TECHNICAL REPORT

Remedial Design Work Plan

Universal Instruments Corporation
Kirkwood, New York

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BBL
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consultants with focus

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1. Introduction

Blasland, Bouck & Lee, Inc. (BBL) was retained by Universal Instruments Corporation (Universal Instruments) to prepare the Remedial Design (RD) Work Plan for the former Dover Electronics facility in Kirkwood, New York (Site Number 7-04-026). The RD Work Plan was prepared in accordance with the executed Order on Consent between Universal Instruments and the New York State Department of Environmental Conservation (NYSDEC), dated January 2001.

This work plan is divided into the following sections:

- Section 1 - Introduction;
- Section 2 - Background;
- Section 3 - Remedial Design Tasks;
- Section 4 - Schedule and Submittals; and
- Section 5 - References.

Section 1 contains the introduction to the work plan summarizing the purpose and the goals of the RD.

Section 2 summarizes the site history and results from previous investigative activities at the site.

Section 3 begins with a description of the SVE pilot study that will determine the parameters necessary for designing the full-scale SVE system. The next subsection presents the field study that will determine the effectiveness of in-situ bioremediation for groundwater at the site. It also contains the performance evaluation criteria and detailed description of a written report (the "Pre-Design Report") assessing the effectiveness of in-situ bioremediation based on results of the pilot study. A contingency plan is also included in the event that bioremediation should fail to achieve its objectives or otherwise fails to protect human health or the environment during the pilot study. Finally, this section presents the tasks for completing the full-scale remedial system design and documenting it in a report entitled "Remedial Design Package" to be submitted to the NYSDEC.

Sections 4 and 5 present the schedule for the submittal of documents to the NYSDEC and the references for this document, respectively.

1.1 Purpose

The purpose of this RD Work Plan is to provide a detailed scope of work and schedule for:

- the proposed field study to determine the effectiveness of in-situ bioremediation for achieving the remedial action objectives for the site;

- the soil vapor extraction (SVE) pilot study to determine the parameters necessary for designing the full-scale SVE system;

- the submittal of a written report assessing the effectiveness of in-situ bioremediation at the site based on results of the field study; and

- the preparation and submittal of the Remedial Design Package, which will contain specifications and a schedule for the SVE system, the possible implementation of in-situ bioremediation (depending on results from the field study), and the other remedial actions in the Record of Decision (ROD), dated March 30, 2000.

The selected remedial actions in the ROD include:

- soil vapor extraction (SVE) to address the contaminated inaccessible soils located beneath the building located on site (depending on its integrity and suitability, the abandoned sub-slab roof drain piping may be used as part of the SVE system);
- replacement and re-routing of the stormwater piping system between the roof drains in the front of the building and CB-1537 outfall;
- excavation and off-site disposal of the limited amount of affected soils that are located outside of the footprint of the building and are thus accessible for excavation;
- evaluation of in-situ groundwater treatment in areas where the highest concentrations are present to accelerate groundwater cleanup (in-situ bioremediation field study);
- groundwater extraction and treatment for the impacted groundwater if in-situ bioremediation is not effective;
- deed restrictions placed upon the property as long as residual contamination remains at the site; and
- an operation & maintenance (for the active components of the remedy) and long-term monitoring program.

Based on recent correspondence and conversations with the NYSDEC, the remedial action of groundwater extraction and treatment will only be implemented in the event that the in-situ bioremediation field study fails to demonstrate its effectiveness in attaining the remedial action objectives for the site.

1.2 Goals

The goal of the remedial program is to meet the NYSDEC's Standards, Criteria, and Guidance (SCGs) and to be protective of human health and the environment. The goals of the RD for this site are:

- to reduce, control, or eliminate, to the extent practicable, the constituents of concern (COCs) present in the subsurface soils at the site;
- to reduce, control, or eliminate, to the extent practicable, the continued migration of impacted groundwater and storm water from the site;
- to eliminate, to the extent practicable, exceedances of applicable environmental quality standards related to groundwater and stormwater;
- to reduce, control, or eliminate, to the extent practicable, the source of the contamination that has been detected in the indoor air samples; and
- to protect human health and the environment through implementation, operation, and monitoring of the remedial program.

2. Background

The former Dover Electronics facility is located at 29 Industrial Park Drive, Kirkwood, Broome County, New York. The facility is located on a site approximately 9.58 acres in size. A site location map is shown on Figure 1, and Figure 2 is the site map.

The property is situated in an industrial setting. Major plants in the area include Truckstops of America Landfill (0.5 mile southeast), Frito Lay Plant (0.5 mile south), Universal Instruments (147 Industrial Park Drive, 0.5 mile east), Kason Industries (eastern property boundary), Consolidated Freightways (northern property boundary), and the newly developed Pilot Truckstop to the south. Industrial properties surround the property on north, east, and west. The property consists of an industrial building with areas outside and inside used for drum and chemical storage. The site currently serves as the corporate headquarters for Universal Instruments and is being used as an electronic circuit board manufacturing facility.

2.1 Site History

The facility was first constructed in 1973, with subsequent additions built in 1978, 1982, and 1984. It has been occupied by Universal Instruments and Dover Electronics. In 1993, Dover Electronics was renamed Dovatron, Inc. (Dovatron). In 1995, Dovatron transferred its title to the facility to Universal Instruments. In 1996, Dovatron changed its name to the DII Group. The site currently serves as the corporate headquarters for Universal Instruments. The facility has reportedly been used for electronic circuit board manufacturing since 1973.

Previous on-site circuit board manufacturing processes used tetrachloroethene (PCE) as a cleaning solvent. Originally, the virgin PCE was stored in 55-gallon drums at an outer drum storage area. During the initial facility expansion, a ramp to the east-side overhead door served as the entry point for PCE drums. As production increased and the facility was again expanded, virgin PCE was stored in a 3,000-gallon aboveground storage tank that has since been removed. An aboveground 5,000-gallon waste PCE flux storage tank was also located on the site. In March 1992, a 10,000-gallon fuel oil tank was reportedly removed from the site, and in March 1993, the aboveground PCE system was dismantled. Two 480-gallon PCE tanks were reportedly dismantled and removed from the building interior at that time. Historical handling and use of PCE has resulted in its documented presence in the soil, stormwater, and groundwater at this site. Figure 3 shows the historical site features of the facility.

2.2 Summary of Previous Site Investigations

Several remedial investigations at the facility have been conducted since the 1990s. The chronology of the activities undertaken by various environmental consultants is summarized below:

1990 – Phase I Investigation

Hagopian Engineering Associates (Hagopian) conducted the first investigation, which consisted of limited soil sampling near the empty drum storage shed, the PCE storage area, and the PCE aboveground storage tanks. Information concerning this investigation is contained in the report entitled *Environmental Site Investigation for Dover Electronics Company: DEM-East and Kirkwood North Locations* (Hagopian, 1990).

1991 – Phase II Investigation

Hagopian conducted a subsequent investigation consisting of two soil gas sampling events, one groundwater monitoring well installation and sampling (MW-1), surface water sampling, and subsurface soil boring advancement. Details of this investigation are summarized in the report entitled *Phase II Environmental Site Investigation for Dover Electronics* (Hagopian, 1991).

1992 – Phase III Investigation

Stetson-Harza began a site investigation in July 1992. This investigation consisted of advancing additional borings, converting two of these borings into groundwater monitoring wells (MW-2 and MW-3), and collecting soil and groundwater samples. Based on the previous site investigations, Stetson-Harza recommended a groundwater treatment system be installed at the site to remediate the groundwater.

1993 – Groundwater Interim Remedial Measure

The aboveground PCE tank system was dismantled in March 1993, and two groundwater recovery wells (RW-1 and RW-2) were installed near the former PCE tanks in April 1993. These wells were constructed of 4-inch-diameter PVC to a depth of approximately 58 feet below ground surface (bgs). This groundwater treatment system was installed as an interim remedial measure (IRM) and became operational on August 17, 1994. Due to cracked piping, the system was not operational from December 1994 to May 1995. The piping was replaced with polyethylene tubing with heat trace tape. The system was again not operational from July 1995 to October 1995 due to a decline in the groundwater levels to below the bottom of the recovery wells. Historically, groundwater at the two recovery wells (RW-1 and RW-2) has been pumped at very low flow rates. Reportedly, the maximum amount of groundwater pumped in one day was 90 gallons. The recorded flow over 150 days of operation (early operational data) shows the system pumping an average of 30 gallons per day. The system operated on a limited schedule, but was shut down and abandoned in 1996.

