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HAZARDOUS WASTE REMEDIATION
NYSDEC REGION 1

INVESTIGATION WORK PLAN

Former Thypin Steel, Inc. Plant
Manorhaven, New York

September 26, 2000

Prepared for:

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TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

On behalf of MBA-Manorhaven, LLC, Roux Associates, Inc. (Roux Associates) has prepared this Investigation Work Plan (Work Plan) for the former Thypin Steel, Inc. (Thypin Steel) Plant in Manorhaven, New York (Site). The Work Plan objectives are designed to develop additional Site-specific data to supplement previous investigation results and to develop remedial alternatives. The Work Plan has been prepared as Appendix B of the Voluntary Cleanup Agreement (VCA) between the New York State Department of Environmental Conservation and MBA-Manorhaven, LLC.

A significant amount of soil and groundwater quality data have been developed during several investigations and remedial activities performed at the Site. The results of the previous investigations indicate that soil and groundwater quality impacts have been identified at levels that warrant an additional investigation. In general, metals (primarily background) and total petroleum hydrocarbon (TPH) impacts have been identified in soil at the former plating area, while base neutral compound (BN) impacts in soil have been identified at former UST Area TP-9. Chlorinated volatile organic compounds (CVOCs) have been detected in groundwater at concentrations that exceed the NYSDEC Ambient Water-Quality Standards and Guidance Values (AWQSGVs) throughout most of the Site. However, CVOCs in soil were only detected in the vicinity of the former plating area, and their concentrations were significantly below the NYSDEC Recommended Soil Cleanup Objectives (RSCOs).

The results of the previous investigations coupled with the results of this investigation will be used to perform an exposure assessment and to develop remedial alternatives (e.g., phytoremediation and natural attenuation with monitoring) for the affected media. Based on the results of the exposure assessment and the proposed remedial alternatives, MBA-Manorhaven, LLC will recommend to the NYSDEC the remedial alternatives that the best support the intended future residential Site use.

The remaining sections of this Work Plan include:

- Section 2.0 – Pertinent Background Information;
- Section 3.0 – Investigation Rationale;
- Section 4.0 – Scope of Work; and
- Section 5.0 – Schedule.

This Work Plan also includes the following Project Operation Plans (POPs):

- Sampling and Analysis Plan (SAP);
- Quality Assurance Project Plan (QAPP); and
- Health and Safety Plan (HASP).

The SAP, QAPP and HASP are provided in Appendices A through C, respectively. The SAP describes the types of soil and groundwater samples to be collected and the procedures to be followed (e.g., drilling, decontamination, and sample collection). The QAPP presents the organization, objectives, functional activities and specific quality assurance/quality control (QA/QC) activities associated with the investigation. The HASP has been prepared in accordance with the Occupational Safety and Health Administration (29 CFR Part 1910.120).

2.0 PERTINENT BACKGROUND INFORMATION

A description of the pertinent background information is provided below, which includes the Site setting and history and previous investigations/remedial activities.

2.1 Site Setting and History

The former Thypin Steel property is located at 5 Sagamore Hill Drive in the Village of Manorhaven, New York (Figure 1). The Site is bordered to the north by Yennicock Avenue, to the south by Toms Point Lane, to the east by Sagamore Hill Drive and to the west by Manhasset Bay (Figure 2). The property is approximately 11 acres in size, and is currently vacant and no buildings are present.

The Site history was developed based on Mr. Richard Thypins' (MBA-Manorhaven, LLC) knowledge of the Site and the interpretation of fire insurance maps (i.e., Sanborn Maps) and aerial photographs. The Sites' past and current owners and operators are provided in Tables 1 and 2.

2.2 Previous Environmental Investigations/Remedial Activities

Previous environmental investigations/remedial activities were completed at the Site as part of the building demolition and potential property transfer. A brief summary of the previous environmental investigations/remedial activities and key results is provided below.

Environmental Assessment, Existing Thypin Steel Site,
Port Washington (Manorhaven), New York
Soil Mechanics Drilling Corporation, May 1989

A Phase I Environmental Site Assessment (ESA) was performed to characterize the environmental conditions at the Site. The scope of work included a visual inspection of the Site, a regulatory agency file review, a soil gas survey, soil boring and sampling, monitoring well installation, water-level measurements and ground-water sampling. A total of 35 soil gas points and 18 soil borings were sampled, while six monitoring wells were installed and groundwater sampled. Four of the 18 soil borings were sampled through drywells. One round of water-level measurements was collected from the six monitoring wells. The soil and groundwater samples were analyzed for volatile organic compounds (VOCs), metals and TPH. The soil gas was screened for organic compounds in the field using an organic vapor analyzer (OVA).

The key results of this Phase I ESA are summarized below.

- Based on a Site inspection, the buildings were present. Additionally, 44 drywells, 78 empty drums (previous contents noted to be laticrete, soluble oil, anti-freeze and deoxider), 45 full drums (noted contents were oakite, hydraulic oil, polyethylene and trichloroethene [TCE]), stained pavement and surface soil, four electrical transformers, two fuel oil above ground storage tanks, trash, wood and metal debris, abandoned cars, stockpiles of asphalt, two truck bays containing floor drains, and two drum storage areas were observed.

- The results of the regulatory agency file review indicated that no violations existed for the Site, and that the Nassau County Department of Health (NCDOH) had inspected the sewage pump station, which they viewed as in "disrepair."

- Based on an inspection of the soil, the Site was underlain by fill material comprised of sand, silt and gravel, which overlies native soil comprised of sand and trace silt and gravel. Based on the geologic logs, the fill material ranged in thickness from 2 feet (ft) to 11 ft.

- The results of the soil gas survey indicated that concentrations of organic compounds ranged from not detected to 100 parts per million (ppm) at a depth of 3 ft to 4 ft below land surface (bls). ✓P-11 ✓P-15 Ph 1 P46

- No organic vapors were detected using an OVA in any of the soil samples collected at the Site.

- The soil quality results indicated that beryllium and zinc were the only metals detected above the NYSDEC RSCOs at the Site. Specifically, these metals were detected in soil throughout the Site, outside of the former building footprint. Additionally, these metals were distributed through the soil column from 2 ft to 10 ft bls, which was above groundwater.

- The soil quality results indicated that VOCs were detected in soil at concentrations below the NYSDEC RSCOs at the Site. TPH concentrations in the soil ranged from not detected to 310 ppm.

- The soil quality results from four drywells (B-90, B-100, B-110 and B-120) indicated that concentrations of six metals (cadmium, chromium, copper, mercury, nickel and zinc) were detected above the NYSDEC RSCOs. (No sample depths were reported by Soil Mechanics Drilling Corporation.) One VOC (xylene at 1900 parts per billion [ppb]) was detected at a concentration above its NYSDEC RSCO of 1200 ppb in Drywell B-90. TPH concentrations in the drywell material ranged from 620 ppm to 140,000 ppm.

- Depth to groundwater ranged from 8 ft to 10 ft bls. The estimated ground-water flow direction was west-southwest toward Manhasset Bay, based on one round of water-level measurements.

- The ground-water quality results indicated that the concentrations of metals detected in groundwater were below the NYSDEC AWQSGVs. Two CVOCs (tetrachloroethene [PCE] and TCE) were detected in groundwater above their NYSDEC AWQSGVs in four of six monitoring wells at the Site. TPH was not detected in any of the ground-water samples.

Drywell Excavation and Removal Program
Soil Mechanics Drilling Corporation, January 14 through February 25, 1992

A drywell excavation and removal program was performed at the Site. A total of 77 drywells were excavated and removed. Most of the drywells were located within the northwestern portion of the Site (former leaching field), while a few were scattered throughout the Site. Prior to excavation activities, each drywell was inspected for the presence of liquids, and subsequently pumped out if present. As the excavation proceeded, the soil was screened for VOCs using a photoionization detector (PID). If the field screening or results of visual inspection indicated that the soil was contaminated, those soils were then segregated for proper disposal.

The key results of the Drywell Excavation and Removal Program are summarized below.

- Six of the 77 drywells did contain liquids, which were subsequently pumped out into six 55-gallon drums. These drums were disposed offsite.

- A total of 737.5 cubic yards of soil and demolition debris (i.e., drywell structures) were disposed offsite as construction and demolition debris. Please note that any soil that was considered contaminated was disposed offsite separately from the construction and demolition debris.

- After each of the excavations was completed, the excavations were backfilled with clean sand.

Underground Storage Tank Closure Reports
Soil Mechanics Drilling Corporation, February 10, 1992 and March 25, 1992

An Underground Storage Tank (UST) Removal Program was performed to remove 12 USTs (i.e., eight fuel oil, three gasoline, and one diesel) ranging in capacity from 100 gallons to 25,000 gallons. The NYSDEC or the NCDOH inspected the excavations for impacts.

The key results of the UST Removal Program are summarized below.

- No impacts were identified in any of the UST excavations.
- The NYSDEC or the NCDOH approved the backfilling of each former UST excavation.

Water-Level Measurement Study
Soil Mechanics Environmental Services, October 30, 1997

Continuous water-level measurements were collected from three monitoring wells for approximately one month using data loggers to determine the minimum and maximum water-level elevations at the Site.

The key results of the Water-Level Measurement Study are summarized below.

- The results of the continuous water-level measurements indicated a daily tidal fluctuation that ranged from 0.04 ft to 0.16 ft at the Site.
- The results also indicated a monthly ground-water level fluctuation of 0.1 ft to 0.2 ft at the Site.

Phase I Environmental Site Assessment
CA Rich Consultants, Inc., February 8, 1999

A Phase I ESA was performed to characterize the environmental conditions at the Site. The scope of work for this Phase I ESA included a visual inspection of the Site, a regulatory agency file review, a historical Site review using fire insurance maps and aerial photographs, and an inspection of subsurface materials from seven test pits and analysis of two soil samples.

The key results of this Phase I ESA are summarized below.

- Based on the Site inspection, the buildings were no longer present, the Site contained overgrown brush and some trees, portions of the former building footprint were covered with crushed stone and gravel, and no surficial staining was observed. Two manholes were identified, one on the eastern and one on the western portion of the Site. The function of these manholes is unknown. A total of three monitoring wells were identified along the eastern, northwestern and southern Site boundaries, which were used to determine the depth to groundwater beneath the Site.
- No impacts to the soil were identified within Test Pits TP-1 through TP-5 and TP-7.
- The results of the subsurface material inspection indicated that only the soil from Test Pit TP-6, located within the area of the former metals plating, contained grey and blue

staining. The staining was identified in a 1 ft to 2 ft layer from approximately 10 ft to 15 ft bls. At approximately 20 ft bls (immediately above groundwater), black sand and silt were encountered that contained petroleum odors. A sample from each of the two stained areas was analyzed; the soil with blue and grey staining for metals and the black-stained soil for TPH.

- The soil quality results of the grey and blue stained soil indicated that metals concentrations of arsenic, cadmium, copper, chromium, lead, nickel and zinc were detected above the NYSDEC RSCOs. The soil quality results of the black stained soil indicated that petroleum hydrocarbons (lubricating oil) were present.

Phase II Environmental Investigation
CA Rich Consultants, Inc., April 12, 1999

A Phase II Environmental Investigation was performed to further address potential environmental concerns identified during the Phase I ESA performed by CA Rich Consultants, Inc. The scope of work for this Phase II Investigation included the excavation of 10 test pits from land surface to groundwater, which CA Rich anticipated to be 20 ft bls. Five of the 10 test pits (TP-6A through TP-6E) were excavated surrounding former Test Pit TP-6, which the soil quality results during the Phase I ESA indicated that metals concentrations were detected above the NYSDEC RSCOs. The remaining test pits (TP-7 through TP-11) were located throughout the Site. Soil samples collected were analyzed for VOCs, semivolatile organic compounds (SVOCs), and metals.

One ground-water sample (GW-01) was collected adjacent to the northern portion of the former plating area using the Geoprobe™ method. This ground-water sample was analyzed for VOCs, SVOCs, and metals.

The key results of this Phase II Investigation are summarized below.

- No impacts to the soil were identified within Test Pits TP-6A, TP-6B, TP-6C, TP-6E, TP-7, TP-8 and TP-11.
- The remnants of an abandoned drain were identified in Test Pit TP-6D at approximately 15 ft bls, which according to CA Rich Consultants, Inc., was above groundwater. Please note that groundwater was approximately 8 ft to 10 ft bls as measured in monitoring wells during other previous investigations and during the Roux Associates' limited ground-water investigation. Therefore, it is our opinion that the remnants of the abandoned drain and soil samples collected for laboratory analysis were in groundwater. Blue-green and grey sludge was encountered within a cement collar and brick wall. A

sample of the sludge was analyzed, and the results indicated that CVOCs, SVOCs, metals and polychlorinated biphenyls (PCBs) were detected. Metals were the only constituents to exceed the NYSDEC RSCOs. Even though the CVOCs were detected below their respective regulatory guideline, their presence in a saturated soil sample appeared to be a reflection of ground-water quality. Additionally, the sample was tested using the Toxicity Characteristic Leaching Procedure (TCLP), and the results indicated that the sample was non-hazardous. The test pit was then extended to the north, west and east, but no visual impacts were identified.

- The soil encountered in Test Pits TP-9 and TP-10, located near the former USTs, indicated staining. A sample from each test pit was analyzed, and the results indicated that one SVOC (i.e., chrysene) in Test Pit TP-9 and metals in soil from both test pits were detected above the NYSDEC RSCOs.
- The ground-water quality results near the former plating area indicated detections of CVOCs, SVOCs, and metals. CVOCs were the only constituents detected above the NYSDEC AWQSGVs.

Limited Ground-Water Quality Investigation
Roux Associates, Inc., June 7, 1999

A limited ground-water quality investigation was performed to further evaluate the CVOCs previously detected in on-site groundwater and to determine if there was an off-site groundwater source of CVOCs impacting the Site. The scope of work for this investigation included water-level measurements and ground-water sampling. Please note that Monitoring Wells MW-6, MW-10, MW-14, MW-17 and MW-20 were no longer present at the Site.

Water-level measurements were taken from Monitoring Wells MW-1 and MW-2 using an electronic measuring scope and Staff Gauge-1. Staff Gauge-1 was installed into Manhasset Bay, adjacent to the western portion of the Site. Please note that the installation of the staff gauge was deemed necessary since Monitoring Well MW-3 was dry and, therefore, a water-level measurement could not be taken along the western Site boundary.

A total of 13 ground-water samples were collected from 11 Geoprobe™ points throughout the Site and the two existing functional monitoring wells (i.e., MW-1 and MW-2). Each ground-water sample was inspected for impacts (i.e., sheen, odors and PID readings). The ground-water samples were analyzed for CVOCs only using the United States Environmental Protection

Agency (USEPA) Method 8260. Please note that the sampling was intended as a screening technique.

Additionally, the 11 Geoprobe™ points, the three monitoring wells and the staff gauge were surveyed for their measuring point or land surface elevation and location by a New York State-licensed surveyor.

The key results of this investigation are summarized below.

- Due to the limited water-level data (i.e., two wells and one staff gauge), a ground-water flow map could not be accurately drawn. However, since the water-level measurements made in MW-1 and MW-2 were generally consistent with previous water-level measurements made in other wells at the Site, the estimated ground-water flow direction was west-southwest toward Manhasset Bay.

- During the sampling, the groundwater was inspected, and the results indicated that no sheens or odors were present and PID readings were 0 ppm.

- Eight CVOCs were detected in groundwater at the Site. Five of the eight CVOCs (i.e., PCE, TCE, 1,1-dichloroethene [1,1-DCE], cis-1,2-dichloroethene [1,2-DCE] and vinyl chloride) were detected above the NYSDEC AWQSGVs (Table 3). CVOCs were not detected in groundwater at GW-4, GW-5 and GW-6, along Manhasset Bay. CVOCs were also not detected in groundwater in three of four samples (i.e., GW-1, GW-3 and MW-1) on the eastern side of the Site along Sagamore Hill Drive (upgradient portion of the Site). However, PCE was detected in GW-2 on the upgradient portion of the Site, along Sagamore Hill Drive. CVOCs were detected in groundwater in three of five samples (i.e., GW-8, GW-10 and GW-11) above the NYSDEC AWQSGVs in the central portion of the Site. TCE at GW-8 was detected at the highest concentration northwest of the former plating area, which is a breakdown product of PCE. The other CVOCs detected in this area above the NYSDEC AWQSGVs consisted of PCE, 1,1-DCE, cis-1,2-DCE and vinyl chloride.

- TCE was also detected at MW-2, which is above its NYSDEC AWQSGV, located on the south-central portion of the Site.

Additional Investigation
Roux Associates, Inc., September 29 through 30, 1999

An additional soil and ground-water investigation was performed at the Site. The objective of the soil investigation was to further delineate the soil impacts previously identified around the former plating area, and at former Test Pits TP-9 and TP-10 (near the former USTs). Additionally, one soil boring was sampled and analyzed from the former plating area for confirmation of previous soil quality results (i.e., CVOCs in soil). The objective of the groundwater investigation was to delineate the extent of on-site CVOCs in groundwater in the vicinity of Geoprobe™ Point GW-2 (along Sagamore Hill Drive), determine if there is an off-site source and to evaluate natural attenuation as a potential remedial alternative. Additionally, the groundwater quality at a downgradient portion of the Site and within the abandoned leaching field was determined.

Four soil borings were sampled approximately 5-ft radially outward surrounding each of the former UST areas of concern, two soil borings on the north side of the former plating area, and one soil boring was sampled in the middle of the former plating area. These soil samples were collected using the Geoprobe™™ method. Soil samples were collected at each soil boring from land surface to groundwater (i.e., approximately 10 ft bls). Each sample was inspected for contamination (e.g., staining and odors), and screened in the field for VOCs using a PID.

One soil sample from each soil boring was submitted to the laboratory for analysis. The actual sample selected for analysis was based on the sample that exhibited the highest degree of potential contamination. The samples collected around the former plating area were analyzed for Target Analyte List (TAL) metals using the USEPA Method 6000-7000 Series. The soil sample collected in the middle of the former plating area was analyzed for CVOCs using the USEPA Method 8260. Because the soil analytical results indicated that CVOCs were present in the middle of the former plating area, the samples north of the former plating area were also analyzed for CVOCs. The samples collected at Test Pits TP-9 and TP-10 were analyzed for TAL metals using the USEPA Method 6000-7000 Series and total organic carbon (TOC), and the sample collected at TP-9 was also analyzed for SVOCs using the USEPA Method 8270.

Six ground-water samples were collected using the Geoprobe™™ method. Please note that the sampling was intended as a screening technique. Four of the six samples were located surrounding Geoprobe™ Point GW-2 and at the approximate location of former Monitoring Well MW-6, where PCE was previously detected above the NYSDEC AWQSGVs. These samples were analyzed for CVOCs using USEPA Method 8260 and pertinent natural attenuation indicator parameters (i.e., chloride, total organic carbon [TOC], total dissolved solids, dissolved iron and manganese, sulfate, nitrate, ethene, ethane and carbon dioxide). Additionally dissolved oxygen, oxidation and reduction potential, pH, temperature, and specific conductivity were measured in the field at the time of sampling.

The remaining two ground-water samples were collected from Test Pit TP-9 (i.e., downgradient property boundary) and in the middle of the former leaching field. The ground-water sample collected at TP-9 was analyzed for CVOCs using USEPA Method 8260. The ground-water sample collected in the middle of the former leaching field was analyzed for VOCs using USEPA Method 8260, SVOCs using USEPA Method 8270, and TAL metals using USEPA Method 6000-7000 Series.

The key results of this investigation are summarized below.

- Chromium and iron were detected in soil at concentrations that exceed the NYSDEC RSCOs immediately north of the former plating area (Table 4). These metals were previously detected in soil at similar concentrations in the vicinity of the former plating area.

- TCE was the only CVOC detected in soil immediately above groundwater near the center of the former plating area, while CVOCs were not detected in soil immediately north of the former plating area (Table 5). This TCE concentration was also detected significantly below its NYSDEC RSCO of 700 micrograms per kilogram (μg/kg). The presence of TCE at a very low concentration near the center of the former plating area and the absence of CVOCs immediately north of the former plating area suggests that the former plating area may not be a source of CVOCs in groundwater.

- Iron, zinc and chromium (one detection) were detected in soil at concentrations that exceed the NYSDEC RSCOs surrounding former Test Pits TP-9 and TP-10 (Table 4). These metals were detected at lower concentrations than those previously detected within the center of former Test Pits TP-9 and TP-10.

- SVOCs (all polycyclic hydrocarbons [PAHs]) were detected in soil at concentrations that exceed the NYSDEC RSCOs at former Test Pit TP-9 (Table 6).

- TCE was detected in groundwater, which exceeded its NYSDEC AWQSGV immediately north of a manhole and Geoprobe™ Point GW-2 (where PCE was previously detected) along Sagamore Hill Drive (i.e., upgradient Site boundary) (Table 7). No CVOCs were detected in the two ground-water samples collected west (i.e., downgradient) and south of GW-2 (Table 7).

- PCE was detected in groundwater, which slightly exceeded its NYSDEC AWQSGV at former Test Pit TP-9 along the downgradient portion of the Site (Table 8).

- No VOCs were detected in groundwater that exceeded the NYSDEC AWQSGVs within the former leaching field (Table 9). No SVOCs were detected in groundwater within the former leaching field (Table 10). Twelve metals were detected in unfiltered ground water at concentrations that exceed the NYSDEC AWQSGVs (Table 11). However, only three metals (iron, manganese and sodium) were detected in a filtered ground-water sample that exceeded the NYSDEC AWQSGVs. Therefore, the presence of the other nine metals (which exceeded the NYSDEC AWQSGVs) in the unfiltered ground-water sample was a result of suspended sediment, and not representative of ground-water quality. Please note that the three metals (iron, manganese and sodium) that exceeded the NYSDEC AWQSGVs in a filtered ground-water sample commonly occur in Long Island groundwater.

- Based on previous ground-water data, the concentrations of degradation products of PCE and/or TCE, including 1,1,1-Trichloroethane, 1,1-Dichloroethane, 1,1-DCE, 1,2-DCE and vinyl chloride indicate that the PCE and TCE are degrading as the result of naturally-occurring processes. Analytical results of the four ground-water samples collected specifically to evaluate the occurrence of natural attenuation of CVOCs in groundwater were not conclusive (Table 12). However, based on these limited results, natural attenuation is still considered to be a viable remediation alternative for the CVOCs in groundwater at the Site.

Building Department Review
Roux Associates, Inc., April 10, 2000

Roux Associates reviewed available Site drawings at the Incorporated Village of Manorhaven Building Department on April 10, 2000. The review indicated that drawings showing former floor drains, sewers, former drywells or other subsurface structures at the Site were not available.

3.0 INVESTIGATION RATIONALE

As discussed in Section 2.0, a significant amount of soil and groundwater quality data have been collected at the Site. The data indicate that a limited soil and groundwater investigation is warranted to achieve the project objectives. A description of the investigation rationale is provided below.

3.1 Soil

Additional soil quality data is required at four discrete areas of the Site. These areas include:

- the Former Plating Area;
- the Former UST Area at TP-9;
- the Former Leaching Field; and
- inside the Former Building Footprint.

In addition, soil quality data is required for the upper 2 ft throughout the Site to support the exposure assessment.

A description of the sampling rationale is provided below. Details on the proposed sampling is included in Section 4.0. The evidence indicating sufficient sampling has already been performed at the remaining former UST areas, at former drywells located outside of the former leaching field, at selected areas outside of the former building footprint, and in the two manholes is provided below.

3.1.1 Former Plating Area

The soil quality results at the former plating area indicate that metals concentrations detected above the NYSDEC RSCOs appear to be limited to the area at former Test Pits TP-6 and TP-6D. Blue-grey/green staining was identified in the excavated soil at TP-6 and TP-6D at approximately 15 ft bls. The soil surrounding the former plating area was visually inspected, and the results did not indicate that staining was present. Soil quality results of two samples collected north of the former plating area indicate that metals concentrations were not detected above the NYSDEC RSCOs and/or the Eastern USA Background Concentrations.

Additionally, the soil quality results at former Test Pit TP-6D indicate that VOCs, SVOCs and PCBs were detected below the NYSDEC RSCOs.

The soil quality results also indicate that the soil at former Test Pits TP-6 and TP-6A was stained black and contained high concentrations of TPH at approximately 20 ft bls, which a laboratory identified as lubricating oil. Additionally, only one VOC (i.e., TCE) was detected in soil and it was at a concentration significantly below the NYSDEC RSCOs adjacent to TP-6.

No further soil sampling is warranted immediately surrounding the plating area to the north, east, and west, based on previous field and laboratory results. No visual impacts were identified in these areas, and no VOCs were present, based on screening the samples with a PID. The results of the previous analytical data in these areas indicate that metals were detected below the NYSDEC RSCOs and/or the Eastern USA Background Concentrations. Since VOCs, SVOCs and PCBs were detected in soil below the NYSDEC RSCOs at the former plating area, no additional sampling for these constituents is warranted. Soil sampling to vertically delineate the impacts identified in soil at TP-6/TP-6D and TP-6A is warranted. Additionally, soil sampling at TP-6A to determine the lateral extent of the previously identified black stained soil is warranted.

3.1.2 Former UST Area at TP-9

Two former 150-gallon capacity gasoline USTs resided at the location of former Test Pit TP-9. Soil quality results indicate that no VOCs were detected at former Test Pit TP-9. However, BNs were detected in soil (6 ft to 8 ft bls) at concentrations that exceed the NYSDEC Spill Technology and Remediation Series (STARS) guidelines. Delineation soil samples were collected surrounding the former UST excavation, and the analytical results indicate that three of the four former excavation sides (i.e., north, east and west sides) contain BNs at concentrations that exceed the NYSDEC STARS guidelines. Therefore, further lateral delineation of BNs in soil on the north, east and west sides of the former excavation is warranted.

A groundwater sample will be collected at former Test Pit TP-9 to determine if the BNs in soil have impacted groundwater (see Section 4.4).

3.1.3 Former Leaching Field

As discussed in Section 2.0, a drywell removal program was completed by Soil Mechanics in 1992 that included the removal of 77 drywells at the Site. The majority of the drywells were located in the former leaching field.

During the drywell removal program, residual liquids were pumped out and disposed offsite accordingly. As the removal of the drywells progressed, the material in each drywell was inspected for contamination (e.g., staining and odors), and screened in the field using a PID. The results of the material inspection (i.e., visual inspection and PID readings) indicated that a minor amount of the 737.5 cubic yards of soil and construction and demolition debris excavated and disposed offsite was considered contaminated. Analytical results of the contaminated material indicate that the material is non-hazardous. The excavations were backfilled with clean sand.

Two test pits (TP-8 and TP-11) were performed by CA Rich during their Phase II ESA in the former leaching field (after the removal of the drywells). These test pits were excavated to the water table, which is approximately 8 ft bls. Test Pit TP-11 was located at the 'manhole' along the western portion of the Site. This 'manhole' is likely a former drywell, where the drywell had been removed but its cement collar remains on top of the ground surface at the former drywell location. The soil at Test Pits TP-8 and TP-11 was inspected, and the results indicated that contamination was not present at these areas of the former leaching field.

Therefore, to confirm the inspection results and to verify that residual contamination from the former drywells is not present, soil sampling is warranted.

3.1.4 Inside Former Building Footprint

Soil quality data have been developed for most of the central portion within the former building footprint. Please note that the former plating area was located in the central portion of the former building footprint. The sampling rationale for the plating area is described in Section 3.1.1.

Since no sampling has been performed in the southern and northern portions of the former building footprint, sampling in these areas to determine the presence or absence of soil impacts is warranted. Additionally, sampling in the eastern and western-central portions of the former building footprint where no previous sampling has occurred is warranted.

3.1.5 Exposure Assessment Soil Sampling

To perform the exposure assessment, the soil quality in the upper 2 ft of the Site needs to be determined. Since no previous soil sampling has occurred in the upper to 2 ft, limited soil sampling throughout the Site is warranted.

3.1.6 Site-Wide UST Areas

As discussed in Section 2.0, the 12 USTs were removed with the NYSDEC and/or the NYCDOH providing oversight. Petroleum-related impacts in soil were not identified by Soil Mechanics, the NYSDEC or the NYCDOH; therefore, the UST excavations were backfilled. During the CA Rich Phase II ESA, a total of three test pits were performed adjacent to seven of the 12 former UST locations (Figure 2) to confirm that soil impacts were not present based on visual inspection. Petroleum-related impacts were only identified at former UST Area TP-9 (see Section 3.1.2), while no petroleum-related impacts were identified at the other UST locations inspected. Therefore, no further investigations at these former UST locations are warranted.

3.1.7 Site-Wide Drywells

The drywells located outside of the former leaching field were removed and its material inspected as stated in Section 3.1.3. Two specific drywells (B-130 and B-140) were sampled for PCBs. The results of this sampling indicated that no visual contamination was present and that PCBs were not detected in the material analyzed. Therefore, additional soil sampling at drywell locations outside of the former leaching field is not warranted.

3.1.8 Outside Former Building Footprint

The areas outside of the former building footprint include the east (former parking lot), west (former leaching field) and south (former UST areas) portions of the Site. Please note that the former building resided along a large potion of the northern property boundary of the Site. The sampling rationale for the former UST areas and the former leaching field is provided in Section 3.1.2/3.1.6 and 3.1.3, respectively.

A soil investigation was performed within the former parking lot (eastern portion of the Site) by Soil Mechanics in 1989. The soil analytical results from these soil borings indicate that VOCs were not detected and that the metals concentrations were detected either below the NYSDEC RSCOs or the Eastern USA Background Concentrations. Therefore, since the soil quality in this area does not indicate impacts, no additional soil sampling outside the former building footprint along the eastern portion of the Site is warranted.

3.1.9 Manholes

Two manholes have been previously identified by CA Rich along the eastern and western boundaries of the Site. The 'manhole' identified along the western boundary was actually a former drywell, where its cement collar is present on top of the ground surface at the former drywell location. This drywell was removed as part of the drywell removal program performed by Soil Mechanics in 1992 (see Section 3.1.3). Additionally, former Test Pit TP-11 was performed at the drywell location, and the inspection results indicate that soil impacts were not present. Therefore, no soil sampling at this former drywell is warranted.

The 'manhole' along the eastern boundary of the Site was opened and inspected. A former water main vault is present; therefore, a soil investigation is not warranted.

3.2 Groundwater

Additional groundwater quality and monitoring data is warranted. A description of the sampling and monitoring rationale is provided below. The evidence indicating sufficient groundwater sampling has already been performed in the former leaching field is provided below.

