt operations and notify Field Manager. ERM's Director of Health and Safety will then assess the hazard and determine the appropriate procedures to complete the field activity.

5.0 *PROJECT REPORTING AND SCHEDULE*

ERM will prepare a technical memorandum to summarize the results of the soil vapor survey and confirmation soil sampling events. This memorandum will present preliminary data tables for the purpose of evaluating the source area soil characterization and migration of contamination along the subsurface utility lines.

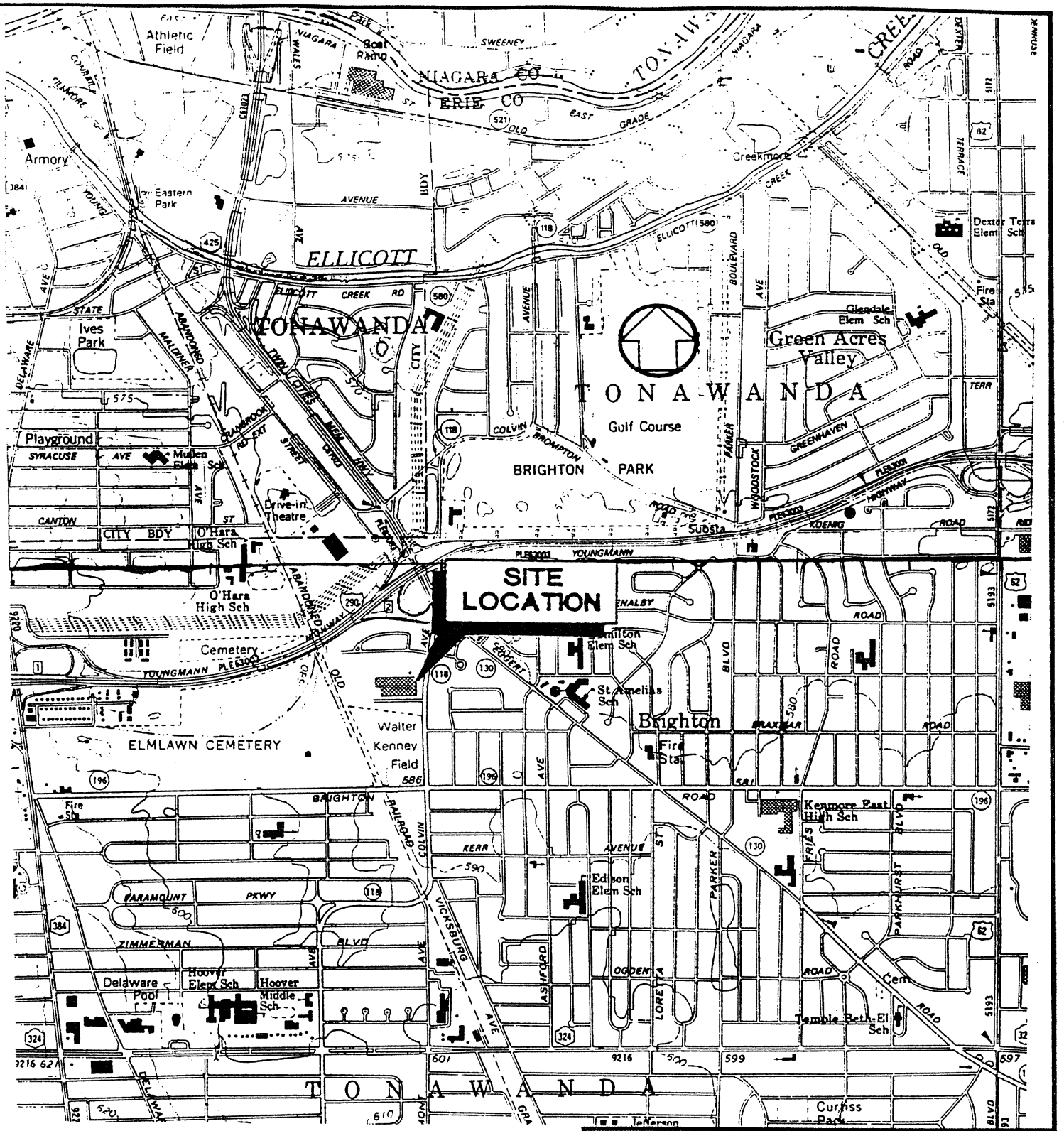
At the conclusion of the monitoring well installation and sampling efforts, ERM will prepare a report summarizing the overall RI findings. The report will include data summary tables and figures integrating the results of this investigation with the previous investigations conducted at the site. The report will identify any additional investigation that may be warranted, if any, based on the results of this and previous investigations. Recommendations for off-site investigation will be presented in the report if warranted based on findings of the investigations. The report will indicate that a remedial plan will be prepared to address contamination found at the site. Appendices to the report will include copies of soil boring logs, ground water collection sheets, laboratory reports, QA/QC information, and chain-of-custody forms.

An overall project schedule is included as Figure 4.

6.0 REFERENCES

ERM. 1999. *Subsurface Environmental Investigation Report, Greif Bros. Corporation Facility, 2122 Colvin Boulevard, Tonawanda, New York, prepared by ERM, April 1999.*

Figures



Based on USGS Tonowanda East and Buffalo Northeast 7.5 Minute Planimetric Quadrangles.

SITE LOCATION MAP
GRIEF BROTHERS FACILITY
TONOWANDA, NEW YORK

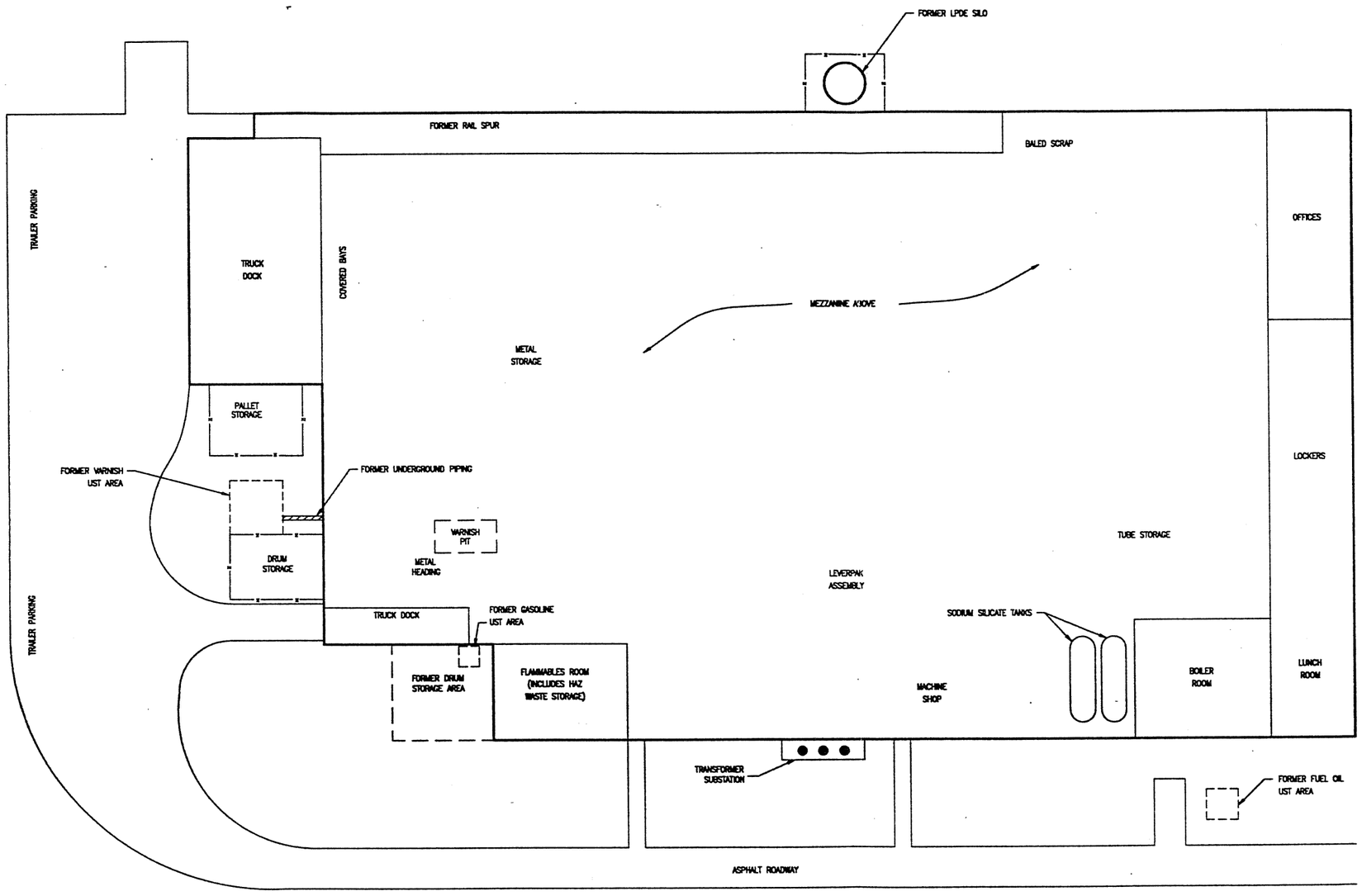
PREPARED FOR

SONOCO

ERM

SCALE	FIGURE
1:24,000	1
DATE 08/00	

/tbloc.dwg



NORTH

COLVIN BLVD

GRAPHIC SCALE
(IN FEET)

60 0 60

1" = 60'

No.	Date	Revision	Subconsultant	ERM

2122 COLVIN BLVD.
TONOWANDA, NY

ERM
ENVIROMENTAL RESOURCES MANAGEMENT
COLUMBUS, OHIO

SITE MAP

Date : 3/2/00

Scale : 1"=60'-0"

Principal : L.T.

Project Manager : L.T.

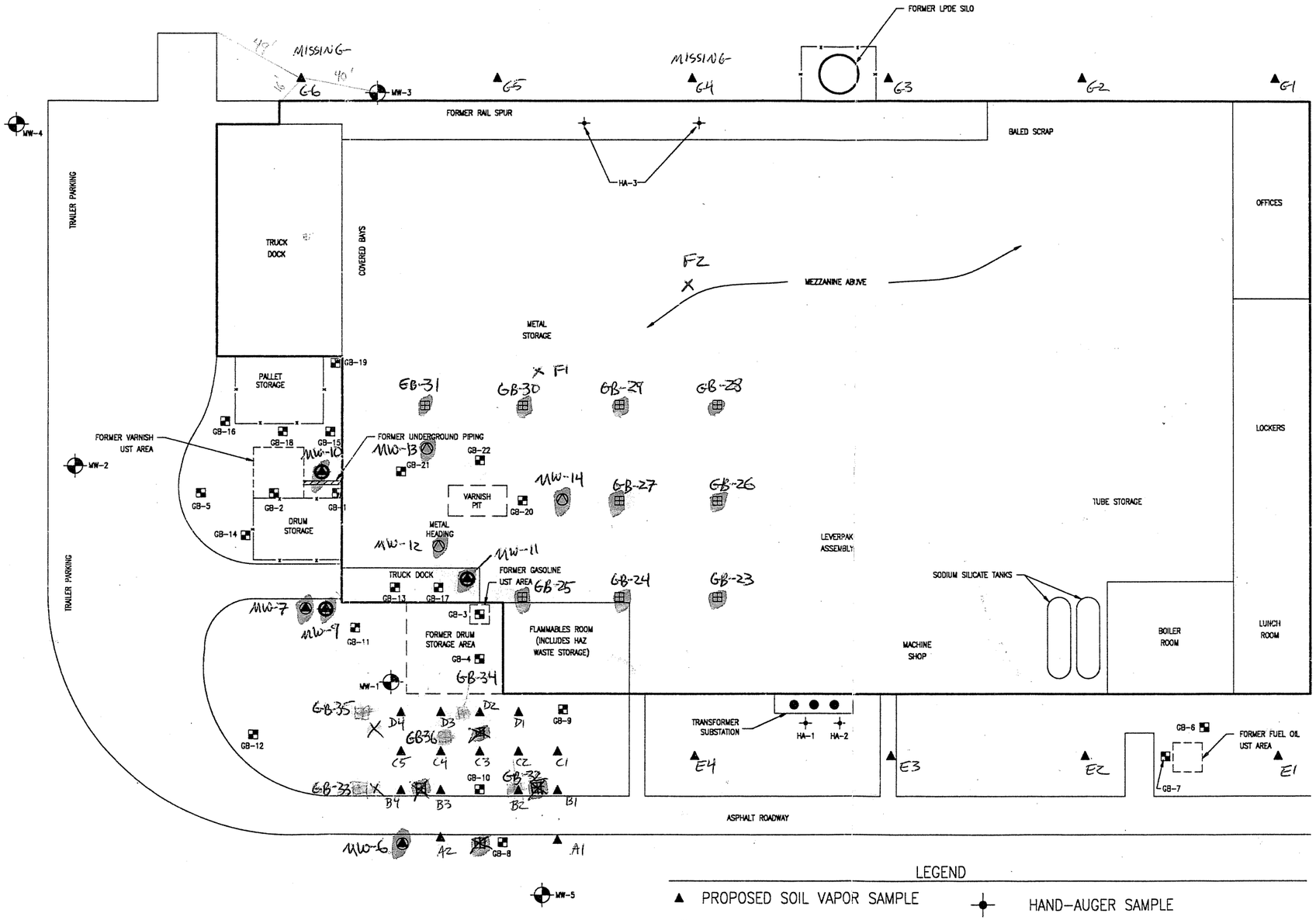
Drawn : SEP

Sheet : FIGURE 2

Project No. : D6713.00.01

Drawing No. : SITEMAP.DWG

SITEMAP.DWG (3/2/00)



LEGEND

- ▲ PROPOSED SOIL VAPOR SAMPLE
- ⊞ PROPOSED SOIL BORING
- ⌀ PROPOSED SHALLOW PERCHED WATER MONITORING WELL
- ⌀ PROPOSED SHALLOW OVERBURDEN MONITORING WELL
- ⌀ PROPOSED DEEP OVERBURDEN MONITORING WELL
- ✛ HAND-AUGER SAMPLE
- ■ PHASE II SOIL BORING
- ■ PHASE III SOIL BORING
- ✛ EXISTING OVERBURDEN MONITORING WELL

GRAPHIC SCALE (IN FEET)

60 0 60

1" = 60'

No.	Date	Revision	Subconsultant	ERM

2122 COLVIN BLVD.
TONOWANDA, NY

ERM
ENVIROMENTAL RESOURCES MANAGEMENT
COLUMBUS, OHIO

PROPOSED SAMPLE LOCATIONS

Date : 3/2/00

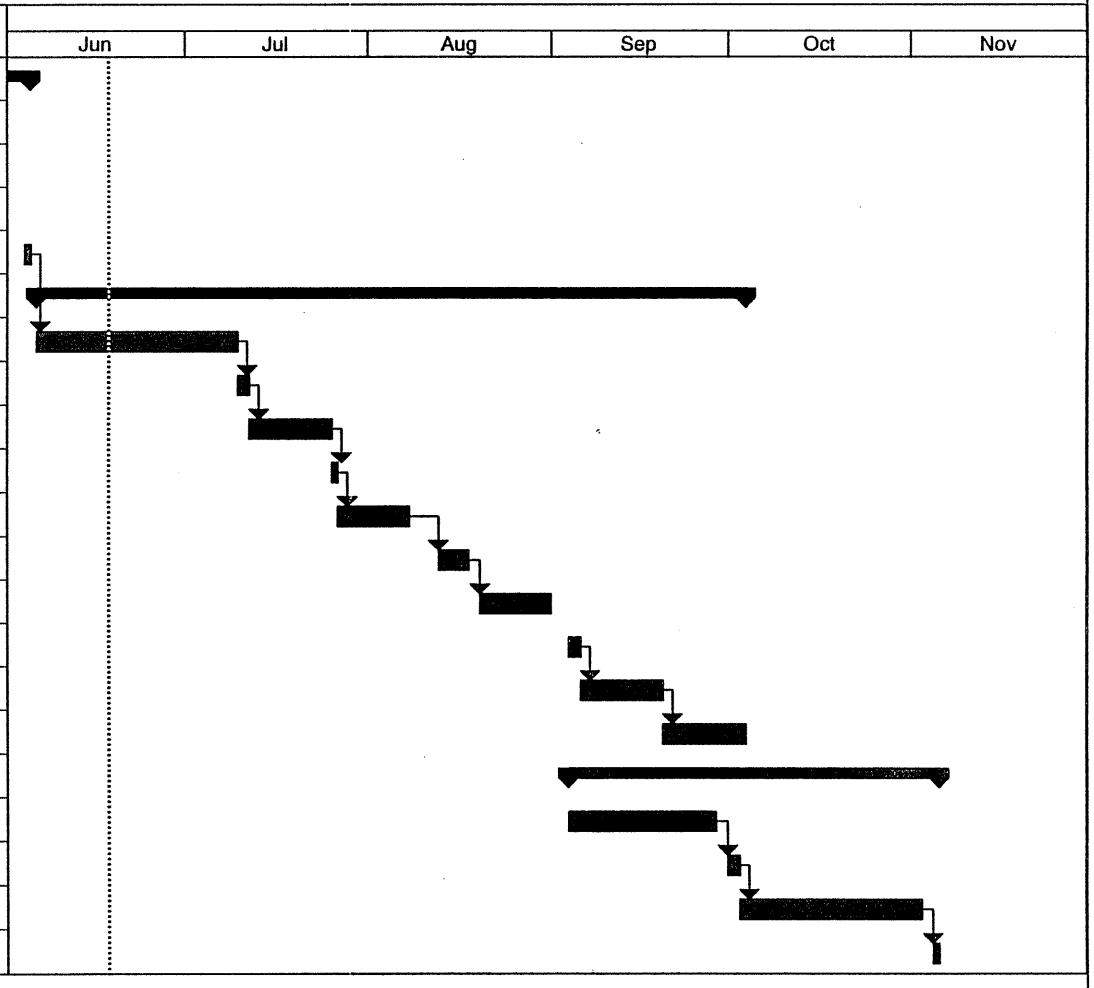
Scale : 1"=60'-0"

Principal : L.T.
Project Manager : L.T.
Drawn : SEP
Sheet : FIGURE 3
Project No. : 0613.00.01
Drawing No. : INVLOC.DWG

INVLOC.DWG (3/2/00)