1996-1999 – Additional Investigations

Shield Environmental Associates, Inc. (Shield Environmental) undertook a series of site investigations between 1996 and 2000. The investigations prior to the initiation of the Remedial Investigation (RI)/Feasibility Study (FS) were summarized and reported to the NYSDEC in the *Baseline Summary Report* (Shield Environmental, 1997) and *Baseline Summary Report Addendum* (Shield Environmental, 1998).

Soil Gas Survey

A soil gas survey was conducted in February 1996 to collect relevant data regarding subsurface conditions around the building perimeter and inside the rear addition to the building. The rear addition is reportedly where PCE processes were located. The main building area was undergoing extensive renovation at the time of the survey and was not accessible for sample point installation. The soil gas survey results showed the highest volatile organic compound (VOC) levels to be from beneath the rear addition and in the exterior area near MW-1, RW-1, and RW-2.

Geoprobe® Soil Sampling

From 1996 to 1997, Shield Environmental collected soil samples at the facility to establish the vertical and horizontal extent of site contamination. In April 1996, soil samples were collected using a Geoprobe® system

at depths ranging from 2 to 19 feet. The sampling points were in the back addition and in the area of the former aboveground tank. The entire building was not accessible for soil sampling due to building renovations being conducted at the time. In June 1996, five borings were advanced to maximum depths between 27 and 44 feet. Split-spoon samples were collected for laboratory analysis from various depths to help define the vertical contaminant profile. A sixth soil boring was advanced to a depth of 82 feet. This boring was completed as a groundwater monitoring well (MW-4). After October 1996, when six additional groundwater monitoring wells (MW-5, MW-6, MW-7, MW-8, MW-9, and MW-10) were installed, split-spoon sampling was used to collect soil samples from MW-9 and MW-10. In October 1997 and January 1998, continuous split-spoon samples were collected during the drilling of MW-11, MW-12, MW-13, MW-14, and RW-4.

Monitoring Well Installation

Shield Environmental installed 11 groundwater monitoring wells (MW-4 to MW-14) from 1996 to January 1998 to define the horizontal and vertical extent of groundwater contamination. In addition, two recovery wells were installed (RW-3 and RW-4) in 1997. RW-3 was installed adjacent to MW-7 as part of an IRM groundwater treatment system. RW-4 was used for the vacuum-enhanced pumping pilot treatment well in the source area. The locations of these wells are shown on Figure 2.

Storm Drain/Catch Basin Activities

Water and sediment samples from the North Catch Basin (NCB) CB-2044 and the Northeast Catch Basin (NECB) CB-1846 have historically had elevated PCE concentrations. Several catch basin cleaning events were unsuccessful in eliminating PCE from the stormwater associated with these two catch basins. Sections 4.2.4 and 7.2.3 of the *Baseline Summary Report* (Shield Environmental, 1997) contain details of prior catch basin activities.

On August 13, 1997, Shield Environmental excavated around the NCB (CB-2044) and NECB (CB-1846) where the influent pipes penetrated the basins. A 2-foot-thick concrete seal was poured around each pipe to keep water from entering the basins from around the pipes. After the concrete seals were installed, additional water samples were collected from the NCB and NECB on September 25, 1997. Elevated PCE levels were detected in the NCB, and low PCE levels were detected in the NECB.

During the week of December 15, 1997, a new catch basin and associated piping were installed in the NCB (CB-2044) for the structural integrity of the stormwater drainage system. In addition, the new catch basin was equipped with rubber gaskets at the piping/catch basin junction to prevent outside water from entering the stormwater piping. During the NCB and piping replacement, over-excavation activities were also conducted around the catch basin, along the building perimeter, and along the piping trench.

VEP Pilot Test

A vacuum-enhanced pumping (VEP) pilot test was performed on December 9 and 10, 1997 at the recovery well RW4 to test the potential for source area remediation and to reduce downgradient contaminant migration. The pilot test lasted approximately three hours. After a vacuum was applied to RW-4, low magnitude responses were observed in the vapor monitoring points (VMPs) at different depths and lateral points of the formation. The radius of influence (ROI) observed in the field was generally not radially symmetrical. The largest recorded manometer response was in VMP-2 (shallow) at 15 lateral feet from the vacuum well.

2.3 Summary of the Remedial Investigation/Feasibility Study

Shield Environmental initiated the RI fieldwork in October 1998. The scope of the work included an additional contaminant source area investigation, surface water and sediment sampling, geologic investigation, on-site and off-site groundwater investigation, and indoor air monitoring.

Three investigative techniques were used to implement the contaminant source area investigation. These techniques included exploratory trenching, split-spoon soil sampling, and surface water and sediment sampling. A subsurface trenching operation was conducted to collect data along the footer of the existing building and along utility lines to determine the pathways of contaminant migration at the facility. Split-spoon soil samples were collected through hollow-stem augers to define the vertical and lateral extent of vadose zone soil contamination in suspected primary and secondary source areas. The focus areas for split-spoon sampling included the former oil storage shed and around previously known contaminated stormwater catch basins. Surface water and sediment samples were collected at various stormwater catch basins, catch basin outfalls, and at the property lines.

Groundwater monitoring well installation, monitoring well sampling, and aquifer testing were conducted during the RI field activities. Monitoring wells MW-1 through MW-14 existed prior to the initiation of RI activities, with the exception of MW-4 and MW-10, which had been abandoned. RW-1, RW-2, and RW-4 were also abandoned prior to the initiation of RI field activities.

Shield Environmental installed 23 groundwater monitoring wells during the RI field activities: 7 wells on the Universal Instruments property, 2 wells on the Colesville Road right-of-way, and 14 across Industrial Park Drive (see Figure 2 for all monitoring well locations). Five monitoring wells (MW-22, MW-23, MW-25, MW-26, and MW-34) were constructed using a conductor casing. These wells were installed through a steel conductor casing to prevent vertical migration of contamination down the boring wall/PVC casing interface. Wells MW-1 and MW-7 were abandoned during the RI activities, and a replacement well MW-7A was installed approximately 8 feet north of the former MW-7.

The monitoring wells were gauged and/or sampled in November 1998 and February, April, and July 1999 to determine the potentiometric surface of the aquifer and the lateral and vertical extent of the contaminant plume.

Aquifer tests were also performed using limited (in time and in observation points) pumping tests in monitoring wells MW-3, MW-12, MW13, MW-22, MW-25, and MW-34 to establish the approximate hydraulic conductivity, transmissivity, and permeability of the aquifer(s). Another goal of the pumping test was to assess potential hydraulic connections between clustered wells screened within the same aquifer or in different aquifers. The estimated hydraulic conductivities derived from the pump testing ranged from 10^{-3} to 10^{-6} cm/sec, indicating that there is variation in the hydrogeologic setting at the site. Hydraulic connections between the clustered well pairs were not observed.

Air monitoring activities were conducted in the building to document worker safety and potential exposure. Three different air sampling events were conducted inside the facility. The air sampling was conducted according to the amended IRM Work Plan based on Shield Environmental's letter dated October 30, 1999. Canisters were placed in the office area, A/C area, electrical area, and outside (background sample). Sampling events were conducted on November 3, 1998; December 7, 1998; and March 4, 1999.

The RI and FS final reports were presented to the NYSDEC in July 2000. The RI Report summarizes the results of all investigations conducted to date at the site and presents a conceptual model of contaminant migration. It also

evaluates the nature and extent of any threat to human health or the environment caused by contamination at the site. The FS Report contains alternatives for appropriate remedial action to minimize or mitigate any identified risks associated with chemicals of concern at the site. The remedy recommended in the FS Report and subsequently selected in the March 2000 ROD by the NYSDEC was summarized above in Section 1.1.

In July 2000, Gannett Fleming, Inc. (Gannett Fleming) was retained by Universal Instruments to assess the feasibility of in-situ groundwater treatment of chlorinated hydrocarbons. Gannett Fleming proposed the use of hydrogen and oxygen releasing compounds that can cost-effectively accelerate the removal of dissolved constituents at the site, and provide containment and control of the byproducts that are produced during the in-situ biodegradation process. As a result of the conference call on November 8, 2000, the NYSDEC agreed on the proposed in-situ bioremediation field testing program.

3. Remedial Design Tasks

The RD for the soil remediation and for the groundwater remediation will proceed independently in order to expedite the project The RD tasks for each media will be conducted in two phases: pre-design and full-scale RD. Because results of the activities of the pre-design phase will affect the full-scale RD, tasks described in Section 3.3 Remedial Design Package Preparation and Submittal will be fully developed upon the NYSDEC's approval of the soil and groundwater pre-design reports.

3.1 Soil Remediation Pre-Design Tasks

The purpose of the SVE pilot study is to determine the parameters necessary for designing the full-scale SVE system for the remedial action, including:

- the achievable air flow rate from the SVE system under a given vacuum;
- the area of influence of the SVE well;
- the permeability (k) of the soil to air flow; and
- an estimate of VOC removal rates.