3.2.1 Site Wide

Groundwater quality results indicate that CVOCs are present in groundwater throughout most the Site. Based on the low concentrations of the CVOCs detected in groundwater, the source(s) of the CVOCs has not been identified. The groundwater quality results also indicate that the lateral and vertical extent of the CVOCs has not been determined. Therefore, additional groundwater sampling for CVOCs is warranted.

DNAPL is denser than water non-aqueous phase liquid, which will tend to move vertically down (i.e., sink) until it reaches a semi-confining/confining material (e.g., clay) where it accumulates. Typically, a DNAPL will form when pure product is released. The low concentrations of dissolved CVOCs in groundwater at the Site do not indicate the presence of a DNAPL. However, verification of the absence of DNAPL at the Site is prudent.

The groundwater flow direction has been estimated to be west-southwest from the Site towards Manhasset Bay. A current groundwater flow direction can not be determined since only two wells currently exist at the Site. Therefore, the collection of water-level measurements in the new proposed wells to determine the groundwater flow direction at the Site is warranted.

3.2.2 Former UST Area at TP-9

To verify that the BNs detected in soil immediately above the water table at former Test Pit TP-9 have not impacted groundwater, collection and analysis of a groundwater sample is warranted.

3.2.3 Former Leaching Field

The most recent groundwater sampling (October 1999) in the former leaching field indicated that VOCs were not detected above the NYSDEC AWQSGVs. SVOCs were also not detected except for one SVOC (bis [2-ethylhexyl] phthalate), which is a common laboratory artifact, and is not representative of groundwater conditions. Thirteen of 23 metals were detected above the NYSDEC AWQSGVs in an unfiltered sample, while only three of the 23 metals were detected above the NYSDEC AWQSGVs in a filtered sample. Therefore, the metals data for the unfiltered sample appears to be a result of suspended sediment. The three metals detected in the filtered sample were iron, manganese, and sodium, which naturally occur in groundwater on Long Island (USGS, 1992). Based on the groundwater results provided above for the leaching field, no additional groundwater sampling for this area is warranted.

4.0 SCOPE OF WORK

The Work Plan objectives are to:

- complete the lateral and/or vertical soil quality delineation at the former plating area and at former UST Area TP-9;
- perform confirmation soil sampling and analysis in the former leaching field;
- characterize soil quality in uninvestigated areas inside of the former building footprint;
- determine whether there is an onsite source(s) of CVOCs in groundwater;
- determine the lateral and vertical extent of CVOCs in groundwater;
- determine the BN groundwater impacts, if any, at former UST Area at TP-9;
- verify the absence of a dense non-aqueous phase liquid (DNAPL);
- verify the direction of groundwater flow at the Site;
- determine the likelihood for human exposure to chemicals of potential concern identified in the soil and groundwater based on a future residential-use scenario; and
- develop remedial alternatives for soil and groundwater impacts identified at the Site including, evaluating whether phytoremediation and natural attenuation are viable remedial technologies for the removal and/or degradation of CVOCs in groundwater at the Site.

The Work Plan has been developed to be flexible due to time constraints for the redevelopment of the Site, which would allow Roux Associates to respond expeditiously to information developed in the field that may require a scope of work modification(s). For example, if the field inspection results indicate that the extent of an impacted area has not been delineated, an additional soil boring will be sampled. If a scope of work modification(s) is required, an attempt will be made to contact the NYSDEC for its approval. However, if the NYSDEC is unavailable at the time approval is needed so that the field work my continue without delay, Roux Associates is requesting that we are granted permission to make the necessary changes followed by contact with the NYSDEC regarding the scope of work modification(s).

Additionally, the flexibility of the Work Plan will permit an evaluation of Tasks 1 through 4 after their completion if further sampling is warranted. The purpose of further sampling would be to complete delineation of soil and/or groundwater impacts. If further sampling is warranted, a letter will be expedited so that delays are minimized.

To achieve the Work Plan objectives, the scope of work includes:

- Task 1: Soil Boring and Sampling;
- Task 2: Monitoring Well Installation;
- Task 3: Water-Level Measurements and Groundwater Sampling;
- Task 4: Geoprobe™ Groundwater Sampling;
- Task 5: Exposure Assessment;
- Task 6: Phytoremediation Pilot Study;
- Task 7: Data Usability Summary Report; and
- Task 8: Data Evaluation and Report Preparation.

A brief description of each scope of work task is provided below, while a detailed description is provided in the Sampling and Analysis Plan (Appendix A).

4.1 Task 1: Soil Boring and Sampling

A total of 21 soil borings (SB-4 through SB-24) will be sampled continuously at 2 ft intervals from land surface to the depth where groundwater is encountered, which is approximately 8 ft bls. Four of the 21 soil borings (SB-4 through SB-7) will be sampled below the water table to determine the vertical extent of impacts within the former plating area. Additionally, four of the 21 soil borings (SB-7, SB-12, SB-23 and SB-24) will be sampled to verify the absence of a DNAPL. The location of each soil boring is shown in Figure 3.

The soil samples will be collected using the Geoprobe™ method. Each sample will be inspected for contamination (e.g., odors and staining), and will be screened in the field for VOCs using a PID. The lithology of each sample will be described, and recorded in the field notebook.

The soil sample that exhibits the highest degree of contamination from each soil boring will be selected for laboratory analysis. However, if no discernable contamination is present, the sample at the 2-ft interval immediately above the water table will be submitted for laboratory analysis. One soil sample will be selected for laboratory analysis from each vertical delineation soil boring based on the sample that exhibits no discernable contamination immediately below the deepest sample in that soil boring that exhibits contamination.

The specific locations for soil boring and sampling, the proposed number of soil borings for each location, and the method of sample analysis are provided below.

4.1.1 Former Plating Area

One soil boring (SB-4) will be sampled (20 ft to 22 ft bls) at former Test Pit TP-6A to determine the vertical extent of the black stained material (which was previously identified at 20 ft bls) identified during the February 8, 1999 CA Rich Phase I ESA. This sample will be analyzed for TPH using the USEPA Method 8015.

One soil boring will be sampled (20 ft to 22 ft bls) at approximately 5 ft southwest (SB-5) and 5 ft southeast (SB-6) of former Test Pit TP-6A to determine the lateral and vertical extent of TPH concentrations (which was previously identified at 20 ft bls) detected at former Test Pit TP-6A. These samples will be analyzed for TPH using the USEPA Method 8015.

One soil boring (SB-7) will be sampled (15 ft to 17 ft bls) at former Test Pit TP-6 to determine the vertical extent of the blue-grey/green stained material (which was previously identified at 15 ft bls) identified during the February 8, 1999 CA Rich Phase I ESA. This sample will be analyzed for Target Analyte List (TAL) metals plus cyanide using the USEPA Method 6000-7000 Series. Additionally, this boring will be sampled to the clay layer (approximately 32 ft bls), and a sample from the 2 ft depth interval immediately above the clay layer will be collected to verify the absence of DNAPL (See Section 4.1.5). Please note that the samples collected below 17 ft bls will be field inspected for impacts, and a sample will be collected for analysis as described in Section 4.1.

4.1.2 Former UST Area at TP-9

A total of three soil borings will be sampled at former UST Area TP-9 to determine the lateral extent of BNs in this area. Each soil boring will be sampled at approximately 5 ft further from the previous soil boring locations TP-9A, TP-9B, and TP-9D, located on the north (SB-8), east (SB-9) and west (SB-10) sides of former Test Pit TP-9, respectively. Please note that if the results of the field inspection indicate the evidence of BN impacts (e.g., oil staining or petroleum odor), the soil boring(s) will be abandoned and sampling will continue approximately 5 ft further from the first soil boring(s). This process will continue until the soil inspection results do not indicate BN impacts. Each sample will be analyzed for BNs using the USEPA Method 8270 (NYSDEC STARS list only).

4.1.3 Former Leaching Field

One soil boring will be sampled in the vicinity of the north (SB-11), central (SB-12) and south (SB-13) portions of the former leaching field to verify that no residual contamination from the former drywells remain. Each soil sample will be analyzed for VOCs using the USEPA Method 8260, SVOCs using the USEPA Method 8270, and TAL metals plus cyanide using the USEPA Method 6000-7000 Series.

4.1.4 Inside Former Building Footprint

Nine soil borings (SB-14 through SB-22) will be sampled within the former building footprint in areas not previously investigated and to determine whether a CVOC source(s) is (are) at the Site. Each sample will be analyzed for VOCs using the USEPA Method 8260, SVOCs using the USEPA Method 8270, and TAL metals plus cyanide using the USEPA Method 6000-7000 Series.

4.1.5 Site Wide

Four soil borings (SB-7, SB-12, SB-23 and SB-24) will be sampled at the 2-ft depth interval immediately above the clay layer (approximately at 32 ft bls) to verify the absence of DNAPL using a hydrophobic test (see Section 6.2.1 of the SAP).

4.2 Task 2: Monitoring Well Installation

A total of eight monitoring wells (MW-21 through MW-28) will be installed using a hollow-stem auger drilling rig. Please note that Monitoring Wells MW-27 and MW-28 will be installed as part of the Phytoremediation Pilot Study (Task 6), and will also be utilized for the Site Investigation. The locations of the monitoring wells are shown in Figure 4. The locations of the wells were selected to confirm the Geoprobe™ groundwater data, to determine the direction of groundwater flow, delineate concentrations of CVOCs previously detected in groundwater above the NYSDEC AWQSGVs, and to determine whether there is an onsite source(s) of CVOCs in groundwater.

During the drilling of the monitoring well pilot boreholes, soil samples will be collected continuously from land surface to the anticipated bottom depth of each well. Each soil sample will be inspected for contamination (e.g., odors and staining), and will be screened in the field for VOCs using a PID. The lithology of each sample will be described, and recorded in the field notebook.

Soil samples will only be submitted to the laboratory if the results of the sample inspection indicate the presence of impacts (e.g., staining). If a sample is submitted to the laboratory, the analysis will be determined in the field based on the results of the type(s) of impacts present.

The monitoring wells will consist of 2-inch diameter PVC casing and screen. The wells will be completed in accordance with the NYSDEC well installation procedures. After completion, the wells will be developed to establish connection with the aquifer and to remove fined-grained material to the extent possible. The well development procedures will be performed in accordance with the NYSDEC guidelines.

Each monitoring well will be surveyed for its horizontal and vertical coordinates relative to the North American Vertical Datum (NAVD) 1988 using a New York State-licensed surveyor.

4.3 Task 3: Water-Level Measurements and Groundwater Sampling

Two rounds of water-level measurements will be performed in the new and existing wells using an electronic measuring scope during low and high tide to determine the direction of groundwater flow at the Site. One of the two water-level measurement rounds will coincide with the groundwater sampling.

Prior to sampling, each new well (MW-21 through MW-26), one of the two phytoremediation wells (MW-27 or MW-28), and the two existing wells (MW-1 and MW-2) will be purged into 55-gallon DOT-approved drums using a low-flow pump. During purging, field parameters (i.e., turbidity, pH, specific conductivity, and temperature) will be collected. Once purging is completed, each well will be sampled using a Teflon bailer.

The wells will be analyzed for CVOCs using the USEPA Method 8260, natural attenuation parameters (see Appendix A), total dissolved solids (TDS) using USEPA Method 160.1 and chloride using USEPA Method 325.1. Monitoring Wells MW-23 and MW-24 will also be analyzed for TAL metals (filtered and unfiltered) plus cyanide using the USEPA Method 6000-7000 series.

Additionally, Monitoring Well MW-26 will be sampled for BNs using the USEPA Method 8270 (NYSDEC STARS list) to determine if the BNs in soil at former UST Area TP-9 have impacted groundwater.

4.4 Task 4: Geoprobe™ Groundwater Sampling

Two groundwater samples will be collected at Soil Borings SB-7 (at the former plating area), SB-12 (near the central portion of the former leaching field), SB-23 (at the upgradient Site boundary adjacent to Sagamore Hill Road), and at SB-24 (downgradient of Monitoring Well MW-2). The purpose for the collection and analysis of the groundwater samples is to:

- vertically delineate CVOC concentrations; and
- verify the absence of a DNAPL.

The location of these groundwater samples is shown in Figure 4. The groundwater samples will be collected from the top 2 ft of groundwater and the 2 ft depth interval immediately above the first confining unit (e.g., clay) using the Geoprobe™™ method. It is estimated that the first confining unit is 32 ft bls.

Each groundwater sample will be inspected for contamination (e.g., sheen and odors). The presence of DNAPL will be determined using a product interface probe and by performing a hydrophobic dye test. The groundwater samples will be analyzed for CVOCs using the USEPA Method 8260.

4.5 Task 5: Exposure Assessment

An exposure assessment will be performed to determine the likelihood for human exposure to chemicals of potential concern in the soil and groundwater at the site. The exposure assessment will include:

- identifying the chemicals of potential concern;
- identifying potential receptors;
- determining viable exposure pathways; and
- determining the potential exposure levels for each identified receptor.

The exposure assessment will consider the future contemplated use of the Site, which is residential with landscaped areas. The exposure assessment will be performed consistent with the following guidance documents, where applicable:

- USEPA, 1989. Risk Assessment Guidance for Superfund (RAGS). Volume I: Human Health Evaluation Manual (Part A) Interim Final. Office of Emergency and Remedial Response. EPA/540/1-89/002.
- USEPA, 1991. Risk Assessment Guidance for Superfund. Human Health Evaluation Manual: Supplemental Guidance: Standard Default Factors – Interim Final. Office of Emergency and Remedial Response. 9285.6-03.

To perform the exposure assessment, soil quality data is needed from the 0 to 2 ft and 4 ft to 6 ft depth intervals throughout the Site to supplement the existing soil quality data. A total of six composite soil samples will be collected at each depth interval using a hand auger or

Geoprobe™. Each composite sample will be comprised of six to ten sampling locations. These samples will be analyzed for CVOCs using the USEPA Method 8260 and TAL metals plus cyanide using the USEPA Method 6000-7000 Series.

4.6 Task 6: Phytoremediation Pilot Study

A phytoremediation pilot study will be performed to determine if phytoremediation is a viable remedial technology for the removal and/or degradation of CVOCs in groundwater at the Site. The use of plants (e.g., trees) to promote the *in situ* treatment of contaminants in soil and groundwater, referred to as phytoremediation, is a viable, innovative, cost effective, and aesthetically appealing remediation alternative. Phytoremediation is suited for use at the Site due to the relatively shallow water table (between 8 ft to 10 ft bls) and the anticipated redevelopment plans (i.e., residential with landscaped areas).

Phytoremediation removes a wide variety of organic contaminants including PCE and its associated breakdown products from the subsurface through transformation, bioremediation, and filtration. Plants act as natural pumps for groundwater. Along with water, the plants also uptake and transform contaminants from soil and groundwater through the roots. This action physically removes contaminants from the subsurface. Organic contaminants that are taken up by the plants are transformed and ultimately expired through the leaves as innocuous carbon dioxide and water. Contaminants in groundwater that are drawn to the roots become concentrated in the root zone through sorption and become available for biodegradation. In a similar manner that the leaves transpire carbon dioxide and water, the roots release oxygen to the subsurface. The boost of oxygen from the roots promotes propagation of bacteria in the root zone, which in turn, aerobically degrade the organic contaminants during metabolic processes.

The area of the Site selected for the pilot study is shown in Figure 5. This area is located in the southeastern portion of the Site near former Monitoring Well MW-6 (where one of the highest PCE concentrations was detected in groundwater). Additionally, the pilot study area is directly downgradient from an upgradient portion of the Site where concentrations of PCE and the associated breakdown products were detected in September 1999 (i.e., the most recent sampling).

The phytoremediation pilot study field tasks include soil sampling, installation of monitoring wells, tree planting, and groundwater monitoring. A description of each field task is provided below. Additionally, a brief description of the data evaluation for the effectiveness of the pilot study is provided below.

4.6.1 Soil Sampling

Prior to planting, two composite soil samples from the pilot study area will be collected for agronomic analyses to determine nutrient levels in the soil and to identify soil components that may be potentially toxic to the trees, if any. Based on current soil quality data, it is not anticipated that the soil will be toxic to the trees. These samples will be collected during the drilling of the monitoring well pilot boreholes (see below).

4.6.2 Monitoring Well Installation

Two groundwater monitoring wells (i.e., MW-27 and MW-28) will be installed prior to the tree planting to monitor the effectiveness of the phytoremediation using a hollow-stem auger drilling rig (Figure 5). These wells will be constructed of 2-inch diameter PVC casing and screen, and installed in accordance with the NYSDEC well installation procedures. One of the proposed wells will be installed upgradient of the pilot study test area (MW-27) and the other well will be installed downgradient (MW-28).

4.6.3 Tree Planting

Consistent with conditions at the Site, the proposed phytoremediation entails the installation of 30 12-ft tall one-year old rooted hybrid poplar trees. The selection of the hybrid poplar tree is based on its high water uptake and evapotranspiration rates, its ability to withstand winter climates, and its rapid root development.

The tree cuttings will be planted at a depth of approximately 9 ft bls, which is immediately at the surface of the water table. This planting depth was selected to promote rapid root propagation into the shallow groundwater at the Site. Planting will entail either trenching, using a drive-on trencher (e.g., Ditch Witch™), or boring followed by the installation of the tree cuttings. During planting, the rooted tree cuttings will be placed at 5-ft intervals along rows spaced approximately five feet apart. Therefore, based on the planting of 30 trees, the plot will contain five rows of six trees in each row. The phytoremediation test plot will measure 20 ft by 25 ft (Figure 5). After the trees are placed in the ground, fertilizer pellets and a soil humus mixture will be added around the trees. To promote root development and support the long term viability of the trees, watering of the trees will be performed periodically depending upon the weather conditions. The trees will be watered by a landscaper using potable water.

4.6.4 Groundwater Monitoring

Comparison of the monitoring results (i.e., quality and water-level measurements) from these two wells (MW-27 and MW-28) will be used to determine the effect of the phytoremediation. The initial groundwater monitoring will be performed prior to planting. The results from this monitoring round will be used to establish background (i.e., pre-phytoremediation conditions) water elevations and groundwater quality at the pilot study test area. Subsequently, monitoring will be performed one month after planting and then quarterly thereafter for a minimum of one year (not to exceed two years) from the completion of tree planting. The results of the quarterly monitoring will be used to evaluate the effects of the trees on groundwater elevations and quality as they continue to grow. Samples will be analyzed for CVOCs using the USEPA Method 8260.

Based on our experience at other sites, we anticipate that the initial effects of the trees in the pilot study test area will be to lower the water table. As the roots of the trees become more mature, the effects of the phytoremediation will produce a decrease in organic contaminant concentrations.

4.6.5 Data Evaluation and Summary Letter Preparation

After the completion of one year of groundwater monitoring, the data (i.e., quality and water-level measurements) will be evaluated, and the results summarized in a letter. The summary letter will include a discussion of the methods performed to collect the data, analytical results, conclusions, and recommendation(s) as to whether the Phytoremediation Pilot Study should continue, be expanded or modified.

4.7 Task 7: Data Usability Summary Report

A Data Usability Summary Report (DUSR) will be prepared by Data Validation Services, North Creek, New York, in accordance with the September 1997 NYSDEC Guidance for the

Development of DUSRs. The DUSR will include a data review of the raw data and the quality control parameters. The quality control parameters include custody documentation, holding times, surrogate and matrix spike recoveries, duplicate correlation, calibration standard/blank performance, instrument performance, blank contamination, matrix interferences, and method compliance. Additionally, the precision, accuracy and completeness of the data will be evaluated.

4.8 Task 8: Data Evaluation and Report Preparation

After the completion of Task 1 through Task 5 and Task 7, a summary report will be prepared and submitted to the NYSDEC. This report will include a summary of the field methods performed, soil and groundwater quality results, DNAPL results, a DUSR, an exposure assessment, conclusions, and proposed remedial alternatives.

5.0 SCHEDULE

Following the NYSDEC approval of the Work Plan, a total of 14 weeks are anticipated to complete Task 1 through Task 5 and Task 7. The project schedule is presented in Figure 6. The schedule includes:

- completion of the field work in four weeks from written NYSDEC approval of the Work Plan;
- receipt of the analytical data package two weeks following completion of the field work;
- preparation of a DUSR within two weeks of receipt of the analytical data package;
- preparation of an exposure assessment within two weeks after the completion of the DUSR; and
- preparation and submittal of a summary report to the NYSDEC within four weeks of the completion of the exposure assessment.

The phytoremediation pilot study (Task 6) schedule will be implemented as shown in Figure 6, and the pilot study will continue for a minimum of one year (not to exceed two years). After the first year of monitoring, the data will be evaluated and a summary letter prepared. This summary letter will be submitted to the NYSDEC approximately one month after completion of the first year of monitoring.

Respectfully submitted,

ROUX ASSOCIATES, INC.

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Joseph D. Dum

Joseph D. Duminuco
Vice President

Table 1. Summary of Past and Current Owners, Owner Address and Telephone Number, and Approximate Dates of Ownership, Former Thypin Steel, Inc. Plant, Manorhaven, New York

Owners	Last Known Owner Address and Telephone Number	Approximate Dates of Ownership	Relationship to Current Owner
Pre-United States (US) General Services Administration (GSA)	Unknown	Unknown	None
US GSA	Mr. William Mullery, P.E. Department of the Army New York District Corps of Engineers Jacob K. Javits Federal Building New York, New York 10278-0090	Early 1940s - 1958	None
Thypin Realty Company	Mr. Richard Thypin P.O. Box 309 Princeton, New Jersey 08452	1958 - 1983	None
Manhassat Bay Associates	Mr. Richard Thypin P.O. Box 309 Princeton, New Jersey 08452	1983 - 1997	Sold to MBA-Manorhaven
MBA - Manorhaven, LLC	Mr. Richard Thypin P.O. Box 309 Princeton, New Jersey 08452	1997 - Present	Current Owner

Table 2. Summary of Past and Current Operators, Operator Address and Telephone Number, Approximate Dates of Operation, and Type of Operation, Former Thypin Steel, Inc. Plant, Manorhaven, New York

Operators	Address and Telephone Number	Approximate Dates of Operation	Type of Operation
Unknown	Unknown	Pre - 1931	Unknown
American Aeronautical Corporation	Unknown	1931 - 1936	Manufacturer of Seaplanes
Marine Airport Corporation	Unknown	1936 - Early 1940s	Unknown
Grumman Aircraft Plant	Northrop Grumman 1840 Century Park East Los Angeles, California 90067 (310)553-2076	Early 1940s - 1958	Manufacturer of Planes
Port Washington Metal Products Corporation	Unknown	1951 - 1958	Manufacturer of Metal Heaters
Thypin Steel, Inc.	Mr. Richard Thypin P.O. Box 309 Princeton, New Jersey 08452	1958 - 1988	Storage and Cutting of Steel Products
Unknown	Unknown	1961 - Unknown	Manufacturer of Doors and Windows
United Utensils Company, Inc. (Utensco)	Unknown	1966 - 1985	Manufacturer of Steel and Plastic Vessels
Sound Spars	Unknown	1975 - 1980	Manufacturer of Sailboat Masts

Note: The Site has been vacant since 1988. The buildings and structures at the Site were demolished in the early 1990s. The members of MBA-Manorhaven, LLC were the majority shareholders of Thypin Steel, Inc.

Table 3. Summary of Chlorinated Volatile Organic Compounds Detected in Groundwater, Former Thypin Steel Inc., Plant, Manorhaven, New York.

	Sample Designation:	**GW-1**	**GW-2**	**GW-3**	**GW-4**	**GW-5**	**GW-6**	**GW-7**
	Sample Date:	**6/9/99**	**6/9/99**	**6/9/99**	**6/9/99**	**6/9/99**	**6/9/99**	**6/9/99**
PARAMETER (Concentrations in µg/L)	**NYSDEC AWQSGs[1] (µg/L)**							
1,1,1-Trichloroethane	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	50	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Disulfide	NA	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform	7	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	NA	10 U	10 U	10 U	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	50	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylene Chloride	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	5	5 U	**21**	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	NA	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5	5 U	0.6 J	5 U	5 U	5 U	5 U	2 J
Vinyl Chloride	2	10 U	10 U	10 U	10 U	10 U	10 U	10 U

[1] - New York State Department of Environmental Conservation (NYSDEC) Ambient Water Quality Standards and Guidance Values (AWQSGVs), Division of Water Technical and Operational Guidance Series (1.1.1), October 22, 1993

µg/L - Micrograms per liter

U - Compound was analyzed for but not detected

J - Estimated Value

Note: Geoprobe ground-water samples are designated GW-1 through GW-11, while monitoring well ground-water samples are designated MW-1 and MW-2.
Data highlighted in bold represents detections that exceed the NYSDEC AWQSGVs

Table 3. Summary of Chlorinated Volatile Organic Compounds Detected in Groundwater, Former Thypin Steel Inc., Plant, Manorhaven, New York.

	Sample Designation:	GW-8	GW-9	GW-10	GW-11	MW-1	MW-2
	Sample Date:	6/9/99	6/9/99	6/9/99	6/9/99	6/9/99	6/9/99
PARAMETER (Concentrations in µg/L)	**NYSDEC AWQSGs[1] (µg/L)**						
1,1,1-Trichloroethane	5	5 U	5 U	5 U	0.7 J	5 U	0.6 J
1,1,2,2-Tetrachloroethane	5	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5	0.6 J	5 U	5 U	5 U	5 U	0.5 J
1,1-Dichloroethene	5	**6**	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	5	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	50	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Disulfide	NA	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	5	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform	7	5 U	5 U	5 U	5 U	5 U	5 U
Chloromethane	NA	10 U	10 U	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	5	**24**	5 U	5 U	2 J	5 U	1 J
cis-1,3-Dichloropropene	5	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	50	5 U	5 U	5 U	5 U	5 U	5 U
Methylene Chloride	5	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	5	5 U	0.3 J	5 U	**6**	5 U	3 J
trans-1,2-Dichloroethene	NA	1 J	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5	**66**	4 J	**13**	**19**	5 U	**26**
Vinyl Chloride	2	**13**	10 U	10 U	10 U	10 U	10 U

[1] - New York State Department of Environmental Conservation (NYSDEC) Ambient Water Quality Standards and Guidance Values (AWQSGVs), Division of Water Technical and Operational Guidance Series (1.1.1), October 22, 1993

µg/L - Micrograms per liter

U - Compound was analyzed for but not detected

J - Estimated Value

Note: Geoprobe ground-water samples are designated GW-1 through GW-11, while monitoring well ground-water samples are designated MW-1 and MW-2.
Data highlighted in bold represents detections that exceed the NYSDEC AWQSGVs

Table 4. Summary of Metals Detected in Soil Surrounding Former Test Pits TP-9 and TP-10 and North of Former Plating Area, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Parameter (Concentrations in mg/kg)	NYSDEC RSCOs (mg/kg)	Sample Designation:	**TP9-A**	**TP9-B**	**TP9-C**	**TP9-D**
		Sample Date:	9/30/99	9/30/99	9/30/99	9/30/99
		Depth (ft bls):	6-8	6-8	6-8	4-6
Aluminum	33,000		2,100	2,400	2,300	1,600
Antimony	--		1.5U	1.4U	1.6U	1.4U
Arsenic	7.5		2.1U	2U	2.4U	2U
Barium	300		29	32	40	18
Beryllium	0.16		0.2U	0.19U	0.23U	0.19U
Cadmium	1.0		0.34U	0.32U	0.37U	0.32U
Calcium	35,000		1,100	1,200	2,700	540U
Chromium	10		7.7	10	**17**	6.8
Cobalt	30		4	5.1	4.6	2.6
Copper	25		6.2	5.6	12	3.7
Iron	2,000		**6,500**	**6,400**	**7,800**	**4,400**
Lead	500		6.3	6.1	31	5.4
Magnesium	5,000		1,100	1,300	1,100	880
Manganese	5,000		180	180	200	100
Mercury	0.1		0.036U	0.035U	0.04U	0.035U
Nickel	13		7.7	10	11	5.2
Potassium	43,000		900	1,100	770	650
Selenium	2		3U	2.9U	3.4U	2.9U
Silver	--		1.3U	1.3U	1.5U	1.3U
Sodium	8,000		210U	200U	240U	200U
Thallium	--		1.1U	1.1U	1.2U	1.1U
Vanadium	150		12	12	100	6.9
Zinc	20		**21**	**23**	**54**	19U

mg/kg - Milligrams per kilogram
U - Metal was analyzed for but not detected
ft bls - Feet below land surface
NYSDEC RSOCs - New York State Department of Environmental Conservation Recommended Soil Cleanup Objectives
-- NO NYSDEC RSCO
FP - Former Plating
Note: Data highlighted in bold represent detections that exceed the NYSDEC RSCOs.

Table 4. Summary of Metals Detected in Soil Surrounding Former Test Pits TP-9 and TP-10 and North of Former Plating Area, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

		Sample Designation:	TP10-A	TP10-B	TP10-C	TP10-D	FP-SB-2	FP-SB-3
		Sample Date:	9/30/99	9/30/99	9/30/99	9/30/99	9/30/99	9/30/99
		Depth (ft bls):	6-8	6-8	2-4	6-8	8-10	6-8
Parameter (Concentrations in mg/kg)	**NYSDEC RSCOs (mg/kg)**							
Aluminum	33,000		1,400	1,900	2,200	970	2,500	2,700
Antimony	--		1.4U	1.4U	1.4U	1.4U	1.4U	1.5U
Arsenic	7.5		2U	2U	2U	2U	2.1U	2.2U
Barium	300		24	28	34	14	22	39
Beryllium	0.16		0.19U	0.19U	0.19U	0.19U	0.2U	0.2U
Cadmium	1.0		0.32U	0.32U	0.32U	0.32U	0.33U	0.34U
Calcium	35,000		840	970	620	970	570	930
Chromium	10		6.4	8.3	9.6	10	**24**	**13**
Cobalt	30		3.1	4.6	3.5	2.2	2.8	5.1
Copper	25		7.4	6.2	20	5.7	5.4	8.4
Iron	2,000		**5,300**	**7,000**	**6,400**	**4,800**	**7,400**	**8,000**
Lead	500		5.4	4.5	17	4.7	3	3.4
Magnesium	5,000		780	1,000	710	630	1,000	1,200
Manganese	5,000		190	230	210	120	110	230
Mercury	0.1		0.035U	0.035U	0.035U	0.034U	0.036U	0.037U
Nickel	13		6.5	8	6.6	5.2	5.8	7.5
Potassium	43,000		550	750	520	300	680	940
Selenium	2		2.9U	2.9U	2.9U	2.8U	3U	3.1U
Silver	--		1.3U	1.3U	1.3U	1.3U	1.3U	1.4U
Sodium	8,000		200U	200U	200U	200U	210U	220U
Thallium	--		1.1U	1.1U	1.1U	1.1U	1.1U	1.1U
Vanadium	150		6.7	8.6	7.1	4.8	8.3	9.6
Zinc	20		**21**	20	**55**	19U	20U	20U

mg/kg - Milligrams per kilogram

U - Metal was analyzed for but not detected

ft bls - Feet below land surface

NYSDEC RSOCs - New York State Department of Environmental Conservation Recommended Soil Cleanup Objectives

-- NO NYSDEC RSCO

FP - Former Plating

Note:

Data highlighted in bold represent detections that exceed the NYSDEC RSCOs.