FIGURE 4
SCHEDULE FOR GREIF BROTHERS FACILITY RI - TONAWANDA, NEW YORK

ID	Task Name	Duration	Start	Finish
1	**WORKPLAN/VCP AGREEMENT**	**307 days**	**Mon 4/3/00**	**Mon 6/4/01**
2	1b - Draft RI workplan to NYSDEC	2 days	Mon 4/3/00	Tue 4/4/00
3	1c - NYSDEC review and comment	30 days	Wed 4/5/00	Tue 5/16/00
4	1d - Finalization of RI work plan	31 days	Wed 5/17/00	Wed 6/28/00
5	1e - NYSDEC approval to proceed	1 day	Mon 6/4/01	Mon 6/4/01
6	**FIELD INVESTIGATION**	**86 days**	**Wed 6/6/01**	**Wed 10/3/01**
7	2a - RI fieldwork preparation	24 days	Wed 6/6/01	Mon 7/9/01
8	2b - Onsite fieldwork/soil vapor installation	2 days	Tue 7/10/01	Wed 7/11/01
9	2c - Soil vapor module exposure	10 days	Thu 7/12/01	Wed 7/25/01
10	2d - Soil vapor retrieval	1 day	Thu 7/26/01	Thu 7/26/01
11	2e - Soil vapor analysis	8 days	Fri 7/27/01	Tue 8/7/01
12	2f - Onsite fieldwork/drilling	5 days	Mon 8/13/01	Fri 8/17/01
13	2e - Laboratory analysis (soil)	10 days	Mon 8/20/01	Fri 8/31/01
14	2g - Onsite fieldwork/ground water sampling	2 days	Tue 9/4/01	Wed 9/5/01
15	2h - Laboratory analysis (ground water)	10 days	Thu 9/6/01	Wed 9/19/01
16	2i - Data Analysis	10 days	Thu 9/20/01	Wed 10/3/01
17	**REPORT**	**45 days**	**Tue 9/4/01**	**Mon 11/5/01**
18	3a - RI report preparation	19 days	Tue 9/4/01	Fri 9/28/01
19	3b - RI report to NYSDEC	2 days	Mon 10/1/01	Tue 10/2/01
20	3c - NYSDEC review & comment	31 edays	Tue 10/2/01	Fri 11/2/01
21	3d - NYSDEC RI completion meeting	1 day	Mon 11/5/01	Mon 11/5/01



Project: Tonawanda Field Schedule
Date: Mon 6/18/01

Task
Split
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Split
Rolled Up Milestone
Rolled Up Progress
External Tasks
Project Summary

Appendix A
Utility Clearance Procedures

UNDERGROUND FACILITIES PROTECTIVE ORGANIZATION

3650 James Street, Syracuse, New York 13206

Ticket No. 07021-032-079 Today's Date 7/2/01, 1640 ±

Excavating Company ERM

Caller's Name Jon Fox

Excavator's Address ERM - DeWitt, NY

City DeWitt State NY ZIP 13214

Fax # 315-445-2543 Phone # 315-445-2554 Ext. NA

Call Back (Person or Phone#) Jon Fox

Excavation Site: State New York County Erie

Name of (Town), Village or City Tonawanda

Street Address of Work Site 2122 Colvin Boulevard

Nearest Intersecting Street Sharon Avenue

Are you working within 500' of a:

Not asked

Not asked → Traffic signal ☑ No ☐ Yes Intersection ☐ No ☐ Yes

Other pertinent details/additional site information: _____

Work Date 7/9/01 Time Not asked

NYS law requires at least 2 full working days notice, not including the day you call in!

Type of Work soil vapor points

Are you blasting? ☒ No ☐ Yes Means of Excavation hammer drill

Done for (*if applicable*) property owner

Field Contact (*Name*) not asked

Cellular or Field Office # not asked

UFPO Members Contacted: ARCO pipeline, AT&T, Erie Co. Water Authority, Lake Head Pipeline, NFG, Niagara Mohawk, Town of Tonawanda

REMINDER NON-MEMBER UTILITIES MUST BE CONTACTED SEPARATELY

1-800-962-7962

www.ufpo.org

Dig Safely New York, Inc.

1-800-962-7962

3650 James Street, Syracuse New York 13206

Ticket Number:	08-081-016-066	Today's Date:	8/8/01 @ 1431
Information about you...			
Company ID:	8249	Phone:	315-445-2554
Your Name:	Jon Fox	Type:	☒ Contractor ☐ Member ☐ Homeowner
Company Name:	ERM, Inc.		
Address:	5788 Widewaters Pkwy.		
City:	DeWitt	State: NY	Zip: 13214
Fax:	315-445-2554	E-Mail:	jon_fox@erm.com
Industry:	Env. Consulting Firm		
Information about the job... Remember to give at least two full working days notice!			
Field Contact:	Jon Fox	Field Phone: 315	315-436-6355
		Field Fax: ~~NA~~	NA
Work Start Date:	8/13/01	Time:	09:00 (am) pm
Site Information			
State: NY	County: Erie	Place: Tonawanda	City (Town) Village
Address:	2122 Colvin Boulevard		
Nearest Intersection Left:	Sharon Avenue		
Nearest Intersection Right:	not known		
Describe area to be staked out:	entire property		
Type of work: soil borings well installations	Means of excavation: drilling rig geoprobe	Blasting? NO	☐ Yes ☒ No
Comments / additional info / special instructions on back			

Project No. D6714.00 "REFERENCES" Source ERM Network

(*) NEED VERBAL REPORT OR MARKED LINE TO PROCEED

Members: **Remember, non-member utilities must be contacted separately.**

ARCO Pipeline, AT&T, Erie Co. Water Auth., Lakehead Pipeline, NFG, Niagara Mohawk, Town of Tonawanda water, and Verizon

Appendix B
Standard Operating Procedures (SOPs)

SOP #1: SOIL VAPOR SAMPLING AND ANALYSIS

1.0 *PURPOSE AND SCOPE*

The purpose of this document is to define the standard operating procedure (SOP) for the passive soil vapor investigation at the Greif Bros. Facility site at 2122 Colvin Boulevard in Tonowanda, New York.

Soil vapor sampling and analysis is a qualitative technique and is principally used for identifying contaminated areas and specific locations for subsequent soil and ground water sampling. This SOP describes how to correctly obtain a soil vapor sample including collection, documentation, and quality control requirements. Any deviation from this procedure should be thoroughly documented and evaluated prior to proceeding, to ensure that the data quality objectives are met.

This SOP serves as a reference to the project Workplan and applies to all soil vapor samples collected by ERM personnel or their subcontractors. This Workplan is to be strictly followed, and any modifications to this SOP shall be approved by the Project Manager (PM) in advance.

2.0 RESPONSIBILITIES AND QUALIFICATIONS

The PM is responsible for assigning project staff to complete soil vapor sampling and analysis activities at the site and to assure that this and any other appropriate procedures are followed by all project personnel.

The project staff assigned to the soil vapor investigation is responsible for completing all tasks according to this and other appropriate procedures and must report any deviations from the procedure or nonconformance to the PM or Project Quality Assurance/ Quality Control (QA/QC) Officer.

Only qualified personnel shall be allowed to perform this procedure or supervise subcontractors hired to perform this procedure. At a minimum, ERM employees qualified to perform soil vapor investigations will be required to:

- Read this SOP;
- Indicate to the PM that they understand all procedures contained in this SOP;
- Have completed the OSHA 40-hour training course and/or 8-hour refresher course, as appropriate; and
- Have soil vapor investigation experience generally consistent with the procedures described in this SOP.

ERM employees who do not have previous experience in soil vapor investigation will be trained on site by a qualified employee, and will be supervised directly by that employee until they have demonstrated an ability to perform the procedures. An experienced subcontractor may be used for soil vapor investigations in place of a qualified ERM employee. The subcontractor should have a least 1-year of experience performing similar analyses. In this case, an ERM employee fulfilling the first three prerequisites for qualification will oversee the subcontractor's activities during the soil vapor investigation. The PM shall document personnel qualifications related to this procedure in the project quality assurance files.

3.0 PROCEDURES FOR SOIL VAPOR SAMPLING

3.1 EQUIPMENT LIST

The following is a typical list of equipment that may be needed to perform a passive soil vapor survey:

- Pin flags, spray paint, and measuring tape to mark out and record soil vapor sample locations;
- Field notebook and a location map;
- Slide hammer/tile probe (slam bar) or electric rotary hammer drill (AC power outlet or portable generator and extension cords required) with carbide-tipped bits or augers (1/2 to 1-inch diameter up to 36 inches long) to make a pilot hole;
- Shipping boxes containing individually numbered passive soil gas modules, including trip blanks;
- Stainless steel insertion rod in threaded section to place modules in pre-drilled/driven pilot holes;
- Corks with screw eyes attached;
- String (cord) to allow the module to be installed to the recommended depth;
- Knife or scissors for cutting string;
- Chain of Custody (COC) forms;
- Disposable gloves and equipment decontamination supplies; and
- Personal protective equipment (specified by the Health and Safety Plan).

3.2 SAMPLE COLLECTION PROCEDURE

This section describes the procedures for documentation, sample collection, and QA/QC during soil vapor sampling activities.

3.2.1 *Preparation*

Prior to initiating any fieldwork, the project personnel and subcontractors must be familiar with site-specific health and safety requirements and have the appropriate protective clothing and equipment needed to comply

with this plan. Also, underground utilities must be located by Greif Bros. or their representative in all areas where soil vapor sampling is proposed.

3.2.2 *Sample Locations*

All samples will be collected according to the sampling grid presented in the Workplan. Samples will be given the prefix of SV- and the suffix of a letter followed by a number in accordance with the sampling grid. For example, the soil vapor sample in the lower right-hand corner of the sampling grid will be identified as SV-A1. All soil vapor sample locations will be marked with paint and flags prior to initiating installation of the passive sampling modules. All locations will be professionally surveyed between module insertion and retrieval.

3.2.3 *Sample Collection*

At each soil vapor sample location, a one-inch-diameter pilot hole will be drilled to a total depth of 3 feet below ground surface. The pilot hole will be drilled with an electric rotary hammer-drill powered by a portable generator. After the pilot hole is completed, a module will be tied to a section of nylon cord and inserted into the completed borehole using the stainless steel insertion rod. The nylon cord is then fastened to a cork which is tamped flush with the ground surface to assist in retrieval of the module and to seal the annulus of the boring. The serial number of the module and the corresponding soil vapor sample location will be recorded at each location in the field notebook and/or the data collection form. Additional modules designated as trip blanks will be identified in the field notebook and left unopened in the shipping box for the duration of the field work.

Modules will remain in the ground for a minimum of 10 days. Modules are retrieved by locating the module, removing the cork, grasping the nylon cord, and manually pulling the module from the ground. The corks and nylon cord are separated from the module and discarded. The exposed modules are resealed in their respective designated shipping vials and placed in a cooler containing enough ice to maintain a temperature of 4°C. Each soil vapor sample and associated trip blanks will be recorded on the COC. Associated trip blanks and temperature blanks will be placed in the cooler prior to shipment to the offsite laboratory. The cooler containing samples and completed COC forms will then be sent overnight to W.L. Gore and Associates, Inc. in Elkton, Maryland for analysis.

Clean, nitrile gloves will be donned at each sampling location during both module insertion and retrevial to prevent cross-contamination of samples and to protect field employees from potential dermal exposure.

3.3 *SAMPLE TRACKING*

A COC form will be filled out in the field, and will accompany every shipment of modules to the analytical laboratory. The purpose of the COC form is to document possession of a sample from the time of collection in the field to its final disposal by the laboratory.

Information to be provided on the COC form includes:

- Project name and number;
- Sampler signatures;
- Sample number;
- Sample collection date and time;
- Analysis parameters;
- Number of containers;
- Preservatives; and
- Comments.

The laboratory will record the following information:

- Name of persons receiving the sample;
- Date of sample receipt; and
- Sample condition.

All corrections to the COC record will be initialed and dated by the person making the corrections.

Each COC form will include signatures of the appropriate individuals indicated on the form. The originals will follow the samples to the laboratory, and copies documenting each custody change will be retained and kept on file by ERM. All COC will be maintained until final disposition of the samples.

3.4 *QA/QC SAMPLES*

3.4.1 *Blanks*

Trip blanks will be provided by the laboratory and will accompany the modules from the laboratory to the field and back to the laboratory. These samples are to remain unopened until analyzed by the laboratory. The purpose of trip blanks is to determine the presence and magnitude of contamination resulting from sample exposure at the laboratory, during shipping, or during other sample handling activities. One trip blank will accompany each shipment of soil vapor modules and will be analyzed for the same target compound list as the sample modules.

3.4.2 *Duplicate Samples*

A duplicate (or co-located) sample may be analyzed to assess the precision of the analytical system and any potential bias associated with the site. A co-located sample is a module placed in the pilot hole adjacent to the primary module for that pilot hole. One duplicate will be collected per 20 samples.

4.0 *DECONTAMINATION*

Any equipment that invades the subsurface soil at each soil vapor sampling location must be decontaminated. Equipment requiring decontamination at each sample location includes but is not limited to the drill bit and the insertion tool. Each piece of equipment will be decontaminated before sampling begins and between each sample location. Nitrile gloves will be worn whenever handling the equipment. The decontamination procedure is as follows:

- Wash equipment in an Alconox (or equivalent) and water soution using a brush or clean cloth to ensure removal of all contaminants.
- Rinse equipment in fresh tap water.
- Rinse equipment with a deionized water rinse.
- Dry equipment with a paper towel and place in clean plastic, if appropriate.

Decontamination activities will be noted for every sample location in the field note book.

5.0 *CALIBRATION PROCEDURE*

Mechanical equipment used during the soil vapor sampling activities will include a photoionization detector (PID), electric generator, and a rotary hammer drill. Before going into the field, the sampler will verify that all of these are operating properly. In addition, the PID requires daily calibration. Calibration times and appropriate readings will be recorded in the field notebook and/or on data collection forms. Specific instructions for calibrating the PID will accompany the instrument.

6.0 *DOCUMENTATION*

For each soil vapor location, all the pertinent data on sampling and analysis will be recorded in the field notebook and/or data collection forms. This information should include the following for soil vapor samples:

- Sampler's name;
- Date and time of module insertion;
- Date and time of module retrieval;
- Sampling location number, and descriptive location of the sampling area;
- Weather conditions;
- Sampling depth(s);
- Soil type at sample location;
- Description of the surface features (i.e., drainage, facilities), soils, any contamination noted, and trenches or any other feature that may impact the soil vapor measurement;
- PID reading during module insertion; and
- All calibrations performed.

SOP #2: SOIL AND GROUND WATER SAMPLING TECHNIQUES

1.0 PURPOSE AND SCOPE

The purpose of this document is to define the standard operating procedure (SOP) for conducting soil and ground water sampling using a direct push (GeoProbe or equivalent) rig. Direct push sampling offers an alternative, or a supplement, to conventional drilling methods by enabling rapid, high quality subsurface exploration and sampling, while significantly reducing site disturbance and waste generation.

The ultimate goal of direct push sampling is to obtain samples and data that meet acceptable standards of accuracy, precision, comparability, representativeness, and completeness. In this SOP, all steps that could affect tracking, documentation, or integrity of samples have been explained in sufficient detail to allow sampling personnel to collect reliable and consistent samples. The following items will be discussed in detail in Section 3.0 of this SOP:

- Direct push investigation techniques;
- Soil sampling;
- Ground water sampling; and
- Soil and ground water disposal.

Specifically, Section 3.0 describes the equipment, field procedures, sample containers, storage and holding times, decontamination, documentation, and field quality assurance/quality control (QA/QC) procedures necessary to conduct direct push investigation and sampling at the Greif Bros. Facility site at 2122 Colvin Boulevard in Tonowanda, New (site). The step-by-step procedures are described in detail to allow field personnel to obtain data of sufficient integrity and to ensure representative soil and ground water sample collection.

This SOP serves as a reference to the Workplan and applies to all direct push sample collection by ERM personnel and/or their subcontractors. The Workplan is to be strictly followed, and any modifications to this SOP must be approved by the Project Manager (PM) in advance.

2.0 *RESPONSIBILITIES AND QUALIFICATIONS*

The PM is responsible for assigning project staff to perform direct push investigation and sampling activities and for assuring that all procedures are followed by project personnel.

The project staff assigned to the collection of data, soil samples, and ground water samples with direct push techniques is responsible for completing all tasks in accordance with the procedures detailed in this SOP. All staff is responsible for reporting deviations from the procedure or nonconformance to the PM or Project QA/QC Officer.

Only qualified personnel shall supervise subcontractors hired to perform this procedure. At a minimum, ERM employees qualified to supervise direct push investigations and sampling will be required to:

- Read this SOP;
- Indicate to the PM that they understand all procedures contained in this SOP;
- Have completed the Occupational Safety and Health Association (OSHA) 40-hour training course, and/or annual 8-hour refresher course, as appropriate; and
- Have direct push investigation and sampling experience that is generally consistent with the procedures described in this SOP.

ERM employees who do not have previous experience supervising direct push techniques will be trained on site by a qualified ERM employee. A qualified geologist or professional engineer will oversee the project. The PM shall document personnel qualifications related to this procedure in the project QA files.

3.0 *DIRECT PUSH SOIL AND GROUND WATER SAMPLING PROCEDURES*

3.1 *EQUIPMENT LIST*

Typical equipment for direct push investigation, soil sampling, and ground water sampling includes:

- Direct push (GeoProbe or equivalent) rig;
- Soil sampling tools;
- Stainless steel, brass, or polyvinyl chloride (PVC) liners;
- Teflon sheets;
- Plastic caps;
- Self-adhesive labels;
- Appropriate HydroPunch or similar device for sampling ground water;
- Sample bottles for water samples (prepared by laboratory);
- Water quality test kit;
- Ice chest/cooler;
- Ice or frozen ice packs;
- Field notebook and location map;
- Personal protective equipment, including nitrile or powderless surgical gloves, hard hat, steel-toed boots, and respirator;
- Drums or bulk containers for storage of ground water and soil;
- Photoionization detector (PID) and/or flame ionization detector (FID); and
- Data collection forms.

Typical equipment for decontamination includes:

- Brushes;
- Wash/rinse tubs;
- Alconox detergent (or equivalent); and
- Deionized water.

Typical equipment for sample filtration, if needed, includes:

- Disposable, in-line, 0.45-micron-pore-size, high capacity filter;
- One clean plastic container approximately l-liter size;
- Sample container with necessary preservatives;
- Peristaltic pump; and
- A length of disposable polyethylene and/or surgical tubing.

3.2 *PROCEDURE*

Direct push soil sampling and ground water sampling will be conducted during this investigation. Direct push ground water sampling may be conducted during this investigation, if warranted. The soil sampling will be used to characterize chemical impacts to the vadose zone (to approximately 16 feet bgs) and to refine source areas of concern. The ground water sampling may be used to characterize plume definition and potential migration.

An air monitor (a PID or FID) will be available at the site during the direct push investigation. This equipment shall be checked at least daily to ensure that it is calibrated and operational. A background reading will be taken, and the instrument will be reset to zero each time the instrument is used.