3.1.1 Pilot Study Design and Submittal

The pilot study will be conducted in two phases outside the rear addition (1978 and 1984 additions) of the building near the former 5,000-gallon flux tank to address the residual contaminants (see Figure 3). Two SVE test wells and three nested soil gas monitoring probe clusters will be installed in the test area to assess the full thickness of the unsaturated zone. Exhaust from the SVE pilot system will be treated by vapor-phase carbon before discharging to the atmosphere. In the first phase, a short-term test will be performed, during which air will be extracted from one SVE test well for approximately eight hours while pressure changes are monitored at soil gas monitoring points. Using data from the short-term test, an air extraction rate will then be determined for use in the second phase of the pilot study. During the second phase, air will be extracted from the same SVE test well for approximately four weeks. Periodic measurement of the contaminant soil gas concentrations will be made at the exhaust point of the SVE system and soil gas monitoring points to evaluate the effectiveness of SVE on this site.

A pre-design work plan will be prepared and submitted to the NYSDEC for review and approval. The pre-design work plan will include the following:

- specifications and design of the test well, monitoring point(s), and equipment;
- specifications and design of the manifold piping and associated instrumentation;
- procedures for short-term and long-term field tests;
- data evaluation procedures and computer modeling protocols; and
- a detailed schedule for field implementation and reporting.

3.1.2 Pilot Study System Installation

After receiving the NYSDEC's comments and approval of the pre-design work plan, we will begin installation of the pilot study system. Installation of the pilot study system will be done in accordance with the approved pre-design work plan. Deviations from the approved work plan, if any, will be discussed with the NYSDEC. We will obtain the NYSDEC's approval before making any modification to the pre-design work plan.

3.1.3 Pilot Study Implementation

At the conclusion of the system construction and installation, field tests will be conducted in accordance with the test procedures described in the approved pre-design work plan. Modifications to the test procedures, if any, will be discussed with the NYSDEC. Revisions to the test procedures will not be made without prior NYSDEC's approval.

3.1.4 Soil Remediation Pre-Design Report Submittal

The results of the SVE pilot study will be evaluated and summarized in the pre-design report. The pre-design report will include the following:

- date and description of the field activities;
- description of test design and procedures;
- discussion of test results;
- calculation of design parameters and estimation of VOC removal rates;
- chain-of-custody and field measurement records and laboratory results;
- conclusions and recommendations; and
- a conceptual layout and design of the recommended remedial action.

The conceptual layout and design of the recommended remedial action, which may include use of the abandoned roof drain line, will address the residual soil contamination underneath the front part of the facility building. The pre-design report will be submitted to the NYSDEC for review and comment upon conclusion of the SVE pilot study.

3.2 Groundwater Remediation Pre-Design Tasks

A pre-design work plan will be prepared that contains a detailed description of the construction and implementation of the in-situ bioremediation field study, which will include the following tasks:

- designing and implementing the field study;
- drafting a monitoring program to assess the effectiveness of the field study and the status of plume movement horizontally and vertically;
- defining measures to evaluate the success of the field study by the end of the testing period and of the resulting proposed full-scale system as the sole remedy to achieve the remediation goals at the site; and
- creating a contingency plan to implement hydraulic control promptly in case any element of the in-situ bioremediation field study fails to control migration of the plume.

3.2.1 In-Situ Bioremediation Field Study Design

The in-situ bioremediation field study is being conducted to evaluate the effectiveness of this technology as the sole means of containing and reducing the dissolved organic hydrocarbons at the site. Previous investigations have shown the presence of PCE degradation products (trichloroethene [TCE] and cis-1,2-dichloroethene [DCE]) and relatively low total organic carbon concentrations, indicating the occurrence of reductive dechlorination. Hydrogen

Release Compound (HRC), manufactured by Regenesis, will be used in the field study to enhance the reductive dechlorination process, thereby decreasing the concentration of dissolved-phase VOCs. HRC will be used to enhance in-situ biodegradation rates for chlorinated hydrocarbons (CHs) in the treatment area by fueling anaerobic reductive dechlorination processes. HRC is a proprietary polylactate ester manufactured as a viscous gel that will be injected into the saturated zone of the treatment area. Upon being deposited into the subsurface, HRC will slowly release lactate. Lactate will be metabolized by naturally occurring microorganisms, resulting in the creation of anaerobic aquifer conditions and the production of hydrogen. Naturally occurring microorganisms capable of reductive dechlorination will then use the hydrogen to progressively remove chlorine atoms from the chlorinated hydrocarbon contaminants (i.e., convert TCE to DCE to vinyl chloride [VC] to ethene).

All of the CHs present at the site are amenable to anaerobic reductive dechlorination processes; however, the rates of biodegradation for the less chlorinated compounds (e.g., DCE and VC) can be slower under anaerobic condition than under aerobic or semi-aerobic conditions. Oxygen Release Compound (ORC), which provides oxygen to support the aerobic biodegradation of petroleum hydrocarbons and CHs such as chlorobenzene, DCE, and VC will be used to address these reductive dechlorination products. ORC is a proprietary formulation of magnesium peroxide designed to provide a timed release of oxygen. Manufactured as a powder, ORC will be mixed with water for slurry injection into the saturated zone.

The field study will be implemented over a 6- to 12-month period to collect data needed to determine the feasibility of using this approach as the sole remedy for the impacted groundwater at the site. The preliminary results of the proposed program will be available for analysis in a written report entitled "Pre-Design Report" within the time line of the original selected remedial actions.

3.2.1.1 Treatment Zones

This prototype field study has been designed to address both source removal and potential plume migration. Figure 4 shows the treatment locations for the in-situ bioremediation field study. Three testing areas have been selected for HRC injection for evaluation of the feasibility of in-situ bioremediation as a remedial method:

- on site near existing monitoring well MW-24;
- on site near existing monitoring well MW-7A; and
- off site near existing monitoring well MW-28.

The three HRC injection areas cover a large extent of the two source areas of impacted groundwater, which is comparable to a full-scale in-situ bioremediation program. In addition, an aerobic bio-barrier will be installed in the 25- to 35-foot zone downgradient of the pilot study area for the treatment of PCE degradation byproducts, such as DCE and vinyl chloride (VC). This bio-barrier is designed to cover the off-site treatment area plume edge to prevent further migration of PCE daughter products.

3.2.1.2 Source Area Treatment Using HRC Grid Design

The RI Report (Shield Environmental, 2000) identified two areas as having the highest levels of dissolved chlorinated hydrocarbon detected in groundwater samples: MW-24 near Catch Basin 1537 and 1547 Outfalls, and MW-25 off site south of Industrial Park Drive. Because the two areas do not appear to have uniform geological and hydrological characteristics, the field study will be conducted separately in each location to determine design parameters and feasibility of in-situ bioremediation at the site. Two separate demonstration plots will address the area around MW-24 because the steep terrain is not able to accommodate a larger single treatment area.

Groundwater in well MW-24 showed a dissolved PCE concentration of 2,700 ug/L in the latest analytical results. There is a steep gradient at the catch basin outfall discharge points (~ 0.1 ft/ft), with a gradual decrease toward Industrial Park Drive. The pump test results performed near MW-12 and MW-13 yielded a hydraulic conductivity in the range of 0.003 to 0.05 ft/day (10^{-5} to 10^{-6} cm/sec). These parameters will require special design considerations for the HRC application.

Groundwater in wells MW-25 and MW-28 contains dissolved PCE concentrations ranging from approximately 1,100 to 1,200 ug/L. This area is ideally suited to a field study area because it is easily accessible and the dissolved constituents have been defined both vertically and horizontally. In addition, this area is characterized by a very shallow hydraulic gradient (0.01 ft/ft) and higher hydraulic conductivity (2.8 ft/day or 1 x 10^{-3} cm/sec). These conditions will allow the total plume mass to be effectively targeted for injection of HRC.

In the field test, the on-site areas will include high-pressure HRC injection points in a 50-foot by 40-foot grid at MW-24 and a 60 foot by 50 foot grid at MW-7A, while the off-site area (MW-28) will have a 100-foot by 50-foot grid. The injection points will extend throughout the saturated thickness of the upper ten feet of the PCE affected water-bearing zone. The preliminary design parameters for the HRC field study are listed in Table 1.