Table 5. Summary of Volatile Organic Compounds Detected in Soil in the Center and North of the Former Plating Area, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

	Sample Designation:	FP-SB-1(1)	FP-SB-2(2)	FP-SB-3(2)
	Sample Depth (ft bls):	8-10	8-10	8-10
	Sample Date:	10/1/99	10/1/99	10/1/99
Parameter (Concentrations in µg/kg)	**NYSDEC RSCOs (µg/kg)**			
1,1,1-Trichloroethane	800	5.7U	5.5U	5.7U
1,1,2,2-Tetrachloroethane	600	5.7U	5.5U	5.7U
1,1,2-Trichloroethane	--	5.7U	5.5U	5.7U
1,1-Dichloroethane	200	5.7U	5.5U	5.7U
1,1-Dichloroethene	400	5.7U	5.5U	5.7U
1,2-Dichlorobenzene	7900	5.7U	5.5U	5.7U
1,2-Dichloroethane	100	5.7U	5.5U	5.7U
1,2-Dichloropropane	--	5.7U	5.5U	5.7U
1,3-Dichlorobenzene	1600	5.7U	5.5U	5.7U
1,4-Dichlorobenzene	8500	5.7U	5.5U	5.7U
2-Butanone	300	28U	27U	28U
2-Chloroethyl Vinyl Ether	--	5.7U	5.5U	5.7U
2-Hexanone	--	23U	22U	23U
4-Methyl-2-Pentanone	1000	23U	22U	23U
Acetone	200	23U	22U	23U
Acrolein	--	17U	16U	17U
Acrylonitrile	--	7.9U	7.6U	7.9U
Benzene	60	1.1U	1.1U	1.1U
Bromodichloromethane	--	5.7U	5.5U	5.7U
Bromoform	--	5.7U	5.5U	5.7U
Bromomethane	--	5.7U	5.5U	5.7U
Carbon Disulfide	2700	5.7U	5.5U	5.7U
Carbon Tetrachloride	600	5.7U	5.5U	5.7U
Chlorobenzene	1700	5.7U	5.5U	5.7U
Chloroethane	1900	5.7U	5.5U	5.7U
Chloroform	300	5.7U	5.5U	5.7U
Chloromethane	--	5.7U	5.5U	5.7U
cis-1,2-Dichloroethene	--	5.7U	5.5U	5.7U
cis-1,3-Dichloropropene	300	5.7U	5.5U	5.7U
Di-isopropyl-ether	--	5.7U	5.5U	5.7U
Dibromochloromethane	--	5.7U	5.5U	5.7U
Ethylbenzene	5500	1.1U	1.1U	1.1U
m+p-Xylene	1200	2.3U	2.3U	2.3U
Methyl Tertiary Butyl Ether	--	1.1U	1.1U	1.1U
Methylene Chloride	100	5.7U	5.5U	5.7U
o-Xylene	1200	1.1U	1.1U	1.1U
Styrene	--	1.1U	1.1U	1.1U
t-Butyl Alcohol	--	11U	11U	11U
Tetrachloroethene	1400	5.7U	5.5U	5.7U
Toluene	1500	1.1U	1.1U	1.1U
trans-1,2-Dichloroethene	300	5.7U	5.5U	5.7U
trans-1,3-Dichloropropene	--	5.7U	5.5U	5.7U
Trichloroethene	700	6.3	5.5U	5.7U
Trichlorofluoromethane	--	5.7U	5.5U	5.7U
Vinyl Acetate	--	11U	11U	11U
Vinyl Chloride	200	5.7U	5.5U	5.7U

µg/kg - Micrograms per kilogram
U - Compound was analyzed for but not detected
ft bls - Feet below land surface
NYSDEC RSCOs - New York State Department of Environmental Conservation Recommended Soil Cleanup Objectives
-- No NYSDEC RSCO
FP - Former Plating
(1) - In center of Former Plating Area
(2) - North of Former Plating Area

Table 6. Summary of Semivolatile Organic Compounds Detected in Soil Surrounding Former Test Pit TP-9, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

		Sample Designation:	**TP9-A**	**TP9-B**	**TP9-C**	**TP9-D**
		Sample Date:	**10/2/99**	**10/2/99**	**10/2/99**	**10/2/99**
		Depth (ft bls):	**6-8**	**6-8**	**6-8**	**4-6**
Parameter (Concentrations in µg/kg)	**NYSDEC RSCOs (µg/kg)**					
1,2,4-Trichlorobenzene	3,400		190U	180U	180U	180U
1,2-Dichlorobenzene	7,900		190U	180U	180U	180U
1,3-Dichlorobenzene	1,600		190U	180U	180U	180U
1,4-Dichlorobenzene	8,500		190U	180U	180U	180U
2,4,5-Trichlorophenol	100		190U	180U	180U	180U
2,4,6-Trichlorophenol	--		190U	180U	180U	180U
2,4-Dichlorophenol	400		190U	180U	180U	180U
2,4-Dimethylphenol	--		190U	180U	180U	180U
2,4-Dinitrophenol	200		370U	360U	350U	360U
2,4-Dinitrotoluene	--		190U	180U	180U	180U
2,6-Dinitrotoluene	1,000		190U	180U	180U	180U
2-Chloronaphthalene	--		190U	180U	180U	180U
2-Chlorophenol	800		190U	180U	180U	180U
2-Methylnaphthalene	36,400		110J	180U	180U	840J
2-Methylphenol	100		190U	180U	180U	180U
2-Nitroaniline	430		190U	180U	180U	180U
2-Nitrophenol	330		190U	180U	180U	180U
3,4-Methylphenol	900		190U	180U	180U	180U
3,3'-Dichlorobenzidine	--		190U	180U	180U	180U
3-Nitroaniline	--		190U	180U	180U	180U
4,6-Dinitro-2-methylphenol	--		190U	180U	180U	180U
4-Bromophenyl phenyl ether	--		190U	180U	180U	180U
4-Chloro-3-methylphenol	240		190U	180U	180U	180U

µg/kg - Micrograms per kilogram

J - Estimated value

U - Compound was analyzed for but not detected

ft bls - Feet below land surface

NYSDEC RSCOs - New York State Department of Environmental Conservation Recommended Soil Cleanup Objectives

-- No NYSDEC RSCO

Note: Data highlighted in bold represent detections that exceed the NYSDEC RSCOs

Table 6. Summary of Semivolatile Organic Compounds Detected in Soil Surrounding Former Test Pit TP-9, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

		Sample Designation:	**TP9-A**	**TP9-B**	**TP9-C**	**TP9-D**
		Sample Date:	**10/2/99**	**10/2/99**	**10/2/99**	**10/2/99**
		Depth (ft bls):	**6-8**	**6-8**	**6-8**	**4-6**
Parameter (Concentrations in µg/kg)	**NYSDEC RSCOs (µg/kg)**					
4-Chloroaniline	220		190U	180U	180U	180U
4-Chlorophenyl phenyl ether	--		190U	180U	180U	180U
4-Nitroaniline	500		190U	180U	180U	180U
4-Nitrophenol	--		190U	180U	180U	180U
Acenaphthene	50,000		380	470	180U	390
Acenaphthylene	41,000		190U	180U	180U	180U
Anthracene	50,000		770	830	180U	960
Benzidine	--		370U	360U	350U	360U
Benzo[a]anthracene	224		**1,500**	**2,100**	180U	**1,900**
Benzo[a]pyrene	61		**1,200**	**1,800**	180U	**1,600**
Benzo[b]fluoranthene	1,100		**1,500**	**2,100**	180U	**1,900**
Benzo[g,h,i]perylene	50,000		470	650	180U	650
Benzo[k]fluoranthene	1,100		560	1,000	180U	940
Benzoic acid	--		370U	360U	350U	360U
Benzyl alcohol	--		190U	180U	180U	180U
bis(2-Chloroethoxy)methane	--		190U	180U	180U	180U
bis(2-Chloroethyl) ether	--		190U	180U	180U	180U
bis(2-Chloroisopropyl) ether	--		190U	180U	180U	180U
bis(2-Ethylhexyl) phthalate	50,000		210	150J	100J	230
Butylbenzylphthalate	50,000		190U	180U	180U	180U
Carbazole	--		340	240	180U	400
Chrysene	400		**1,300**	**2,000**	180U	**1,700**
Di-n-butyl phthalate	50,000		190U	180U	180U	180U

µg/kg - Micrograms per kilogram
J - Estimated value
U - Compound was analyzed for but not detected
ft bls - Feet below land surface
NYSDEC RSCOs - New York State Department of Environmental Conservation Recommended Soil Cleanup Objectives
-- No NYSDEC RSCO
Note: Data highlighted in bold represent detections that exceed the NYSDEC RSCOs

Table 6. Summary of Semivolatile Organic Compounds Detected in Soil Surrounding Former Test Pit TP-9, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

		Sample Designation:	**TP9-A**	**TP9-B**	**TP9-C**	**TP9-D**
		Sample Date:	**10/2/99**	**10/2/99**	**10/2/99**	**10/2/99**
		Depth (ft bls):	**6-8**	**6-8**	**6-8**	**4-6**
Parameter (Concentrations in µg/kg)	**NYSDEC RSCOs (µg/kg)**					
Di-n-octyl phthalate	50,000		190U	180U	180U	180U
Dibenzo[a,h]anthracene	14		**170J**	**270**	180U	**250**
Dibenzofuran	6,200		250	130J	180U	250
Diethyl phthalate	7,100		190U	180U	180U	180U
Dimethyl phthalate	2,000		190U	180U	180U	180U
Fluoranthene	50,000		2,900	3,800	180U	3,900
Fluorene	50,000		470	330	180U	510
Hexachlorobenzene	410		190U	180U	180U	180U
Hexachlorobutadiene	--		190U	180U	180U	180U
Hexachlorocyclopentadiene	--		560U	540U	530U	540U
Hexachloroethane	--		190U	180U	180U	180U
Indeno[1,2,3-cd]pyrene	3,200		530	730	180U	720
Isophorone	4,400		190U	180U	180U	180U
N-Nitrosodi-n-propylamine	--		190U	180U	180U	180U
N-Nitrosodimethylamine	--		190U	180U	180U	180U
N-Nitrosodiphenylamine	--		190U	180U	180U	180U
Naphthalene	13,000		230	180U	180U	170
Nitrobenzene	200		190U	180U	180U	180U
Pentachlorophenol	1,000		190U	180U	180U	180U
Phenanthrene	50,000		2,400	2,500	180U	2,800
Phenol	30		190U	180U	180U	180U
Pyrene	50,000		2,000	2,700	180U	2,500
Pyridine	--		560U	540U	530U	540U

µg/kg - Micrograms per kilogram
J - Estimated value
U - Compound was analyzed for but not detected
ft bls - Feet below land surface
NYSDEC RSCOs - New York State Department of Environmental Conservation Recommended Soil Cleanup Objectives
-- No NYSDEC RSCO
Note: Data highlighted in bold represent detections that exceed the NYSDEC RSCOs

Table 7. Summary of Volatile Organic Compounds Detected in Groundwater in the Vicinity of Geoprobe Point GW-2 (Upgradient Property Boundary), Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Parameter (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	Sample Designation:	GW-12	GW-13	GW-14	GW-15
		Sample Date:	9/28/99	9/28/99	9/28/99	9/28/99
1,1,1-Trichloroethane	5		5U	5U	5U	5U
1,1,2,2-Tetrachloroethane	5		5U	5U	5U	5U
1,1,2-Trichloroethane	1		5U	5U	5U	5U
1,1-Dichloroethane	5		5U	5U	5U	5U
1,1-Dichloroethene	5		5U	5U	5U	5U
1,2-Dichlorobenzene	3		5U	5U	5U	5U
1,2-Dichloroethane	0.6		5U	5U	5U	5U
1,2-Dichloropropane	1		5U	5U	5U	5U
1,3-Dichlorobenzene	3		5U	5U	5U	5U
1,4-Dichlorobenzene	3		5U	5U	5U	5U
2-Chloroethyl Vinyl Ether	--		5U	5U	5U	5U
Bromodichloromethane	50		5U	5U	5U	5U
Bromoform	50		5U	5U	5U	5U
Bromomethane	5		5U	5U	5U	5U
Carbon Tetrachloride	5		5U	5U	5U	5U
Chlorobenzene	5		5U	5U	5U	5U
Chloroethane	5		5U	5U	5U	5U
Chloroform	7		5U	5U	5U	5U
Chloromethane	--		5U	5U	5U	5U
cis-1,2-Dichloroethene	5		5U	5U	5U	5U
cis-1,3-Dichloropropene	0.4		5U	5U	5U	5U
Dibromochloromethane	50		5U	5U	5U	5U
Methylene Chloride	5		5U	5U	5U	5U
Tetrachloroethene	5		5U	5U	5U	5U
trans-1,2-Dichloroethene	5		5U	5U	5U	5U
trans-1,3-Dichloropropene	0.4		5U	5U	5U	5U
Trichloroethene	5		**28**	5U	5U	5U
Trichlorofluoromethane	5		5U	5U	5U	5U
Vinyl Chloride	2		5U	5U	5U	5U

µg/L - Micrograms per liter
U - Compound was analyzed for but not detected
NYSDEC AWQSGVs - New York State Department of Environmental Conservation Ambient Water-Quality Standards and Guidance Values
-- No NYSDEC AWQSGV
Note: Data highlighted in bold represent detections that exceed the NYSDEC AWQSGVs

Table 8. Summary of Volatile Organic Compounds Detected in Groundwater at Former Test Pit TP-9 (Downgradient Property Boundary), Former Thypin Steel, Inc. Plant, Manorhaven, New York.

		Sample Designation:	TP-9D
		Sample Date:	9/30/99
Parameter (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)		
1,1,1-Trichloroethane	5		5U
1,1,2,2-Tetrachloroethane	5		5U
1,1,2-Trichloroethane	1		5U
1,1-Dichloroethane	5		5U
1,1-Dichloroethene	5		5U
1,2-Dichlorobenzene	3		5U
1,2-Dichloroethane	0.6		5U
1,2-Dichloropropane	1		5U
1,3-Dichlorobenzene	3		5U
1,4-Dichlorobenzene	3		5U
2-Chloroethyl Vinyl Ether	--		5U
Bromodichloromethane	50		5U
Bromoform	50		5U
Bromomethane	5		5U
Carbon Tetrachloride	5		5U
Chlorobenzene	5		5U
Chloroethane	5		5U
Chloroform	7		5U
Chloromethane	--		5U
cis-1,2-Dichloroethene	5		5U
cis-1,3-Dichloropropene	0.4		5U
Dibromochloromethane	50		5U
Methylene Chloride	5		5U
Tetrachloroethene	5		**5.6**
trans-1,2-Dichloroethene	5		5U
trans-1,3-Dichloropropene	0.4		5U
Trichloroethene	5		5U
Trichlorofluoromethane	5		5U
Vinyl Chloride	2		5U

µg/l. - Micrograms per liter
U - Compound was analyzed for but not detected
NYSDEC AWQSGVs - New York State Department of Environmental Conservation Ambient Water-Quality Standards and Guidance Values
-- No NYSDEC AWQSGV
Note: Data highlighted in bold represent detections that exceed the NYSDEC AWQSGVs

Table 9. Summary of Volatile Organic Compounds Detected in Groundwater in the Vicinity of the Former Leaching Field, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Parameter (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	Sample Designation: GW-16 Sample Date: 10/1/99
1,1,1-Trichloroethane	5	2.5J
1,1,2,2-Tetrachloroethane	5	5U
1,1,2-Trichloroethane	1	5U
1,1-Dichloroethane	5	5U
1,1-Dichloroethene	5	5U
1,2-Dichlorobenzene	3	5U
1,2-Dichloroethane	0.6	5U
1,2-Dichloropropane	1	5U
1,3-Dichlorobenzene	3	5U
1,4-Dichlorobenzene	3	5U
2-Butanone	50	25U
2-Chloroethyl Vinyl Ether	--	5U
2-Hexanone	50	20U
4-Methyl-2-Pentanone	--	20U
Acetone	50	20U
Acrolein	5	15U
Acrylonitrile	5	10U
Benzene	1	1U
Bromodichloromethane	50	5U
Bromoform	50	5U
Bromomethane	5	5U
Carbon Disulfide	--	5U
Carbon Tetrachloride	5	5U
Chlorobenzene	5	5U
Chloroethane	5	5U
Chloroform	7	5U
Chloromethane	--	5U
cis-1,2-Dichloroethene	5	5U
cis-1,3-Dichloropropene	0.4	5U
Di-isopropyl-ether	--	5U
Dibromochloromethane	50	5U
Ethylbenzene	5	1U
m+p-Xylene	5	2U
Methyl Tertiary Butyl Ether	--	1U
Methylene Chloride	5	5U
o-Xylene	5	1U
Styrene	5	1U
t-Butyl Alcohol	--	10U
Tetrachloroethene	5	5U
Toluene	5	1U
trans-1,2-Dichloroethene	5	5U
trans-1,3-Dichloropropene	0.4	5U
Trichloroethene	5	1.1J
Trichlorofluoromethane	5	5U
Vinyl Acetate	--	10U

µg/L - Micrograms per liter
U - Compound was analyzed for but not detected
J - Estimated Value
NYSDEC AWQSGVs - New York State Department of Environmental Conservation Ambient Water-Quality Standards and Guidance Values
-- No NYSDEC AWQSGV

Table 10. Summary of Semivolatile Organic Compounds Detected in Groundwater in the Vicinity of the Former Leaching Field, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Parameter (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	Sample Designation: GW-16 Sample Date: 10/1/99
1,2,4-Trichlorobenzene	5	0.56 U
1,2-Dichlorobenzene	3	0.55 U
1,3-Dichlorobenzene	3	0.47 U
1,4-Dichlorobenzene	3	0.48 U
2,4-Dinitrotoluene	5	0.49 U
2,6-Dinitrotoluene	5	0.7 U
2-Chloronaphthalene	10	0.29 U
2-Methylnaphthalene	--	3.1 U
2-Nitroaniline	5	2.7 U
3,3'-Dichlorobenzidine	5	3 U
3-Nitroaniline	5	2.5 U
4-Bromophenyl phenyl ether	--	0.85 U
4-Chloroaniline	5	2.2 U
4-Chlorophenyl phenyl ether	--	0.37 U
4-Nitroaniline	5	2.6 U
Acenaphthene	20	0.35 U
Acenaphthylene	--	0.16 U
Anthracene	50	0.21 U
Benzidine	5	22 U
Benzo[a]anthracene	0.002	0.35 U
Benzo[a]pyrene	ND	0.28 U
Benzo[b]fluoranthene	0.002	0.42 U
Benzo[g,h,i]perylene	--	0.27 U
Benzo[k]fluoranthene	0.002	0.45 U
Benzoic acid	--	0.71 U
Benzyl alcohol	--	2.4 U
bis(2-Chloroethoxy)methane	5	0.24 U
bis(2-Chloroethyl) ether	1	0.42 U
bis(2-Chloroisopropyl) ether	--	0.53 U
bis(2-Ethylhexyl) phthalate	5	**11 B**
Butylbenzyl phthalate	50	0.25 U
Carbazole	--	0.4 U
Chrysene	0.002	0.22 U
Di-n-butyl phthalate	50	0.16 U
Di-n-octyl phthalate	50	0.3 U
Dibenzo[a,h]anthracene	--	0.55 U
Dibenzofuran	--	1.7 U
Diethyl phthalate	50	1.7 U
Dimethyl phthalate	--	0.38 U

µg/L - Micrograms per liter

U - Compound was analyzed for but not detected

B - Compound detected in laboratory blank

NYSDEC AWQSGVs - New York State Department of Environmental Conservation Ambient Water-Quality Standards and Guidance Values

-- No NYSDEC AWQSGV

Table 10. Summary of Semivolatile Organic Compounds Detected in Groundwater in the Vicinity of the Former Leaching Field, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

	Sample Designation:	GW-16
	Sample Date:	10/1/99
Parameter (Concentrations in µg/L)	**NYSDEC AWQSGVs (µg/L)**	
ND - Non Detect		
Note: Data highlighted in bold represent detections that exceed the NYSDEC AWQSGVs		
Fluoranthene	50	0.25 U
Fluorene	50	0.16 U
Hexachlorobenzene	0.04	0.53 U
Hexachlorobutadiene	0.5	0.97 U
Hexachlorocyclopentadiene	5	9.7 U
Hexachloroethane	5	1.1 U
Indeno[1,2,3-cd]pyrene	0.002	0.31 U
Isophorone	50	0.13 U
N-Nitrosodi-n-propylamine	--	0.35 U
N-Nitrosodimethylamine	--	16 U
N-Nitrosodiphenylamine	50	0.45 U
Naphthalene	10	0.42 U
Nitrobenzene	0.4	0.56 U
Phenanthrene	50	0.31 U
Pyrene	50	0.39 U
Pyridine	50	4.7 U
2,4,5-Trichlorophenol	--	2.1 U
2,4,6-Trichlorophenol	--	1.5 U
2,4-Dichlorophenol	5	2.3 U
2,4-Dimethylphenol	1	2.5 U
2,4-Dinitrophenol	10	4 U
2-Chlorophenol	--	3.2 U
2-Methylphenol	--	3.3 U
2-Nitrophenol	--	2.4 U
3&4-Methylphenol	--	3.1 U
4,6-Dinitro-2-methylphenol	--	2.4 U
4-Chloro-3-methylphenol	--	1.8 U
4-Nitrophenol	--	2.7 U
Pentachlorophenol	1	5.7 U
Phenol	1	1.3 U

µg/L - Micrograms per liter

U - Compound was analyzed for but not detected

B - Compound detected in laboratory blank

NYSDEC AWQSGVs - New York State Department of Environmental Conservation
Ambient Water-Quality Standards and Guidance Values

-- No NYSDEC AWQSGV

ND - Non Detect

Table 11. Summary of Metals Detected in Groundwater in the Vicinity of the Former Leaching Field, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

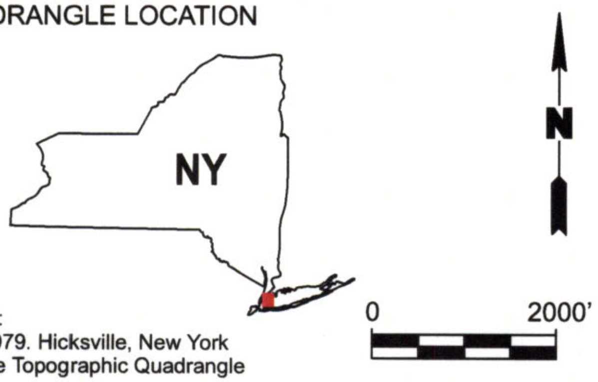
Parameter (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	Sample Designation:	GW-16	GW-16F
		Sample Date:	10/1/99	10/1/99
Aluminum	--		720,000	180U
Antimony	3		10U	10U
Arsenic	25		**330**	6U
Barium	1,000		**9,600**	35
Beryllium	3		**63**	0.7U
Cadmium	5		11U	1.3
Calcium	--		240,000	33,000
Chromium	50		**2,900**	4.6U
Cobalt	--		1,600	8U
Copper	200		**2,400**	70U
Iron	300		**2,300,000**	**3,300**
Lead	25		**750**	7.6U
Magnesium	35,000		**380,000**	12,000
Manganese	300		**32,000**	**820**
Mercury	0.7		**0.72**	0.3U
Nickel	100		**3,600**	45
Potassium	--		340,000	5,500
Selenium	10		40U	40U
Silver	50		2.5U	2.5U
Sodium	20,000		**70,000**	**70,000**
Thallium	0.5		7.5U	7.5U
Vanadium	--		2,500	17U
Zinc	2,000		**6,200**	30U

µg/L- Micrograms per liter
F - Sample was filtered in the field
U - Metal was analyzed for but not detected
NYSDEC AWQSGVs - New York State Department of Environmental Conservation Ambient Water-Quality Standards and Guidance Values
-- No NYSDEC AWQSGV
Note: Data highlighted in bold represent detections that exceed the NYSDEC AWQSGVs.

Table 12. Summary of Natural Attenuation Parameters Detected in Groundwater in the Vicinity of Geoprobe Point GW-2 (Upgradient Property Boundary), Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Sample Designation:	GW-12	GW-13	GW-14	GW-15
Sample Date:	9/28/99	9/28/99	9/28/99	9/28/99
Parameter (Concentrations in mg/L)				
Nitrate	0.949	0.381	1.55	1.02
TOC	10.6	0.6U	1.0	4.8
Sulfate	27.9	16.0	27.3	209.0
Carbon Dioxide$^{(1)}$	10U	10U	10U	10U
Chloride	2.7	2.7	6.2	2.7
Dissolved Oxygen	2.5	2.7	2.5	2.7
Dissolved Iron	0.49	0.3	0.34	0.39
Dissolved Manganese	0.22	0.23	0.64	0.19
Turbidity (NTU)	71	11	510	294
Salinity$^{(2)}$	0.01	0	0	0.01
pH$^{(3)}$	6.58	7.05	7.45	6.93
TDS	150	100	160	360
Ethene	0.0004U	0.0004U	0.0004U	0.0004U
Ethane	0.0004U	0.0004U	0.0004U	0.0004U

mg/L - Milligrams per liter
TOC - Total Organic Carbon
TDS - Total Dissolved Solids
NTU - Nephelometer Turbidity Units
U - Indicates compound analyzed for but not detected
(1) Determined by Acidity Method 2310
(2) Reported in percent
(3) Reported in Standard Units
Note: Turbidity, salinity and pH were measured in the field at the time of ground-water sampling.



QUADRANGLE LOCATION

SOURCE:
USGS; 1979. Hicksville, New York
7.5 Minute Topographic Quadrangle

Title:

SITE LOCATION MAP

Prepared for:

FORMER THYPIN STEEL, INC. PLANT
MANORHAVEN, NEW YORK

ROUX ROUX ASSOCIATES, INC. *Environmental Consulting & Management*	Compiled by: S.G.	Date: 18MAY00	FIGURE
	Prepared by: G.M.	Scale: 1:25000	1
	Project Mgr.: S.G.	Office: NY	
	File No.: MBA0110209.CDR	Project No.: 77101Y	

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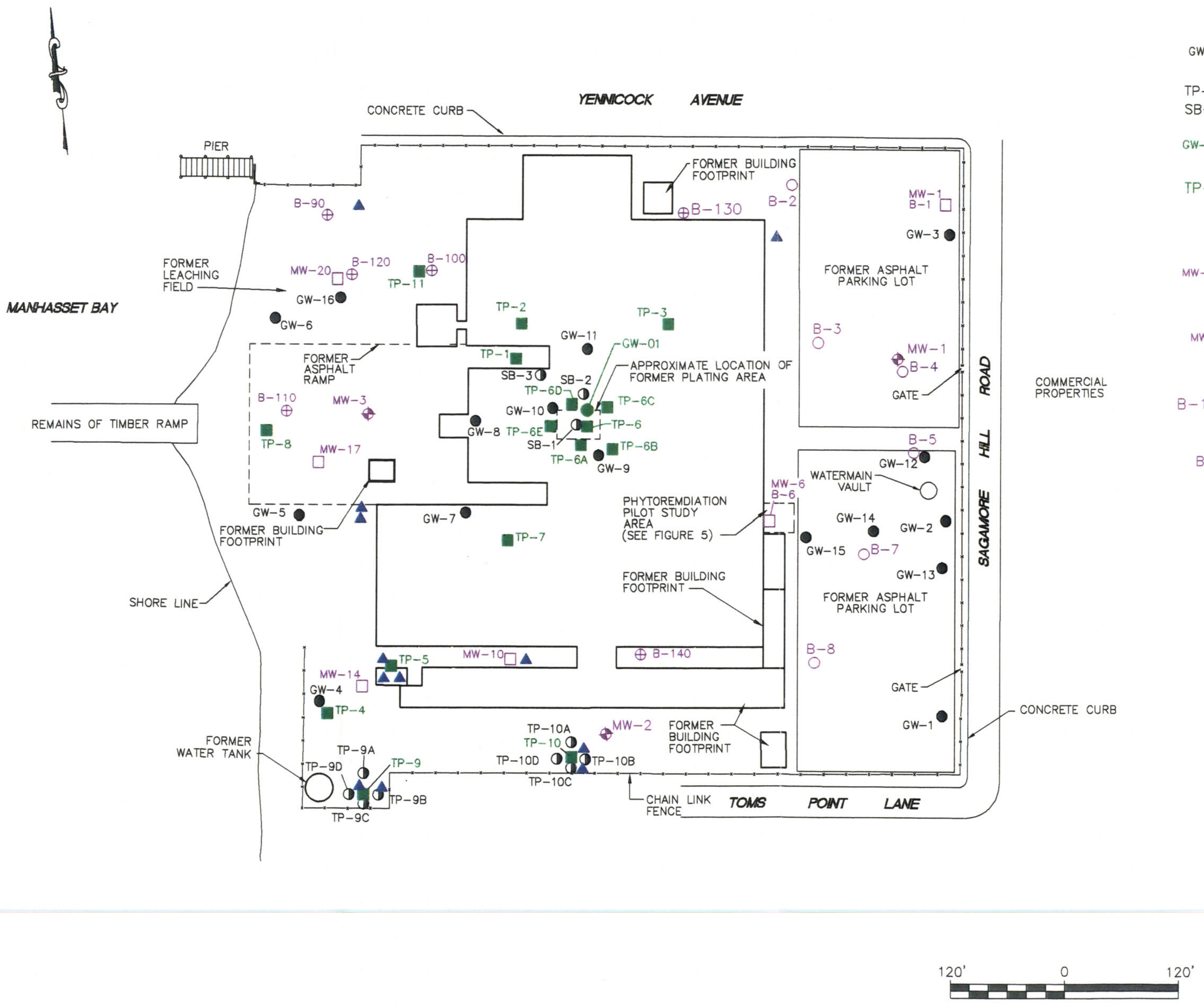


LEGEND

GW-7 ●	LOCATION AND DESIGNATION OF GEOPROBE POINT INSTALLED BY ROUX ASSOCIATES, INC.
TP-9D SB-1 ◑	LOCATION AND DESIGNATION OF FORMER SOIL BORING SAMPLED BY ROUX ASSOCIATES, INC.
GW-01 ●	LOCATION AND DESIGNATION OF GEOPROBE POINT INSTALLED BY CA RICH CONSULTANTS, INC.
TP-5 ■	LOCATION AND DESIGNATION OF FORMER TEST PIT EXCAVATED BY CA RICH CONSULTANTS, INC.
▲	LOCATION OF FORMER UNDERGROUND STORAGE TANK
MW-14 ☐	LOCATION AND DESIGNATION OF FORMER MONITORING WELL INSTALLED BY SOIL MECHANICS DRILLING CORPORATON
MW-1 ⊕	LOCATION AND DESIGNATION OF EXISTING MONITORING WELL INSTALLED BY SOIL MECHANICS DRILLING CORPORATION
B-100 ⊕	LOCATION AND DESIGNATION OF DRY WELL SAMPLED BY SOIL MECHANICS DRILLING CORPORATION
B-8 ○	LOCATION AND DESIGNATION OF FORMER SOIL BORING SAMPLED BY SOIL MECHANICS DRILLING CORPORATION

NOTE: SOIL MECHANICS DRILLING CORPORATION DESIGNATED TWO MONITORING WELLS AS MW-1

PLEASE NOTE THAT THE LOCATIONS OF THE MONITORING WELLS INSTALLED BY SOIL MECHANICS DRILLING CORPORATION, THE TEST PITS AND THE GEOPROBE POINT INSTALLED BY CA RICH CONSULTANTS, INC., THE SOIL BORINGS SAMPLED BY ROUX ASSOCIATES, INC., AND THE FORMER USTs WERE NOT SURVEYED. THEREFORE, THESE LOCATIONS SHOWN ARE CONSIDERED APPROXIMATE. THE BUILDING FOOTPRINT WAS OBTAINED FROM THE APRIL 23, 1951 AERIAL PHOTOGRAPH.