Health and safety equipment described in the site-specific Health and Safety Plan will be donned before proceeding to the sample location. Organic vapor readings measured in the breathing zone with an FID or PID will be used to determine if respirators are needed throughout the sampling procedures, based on action levels set by the site specific Health and Safety Plan. Air monitoring readings will be recorded in the field notebook and/or on data collection forms.

Although the number and type of soil samples to be collected may vary according to the Workplan, the sequence of steps will generally follow that described in this section. If a soil or water sample is to be submitted for laboratory analysis, the procedures for sample labeling, handling and tracking, described in Section 4.0 of this SOP, will be followed.

3.2.1 *Direct Push Soil Sampling*

A direct push soil sampling rig will be used to collect soil at each specified location. The necessary sampling equipment shall be assembled and checked for proper operation before soil sampling. Soil sampling devices

vary between subcontractors but most consist of a piston-type sampler with a retractable point and an inner liner. The specific soil sampling tool will be identified in the Workplan. The general sampling procedure will be as follows:

- The soil sampling tool will be deployed using a truck-mounted sampling rig to collect soil samples, at the intervals specified in the Workplan, for visual inspection and/or chemical analysis at a certified off-site laboratory;
- The soil sampling tool is pushed to the desired sampling depth with the drive tip locked in place to prevent soil from entering the sampler body;
- At the desired sampling depth, the locking mechanism is released, causing the drive tip to retract inside the drive rod and seat above the liner; and
- The sampling device is subsequently pushed into the soil to collect a sample.

Sampler retrieval is dependent on the subcontractor. The most common form of retrieval is achieved by pulling the drive rods from the sample location and unthreading the sampling tool from the rods. A wireline system is also employed by a number of subcontractors. Following retrieval, the liner shall be removed from the sampler and placed on a flat surface for evaluation. The top and bottom of the core and sampled interval will be marked on the liner. The ends of each liner containing soil to be submitted for analysis shall be covered with Teflon film before being covered with plastic caps. Each submitted sample will be labeled with the boring number, bottom depth of liner, date and time of sampling, the individual performing the sampling, and job number. Alternately, the information may be recorded directly on the liner. The labeled liners shall be placed in Zip-Loc® plastic bags in a cooler with ice or frozen ice packs for storage until they are delivered to the analytical laboratory. Each cooler shall contain a Chain of Custody (COC) record, and each sample placed in a given cooler shall be listed on the COC record for that cooler. The COC protocols are presented in Section 4.3 of this SOP. The remainder of the soil sample shall be logged for lithology, soil structure, Unified Soil Classification System (USCS), and other pertinent information.

3.2.2 *Ground Water Sampling*

The necessary sampling equipment shall be assembled and checked before ground water sampling to ensure proper operation. Ground water samplers vary depending on the subcontractor used; however, most offer

HydroPunch-type samplers. The ground water sampler is hydraulically pushed by the sampling rig to the water table, or to a depth specified in the Workplan.

HydroPunch-type samplers consist of an air-tight, water-tight, sealed intake screen and sample chamber that is isolated from soil and ground water while the tool is advanced. As the tool advances, soil particles are displaced to the side and compacted into the walls of the hole, producing a tight annular seal around the tool. The surface of the HydroPunch is designed to prevent the downward transport of chemical constituents. Collection of a discrete ground water sample from a specific depth is made possible by the tight annular seal.

Upon reaching the desired depth for collecting a sample, the HydroPunch is opened by pulling back on the tool shaft. The drive cone (with attached screen) is held in place by soil friction as the body is pulled back. Once the HydroPunch is open and the O-ring seal (between the drive cone and the body of the tool) is broken, the tool fills from the bottom with ground water. No aeration and minimal agitation of the water sample occurs during this procedure.

The HydroPunch II-type samplers may be used if:

- A sample of floating product is desired; or
- A large volume of sample is required.

The HydroPunch II-type samplers are equipped with a 3- to 5-foot screen that may be reusable or disposable depending on the specific system. The reusable screens are constructed of stainless steel and decontaminated with the tool between samples. Using a HydroPunch II-type system, the tool is connected to the surface with hollow sampling rods. These rods are large enough to permit the passage of a bailer. The sample is collected by lowering the bailer through the rods into the screened section of the tool. This configuration allows for the collection of floating product phases. In addition, the system allows for the collection of large volumes of ground water.

Ground water sampling will commence as soon after installation of the ground water sampling tool as is practical. All ground water sampling equipment will be thoroughly decontaminated prior to sampling at each designated depth and/or location in accordance with the procedures described in Section 5.0. Care will be taken to ensure that all decontaminated equipment avoids contact with potentially contaminated materials prior to obtaining samples. Sampling personnel will put on new

or freshly decontaminated gloves prior to sampling ground water to reduce the potential for cross contamination.

The sample containers, preservatives, and holding times required for specific ground water parameters are specified in Section 4.0. Upon commencement of sampling, the volatile organic analysis (VOA) vials will be completely filled first. Each filled, capped vial will be inverted and tapped to ensure no air bubbles are present. If an air bubble is present, the vial will be opened and topped off with additional sample. The vial will be immediately capped and checked again for bubbles. If air bubbles are still present, the VOA vial will be discarded and a new vial used. The VOA vial-filling procedure is repeated until no air bubbles are present.

After the VOA vials are filled, the other sample containers will be filled. Samples collected for metals and general minerals analysis will be filled to the base of the bottle neck. Care will be taken not to aerate the sample during transfer from the bailer to the sample bottles and not to overfill bottles containing preservatives. All water samples will be kept in a cooler with ice or frozen ice packs from the time they are collected until they are extracted or analyzed.

3.2.3 *Cuttings and Wastewater Disposal*

Upon completion of sampling and investigation activities, all soil cuttings, if generated, will be collected and stored on site in labeled drums or bulk containers until ultimate disposal is performed, if necessary. A drum log will be completed each time a drum is used. Labeled information includes the sample location number, contents, and the date of filling. Any fluids from the subsurface investigation will be stored and appropriately disposed of pending ground water sampling analytical results.

4.0 SAMPLES

4.1 SAMPLE CONTAINERS, IDENTIFICATION AND LABELING

4.1.1 Sample Containers

Soil samples for laboratory analysis will be collected in stainless steel, brass, or PVC liners. The ends of the liners will be covered with Teflon film and plastic caps.

Ground water samples will be immediately transferred to an appropriate sample bottle. Table 1 indicates the appropriate sample containers, preservatives, and holding times for test parameters.

4.1.2 Sample Identification

Sample identification numbers will follow the labeling conventions discussed in the Workplan.

4.1.3 Sample Labeling

Samples will have a plastic or waterproof paper label attached that will be filled out using waterproof ink, or information may be recorded directly onto the sampling container. The label will contain the following information:

- Project number;
- Task number (if appropriate);
- Site/project name;
- Sample number;
- Boring number;
- Sample depth;
- Sampler's name;
- Date and time the sample was collected;
- Sample description (soil or water);
- Preservatives; and
- Parameters for analysis.

4.2 SAMPLE PRESERVATION AND HANDLING

4.2.1 Sample Preservation

After collection, samples will be immediately stored in a cooler with ice or frozen ice pack to maintain a temperature of 4°C. The appropriate preservation techniques for soil and water samples are shown in Table 1.

4.2.2 Sample Handling

4.2.2.1 Packing and Storage

Samples will be packaged and stored in a manner that will prevent damage. If sample bottles are used in addition to liners, they will be labeled, wrapped in protective packing material, and placed right side up in a cooler for delivery to the laboratory.

4.2.2.2 Transportation

The samples will be delivered or shipped to the laboratory on the date of sample collection, or as soon afterwards as possible.

4.2.2.3 Holding Times

The holding times for the various analytical parameters listed in Table 1 are the total time from sample collection to extraction or analysis. The analyses required for each soil and ground water sample will be specified in the Workplan.

4.3 SAMPLE TRACKING

A COC record will be filled out in the field, and will accompany every shipment of samples to the analytical laboratory. The purpose of the COC record is to document possession of a sample from the time of collection in the field to its final disposal by the laboratory.

Information to be provided on the COC record includes:

- Project name and number;
- Sampler's signature;
- Sample number;
- Sample collection date and time;
- Analysis parameters;

- Number of containers;
- Preservatives; and
- Comments.

The laboratory will record the following information:

- Name of persons receiving the sample;
- Date of sample receipt; and
- Sample condition.

All corrections to the COC record will be initialed and dated by the person making the corrections. Each COC record will include signatures of the appropriate individuals. The originals will follow the samples to the laboratory, and copies documenting each custody change will be retained and kept on file. The COC record will be maintained until final disposition of the samples.

4.4 *QUALITY ASSURANCE/QUALITY CONTROL SAMPLES*

4.4.1 *Trip Blanks*

A trip blank is a suite of VOA sample bottles containing deionized water that is prepared by the laboratory. Trip blanks (aqueous) will accompany each shipment of water sample containers from the laboratory. The trip blanks will be kept with the same shipment of sample containers at all times and will be returned, unopened, to the laboratory with that shipment. Trip blanks will be used to detect any contamination or cross contamination during handling and transportation. One trip blank set is sent per cooler of samples for volatile analysis per day.

4.4.2 *Rinsate Samples*

Rinsate samples are defined as samples that are obtained by running deionized water through sample collection equipment (i.e., soil samplers, HydroPunch tools, bailers) after decontamination. These rinsate samples will be collected in the appropriate sample containers and sent to the laboratory for analysis. They will be used to determine if decontamination procedures have been effective. One rinsate sample per 20 samples will be collected and sent to the laboratory. If only disposable equipment is used, no rinsate samples are necessary.

4.4.3 *Matrix Spike/Matrix Spike Duplicate for Soil Samples*

Matrix spikes and matrix spike duplicates (MS/MSDs) are prepared in the laboratory to assess precision and accuracy of an analytical method on various matrices. An MS/MSD is generated by preparing three separate samples for analysis from the same soil sample, and then spiking the second and third samples with selected target compounds. For metals determined by Inductively Coupled Plasma (ICP) analysis, for example, the spike contains all the analyte metals at levels approximately five times the reporting limit. Following the addition of the spike to the MS/MSD, these two QC samples are carried through all laboratory procedures and analyzed as are the routine soil samples taken for the investigation. One MS/MSD will be prepared per 20 samples shipped to the laboratory.

The collection and handling of all QA/QC samples will be documented in the field notebook and/or on data collection forms.

5.0 EQUIPMENT DECONTAMINATION

This section describes specific equipment decontamination procedures for this project. Equipment decontamination will include the following:

- Decontamination of soil collection, and/or HydroPunch equipment (rods and sampling devices) will be conducted between individual sampling points to minimize potential cross contamination. Sampling equipment will be decontaminated between each sample collected; and
- The direct push rig, depending on the extent of chemical occurrence and the cleaning requirements, will be decontaminated at each sampling site or at the equipment decontamination pit.

5.1 EQUIPMENT DECONTAMINATION PROCEDURES

The following steps will be used to decontaminate sampling equipment.

- Personnel will dress in suitable safety equipment to reduce personal exposure.
- If any equipment remains caked with soil or other material, it will be placed in a wash tub. The caked material will be scraped off with a flat-bladed scraper. The scrapings will be disposed in drums or roll-off bins.
- All soil and ground water collection devices (rods and sampling equipment) that will not be damaged by water will be sprayed with pressurized hot water and detergent by a steam cleaner, then rinsed with clear potable water. Rinsate will be contained in a 55-gallon drum for later disposal.
- Equipment that may be damaged by water will be carefully wiped clean using a sponge and detergent water, then it will be wiped with deionized water. Care will be taken to prevent any equipment damage.
- Rinse and detergent waters will be replaced between borings.

Following decontamination, equipment will be placed in a clean area on clean plastic sheeting to prevent contact with contaminated soil. If the equipment is not used immediately, the equipment will be covered or wrapped in plastic sheeting to minimize potential airborne contamination.

5.2 *HEAVY EQUIPMENT DECONTAMINATION PROCEDURES*

The following steps will be used to decontaminate drilling and heavy equipment.

- Personnel will dress in suitable safety equipment to reduce personal exposure.
- Equipment caked with soil or other material will be scraped off with a flat-bladed scraper. The scrapings will be disposed in drums or roll-off bins.
- Equipment that will not be damaged by water, such as the soil sampling rig and shovels, will be sprayed with detergent water by a high-pressure steamer, then rinsed with clear potable water.

Following decontamination, equipment will be placed on the clean soil sampling rig and moved to a clean area. If the equipment is not used immediately, it should be stored in a designated secure, clean area.

5.3 *QA/QC SAMPLING AND DOCUMENTATION*

Field rinsate samples will be taken from the decontaminated sampling equipment to verify the effectiveness of the decontamination procedures. The rinsate procedure will include rinsing reagent-quality deionized water through or over a decontaminated sampling tool (such as liners or bailers). Samples of the rinsate water will be collected in sample bottles and sent to the laboratory for analysis. The rinsate procedure will be recorded by a qualified ERM employee.

6.0 *DOCUMENTATION*

The field documentation requirements for the ERM direct push rig supervisor will include recording all observations made during probing, sampling, or decontamination that could affect the quality of a sample. The documentation for each sample should be entered in a bound field notebook with consecutively numbered pages or on a data collection form.

Documentation should include at a minimum:

- Date of investigation/location/diagram or map;
- Date of sample collection;
- Time of day;
- Direct push rig identification number;
- Depth of sample;
- Type of sample (i.e., soil or water, QA/QC sample);
- Sampling device;
- Surrounding conditions (i.e., weather, etc.);
- Unusual conditions;
- Decontamination procedures;
- FID or PID readings;
- Generalized log with sample locations, sample numbers, and relevant observations; and
- A brief description of the area around the soil sampling, CPT, and/or HydroPunch location and the weather conditions at the time of sample collection. Each entry (or page) in the field notebook should be dated and initialed by the individual making the entry.

Detailed field data logs of each boring will be kept by the soil sampling rig supervisor.

Table 1 Sample Containers, Preservative, and Holding Times For Test Parameters

Parameter	Matrix	Container	Preservative	Lab Holding Times
Volatile Organic Compounds	Soil	Acetate, brass, or stainless steel liner with Teflon sheeting and plastic caps	Refrigerate at 4° ±2°C	Analysis performed within 14 days from sample collection date
Volatile Organic Compounds	Water	40 ml vial with Teflon faced septa cap	Acidity to pH <2 with hydrochloric acid. Refrigerate at 4° ±2°C	Analysis performed 14 days from sample collection date
Semivolatile Organic Compounds	Soil	Acetate, brass, or stainless steel liner with Teflon sheeting and plastic caps	Refrigerate at 4° ±2°C	Extract within 14 days from collection date/ analyze within 40 days from sample extraction date
Semivolatile Organic Compounds	Water	1 liter amber glass bottles with Teflon-lined cap	Refrigerate at 4° ±2°C	Extract within 7 days from collection date/analyze within 40 days from sample extraction date
Total Petroleum Hydrocarbons (Extractable)	Soil	Acetate, brass, or stainless steel liner with Teflon sheeting and plastic caps	Refrigerate at 4° ±2°C	Analysis performed within 14 days from sample collection date
Total Petroleum Hydrocarbons (Extractable)	Water	1 liter amber glass bottles with Teflon-lined cap	Refrigerate at 4° ±2°C	Extract within 7 days from collection date/ analyze within 14 days from sample extraction date

Table 1 Sample Containers, Preservative, and Holding Times For Test Parameters

Parameter	Matrix	Container	Preservative	Lab Holding Times
Total Petroleum Hydrocarbons (Purgeable)	Soil	Acetate, brass, or stainless steel liner with Teflon sheeting and plastic caps	Refrigerate at 4° ±2°C	Analysis performed within 14 days from sample collection date
Total Petroleum Hydrocarbons (Purgeable)	Water	40 ml vial with Teflon-faced septa cap	Acidity of pH <2 or below with hydrochloric acid. Refrigerate at 4° ±2°C	Analysis performed within 14 days from sample collection date
Organochlorine Pesticides	Soil	Acetate, brass, or stainless steel liner with Teflon sheeting and plastic caps	Refrigerate at 4° ±2°C	Extract within 14 days from collection date/ analyze within 40 days from sample extraction date
Organochlorine Pesticides	Water	1 liter amber glass bottles with Teflon-lined cap	Refrigerate at 4° ±2°C	Extract within 14 days from collection date/ analyze within 40 days from sample extraction date
General Minerals	Water	500 ml polyethylene vial	Varies depending on compounds	Varies depending on compounds
Methane, Ethane, and Ethene	Water	40 ml vial with Teflon-faced septa cap	Acidity of pH <2 or below with hydrochloric acid. Refrigerate at 4° ±2°C	Analysis performed within approximately 14 days from sample collection date (hold time not specified)

SOP #3: MONITORING WELL INSTALLATION USING HOLLOW-STEM AUGERS

1.0 *PURPOSE AND SCOPE*

The purpose of this document is to define the standard operating procedure (SOP) for installing monitoring wells using hollow-stem augers. The following items will be discussed in detail in the procedure section of this SOP:

- Soil sampling;
- Well material specifications;
- Well installation;
- Well development;
- Surveying well casings; and
- Cuttings and well development water disposal.

This SOP describes the needed equipment, field procedures, well material specifications, sample containers, holding times, decontamination, documentation, and field Quality Assurance/Quality Control (QA/QC) procedures necessary to collect soil samples and install monitoring wells using hollow-stem augers. This SOP does not address sampling ground water from monitoring wells already located on site. Ground water sampling procedures are discussed in a separate SOP.

The step-by-step procedures are described in sufficient detail to allow field personnel to install monitoring wells of sufficient integrity and to ensure representative soil sample collection.

This procedure serves as a supplement to the Quality Assurance Project Plan (QAPP). It serves as a reference to project workplans and applies to all monitoring well installation and soil sample collection using hollow-stem augers by ERM personnel or their subcontractors. This plan is to be strictly followed, and any modification to the procedure shall be approved by the Project Manager or Task Leader in advance. Where SOP modification is planned in advance, the modification will be included in the project workplan or supplemental project memoranda.

2.0 *RESPONSIBILITIES AND QUALIFICATIONS*

The Project Manager or Task Leader is responsible for assigning project staff to collect soil samples and install monitoring wells using hollow-stem augers. The Task Leader is also responsible for assuring that this and any other appropriate procedures are followed by all project personnel.

The project staff assigned to the collection of soil and ground water samples with hollow-stem augers are responsible for completing their tasks according to this and other appropriate procedures. All staff are responsible for reporting deviations from the procedure or nonconformance to the Task Leader, Project Manager, or Project QA/QC Officer.