TABLE 1 - PRELIMINARY DESIGN PARAMETERS FOR THE HRC TREATMENT FIELD STUDY

Design Parameter	MW-24 Area	MW-7A Area	MW-28 Area
Contaminant Saturated Thickness	10 feet	10 feet	10 feet
Treatment Area Size	50 feet x 40 feet	60 feet x 50 feet	100 feet x 50 feet
Injection Spacing	10 feet	10 feet	10 feet
Number of Injection Points	4 rows of 5 points; 20 total points	5 rows of 6 points; 30 total points	5 rows of 10 points; 50 total points
HRC Application Rate (lbs/vertical ft of injection)	5 lbs/ft (50 lbs/point)	5 lbs/ft (50 lbs/point)	5 lbs/ft (50 lbs/point)
HRC Material Requirement	1,000 lbs	1,500 lbs	2,500 lbs

3.2.1.3 Plume Cut-Off Treatment Using ORC Barrier Design

The reductive dechlorination of PCE should result in the generation of several daughter compounds prior to the formation of the final end products of water, ethane, and carbon dioxide. The common intermediate compounds in the degradation process of PCE are 1,2-cis-DCE and VC. Many studies have documented that these compounds degrade rapidly in an aerobic environment.

In order to insure the existence of a treatment zone for aerobic degradation, an Oxygen Release Compound (ORC) barrier will be installed in the 25- to 35-foot zone downgradient of the field study area. ORC is an injectable compound also manufactured by Regenesis that supplies oxygen to groundwater, creating an aerobic condition to facilitate microbial metabolism of 1,2-cis-DCE and VC.

The 10-foot ORC barrier will provide a minimum of a 100-day retention time based on a conservative average groundwater flow velocity of 0.1 ft/day. The half-life of VC in the terrestrial environment has been demonstrated by numerous investigators to be from 45 to 120 days without enhancement, and 10 to 30 days in an aerobic oxidation environment. With the enhanced ORC metabolism, the buffer zone in the pilot study should provide adequate retention time to treat VC and prevent migration off the barrier boundary. Table 2 contains the preliminary design parameters for the ORC barrier treatment.

TABLE 2 - PRELIMINARY DESIGN PARAMETERS FOR THE ORC BARRIER TREATMENT FIELD STUDY

Design Feature	ORC Barrier Treatment
Contaminant Saturated Thickness	10 feet
Treatment Area	150-foot-long barrier
Delivery Pt. Spacing and Configuration	10 feet-on-center within rows
Number of Injection Points	2 rows of 15 points, 30 total points
ORC Dose Rate (lbs/vertical ft of injection)	4 lbs/ft (40 lbs/point)
ORC Material Requirement	1,200 lbs

3.2.2 In-Situ Bioremediation Implementation

Direct push hydraulic equipment and slurry pumps will be used to deliver the reagents into the subsurface. This approach usually achieves good mixing and spreading into the aquifer. Inland Pollution Services, Inc. (IPSI) will perform the injection of HRC and ORC over 14 8-hour days. A total of 5,000 lbs of HRC will be distributed at 5 lbs/ft within the treatment areas of the 100 plume area borings. 1,200 lbs of ORC will be injected at a rate of 4 lbs/ft along the barrier in 30 borings. HRC will be applied at the site using direct push hydraulic equipment. Drive rods will be pushed to the bottom of the contaminated saturated zone and HRC injected at an average rate of 5 lbs per foot as the rods are withdrawn. The rods will have a minimum inner diameter of 0.625 inches. Given that the boring log for well MW-24 indicates that the drill will need to pass through a 17 ft zone of large, poorly sorted gravel (at 16-33 ft bgs), an alternate means of drilling may be required beyond direct push methods to reach the large depths. A combination of direct push and auger drilling methods as well as packer injection through casing techniques may be employed at these locations on a case by case basis to attain these depths and allow for the pressure injection of HRC. Additionally, some of the locations may require the use of a track-mounted direct push rig due to sloped terrain. The exact installation locations and methods at the site will be determined based on field conditions.

3.2.3 Monitoring Program

An initial round of groundwater sampling of COCs and bioremediation parameters will be conducted prior to the installation of the HRC and ORC materials to establish the baseline conditions. Following their installation, monitoring of selected wells will be conducted to validate the effectiveness of the in-situ bioremediation.

Periodic samples may be taken from the following locations:

- an upgradient location to determine the background groundwater conditions;
- inside the treatment area;
- an appropriate distance downgradient of the treatment area to identify potential residence time requirements for complete biodegradation, the chemical flux, and biodegradation performance; and
- a downgradient compliance point to confirm that off-site migration is not occurring.

3.2.3.1 Installation of Monitoring Points

In addition to the existing monitoring wells, a total of 13 monitoring points will be installed prior to the application of ORC and HRC at the site to evaluate the performance of in-situ bioremediation. At three locations, deeper points will be installed to monitor the vertical containment of the dissolved COCs. The 13 monitoring points will be installed as follows:

- three monitoring points near MW-24: one upgradient and one inside the treatment zone to a depth of 45 feet, and one deeper monitoring point (~75 feet bgs) next to MW-24 downgradient of the treatment zone;
- three monitoring points near MW-7A: one upgradient and two downgradient of the treatment zone to a depth of 25 feet bgs, and one deeper monitoring point (~55 feet bgs) at a downgradient location MW-7A;
- two monitoring points downgradient of the off-site treatment area to a depth of 25 feet and one deeper monitoring point (~55 feet bgs) at a location downgradient of MW-28; and
- two monitoring points downgradient of the ORC barrier to a depth of 25 feet, and one deeper monitoring point (~55 feet bgs) at one of the downgradient locations.

The monitoring points will be constructed of one-inch diameter PVC with 10 feet of 0.020-slot screen and finished with flush-mounted protective covers. They will all be installed as permanent wells, which may be utilized as re-injectable points during full-scale remediation after the conclusion of the pilot study.

In addition, two deep monitoring wells MW-37 and MW-38 will be installed in the vicinity of wells MW-30 and MW-2, respectively. Monitoring well MW-37 will be drilled to approximately 40 feet below grade. Monitoring well MW-38 will be drilled to between 25 to 30 feet below grade. The final depth MW-38 will be field determined. Both wells will be completed with 2-inch-diameter, flush-joint Schedule 40 PVC riser, and 5 feet of machine-perforated PVC well screen with a slot size of 0.020 inch (20 slot). The wells will be finished with flush mounted protective covers and developed until turbid free discharges occur.

3.2.3.2 Monitoring Parameters and Frequency

The monitoring program will employ low-flow sampling techniques and include the measurement of the following field/laboratory parameters for the HRC treatment areas:

- all COCs (using United States Environmental Protection Agency [USEPA] Method 8260);
- bioremediation field redox parameters: pH, temperature, redox potential, dissolved oxygen;
- bioremediation laboratory redox parameters: nitrate, sulfate, sulfide, chloride, dissolved iron(II), dissolved manganese, and alkalinity; and
- dissolved gas end-products: carbon dioxide, methane, ethane, and ethene.

The ORC treatment area will be monitored for field redox parameters, temperature, pH, and dissolved oxygen.

The analytical procedures to be used to analyze the COCs will be consistent with the previously approved *Quality Assurance Project Plan* (QAPP) included in the *Remedial Investigation/Feasibility Study Work Plan* (Shield Environmental, 1998) for the site.

An initial baseline sampling will be conducted on all existing monitoring wells and on the newly installed monitoring points to establish pre-treatment conditions. Samples collected from the newly installed wells MW-37 and MW-38, the newly installed monitoring points (MP-1 through MP-10D) and all existing monitoring wells will be tested for all of the above parameters (see Table 3). Following completion of the pilot study, a round of groundwater samples will be collected in accordance with Table 3.

TABLE 3 - BASELINE SAMPLING LOCATIONS AND PARAMETERS

	Monitoring Location	Parameter
Field Study Monitoring Locations	MP-1 through MP-10D MW-2 MW-7A MW-12 MW-13 MW-15 MW-16 MW-24 MW-25 MW-28 MW-31 MW-32 MW-34 MW-35	• All COCs • Bioremediation Field Redox Parameters • Bioremediation Lab Redox Parameters • Dissolved Gas End-Products
Other Existing Monitoring Locations (not used in Field Study)	MW-3 MW-5 MW-6 MW-8 MW-9 MW-11 MW-14 MW-17 MW-18 MW-19 MW-20 MW-21 MW-22 MW-23 MW-26 MW-27 MW-29 MW-30 MW-33 MW-36 MW-37 MW-38	• All COCs • Bioremediation Field Redox Parameters • Bioremediation Lab Redox Parameters • Dissolved Gas End-Products

During the field study, samples will be regularly collected for analysis from the newly installed monitoring points and the selected existing monitoring wells to validate the enhancement of the biodegradation processes with HRC and to monitor the vertical and horizontal containment of the plume. The monitoring program to be implemented during the field study is summarized in Table 4.