Title:

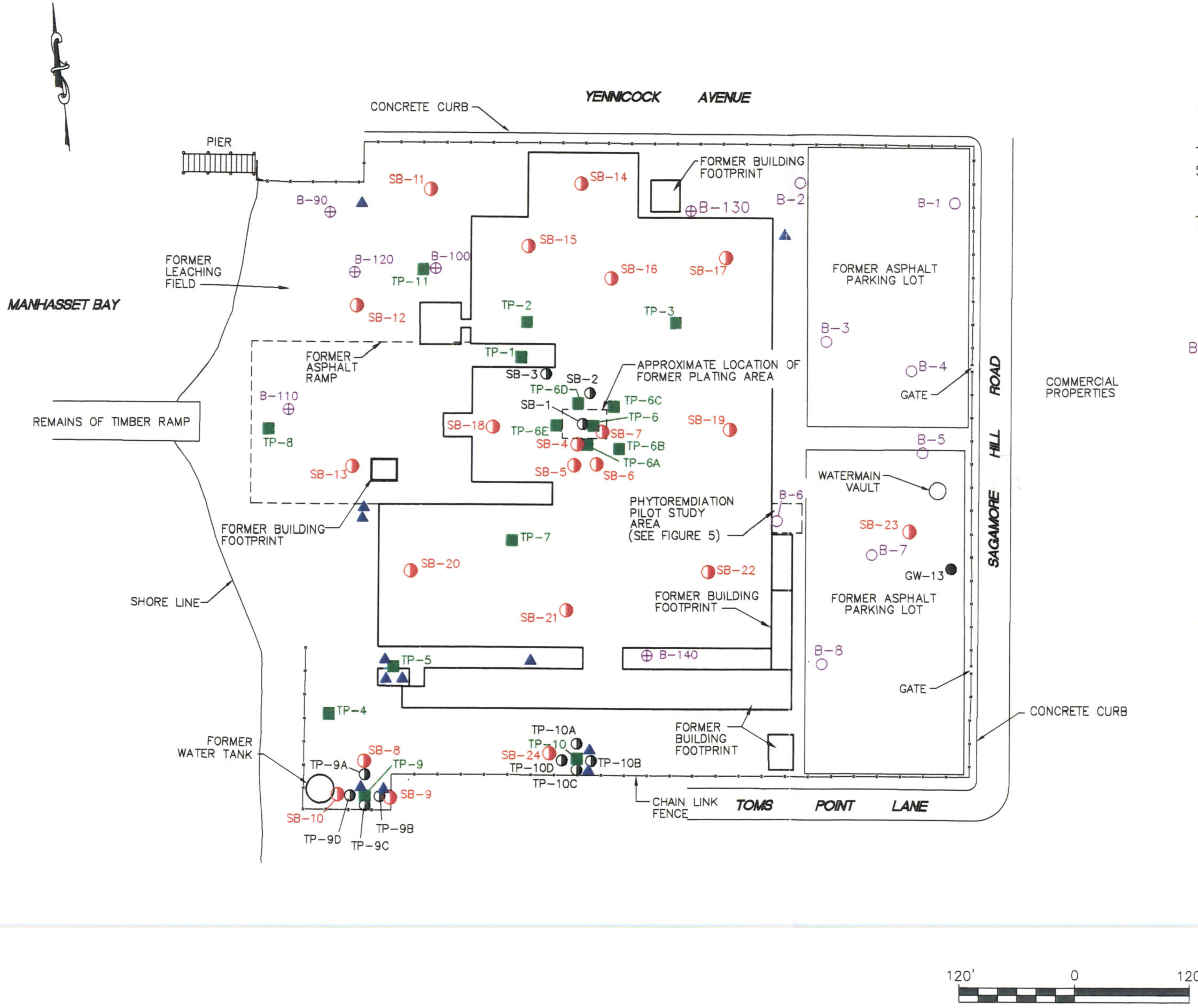
SITE PLAN

Prepared For:

MBA-MANORHAVEN, LLC
MANORHAVEN, NEW YORK

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: J.W.	Date: 16MAY00	FIGURE
Prepared by: B.H.C.	Scale: AS SHOWN	2
Project Mgr: S.J.G.	Office: NY	
File No: MBA0110202	Project: 77101Y	



LEGEND

SB-12 ◐	LOCATION AND DESIGNATION OF PROPOSED SOIL BORING
TP-9D SB-1 ◑	LOCATION AND DESIGNATION OF FORMER SOIL BORING SAMPLED BY ROUX ASSOCIATES, INC.
TP-5 ■	LOCATION AND DESIGNATION OF FORMER TEST PIT EXCAVATED BY CA RICH CONSULTANTS, INC.
▲	LOCATION OF FORMER UNDERGROUND STORAGE TANK
B-100 ⊕	LOCATION AND DESIGNATION OF DRY WELL SAMPLED BY SOIL MECHANICS DRILLING CORPORATION
B-8 ○	LOCATION AND DESIGNATION OF FORMER SOIL BORING SAMPLED BY SOIL MECHANICS DRILLING CORPORATION

NOTE: PLEASE NOTE THAT THE LOCATIONS OF THE TEST PITS, THE SOIL BORINGS SAMPLED BY ROUX ASSOCIATES, INC., AND THE FORMER USTs WERE NOT SURVEYED. THEREFORE, THESE LOCATIONS SHOWN ARE CONSIDERED APPROXIMATE. THE BUILDING FOOTPRINT WAS OBTAINED FROM APRIL 23, 1951 AERIAL PHOTOGRAPH.

Title:

PROPOSD SOIL BORING LOCATIONS

Prepared For:
MBA-MANORHAVEN, LLC
MANORHAVEN, NEW YORK

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: J.W.	Date: 16MAY00	FIGURE
Prepared by: B.H.C.	Scale: AS SHOWN	3
Project Mgr: S.J.G.	Office: NY	
File No: MBA0110204	Project: 77101Y	

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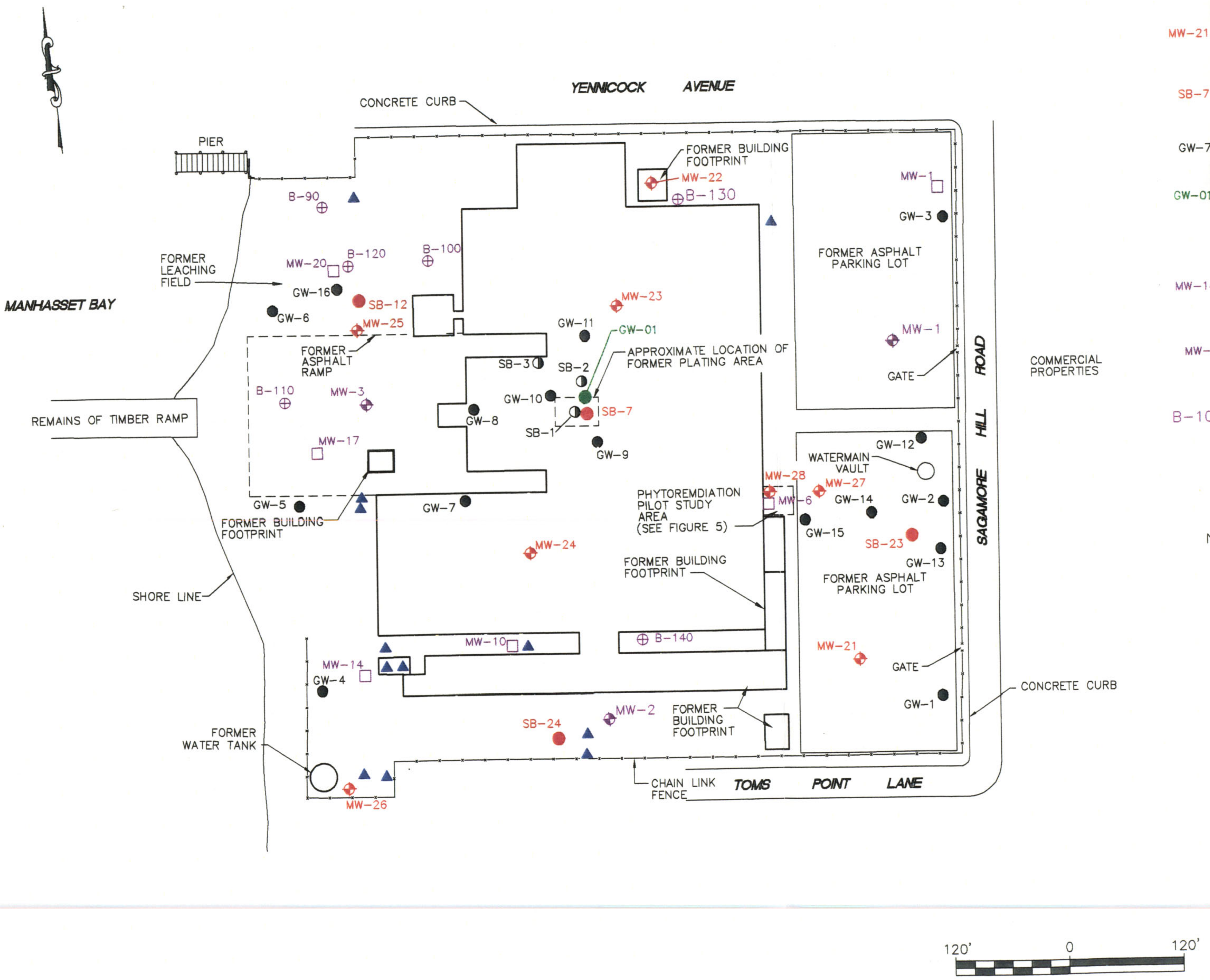


LEGEND

MW-21 ⊕ LOCATION AND DESIGNATION OF PROPOSED MONITORING WELL

SB-7 ● LOCATION AND DESIGNATION OF PROPOSED GEOPROBE GROUNDWATER SAMPLE

GW-7 ● LOCATION AND DESIGNATION OF GEOPROBE POINT INSTALLED BY ROUX ASSOCIATES, INC.

GW-01 ● LOCATION AND DESIGNATION OF GEOPROBE POINT INSTALLED BY CA RICH CONSULTANTS, INC.

▲ LOCATION OF FORMER UNDERGROUND STORAGE TANK

MW-14 ☐ LOCATION AND DESIGNATION OF FORMER MONITORING WELL INSTALLED BY SOIL MECHANICS DRILLING CORPORATON

MW-1 ⊕ LOCATION AND DESIGNATION OF EXISTING MONITORING WELL INSTALLED BY SOIL MECHANICS DRILLING CORPORATION

B-100 ⊕ LOCATION AND DESIGNATION OF DRY WELL SAMPLED BY SOIL MECHANICS DRILLING CORPORATION

NOTE: SOIL MECHANICS DRILLING CORPORATION DESIGNATED TWO MONITORING WELLS AS MW-1.

PLEASE NOTE THAT THE LOCATIONS OF THE MONITORING WELLS INSTALLED BY SOIL MECHANICS DRILLING CORPORATION AND THE FORMER USTs WERE NOT SURVEYED. THEREFORE, THESE LOCATIONS SHOWN ARE CONSIDERED APPROXIMATE. THE BUILDING FOOTPRINT WAS OBTAINED FROM APRIL 23, 1951 AERIAL PHOTOGRAPH.

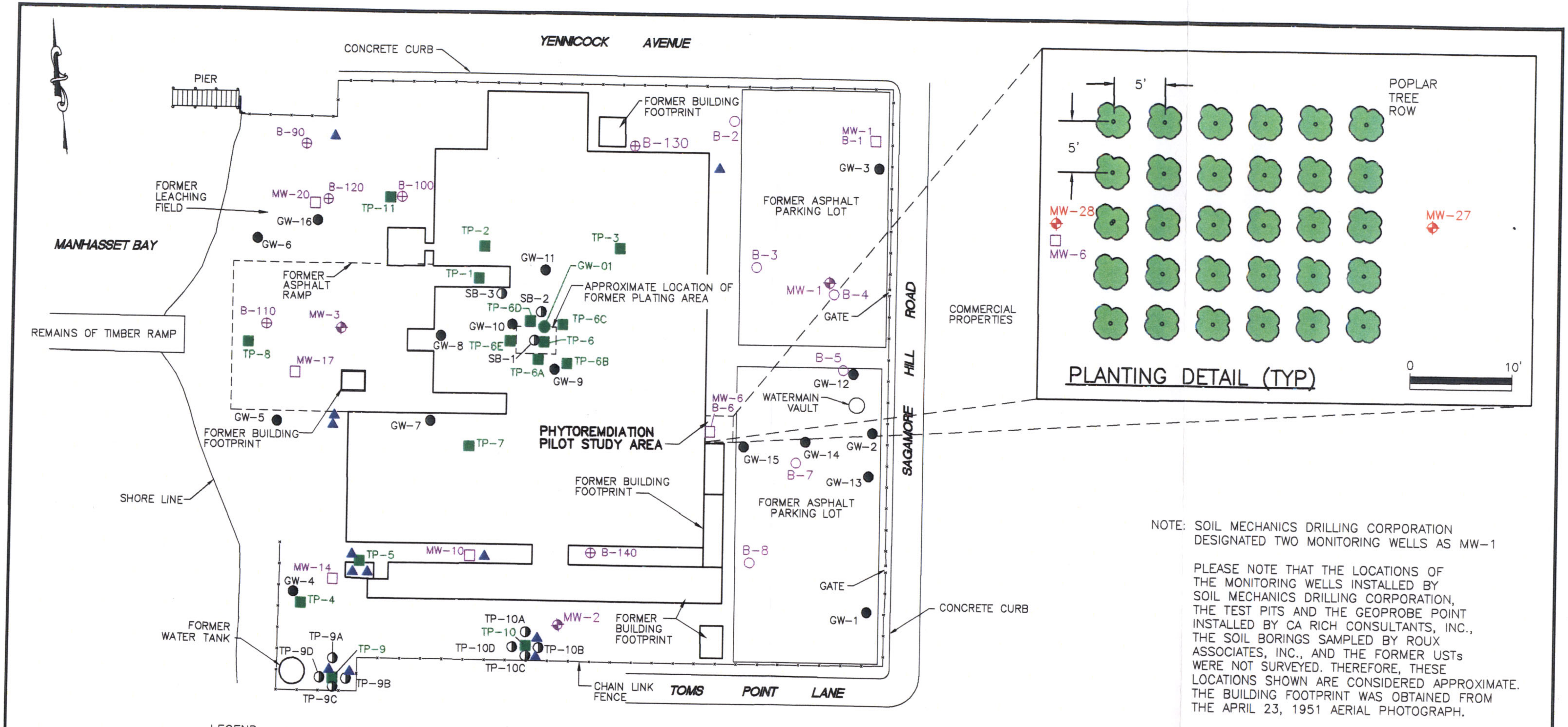
Title:

PROPOSED MONITORING WELL AND GEOPROBE GROUNDWATER SAMPLING LOCATIONS

Prepared For:
MBA-MANORHAVEN, LLC
MANORHAVEN, NEW YORK

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: J.W.	Date: 16MAY00	FIGURE
Prepared by: B.H.C.	Scale: AS SHOWN	4
Project Mgr: S.J.G.	Office: NY	
File No: MBA0110203	Project: 77101Y	



NOTE: SOIL MECHANICS DRILLING CORPORATION DESIGNATED TWO MONITORING WELLS AS MW-1

PLEASE NOTE THAT THE LOCATIONS OF THE MONITORING WELLS INSTALLED BY SOIL MECHANICS DRILLING CORPORATION, THE TEST PITS AND THE GEOPROBE POINT INSTALLED BY CA RICH CONSULTANTS, INC., THE SOIL BORINGS SAMPLED BY ROUX ASSOCIATES, INC., AND THE FORMER USTs WERE NOT SURVEYED. THEREFORE, THESE LOCATIONS SHOWN ARE CONSIDERED APPROXIMATE. THE BUILDING FOOTPRINT WAS OBTAINED FROM THE APRIL 23, 1951 AERIAL PHOTOGRAPH.

LEGEND

MW-27 ⊕	LOCATION AND DESIGNATION OF PROPOSED MONITORING WELL
GW-7 ●	LOCATION AND DESIGNATION OF GEOPROBE POINT INSTALLED BY ROUX ASSOCIATES, INC.
TP-9D SB-1 ◐	LOCATION AND DESIGNATION OF FORMER SOIL BORING SAMPLED BY ROUX ASSOCIATES, INC.
GW-01 ●	LOCATION AND DESIGNATION OF GEOPROBE POINT INSTALLED BY CA RICH CONSULTANTS, INC.
TP-5 ■	LOCATION AND DESIGNATION OF FORMER TEST PIT EXCAVATED BY CA RICH CONSULTANTS, INC.
▲	LOCATION OF FORMER UNDERGROUND STORAGE TANK
MW-14 ☐	LOCATION AND DESIGNATION OF FORMER MONITORING WELL INSTALLED BY SOIL MECHANICS DRILLING CORPORATON
MW-1 ⊕	LOCATION AND DESIGNATION OF EXISTING MONITORING WELL INSTALLED BY SOIL MECHANICS DRILLING CORPORATION
B-100 ⊕	LOCATION AND DESIGNATION OF DRY WELL SAMPLED BY SOIL MECHANICS DRILLING CORPORATION
B-8 ○	LOCATION AND DESIGNATION OF FORMER SOIL BORING SAMPLED BY SOIL MECHANICS DRILLING CORPORATION

120' 0 120'

Title:

PROPOSED PHYTOREMEDIATION PLOT PLAN

Prepared For:

MBA-MANORHAVEN, LLC
MANORHAVEN, NEW YORK

ROUX
ROUX ASSOCIATES, INC.

Compiled by: J.W.	Date: 16MAY00	FIGURE
Prepared by: B.H.C.	Scale: AS SHOWN	

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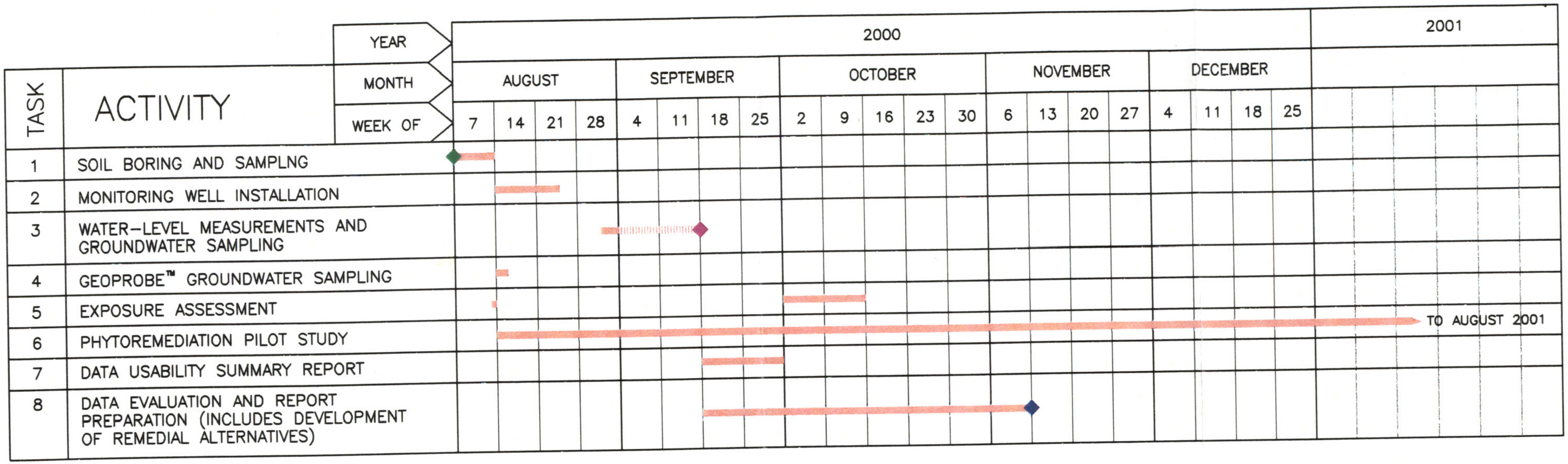

LEGEND

- 🟥 SCHEDULE TO COMPLETE TASK
- ◆ APPROVAL TO PROCEED
- ◆ RECEIPT OF ANALYTICAL DATA
- ◆ SUBMITTAL OF SUMMARY REPORT TO THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Title:

PROJECT SCHEDULE

Prepared For:

MBA-MANORHAVEN, LLC
MANORHAVEN, NEW YORK

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: J.W.	Date: 16MAY00	FIGURE
Prepared by: B.H.C.	Scale: AS SHOWN	6
Project Mgr: S.J.G.	Office: NY	
File No: MBA0110207	Project: 77101Y	

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APPENDIX A

Sampling and Analysis Plan

SAMPLING AND ANALYSIS PLAN

Former Thypin Steel, Inc. Plant
Manorhaven, New York

Appendix A

September 26, 2000

Approvals:

Roux Associates, Inc. Project Manager	Scott J. Glash Scott J. Glash	9/26/00 Date
Roux Associates, Inc. Project Quality Assurance Coordinator	Stephen E. Graham Stephen Graham, Ph.D.	9/26/00 Date

ROUX

CONTENTS

CONTENTS (Continued)

TABLES

FIGURES

ATTACHMENTS

1.0 INTRODUCTION

Roux Associates, Inc. (Roux Associates) has developed this Investigation Work Plan (Work Plan) for the former Thypin Steel, Inc. (Thypin Steel) Plant in Manorhaven, New York (Site) (Figure A-1). The Work Plan objectives are to:

- complete the lateral and/or vertical soil quality delineation at the former plating area and at former UST Area TP-9;
- perform confirmation soil sampling and analysis in the former leaching field;
- characterize soil quality in uninvestigated areas inside of the former building footprint;
- determine whether there is an onsite source(s) of chlorinated volatile organic compounds (CVOCs) in groundwater;
- determine the lateral and vertical extent of CVOCs in groundwater;
- determine the base neutral compound (BN) groundwater impacts, if any, at former UST Area at TP-9;
- verify the absence of a dense non-aqueous phase liquid (DNAPL);
- verify the direction of groundwater flow at the Site;
- determine the likelihood for human exposure to chemicals of potential concern identified in the soil and groundwater based on a future residential-use scenario; and
- develop remedial alternatives for soil and groundwater impacts identified at the Site including, evaluating whether phytoremediation and natural attenuation are viable remedial technologies for the removal and/or degradation of CVOCs in groundwater at the Site.

The Work Plan and this Sampling and Analysis Plan (SAP) were developed in accordance with direction provided in the United States Environmental Protection Agency (USEPA) guidelines for conducting investigations (USEPA, 1988).

To prepare the Work Plan, Roux Associates reviewed available information including previous investigations/remedial activities conducted at the Site, historical aerial photographs and Sanborn maps, and Site plans and drawings. A detailed description of the Site history and setting based on available data are provided in Section 2.0 of the Work Plan.

As discussed in Section 4.0 of the Work Plan, soil and groundwater will be investigated to further characterize the soil and groundwater quality at the Site. Methods to perform the field scope of work tasks in the Work Plan are described in detail in this SAP.

2.0 SAMPLING OBJECTIVES

This SAP describes in detail the sampling and data-gathering methods to be used during implementation of the scope of work. Guidance for the SAP methodology was acquired from the USEPA Compendium of Superfund Field Operations Methods (USEPA, 1987). The SAP was developed based upon a detailed review of available information developed during previous investigations/remedial activities performed at the Site, and is designed to obtain the data necessary to achieve the objectives specified in Section 1.0:

2.1 Scope of Work

The scope of work discussed in this SAP includes the tasks described in the Work Plan. Specifically, these tasks are:

- Task 1: Soil Boring and Sampling;
- Task 2: Monitoring Well Installation;
- Task 3: Water-Level Measurements and Groundwater Sampling;
- Task 4: Geoprobe Groundwater Sampling;
- Task 5: Exposure Assessment;
- Task 6: Phytoremediation Pilot Study;
- Task 7: Data Usability Summary Report; and
- Task 8: Data Evaluation and Report Preparation.

A detailed description of each task is provided in Section 6.0 of this SAP.

2.2 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements used to develop a scientific and resource effective sampling design. As stated in the Guidance for the Data Quality Objectives Process (EPA QA/G4), DQOs are derived from the outputs of each step of the DQO process that:

- classify the study objective;
- define the most appropriate type of data to collect;

- determine the most appropriate conditions from which to collect the data; and
- specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the decision (USEPA, 1994).

The objective of the sampling at the Site is to further assess the soil and groundwater quality conditions. A nonprobabilistic (judgmental) sampling approach will be used to select the specific sampling locations for areas of concern. A judgmental sampling design consists of directed samples at specific sampling locations to confirm the existence of contamination at these chosen locations based on visual or historical information.

Total study error is a combination of sampling and measurement error. The total study error is directly related to decision error. The decision errors can be controlled through the use of hypothesis testing. For this sampling, the null hypothesis (baseline conditions) is that the parameters of interest exceed the action level. This decision has the smallest degree of decision error. In addition, measurement error is reduced by analyzing individual samples using precise laboratory methods. Analyses will be performed using the Test Methods for Evaluating Solid Waste (SW-846) in accordance with the New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP).

3.0 SAMPLE TYPES, LOCATION AND FREQUENCY

Soil and groundwater sampling locations will be selected in the field in areas where additional soil and groundwater quality data is needed to complete delineation and in areas where no soil quality data have been collected. Locations of the proposed soil and groundwater samples are shown in Figures A-2 and A-3.

3.1 Sample Matrix Types

The two sample media to be collected during implementation of the Work Plan are soil and groundwater. Sample types and analytical parameters are summarized in Table A-1.

Soil and groundwater samples collected during the course of the field investigation at the Site will be analyzed in accordance with the SW-846 Test Methods for Evaluating Solid Waste for organic and inorganic parameters. The analytical suite for these samples may include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), Target Analyte List (TAL) metals plus cyanide, total petroleum hydrocarbons (TPH), total dissolved solids (TDS), chloride, natural attenuation parameters (dissolved oxygen, carbon dioxide, alkalinity, sulfate, ammonia, dissolved iron/reduced iron, dissolved manganese/reduced manganese, ethane, and ethene) and agronomic analyses. The analytical parameters for the projected field samples are presented in Table A-2 and further described in the Quality Assurance Project Plan (QAPP), Appendix B of the Work Plan.

Field instrumentation will be used to measure physical parameters (i.e., turbidity, pH, specific conductance, and temperature) in groundwater. Sections 4.0 and 7.0 of the QAPP discuss the field and laboratory analytical method choice rationale.

3.2 Sample Location and Frequency

The sample locations and the number of samples to be collected are summarized in Table A-2. Specifics regarding the collection of samples at each location are provided in Section 6.0. The project quality control samples are summarized in Table A-3. Quality control samples for the field and laboratory are summarized in Tables A-4 and A-5, respectively.

4.0 SAMPLE DESIGNATION

Sample bottles (preserved, if necessary), labels and shipping containers will be provided by the laboratory. During collection and containment of samples, the sample container will be labeled with the following information:

- Site identifier;
- Roux Associates' project number;
- sample type (media) identification code;
- sample location identifier and field Quality Control (QC) identifier (if applicable);
- sample depth and analysis identifier;
- date and time of collection; and
- type of preservative added (if applicable).

The sample identification code and number provided on each sample label will follow a sample number and coding system to remain consistent with the previously work performed at the Site.

1. Sample location abbreviations will be as presented below.

   Soil Borings Within the Former Building Footprint = SB-14 through SB-22

   Soil Borings Within the Plating Area at former Test Pit TP-6A = SB-4

   Soil Borings Within the Plating Area near former Test Pit TP-6A = SB-5 and SB-6

   Soil Borings Within the Plating Area at former Test Pit TP-6 = SB-7

   Soil Borings Surrounding Former UST Area at TP-9 = SB-8, SB-9, SB-10

   Soil Borings Within the Former Leaching Field Area = SB-11, SB-12, SB-13

   Groundwater - Site Wide = MW-21 though MW-28

   Groundwater - Vertical Delineation = SB-7, SB-12, SB-23, SB-24

2. Depth intervals will be designated in feet or tenths of a foot (e.g., 0.1, 1.0, etc.).

3. Analytical Method Designations will be as presented below.

Volatile Organic Compounds	=	VOC
Semivolatile Organic Compounds	=	SVOC
Metals	=	MET
Total Petroleum Hydrocarbons	=	TPH
Base Neutral Compounds	=	BN
Chlorinated Volatile Organic Compounds	=	CVOC
Total Dissolved Solids	=	TDS
Chloride	=	CHL

4. QC identifiers will be as follows:

Field duplicate/replicate	=	R

For example, the designation "SB9/0-2/VOC" would indicate that the sample was a soil sample collected at Soil Boring SB-9 within the former building footprint, that it was collected at a depth interval of 0 to 2 ft below land surface (bls), and was selected for VOC analysis.