Only qualified personnel shall be allowed to perform this procedure. At a minimum, ERM employees qualified to perform monitoring well installation will be required to have:

- Read this SOP;
- Indicated to the Task Leader that all procedures contained in this SOP are understood;
- Completed the OSHA 40-hour training course, and/or annual 8-hour refresher course, as appropriate; and
- Previously performed monitoring well installation in a manner generally consistent with the procedures described in this SOP.

ERM employees who do not have previous experience installing monitoring wells will be trained on site by a qualified ERM employee, and will be supervised directly by that employee until they have demonstrated an ability to perform the procedures. A qualified geologist or engineer will maintain close supervision of the project progress, results, and interpretations. The Project Manager shall document personnel qualifications related to this procedure in the project QA files.

3.0 *PROCEDURE FOR SOIL SAMPLING AND MONITORING WELL INSTALLATION USING HOLLOW-STEM AUGERS*

3.1 *EQUIPMENT LIST*

Typical equipment for sampling soil and well installation:

- Continuous Soil Sampler (2-1/2-inch x 2-foot split-spoon sample tube);
- Thin-walled sampler;
- Stainless steel or brass liners;
- Teflon film;
- Plastic caps;
- Self-adhesive labels;
- Well casing and well screen;
- Bentonite pellets or chips;
- Filter sand;
- Cement for grouting;
- Protective well casing with locking cap;
- Steel guard posts;
- Manhole assembly for subgrade completions;
- Water quality test kit (pH, SC, and temperature);
- Ice chests/coolers;
- Submersible pump or bailer with polypropylene twine for well development;
- Ice or frozen ice pack;
- Location map;
- Auger rig with appropriate equipment for sampling;
- Weighted tape measure;
- Water level probe;
- Drums or dumpsters for containment of cuttings and development water;
- Appropriate health and safety equipment;

- Flame Ionization Detector (FID) and/or Photoionization Detector (PID); and
- Field notebook and data collection forms.

Typical equipment for decontamination:

- High pressure steam cleaner (provided by drilling contractor);
- Brushes;
- Wash/rinse tubs;
- Alconox detergent (or equivalent); and
- Deionized water.

3.2 *PROCEDURE*

Wells will be installed to monitor ground water quality and record static water levels at the site. The well installation procedures outlined in this SOP are only intended for use when installing a monitoring well no larger in diameter than 4-inch-inside diameter to approximately 65 feet below ground surface. Wells installed at deeper depths may require different drilling and installation techniques.

Boring will be installed with a hollow-stem auger that will result in an annulus of greater than or equal to 2.5 inches and less then or equal to 5 inches between casing and boring side walls.

Although the number and type of soil samples to be collected may vary according to the workplan, the sequence of steps will generally follow that described in Section 3.2.1. If a soil sample is to be submitted for laboratory analysis, the procedures for sample labeling, handling and tracking, described in Section 4.0 of this SOP, will be followed.

Personal protective equipment as specified in an area specific Health and Safety Plan will be donned before proceeding with sampling or well installation activities. Organic vapor readings measured in the breathing zone with a PID and/or FID will be used to determine, based on action levels set by the specific Health and Safety Plan, if respirators are needed throughout the sampling and well installation procedures. The organic vapor readings will be recorded in the field notebook and/or on data collection forms.

3.2.1 *Soil Samples*

The borings will be drilled with hollow-stem augers and sampled at the intervals specified in the workplan. Sampling shall be done in advance of the lead auger to minimize potential cross-contamination. Samples collected for chemical analyses shall be taken with a Continuous Soil Sampler. Blow counts shall be recorded for each 6-inch interval of driving per ASTM Method D 1586. Soil samples collected for physical properties (if any) that require minimal disturbance will be obtained using a thin-walled sampler. The thin-walled sampler will be advanced using the weight of the drill rig. This procedure is described in detail in ASTM Method D 1597. Specific physical property analyses to be performed on the samples will be outlined in the project workplan.

Upon retrieval of the sampler, soil that is to be submitted for laboratory analysis shall be removed from the sampler and placed in appropriate laboratory-supplied containers.

Samples will be placed in a chilled cooler with sufficient ice or frozen ice packs to maintain a temperature of 4°C until they are delivered to the analytical laboratory. Each cooler shall contain a COC form, and each sample placed in a given cooler shall be listed on the COC form for that cooler. COC protocols are presented in Section 4.3 of this SOP.

The remainder of the sample shall be extruded and logged for lithology, soil structure, Unified Soil Classification, and other pertinent information. These portions may also be used for sieve analysis for design of filter pack and screen sizes.

If the workplan calls for the collection of soil samples for geologic/visual classification only, then a sampler without liners may be used. The sampler will be driven using a 140-pound hammer with a 30-inch drop. The logged sample will be discarded for subsequent disposal.

A boring log will be completed for each borehole using a boring log form. The field notebook and/or data collection forms will contain the following information:

- Project name and number;
- Drilling company name;
- Date drilling started and finished;
- Type of auger and size (ID & OD);
- Type of equipment for air monitoring (PID or FID);

- Air monitoring measurements;
- Drive sample blow counts;
- Well completion and graphic log;
- Driller's name;
- Geologist or engineer's name;
- Type of drill rig;
- Boring number;
- Surface elevation (if available);
- Sample depths and types;
- Sample recovery information;
- Stratigraphic description with depth;
- Unified Soil Classification (USCS) of samples;
- Water levels;
- Drilling observations; and
- Map of boring or monitoring well location.

3.2.2 *Well Materials Specifications*

3.2.2.1 *Well Casing*

Well casing will consist of threaded, flush-joint pipe with diameter and type (i.e., Schedule 40 PVC, Schedule 80 PVC, or steel) as specified in the workplan. Well casing will be provided with a vented cap of similar diameter. No solvents, cements, or adhesive tapes may be used to connect sections of well casing.

3.2.2.2 *Well Screen*

Well screen will consist of threaded, flush-joint pipe with factory machine slots or wire-wrapped design screen of a size specified in the workplan. The slot size will be small enough to retain approximately 80 to 90 percent of the filter pack material. Well screen length will be specified by the workplan. Well screens will be provided with end caps that are 0.5 feet in length. A bottom sump up to 2 feet in length may be installed in wells designed for ground water extraction to serve as a silt trap. No solvents, cements, or adhesive tapes may be used to connect sections of screen.

3.2.2.3 *Filter Pack*

The annular space between the well screen and the borehole wall will be backfilled with clean, washed, well-graded, silica sand compatible in size with the formation. The appropriate filter pack gradation will be determined for each well from what has historically been used at the site to produce non-turbid water samples, or from aquifer material sieve analysis results. The proposed filter pack gradations to be used will be specified in the well installation workplan.

3.2.2.4 *Bentonite Seal*

The bentonite seal will consist of a layer of bentonite pellets, chips, or slurry.

3.2.2.5 *Cement/Bentonite Grout*

Grout used for sealing a well will consist of Portland cement, and potable water. Approximate constituent proportions are as follows:

- 94 pounds (one bag) Portland cement; and
- 5.5 gallons of potable water.

The grout will be prepared by thoroughly mixing the Portland cement and water so that it is free of lumps.

The quantities of materials used in the preparation of the grout and the total quantity of grout used will be recorded in the field notebook and/or on data collection forms.

3.2.2.6 *Protective Steel Casing (above grade completions)*

A minimum 6-inch-inside diameter, 5-foot-long, protective steel casing with a hinged or removable lockable steel cap shall be installed over the monitoring well casing that projects above ground surface.

3.2.2.7 *Concrete Pad (for above grade completions)*

Concrete used for completion at grade will be Sakrete, Quikrete, or equivalent, and will not be placed prior to 24 hours after setting the protective steel casing in the cement grout.

3.2.2.8 *Steel Guard Posts (for above-grade completions)*

If necessary, 2-inch-diameter, 5-foot-long steel posts may be installed to provide extra well head protection.

3.2.2.9 *Manhole (for below grade completions)*

If a well is required to be completed below grade due to traffic or other considerations, a lockable cap will be used beneath a steel manhole cover. Alternatively, a locking manhole cover may be used.

3.2.3 *Well Installation*

The following procedures will be used for well installation using hollow-stem augers:

- If necessary, overdrill well depth by approximately 5 feet to compensate for heaving sands.
- Measure total depth of completed boring using a weighted tape.
- Remove temporary plug from base of lead auger or remove center bit (depending on which method is used). Removal of the temporary plug will be confirmed by tagging the borehole.
- It may be necessary to fill the augers with potable water before the center bit is removed in order to achieve the desired screen interval. The column of water inside the augers will prevent sand from heaving into the auger. A sample of the potable water will be collected for chemical analysis, and the volume of water placed into the borehole will be recorded on the boring log or field log book.
- Re-measure depth of well.
- Calculate volumes of filter pack, bentonite pellets, and grout required, based on boring and well dimensions.
- If the boring did not heave, raise the total depth to the desired well screen depth by placing a layer of filter sand or bentonite pellets or chips at the bottom of the hole. If the bottom of the borehole is more than 1 foot below the bottom of the desired well screen depth, bentonite will be added to the borehole. If bentonite is used, it will be added gradually to prevent bridging. Bentonite addition will stop when its level has reached approximately 1 foot below the desired base of the screen end cap. Approximately 1 foot of filter sand will be poured downhole on top of the bentonite, to raise the bottom of the hole to the desired level. Filter sand must be added incrementally, while withdrawing the auger. No more than 1 foot of sand will be placed below the screen.

- Lower the well casing assembly through the hollow portion of the augers until the casing reaches the bottom of the boring. The casing will then be suspended under tension just above the bottom during well installation. The casing will extend from the top of the well screen to approximately 2 feet above ground surface unless a subgrade completion is necessary.
- Record top of casing level and calculate level of screen interval.
- Withdraw the augers at a maximum of 5-foot increments while adding filter pack sand. The filter pack will extend from approximately 1 foot below the base of the well screen and extend at least 2 feet but not more than 4 feet above the top of the well screen.
- Repeated depth soundings using a weighted tape on top of the sand pack shall be taken to monitor the level of the sand and detect any bridging of sand. The top of the well casing shall also be monitored to detect any movement (up or down) due to settlement of filter or auger removal.
- Sufficient time shall be allowed for the filter sand to settle before measuring the sand level or continuing to withdraw the augers. The screen and casing should always be protected from the formation soils by the augers or the filter pack material (e.g., maintain sand level inside of augers at all times).
- The screen will be surged and the casing will be moved gently back and forth during placement of the filter pack to facilitate the settling of the filter pack sand.
- Install a 2 to 5-foot thick bentonite seal above the filter pack. If pellets or chips are used, they will be added gradually to avoid bridging. Repeated depth soundings will be taken using a weighted tape to ascertain the top of the bentonite seal. The seal will be allowed to hydrate for approximately 30 minutes before proceeding with the grouting operation.
- While raising the auger in incremental intervals (to prevent contact of casing with formation), grout the remaining annulus from the top of the bentonite seal to the ground surface (except for subgrade completions) with the cement grout specified in Section 3.2.5. The grout will be pumped through a tremie pipe if the depth in the annular space is greater than 15 feet. Grouting will cease when the annulus is completely filled. For subgrade completions, grouting will cease when the grout level has risen to within approximately 2 feet of the ground surface.
- Once the grout sets, the protective steel casing will be centered on the well casing and inserted into the annular space a few feet below grade

(if the well is completed above grade). A 2-inch deep temporary spacer shall be placed between the PVC well cap and the bottom of the protective casing cover prior to installation to keep the protective cover from settling onto the well cap.

- After the casing has set, a drainage hole may or may not be drilled in the protective steel casing approximately 2 inches above ground surface. The protective casing will be painted with a rust-preventive, conspicuously-colored paint.
- Label well cap with well number, depth, and date.
- At least 24 hours after grouting, install the concrete pad and steel guard posts, if necessary (for above-grade completions), or manhole (for subgrade completions).
- For above grade completions, install a minimum 4-inch thick, 3 feet by 3 feet concrete pad at ground surface around the protective steel casing. Slope the concrete away from the well casing to promote surface drainage away from the well.
- For above-grade completions, where traffic conditions warrant extra protection, three steel posts will be embedded to a depth approximately 1.5 feet below the top of the concrete pad. The posts will be installed in concrete-filled post holes spaced equally around the well at a distance of approximately 1.5 feet from the protective steel casing.
- For subgrade completions, set the manhole in place with concrete, raising it slightly above grade and slope the concrete away from the manhole to promote surface drainage away from the well.

Monitoring well installation information is recorded on the field well construction form.

3.2.4 *Well Development*

Well development will proceed after the cement grout has set for a minimum of 24 hours. The well will be developed using a submersible pump, airlift equipment, a bailer, and/or a vented surge block. Well development will begin by alternating bailing and swabbing to cause fines to be removed from the well and surrounding filter pack. Following this the well will be overpumped using a submersible pump. During overpumping the pump will be turned off to allow water within the pump discharge pipe to recharge back into the well. The bailing/swabbing and pumping/surging activities will be alternated until water clarity has stabilized. In addition, temperature, conductivity, and pH will be monitored during the development process until these parameters

stabilize. In cases where well development is not complete after the above steps have been taken, the use of airlifting may be employed. A minimum of 10 well volumes will be purged and at least three times the volume of any potable water added during drilling will be removed. The well development information will be recorded on a well development forms.

3.2.5 *Cuttings/Fluid Disposal*

Upon completion of drilling, sampling, and well installation activities, all cuttings will be collected and stored on site in labeled drums or bulk containers until ultimate disposal is performed. A drum log will be completed each time a drum is used. Labeled information includes the boring number, contents, and the date of filling. Any fluids from the borings (such as well development water) will be stored in drums on site pending laboratory analysis of the drummed fluids.

3.2.6 *Surveying Well Casings*

ERM field personnel will mark the permanent datum point on newly installed wells by cutting a small notch on the north side of the casing. All future static water elevations will be measured from that point. A licensed surveyor will survey the well casing elevation datum to the nearest 0.01 foot and the x and y coordinates to the nearest 0.1 foot. Ground surface elevation will be surveyed to the nearest 0.1 foot.

4.0 SAMPLES

4.1 SAMPLE CONTAINERS, IDENTIFICATION, AND LABELING

4.1.1 Sample Containers

Soil samples for laboratory analysis will be collected from the soil sampler directly into laboratory-supplied sample containers.

4.1.2 Sample Identification

Sample identification numbers will follow the labeling conventions discussed in the workplan.

4.1.3 Sample Labeling

Samples will have a plastic or waterproof paper label attached which will be filled out using waterproof ink or information may be recorded directly onto sampling container. The label will contain the following information:

- Project number;
- Task number (if appropriate);
- Site/project name;
- Sample number;
- Boring number;
- Sample depth;
- Sampler's name;
- Date and time the sample was collected;
- Sample description (soil or water);
- Preservatives; and
- Parameters for analysis.

4.2 SAMPLE PRESERVATION AND HANDLING

4.2.1 *Sample Preservation*

Samples will be stored immediately after collection in self-sealing plastic bags in a chilled cooler with ice or frozen ice pack. The appropriate preservation techniques for soil samples are shown in Table 1.

4.2.2 *Sampling Handling*

4.2.2.1 *Packing and Storage*

Samples will be packaged and stored in a manner that will prevent damage to each sample container. Sample bottles will be labeled, wrapped in protective packing material and placed right side up in a cooler for delivery to the laboratory.

4.2.2.2 *Transportation*

Samples may be hand-delivered or shipped to the laboratory on the date of sample collection, or as soon afterwards as possible.

4.2.2.3 *Holding Times*

The holding times for the analytical parameters listed in Table 1 are the total time from sample collection to extraction or analysis. The analyses required for each soil sample will be specified in the workplan.

4.3 SAMPLE TRACKING

A COC form will be filled out in the field, and will accompany every shipment of samples to the analytical laboratory. The purpose of the COC form is to document possession of a sample from the time of collection in the field to its final disposal by the laboratory.

Information to be provided on the COC form includes:

- Project name and number;
- Sampler signatures;
- Sample number;
- Sample collection date and time;
- Analysis parameters;

- Number of containers;
- Preservatives; and
- Comments.

The laboratory will record the following information:

- Name of persons receiving the sample;
- Date of sample receipt; and
- Sample condition.

All corrections to the COC record will be initialed and dated by the person making the corrections.

Each COC form will include signatures of the appropriate individuals indicated on the form. The originals will follow the samples to the laboratory, and copies documenting each custody change will be retained and kept on file by ERM. All COC will be maintained until final disposition of the samples.

4.4 *QUALITY ASSURANCE/QUALITY CONTROL SAMPLES*

4.4.1 *Trip Blanks*

A trip blank is a Volatile Organic Analysis (VOA) bottle set containing deionized water which is prepared by the laboratory. Trip blanks (aqueous) will accompany each shipment of water sample containers from the laboratory. The trip blanks will be kept with the same shipment of sample containers at all times and will be returned, unopened, to the laboratory with that shipment. Trip blanks will be used to detect any contamination or cross-contamination during handling and transportation. One trip blank set is sent per cooler of samples per day.

4.4.2 *Rinsate Samples*

Rinsate samples are defined as samples which are obtained by running deionized water through sample collection equipment (i.e, Continuous Soil Sample, auger, spatula) after decontamination. These rinsate samples will be collected in the appropriate sample containers and sent to the laboratory for analysis. They will be used to determine if decontamination procedures have been effective. Rinsate samples will be collected and included per 20 samples sent to the laboratory.

4.4.3 *Matrix Spike/Matrix Spike Duplicate for Soil Samples*

Matrix spikes and matrix spike duplicates are prepared in the laboratory to assess precision and accuracy of an analytical method on various matrixes. A matrix spike and matrix duplicate are generated by preparing three separate samples for analysis from the same soil sample, and then spiking the second and third samples with selected target compounds. For metals determined by ICP analysis, for example, the spike contains all the analyte metals at levels approximately five times the reporting limit. Following the addition of the spike to the matrix spike and matrix spike duplicate, these two QC samples are carried through all laboratory procedures and analyzed as are the routine soil samples taken for the investigation. One matrix spike/matrix spike duplicate will be prepared per 20 samples.

The collection and handling of all QA/QC samples will be documented in the field notebook and/or on data collection forms.

5.0 EQUIPMENT DECONTAMINATION

Specific equipment decontamination procedures are described in the following paragraphs. Equipment decontamination will include:

- Decontamination of sampling equipment (continuous soil sampler, liners, bailers) will be conducted between individual sampling points to minimize potential cross-contamination. Sampling equipment will be decontaminated between each sample collected.
- Drilling equipment decontamination (augers, drill stems, drill bits, and other downhole equipment) will be conducted after each well is complete. The drill rig will be decontaminated between each well location.
- Heavy equipment decontamination (i.e., drill rig), depending on the extent of the contamination and the cleaning requirements, will be conducted at each sampling site or at the equipment decontamination pit.
- Well material decontamination (well casing, well screens, and end caps) will be conducted using a steam cleaner before the materials are installed in the borehole. If factory-cleaned hermetically sealed materials are used, no decontamination will be necessary.