TABLE 4 - MONITORING PROGRAM FOR ORC AND HRC TREATMENT ZONES

Treatment Zone	Monitoring Wells	Sampling Frequency	Analysis Parameters
MW-24 (HRC)	MP-1 MP-2 MP-3D MW-15 MW-24 MW-12 MW-13 MW-16	• First 6 months: bimonthly • Last 6 months, if needed: quarterly	• All COCs • Bioremediation Field Redox Parameters • Bioremediation Lab Redox Parameters • Dissolved Gas End-Products
MW-7A (HRC)	MP-4 MP-5 MP-6S MP-6D MW-7A MW-2 MW-38	• First 6 months: bimonthly • Last 6 months, if needed: quarterly	• All COCs • Bioremediation Field Redox Parameters • Bioremediation Lab Redox Parameters • Dissolved Gas End-Products
MW-25 (HRC)	MP-7 MP-8S MP-8D MW-25 MW-28 MW 34	• First 6 months: bimonthly • Last 6 months, if needed: quarterly	• All COCs • Bioremediation Field Redox Parameters • Bioremediation Lab Redox Parameters • Dissolved Gas End-Products
Barrier (ORC)	MP9 MP-10S MP-10D MW-30 MW-31 MW-32 MW-35 MW-37	• First 6 months: bimonthly • Last 6 months, if needed: quarterly	• Bioremediation Field Redox Parameters • All COCs

At the end of the six-month period, test results will be evaluated against the baseline data, and a status report will be submitted to the NYSDEC for review. If the test results indicate in-situ bioremediation to be successful in reducing dissolved chlorinated hydrocarbons in the aquifer, a quarterly monitoring program will be implemented throughout the remaining test period (two additional sampling events). If the six-month test results show that in-situ bioremediation does not contain or reduce dissolved chlorinated hydrocarbons at the site, then the Contingency Plan, as described in Section 3.1.4, will be implemented.

3.2.3.3 Performance Evaluation Criteria

To assess in-situ bioremediation as the sole remedy for treating the impacted groundwater at the site, the field study will be evaluated according to the following performance evaluation criteria:

- decrease in PCE and TCE concentrations in monitoring wells located within the treatment zones and immediately downgradient;
- reduction of all COC concentrations in monitoring points downgradient of the ORC biobarrier to below SCGs;
- favorable reducing environment, indicated by Redox potential and specific electron acceptors;

- presence of gaseous products such as methane, ethane, and ethene; and
- stability of the dissolved-phase PCE plume after the treatment.

The performance criteria are based on the current understanding of the site conditions and contaminant profiles, and are subject to modification based upon the results of the baseline sampling. The baseline results along with any modification of the performance criteria will be submitted to the NYSDEC for review.

3.2.4 Field Study Contingency Plan

A contingency plan will be prepared once the remedial design work plan has been approved by the NYSDEC. The plan will be ready for implementation in the event that in-situ bioremediation proves to be ineffective in remediating the dissolved constituents in the groundwater. A draft contingency plan will be completed 90 days after approval of the remedial design work plan by the NYDEC. The draft contingency plan will be submitted to the NYDEC for review and approval. This plan will include a hydraulic control system to mitigate any potential off-site plume migration. The number of wells, an estimate of their respective pumping rates, and associated equipment will be determined based on aquifer parameters collected during the RI and the bioremediation field study. Pumping rates will be adjusted after system startup.

3.2.5 Pre-Design Report Submittal

The field study results will be analyzed and summarized in a written report (the Pre-Design Report) four weeks after receipt of the final laboratory data. The report will include the following:

- date and descriptions of the field activities;
- description of test design and procedures;
- discussion of test results based on the performance evaluation criteria;
- calculation of design parameters and estimation of removal rates on individual constituents of concern;
- feasibility of a full-scale in-situ bioremediation system to remediate the dissolved-phase plume on site and off site; and
- chain-of-custody and field measurement records and laboratory results.

The Pre-Design Report will also provide a plan for preparation and submission of the "Remedial Design Package" that includes specifications and schedule for implementing the selected remedy described in the ROD.

3.3 Remedial Design Package Preparation and Submittal

The remedial design for soil and groundwater will begin upon NYSDEC's approval of the respective Pre-Design Reports. Since the SVE pilot study is much shorter in duration than the in-situ bioremediation field study, the Soil Remediation Pre-Design Report will be submitted much sooner than the Groundwater Pre-Design Report. The subsequent Remedial Design Package submittal will then contain specifications only for the soil remediation. Implementation of the soil remedial action will begin once the NYSDEC has approved the soil portion of the remedial design package. Specifications for the groundwater remediation system will be included in the Remedial

Design Package Addendum, which will be prepared and submitted upon approval of the Groundwater Remediation Pre-Design Report. Implementation of the groundwater remedial action will begin upon the NYSDEC's approval of this groundwater portion of the remedial design package. The Remedial Design Package will include the technical specifications and design drawings for the selected remedial actions, an operation and maintenance (O&M) program, a Contingency Plan, a site-specific Health and Safety Plan, and a Citizen Participation Plan.

3.3.1 Technical Specifications and Design Drawings

The technical specifications of the full-scale remediation system will be prepared to include a detailed engineering design of the selected remedial actions, the material and schedule of the associated equipment, controls, equipment enclosure, operational monitoring systems, manifold piping, etc. A detailed set of construction drawings will also be prepared to show site plans, well and equipment details, and sections of the proposed equipment and work.

3.3.2 Operation and Maintenance Program

The O&M Program will be developed to monitor the progress of the remedial actions and maintain optimal performance of the remedial system. The plan will include:

- background site information and the rationale for the components of the O&M plan;
- operating procedures;
- a schedule for the periodic sampling of groundwater and soil vapor in the remedial area;
- parameters, conditions, procedures, and protocols for determining the effectiveness of the RD;
- reporting requirements; and
- conclusions and recommendations.

3.3.3 Contingency Plan

A contingency plan will be prepared in the event that any element of the RD fails to achieve its objectives or otherwise fails to protect human health or the environment. This plan will contain alternative methods for treating the soil vapor beneath the building and the impacted groundwater plume if the chosen technology should fail to achieve the remedial objectives. If in-situ bioremediation is prescribed in the RD, a hydraulic control system will be included in this contingency plan.

3.3.4 Health and Safety Plan

The site-specific Health and Safety Plan will be prepared for the protection of persons at and in the vicinity of the site during the construction and O&M of the remedial system. It will be prepared in accordance with 29 CFR 1910 by a certified health and safety professional.

3.3.5 Citizen Participation Plan

The Citizen Participation Plan will include the appropriate activities outlined in the NYSDEC's publication entitled "Citizen Participation in New York's Hazardous Waste Site Remediation Program: A Guide Book" (June 1998) and any subsequent revisions, and 6 NYCRR Part 375.

3.3.6 Remedial Design Package Submittal

The components described above will be compiled into the Remedial Design Package, which will be submitted to the NYSDEC for review and comment. The Remedial Design Package will include the following:

- detailed descriptions of the remedial objectives and implementation of the selected remedial alternative to achieve those objectives;
- design drawings, specifications, and documents prepared, signed, and sealed by a New York Professional Engineer and in compliance with all local, state, and federal laws, rules, and regulations;
- a detailed time schedule for implementation of the RD;
- parameters, conditions, procedures, and protocols to determine the effectiveness of the RD, including a schedule for the periodic sampling of groundwater monitoring wells on site and off site;
- O&M and monitoring activities to be implemented after approval of the construction of the RD, including the duration of the activities and a specific description of the criteria to be used to decide when an operation of the remedy may be discontinued;
- a contingency plan in the event of a failure of any element of the RD to achieve its objectives;
- a Health and Safety Plan; and
- a Citizen Participation Plan.

The RD will be prepared by and bear the signature and seal of a professional engineer who will certify that the RD was prepared in accordance with the Order on Consent (NYSDEC, 2001) and the ROD (NYSDEC, 2000).

4. Schedule and Submittals

Upon the NYSDEC's written approval of this RD Work Plan, the work plan will be implemented in accordance with the schedule presented in this section. The schedule for the preparation and submittal to the NYSDEC of the plans and specifications for implementation of the RD and progress reports during this phase is summarized on Figure 5. The schedule presented below and on Figure 5 is based on a 12-month in-situ bioremediation field study.