5.0 FIELD ACTIVITIES

The following sections describe the standard protocols to be used by field personnel during the course of the sampling activities. Roux Associates' Standard Operating Procedures (SOPs) included in Attachment A-1 will be referenced where applicable. Additional information regarding Quality Assurance/Quality Control (QA/QC) protocols and methods may be found in the QAPP (Appendix B of this Work Plan).

5.1 Field Management

The overall management structure for field activities is presented in Figure A-4. A general discussion of the responsibilities of the technical staff is provided below.

Project Manager

The Project Manager bears the primary responsibility for the successful completion of the work assignment within budget and schedule. The Project Manager provides overall management for the execution of the work and directs the activities of the Field Manager and technical staff. The Project Manager will perform technical review of all field activities, data review and interpretation, and the preparation of the report. The Project Manager works closely with the analytical laboratory, drillers, and surveyors during the execution of the field program. The activities of the Project Manager are supported by senior management, the Project Quality Assurance Coordinator, and support staff.

Field Manager

The Field Manager bears the primary responsibility for the successful execution of the field program. The Field Manager directs the activities of technical staff in the field and assists in the interpretation of all physical and chemical data, and in report preparation. The Field Manager will be responsible for the management of technical staff including hydrogeologists and technicians, and subcontractors such as drillers and surveyors. In addition, the Field Manager will work closely with Site Health and Safety Officer to ensure compliance with the Health and Safety Plan (HASP).

Field Technical Staff

Field technical staff consists of hydrogeologists, geologists, engineers and technicians who will perform activities such as soil sampling, geologic logging and preparation of any necessary field documentation.

Site Health and Safety Officer

The Site Health and Safety Officer (SHSO) will be responsible for the implementation of the HASP. The SHSO will revise the HASP, if required, based upon the results of the former Thypin Steel Facility investigation. Any necessary revision to the HASP will be submitted to the Health and Safety Manager for approval.

Project Quality Assurance Coordinator (PQAC)

The PQAC provides technical quality assurance assistance, prepares, reviews and approves the QAPP, oversees any contractor quality assurance activities to ensure compliance with contract specifications, monitors field investigations and prepares QAPP reports, if necessary. The PQAC will work closely with senior management and technical reviewers.

5.2 Site Control

The Site control procedures have been developed to minimize both the risk of exposure to contamination and the spread of contamination during field activities. In order to accomplish this objective, the following three considerations have been addressed:

- the establishment of discrete work zones in the investigative area;
- the decontamination of field equipment; and
- the security and access procedures for the Site.

All personnel who come onto the Site, including plant employees, contractors, and observers, will be required to adhere strictly to the conditions imposed herein, and within the provisions of the HASP (Appendix C of this Work Plan).

5.2.1 Field Work Zones

Field work zones will be established in areas where soil sampling is conducted. Access will be limited in accordance with the HASP (Appendix C of this Work Plan). Control of work zone access will be the responsibility of the Field Manager.

5.2.2 Decontamination Area

The location of the decontamination area will be determined prior to the start of operations. The decontamination area will be constructed so that wash water generated during decontamination will be collected and containerized for proper disposal.

5.2.3 Site Security and Access

The Site security and access control protocols used by the facility will be followed during implementation of the scope of work. At the completion of each working day, all loose equipment (e.g., sampling equipment, coolers, etc.) will be secured. Heavy equipment, such as the drill rig, will remain onsite, within the current work zone.

5.3 Field Equipment

All measurement systems utilized in the field will be operated in accordance with the manufacturer's instructions and the applicable SOPs in Attachment A-1. Methods of calibrating and maintaining the equipment are provided below.

5.3.1 Equipment Calibration

All measurement equipment will be calibrated according to the manufacturer's recommendations, where applicable. Frequency of instrument calibration will be dictated by the type of measurement device. Table A-6 lists the field measurement equipment to be used and the calibration frequency for the instrument. Records of all calibrations (both frequency and results) will be kept in the field or instrument logbook.

5.3.2 Equipment Maintenance

All field equipment will be stored in a clean, controlled environment (as necessary) to prevent damage due to heat, cold, moisture, etc. prior to use. Reusable equipment will be decontaminated as soon as reasonably possible after use and stored as described above. Decontamination procedures are provided in Section 5.7 and in the SOPs in Attachment A-1. Maintenance for measurement and health and safety equipment will be in accordance with the schedule found in Table A-6.

Equipment failing to meet manufacturer's minimum specifications will be removed from service immediately and kept out of service until the problem is identified and/or resolved. Records of all routine maintenance and repair will be kept in the instrument or field logbook.

5.4 Field Documentation

The following sections provide guidance to field personnel in the areas of documentation and record keeping. The goal of field documentation is to provide a clear and complete record that can be used for reference and information retrieval at a later date. All field documentation will be recorded in bound logbooks or pre-generated activity specific forms using indelible (waterproof) ink. Details of record keeping requirements are described in the SOPs in Attachment A-1, and in Section 6.1.2 of the QAPP. Samples of field forms are provided in Attachment A-2.

5.4.1 Field Logbooks

Field logbooks will be used for all record keeping, providing a permanent bound record of all field-related activities. Additional records may be kept on pre-generated forms for sample tracking and other purposes. The types of information and level of detail required for logbook recording are described in the Field Record Keeping and Quality Assurance/Quality Control SOP in Attachment A-1 and in Section 6.1.2 of the QAPP.

5.4.2 Field Documentation for Drilling

Daily field activities will be summarized in a field notebook to ensure that an accurate record of all field investigation tasks is maintained. Geologic logs will be prepared during the drilling of soil borings. An example of a geologic log form is provided in Attachment A-2.

5.4.3 Sampling Documentation

A complete record of how each sample was selected, aliquoted, packaged, and preserved for analysis will be maintained in field logbooks. Specific procedures regarding the level and type of sampling documentation can be found in the activity-specific Roux Associates' SOPs in Attachment A-1. Sample designation and labeling are discussed in Section 4.0 of this SAP.

Questions regarding sampling methods and QA will be addressed by the Project Manager or the Roux Associates PQAC.

5.5 Custody Procedures and Documentation

The following sections describe the procedures necessary to document sample custody. The purpose of documenting sample custody is to ensure that the integrity and handling of the samples is not subject to question. Sample custody will be maintained from the point of sampling through the analysis (and return of unused sample portion, if applicable). Specific procedures regarding sample tracking from the field to the laboratory are described in the SOP for sample handling (Attachment A-1) and in Section 6.0 of the QAPP. Examples of a chain-of-custody form and a custody seal can be found in Attachment A-2.

5.5.1 Field Custody

Each individual collecting samples is personally responsible for the care and custody of the samples. All sample labels should be pre-printed or filled out using waterproof ink. Field technical staff will review all field activities with the Field Manager to determine whether proper custody procedures were followed during the field work and to decide if additional samples are required.

Samples must be accompanied by a properly completed chain-of-custody form (Attachment A-2). The sample numbers will be listed on the chain-of-custody form. When transferring the possession of samples, individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to/from a secure storage area, and to the laboratory.

Samples will be packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be locked and/or secured with strapping tape in at least two locations for shipment to the laboratory. If split samples are requested, a separate chain-of-custody form is prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency will request the representative's signature on the chain-of-custody form, acknowledging sample receipt. If the representative is unavailable or refuses, this will be noted in the "Received By" space.

If samples are to be collected and delivered directly to the Field Manager, the Field Manager will complete the chain of custody for laboratory shipment and have the field sampler sign in the "sampler" box. If samples are transferred from the field sampler to an intermediary person before being transferred to the Field Manager, a separate chain-of-custody form from that used to ship samples to the laboratory must be completed for the field transfers. Any questions regarding custody procedures or QA will be addressed by the Field Manager and/or the PQAC.

5.5.2 Laboratory Custody

The sample custodian at each laboratory will ensure that chain-of-custody records are completed upon receipt of the samples and will note questions or observations concerning sample integrity. The laboratory QA officer will also ensure that sample tracking records are maintained. These records will follow each sample through all stages of laboratory processing. The sample tracking records must show the date of sample extraction or preparation and the date of instrument analysis. These records will be used, in part, to determine compliance with holding time requirements. Section 6.0 of the QAPP describes the specific laboratory custody and sample handling procedures required for this project.

5.6 Sample Handling and Analysis

To assure quality data acquisition, and the collection of representative samples, there are selective procedures to minimize sample degradation or contamination. These include procedures for preservation of the samples as well as sample packaging and shipping procedures. These procedures are summarized below and are also discussed in Section 6.0 of the QAPP.

5.6.1 Field Sample Handling and Shipment

All samples will be collected and handled according to the protocol described in the sampling SOP (Attachment A-1). The types of containers, volumes needed, and preservation techniques for the specified testing parameters are presented in Table A-7.

Sample packaging and shipping procedures are based upon USEPA specifications, as well as U.S. Department of Transportation (DOT) regulations. The procedures vary according to potential sample analytes, concentration, and matrix, and are designed to provide optimum protection for the samples and the public. Sample packaging and shipment must be performed using the general outline described below. Additional information regarding sample handling is provided in the SOPs (Attachment A-1) and in Section 6.0 of the QAPP.

All samples will arrive within 48 hours of collection and will be preserved appropriately at the time of sample collection. A description of the sample packing and shipping procedures is presented below.

1. Prepare cooler(s) for shipment:
   - Tape drain(s) of cooler shut;
   - Affix "This Side Up" arrow labels and "Fragile" labels on each cooler; and
   - Place mailing label with laboratory address on top of cooler(s).
2. Arrange sample containers in groups by sample number.
3. Ensure that all bottle labels are completed correctly. Place clear tape over bottle labels to prevent moisture accumulation from causing the label to peel off.
4. Seal sample containers within plastic zip-lock bags to prevent vermiculite from contacting samples, where possible.
5. Place approximately 2 inches of vermiculite or other packaging material at the bottom of the cooler to act as a cushion for the sample containers.
6. Arrange containers in the cooler so that they are not in contact with the cooler or other samples.
7. Fill remaining spaces with vermiculite or other packaging material.
8. Ensure all containers are firmly packed in vermiculite or other packaging material.
9. If ice is required to preserve the samples, ice cubes should be repackaged in double zip-lock bags, and placed on top of the vermiculite or other packaging material.
10. Sign chain-of-custody form (or obtain signature) and indicate the time and date it was relinquished to Airborne or other carrier, as appropriate.
11. Separate copies of chain-of-custody forms. Seal proper copies within a large zip-lock bag and tape to cooler. Retain copies of all forms.
12. Close lid and latch.
13. Secure each cooler using custody seals.

14. Tape cooler shut on both ends.
15. Relinquish to Federal Express or other courier service as appropriate. Retain airbill receipt for project records. (Note: All samples will be shipped for "NEXT DAY" delivery).
16. Telephone laboratory contact and provide him/her with the following shipment information:
    - sampler's name;
    - project name;
    - number of samples sent according to matrix and concentration; and
    - airbill number.

5.6.2 Laboratory Analysis

Analytical methods for the chemical analysis of constituents of concern have been chosen based upon DQOs to provide the highest level of data quality for the purpose of evaluating remedial alternatives. Laboratory analyses will be conducted using standard methodologies as summarized in Table A-3. Applicable QA/QC is described in Table A-4 and Table A-5 for field QC and laboratory QC, respectively. Rationale for the choice of specific analytical methods is provided in Section 7.5 of the QAPP.

The sample analyses will be performed by Severn Trent Laboratories-Connecticut of Shelton, Connecticut, which is a New York State Department of Health-certified laboratory.

5.7 Decontamination Procedures

The procedures for the decontamination of field equipment, personnel and sampling equipment are outlined in the following sections. Detailed procedures for the decontamination of field and sampling equipment are included in the SOPs provided in Attachment A-1.

In an attempt to avoid the spread of contamination, all equipment (e.g., drill rigs, drilling tools, sampling equipment, etc.) must be decontaminated at a reasonable frequency in the decontamination area. The location of the decontamination area will be determined prior to the start of operations. All wash water generated during cleaning will be collected and removed for proper disposal.

5.7.1 Drilling Equipment

The augers, drilling casings, rods, Geoprobe™, samplers, tools, and any piece of equipment that may come in contact (directly or indirectly) with the soil or groundwater, will be steam cleaned prior to set up for drilling to ensure proper decontamination. The same steam cleaning procedures will be followed for augers and sampling tools used for each borehole. All steam cleaning (decontamination) activities will be monitored and documented by Roux Associates. Specific procedures for decontaminating drilling equipment are provided in the Roux Associates' SOP for decontamination of field equipment in Attachment A-1.

5.7.2 Personnel Protection

The field work will be performed in level D protection with air monitoring provided to demonstrate the adequacy of this protection. Any decontamination of personnel required will be performed at a designated area of the facility, and appropriate decontamination materials (e.g., eye wash) will be maintained for use in this area. The required photoionization detector (PID) readings for changing protection levels and other specifics regarding personnel protection and decontamination are discussed in the HASP (Appendix C of this Work Plan).

5.7.3 Sampling Equipment

All sampling equipment will be decontaminated prior to sampling and between sampling locations according to the procedures outlined in the SOPs included in Attachment A-1. All sampling equipment will be decontaminated using steam cleaning equipment or using a non-phosphate, laboratory-grade detergent solution and distilled or potable water in a clean bucket.

5.8 Waste Handling and Disposal

Wastes generated during performance of field tasks (e.g., drill cuttings) will be minimized to the extent possible. However, cuttings generated will be placed on plastic and covered with plastic, and stored within a designated area of the Site. All decontamination water produced and water from the purging of wells during installation will be containerized in labeled 55-gallon drums. Each drum will be labeled with the Site name, drum number, date and nature of contents. Drill cuttings and excess soil materials, liquid wastes and disposable personnel protective equipment will be stored separately.

The handling of all wastes will conform to the health and safety requirements of the HASP. Composite samples will be collected to characterize the wastes prior to transport and disposal. Sample types, analytical parameters, and number of samples analyzed will be dependent upon state and federal transportation, landfill and/or site disposal requirements, and the requirements of the contracted waste hauler and waste-processing facility for wastes determined to be hazardous.

In addition, all vehicles leaving the facility must be properly logged. The log will contain the vehicle identification, the driver's name, time of departure, and approximate volume of material carried. Copies of truck weight tickets, waste manifests, and other receipts as provided by the disposal facility, will be maintained as evidence of the arrival and disposal of the material at the disposal site.

6.0 FIELD INVESTIGATION PROCEDURES

This section describes the methods to be utilized during implementation of the field tasks described in the Scope of Work section of the Work Plan. The field tasks identified in the Work Plan are:

- Task 1: Soil Boring and Sampling;
- Task 2: Monitoring Well Installation;
- Task 3: Water-Level Measurements and Groundwater Sampling;
- Task 4: Geoprobe™ Groundwater Sampling;
- Task 5: Exposure Assessment (Soil Sampling); and
- Task 6: Phytoremediation Pilot Study.

The remainder of this section provides a description of the methods to be utilized in the performance of each field task.

6.1 Task 1: Soil Boring and Sampling

A total of 21 soil borings (SB-4 through SB-24) will be sampled continuously at 2 ft intervals from land surface to the depth where groundwater is encountered, which is approximately 8 ft bls. Four of the 21 soil borings (SB-4 through SB-7) will be sampled below the water table to determine the vertical extent of impacts within the former plating area. Additionally, four of the 21 soil borings (SB-7, SB-12, SB-23 and SB-24) will be sampled to verify the absence of a DNAPL. The location of each soil boring is shown in Figure A-3.

The soil samples will be collected using the Geoprobe™ method. The truck-mounted Geoprobe™ equipment will be positioned over the selected boring location, and a 2-ft or 4-ft long drive-point sampler containing a disposable acetate liner will be attached to steel rods and driven to the desired sampling depth. The drive-point sampler will remain closed while it is being driven to the sampling depth. The sampler will be opened by releasing a stop pin from the surface, and the sampler will be driven 2 ft or 4 ft into the material to be sampled (releasing the stop pin allows a piston to retract inside of the sampling tube while it is displaced by the soil core). The soil core contained within the disposable acetate liner will be retrieved by retracting the steel rods and the drive-point sampler. The disposable acetate liner, with the intact soil sample, will then be removed from the drive point sampler.

Each sample will be inspected for contamination (e.g., odors and staining). A portion of each sample will be placed in a Ziploc™ bag and screened in the field for VOCs using a PID. Please note that these samples will be screened (i.e., headspace) after each sample has equilibriated for a minimum of 15 minutes. The lithology of each sample will be described, and recorded in the field notebook.

The soil sample that exhibits the highest degree of contamination from each soil boring will be selected for laboratory analysis. However, if no discernable contamination is present, the sample at the 2-ft interval immediately above the water table will be submitted for laboratory analysis. One soil sample will be selected for laboratory analysis from each vertical delineation soil boring based on the sample that exhibits no discernable contamination immediately below the deepest sample in that soil boring that exhibits contamination.

After the completion of each soil boring sampled to the water table, these borings will be backfilled will a bentonite seal (6-inch minimum thickness), and clean sand placed on top to the surface. The soil borings sampled below the water table will be backfilled with a bentonite seal from the bottom of the boring to approximately 6 inches above the water table, and clean sand placed on top to the surface.

All dedicated sampling equipment will be decontaminated using a non-phosphate soap with a potable water rinse. The decontamination water will be contained in DOT-approved 55-gallon capacity drums, characterized and disposed accordingly. Soil cuttings generated from each soil boring will be placed adjacent to that boring.

The location of each soil boring will be surveyed for its horizontal coordinates by a New York State-licensed surveyor.

The specific locations for soil boring and sampling, the proposed number of soil borings for each location, and the method of sample analysis is provided below.

6.1.1 Former Plating Area

One soil boring (SB-4) will be sampled (20 ft to 22 ft bls) at former Test Pit TP-6A to determine the vertical extent of the black stained material (which was previously identified at 20 ft bls) identified during the February 8, 1999 CA Rich Phase I ESA. This sample will be analyzed for TPH using the USEPA Method 8015.

One soil boring will be sampled (20 ft to 22 ft bls) at approximately 5 ft southwest (SB-5) and 5 ft southeast (SB-6) of former Test Pit TP-6A to determine the lateral and vertical extent of TPH concentrations (which was previously identified at 20 ft bls) detected at former Test Pit TP-6A. These samples will be analyzed for TPH using the USEPA Method 8015.

One soil boring (SB-7) will be sampled (15 ft to 17 ft bls) at former Test Pit TP-6 to determine the vertical extent of the blue-grey/green stained material (which was previously identified at 15 ft bls) identified during the February 8, 1999 CA Rich Phase I ESA. This sample will be analyzed for Target Analyte List (TAL) metals plus cyanide using the USEPA Method 6000-7000 Series. Additionally, this soil boring will be sampled to the clay layer (approximately 32 ft bls), and a sample from the 2 ft depth interval immediately above the clay will be collected to verify the absence of DNAPL (See Section 6.4.1). Please note that the samples collected below 17 ft bls will be field inspected for impacts, and a sample will be collected for analysis as described in Section 6.1.

6.1.2 Former UST Area at TP-9

A total of three soil borings will be sampled at former UST Area TP-9 to determine the lateral extent of BNs in this area. Each soil boring will be sampled at approximately 5 ft further from the previous soil boring locations TP-9A, TP-9B, and TP-9D, located on the north (SB-8), east (SB-9) and west (SB-10) sides of former Test Pit TP-9, respectively. Please note that if the results of the field inspection indicate the evidence of BN impacts (e.g., oil staining or petroleum odor), the soil boring(s) will be abandoned and sampling will continue approximately 5 ft further from the first soil boring(s). This process will continue until the soil inspection results do not indicate BN impacts. Each sample will be analyzed for BNs using the USEPA Method 8270 (NYSDEC STARS list only).

6.1.3 Former Leaching Field

One soil boring will be sampled in the vicinity of the north (SB-11), central (SB-12) and south (SB-13) portions of the former leaching field to verify that no residual contamination from the former drywells remain. Each soil sample will be analyzed for VOCs using the USEPA Method 8260, SVOCs using the USEPA Method 8270, and TAL metals plus cyanide using the USEPA Method 6000-7000 Series.

6.1.4 Inside Former Building Footprint

Nine soil borings (SB-14 through SB-22) will be sampled within the former building footprint in areas not previously investigated and to determine whether a CVOC source(s) is (are) at the Site. Each sample will be analyzed for VOCs using the USEPA Method 8260, SVOCs using the USEPA Method 8270, and TAL metals plus cyanide using the USEPA Method 6000-7000 Series.

6.1.5 Site Wide

Four soil borings (SB-7, SB-12, SB-23 and SB-24) will be sampled at the 2-ft depth interval immediately above the clay layer (approximately 32 ft bls) to verify the absence of DNAPL using a hydrophobic test (see Section 6.4.1).

6.2 Task 2: Monitoring Well Installation

A total of eight monitoring wells (MW-21 through MW-28) will be installed using a hollow-stem auger drilling rig. Please note that Monitoring Wells MW-27 and MW-28 will be installed as part of the Phytoremediation Pilot Study (Task 6), and will also be utilized for the Site Investigation. The locations of the monitoring wells are shown in Figure A-4. The locations of the wells were selected to confirm the Geoprobe™ groundwater data, to determine the direction of groundwater flow, delineate concentrations of CVOCs previously detected in groundwater above the NYSDEC Ambient Water-Quality Standards and Guidance Values (AWQSGVs), and to determine whether there is an onsite source(s) of the CVOCs in groundwater.

Each well will be drilled using the hollow-stem auger drilling method and will be completed in accordance with the SOPs for constructing monitoring wells in unconsolidated formations (Attachment A-1). Four and one quarter (4 1/4 inch) inside diameter (ID) hollow stem augers will be used to drill the borehole for each monitoring well to accommodate a 2-inch ID casing and screen. During drilling of the well borehole, split-spoon core barrel samples will be collected continuously at 2-ft intervals from land surface to the anticipated bottom depth of each well.

During the drilling of the monitoring well pilot boreholes, soil samples will be collected continuously from land surface to the anticipated bottom depth of each well. Each soil sample will be inspected for contamination (e.g., odors and staining), and will be screened in the field for VOCs using a PID. The lithology of each sample will be described, and recorded in the field notebook.

Soil samples will only be submitted to the laboratory if the results of the sample inspection indicate the presence of impacts (e.g., staining). If a sample is submitted to the laboratory, the analysis will be determined in the field based on the results of the type(s) of impacts present.

Each well will be constructed of 2-inch ID, schedule 40, flush joint internally-threaded, polyvinyl chloride (PVC) casing and screen. Well screens will be a maximum of 10 ft in length depending on subsurface conditions, and will bridge the water table. The well screens will extend a minimum of 3 ft above the water table to accommodate seasonal water-level fluctuations. Glue will not be used to joint the casing and screen lengths. It is anticipated that the screen slot size will be 0.01 inch (10 slot) or 0.02 inch (20 slot), but may be modified based upon the size of the saturated sediments encountered in the borehole. The screen annulus of each well will be gravel packed to approximately 2 ft above the top of the screen, unless field conditions necessitate a shorter gravel pack zone. The additional 2 ft of gravel pack is to account for any settlement that may occur during well development. A 2-ft thick bentonite pellet seal will be placed on top of the gravel pack.

The remainder of the annulus will be grouted to within 2 ft of land surface, and topped with a concrete cap. The concrete cap will be sloped to divert precipitation away from the well. Each monitoring well will be finished either approximately 2 ft above grade and fitted with a 5-ft steel protective casing, or finished flush with land surface and fitted with an 8-inch diameter steel curb box.

The monitoring wells will be developed by a submersible pump or by surging (with a surge block) with subsequent pumping. Development will continue until each monitoring well produces sediment-clear water to the extent possible, and a good hydraulic connection is established between the well screen and the aquifer. Turbidity measurements will be made during the development activities, and an attempt will be made to obtain turbidity measurements under 50 Nephalameter Turbidity Units. The well development will be conducted in accordance with SOPs provided in Attachment A-1.

The top of the PVC well casing will be the permanent measuring point and will be surveyed vertically using the North American Vertical Datum (1988) and horizontally by a New York State-licensed surveyor.

All dedicated sampling equipment will be decontaminated using a non-phosphate soap with a potable water rinse. The drill rig and associated drilling equipment will be decontaminated by steam cleaning. The decontamination water will be contained in DOT-approved 55-gallon capacity drums, characterized and disposed accordingly. Additionally, the well development water will be contained in drums, characterized and disposed accordingly. Soil cuttings that are generated from the monitoring well installation will be placed adjacent to that well.

6.3 Task 3: Water-Level Measurements and Groundwater Sampling

Two rounds of water-level measurements will be performed in the new and existing wells using an electronic measuring scope during low and high tide to determine the direction of groundwater flow at the Site. One of the two water-level measurement rounds will coincide with the groundwater sampling. The SOP for water-level measurements to be followed is provided in Attachment A-1.

SOPs for measuring water levels, sounding monitoring wells, purging monitoring wells, sampling monitoring wells, decontamination of nondisposable measuring, sampling, and field analytical equipment, and implementing QA/QC procedures are provided in Attachment A-1. All disposable sampling equipment (e.g., ropes, disposable bailers) will be discarded in an appropriate manner.

Prior to sampling, each new well (MW-21 through MW-26), one of the two phytoremediation wells (MW-27 or MW-28), and the two existing wells (MW-1 and MW-2) will be purged into 55-gallon DOT-approved drums using a low-flow pump. Three to five times the volume of standing water in each monitoring well will be purged (evacuated) prior to sample collection. Removing all stagnant water from the well will ensure the collection of a representative sample from the aquifers. Purging will be implemented using a submersible pump or bailer, depending upon the well size, depth to water, and yield. During purging, field parameters (i.e., turbidity, pH, specific conductivity, and temperature) will be collected.

Groundwater samples will be collected using precleaned (decontaminated), bottom-filling bailers and new nonabsorbent cord. Bailers will either be discarded (if disposable type) or decontaminated after sampling each monitoring well, and new rope will be used for each sampling event.

Groundwater samples will be poured into appropriate laboratory-supplied containers (Table A-6) and covered with Teflon™ septa and caps. The sample for VOCs will be decanted with minimum agitation and the vials will be filled to exclude headspace.

The wells will be analyzed for CVOCs using the USEPA Method 8260, natural attenuation parameters (dissolved oxygen, carbon dioxide, alkalinity, sulfate, nitrite, dissolved iron/reduced iron, dissolved manganese/reduced manganese, ethane, and ethene), total dissolved solids (TDS) using USEPA Method 160.1 and chloride using USEPA Method 325.2. Monitoring Wells MW-23 and MW-24 will also be analyzed for TAL metals (filtered and unfiltered) plus cyanide using the USEPA Method 6000-7000 Series.

Additionally, Monitoring Well MW-26 will be sampled for BNs using the USEPA Method 8270 (NYSDEC STARS list) to determine if the BNs in soil at former UST Area TP-9 have impacted groundwater.

6.4 Task 4: Geoprobe Groundwater Sampling

Two groundwater samples will be collected at Soil Borings SB-7 (near the central portion of the former leaching field), SB-12 (at the former plating area), GW-23 (at the upgradient Site boundary adjacent to Sagamore Hill Road), and at GW-24 (downgradient of Monitoring Well MW-2). The purpose for the collection and analysis of the groundwater samples is to:

- vertically delineate CVOC concentrations; and
- verify the absence of a DNAPL.

The location of these groundwater samples is shown in Figure A-4. The groundwater samples will be collected from the top 2 ft of groundwater and the 2 ft depth interval immediately above the first confining unit (e.g., clay) using the Geoprobe™ method. It is estimated that the first confining unit is 32 ft bls.

The truck-mounted Geoprobe™ equipment will be positioned over the selected sampling location. Steel 1½-inch diameter samplers with retractable heads are mounted on the end of 8 foot lengths of steel casing and hydraulically pushed or driven into the subsurface to each desired sampling depth. Once that depth has been reached, the retractable head is lifted and the probe is advanced into the material to be sampled.

To collect the groundwater samples, a sampler with a screened head is advanced, and the sample is extracted through a sampling tube. At least three tube volumes of water will be drawn through the sampling tube prior to collecting the sample for laboratory analysis.

Each groundwater sample will be inspected for contamination (e.g., sheen and odors). The presence of DNAPL will be determined using a product interface probe and by performing a hydrophobic dye test (see below). The groundwater samples will be analyzed for CVOCs using the USEPA Method 8260.

After the completion of sampling, each boring will be backfilled will a bentonite seal from the bottom of the boring to approximately 6 inches above the water table, and clean sand placed on top to the surface.

All dedicated sampling equipment will be decontaminated using a non-phosphate soap with a potable water rinse. The decontamination water will be contained in DOT-approved 55-gallon capacity drums, characterized and disposed accordingly. If soil cuttings are generated from these Geoprobe™ borings, the soil will be placed adjacent to each boring.

The location of each Geoprobe™ groundwater sampling boring will be surveyed for its horizontal coordinates by a New York State-licensed surveyor.

6.4.1 DNAPL Monitoring

A measurement for DNAPL will be made in each of the four Geoprobe™ borings. DNAPL will be determined using a product interface probe, collection and analysis of a groundwater sample in the 2 ft interval immediately above the clay layer, and performing a hydrophobic dye test (i.e., on saturated soil and groundwater). The groundwater samples will be analyzed for CVOCs using the USEPA Method 8260.

A description of a hydrophobic dye test is provided below.

Hydrophobic Dye Test - The hydrophobic dye test is used to determine the presence of DNAPL in groundwater. Sudan IV, a non-volatile hydrophobic dye, is used to color the chlorinated hydrocarbon phase of a two-phased hydrocarbon and water mixture. To test a groundwater sample for potential DNAPL, a small amount of Sudan IV (powdered form) is added to the groundwater sample and agitated for approximately 15 seconds. Following the agitation of the samples, the vials must be allowed to sit for approximately 15 minutes prior to visual inspection. If DNAPL were present in the groundwater sample, the dye would become liquid in the hydrocarbon phase and "sink" to the bottom of the sample container.

Two control samples will also be tested, which include:

- a potable water sample; and
- a potable water sample mixed with vegetable oil.

Additionally, a saturated soil sample will be collected from each boring from the 2 ft interval immediately above the clay layer. This soil sample will also be tested for DNAPL using the hydrophobic test.

6.5 Task 5: Exposure Assessment (Soil Sampling)

To perform the exposure assessment, soil quality data is needed from the 0 to 2 ft and 4 ft to 6 ft depth intervals throughout the Site to supplement the existing soil quality data. A total of six composite soil samples will be collected at each depth interval using a hand auger or Geoprobe™. The Site will be divided into six sections where each composite sample will be comprised of six to ten sampling locations within each section. These samples will be analyzed for CVOCs using the USEPA Method 8260 and TAL metals plus cyanide using the USEPA Method 6000-7000 Series.