5.1 SAMPLING EQUIPMENT DECONTAMINATION PROCEDURES

The following steps will be used to decontaminate sampling equipment:

- Personnel will dress in suitable safety equipment to reduce personal exposure.
- Equipment caked with soil or other material will be placed in a wash tub, and the caked material will be scraped off with a flat-bladed scraper. The scrapings will be disposed in drums or roll-off bins.
- Equipment that will not be damaged by water will be placed in a wash tub containing Alconox or an equivalent low-sudsing detergent along with potable water and will be scrubbed with a brush or clean cloth. Equipment will then be rinsed thoroughly with potable water, followed by a rinse with deionized water.
- Equipment that may be damaged by water will be carefully wiped clean using a sponge and detergent water and wiped with deionized water. Care will be taken to prevent any equipment damage.
- Rinse and detergent waters will be replaced between borings.

- Following decontamination, equipment will be placed in a clean area on clean plastic sheeting to prevent contact with contaminated soil. If the equipment is not used immediately, the equipment will be covered or wrapped in plastic sheeting to minimize potential airborne contamination.

5.2 *DRILLING AND HEAVY EQUIPMENT DECONTAMINATION PROCEDURES*

Augers should be scraped off as they are withdrawn from a boring. The cuttings should be placed in a drum or bulk container for disposal. The following steps will be used to decontaminate drilling and heavy equipment.

- Personnel will dress in suitable safety equipment to reduce personal exposure.
- Equipment caked with drill cuttings or other material will be scraped off with a flat-bladed scraper. The scrapings will be disposed in drums or roll-off bins. Drill cuttings will not be washed down the drain into the sewer system.
- Equipment that will not be damaged by water, such as drill rigs, augers, drill bits and shovels, will be sprayed with detergent water by a high-pressure steamer, then rinsed with clear potable water. Care will be taken to adequately clean the insides of the hollow-stem augers.
- Following decontamination, drilling equipment will be placed on the clean drill rig and/or support truck and moved to a clean area. If the equipment is not used immediately, it should be stored in a designated secure, clean area.
- Drilling equipment will be decontaminated between each boring at the designated decontamination area.

5.3 *QA/QC SAMPLING AND DOCUMENTATION*

Field rinsate samples will be taken from the decontaminated sampling equipment to verify the effectiveness of the decontamination procedures. The rinsate procedure will include rinsing deionized water through or over a decontaminated sampling tool (such as liners or Teflon bailer). Samples of the rinsate water will be collected in sample bottles and sent to the laboratory for analysis. The rinsate procedure will be recorded by qualified ERM personnel.

6.0 *DOCUMENTATION*

The field documentation requirements for the ERM drill rig supervisor will include recording all observations made during drilling, sampling, or decontamination that could affect the quality of a sample. The documentation for each sample should be entered in a bound field notebook with consecutively numbered pages and/or on data collection forms.

Documentation should include:

- Project number;
- Project personnel;
- Subcontractor (including names and telephone numbers);
- Date of drilling/location/diagram or map;
- Date of sample collection;
- Time of day;
- Borehole ID number;
- Depth of sample;
- Type of sample (i.e., soil or water, QA/QC sample);
- Sampling method (i.e., Continuous sampler);
- Boring method (i.e., 12-inch hollow-stem auger);
- Surrounding conditions (i.e., weather);
- Unusual conditions;
- Decontamination procedures;
- FID or PID readings;
- Generalized boring log with sample locations, sample numbers, and general lithology; and
- A brief description of the area around the pilot boring/monitoring well location and the weather conditions at the time of sample collection. Each page in the field notebook and each data collection form should be dated and initialed by the individual making the entry.

Detailed field borehole logs of each boring will be kept by the ERM drill rig supervisor. Well construction information will be recorded in the field notebook and/or on the well construction form.

Table 1 Sample Containers, Preservative, and Holding Times For Test Parameters

Parameter	Matrix	Container	Preservative	Lab Holding Times
Volatile Organic Compounds	Soil	Acetate, brass, or stainless steel liner with Teflon sheeting and plastic caps	Refrigerate at 4° ±2°C	Analysis performed within 14 days from sample collection date
Volatile Organic Compounds	Water	40 ml vial with Teflon faced septa cap	Acidity to pH <2 with hydrochloric acid. Refrigerate at 4° ±2°C	Analysis performed 14 days from sample collection date
Semivolatile Organic Compounds	Soil	Acetate, brass, or stainless steel liner with Teflon sheeting and plastic caps	Refrigerate at 4° ±2°C	Extract within 14 days from collection date/ analyze within 40 days from sample extraction date
Semivolatile Organic Compounds	Water	1 liter amber glass bottles with Teflon-lined cap	Refrigerate at 4° ±2°C	Extract within 7 days from collection date/analyze within 40 days from sample extraction date
Total Petroleum Hydrocarbons (Extractable)	Soil	Acetate, brass, or stainless steel liner with Teflon sheeting and plastic caps	Refrigerate at 4° ±2°C	Analysis performed within 14 days from sample collection date
Total Petroleum Hydrocarbons (Extractable)	Water	1 liter amber glass bottles with Teflon-lined cap	Refrigerate at 4° ±2°C	Extract within 7 days from collection date/ analyze within 14 days from sample extraction date

Table 1 Sample Containers, Preservative, and Holding Times For Test Parameters

Parameter	Matrix	Container	Preservative	Lab Holding Times
Total Petroleum Hydrocarbons (Purgeable)	Soil	Acetate, brass, or stainless steel liner with Teflon sheeting and plastic caps	Refrigerate at 4° ±2°C	Analysis performed within 14 days from sample collection date
Total Petroleum Hydrocarbons (Purgeable)	Water	40 ml vial with Teflon-faced septa cap	Acidity of pH <2 or below with hydrochloric acid. Refrigerate at 4° ±2°C	Analysis performed within 14 days from sample collection date
Organochlorine Pesticides	Soil	Acetate, brass, or stainless steel liner with Teflon sheeting and plastic caps	Refrigerate at 4° ±2°C	Extract within 14 days from collection date/ analyze within 40 days from sample extraction date
Organochlorine Pesticides	Water	1 liter amber glass bottles with Teflon-lined cap	Refrigerate at 4° ±2°C	Extract within 14 days from collection date/ analyze within 40 days from sample extraction date
General Minerals	Water	500 ml polyethylene vial	Varies depending on compounds	Varies depending on compounds
Methane, Ethane, and Ethene	Water	40 ml vial with Teflon-faced septa cap	Acidity of pH <2 or below with hydrochloric acid. Refrigerate at 4° ±2°C	Analysis performed within approximately 14 days from sample collection date (hold time not specified)

SOP #4: WELL DEVELOPMENT AND SAMPLING TECHNIQUES

1.0 *PURPOSE AND SCOPE*

The purpose of this document is to define the standard operating procedure (SOP) for the development and sampling of monitoring wells at the Greif Bros. Facility site at 2122 Colvin Boulevard in Tonowanda, New York (site). The ultimate goal of the sampling program is to obtain samples that meet acceptable standards of accuracy, precision, comparability, representativeness, and completeness. All steps that could affect tracking, documentation, or integrity of samples are explained in sufficient detail to allow all sampling personnel to collect samples that are reliable and consistent.

This SOP describes equipment, field procedures, sample containers, decontamination, documentation, storage, holding times, and field quality assurance/quality control (QA/QC) procedures necessary to develop existing ground water monitoring wells and to collect water samples from the site wells.

This SOP serves as a reference to the Workplan and applies to all ground water sampling of monitoring wells by ERM personnel or their subcontractors. This plan is to be strictly followed, and any modification to the procedure shall be approved by the Project Manager (PM) in advance.

2.0 *RESPONSIBILITIES AND QUALIFICATIONS*

The PM is responsible for assigning project staff to conduct water sampling activities at the site. The PM also ensures that this and any other appropriate SOPs are followed by all project personnel.

The project staff assigned to the water sampling task is responsible for completing all tasks according to this and other appropriate procedures. All staff is responsible for reporting deviations from the procedure or nonconformance to the PM or Project QA/QC Officer.

Only qualified personnel shall be allowed to perform water sampling. At a minimum, ERM employees qualified to perform water sampling are required to:

- Read this SOP;
- Indicate to the PM that they understand all procedures contained in this SOP;
- Have completed the OSHA 40-hour training course and/or 8-hour refresher course, as appropriate; and
- Have water sampling experience generally consistent with the procedures described in this SOP.

ERM employees who do not have previous experience sampling ground water will be trained on site by a qualified employee and will be supervised directly by that employee until they have demonstrated an ability to perform the procedures. The PM shall document personnel qualifications related to this procedure in the project QA files.

3.0 WATER SAMPLING PROCEDURE

3.1 EQUIPMENT LIST

Sample bottles may be obtained from the analytical laboratory for collecting and testing for volatile and semivolatile organic compounds (VOCs and SVOCs) and metals. Extra sample containers will be obtained in case of breakage or other problems. Trip blanks will also be obtained from the analytical laboratory.

Typical equipment list for well evacuation and sampling:

- Personal protective equipment, including nitrile or powderless surgical gloves and safety glasses;
- Photoionization detector (PID) or flame ionization detector (FID);
- Water level probe;
- Disposable polyethylene bailers (2 or 4-inch diameter);
- Teflon-coated bailing wire rope or disposable polyethylene cord;
- Pumps;
- Electric generator;
- pH meter;
- Specific conductivity meter;
- Thermometer;
- Ground Water Sample Collection Data Forms;
- Data recording sheets;
- Field notebook;
- Chain-of-Custody (COC) forms;
- Labels;
- Appropriate sample containers;
- Self-sealing plastic bags;
- Cooler;
- Ice or frozen ice packs;
- Spray bottle for deionized water;
- Deionized water;

- Peristaltic filtration pump;
- Disposable, in-line, 0.45-micron pore size, high-capacity filter;
- A length of disposable polyethylene and/or surgical tubing; and
- 55-gallon drums or other type of portable storage container.

Equipment used during decontamination:

- Alconox detergent (or equivalent);
- Deionized water;
- Containers, brushes, paper towels, plastic sheeting; and
- Personal protective equipment, including nitrile or powderless surgical gloves and safety glasses.

3.2 *SAMPLING PROCEDURE*

This section describes the sequence of events to be followed for well development, purging, and sample collection in the field.

3.2.1 *Equipment Decontamination*

Before any development, purging, or sampling begins at a well, all non-disposable bailers, well probes, pumps, and pump hoses shall be decontaminated. Details of decontamination procedures are given in Section 7.

3.2.2 *Well Development*

All wells will be developed prior to sampling using a submersible pump or a disposable bailer. Well development will occur by alternating bailing and surging to cause fines to be removed from the well and surrounding filter pack. The bailing and surging activities will be alternated until water clarity has stabilized. In addition, temperature, conductivity, and pH will be monitored during the development process until these parameters stabilize. A minimum of 10 well volumes will be removed. The well development information will be recorded on a well development form.

3.2.3 *Well Purging*

All wells will be purged prior to sampling. The purpose of well purging is to remove stagnant water from the well and obtain fresh water from the geologic material screened by the well. Typically, three to five casing

volumes of water are removed prior to sampling. A record will be maintained during the procedure that will contain at a minimum:

- FID and/or PID measurements in the head space;
- Decontamination procedures;
- Initial depth to water;
- Volume of water removed;
- Purging method;
- Physical parameters of the purged water; and
- Disposal method of purged water.

The data shall be recorded on a Ground Water Sample Collection Data Form for each well that is evacuated and sampled.

Health and safety equipment will be described in the Health and Safety Plan , and will be donned as appropriate before proceeding with purging and sampling. Organic vapor readings will be measured when well caps are initially removed. Details of procedures for action levels based on the readings are specified in the Health and Safety Plan.

Static water levels shall be measured for each well immediately before evacuating the well for sampling. Water levels will be measured following the procedures described in a separate SOP. As specified in the SOP for manual measurements of water levels, the procedure shall be accomplished with a decontaminated electronic measuring probe. Water levels will be measured from the elevation reference point marked on the PVC inner casing. The measuring process will be repeated until consecutive water level measurements agree to within 0.01 foot. If floating product is historically known to occur in a well or if there is reason to believe there will be floating product in a new well, an interface probe will be used to measure the depth to water and the thickness of the floating material.

The purging method for each well will be determined by the historic yield of the well. Typically, wells that historically have or are expected to have a low yield will be evacuated by bailing, and wells with higher yields may be evacuated using submersible pumps.

Evacuated well water will be placed into a 55-gallon drum or portable tank and stored on site in a secured area until disposal. A drum log shall be completed each time a drum is used. Necessary precautions shall be taken to prevent spilling of drummed water, and drums or portable tanks

shall not be left overnight at well locations outside a fenced area at the site.

The following sampling procedures are to be followed:

- Note well condition and any unusual conditions of the area immediately surrounding the well;
- In unpaved areas, place a clean plastic sheet around the well to prevent surface soils from coming in contact with purging and sampling equipment if no dedicated pump system is present in well;
- Remove well cover and unlock cap;
- If necessary, evacuate any standing water within well box prior to removing inner well caps;
- When inner well caps are removed, perform head space analysis using a PID or FID;
- Measure and record depth to static water level from measuring point on PVC inner well casing. Repeat the measurement process until values agree within 0.01 foot. Indicate time of measurement;
- Record total depth of well (measured during water level measurement process) and use this depth to calculate volume of water in well (casing volume) in feet (of water) and gallons;
- Calculate three casing volumes (3 times the casing volume) to be evacuated;
- Evacuate three or more casing volumes of water by pump or bailer; collect and dispose of water as specified above. For high turbidity wells, evacuate at least five casing volumes. If a bailer is used, care will be taken during lowering and removal to prevent surging;
- For wells without dedicated equipment, when using a pump for evacuating, the pump intake will be initially placed as close to the water table as possible. As the water level drops in the well, the pump will be gently lowered and the discharge will be throttled to a maximum rate of 5 gpm;
- Measure specific conductance, temperature, and pH after evacuation of each well volume. The pH readings may change slightly over time due to exchange of CO_2 with the atmosphere. Field equipment used to obtain these measurements shall be rinsed with deionized water after each measurement; and
- All wells will be purged until either a minimum of three casing volumes have been removed or the well casing has been bailed dry. For wells not bailed dry, purging will continue until pH, specific conductivity, and temperature measurements have stabilized (e.g.,

measured values are within 0.1 pH unit, 10% specific conductivity, and 1°C between consecutive well casing volumes). Record all pH, specific conductivity, and temperature readings and time of measurements on the Ground Water Sample Collection Data Form. If a well is evacuated to dryness, purging will be deemed complete.

3.2.4 *Water Sample Collection*

After well evacuation, ground water samples shall be collected as soon as the water level has recovered to within 90 percent of the static level. Typically, water quality samples will be collected from within the well screen interval in shallower wells or at least 10 feet below the water surface in deep wells.

Sampling shall be accomplished with a disposable polyethylene bailer. Bailers will be lowered into the well using either a Teflon-coated wire rope or disposable (one-time use) polypropylene cord. Clean nitrile or powderless surgical gloves shall be worn by sampling personnel and changed often during all sampling procedures.

The following sampling procedure is to be followed at each well:

- Assemble decontaminated sampling equipment;
- Label sample containers (see section 6.2.1 for instruction and example);
- Measure water level with well probe to assure that well has recovered to at least 90 percent of pre-purge level before sampling;
- Don clean nitrile or powderless surgical gloves immediately before obtaining sample;
- Obtain sample from well, directly from the disposable polyethylene bailer. Care will be taken when using the bailer to minimize degassing or contamination of the sample; therefore, the bailer will be submerged and withdrawn slowly to avoid splashing. The bailer will not be placed on the ground;
- Transfer sample water directly into sample bottles, maintaining a slow linear flow with as little aeration as possible. Samples will be preserved according to Table 1;
- After each sample is collected, place the bottles in self-sealing plastic bags and immediately place the bags in a chilled cooler with ice or frozen ice packs;
- Each volatile organic analysis (VOA) sample vial will be completely filled so the water forms a convex meniscus at the top to ensure that no air space exists in the vial after the vial has been capped. After

filling, the vial will be immediately capped, turned over, and tapped to check for trapped air. If air bubbles are observed, the vial will be opened and filled again with sample water. If bubbles are still present, the vial will be discarded;

- Fill non-VOA sample containers to the base of the bottle neck;
- Record sample number, time of sampling, location, and sampler name on the Ground Water Sample Collection Data Form;
- Replace well cap, close well cover, and lock well;
- Complete a COC form for transportation of samples to laboratory; and
- Hand deliver or ship samples to the laboratory on the same day they are collected, or as soon afterwards as possible.

3.2.5 *Sample Filtration*

The following filtering procedure may be used on samples collected for metals analyses. Clean nitrile or powderless surgical gloves will be worn during this procedure:

- Connect disposable in-line filter (0.45-micron pore size) to pump tubing, using filter adapter, if necessary;
- Fill sample bottle containing necessary preservatives;
- Store filtered samples in a chilled cooler with ice or frozen ice packs;
- Discard filter; and
- Decontaminate filter adapter.

The following procedure will be followed for samples requiring field filtration. Clean nitrile or powderless surgical gloves will be worn during this procedure:

- Transfer the water from the bailer to a precleaned, non-acidified plastic container;
- Attach a new length of polyethylene and/or surgical tubing to the peristaltic pump;
- Attach a disposable 0.45-micron pore size filter to the peristaltic pump tubing;
- Transfer the water to the new sample bottle (containing the necessary preservatives);
- Store filtered samples in chilled cooler with ice or frozen ice packs; and

- Remove and dispose of the used filter and peristaltic pump tubing.

3.2.6 *Field QA/QC Procedures and Samples*

The well sampling order will be dependent on expected chemical concentrations in each well, and will be determined prior to sampling. The objective is to sample those wells with lower chemical concentrations first, followed by wells with increasing chemical concentrations based on historical trends.

Field duplicate bottles shall be filled at the well from the same bailer of water as the original well sample, if collected from a bailer. If a sample is collected using a pump, the duplicate will be filled immediately after filling the first bottle. These duplicate samples are given QC numbers and sent along with the actual samples for analysis. One duplicate is sent per 20 samples, or per batch if the batch contains fewer than 20 samples.

Trip blanks (VOA vials with deionized water) are received from the laboratory and taken to the well site but never opened. One trip blank set is sent per cooler containing water samples per day. Trip blanks are labeled as such by the laboratory, with identification of the cooler they were in, company name, and date.

Matrix spikes and matrix spike duplicates are taken from a single bailer of water when possible, or a consecutive sample is collected if a pump is used. These are labeled with the well number and may be identified as matrix spikes to the laboratory. Spiking of the samples is done by the laboratory.