The deliverables and their dates of submission to the NYSDEC are listed below:

- Remedial Design Work Plan - June 8, 2001
- Pilot Study Design - July 6, 2001
- Soil Remediation Pre-Design Report - November 23, 2001
- In-Situ Bioremediation Field Study Contingency Plan - October 26, 2001*
- In-Situ bioremediation Field Study Status Report - March 15, 2002*
- Groundwater Remediation Pre-Design Report - October 18, 2002
- Remedial Design Package - March 29, 2002
- Remedial Design Package Addendum - February 21, 2003

**Tentative submittal dates; exact dates will depend on actual start date of the in-situ bioremediation field study*

Copies of final work plan and report submittals will be distributed as follows:

- Four copies (one unbound) to:

  Andrew English
  Division of Environmental Remediation
  New York State Department of Environmental Conservation
  50 Wolf Road
  Albany, New York 12233-7010

- One copy to:

  Regional Director
  New York State Department of Environmental Conservation, Region 7
  615 Erie Boulevard West
  Syracuse, New York 13204-2400

- Two copies to:

  G. Anders Carlson, Ph.D.
  Director, Bureau of Environmental Exposure Investigation
  New York State Department of Health
  Flanigan Square
  547 River Street
  Troy, New York 12180-2216

- One copy to:

  Maura C. Desmond, Esq.
  Division of Environmental Enforcement
  New York State Department of Environmental Conservation
  270 Michigan Avenue
  Buffalo, New York 14203

Each report submitted to the NYSDEC will be reviewed and either approved or disapproved in writing. Once a report is approved, it will be incorporated into and become an enforceable part of the Order on Consent. Should the NYSDEC disapprove a report submittal, a revised submittal addressing all of the NYSDEC's reasons for disapproval will be submitted within 45 calendar days of receiving the written notice.

Within 30 days of the NYSDEC's approval of any submitted report, a computer readable magnetic media copy of the approved report in American Standard Code for Information Interchange (ASCII) format will be submitted to the Director of the Division of Environmental Remediation.

Ninety days following construction of the RD, a detailed post-remedial O&M Plan, as-built drawings, and a final engineering report will be submitted to the NYSDEC. Within 30 days of the NYSDEC's approval of the submittal, one microfilm copy (16-mm roll film M type cartridge) of these drawings and submittals will be prepared. The microfilm copy will be submitted to the NYSDEC, as well as the Division of Environmental Remediation, upon request.

5. References

Gannett Fleming, Inc. November 9, 2000. Letter to Mr. James A. Moras, P.E. of the New York State Department of Environmental Conservation (NYSDEC), regarding *Universal Instruments Corporation, Kirkwood, Broome County, New York, Dover Electronics Site (Site Number 7-04-026).*

Hagopian Engineering Associates. October 8, 1990. *Environmental Site Investigation for Dover Electronics Company: DEM-East and Kirkwood North Locations.*

Hagopian Engineering Associates. August 29, 1991. *Phase II Environmental Site Investigation for Dover Electronics.*

New York State Department of Environmental Conservation (NYSDEC). March 2000. *Record of Decision: Dover Electronics Site, Kirkwood (T), Broome County, Site Number 7-04-026.*

New York State Department of Environmental Conservation (NYSDEC). January 2001. *Order on Consent: Index #B7-0515-97-05.*

Shield Engineering Associates, Inc. July 2000. *Feasibility Study Report.*

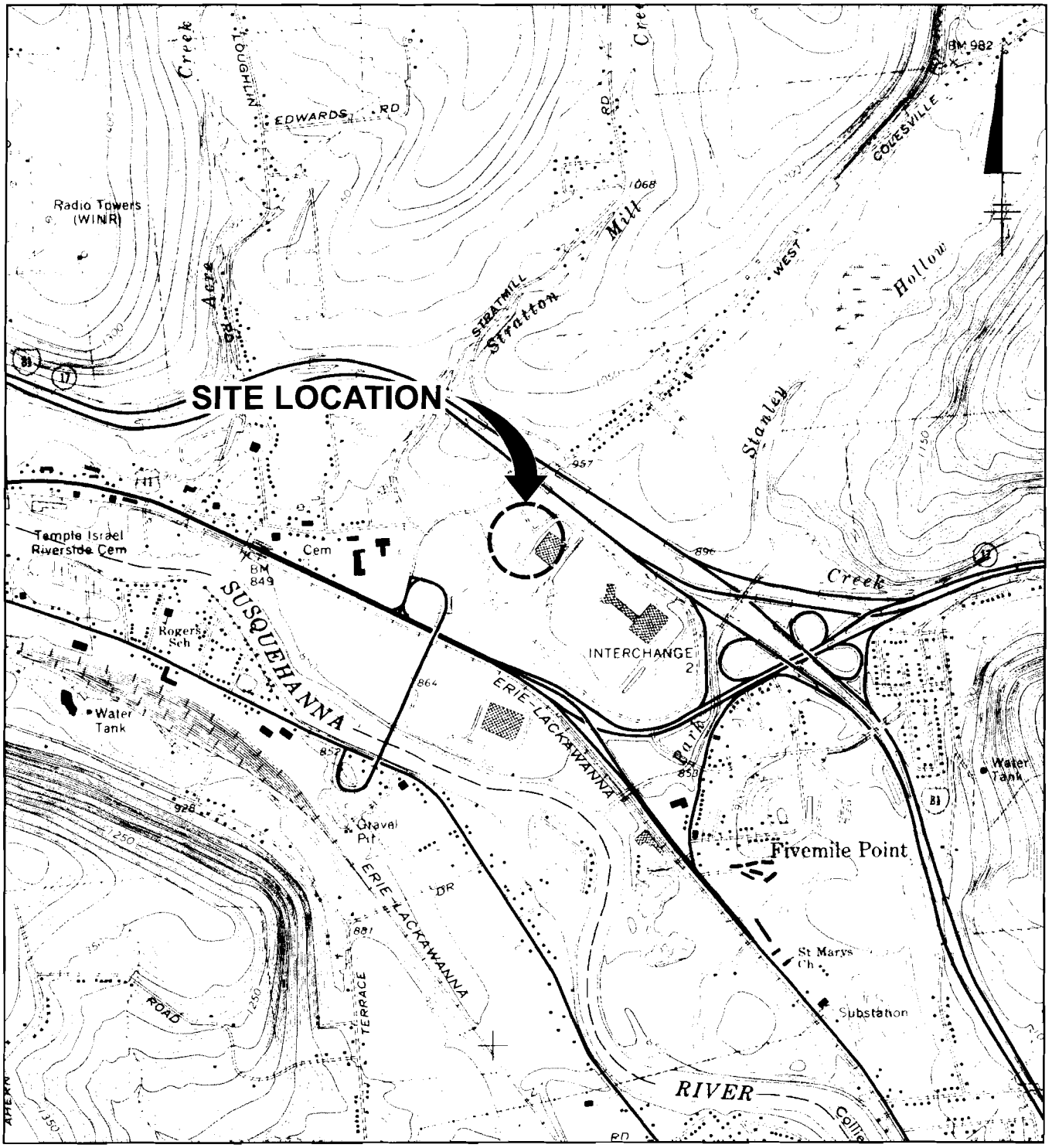
Shield Environmental Associates, Inc. October 14, 1998. *Remedial Investigation/Feasibility Study Work Plan.*

Shield Environmental Associates, Inc. February 20, 1999. *Baseline Summary Report.*

Shield Environmental Associates, Inc. February 20, 1999. *Addendum Baseline Summary Report.*

Shield Environmental Associates, Inc. July 2000. *Remedial Investigation Report.*

FIGURES



REFERENCE: Base Map Source USGS 7.5 Minute Quad. Series Binghamton East, New York, 1968, Photorevised 1976.