Soil sampling, decontamination, and borehole abandonment procedures for the Exposure Assessment soil sampling will be performed consistent with Task 1: Soil Boring and Sampling. These procedures will also be implemented consistent with the SOPs (Attachment A-1).

6.6 Task 6: Phytoremediation Pilot Study

The phytoremediation pilot study field tasks include soil sampling, installation of monitoring wells, tree planting, and groundwater monitoring. A description of each field task is provided below.

Soil and groundwater sampling, water-level measurements, decontamination, and borehole abandonment procedures will be performed consistent with the SOPs (Attachment A-1).

6.6.1 Soil Sampling

Prior to planting, two composite soil samples from the pilot study area will be collected for agronomic analyses to determine nutrient levels in the soil and to identify soil components that may be potentially toxic to the trees, if any. Based on current soil quality data, it is not anticipated that the soil will be toxic to the trees. These samples will be collected during the drilling of the monitoring well pilot boreholes (see below).

6.6.2 Monitoring Well Installation

Two groundwater monitoring wells (i.e., MW-27 and MW-28) will be installed prior to the tree planting to monitor the effectiveness of the phytoremediation using a hollow-stem auger drilling rig (Figure A-5). These wells will be constructed of 2-inch diameter PVC casing and screen, and installed in accordance with the NYSDEC well installation procedures. One of the proposed wells will be installed upgradient of the pilot study test area (MW-27) and the other well will be installed downgradient (MW-28).

6.6.3 Tree Planting

Consistent with conditions at the Site, the proposed phytoremediation entails the installation of 30 12-ft tall one-year old rooted hybrid poplar trees. The selection of the hybrid poplar tree is based on its high water uptake and evapotranspiration rates, its ability to withstand winter climates, and its rapid root development.

The tree cuttings will be planted at a depth of approximately 9 ft bls, which is immediately at the surface of the water table. This planting depth was selected to promote rapid root propagation into the shallow groundwater at the Site. Planting will entail either trenching, using a drive-on trencher (e.g., Ditch Witch™), or boring followed by the installation of the tree cuttings. During planting, the rooted tree cuttings will be placed at 5-ft intervals along rows spaced approximately five feet apart. Therefore, based on the planting of 30 trees, the plot will contain five rows of six trees in each row. The phytoremediation test plot will measure 20 ft by 25 ft (Figure A-5). After the trees are placed in the ground, fertilizer pellets and a soil humus mixture will be added around the trees. To promote root development and support the long term viability of the trees, watering of the trees will be performed periodically depending upon the weather conditions. The trees will be watered by a landscaper using potable water.

6.6.4 Groundwater Monitoring

Comparison of the monitoring results (i.e., quality and water-level measurements) from these two wells (MW-27 and MW-28) will be used to determine the effect of the phytoremediation. The initial groundwater monitoring will be performed prior to planting. The results from this monitoring round will be used to establish background (i.e., pre-phytoremediation conditions) water elevations and groundwater quality at the pilot study test area. Subsequently, monitoring will be performed one month after planting and then quarterly thereafter for a minimum of one year (not to exceed two years) from the completion of tree planting. The results of the quarterly monitoring will be used to evaluate the effects of the trees on groundwater elevations and quality as they continue to grow. Samples will be analyzed for CVOCs using the USEPA Method 8260.

7.0 REFERENCES

USEPA. December 1987. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response, EPA/540/P-87/001.

USEPA. 1988. Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA. Office of Emergency and Remedial Response, EPA/540/G-89/004.

USEPA. 1994. Guidance for the Data Quality Objectives Process. September 1994, EPA QA/G4.

Table A-1. Sample Types/Analyses by Task, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Task	Media	Field Analyses	Laboratory Analyses
Task 1: Soil Boring and Sampling -	Soil	PID(1) Screening	
Former Plating Area			TPH, TAL metals plus cyanide
Former UST Area at TP-9			BNs
Former Leaching Field			VOCs, SVOCs, TAL metals plus cyanide
Inside Former Building Footprint			VOCs, SVOCs, TAL metals plus cyanide
Task 3: Water-Level Measurements and Groundwater Sampling	Water	Field Parameters(2)	CVOCs, TDS, TAL metals plus cyanide, chloride, natural attenuation parameters(3), BNs
Task 4: Geoprobe™ Groundwater Sampling	Water	DNAPL Monitoring	CVOCs
Task 5. Exposure Assessment (Soil Sampling)	Soil	PID(1) Screening	CVOCs, TAL metals plus cyanide
Task 6: Phytoremediation Pilot Study	Soil Water		Agronomic analyses CVOCs

(1) Photoionization Detector - screens for volatile organic compounds (vapor phase).

(2) Field Parameters include turbidity, pH, specific conductivity and temperature.

(3) Natural attenuation parameters include dissolved oxygen, carbon dioxide, alkalinity, sulfate, nitrite, dissolved iron/reduced iron, dissolved manganese/reduced manganese, ethane, and ethene.

VOCs	Volatile Organic Compounds
CVOCs	Chlorinated Volatile Organic Compounds
SVOCs	Semivolatile Organic Compounds
TPH	Total Petroleum Hydrocarbons
BNs	Base Neutral Compounds
TDS	Total Dissolved Solids
TAL	Target Analyte List

Table A-2. Projected Number of Field Samples, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Task	Parameter	Field Samples	Field Duplicates	Field Blanks[(a)]	Trip Blanks[(b)]	MS/MSD[(c)] (Extra Volume)	Total Laboratory Samples
1. Soil Boring and Sampling							
Soil	Former Plating Area						
	TPH	3	NA	1	NA	NA	4
	TAL metals plus cyanide	1	NA	1	NA	NA	2
	Former UST Area at TP-9						
	BNs	3	1	1	NA	NA	5
	Former Leaching Field						
	VOCs	3	NA	1	1	NA	5
	SVOCs	3	NA	1	NA	NA	4
	TAL metals plus cyanide	3	NA	1	NA	NA	4
	Inside Former Building Footprint						
	VOCs	9	1	1	1	1	13
	SVOCs	9	1	1	NA	1	12
	TAL metals plus cyanide	9	1	1	NA	1	12
3. Water-Level Measurements and Groundwater Sampling							
Groundwater	CVOCs	9	1	3	3	1	17
	TDS	9	NA	NA	NA	NA	9
	Chloride	9	NA	NA	NA	NA	9
	Natural Attenuation Parameters [(d)]	9	NA	NA	NA	NA	9
	TAL metals (Filtered/Unfiltered) plus cyanide	4	2	2	NA	2	10
	BNs	1	1	1	NA	1	4
4. Geoprobe™ Groundwater Sampling							
Groundwater	CVOCs	8	1	NA	1	1	11
5. Exposure Assessment (Soil Sampling)							
Soil	CVOCs	12	1	1	1	1	16
	TAL metals plus cyanide	12	1	1	NA	1	15

Table A-2. Projected Number of Field Samples, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Task	Parameter	Field Samples	Field Duplicates	Field Blanks[a]	Trip Blanks[b]	MS/MSD[c] (Extra Volume)	Total Laboratory Samples
6. Phytoremediation Pilot Study							
Soil	Agronomic Analyses	2	NA	NA	NA	NA	2
Water	CVOCs	12	2	6	6	NA	26

[a] Field blank frequency estimates based on one per twenty, or one per day minimum, whichever is more frequent.

[b] The number of trip blanks is estimated due to requirement of one trip blank per cooler.

[c] Frequency estimates based on one per twenty, where applicable.

[d] Natural attenuation parameters include dissolved oxygen, carbon dioxide, alkalinity, sulfate, nitrite, dissolved iron/reduced iron, dissolved manganese/reduced manganese, ethane, and ethene.

VOCs	Volatile Organic Compounds
CVOCs	Chlorinated Volatile Organic Compounds
SVOCs	Semivolatile Organic Compounds
TPH	Total Petroleum Hydrocarbons
BNs	Base Neutral Compounds
TDS	Total Dissolved Solids
NA	Not Applicable
MS/MSD	Matrix Spike/Matrix Spike Duplicate
TAL	Target Analyte List

Table A-3. Project Quality Control Summary, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Parameter	Matrix	Quantitation Limit[a]	Estimated Accuracy	Estimated Precision	Completeness	Analysis Method[b]
VOCs and CVOCs	Soil	0.01 mg/kg[c]	75-125%[d]	35 RPD[e]	95%	USEPA 8260
SVOCs	Soil	0.33 to 0.83 mg/kg	75-125%	50 RPD	95%	USEPA 8270
TAL metals plus cyanide	Soil	0.0002 to 5 mg/kg	75-125%	35 RPD	95%	USEPA 6000/7000 Series
TPH	Soil	17 mg/kg	75-125%	NA	90%	USEPA 8015
BNs	Soil	0.33 to 0.83 mg/kg	75-125%	50 RPD	90%	USEPA 8270[f]
CVOCs	Water	0.01 mg/L	75-125%	24 RPD	95%	USEPA 8260
TDS	Water	10 mg/L	NA	NA	90%	USEPA 160.1
Chloride	Water	2 mg/L	75-125%	15 RPD	90%	USEPA 325.2
Natural Attenuation Parameters[g]	Water	NA	NA	NA	95%	SW-846
TAL metals plus cyanide	Water	0.0002 to 5 mg/L	75-125%	20 RPD	95%	USEPA 6000/7000 Series
BNs	Water	0.01 to 0.050 mg/L	10-111%	50 RPD	95%	USEPA 8270[f]

[a] Quantitation limits are based on Contract Laboratory Program Statement of Work (CLP SOW) 3/90 requirements (where applicable) or on method references.

[b] Test Methods for Evaluating Solid Waste (SW-846).

[c] Limits are based on nominal wet weight of sample. Dry weight limits will be higher.

[d] Actual limits for matrix spikes, surrogates and laboratory control samples are provided in the CLP SOW.

[e] Actual limits for relative percent difference (RPD) of matrix spike duplicates are provided in the CLP SOW.

[f] New York State Department of Environmental Conservation Spill Technology and Remediation Series List.

[g] Natural attenuation parameters include dissolved oxygen, carbon dioxide, alkalinity, sulfate, nitrite, dissolved iron/reduced iron, dissolved manganese/reduced manganese, ethane, and ethene.

USEPA	United States Environmental Protection Agency
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NA	Not applicable
VOCs	Volatile Organic Compounds
CVOCs	Chlorinated Volatile Organic Compounds
SVOCs	Semivolatile Organic Compounds
TPH	Total Petroleum Hydrocarbons
BNs	Base Neutral Compounds
TDS	Total Dissolved Solids
TAL	Target Analyte List

Table A-4. Field Quality Control Sample Frequency, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Parameters	Media	Trip Blank[a]	Field Blank[b]	Field Duplicates[c]
VOCs and CVOCs	Soil	1/20	1/20	1/20
SVOCs	Soil	NA	1/20	1/20
TAL metals plus cyanide	Soil	NA	1/20	1/20
TPH	Soil	NA	NA	NA
BNs	Soil	NA	1/20	1/20
CVOCs	Water	1/20	1/20	1/20
TDS	Water	NA	NA	NA
Chloride	Water	NA	NA	NA
Natural Attenuation Parameters[d]	Water	NA	NA	NA
BNs	Water	NA	1/20	1/20
TAL metals plus cyanide	Water	NA	1/20	1/20

[a] Where applicable, one per twenty or fewer field samples, or one per shipment container (VOC only).

[b] Where applicable, one per twenty or fewer field samples, or one per day, whichever is most frequent.

[c] Where applicable, one per twenty or fewer field samples.

[d] Natural attenuation parameters include dissolved oxygen, carbon dioxide, alkalinity, sulfate, nitrite, dissolved iron/reduced iron, dissolved manganese/reduced manganese, ethane, and ethene.

NA	Not Applicable
VOCs	Volatile Organic Compounds
SVOCs	Semivolatile Organic Compounds
CVOCs	Chlorinated Volatile Organic Compounds
TPH	Total Petroleum Hydrocarbons
BNs	Base Neutral Compounds
TDS	Total Dissolved Solids
TAL	Target Analyte List

Table A-5. Laboratory Quality Control Sample Frequency, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Parameter	Matrix	Method Blank[(a)]	Matrix Spikes or MS/MSD[(a)]	Laboratory Replicates[(a)]	Analysis Methods[(b)]
VOCs and CVOCs	Soil	1/20	1/20	1/20	USEPA 8260 + 10 TICs
SVOCs	Soil	1/20	1/20	1/20	USEPA 8270 + 20 TICs
TAL metals plus cyanide	Soil	1/20	1/20	1/20	USEPA 6000-7000 Series
TPH	Soil	1/20	NA	1/20	USEPA 8015
BNs	Soils	1/20	NA	1/20	USEPA 8270 + 20 TICs[(c)]
CVOCs	Water	1/20	1/20	1/20	USEPA 8260 + 10 TICs
TDS	Water	1/20	NA	1/20	USEPA 160.1
Chloride	Water	1/20	NA	1/20	USEPA 325.1
Natural Attenuation Parameters[(d)]	Water	NA	NA	1/20	--
BNs	Water	1/20	1/20	1/20	USEAP 8270(c) + 20 TICs
TAL metals plus cyanide	Water	1/20	1/20	1/20	USEPA 6000-7000 Series

(a) Where applicable, one per twenty or fewer field samples, or one per analytical batch, whichever is more frequent

(b) Actual analysis method (CLP SOW) version will be dependent on contract held by laboratory

(c) New York State Department of Environmental Conservation Spill Technology and Remediation Series List

(d) Natural attenuation parameters include dissolved oxygen, carbon dioxide, alkalinity, sulfate, nitrite, dissolved iron/reduced iron, dissolved manganese/reduced manganese, ethane, and ethene.

USEPA	United States Environmental Protection Agency
MS/MSD	Matrix Spike/Matrix Spike Duplicate
VOCs	Volatile Organic Compounds
CVOCs	Chlorinated Volatile Organic Compounds
SVOCs	Semivolatile Organic Compounds
TPH	Total Petroleum Hydrocarbons
BNs	Base Neutral Compounds
TDS	Total Dissolved Solids
NA	Not Applicable
TAL	Target Analyte List
TICs	Tentatively Identified Compounds

Table A-6. Field Equipment Calibration Requirements and Maintenance Schedule, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Equipment Type	Calibration Requirements	Maintenance Schedule
Photoionization Detector (PID)	Attachment A-1	Recharge or replace battery. Regularly clean lamp window. Regularly clean and maintain the instrument and accessories.
Turbidity Meter	Attachment A-1	See Manual
pH, Specific Conductivity and Temperature Meter	Attachment A-1	See Manual
Personal Protective Equipment	Not Applicable	Integrity/function test prior to donning equipment. Visual inspection for defects/leakage for all reusable gear.

Table A-7. Preservation, Holding Times and Sample Containers, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Parameter	**Preservation**	**Holding Time**[a]	**Containers**
Soil VOCs and CVOCs	4°C until extraction and analysis	[b]	4 oz jar w/teflon lined lid
Soil SVOCs	4°C until extraction and analysis	40 days[c]	8 oz jar w/teflon lined lid
Soil TAL metals plus cyanide	4°C until extraction and analysis	180 days[d] Hg - 26 days	8 oz jar w/teflon lined lid
Soil TPH	4°C until extraction and analysis	14 days[f]	4 oz jar w/teflon lined lid
Soil BNs	4°C until extraction and analysis	40 days[c]	8 oz jar w/teflon lined lid
Water CVOCs	4°C until extraction and analysis, add HCl pH<2	[b]	4 oz jar w/teflon lined lid
Water TDS	4°C until extraction and analysis	7 days	8 oz jar w/teflon lined lid
Water Chloride	NA	26 days	50 ml glass jar
Water Natural Attenuation Parameters[e]	NA	NA	NA
Water BNs	4°C until extraction and analysis	40 days[c]	1 liter amber jar
Water TAL metals plus cyanide	4°C until extraction and analysis	180 days [c] Hg - 26 days	1 liter plastic

[a] From collection until analysis unless otherwise specified

[b] 7 days for unpreserved samples and 10 days for preserved samples

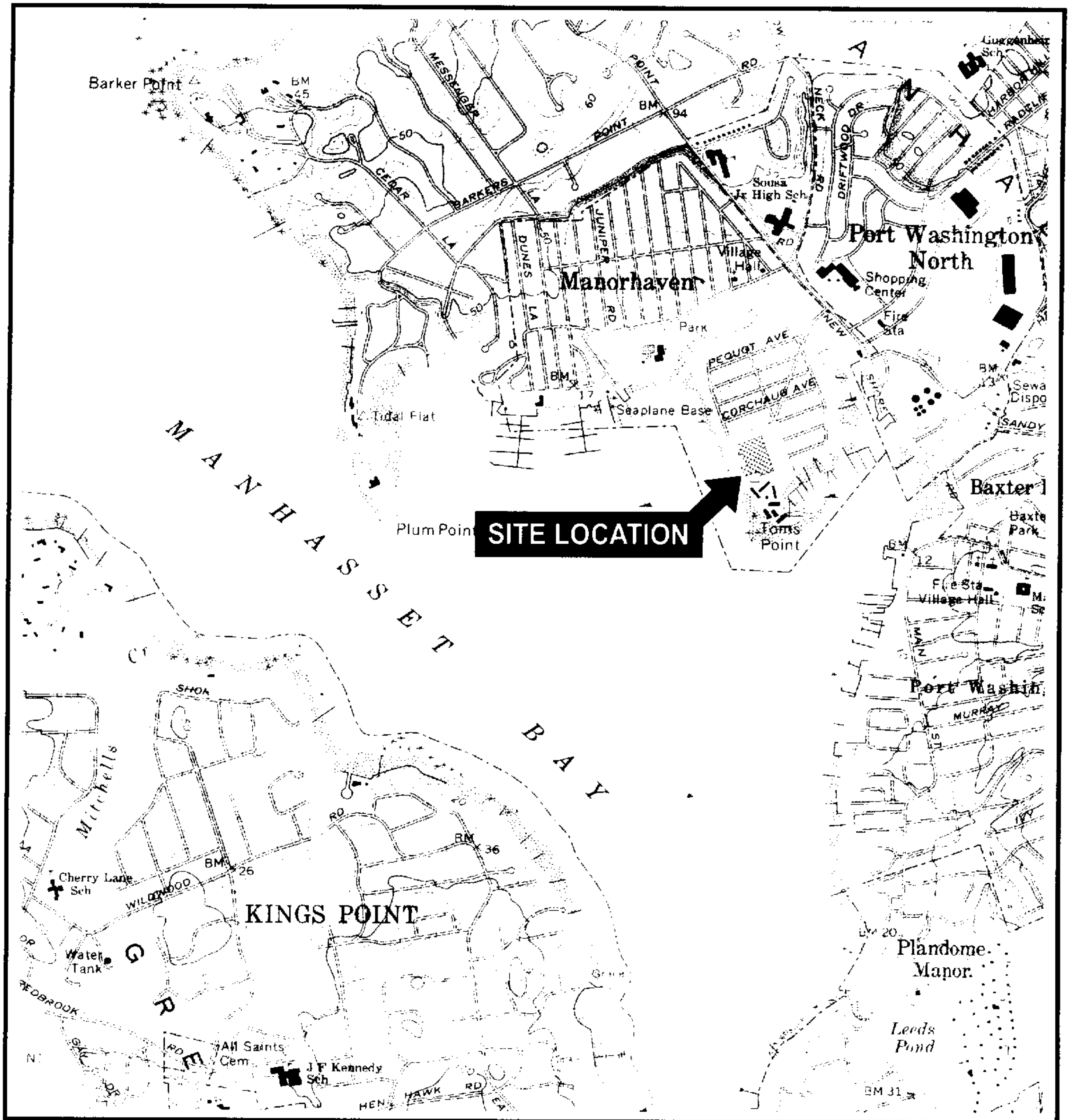
[c] 5 days to preparative extraction/40 days from preparative extraction to analysis

[d] 180 days from field to extraction/180 days from extraction to analysis

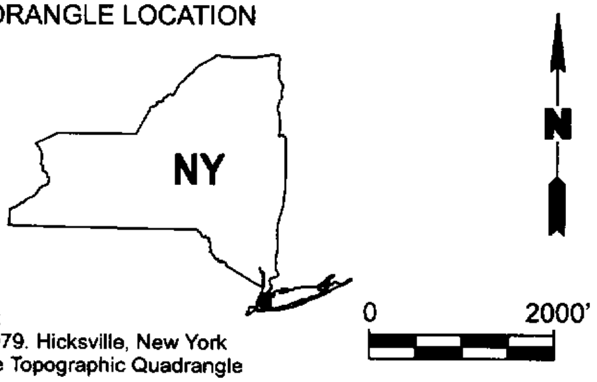
[e] Natural attenuation parameters include dissolved oxygen, carbon dioxide, alkalinity, sulfate, nitrite, dissolved iron/reduced iron, dissolved manganese/reduced manganese, ethane, and ethene.

[f] 14 days from field to extraction/14 days from extraction to analysis

VOCs	Volatile Organic Compounds
CVOCs	Chlorinated Volatile Organic Compounds
SVOCs	Semivolatile Organic Compounds
BNs	Base Neutral Compounds
TPH	Total Petroleum Hydrocarbons
TDS	Total Dissolved Solids
NA	Not Applicable
HCL	Hydrochloric Acid
TAL	Target Analyte List



QUADRANGLE LOCATION



SOURCE:
USGS; 1979. Hicksville, New York
7.5 Minute Topographic Quadrangle

Title:

SITE LOCATION MAP

Prepared for:

FORMER THYPIN STEEL, INC. PLANT
MANORHAVEN, NEW YORK

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: S.G.	Date: 18MAY00	FIGURE
Prepared by: G.M.	Scale: 1:25000	A-1
Project Mgr.: S.G.	Office: NY	
File No.: MBA0110209.CDR	Project No.: 77101Y	

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FIELD ORGANIZATION CHART

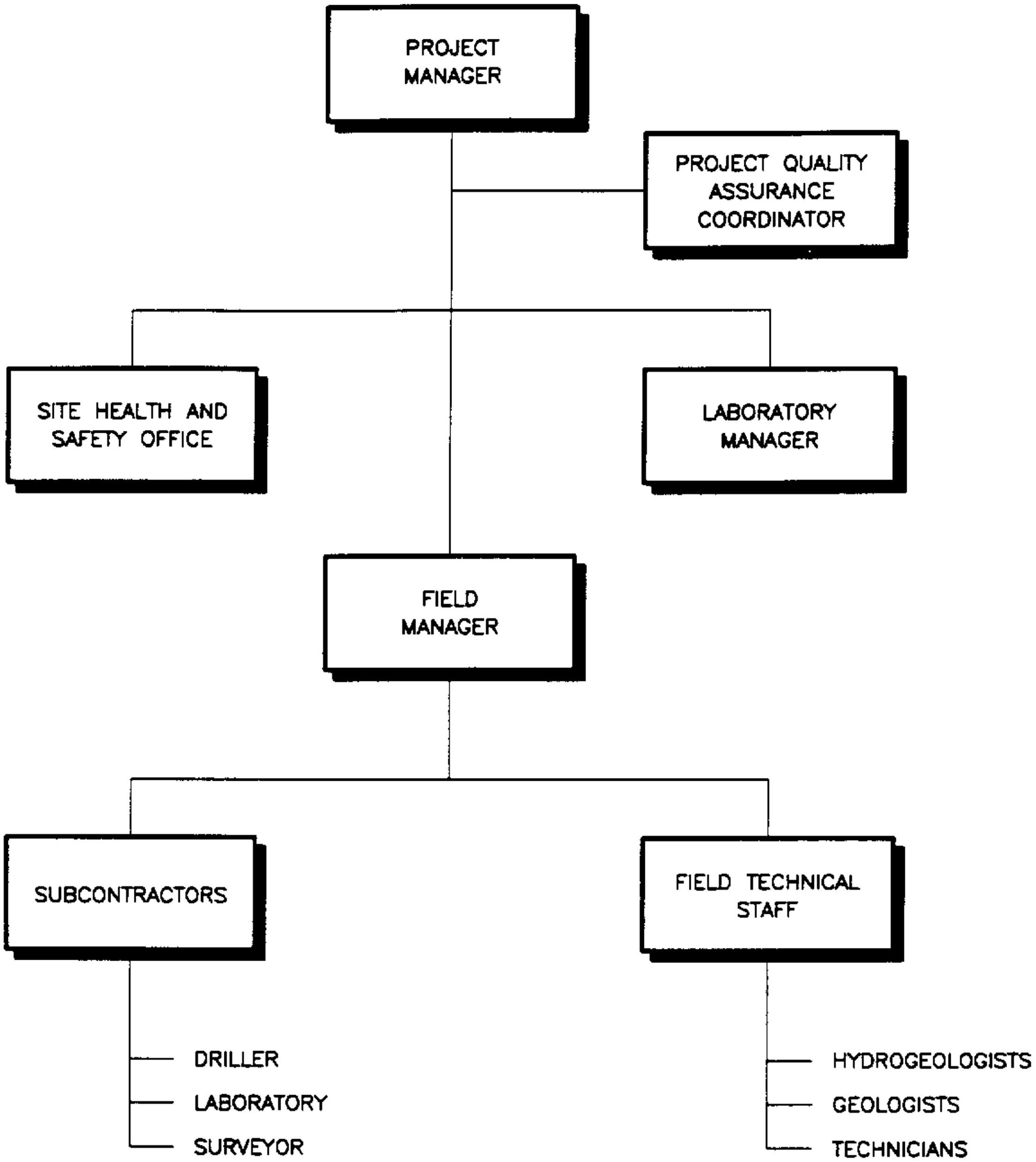

FIGURE A-2

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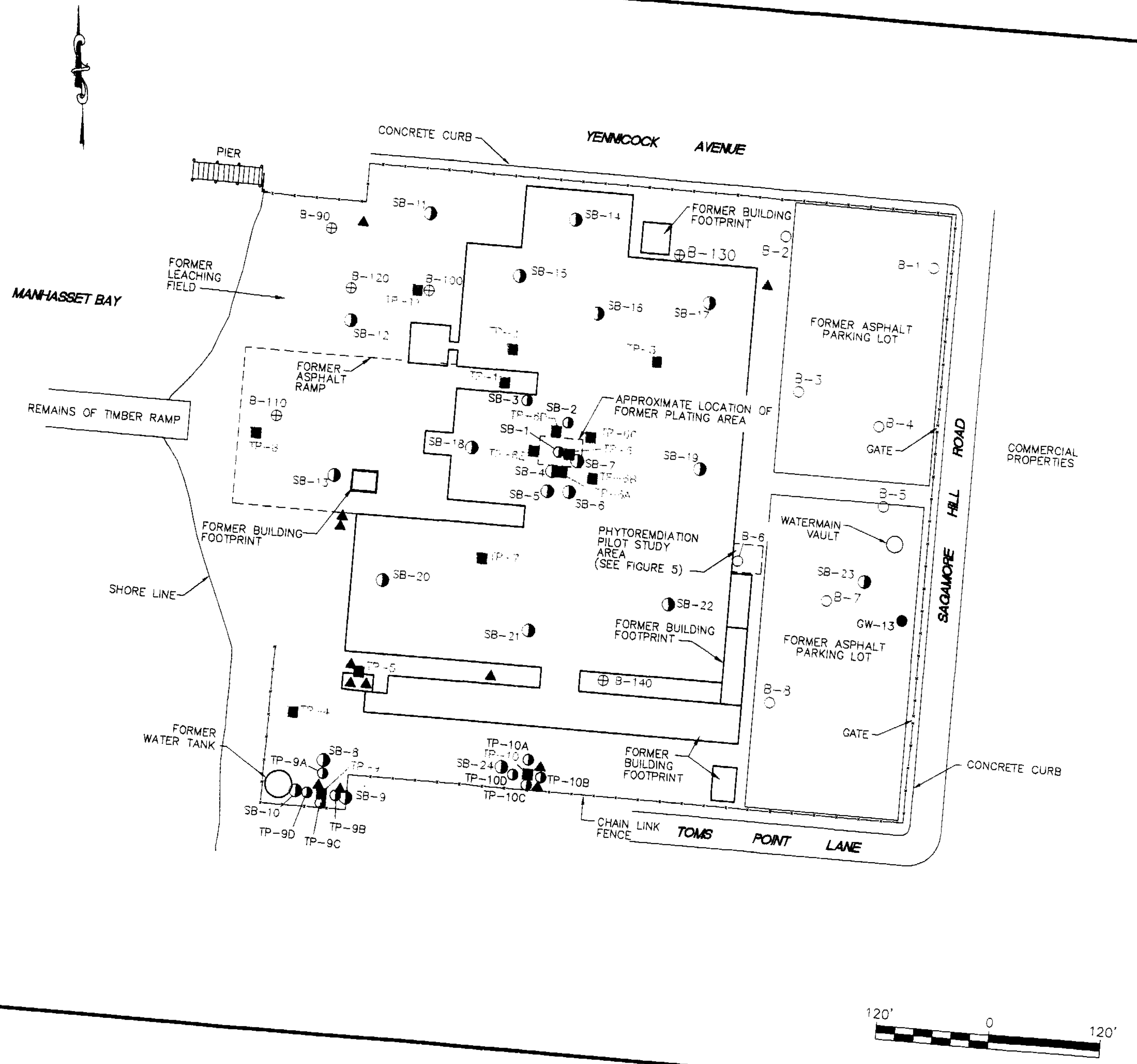


LEGEND

SB-12 ◑ LOCATION AND DESIGNATION OF PROPOSED SOIL BORING

TP-9D
SB-1 ◑ LOCATION AND DESIGNATION OF FORMER SOIL BORING SAMPLED BY ROUX ASSOCIATES, INC.

TP-5 ■ LOCATION AND DESIGNATION OF FORMER TEST PIT EXCAVATED BY CA RICH CONSULTANTS, INC.

▲ LOCATION OF FORMER UNDERGROUND STORAGE TANK

B-100 ⊕ LOCATION AND DESIGNATION OF DRY WELL SAMPLED BY SOIL MECHANICS DRILLING CORPORATION

B-3 ○ LOCATION AND DESIGNATION OF FORMER SOIL BORING SAMPLED BY SOIL MECHANICS DRILLING CORPORATION

NOTE: PLEASE NOTE THAT THE LOCATIONS OF THE TEST PITS, THE SOIL BORINGS SAMPLED BY ROUX ASSOCIATES, INC., AND THE FORMER USTs WERE NOT SURVEYED. THEREFORE, THESE LOCATIONS SHOWN ARE CONSIDERED APPROXIMATE. THE BUILDING FOOTPRINT WAS OBTAINED FROM APRIL 23, 1951 AERIAL PHOTOGRAPH.