Rinsate equipment blank samples are collected in the field by filling a decontaminated bailer with deionized water and then filling the sample vials from the bailer (and/or other equipment used for transferring water samples). The rinsate field blank samples are labeled with a QC number and submitted to the laboratory for analysis. One rinsate field blank will be collected and analyzed per 20 samples for every sampling period in which bailers (and/or other equipment used to transfer water samples) are used during sample collection. Rinsate blanks are not collected if disposable bailers are used.

4.0 SAMPLING INSTRUCTIONS

4.1 CONTAINERS, PRESERVATION AND HOLDING TIMES

Certified clean sample containers and trip blanks will be obtained from the contract analytical laboratory. The bottles will be labeled to indicate the type of analysis to be performed, and necessary preservatives will be present in the bottles when received from the laboratory.

Table 1 summarizes the sampling containers, preservation, and holding times for the various types of analyses.

4.2 SAMPLE TRACKING

Documents for tracking the samples are generated in the field. This documentation includes field notes, sample labeling, and COC forms.

4.2.1 *Sample Labeling*

Each sample will be labeled prior to collection. The sample label will be filled out with waterproof ink. Each sample label contains the following information:

- Project number;
- Company name;
- Site/project name;
- Sample number (well location);
- Parameters for analysis;
- Date and time of collection;
- Preservative; and
- Sampler's signature (or initials).

Information pertinent to field survey measurements (water level, pH, specific conductivity, and temperature) and sampling will be recorded on the Ground Water Sample Collection Data Forms and/or in the field notebook. The ERM field staff is responsible for the data sheets and notebook.

4.2.2 *Chain-of-Custody Forms*

A COC form will be filled out in the field and will accompany every shipment of samples to the analytical laboratory. The purpose of the COC form is to document possession of a sample from the time of collection in the field to its final disposal by the laboratory.

The laboratory will enter the following information on the form:

- Name of persons receiving the sample;
- Date of sample receipt; and
- Sample condition.

All corrections to the COC record will be initialed and dated by the person making the corrections.

Each COC form will include signatures of the appropriate individuals indicated on the form. The originals will follow the samples to the laboratory and copies documenting each custody change will be received and kept on file by ERM. All COC forms will be maintained on file by the ERM until final disposition of the samples.

4.3 *SAMPLES FOR ASSESSING QA/QC*

To identify potential errors, four types of QC samples may be included for analysis. All QC samples are labeled and sent to the laboratory along with the actual samples for analysis. QC sample frequencies are summarized in Table 2. The four types of QC samples are as follows:

4.3.1 *Trip Blanks*

Trip blanks check for contamination due to handling, transport, contact with other samples during storage, or laboratory error. A VOA bottle set is filled with deionized water by the laboratory. This set is taken to the field, labeled with company name, date, and cooler ID, and stored with the other samples until they are delivered for analysis to the laboratory. Trip blanks are opened by laboratory personnel only. One trip blank set is sent per cooler of samples for volatiles analysis per day.

4.3.2 *Field Duplicates*

Sometimes referred to as a split or replicate, a field duplicate is a check on field and laboratory precision. Two samples from a single bailer or consecutive samples collected by means of a bladder pump are filled at

the same sampling location. One is labeled as the actual well sample and the other is labeled as a duplicate sample. Preservation and shipping of samples and their duplicates is identical. One duplicate will be submitted per 20 samples, or one per sampling event if fewer than 20 samples are collected.

4.3.3 *Rinsate Samples*

Bailer or sampling equipment rinsate blanks verify that chemicals are not being carried from one sample to the next via the Teflon sampling bailer or other equipment used in the transfer of water samples. Rinsate field blanks will be taken after sampling the wells known to historically contain the highest chemical concentrations for the group of wells sampled. The sampling bailer and/or other equipment are first decontaminated with deionized water. Deionized water is then poured from the bailer (and/or other equipment) into sample bottles labeled with a QC number. One rinsate sample will be submitted per 20 samples collected with a bailer.

Rinsate samples will not be collected for wells to which specific or disposable sampling equipment (bailer or pump) has been dedicated, as no likelihood of transferring chemicals to other samples exists.

4.3.4 *Matrix Spikes*

Matrix spikes are used to assess precision and accuracy of the analytical method on various matrices. For this procedure, duplicate samples are collected at a well and spiking is done by the laboratory. Samples are labeled as matrix spikes for the laboratory. One matrix spike and one matrix spike duplicate may be submitted per 20 samples.

5.0 *EQUIPMENT DECONTAMINATION*

Decontamination will be performed on all nondedicated sampling equipment that may contact potentially contaminated water, including water level probes, Teflon bailers, and pump hoses. Clean nitrile gloves or powderless surgical gloves are to be worn during decontamination.

An equipment decontamination station will be centrally located on site. Each piece of evacuation and/or sampling equipment will be decontaminated before each sampling period and between each well. Plastic sheeting will be laid down around each well during evacuation/sampling to protect decontaminated equipment from contact with the ground. The decontamination procedure for most equipment will be as follows:

- Disassemble equipment (i.e., sampling pump);
- Wash equipment in an Alconox (or equivalent) and water solution using a brush or clean cloth to ensure removal of all contaminants;
- Rinse equipment in fresh tap water;
- Rinse again with deionized water; and
- Dry equipment with paper towel and place in clean plastic, if appropriate.

The effectiveness of these decontamination procedures will be verified by vigorous QA/QC protocols, including blanks, duplicates, and spikes.

6.0 *INSTRUMENT CALIBRATION*

Mechanical equipment used during sampling includes: pH meter, specific conductivity meter, PID, FID, pump, and an electric generator. Before going into the field, the sampler will verify that all of these are operating properly. In addition, the pH, PID, FID, and specific conductivity meters require daily calibration. If these field instruments require periodic recalibration by the manufacturer, they will be returned accordingly and a record will be kept of the procedure. Calibration times and appropriate readings will be recorded in the field notebook and/or on data collection forms. Specific instructions for calibrating the instruments are provided in the appendix to the SOP.

7.0 DOCUMENTATION

Thorough documentation in the field is required to ensure proper labeling and tracking of samples, identify potential sources of error, and maintain accountability among field personnel.

7.1 FIELD NOTES AND DATA COLLECTION FORMS

Field notes shall be kept in a bound notebook. The following information will be included in the field notes and/or on data collection forms:

General Information

- Names of personnel;
- Weather;
- Date and time of sampling;
- Location and well number;
- Condition of the well;
- Times that procedures and measurements are completed;
- Calibration of meters at start of day;
- Decontamination times;
- PID or FID readings (if taken);
- Initial static water level and total well depth; and
- Calculations (e.g., calculation of evacuated volume).

Sampling Information

- Volume of water evacuated before sampling;
- Conductivity, pH, and temperature during evacuation (note times and number of well volumes);
- General description of sample procedures, or reference the SOP;
- Time of sample collection;
- Number of samples collected;
- Order in which sample bottles were filled;
- Sample identification numbers;
- Preservation and storage of samples;

- Filtration performed, if any;
- Record of any QC samples from site;
- Any irregularities or problems that may have a bearing on sampling quality; and
- Type of sampling equipment.

7.2 *WELL VOLUME CALCULATIONS*

Prior to sampling, wells will be bailed or pumped so that either: (l) three well volumes are removed, or (2) the well is bailed or pumped to dryness. The actual volumes removed shall be written on the Ground Water Sample Collection Data Form or in the field notebook. The following equations will be used to calculate the evacuation volume for a given well:

For 2-inch well:

Evacuation Volume [gal] = Total Depth [ft] - Water Level Depth [ft] x 0.163 gal/ft x 3 = gallons/ 3 casing volumes

For 4-inch well:

Evacuation Volume [gal] = Total Depth [ft] - Water Level Depth [ft] x 0.651 gal/ft x 3 = gallons/ 3 casing volumes

7.3 *DATABASE REDUCTION, VALIDATIONS, REPORTING, AND FILING*

As previously mentioned, field parameters (i.e., pH, specific conductivity, and temperature) will be recorded on the Ground Water Sample Collection Form for each well. These field data sheets will be collected at the ERM, where they shall be checked and filed.

Table 1 Sample Containers, Preservatives, and Holding Times for Test Parameters

Parameter	Container	Preservative	Lab Holding Times
Volatile Organic Compounds	40 ml vial with Teflon faced septa cap	Acidity to pH of <2 with hydrochloric acid. Refrigerate at 4° ±2°C	Analysis performed within 14 days from sample collection date
Semivolatile Organic Compounds	1 liter amber glass bottles with Teflon-lined cap	Refrigerate at 4° ±2°C	Extract within 7 days from collection date/analyze within 40 days from sample extraction date
Total Petroleum Hydrocarbons (Extractable)	1 liter amber glass bottles with Teflon-lined cap	Refrigerate at 4° ±2°C	Extract within 7 days from collection date/ analyze within 14 days from sample extraction date
Total Petroleum Hydrocarbons (Purgeable)	40 ml vial with Teflon faced septa cap	Acidity to pH of <2 with hydrochloric acid. Refrigerate at 4° ±2°C	Analysis performed within 14 days from sample collection date
Organochlorine Pesticides	1 liter amber glass bottles with Teflon-lined cap	Refrigerate at 4° ±2°C	Extract within 7 days from collection date/analyze within 40 days from sample extraction date
General Minerals	500 mL polyethylene vial	Varies depending on compound	Varies depending on compound
Methane, ethane, and ethene	40 ml vial with Teflon faced septa cap	Acidity to pH of <2 with hydrochloric acid. Refrigerate at 4° ±2°C	Analysis performed within 14 days from sample collection date (hold time not specified)

Table 2 QA/QC Sample Frequencies

Sample Type	Laboratory Identification	Frequency
Trip Blanks	Study area followed with a "T," Date, and an "A" for first trip blank.	One per cooler containing water samples.
Field Duplicates	Well ID and followed with a "D"	One per 10 samples, or one per batch if the batch has fewer than 10 samples
Matrix spikes (MS) and matrix spike duplicates (MSD)	MS/MSD	One matrix spike and one matrix spike duplicate are sent every 20 samples.
Rinsate Samples	Last Well Sampled followed with "Rinsate."	One set per 20 samples obtained with nondedicated bailer (collected after sampling wells with historically high chemical concentrations).

APPENDIX

INSTRUMENT CALIBRATIONS

pH Meter:

The pH meter must be calibrated once a day, prior to taking any sample readings. Calibration and operation of the pH meter should follow the manufacturer's specific instruction. In general, calibration is done by adjusting the meter with standard buffers that bracket the expected pH of the field water. Calibration should follow the general procedures outlined below:

1. Adjust the reading with the electrode in the pH 7 buffer using the intercept knob.
2. Adjust the reading with electrode in another buffer (typically pH=10 or pH=4) with the slope (or temperature) knob.
3. Repeat steps 1 and 2 until the meter gives acceptable readings (+0.1 pH) for all the buffers used to calibrate the pH meter.

Note: Always use the same electrode for measurements that were used for calibration, and recalibrate the instrument if the electrode is replaced. Also it is not unusual for the temperature setting on the pH meter not to match the sample temperature. The pH readings will still be accurate provided the response to the buffers is correct.

Record the time and temperature in the notebook every time the pH meter is calibrated.

Conductivity Meter:

The conductivity meter must be calibrated each day prior to taking field measurements. Time, temperature, and instrument response will be recorded in the notebook. Calibration is done by noting the response of the meter to several standard conductivity solutions that bracket the values to be measured in the field. Standards of 100, 1000, and 10,000 μmhos are usually adequate. If the instrument has a calibration adjustment, then set the response to match the standards. Otherwise, simply record the instrument response to each standard in the notebook.

FID:

The FID meter must be calibrated each day it is to be used prior to taking field measurements. The manual describing calibration and operation of the meter should be available to personnel while they are in the field. Record each calibration in the notebook including time, gain setting, and gas standards used. Typical instruments that may be used: Century OVA 128 manufactured by Foxboro and/or Sensidyne model.

PID:

The PID meter must be calibrated each day before the meter is used in the field. Calibration and operation instructions should be done in accordance with the manufacturer's instructions. The manual for the PID should be available to field personnel any time the meter is being used. Record every calibration in the notebook, include time, and any gas standards used. Typical instruments that may be used: HNu model PI 101 manufactured by HNu Systems, Inc., and/or Thermo Environmental Instruments, model 580 organic vapor meter.

SOP #5: WATER LEVEL MEASUREMENTS

1.0 *PURPOSE AND SCOPE*

The purpose of this document is to define the standard operating procedure (SOP) for manual measurement of water levels in monitoring wells at the Greif Bros. Facility site at 2122 Colvin Boulevard in Tonowanda, New York (site). The ultimate goal of the sampling program is to obtain measurements that meet acceptable standards of accuracy, precision, comparability, representativeness, and completeness. All steps that could affect tracking, documentation, or integrity of measurements have been explained in sufficient detail to allow field personnel to obtain water level measurements that are precise.

This SOP describes equipment, field procedures, documentation, decontamination, and field Quality Assurance/Quality Control (QA/QC) procedures necessary to measure water levels in ground water monitoring wells at the site.

This SOP serves as a reference to the Workplan and applies to all water level measurements of monitoring wells by ERM personnel or their subcontractors. This plan is to be strictly followed, and any modification to the procedure shall be approved by the Project Manager (PM) in advance.

2.0 *RESPONSIBILITIES AND QUALIFICATIONS*

The PM is responsible for assigning project staff to complete water level measurements at the site. The PM also ensures that this and any other appropriate procedures are followed by all project personnel.

The project staff assigned to the water level measurement task are responsible for completing their tasks according to this and other appropriate procedures. All staff are responsible for reporting deviations from the procedure or nonconformance to the PM or Project QA/QC Officer.

Only qualified personnel shall be allowed to perform water level measurements. At a minimum, ERM employees qualified to measure water levels are required to:

- Read this SOP;
- Indicate to the PM that they understand all procedures contained in this SOP;
- Have completed the OSHA 40-hour training course and/or 8-hour refresher course, as appropriate; and
- Have experience in measuring water levels that is generally consistent with the procedures described in this SOP.

ERM employees who do not have previous experience measuring water levels will be trained on site by a qualified employee and will be supervised directly by that employee until they have demonstrated an ability to perform the procedures. The PM shall document personnel qualifications related to water level measurements in the project QA files.

3.0 WATER LEVEL MEASUREMENT PROCEDURE

3.1 EQUIPMENT LIST

Typical equipment used to measure water levels includes the following:

- Electronic static water level indicator capable of producing measurements to a precision of 0.01 foot;
- Oil/water interface meter with 0.01-foot increments;
- Personal protective equipment including nitrile or powderless surgical gloves;
- Field data sheets;
- Field notebook; and
- Equipment to measure organic vapors (i.e., flame ionization detector [FID] or photoionization detector [PID]).

Equipment/supplies used during decontamination includes the following:

- Deionized water;
- Alconox detergent (or equivalent); and
- Containers and brushes, paper towels, and plastic sheeting.

3.2 MEASUREMENT PROCEDURE

This section gives the sequence of events to follow when measuring water levels.

3.2.1 *Protective Clothing*

Protective gloves shall be worn during well opening, well measurement, and decontamination procedures.

3.2.2 *Equipment Decontamination*

Before any measurement is taken, the water level probe or fiberglass tape shall be decontaminated. Details of decontamination procedures are given in Section 6.0.

3.2.3 *Wellhead Air Space Monitoring*

A PID or FID shall be used to measure volatile organic concentrations while opening the well. If organic vapors are detected in the well casing, procedures and action levels specified in the Health and Safety Plan will be followed. The procedures exist to protect personnel from exposure to escaping constituents.

3.2.4 *Water Level Measurements*

After opening the well cover, the field staff shall measure the depth of the static water level in the well using an electronic water level indicator. The measuring point for all the wells shall be clearly marked by a notch on the top of the PVC inner casing or outer steel casing.

The static water level of the well shall be measured, recorded in the field notebook, and then immediately rechecked until values agree to within 0.01 foot. After repeated measurements agree, the value and time of the last measurement will be noted and recorded on the field data sheet and/or in the field notebook. If floating product is historically known to occur in a well or if the well is new, an interface probe will be used to measure the depth to water and the thickness of the floating material.

Field data sheets shall be completed for each water level measurement event. If measurements are taken over a period of more than one day, the dates should be clearly indicated on the form.

4.0 *DECONTAMINATION*

Any equipment that comes into contact with water in the monitoring well must be decontaminated before use at another well location to prevent the possibility of cross contamination.

4.1 *DECONTAMINATION PROCEDURE*

The decontamination procedure is as follows:

- The equipment shall be rinsed with deionized water;
- If free product is present in the well, the equipment shall be washed in an Alconox and water solution (using a brush or clean cloth to ensure removal of all chemicals), rinsed in fresh tap water, and then wiped with deionized water, as described above; and
- Each step in this procedure shall be documented in the field notebook and/or on data collection forms.

5.0 *INSTRUMENT CALIBRATION*

If an electronic static water level indicator is to be used, the probe cord shall be checked for precision to ensure that it is correctly calibrated. The check consists of laying out 20 feet of fiberglass tape next to 20 feet of the probe cord. Note any measurement discrepancies between the two at 2-foot intervals.

Any calibration procedures on verifications that the probe is functioning properly shall be performed during decontamination.

The procedures followed during any calibration and verification of equipment shall be documented in the field notebook and/or on data collection forms along with any calculations and calibration constants.

6.0 DOCUMENTATION

This section describes the documentation requirements necessary to complete the water level monitoring program.

6.1 FIELD NOTES AND DATA

6.1.1 Field Notebook and Data Forms

A data collection form and/or a field notebook shall be completed for each measuring period. Information documented during the measuring period will include: describing decontamination procedures, calibration procedures, monitoring procedures and results, and daily occurrences during water level measurements.

6.1.2 Minimum Reporting Requirements

The completed field data collection forms and/or field notebook constitute the minimum reporting requirements designated by ERM. Information to be documented includes: date, time, well number, water level, total depth (if well does not have a dedicated pump system), static water elevation, general observations, procedures followed, and calculations made in the field, as well as date and time of entries. Both the data collection forms and notebook should be neat and legible, and shall be signed and dated by the person completing the page.

6.1.3 Field Data Reduction

The water level will be subtracted from the measuring point elevation to determine the elevation of the static water level. The resulting elevation shall be checked to see that it is reasonable and that the subtraction was performed correctly. If time permits, the water level elevations should be plotted on a base map as they are collected to aid in checking of the measurements.

6.2 DATA REPORTING AND FILING

The field data sheets will be collected at the ERM office where they shall be checked and entered into a water level database for the site. Entries shall be checked against the field data sheets to ensure that the proper values are entered.