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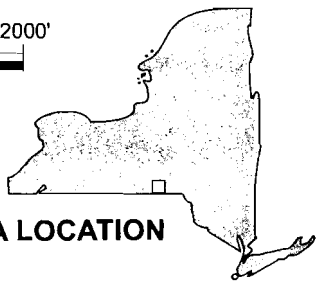
Approximate Scale: 1" = 2000'



AREA LOCATION

UNIVERSAL INSTRUMENTS CORPORATION
KIRKWOOD, NEW YORK

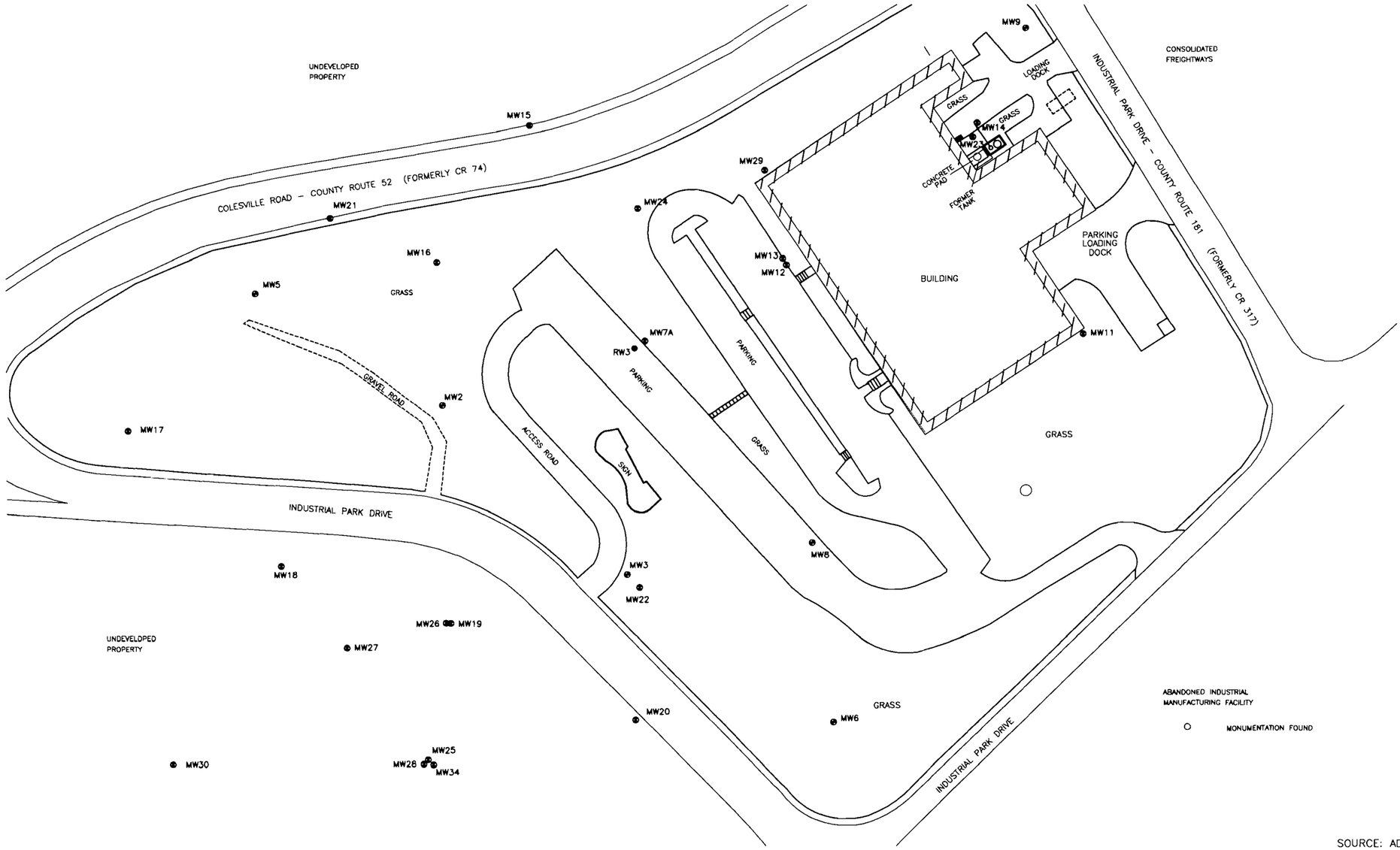
REMEDIAL DESIGN WORK PLAN

LOCATION MAP

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 1

01/01 SYR-D54-DJH
05203001/05203n01.cdr



SOURCE: ADAPTED FROM FIGURES FROM REMEDIAL INVESTIGATION REPORT, SHIELD ENVIRONMENTAL ASSOCIATES, INC., JULY 2000.

X: NONE
L: REF*=OFF
P: STD-PGP/DL
02/06/01 CRA-54-TLF RLP
05203001/05203B01.DWG

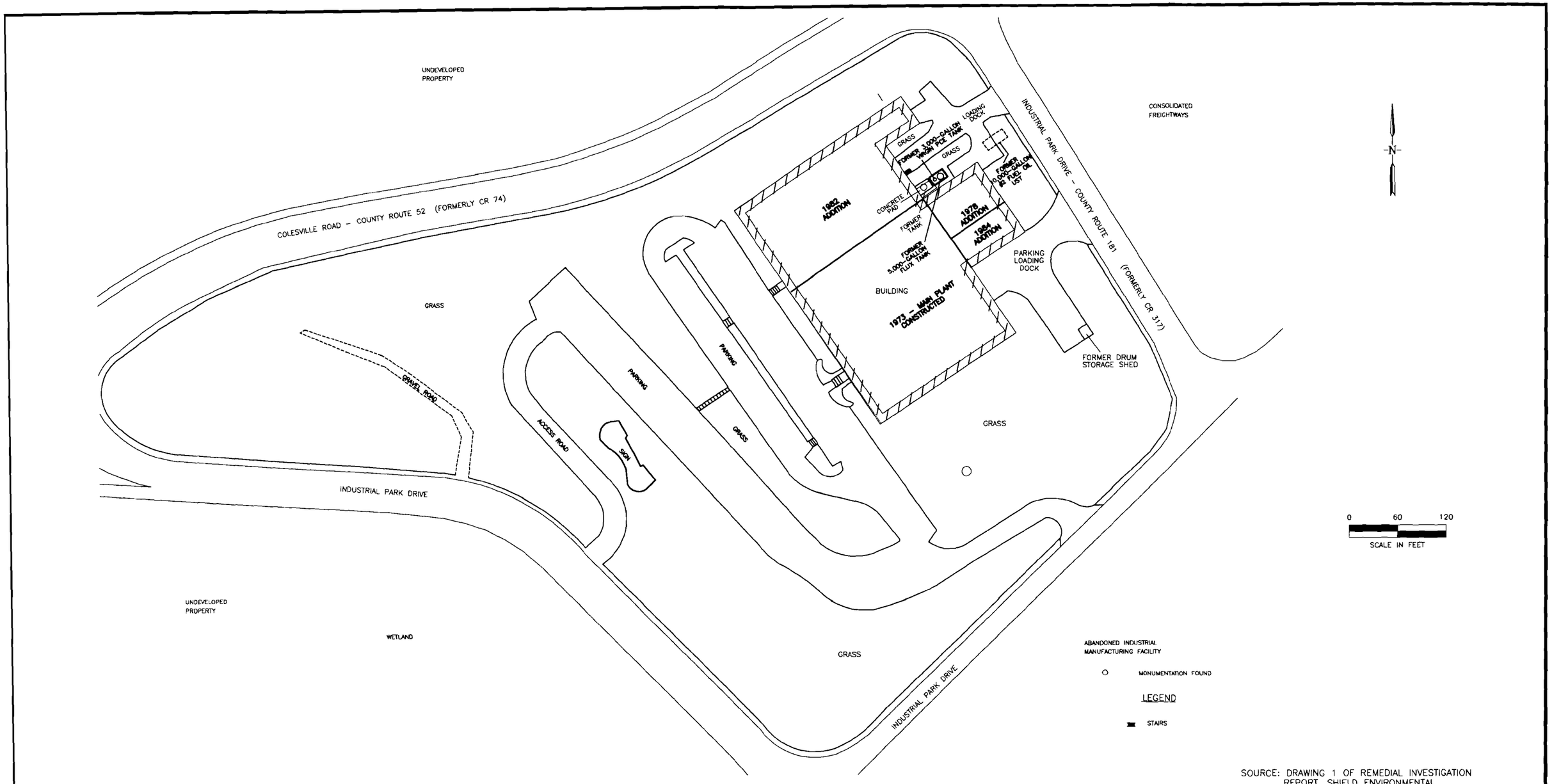
UNIVERSAL INSTRUMENTS CORPORATION
KIRKWOOD, NEW YORK

REMEDIAL DESIGN WORK PLAN

SITE MAP AND MONITORING WELL LOCATIONS

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE **2**



SOURCE: DRAWING 1 OF REMEDIAL INVESTIGATION REPORT, SHIELD ENVIRONMENTAL ASSOCIATES, INC., JULY 2000.