Title:

PROPOSD SOIL BORING LOCATIONS

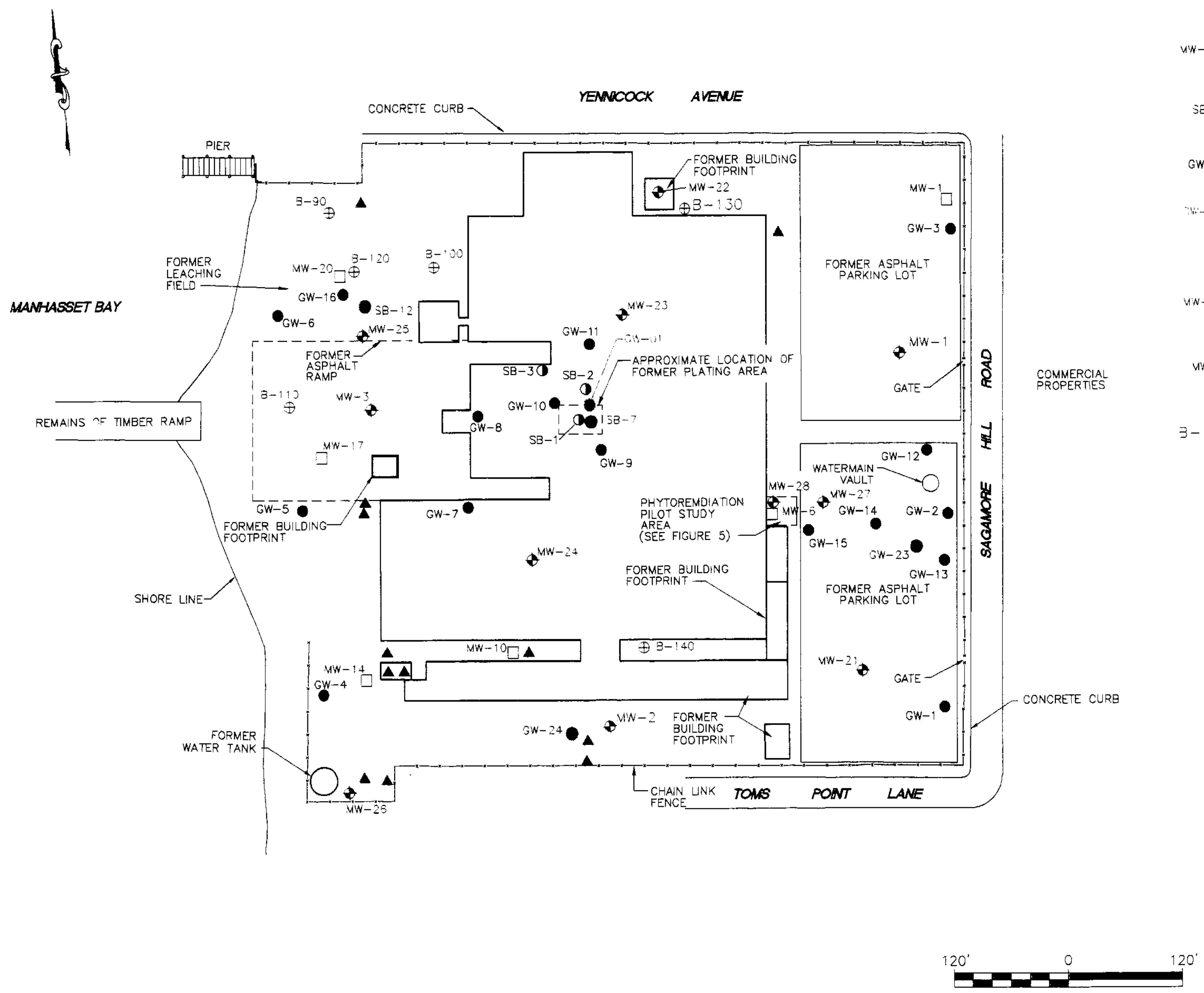
Prepared For:

MBA-MANORHAVEN, LLC
MANORHAVEN, NEW YORK

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting

Compiled by: J.W.	Date: 16MAY00	FIGURE
Prepared by: B.H.C.	Scale: AS SHOWN	
Project Mgr:		

\MBA771Y\MBA01Y\102\MBA0110214.DWG



LEGEND

MW-21 ⯐	LOCATION AND DESIGNATION OF PROPOSED MONITORING WELL
SB-7 ●	LOCATION AND DESIGNATION OF PROPOSED GEOPROBE GROUNDWATER SAMPLE
GW-7 ●	LOCATION AND DESIGNATION OF GEOPROBE POINT INSTALLED BY ROUX ASSOCIATES, INC.
GW-01 ●	LOCATION AND DESIGNATION OF GEOPROBE POINT INSTALLED BY CA RICH CONSULTANTS, INC.
▲	LOCATION OF FORMER UNDERGROUND STORAGE TANK
MW-14 ☐	LOCATION AND DESIGNATION OF FORMER MONITORING WELL INSTALLED BY SOIL MECHANICS DRILLING CORPORATON
MW-1 ⯐	LOCATION AND DESIGNATION OF EXISTING MONITORING WELL INSTALLED BY SOIL MECHANICS DRILLING CORPORATION
B-100 ⊕	LOCATION AND DESIGNATION OF DRY WELL SAMPLED BY SOIL MECHANICS DRILLING CORPORATION

NOTE: SOIL MECHANICS DRILLING CORPORATION DESIGNATED TWO MONITORING WELLS AS MW-1.

PLEASE NOTE THAT THE LOCATIONS OF THE MONITORING WELLS INSTALLED BY SOIL MECHANICS DRILLING CORPORATION AND THE FORMER USTs WERE NOT SURVEYED. THEREFORE, THESE LOCATIONS SHOWN ARE CONSIDERED APPROXIMATE. THE BUILDING FOOTPRINT WAS OBTAINED FROM APRIL 23, 1951 AERIAL PHOTOGRAPH.

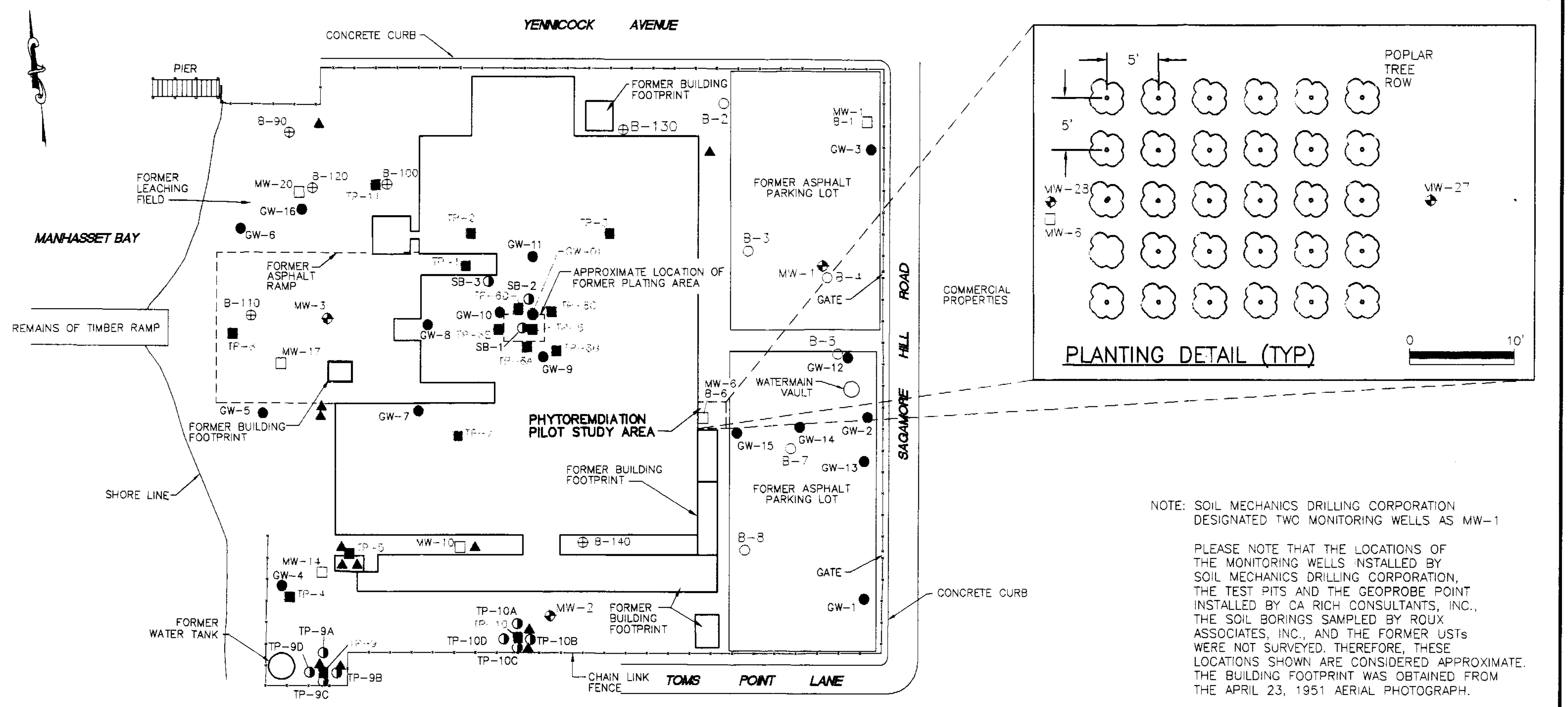
Title:

PROPOSED MONITORING WELL AND GEOPROBE GROUNDWATER SAMPLING LOCATIONS

Prepared For:

MBA-MANORHAVEN, LLC
MANORHAVEN, NEW YORK

ROUX ROUX ASSOCIATES, INC. Environmental Consulting & Management	Compiled by: J.W.	Date: 16MAY00	FIGURE
	Prepared by: B.H.C.	Scale: AS SHOWN	A-4
	Project Mgr: S.J.G.	Office: NY	
	File No: MBA0110214	Project: 77101Y	



NOTE: SOIL MECHANICS DRILLING CORPORATION DESIGNATED TWO MONITORING WELLS AS MW-1

PLEASE NOTE THAT THE LOCATIONS OF THE MONITORING WELLS INSTALLED BY SOIL MECHANICS DRILLING CORPORATION, THE TEST PITS AND THE GEOPROBE POINT INSTALLED BY CA RICH CONSULTANTS, INC., THE SOIL BORINGS SAMPLED BY ROUX ASSOCIATES, INC., AND THE FORMER USTs WERE NOT SURVEYED. THEREFORE, THESE LOCATIONS SHOWN ARE CONSIDERED APPROXIMATE. THE BUILDING FOOTPRINT WAS OBTAINED FROM THE APRIL 23, 1951 AERIAL PHOTOGRAPH.

LEGEND

MW-27 ⊕ LOCATION AND DESIGNATION OF PROPOSED MONITORING WELL

GW-7 ● LOCATION AND DESIGNATION OF GEOPROBE POINT INSTALLED BY ROUX ASSOCIATES, INC.

TP-9D SB-1 ◑ LOCATION AND DESIGNATION OF FORMER SOIL BORING SAMPLED BY ROUX ASSOCIATES, INC.

GW-01 ● LOCATION AND DESIGNATION OF GEOPROBE POINT INSTALLED BY CA RICH CONSULTANTS, INC.

TP-5 ■ LOCATION AND DESIGNATION OF FORMER TEST PIT EXCAVATED BY CA RICH CONSULTANTS, INC.

▲ LOCATION OF FORMER UNDERGROUND STORAGE TANK

MW-14 ☐ LOCATION AND DESIGNATION OF FORMER MONITORING WELL INSTALLED BY SOIL MECHANICS DRILLING CORPORATON

MW-1 ⊕ LOCATION AND DESIGNATION OF EXISTING MONITORING WELL INSTALLED BY SOIL MECHANICS DRILLING CORPORATION

B-100 ⊕ LOCATION AND DESIGNATION OF DRY WELL SAMPLED BY SOIL MECHANICS DRILLING CORPORATION

B-3 ○ LOCATION AND DESIGNATION OF FORMER SOIL BORING SAMPLED BY SOIL MECHANICS DRILLING CORPORATION

120' 0 120'

Title:

PROPOSED PHYTOREMEDIATION PLOT PLAN

Prepared For:

MBA-MANORHAVEN, LLC
MANORHAVEN, NEW YORK

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

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ATTACHMENT A-1

Roux Associates, Inc.
Standard Operating Procedures

STANDARD OPERATING PROCEDURE 3.1
FOR COLLECTION OF QUALITY CONTROL SAMPLES FOR WATER-QUALITY DATA

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to explain the quality control (QC) measures taken to ensure the integrity of the samples collected and to establish the guidelines for the collection of QC samples. The objective of the QC program is to ensure that water-quality data of known and reliable quality are developed.

Because valid water-chemistry data are integral to a hydrogeologic investigation that characterizes water-quality conditions, the data will be confirmed by QC samples. Without checks on the sampling and analytical procedures, the potential exists for contradictory or incorrect results. The acceptance of water-quality data by regulatory agencies and in litigation-support investigations depends heavily on the proper QC program to justify the results presented. The QC sampling requirements must be determined by the project manager and be clearly defined in the work plan. If data validation (for in-house purposes or for compliance with the United States Environmental Protection Agency [USEPA] regulations) is stipulated as part of the hydrogeologic investigation, QC sampling must be conducted.

2.0 QUALITY CONTROL SAMPLES

2.1 Samples taken for analysis of compounds require the use of quality control samples to monitor sampling activities and laboratory performance. Types of quality control samples may include replicate and/or replicate split, trip blank, field equipment blank, matrix spike and matrix spike duplicate, and fortification. A discussion pertaining to each quality control sample follows:

a. Replicate and Replicate Split - Replicate sample analysis is done to check on the reproducibility of results either within a laboratory or between laboratories. A replicate sample is called a split sample when it is collected with or turned over to a second party (e.g., regulatory agency, consulting firm) for an independent analysis. Replicate samples are aliquots (equal portions) from a sample in a common container.

To collect a replicate sample, water from the bailer or pump will be distributed first to fill one container and then to fill the second container. Adequate water should be available to fill the bottles completely before they are capped. If the water is insufficient to fill all the bottles at once, then incrementally fill each bottle with water from two or more bailer volumes or pump cycles.

For some test substances, water may have to be accumulated in a common container and then decanted slowly into the sample bottles. The work plan should be checked for a description of how replicate samples are to be collected. Additionally, in the case of wells that recover slowly and produce insufficient water to fill all the replicate sample containers, the containers should be filled incrementally and kept on ice in the cooler in between filling periods.

b. Trip Blank - A trip blank sample is a sample bottle that is filled with "clean" (e.g., distilled/deionized) water in the laboratory, and travels unopened with the sample bottles. (The USEPA now uses the phrase "demonstrated analyte free water.") It is opened in the laboratory and analyzed along with the field samples for the constituent(s) of interest to detect if contamination has occurred during field handling, shipment, or in the laboratory. Trip blanks are primarily used to check for "artificial" contamination of the sample caused by airborne volatile organic compounds (VOCs) but may also be used to check for "artificial" contamination of the sample by a test substance or other analyte(s). One trip blank per cooler containing VOC samples, or test substance of other analyte(s) of interest would accompany each day's samples.

c. Field Equipment Blank - A field equipment blank (field blank) sample is collected to check on the sampling procedures implemented in the field. A field blank is made with "clean" (e.g., distilled/deionized/demonstrated analyte free) water by exposing it to sampling processes (i.e., the clean water must pass through the actual sampling equipment). For example, if samples are being collected with a bailer, the field blank would be made by pouring the clean water into a bailer which has been decontaminated and is ready for sampling, and then pouring from the bailer into the sample containers. If a metals equipment blank is to be made, and the water was filtered, then the sample must be filtered (i.e., exposed to the sampling process). One equipment blank would be incorporated into the sampling program for each day's collection of samples and analyzed for the identical suite of constituents as the sample. In some situations one equipment blank will be required for each type of sampling procedure (e.g., split-spoon, bailer, hand auger).

A special type of field blank may be needed where ambient air quality may be poor. This field blank sample would be taken to determine if airborne contaminants will interfere with constituent identification or quantification. This field blank sample is a sample bottle that is filled and sealed with "clean" (e.g., distilled/deionized/demonstrated analyte free) water in the analytical laboratory, and travels unopened with the sample bottles. It is opened in the field and exposed to the air at a location(s) to check for potential atmospheric interference(s). The field blank is resealed and shipped to the contract laboratory for analysis.

d. Matrix Spike and Matrix Spike Duplicate - Spikes of compounds (e.g., standard compound, test substance, etc.) may be added to samples in the laboratory to determine if the ground-water matrix is interfering with constituent identification or quantification, as well as a check for systematic errors and lack of sensitivity of analytical equipment. Samples for spikes are collected in the identical manner as for standard analysis, and shipped to the laboratory for spiking. Matrix spike duplicate sample collection, and laboratory spiking and analysis is done to check on the reproducibility of matrix spike results.

e. Fortification - A fortification, which is performed in the field, is used to check on the laboratory's ability to recover the test substance (analyte) added as well as its stability between fortification and analysis.

A field fortification (spike) is prepared by filling the container(s) with field or distilled/deionized/demonstrated analyte free water (as specified by the laboratory) to a predetermined volume (as specified by the laboratory) and adding the spike (supplied by the laboratory). The predetermined volume of water is measured with a clean (decontaminated) graduated cylinder. Field spikes will be prepared following the collection, labeling, and sealing of nonspiked samples in a separate cooler. The spike is kept at a safe distance from the sampling point (e.g., in the hotel room).

2.2 The work plan must be referred to for details regarding the type of QC samples to be collected and the QC sample collection method.

3.0 PROCEDURE

3.1 Implement QC sampling as outlined above, depending on the type of QC sample(s) specified in the work plan.

3.2 Ensure unbiased handling and analysis of replicate and blank QC samples by concealing their identity by means of coding so that the analytical laboratory cannot determine which samples are included for QC purposes. Attempt to use a code that will not cause confusion if additional samples are collected or additional monitoring wells are installed. For example, if there are three existing monitoring wells (MW-1, 2 and 3), do not label the QC blank MW-4. If an additional monitoring well were installed, confusion could result.

3.3 Label matrix spike and field fortification (spike) QC samples so that the analytical laboratory knows which samples are to be spiked in the laboratory and which samples were fortified (spiked) in the field, respectively. In certain situations, the field fortification will be "blind" or undisclosed to the laboratory to independently verify their analytical ability.

3.4 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," and placed in its appropriate container (holder) in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory. Consult the site work plan to determine if a particular ice is specified as the preservative for transportation (e.g., the USEPA prefers the use of wet ice because they claim that blue ice will not hold the samples at 4° Centigrade/Celsius).

3.5 Document the QC samples on the appropriate field form and in the field notebook. On the chain-of-custody form, replicate and blank QC samples will be labeled using the codes (Number 3.2, above), and matrix spike and field fortification QC samples will be identified as such (Number 3.3, above).

3.6 Follow standard shipping procedures for samples (i.e., retain one copy of the chain-of-custody form, secure the cooler with sufficient packing tape and a custody seal, forward the samples via overnight [express] mail or hand deliver to the designated analytical laboratory preferably within 24 hours but no later than 48 hours after sampling). However, check the site work plan for information on the analyte(s), as some have to be analyzed immediately (e.g., CN).

STANDARD OPERATING PROCEDURE 3.3
FOR SAMPLE HANDLING

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for sample handling which will allow consistent and accurate results. Valid chemistry data are integral to investigations that characterize media-quality conditions. Thus, this SOP is designed to ensure that once samples are collected, they are preserved, packed and delivered in a manner which will maintain sample integrity to as great an extent as possible. The procedures outlined are applicable to most sampling events and any required modifications must be clearly described in the work plan.

2.0 CONSIDERATIONS

Sample containers, sampling equipment decontamination, quality assurance/quality control (QA/QC), sample preservation, and sample handling are all components of this SOP.

2.1 Sample Containers

Prior to collection of a sample, considerations must be given to the type of container that will be used to store and transport the sample. The type and number of containers selected is usually based on factors such as sample matrix, potential contaminants to be encountered, analytical methods requested, and the laboratory's internal quality assurance requirements. In most cases, the overriding considerations will be the analytical methodology, or the state or federal regulatory requirements because these regulations generally encompass the other factors. The sample container selected is usually based on some combination of the following criteria:

a. Reactivity of Container Material with Sample

Choosing the proper composition of sample containers will help to ensure that the chemical and physical integrity of the sample is maintained. For sampling potentially hazardous material, glass is the recommended container type because it is chemically inert to most substances. Plastic containers are not recommended for most hazardous wastes because the potential exists for contaminants to adsorb to the surface of the plastic or for the plasticizer to leach into the sample.

In some instances, however, the sample characteristics or analytes of interest may dictate that plastic containers be used instead of glass. Because some metals species will adhere to the sides of the glass containers in an aqueous matrix, plastic bottles (e.g., nalgene) must be used for samples collected for metals analysis. A separate, plastic container should accompany glass containers if metals analysis is to be performed along with other analyses. Likewise, other sample characteristics may dictate that glass cannot be used. For example, in the case of a strong alkali waste or hydrofluoric solution, plastic containers may be more suitable because glass containers may be etched by these compounds and create adsorptive sites on the container's surface.

b. Volume of the Container

The volume of sample to be collected will be dictated by the analysis being performed and the sample matrix. The laboratory must supply bottles of sufficient volume to perform the required analysis. In most cases, the methodology dictates the volume of sample material required to complete the analysis. However, individual laboratories may provide larger volume containers for various analytes to ensure sufficient quantities for duplicates or other QC checks.

To facilitate transfer of the sample from the sampler into the container and to minimize spillage and sample disturbance, wide-mouth containers are recommended. Aqueous volatile organic samples must be placed into 40-milliliter (ml) glass vials with polytetrafluoroethylene (PTFE) (e.g., TeflonTM) septums. Non-aqueous volatile organic samples should be collected in the same type of vials or in 4-ounce (oz) wide-mouth jars provided by the laboratory. These jars should have PTFE-lined screw caps.

c. Color of Container

Whenever possible, amber glass containers should be used to prevent photodegradation of the sample, except when samples are being collected for metals analysis. If amber containers are not available, then containers holding samples should be protected from light (i.e., place in cooler with ice immediately after filling).

d. Container Closures

Container closures must screw on and off the containers and form a leak-proof seal. Container caps must not be removed until the container is ready to be filled with the sample, and the container cap must be replaced (securely) immediately after filling it. Closures should be constructed of a material which is inert with respect to the sampled material, such as PTFE (e.g., TeflonTM). Alternately, the closure may be separated from the sample by a closure liner that is inert to the sample material such as PTFE sheeting. If soil or sediment samples are being collected, the threads of the container must be wiped clean with a dedicated paper towel or cloth so the cap can be threaded properly.

e. Decontamination of Sample Containers

Sample containers must be laboratory cleaned by the laboratory performing the analysis. The cleaning procedure is dictated by the specific analysis to be performed on the sample. Sample containers must be carefully examined to ensure that all containers appear clean. Do not mistake the preservative as unwanted residue. The bottles should not be field cleaned. If there is any question regarding the integrity of the bottle, then the laboratory must be contacted immediately and the bottle(s) replaced.

f. Sample Bottle Storage and Transport

No matter where the sample bottles are, whether at the laboratory waiting to be packed for shipment or in the field waiting to be filled with sample, care must be taken to avoid contamination. Sample shuttles or coolers, and sample bottles must be stored and transported in clean environments. Sample bottles and clean sampling equipment must never be stored near solvents, gasoline, or other equipment that is a potential source of cross-contamination. When under chain of custody, sample bottles must be secured in locked vehicles, and custody sealed in shuttles or in the presence of authorized personnel. Information which documents that proper storage and transport procedures have been followed must be included in the field notebook and on appropriate field forms.

2.2 Decontamination of Sampling Equipment

Proper decontamination of all re-usable sampling equipment is critical for all sampling episodes. The SOP for Decontamination of Field Equipment and SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for decontamination of various types of equipment.

2.3 Quality Assurance/Quality Control Samples

QA/QC samples are intended to provide control over the proper collection and tracking of environmental measurements, and subsequent review, interpretation and validation of generated analytical data. The SOPs for Collection of Quality Control Samples, for Evaluation and Validation of Data, and for Field Record Keeping and Quality Assurance/Quality Control must be referred to for detailed guidance regarding these respective procedures. SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for QA/QC procedures.

2.4 Sample Preservation Requirements

Certain analytical methodologies for specific analytes require chemical additives in order to stabilize and maintain sample integrity. Generally, this is accomplished under the following two scenarios:

a. Sample bottles are preserved at the laboratory prior to shipment into the field.

b. Preservatives are added in the field immediately after the samples are collected.

Many laboratories provide pre-preserved bottles as a matter of convenience and to help ensure that samples will be preserved immediately upon collection. A problem associated with this method arises if not enough sample could be collected, resulting in too much preservative in the sample. More commonly encountered problems with this method include the possibility of insufficient preservative provided to achieve the desired pH level or the need for additional preservation due to chemical reactions caused by the addition of sample liquids to pre-preserved bottles. The use of pre-preserved bottles is acceptable; however, field sampling teams must always be prepared to add additional preservatives to samples if the aforementioned situations occur. Furthermore, care must be exercised not to overfill sample bottles containing preservatives to prevent the sample and preservative from spilling and therefore diluting the preservative (i.e., not having enough preservative for the volume of sample).

When samples are preserved after collection, special care must be taken. The transportation and handling of concentrated acids in the field requires additional preparation and adherence to appropriate preservation procedures. All preservation acids used in the field should be trace-metal or higher-grade.

2.5 Sample Handling

After the proper sample bottles have been received under chain-of-custody, properly decontaminated equipment has been used to collect the sample, and appropriate preservatives have been added to maintain sample integrity, the final step for the field personnel is checking the sample bottles prior to proper packing and delivery of the samples to the laboratory.

All samples should be organized and the labels checked for accuracy. The caps should be checked for tightness and any 40-ml volatile organic compound (VOC) bottles must be checked for bubbles. Each sample bottle must be placed in an individual "zip-lock" bag to protect the label, and placed on ice. The bottles must be carefully packed to prevent breakage during transport. When several bottles have been collected for an individual sample, they should not be placed adjacent to each other in the cooler to prevent possible breakage of all bottles for a given sample. If there are any samples which are known or suspected to be highly contaminated, these should be placed in an indivudual cooler under separate chain-of-custody to prevent possible cross contamination. Sufficient ice (wet or blue packs) should be placed in the cooler to maintain the temperature at 4 degrees Celsius (°C) until delivery at the laboratory. Consult the work plan to determine if a particular ice is specified as the preservation for transportation (e.g., the United States Environmental Protection Agency does not like the use of blue packs because they claim that the samples will not hold at 4°C). If additional coolers are required, then they should be purchased. The chain-of-custody form should be properly completed, placed in a "zip-lock" bag, and placed in the cooler. One copy must be maintained for the project files. The cooler should be sealed with packing tape and a custody seal. The custody seal number should be noted in the field book. Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time. If overnight mail is utilized, then the shipping bill must be maintained for the files and the laboratory must be called the following day to confirm receipt.

3.0 EQUIPMENT AND MATERIALS

3.1 General equipment and materials may include, but not necessarily be limited to, the following:

- a. Sample bottles of proper size and type with labels.
- b. Cooler with ice (wet or blue pack).
- c. Field notebook, appropriate field form(s), chain-of-custody form(s), custody seals.
- d. Black pen and indelible marker.
- e. Packing tape, "bubble wrap", and "zip-lock" bags.
- f. Overnight (express) mail forms and laboratory address.
- g. Health and safety plan (HASP).
- h. Work plan/scope of work.
- i. Pertinent SOPs for specified tasks and their respective equipment and materials.

3.2 Preservatives for specific samples/analytes as specified by the laboratory. Preservatives must be stored in secure, spillproof glass containers with their content, concentration, and date of preparation and expiration clearly labeled.

3.3 Miscellaneous equipment and materials including, but not necessarily limited to, the following:

- a. Graduated pipettes.
- b. Pipette bulbs.
- c. Litmus paper.
- d. Glass stirring rods.
- e. Protective goggles.
- f. Disposable gloves.
- g. Lab apron.
- h. First aid kit.
- i. Portable eye wash station.
- j. Water supply for immediate flushing of spillage, if appropriate.
- k. Shovel and container for immediate containerization of spillage-impacted soils, if appropriate.

4.0 PROCEDURE

4.1 Examine all bottles and verify that they are clean and of the proper type, number, and volume for the sampling to be conducted.

4.2 Label bottles carefully and clearly with project name and number, site location, sample identification, date, time, and the sampler's initials using an indelible marker.

4.3 Collect samples in the proper manner (refer to specific sampling SOPs).

4.4 Conduct preservation activities as required after each sample has been collected. Field preservation must be done immediately and must not be done later than 30 minutes after sample collection.

4.5 Conduct QC sampling, as required.

4.6 Seal each container carefully and place in an individual "zip lock" bag.

4.7 Organize and carefully pack all samples in the cooler immediately after collection (e.g., bubble wrap). Insulate samples so that breakage will not occur.

4.8 Complete and place the chain-of-custody form in the cooler after all samples have been collected. Maintain one copy for the project file. If the cooler is to be transferred several times prior to shipment or delivery to the laboratory, it may be easier to tape the chain-of-custody to the exterior of the sealed cooler. When exceptionally hazardous samples are known or suspected to be present, this should be identified on the chain-of-custody as a courtesy to the laboratory personnel.

4.9 Add additional ice as necessary to ensure that it will last until receipt by the laboratory.

4.10 Seal the cooler with packing tape and a custody seal. Record the number of the custody seal in the field notebook and on the field form. If there are any exceptionally hazardous samples, then shipping regulations should be examined to ensure that the sample containers and coolers are in compliance and properly labeled.

4.11 Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time.

4.12 Maintain the shipping bill for the project files if overnight mail is utilized and call the laboratory the following day to confirm receipt.

STANDARD OPERATING PROCEDURE 4.1 FOR MEASURING WATER-LEVELS AND SOUNDING A WELL WITH A STEEL TAPE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for using steel measuring tapes. A steel tape is used to measure the depth to ground water below an established (surveyed) measuring point (MP) and/or to sound a well (i.e., to measure the depth of well). Measuring the depth to water (DTW) below the surveyed MP provides information for calculating ground-water elevations needed to construct ground-water elevation maps and determine the direction of ground-water flow. A well is sounded to determine the total depth of the well (i.e., to provide information regarding potential siltation problems [filling-in with sediment]). This can be used to eliminate possible confusion concerning identification of the well in cases where there are several similar, adjacent, unlabeled wells. Depth to water and sounding data can also be used to calculate the volume of standing water in the well (which is a prerequisite for purging a well before well sampling, and will be addressed in respective SOPs).