Appendix C
Quality Assurance Project Plan

Sonoco Products Company

Quality Assurance Project Plan
2122 Colvin Boulevard
Tonawanda, New York

June 2000

ERM Project Number D6713.00.01

Environmental Resources Management
355 East Campus, Suite 250
Columbus, Ohio 43235

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1.0 INTRODUCTION

On behalf of Sonoco Products Company (Sonoco), Environmental Resources Management, Inc. (ERM) has prepared this Quality Assurance Project Plan (QAPP) for work related to the Remedial Investigation (RI) at the Greif Bros. Corporation (Greif) property in Tonawanda, New York.

1.1 PURPOSE AND OBJECTIVES

This QAPP identifies the necessary procedures for an orderly, accurate, and efficient data collection and analysis program for the project, and ensures that data meet quality objectives. The objectives for monitoring and ensuring data quality include the following:

- Identify key responsibilities and qualifications of staff responsible for data quality monitoring;
- Ensure that samples are properly managed both in the field and the laboratory;
- Ensure realistic data quality goals that will produce data of known and acceptable quality are established; and
- Ensure that data are accurate, complete, and verifiable.

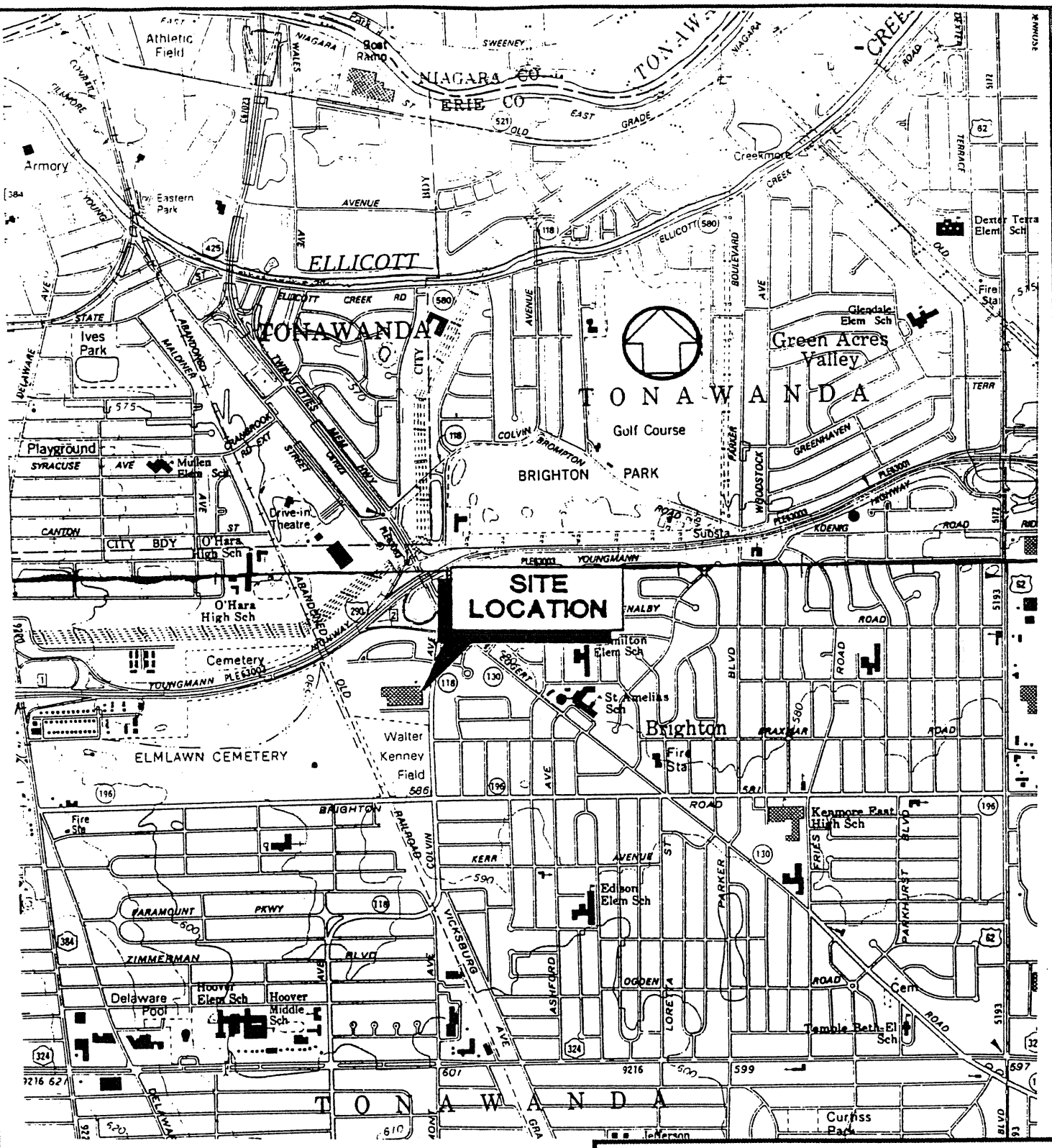
1.2 SITE LOCATION

The site is at 2122 Colvin Boulevard in Tonawanda, New York. The facility is in a mixed industrial and residential area approximately one-quarter mile south of Interstate Route 290 (Figure 1-1). In general, surrounding properties include vacant land and residences.

1.3 SITE HISTORY

Based on information provided by Grief Bros., the building at the subject facility was originally constructed in approximately 1948. From 1948 to approximately 1985 the facility was owned and operated by Continental Fiber Drum and Continental Can Corporation. Historical manufacturing operations at this time consisted of the production of fiber drums but also included production of the metal lids and rims used in the fiber drums.

Sonoco Industrial Container Division acquired the facility in 1985. The major existing manufacturing operations continued generally


SITE LOCATION
TONAWANDA
ELLICOTT
BRIGHTON PARK
Gulf Course
Green Acres Valley
Ives Park
Playground
Mullen Elem Sch
Drive-in Theatre
O'Hara High Sch
Cemetery
ELMLAWN CEMETERY
Walter Kenney Field
Hamilton Elem Sch
St Amelias Sch
Brighton Fire Sta
Kenmore East High Sch
Edison Elem Sch
Hoover Elem Sch
Hoover Middle Sch
Delaware Pool
Temple Beth El Sch
Curtiss Park
Dexter Terra Elem Sch
Glendale Elem Sch
Creekmore
Athletic Field
Armory
Eastern Park
NIAGARA CO
ERIE CO
TONAWANDA CREEK
ELLICOTT CREEK
OLD EAST GRADE
ABANDONED NYW
MAIDNER
CRANBROOK RD EXT
MEM DRIVE
COLVIN
BROMPTON
GREENHAVEN
WOODSTOCK
YOUNGMANN
KOENIG
ROGERT
FINALBY
BRAXMAR
RAILROAD
VICKSBURG
PARAMOUNT PKWY
ZIMMERMAN BLVD
KERR AVENUE
OGDEN
ASHFORD
LORETTA
PARKHURST
FRIES BLVD
PARKER
DELAWARE
NIAGARA
SWEENEY
YOUNG
STATE
SYRACUSE AVE
CANTON
CITY BDY
TWIN CITIES
WILES
BUFFALO
CREEK
TERRACE
BOULEVARD
GRADE
ROAD
AVENUE
STREET
PLEASURE
HIGHWAY
Substa
Fire Sta
Cem
Jefferson
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unchanged until the early 1990s. In the early 1990s, production of the metal lids and rims used in the fiber drums was discontinued. Greif Bros. Corporation subsequently acquired the facility in May 1998.

The site continues to be used for the manufacture of fiber drums. Secondary operations include equipment maintenance and administrative activities.

1.4 *REMEDIAL INVESTIGATION OBJECTIVES*

The RI will build upon the data from previous investigations. The primary goal of the RI is to characterize the geology, hydrogeology, and chemical distribution in soil and ground water to determine the necessity and scope of potential interim remedial actions. To accomplish this goal, the objectives of the RI are to:

- Identify the sources of chemicals in shallow soils to the extent necessary to select a source control remedy for the site; and
- Characterize the lateral and vertical distribution of chemicals in ground water to the extent necessary to evaluate potential source area remedial alternatives.

2.0 *QUALITY ASSURANCE OBJECTIVES*

Quality objectives ensure that data collected are sufficient to meet the intended project goals. Quality objectives are pre-established goals or "benchmarks" that are used to monitor and assess the progress and quality of the work performed. It is essential to define quality objectives prior to initiation of any project work to ensure that activities yield data sufficient to meet project objectives.

Quality objectives are divided into two categories: data quality objectives (DQOs) and quality assurance objectives (QAOs). The DQOs are associated with the overall project objective as it relates to data collection. The QAOs define acceptance limits for project-generated data as they relate to data quality.

2.1 *DATA QUALITY OBJECTIVES*

DQOs are qualitative and quantitative criteria required to support the decision making process. DQOs define the uncertainty in a data set and are expressed in terms of precision, accuracy, representatives, completeness, and comparability (PARCC). The DQOs apply to both characterization and confirmation samples at the site3. These parameters are defined as follows:

- **Precision**: a measure of mutual agreement among measurements of the same property usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation. Various measures of precision exist depending upon the "prescribed similar conditions".

- **Accuracy**: the degree of agreement of a measurement (or an average of measurements) with an accepted reference of "true value". Accuracy is one estimate of the bias in a system.

- **Representativeness**: expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

- **Completeness:** a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions.

- **Comparability:** expresses the confidence with which one data set can be compared with another. Comparability is a qualitative, not quantitative measurement, as in the case of accuracy and precision. Comparability is assessed by reviewing results or procedures for data that do not agree with expected results.

It is the responsibility of the field team to collect representative and complete samples. It is the responsibility of the field-screening chemist at the laboratory to analyze these samples using accepted protocols resulting in data that meet PARCC standards.

2.2 *FIELD SAMPLING QUALITY OBJECTIVES*

The overall quality of sample results depends on proper sample management. Management of samples begins at the time of collection and continues throughout the analytical process. To ensure samples are collected and managed properly and consistently, field procedures for sample collection activities have been developed for the project. The laboratory also has procedures that ensure a proper and consistent analytical process.

Field procedures include descriptions of equipment and procedures required to perform a specific task. The purpose is to increase reproducibility and to document each of the steps required to perform the task. Approved and correctly implemented field procedures should produce data of acceptable quality that meet project DQOs.

2.3 *LABORATORY DATA QUALITY OBJECTIVES*

The laboratory will demonstrate analytical precision and accuracy by the analysis of laboratory duplicates and by adherence to accepted manufacture and procedural methodologies.

The performance of the laboratory will be evaluated by the Project Manager and Project Quality Assurance Officer during data reduction. The evaluation will include a review of all deliverables for completeness and accuracy when applicable.

3.0 *QUALITY CONTROL PROCEDURES*

This section presents a general overview of the quality assurance and quality control procedures that will be implemented during the investigation. These quality control procedures are to be implemented as follows:

- in the field; and
- in the laboratory utilized for selected sample analyses.

3.1 *FIELD QC ACTIVITIES*

Several types of field QC samples will be collected and submitted for analysis during the project. Each type of QC sample monitors a different aspect of the field effort. Analytical results for QC samples provide information regarding the adequacy of the sample collection and transportation of samples.

The frequency of field QC samples collected will depend on the total number of samples being collected. Specifics of the sampling activities, including collection frequency and sampling procedures, are described in the field procedures. The six types of field QC samples that will be generated during the project are defined below.

- **Trip blanks** – Trip blank samples monitor for contamination due to handling, transport, cross contamination from other samples during storage, or laboratory contamination.

- **Temperature blank** – temperature blanks are used to monitor temperature within a sample cooler. Temperature blank results that are outside of acceptable limits (2° to 6° C) indicate unacceptable sample preservation and may require the recollection of samples.

- **Rinsate blanks** – Rinsate blank samples are used to monitor equipment decontamination procedures.

- **Field duplicates** – Field duplicates are used to monitor field and laboratory precision, as well as matrix heterogeneity.

- **Matrix Spikes** – Matrix Spikes (MS) are used to monitor precision and accuracy of the analytical method on various matrices.

3.2 *LABORATORY QC ACTIVITIES*

Laboratory QC samples will include the use of method blanks, MS, laboratory control samples, laboratory duplicates, and surrogate spikes. The five types of laboratory QC samples are defined below.

- **Method blanks** - Method blanks are used to monitor and ensure that the analytical system is free of contamination due either to carryover from previous samples or from laboratory procedures.

- **Matrix Spike samples** - MS samples monitor and assess the effects of the sample matrix on the sample analysis and verify the accuracy and precision of the analysis.

- **Laboratory Control samples** - LCSs are used to monitor the accuracy of the analytical procedure without the potential interferences of a matrix.

- **Laboratory Duplicate samples** - Laboratory duplicate samples are used to monitor and assess laboratory precision, as well as potential matrix heterogeneity.

- **Surrogate Spikes** - Surrogate Spikes are utilized to monitor potential interferences from the sample matrix. Surrogate spikes are required for organic analyses only.

4.0 *CALIBRATION PROCEDURES*

Calibration is an integral part of ensuring that results are quantitated correctly. Instruments that are not calibrated either to manufacturers and/or method specifications are likely to produce unreliable results. Proper procedures must be followed and sufficient documentation maintained to ensure calibrations are performed correctly and that sample quantitations accurately reflect sample concentrations.

During the course of this investigation, instruments that may be used in the field in conjunction with sampling activities include photoionization detector (PID), flame ionization detector (FID), dissolved oxygen meter, turbidity meter, pH and temperature meter, and specific conductance meter. A maintenance, calibration, and operation program will be implemented to ensure that routine calibration and maintenance is performed on all field instruments. The program will be monitored by the Field Team Leader. Trained team members will perform scheduled calibration, field calibrations, checks, and instrument maintenance prior to use each day. Additionally, calibration will be checked as necessary to ascertain that proper measurements are being taken.

Team members are familiar with the field calibration, operation, and maintenance of the equipment, and will perform the prescribed field operating procedures outlined in the operation and field manuals accompanying the respective instrument. Field personnel will keep records of all field instruments calibrations and field checks in the field logbooks. Calibration information recorded in field logbooks will include date, time, instrument model and serial number, a description of calibration or field check procedure, and any instrument deviations.

If on-site monitoring equipment should fail, the Field Team Leader will be contacted immediately. Replacement equipment will be provided or the malfunction will be repaired in a timely fashion.

5.0 ANALYTICAL PROCEDURES AND DATA EVALUATION

Investigation soil and ground water samples will be collected for analysis for some or all of the following analytes: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) and target analyte list (TAL) metals. In general, laboratory analytical procedures will adhere to USEPA SW-846 methodology, although other methods will be utilized as appropriate. Samples will be analyzed by a New York State Department of Health-approved ELAP Contract Laboratory Protocol certified laboratory. A summary of anticipated samples to be collected is presented in Table 5-1.

Upon receipt of analytical reports from the laboratory, ERM will evaluate data packages and confirm that samples were analyzed within required holding time and at proper detection limits. Data validation is not included in the scope of work; however, the laboratory will provide full CLP or ASP category B QA/QC backup for data packages if requested.

The project Quality Assurance/Quality Control (QA/QC) officer will review the data packages and prepare a Data Usability Summary Report (DUSR) in accordance with NYSDEC guidelines. At a minimum, the following information will be evaluated:

- chain-of-custody forms;
- date sampled/date analyzed;
- sample temperature at check-in;
- raw data;
- initial and continuing instrument calibrations;
- matrix spikes;
- laboratory duplicate analyses;
- surrogate recoveries (organics); and
- laboratory control samples (inorganics).

Data reduction will consist of presenting analytical results on summary tables. Data resulting from investigation analyses will then be used to evaluate potential remedial options.

TABLE 5-1
SAMPLING PLAN
GREIF BROS., TONAWANDA, NEW YORK
ERM PROJECT NO. D6713.00.01

LOCATION	DESCRIPTION	MEDIA	ANALYSES		
			VOCs EPA 8260	PNA SVOCs EPA 8270	TAL Metals EPA 200 Series
Varnish Pit Area					
VPSB-1	soil boring	soil	X	X[1]	X
VPSB-2	soil boring	soil	X	X[1]	
VPSB-3	soil boring	soil	X	X[1]	
VPSB-4	soil boring	soil	X	X[1]	
VPSB-5	soil boring	soil	X		
VPSB-6	soil boring	soil	X		
VPSB-7	soil boring	soil	X		
VPSB-8	soil boring	soil	X		
VPSB-9	soil boring	soil	X		X
SB-DUPE-01	duplicate	soil	X	X	X
RB-01	rinse blank	water	X	X	X
MS/MSD-01	matrix spike/duplicate	soil	X	X	X
Soil Boring GB-10 Area					
SV-A1	soil vapor survey	carbon	X		
SV-A2	soil vapor survey	carbon	X		
SV-B1	soil vapor survey	carbon	X		
SV-B2	soil vapor survey	carbon	X		
SV-B3	soil vapor survey	carbon	X		
SV-B4	soil vapor survey	carbon	X		
SV-C1	soil vapor survey	carbon	X		
SV-C2	soil vapor survey	carbon	X		
SV-C3	soil vapor survey	carbon	X		
SV-C4	soil vapor survey	carbon	X		
SV-C5	soil vapor survey	carbon	X		
SV-D1	soil vapor survey	carbon	X		
SV-D2	soil vapor survey	carbon	X		
SV-D3	soil vapor survey	carbon	X		
SV-D4	soil vapor survey	carbon	X		
SVS-TB-01	soil vapor trip blank	carbon	X		
SVS-DUPE-01	soil vapor duplicate	carbon	X		
10SB-1	soil boring	soil	X	X[1]	X
10SB-2	soil boring	soil	X	X[1]	
10SB-3	soil boring	soil	X		
10SB-4	soil boring	soil	X		

NOTES:

X[1] - Actually number and location of SVOC samples will be based on field findings.

<u>Sample Selection Criteria</u>

- PID readings above background and field evidence of petroleum constituents – one sample will be collected from the most affected sample interval and analyzed for VOCs and SVOCs.
- PID readings above background and no evidence of petroleum constituents – one sample will be collected from the most affected sample interval and analyzed for VOCs.
- No PID readings above background and no field evidence of affected soil – one sample will be collected from the bottom of the boring or immediately above the watertable whichever is shallower and analyzed for VOCs.