UNIVERSAL INSTRUMENTS CORPORATION
KIRKWOOD, NEW YORK

REMEDIAL DESIGN WORK PLAN

SURROUNDING PROPERTIES, BUILDING ADDITIONS AND HISTORICAL SITE FEATURES

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 3

X: NONE
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P: STD-PCP/DL
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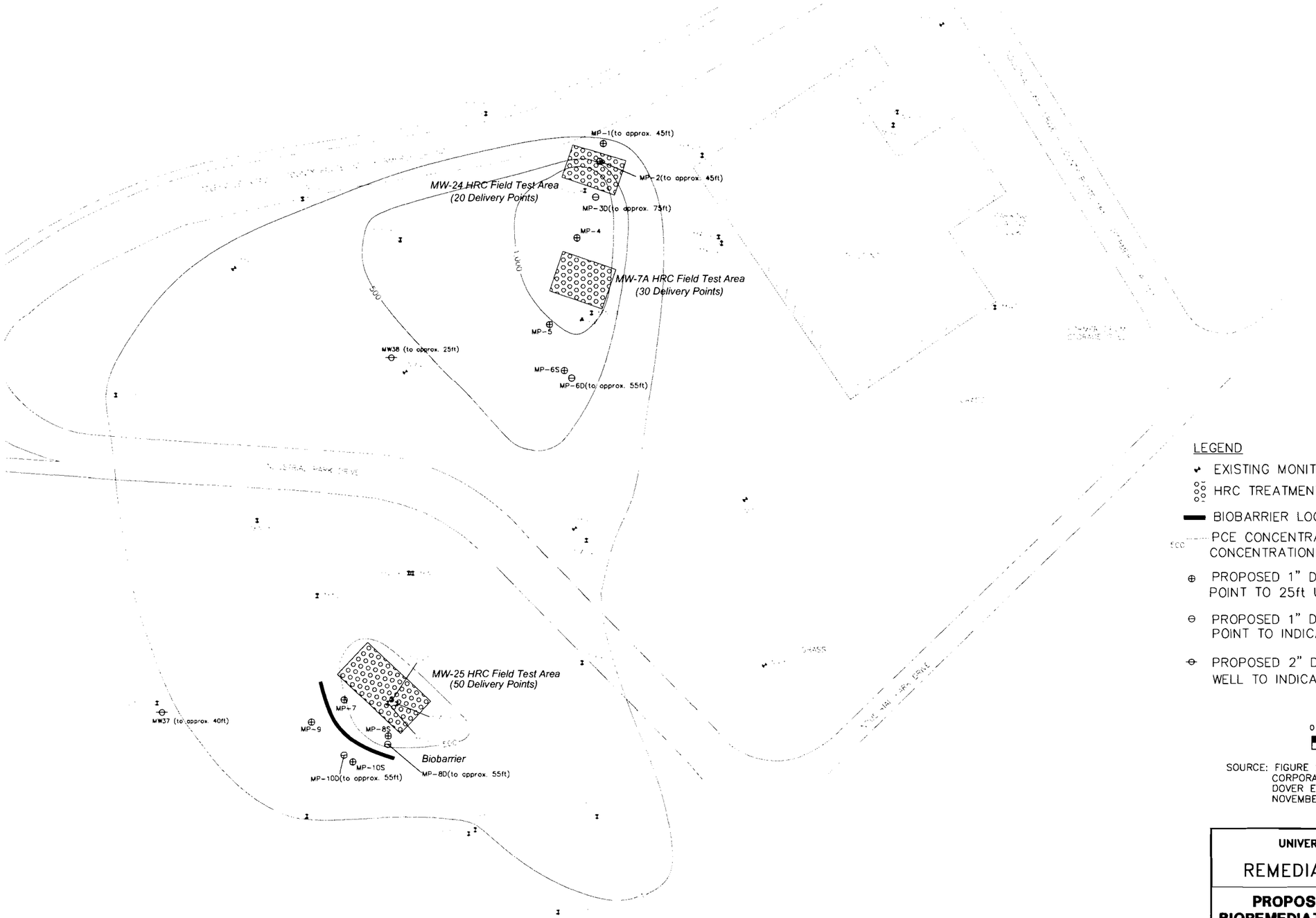

LEGEND

- EXISTING MONITORING WELL
- HRC TREATMENT LOCATION
- BIOBARRIER LOCATION
- 500 PCE CONCENTRATION CONTOUR LINE CONCENTRATIONS IN MICROGRAMS PER LITER
- ⊕ PROPOSED 1" DIAMETER, SHALLOW MONITORING POINT TO 25ft UNLESS OTHERWISE INDICATED
- ⊖ PROPOSED 1" DIAMETER, DEEP MONITORING POINT TO INDICATED DEPTH
- ⊖ PROPOSED 2" DIAMETER, DEEP MONITORING WELL TO INDICATED DEPTH

0 60 120

SCALE IN FEET

SOURCE: FIGURE 2 OF LETTER REPORT "UNIVERSAL INSTRUMENTS CORPORATION, KIRKWOOD, BROOME COUNTY, NEW YORK: DOVER ELECTRONICS SITE", GANNETT FLEMING, INC., NOVEMBER 9, 2000.

UNIVERSAL INSTRUMENTS CORPORATION
KIRKWOOD, NEW YORK

REMEDIAL DESIGN WORK PLAN

PROPOSED GROUNDWATER IN-SITU BIOREMEDIATION FIELD STUDY TREATMENT ZONE AND MONITORING POINTS

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 4

X: NONE
L: REF*=OFF
P: STD-PCP/DL
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05203002/05203W05.DWG

FIGURE 5
PROPOSED REMEDIAL DESIGN SCHEDULE

UNIVERSAL INSTRUMENTS CORPORATION
KIRKWOOD, NEW YORK

ID	Task Name	Duration
1	**RD Work Plan**	**22.4 wks**
2	Preparation of Draft RD Work Plan	4 wks
3	NYSDEC Review of Draft RD Work Plan	5 wks
4	Revision of Draft RD Work Plan	5 wks
5	NYSDEC Review of Revisions to Draft RD Work Plan	5 wks
6	Submittal of Final RD Work Plan to NYSDEC	0 wks
7	**Pre-Design**	**95 wks**
8	**Pilot Study Design**	**8 wks**
9	Preparation of Draft Pilot Study Design	4 wks
10	NYSDEC Review of Draft Pilot Study Design	2 wks
11	Revision of Draft Pilot Study Design	2 wks
12	Submittal of Final Pilot Study Design to NYDEC	0 wks
13	**Soil Remediation Pre-Design**	**38 wks**
14	SVE Pilot Study Construction and Installation	4 wks
15	SVE Pilot Study Implementation	24 wks
16	Preparation of Draft Soil Remediation Pre-Design Report	4 wks
17	NYSDEC Review of Draft Soil Remediation Pre-Design Report	4 wks
18	Revision of Draft Soil Remediation Pre-Design Report	2 wks
19	Submittal of Final Soil Remediation Pre-Design Report	0 wks
20	**Groundwater Remediation Pre-Design**	**91.6 wks**
21	In-Situ Bioremediation Field Study Construction and Installation	4 wks
22	In-Situ Bioremediation Field Study Implementation	52 wks
23	Preparation of Draft Field Study Contingency Plan	10 wks
24	NYSDEC Review of Draft Field Study Contingency Plan	4 wks
25	Revision of Draft Field Study Contingency Plan	2 wks
26	Submittal of Final Field Study Contingency Plan to NYSDEC	0 wks
27	Preparation of In-Situ Bioremediation Field Study Status Report	5 wks
28	Submittal of In-Situ Bioremediation Field Study Status Report to NYSDEC	0 wks
29	Preparation of Draft Groundwater Remediation Pre-Design Report	6 wks
30	NYSDEC Review of Draft Groundwater Remediation Pre-Design Report	4 wks
31	Revision of Draft Groundwater Remediation Pre-Design Report	2 wks
32	Submittal of Final Groudnwater Remediation Pre-Design Report to NYSDEC	0 wks
33	**Remedial Design**	**47 wks**
34	**Soil Remedial Design**	**18 wks**
35	Preparation of Soil Remediation Technical Specifications and Design Drawings	8 wks
36	Preparation of Soil Remediation O&M Program	8 wks
37	Preparation of Soil Remediation Contingency Plan	4 wks
38	Preparation of Soil Remediation Health and Safety Plan	4 wks
39	Preparation of Citizen Participation Plan	4 wks
40	Preparation of Draft Remedial Design Paackage	5 wks
41	NYSDEC Review of Draft Remedial Design Package	4 wks
42	Revision of Draft Remedial Design Package	4 wks
43	Submittal of Final Remedial Design Package to NYSDEC	0 wks
44	**Groundwater Remedial Design**	**18 wks**
45	Preparation of Groundwater Remediation Technical Specifications and Design Drawings	10 wks
46	Preparation of Groundwater Remediation O&M Program	10 wks
47	Preparation of Groundwater Remediation Contingency Plan	4 wks
48	Preparation of Groundwater Remediation Health and Safety Plan	4 wks
49	Preparation of Draft Addendum to the Remedial Design Paackage	5 wks
50	NYSDEC Review of Draft Addendum to the Remedial Design Package	4 wks
51	Revision of Draft Addendum to the Remedial Design Package	4 wks
52	Submittal of Final Addendum to the Remedial Design Package to the NYSDEC	0 wks

Project: k_schedule
Date: Tue 6/19/01

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