TABLE 5-1
SAMPLING PLAN
GREIF BROS., TONAWANDA, NEW YORK
ERM PROJECT NO. D6713.00.01

LOCATION	DESCRIPTION	MEDIA	ANALYSES		
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Underground Utilities					
SV-E1	soil vapor survey	carbon	X		
SV-E2	soil vapor survey	carbon	X		
SV-E3	soil vapor survey	carbon	X		
SV-E4	soil vapor survey	carbon	X		
SV-F1	soil vapor survey	carbon	X		
SV-F2	soil vapor survey	carbon	X		
SV-F3	soil vapor survey	carbon	X		
SV-F4	soil vapor survey	carbon	X		
SV-G1	soil vapor survey	carbon	X		
SV-G2	soil vapor survey	carbon	X		
SV-G3	soil vapor survey	carbon	X		
SV-G4	soil vapor survey	carbon	X		
SV-G5	soil vapor survey	carbon	X		
SV-G6	soil vapor survey	carbon	X		
SVS-DUPE-02	soil vapor duplicate	carbon	X		
Shallow Perched Ground Water					
SPW-1	new well	water	X	X	
SPW-2	new well	water	X	X	
SPW-3	new well	water	X	X	
Shallow Intermediate Ground Water					
MW-1	existing well	water	X		
MW-2	existing well	water	X		
MW-3	existing well	water	X		X
MW-4	existing well	water	X		
MW-5	existing well	water	X		
MW-6	new well	water	X	X	
MW-7	new well	water	X	X	X
MW-8	new well	water	X	X	X
GW-TB-01	trip blank	water	X		
GW-DUPE-01	duplicate	water	X	X	X
GW-MS/MSD-01	matrix spike/duplicate	water	X	X	X
Deep Intermediate Ground Water					
DIW-1	new well	water	X	X	
DIW-2	new well	water	X	X	
DIW-3	new well	water	X	X	

NOTES:

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Sample Selection Criteria

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VPSB-6	soil boring	soil	X		
VPSB-7	soil boring	soil	X		
VPSB-8	soil boring	soil	X		
VPSB-9	soil boring	soil	X		X
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SV-B3	soil vapor survey	carbon	X		
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SV-C3	soil vapor survey	carbon	X		
SV-C4	soil vapor survey	carbon	X		
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SVS-DUPE-01	soil vapor duplicate	carbon	X		
10SB-1	soil boring	soil	X	X[1]	X
10SB-2	soil boring	soil	X	X[1]	
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NOTES:

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SV-F2	soil vapor survey	carbon	X		
SV-F3	soil vapor survey	carbon	X		
SV-F4	soil vapor survey	carbon	X		
SV-G1	soil vapor survey	carbon	X		
SV-G2	soil vapor survey	carbon	X		
SV-G3	soil vapor survey	carbon	X		
SV-G4	soil vapor survey	carbon	X		
SV-G5	soil vapor survey	carbon	X		
SV-G6	soil vapor survey	carbon	X		
SVS-DUPE-02	soil vapor duplicate	carbon	X		
Shallow Perched Ground Water					
SPW-1	new well	water	X	X	
SPW-2	new well	water	X	X	
SPW-3	new well	water	X	X	
Shallow Intermediate Ground Water					
MW-1	existing well	water	X		
MW-2	existing well	water	X		
MW-3	existing well	water	X		X
MW-4	existing well	water	X		
MW-5	existing well	water	X		
MW-6	new well	water	X	X	
MW-7	new well	water	X	X	X
MW-8	new well	water	X	X	X
GW-TB-01	trip blank	water	X		
GW-DUPE-01	duplicate	water	X	X	X
GW-MS/MSD-01	matrix spike/duplicate	water	X	X	X
Deep Intermediate Ground Water					
DIW-1	new well	water	X	X	
DIW-2	new well	water	X	X	
DIW-3	new well	water	X	X	

NOTES:

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- No PID readings above background and no field evidence of affected soil – one sample will be collected from the bottom of the boring or immediately above the watertable whichever is shallower and analyzed for VOCs.

6.0 *PROJECT PERSONNEL*

ERM will staff this project with persons having expertise in the tasks to be performed and experience in working on NYSDEC-listed sites. Key project personnel that would be assigned to this project are presented below.

Lance Traves, CHMM will be the project director for this project. Mr. Traves has more than 13 years of diverse experience providing environmental consulting services to private and public sector clients. Mr. Traves is currently a Program Director of Management Consulting with regional responsibilities throughout Ohio, Michigan, and Indiana. He has extensive experience managing multi-site environmental assessments and compliance audits; conducting environmental risk assessments; performing subsurface investigations; and directing remedial actions. Mr. Traves will be responsible for strategic planning and finalizing Work Scopes, project implementation, and budget and schedule management.

Sean E. Pepling will be the project manager and lead geologist for the field investigation portion of this project. Mr. Pepling has a B.S. in geology and over ten years of experience including investigations at designated State and Federal sites. Mr. Pepling will be responsible for detailed technical aspects of the project and management of all field activities. He will coordinate all investigative components of this project.

Chris Sturick will be the field geologist for this project. Mr. Sturick has a bachelor's degree in geology and four years of professional experience. He has performed many field investigation projects, including projects at designated State and Federal sites.

Appendix D
Health and Safety Plan

Sonoco Products Company

Health and Safety Plan for Remedial Investigation *2122 Colvin Boulevard Tonawanda, New York*

June 2000

ERM Project Number D6713.00.01

Environmental Resources Management
355 East Campus, Suite 250
Columbus, Ohio 43235

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A SIGN-IN SHEET

1.0 HEALTH AND SAFETY PLAN

Environmental Resources Management, Inc. (ERM) has prepared this Health and Safety Plan (HASP) for work being conducted at the Greif Bros. Corporation facility located at 2122 Colvin Boulevard in Tonawanda, New York. This HASP acts as a supporting document to the field activities, which may consist of soil, soil vapor, and ground water sampling. This plan will apply to all ERM personnel involved with the above mentioned site investigation activities.

The procedures set forth in this HASP are designed to reduce the risk of exposure to chemical substances and physical hazards, which may be present at the site. These procedures follow applicable federal, state and local regulations, including Occupational Safety and Health Administration (OSHA) requirements governing activities at hazardous waste sites and the requirements in 29 CFR 1910.120. Specific practices and procedures, including the level of personal protective equipment, are based on research of currently available information for the site.

ERM has fulfilled all of the requirements of a Hazardous Communication Program as specified in 29 CFR 1910.120.

Every potential safety hazard associated with this investigation cannot be predicted. This HASP does not attempt to establish rules to cover every contingency that may arise, but it does provide a basic framework for the safe completion of field activities and plans for reasonable contingencies. The procedures provided herein are to be used by all ERM employees.

2.0 *SCOPE OF FIELD ACTIVITIES*

ERM will mobilize to the site with all materials and equipment needed to conduct the soil, soil vapor, and ground water sampling activities.

3.0 *SITE ENTRY REQUIREMENTS*

The Field Team Leader (FTL) will act in a supervisory capacity over all ERM employees who participate in the field activities specified in this work plan. The FTL is responsible for ensuring that ERM Health and Safety responsibilities are carried out in conjunction with the work plan. As part of these responsibilities, the FTL will distribute the HASP to all field team personnel and discuss the HASP prior to the start of field activities. All field personnel will sign the Health and Safety Plan Review Record shown in Appendix A, verifying that they have read and are familiar with the contents of this HASP.

Training

All personnel entering the site will have completed training requirements for hazardous waste site operations in accordance with OSHA 29 CFR 1910.120 (e)(1)(2)(3), 29 CFR1910.146(d)(8)(g)(h)(i)(j)(k) and 29 CFR1910.147(c)(7)(i)(10)(e)(3) or be certified by their employers as having equivalent training or experience.

Medical Surveillance

All personnel entering the site must have completed appropriate medical surveillance as required by OSHA 29 CFR 1910.120(f).

Respirator Fit Test

All personnel entering the site wearing a negative pressure air purifying respirator must have successfully passed a quantitative fit test in accordance with OSHA 29 CFR 1910.1025 or 1926.58 within the previous 12 months. Employees will be permitted to wear only those brands and models of respirator for which a fit test has been successfully performed.

4.0 *SITE HEALTH AND SAFETY PLAN RISK ANALYSIS*

Chemicals identified in the soil at the Site, which may be encountered during investigation activities, are as follows:

- acetone
- 1,1-dichloroethane
- 1,2-dichloroethane
- 1,1-dichlorothene
- 1,2-dichloroethene (total)
- ethylbenzene
- tetrachloroethene
- toluene
- 1,1,1-trichloroethane
- trichloroethene
- 1,2,4-trimethylbenzene
- xylenes
- benzo (b) fluoroanthene
- chrysene

VOCs are the major group of chemicals that may be present in potentially hazardous concentrations at the facilities. Since the field activities involve subsurface disturbance for short periods of time, these activities may generate the release of VOCs in vapor form with inhalation being the major pathway of concern. This HASP is primarily designed to protect individuals against exposure to these aforementioned compounds during the field activities. Risk posed by hazards of the on-site chemicals will be controlled by minimizing worker contact.

5.0 *TASK RISK ANALYSIS*

This hazard assessment identifies the general hazards associated with specific site operations and presents an analysis of documented or potential hazards existing at the site. Every effort must be made to reduce or eliminate these hazards. Those, which cannot be eliminated, must be guarded against by use of engineering controls and/or personal protective equipment.

5.1 *PHYSICAL HAZARDS AND STANDARD OPERATING PROCEDURES*

Liquid Transfer

Liquid transfer and/or handling will occur at the site during sampling activities (i.e., discharge of decon water or purge water into drums). During liquid handling operations which involve potential contact with skin, appropriate personal protective equipment will be utilized (e.g. gloves, etc.).

Drum Handling

Drum handling will likely occur at this site (i.e., soil cuttings, temporary storage of development water from monitoring wells and decon water). If necessary, the movement and opening of drums will be done in accordance with 29 CFR 1910.120(j).

Cold Stress

When the temperature falls below 40° Fahrenheit (F), cold stress protocol shall be followed. Employees must be supplied with adequate clothing to maintain body core temperature. To minimize the potential for hypothermia, a heated area outside the decontamination area will be available to site workers during breaks.

Heat Stress

When the temperature exceeds 70° F, and personnel are wearing protective clothing, a heat stress-monitoring program shall be implemented as appropriate. Employees shall have access to break periods and drinking water as necessary. The signs of heat stress disorders are described below.

Heat Cramps

Heat cramps are caused by heavy sweating and inadequate electrolyte replacement. Signs and symptoms include muscle spasms and pain in the hands, feet, and abdomen.

Heat Exhaustion

Heat exhaustion occurs from increased stress on various body organs, signs and symptoms include:

- Pale, cool, moist skin;
- Heavy sweating; and,
- Dizziness, nausea, fainting.

Heat Stroke

Heat stroke is the most serious form of heat stress, and should always be treated as a medical emergency. The body's temperature regulation system fails and the body temperature rapidly rises to critical levels. Immediate action must be taken to cool the body before serious injury or death occurs. Signs and symptoms of heat stroke include;

- Red, hot, unusually dry skin;
- Lack of, or reduced, perspiration;
- Nausea;
- Dizziness and confusion;
- Strong, rapid pulse and confusion; and,
- Coma.

Eye Protection

All operations involving the potential for eye injury, splash, etc. must have approved eye wash units locally available as per 29 CFR 1910.151(c).

Confined Space Entry

ERM will not be performing any Permit Required Confined Space Entry (PRCSE) activities at the site.

6.0 *PERSONAL PROTECTIVE EQUIPMENT*

The following is a brief description of the personal protective equipment may be required during various phases of the project. The USEPA terminology for protective equipment will be used: Level C and D.

Respiratory protective equipment shall be NIOSH-approved, and use shall conform to OSHA 29 CFR 1910.134 requirements.

Level C protection shall be used when:

- The types and concentrations of air contaminants are known and an air-purifying respirator capable of protection is available.
- The substance has adequate warning properties and all criteria for the use of APR are met.
- Greater than 5 ppm up to 25 ppm of unknown organic vapors above background levels may be encountered.

Level C protection at a minimum shall consist of:

- Chemical-resistant coveralls (Tyvek).
- Steel-toe and shank work boots with chemical resistant overboots.
- Disposable inner and outer gloves (Nitrile).
- APR with full-face mask with appropriate canisters or cartridges.
- Hard hat.
- All joints taped with duct tape.

Use of Level B or C requires that when persons using Level B are working in the exclusion zone, one person must be available as backup ready to provide emergency assistance.

Level D protection shall be used when:

- The atmosphere contains no known hazard.
- Work functions preclude splashes, immersion, or the potential for unexpected inhalation of, or contact with, hazardous concentrations of any chemicals.

Level D protective equipment at a minimum shall consists of:

- Standard work uniform or coveralls
- Safety-toe work boots

- Gloves as needed
- Safety glasses
- Hard hat

Additional safety equipment which may be required for specific tasks:

- Chemical-resistant aprons
- Dust/mist disposable mask (HEPA rated as specified in 1910.1025)
- Goggles
- Face shields
- Five-minute escape device
- Welders goggles or shields
- Hearing protection

Activity Specific Levels of Protection

The required level of protection is specific to the activity being conducted. At this site, the anticipated levels of protection are as follows:

ACTIVITY	INITIAL LEVEL OF PROTECTION	SPECIAL REQUIREMENTS
Soil and groundwater sampling	Level D	Monitor breathing zone for vapor phase VOCs.

7.0 *AIR MONITORING AND ACTION LEVELS*

According to 29 CFR 1910.120(h), air monitoring shall be used to identify and quantify airborne levels of hazardous substances and health hazards in order to determine the appropriate level of employee protection needed on-site.

Routine air monitoring at a minimum shall be conducted:

- Upon initial entry to rule out IDLH conditions
- When the possibility of an IDLH condition or flammable atmosphere has developed.
- When work begins on a different portion of the site.
- Contaminants other than those previously identified are being handled.
- A different type of operation is initiated.
- Employees are handling leaking drums or containers or working in areas with obvious liquid contamination.

- Air monitoring will consist at a minimum of the criteria listed below. Air monitoring instruments will be calibrated and maintained in accordance with the manufacturer's specifications.

Instrument	Compound	Frequency of Monitoring	Action Level	Action
PID or FID	VOCs	Continuous	>5 ppm in breathing zone	Stop work, vent area, then continue to monitor.
			>25 ppm continuos in breathing zone	Stop work. Contact Project Manager for further instruction. (1)

(1) If instructed by the Project Manager to continue working in atmospheres with >25 ppm and <100 ppm in the breathing zone, air purifying respirators with organic vapor cartridges must be worn (Level C).

8.0 *EMERGENCY PHONE NUMBERS*

Emergency phone numbers are provided below.

AGENCY/ORGANIZATION	TELEPHONE
Fire Department	911
Police	911
Emergency Medical Services	911
Hospital	716-447-6121
ERM Columbus Office	(614) 433-7900
Project Director: Lance Traves	(614) 433-7900
Project Manager: Sean Pepling	(315) 445-2554
Ambulance	911

Directions to the Hospital from the facility: (See Attached Map)

Exit facility to south on Colvin Boulevard

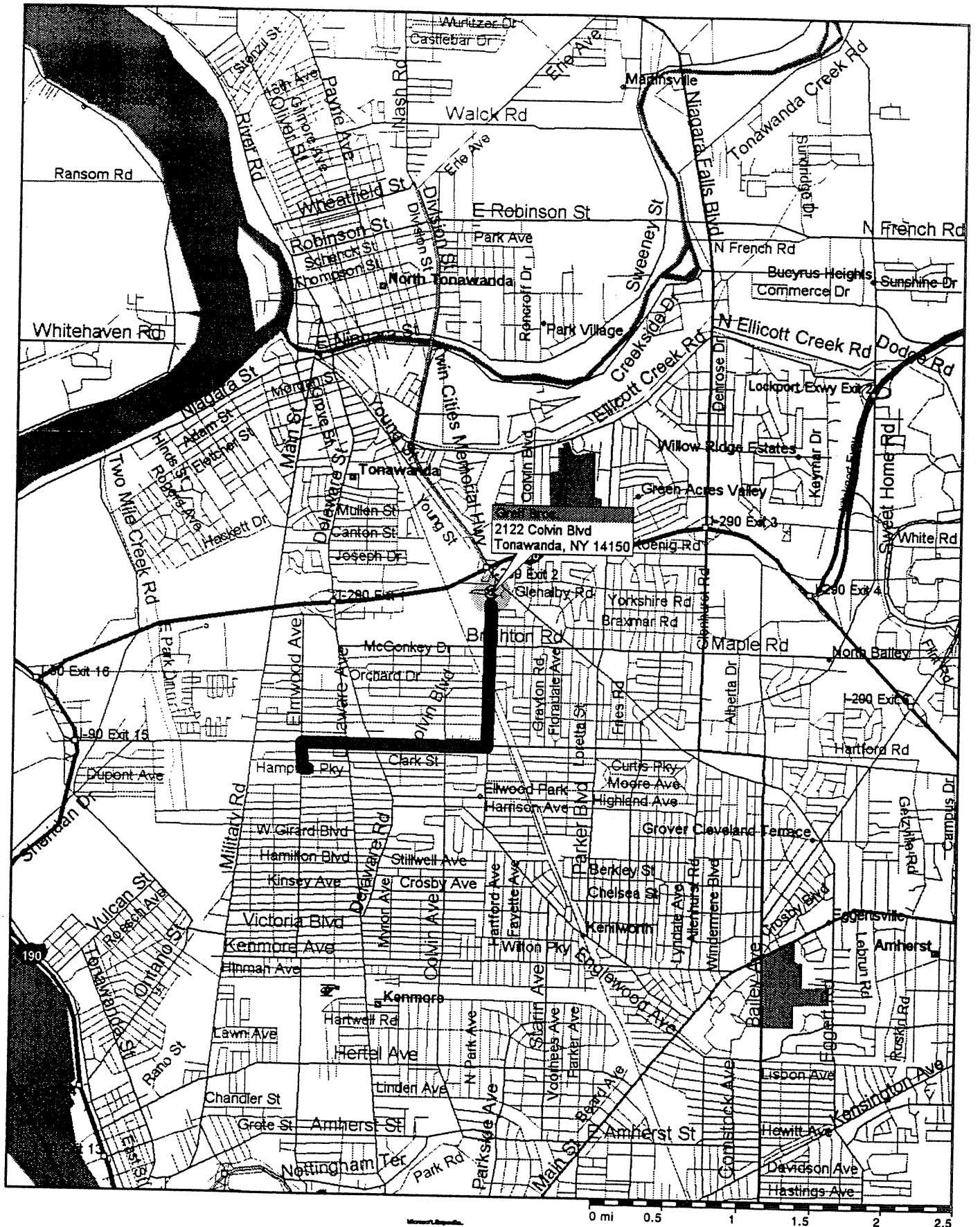
Follow Belmont Ave. South to Sheridan Drive

Turn right onto Sheridan Drive (west)

Follow Sheridan Drive to Elmwood Ave.

Turn left onto Elmwood Ave. (south)

Hospital is on right



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Appendix A

Sign-In Sheet

ACKNOWLEDGEMENT

I have read this Health & Safety Plan, and I understand the material in it. I agree to follow all procedures outlined herein.

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