A steel tape is the preferred water-level measuring device because it is the most accurate, especially when measurements are taken under static conditions. However, this technique may be inappropriate under nonstatic (changing) conditions such as aquifer tests when water levels may be changing rapidly or when water is cascading into a well. These conditions would require the use of an electronic sounding device (refer to SOP for Measuring Water Levels using an Electronic Sounding Device (M-Scope).

2.0 DECONTAMINATION

The steel tape must be precleaned (decontaminated) using a non-phosphate, laboratory-grade solution and rinsed with copious amounts of distilled or deionized water. This process is repeated before each measurement and following the final measurement.

3.0 PROCEDURE

3.1 If the well is not vented, then remove the cap and wait several minutes for the water level to equilibrate. Take several measurements to ensure that the water level measured is in equilibrium with the aquifer (i.e., not changing substantially).

3.2 The tape will be equipped with a weight to ensure the tape is held vertically and is kept taut when lowered into the well. Measure and record the distance from the bottom of the tape to the bottom of the weight to ensure the proper depth is measured when sounding a well.

3.3 If a water-level measurement is to be taken, then apply chalk (e.g., carpenter's chalk) to the bottom few feet of the tape and lower it into the water.

3.4 The top of the tape is held at an even-foot increment at the MP. This is the "held" value, and is recorded as such.

3.5 The tape is rolled up, and the cut (i.e., the mark between the dry and wet chalk) is noted. This "wet" value is measured accurately to the nearest 0.01 foot, and is recorded as such. The difference between the "held" value and the "wet" value is the DTW.

3.6 After measuring all wells in an area, always re-measure at least one well, preferably the first well measured, to see if the static water level has changed (e.g., due to pumping in the area, tidal effects, etc.). If a significant change has occurred, it may be necessary to re-measure the wells.

3.7 If there are previous water-level measurements available for the wells, then have these data available to compare the measurements with those just taken. Use these data to see if water levels are similar or if they have changed. If water levels have changed, then check if the changes are consistent (i.e., all up or all down) and make sense.

3.8 Water-level elevations are calculated by subtracting the DTW from the MP and a water-elevation map is constructed (contoured) on a well location map. This also provides a check to evaluate if the water levels make sense (or anomalies are evidenced). Remeasure the well(s) where anomalies are found as a check on the initial measurement(s).

3.9 If anomalies persist or water-level trends are different from the historical database, then check to see if hydrogeologic conditions and/or stresses have changed (e.g., discharge areas, pumping and/or injection wells, etc.).

3.10 If the well is being sounded (depth measured), then lower the tape to the bottom of the well and measure its length accurately from the MP to the nearest 0.01 foot. Compare the sounded depth to the as-built well construction log (diagram). This will determine if siltation has occurred and redevelopment is necessary to establish a good hydraulic connection between the well screen and the aquifer.

3.11 All pertinent data will be recorded in the field notebook and on appropriate field forms, and initialed and dated.

STANDARD OPERATING PROCEDURE 4.2 FOR MEASURING WATER LEVELS USING AN ELECTRONIC SOUNDING DEVICE (M-SCOPE)

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for using m-scopes. A m-scope is an electronic sounding device used to measure the depth to ground water below an established (surveyed) measuring point (MP). Measuring the depth to water (DTW) below the surveyed MP provides information for calculating ground-water elevations needed to construct ground-water elevation maps and determine the direction of ground-water flow.

M-scopes can be less accurate than a steel tape because the wire can kink, measurement increment marks can shift, and the tip may have been cut off and replaced without proper documentation. Thus, it is mandatory that a m-scope be calibrated before use.

2.0 DECONTAMINATION

The m-scope must be precleaned (decontaminated) using a non-phosphate, laboratory-grade solution and rinsed with copious amounts of distilled or deionized water. This process is repeated before each measurement and following the final measurement.

3.0 CALIBRATION

The m-scope must be calibrated before being used to measure water levels. Calibration is accomplished by measuring the water level with the m-scope followed by a measurement using a steel tape. This dual measurement procedure is continued until the individual is confident that measurements taken using both devices are similar and the m-scope is reliable. The calibration procedure is documented in the field notebook or on an appropriate field form, and initialed and dated.

4.0 PROCEDURE

4.1 If the well is not vented, then remove the cap and wait several minutes for the water level to equilibrate. Take several measurements to ensure that the water level measured is in equilibrium with the aquifer (i.e., not changing substantially).

4.2 The manufacturer's model must be noted because some have switches, lights, beepers, or a combination of the above.

4.3 The 1-foot or 5-foot marked intervals on the electrical line must be checked to ensure that they have not shifted, and the bottom of the probe has not been cut. Check on a periodic basis that the cord has not kinked.

4.4 The water-level measurement is taken by lowering the probe into the well until the instrument-specific detection method (e.g., light, beeper, or both) is activated by contacting the water.

4.5 The electrical line is held at the MP and, using a ruler (e.g., carpenter's folding ruler) or an engineer's scale, the distance from the "held" point to the nearest marked interval is measured. The distance measured is added to, or subtracted from, the marked interval reading. The result is the DTW.

4.6 Measurements will be taken accurately and to the nearest 0.01 foot.

4.7 After measuring all wells in an area, always re-measure at least one well, preferably the first well measured, to see if the static water level has changed (e.g., due to pumping in the area, tidal effects, etc.). If a significant change has occurred, it may be necessary to re-measure other wells.

4.8 If there are previous water-level measurements available for the wells, then have these data available to compare the measurements with those just taken. Use these data to see if water levels are similar or if they have changed. If water levels have changed, then check if the changes are consistent (i.e., all up or all down) and make sense.

4.9 Water-level elevations are calculated by subtracting the DTW from the MP and a water-elevation map is constructed (contoured) on a well location map. This also provides a check to evaluate if the water levels make sense (or anomalies are evidenced). Remeasure the well(s) where anomalies are found as a check on the initial measurement(s).

4.10 If anomalies persist or water-level trends are different from the historical database, then check to see if hydrogeologic conditions and/or stresses have changed (e.g., discharge areas, pumping and/or injection wells, etc.).

4.11 All pertinent data will be documented in the field notebook, and initialed and dated.

STANDARD OPERATING PROCEDURE 4.3
FOR PURGING A WELL

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for purging a well prior to the collection of a ground-water sample. Purging (evacuating) a well involves the removal of the standing column of water in the well to allow "fresh" (representative) formation water to enter the well. Two conventionally used methods for well purging include: 1) discharge of a specified number of casing volumes of water (which is more commonly used); and 2) pumping until specific indicator parameters (e.g., specific conductance, pH, temperature) stabilize. Wells must be purged prior to sampling to ensure the collection of representative formation ground water for water-quality analysis.

For accepted, existing sampling and analysis programs, the same purging method will be used each time to maintain consistency. For new sampling and analysis programs, the basis for the purging technique(s) will be site-specific field conditions, client input, the experience of Roux Associates, Inc. and regulatory agency(ies) guidelines (e.g., some states permit purging a low-yield well to dryness while others insist that some water remains in the well).

2.0 EQUIPMENT AND MATERIALS

2.1 The following equipment may be needed to purge a monitoring well before sampling:

a. Bailers.

b. Centrifugal pumps.

c. Electrical submersible pumps.

d. Peristaltic pumps.

e. Positive gas-displacement devices.

f. Bladder pumps.

g. Hand-operated diaphragm or bilge pump(s).

h. Teflon™ tape, electrical tape.

i. Tape measure (stainless steel, steel, fiberglass) with 0.01-foot measurement increments and chalk (e.g., blue carpenter's) or m-scope.

j. Appropriate discharge hose and valves.

k. Appropriate discharge tubing (e.g., polypropylene) if using a peristaltic pump.

l. Appropriate compressed gas if using bladder-type or gas-displacement device.

m. Extension cord(s) or portable generator (and fuel) if using an electric submersible pump.

n. Non-absorbent cord (e.g., polypropylene, etc.), cotton (absorbent) cord.

o. Tripod(s).

p. Water Well Handbook.

q. Explosimeter.

r. Flow meter.

2.2 Bailers or centrifugal pumps are recommended for shallow, small diameter monitoring wells. For deep wells, or large diameter wells, a submersible pump is recommended.

3.0 DECONTAMINATION

Each piece of equipment that is used to evacuate wells (e.g., bailers, pumps, hoses) will be decontaminated thoroughly prior to the introduction of the equipment into the well and prior to leaving the site. Additionally, disposable items (e.g., cord, tubing) will be changed between each well purged and discarded in an appropriate manner.

4.0 PROCEDURE

4.1 The depth to water (DTW) is measured and subtracted from the sounded (total) depth of the well to calculate the length of the column of standing water in the well (in feet).

4.2 The volume of the standing water in the well is calculated by multiplying the length of standing water by a coefficient which equates the diameter of the well to gallons per linear foot. (Refer to the attached table from the Water Well Handbook for the coefficient or use the following equation [V=(7.48 gal/ft3)(r2h), where V is volume of water in gallons, r is the radius of the well casing in feet, and h is the height of the water column in the well in feet].)

4.3 If purging is performed by evacuating a specified number of casing volumes, then three to five volumes are purged (typical regulatory agency requirement).

4.4 If wells are screened in low permeability formations, then the well may go dry prior to removing the specified volume of water. If the recovery rate is fairly rapid and time allows, then remove more than one casing volume; otherwise, the evacuation of one casing volume may suffice. (Refer to the site sampling and analysis plan [SAP] for details of purging a low-yield well.)

4.5 Evacuation will occur from the top of the water column in the well to ensure that "fresh" formation water enters the bottom of the well through the screen, moves up as standing water is removed from the top, and all standing water is removed (i.e., only representative formation water is in the well).

4.6 The volume of water purged from the well must be measured and can be calculated directly by discharging into containers of known volume or can be calculated by multiplying rate of flow by time.

4.7 If a submersible or centrifugal pump is used, then the intake is set just below the dynamic (pumping) water level in the well. The rate of flow in gallons per minute (gpm) can be measured using a calibrated bucket (e.g., 5-gallon) if the rate is relatively low, or a 55-gallon drum if the rate is relatively high, and a watch capable of measuring time in second intervals. A precalibrated flow meter may also be used if available.

4.8 After the specified number of casing volumes have been evacuated from the well, the pump intake is lifted slowly until it breaks suction to confirm that any standing water above the intake has been purged.

4.9 If a bailer is used, then the bailer is lowered only deep enough to remove water from the top of the water column and a 5-gallon bucket is used to measure the volume of water evacuated.

4.10 If purging is not executed by evacuating a specified number of well volumes, then purging is performed by pumping or bailing the well until specific indicator parameters (e.g., specific conductance, pH, temperature) stabilize. The volume of water removed is documented on an appropriate field form or in the field notebook.

4.11 Water purged from the well will be disposed of in accordance with the appropriate method outlined in the site SAP.

4.12 If historic site data indicate that explosive gases could be present and accumulate in the well, then an explosimeter will be used to check vapor concentrations in wells at the site prior to beginning the purging procedure. Vapor concentrations in a well that exceed the 25 percent lower explosive limit (LEL) will require specific precautionary measures to allow purging the well without danger of explosion or fire (e.g., use of cotton cord for bailers or lowering pumping devices, non-electric powered pumps). These conditions will be addressed in the site health and safety plan (HASP) and/or SAP.

STANDARD OPERATING PROCEDURE 4.4
FOR SAMPLING GROUND-WATER MONITORING WELLS FOR DISSOLVED CONSTITUENTS

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the sampling of ground-water monitoring wells for dissolved constituents. As part of the SOP for the sampling of ground-water monitoring wells, sample collection equipment and devices must be considered, and equipment decontamination and pre-sampling procedures (e.g., measuring water levels, sounding wells, and purging wells) must be implemented. Sampling objectives must be firmly established in the work plan before considering the above.

Valid water-chemistry data are integral to a hydrogeologic investigation that characterizes ground-water quality conditions. Water-quality data are used to evaluate both current and historic aquifer chemistry conditions, as well as to estimate future conditions (e.g., trends, migration pathways). Water-quality data can be used to construct ground-water quality maps to illustrate chemical conditions within the flow system, to generate water-quality plots to depict conditions with time and trends, and to perform statistical analyses to quantify data variability, trends, and cleanup levels.

2.0 EQUIPMENT AND MATERIALS

2.1 In order to sample ground water from monitoring wells, specific equipment and materials are required. The equipment and materials list may include, but not necessarily be limited to, the following:

a. Bailers (Teflon™ or stainless steel).

b. Pumps (centrifugal, peristaltic, bladder, electric submersible, bilge, hand-operated diaphragm, etc.).

c. Gas-displacement device(s).

d. Air-lift device(s).

e. Teflon™ tape, electrical tape.

f. Appropriate discharge hose.

g. Appropriate discharge tubing (e.g., polypropylene, teflon, etc.) if using a peristaltic pump.

h. Appropriate compressed gas if using bladder-type or gas-displacement device.

i. Portable generator and gasoline or alternate power supply if using an electric submersible pump.

j. Non-absorbent cord (e.g., polypropylene, etc.).

k. Plastic sheeting.

l. Tape measure (stainless steel, steel, fiberglass) with 0.01-foot measurement increments and chalk (blue carpenter's).

m. Electronic water-level indicators (e.g., m-scope, etc.) or electric water-level/product level indicators.

n. Non-phosphate, laboratory-grade detergent.

o. Distilled/Deionized water.

p. Potable water.

q. Paper towels, clean rags.

r. Roux Associates' field forms (e.g., daily log, well inspection checklist, sampling, etc.) and field notebook.

s. Well location and site map.

t. Well keys.

u. Stop watch, digital watch with second increments, or watch with a second hand.

v. Water Well Handbook.

w. Calculator.

x. Black pen and water-proof marker.

y. Tools (e.g., pipe wrenches, screwdrivers, hammer, pliers, flashlight, pen knife, etc.).

z. Appropriate health and safety equipment, as specified in the site health and safety plan (HASP).

aa. pH meter(s) and buffers.

bb. Conductivity meter(s) and standards.

cc. Thermometer(s).

dd. Extra batteries (meters, thermometers, flashlight).

ee. Filtration apparatus, filters, pre-filters.

ff. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).

gg. Disposable gloves.

hh. Water jugs.

ii. Laboratory-supplied sample containers with labels.

jj. Cooler(s).

kk. Ice (wet, blue packs).

ll. Masking, duct, and packing tape.

mm. Chain-of-custody form(s) and custody seal(s).

nn. Site sampling and analysis plan (SAP).

oo. Site health and safety plan (HASP).

pp. Packing material (e.g., bubble wrap)

qq. "Zip-lock" plastic bags.

rr. Overnight (express) mail forms.

3.0 DECONTAMINATION

3.1 Make sure all equipment is decontaminated and cleaned before use (refer to the SOP for Decontamination of Field Equipment for detailed decontamination methods, summaries for bailers and pumps are provided below). Use new, clean materials when decontamination is not appropriate (e.g., non-absorbent cord, disposable gloves). Document, and initial and date the decontamination procedures on the appropriate field form and in the field notebook.

a. Decontaminate a bailer by: 1) wearing disposable gloves, 2) disassembling (if appropriate) and scrubbing in a non-phosphate, laboratory-grade detergent and distilled/deionized water solution, and 3) rinsing first with potable water and then distilled/deionized water.

b. Decontaminate a pump by: 1) wearing disposable gloves, 2) flushing the pump and discharge hose (if not disposable) first with a non-phosphate, laboratory-grade detergent and potable water solution in an appropriate container (clean bucket, garbage can, or 55-gallon drum) and then with distilled/deionized water or potable water, and 3) wiping pump-related equipment (e.g., electrical lines, cables, discharge hose) first with a clean cloth and detergent solution and then rinsing or wiping with a clean cloth and distilled/deionized water or potable water.

3.2 Note that the decontamination procedures for bailers and pumps are the minimum that must be performed. Check the work plan to determine if chemicals specified by individual state regulatory agencies must also be used for decontamination procedures (e.g., hexane, nitric acid, acetone, isopropanol, etc.).

4.0 CALIBRATION OF FIELD ANALYSIS EQUIPMENT

Calibrate field analysis equipment before use (e.g., thermometers, pH and conductivity meters, etc.). Refer to the specific SOP for field analysis for each respective piece of equipment. Document, and initial and date the calibration procedures on the appropriate field form, in the field notebook, and in the calibration log book.

5.0 PROCEDURE

5.1 Document, and initial and date well identification, pre-sampling information, and problems encountered on the appropriate field form and in the field notebook as needed.

5.2 Inspect the protective casing of the well and the well casing, and note any items of concern such as a missing lock, or bent or damaged casing(s).

5.3 Place plastic sheeting around the well to protect sampling equipment from potential cross contamination.

5.4 Remove the well cap or plug and, if necessary, clean the top of the well off with a clean rag. Place the cap or plug on the plastic sheeting. If the well is not vented, allow several minutes for the water level in the well to equilibrate. If fumes or gases are present, then diagnose these with the proper safety equipment. Never inhale the vapors.

5.5 Measure the depth to water (DTW) from the measuring point (MP) on the well using a steel tape and chalk or an electronic sounding device (m-scope). Refer to the specific SOPs for details regarding the use of a steel tape or a m-scope for measuring water levels. Calculate the water-level elevation. Document, and initial and date the information on the appropriate field form and in the field notebook.

5.6 Measuring the total depth of the well from the MP with a weighted steel tape. Calculate and record the volume of standing water in the well casing on the appropriate field form and in the field notebook.

5.7 Decontaminate the equipment used to measure the water level and sound the well with a non-phosphate, laboratory-grade detergent solution followed by a distilled/deionized water rinse.

5.8 Purge the well prior to sampling (refer to the SOP for Purging a Well). The well should be pumped or bailed to remove the volume of water specified in the work plan. Usually three to five casing volumes are removed if the recharge rate is adequate to accomplish this within a reasonable amount of time.

If the formation cannot produce enough water to sustain purging, then one of two options must be followed. These include: 1) pumping or bailing the well dry, or 2) pumping or bailing the well to "near-dry" conditions (i.e., leaving some water in the well). The option employed must be specified in the work plan and be in accordance with regulatory requirements.

If the well is purged dry, then all the standing water has been removed and upon recovery the well is ready for sampling. However, depending on the rate of recovery and the time needed to complete the sampling round, one of the following procedures may have to be implemented: 1) the well may have to be sampled over a period of more than one day; 2) the well may not yield enough water to collect a complete suite of samples and only select (most important) samples will be collected; or 3) the well may not recover which will preclude sampling. Regardless of the option that must be followed, the sampling procedure must be fully documented. When preparing to conduct a sampling round, review drilling, development and previous sampling information (if available) to identify low-yielding wells in order to purge them first, and potentially allow time for the well to recover for sampling.

5.9 Record the physical appearance of the water (i.e., color, turbidity, odor, etc.) on the appropriate field form and in the field notebook, as it is purged. Note any changes that occur during purging.

5.10 If a bailer is used to collect the sample, then:

a. Flush the decontaminated bailer three times with distilled/deionized water.

b. Tie the non-absorbent cord (polypropylene) to the bailer with a secure knot and then tie the free end of the bailer cord to the protective casing or, if possible, some nearby structure to prevent losing the bailer and cord down the well.

c. Lower the bailer slowly down the well and into the water column to minimize disturbance of the water surface. If a bottom-filling bailer is used, then do not submerge the top of the bailer; however, if a top-filling bailer is used, then submerge the bailer several feet below the water surface.

d. Remove and properly discard one bailer volume from the well to rinse the bailer with well water before sampling. Again, lower the bailer slowly down the well to the appropriate depth depending on the bailer type (as discussed above in 5.11 c). When removing the bailer from the well, do not allow the bailer cord to rest on the ground but coil it on the protective plastic sheeting placed around the well. Certain regulatory agencies require that the first bailer volume collected be utilized for the samples.

5.11 If a pump is used to collect the sample, then use the same pump used to purge the well and, if need be, reduce the discharge rate to facilitate filling sample containers and to avoid problems that can occur while filling sample containers (as listed in Number 5.14, below). Alternately, the purge pump may be removed and a thoroughly decontaminated bailer can be used to collect the sample.

5.12 Remove each appropriate container's cap only when ready to fill each with the water sample, and then replace and secure the cap immediately.

5.13 Fill each appropriate, pre-labeled sample container carefully and cautiously to prevent: 1) agitating or creating turbulence; 2) breaking the container; 3) entry of, or contact with, any other medium; and 4) spilling/splashing the sample and exposing the sampling team to contaminated water. Immediately place the filled sample container in a ice-filled (wet ice or blue pack) cooler for storage. If wet ice is used it is recommended that it be repackaged in zip-lock bags to help keep the cooler dry and the sample labels secure. Check the work plan as to whether wet ice or blue packs are specified for cooling the samples because certain regulatory agencies may specify the use of one and not the other.

5.14 "Top-off" containers for volatile organic compounds (VOCs) and tightly seal with Teflon™-lined septums held in place by open-top screw caps to prevent volatilization. Ensure that there are no bubbles by turning the container upside down and tapping it gently.

5.15 Filter water samples (Procedure 4.6) collected for dissolved metals analysis prior to preservation to remove the suspended sediment from the sample. If water samples are to be collected for total metals analysis, then collect a second set of samples without field filtering.

In the event that the regulatory agency(ies) want unfiltered samples for metals analysis, a second set of filtered samples should also be collected. Because unfiltered samples are indications of total metals (dissolved and suspended) they are not representative of aquifer conditions because ground water does not transport sediment (except in some rare cases). Thus, the results for dissolved metals in ground water should be based on filtered samples even if both filtered and unfiltered sets are presented in a report.

5.16 Add any necessary preservative(s) to the appropriate container(s) prior to, or after (preferred), the collection of the sample, unless the appropriate preservative(s) have already been added by the laboratory before shipment.

5.17 Collect quality control (QC) samples as required in the work plan to monitor sampling and laboratory performance. Refer to the SOP for Collection of Quality Control Samples.

5.18 Conduct field analyses after sample collection is complete by measuring and recording the temperature, conductivity, pH, etc. (as called for in the work plan). Note and record the "final" physical appearance of the water (after purging and sampling) on an appropriate field form and in the field notebook.

5.19 Wipe the well cap with a clean rag, replace the well cap and protective cover (if present). Lock the protective cover.

5.20 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," placed in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory.

5.21 Decontaminate bailers, hoses, and pumps as discussed in the decontamination SOP. Wrap decontaminated equipment with a suitable material (e.g., clean plastic bag or aluminum foil). Discard cords, rags, gloves, etc. in a manner consistent with site conditions.

5.22 Complete all necessary field forms, field notebook entries, and the chain-of-custody forms. Retain one copy of each chain-of-custody form. Secure the cooler with sufficient packing tape and a custody seal.

5.23 Samples collected from Monday through Friday will be delivered within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Consult the work plan to determine if any of the analytes require a shorter delivery time.

STANDARD OPERATING PROCEDURE 4.6 FOR FILTRATION OF GROUND-WATER AND SURFACE-WATER SAMPLES FOR DISSOLVED METALS ANALYSIS

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the field filtration of ground-water samples for dissolved metals analysis prior to sample preservation. Filtering is implemented when the water sample contains suspended fine-grained materials (fines) that cannot be prohibited from entering the water sample by well development or well design. However, as fines are not always distinctly visible in the water sample, all water samples to be analyzed for dissolved metals will undergo filtration. Ground-water samples from bedrock formations to be analyzed for dissolved metals must also be filtered.

It should be noted that filtration of ground water for metals analysis has been a standard practice with the United States Geological Survey (USGS) for many years. However, it should also be noted that certain regulatory agencies insist that ground-water samples for metals analysis are not filtered. In this case, the analytical results are actually representative of total metals (i.e., dissolved and suspended). Nevertheless, in order to quantify the concentrations of dissolved metals in ground water, filtration will be employed.

Within this framework, filtration refers to the filtering of water either directly or at the end of a filtration series through a 0.45 micrometer (micron) membrane filter. The presence of a large quantity of fines may require the prefiltering of the sample with a larger-size membrane filter prior to the 0.45 micron filter to avoid clogging the 0.45 micron filter and using an exorbitant amount of time to filter the sample.

Filtration must be done as soon as possible after a water sample is collected, preferably at the same time that the water is produced. If there is a delay between the time that the water sample is collected and the time that filtration occurs, then the time lag and reason for the delay must be documented. The filtering equipment and membrane must be suitable for the intended analysis. Where permitted by regulatory agencies, disposable in-line filters and disposable funnel-type filters may be used. Depending upon the sampling needs, sterile disposable filtering devices may be preferable since they eliminate the need for field decontamination. Materials known to adversely affect the analytical procedure must not be used. The site sampling and analysis plan (SAP) must be referred to for these and other site specific filtration conditions.

In the event that surface water is being analyzed for dissolved metals, the filtration process described below is also used.

2.0 MATERIALS AND EQUIPMENT

To field filter ground-water samples, specific equipment and materials are required. The equipment and materials listed below may be needed in addition to the materials and equipment listed in various sampling SOPs.

a. Non-phosphate, laboratory-grade detergent.

b. Distilled/Deionized water.

c. Potable water.

d. Field forms (e.g., daily log, sampling, etc.) and field notebook.

e. Filtration apparatus (e.g., disposable plastic filtering apparatus, disposable in-line filters, Gelman apparatus, Buchner funnel, etc.), filters, prefilters.

f. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).

g. Teflon™ tape.

h. Vacuum pump (e.g., hand-operated or electric).

i. Appropriate tubing and fittings.

j. Disposable gloves.

k. Sample jars with appropriate preservative (e.g., nitric acid) and labels.

3.0 DECONTAMINATION

3.1 Decontamination is not necessary if sterile, disposable plastic filtering equipment is utilized. If applicable, it may be useful to collect a distilled water field blank through a representative disposable filter to demonstrate proper "decontamination." If reusable filtering equipment is being used, the following is the minimum decontamination procedure:

a. Wear disposable gloves while cleaning filtering equipment to avoid contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and distilled or deionized water in a bucket.

c. Remove vacuum tubing from flask.

d. Remove filter membrane from funnel.

e. Disassemble filtering apparatus (flask and funnel) and scrub each piece of equipment with a brush and solution.

f. Rinse with potable water.

g. Rinse with copious amounts of distilled or deionized water.

h. Allow to dry and wrap equipment with a suitable material (e.g., clean plastic bag) in preparation for the next use.

3.2 The decontamination procedure must consider regulatory agency(ies) specifications which must be provided in the site SAP, and may include decontamination variations such as nitric acid rinses, acetone rinses, etc.

4.0 PROCEDURE

4.1. Ensure that the filtering equipment is disposable and dedicated or is properly decontaminated before each use.

4.2. Assemble the filtering apparatus (funnel and flask), and connect the vacuum pump in case it is needed to augment gravity filtration.

4.3. Place a clean (new) 0.45-micron pore-size filter in the funnel. Use larger, pore-size filters if prefiltering is required (i.e., if significant suspended sediment is present that would quickly clog the 0.45-micron filter and prevent continuous filtration or result in excessive time for filtration).

4.4. Obtain the water sample using an appropriate, decontaminated sample-collection device (e.g., bailer, pump).

4.5. Pass the unpreserved water sample through the 0.45 micron filter into the flask. If the sample contains significant sediment, then pass it through a prefilter before using the 0.45 micron filter. Apply a vacuum using the vacuum pump if needed to facilitate filtering.

4.6. Transfer the filtered water sample to the appropriate, prelabeled sample container containing the preservative (e.g., nitric acid) being careful not to overfill the container and dilute the preservative.

4.7. Follow standard operating procedures for sample documentation, shipping, and tracking (i.e., record keeping).

4.8. Decontaminate all reusable filtering (and sampling) equipment that came in contact with the water sample. Properly disposal of all non-reusable equipment in a manner appropriate with site conditions.

STANDARD OPERATING PROCEDURE 5.1
FOR COLLECTION OF SOIL SAMPLES FOR LABORATORY ANALYSIS

Date: May 5, 2000

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the collection of soil samples for laboratory analysis. This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, grab samples from stockpiled soils, surface samples, test pit samples, etc.

2.0 CONSIDERATIONS

Soil samples may be collected in either a random or biased manner. Random samples can be based on a grid system or statistical methodology. Biased samples can be collected in areas of visible impact or suspected source areas. Soil samples can be collected at the surface, shallow subsurface, or at depth. When samples are collected at depth the water content should be noted, since generally "soil sampling" is restricted to the unsaturated zone. Equipment selection will be determined by the depth of the sample to be collected. A thorough description of the sampling locations and proposed methods of sample collection should be included in the work plan.

Commonly, surface sampling refers to the collection of samples at a 0 to 6 inch depth interval. Certain regulatory agencies may define the depth interval of a surface sample differently, and this must be defined in the work plan. Collection of surface soil samples is most efficiently accomplished with the use of a stainless steel trowel or scoop. For samples at greater depths a decontaminated bucket auger or power auger may be needed to advance the hole to the point of sample collection. Another clean bucket auger should then be used to collect the sample. To collect samples at depths of greater than approximately six feet the use of a drill rig and split spoon samples will usually be necessary. In some situations, sample locations are accessed with the use of a backhoe.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines soil sampling requirements.

b. Field notebook, field form(s), maps, chain-of-custody forms, and custody seals.

c. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents, aluminum foil, plastic sheeting, etc.).

d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

e. Stainless steel spoons or spatulas.

f. Disposable sampling gloves.

g. Laboratory-supplied sample containers with labels.

h. Cooler with blue or wet ice.

i. Plastic sheeting.

j. Black pen and indelible marker.

k. Zip-lock bags and packing material.

l. Tape measure.

m. Paper towels or clean rags.

n. Masking and packing tape.

o. Overnight (express) mail forms.

4.0 DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to the decontamination SOP. Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and plastic sheeting will be changed after each use and discarded in an appropriate manner.

5.0 PROCEDURE

5.1 Prior to collecting soil samples, ensure that all sampling equipment has been thoroughly cleaned according to the decontamination SOP. If samples are to be collected at depth, then the boring must be advanced with thoroughly cleaned equipment to the desired sampling horizon and a different thoroughly cleaned sampler must be used to collect the sample.

5.2 Using disposable gloves and a pre-cleaned, stainless steel spatula or spoon, extract the soil sample from the sampler, measure the recovery, and separate the wash from the true sample. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

5.3 Place the sample in a laboratory-supplied, pre-cleaned sample container. This should be done as quickly as possible and this is especially important when sampling for volatile organic compounds (VOCs). Samples to be analyzed for VOCs must be collected prior to other constituents.

5.4 The sample container will be labeled with appropriate information such as, client name, site location, sample identification (location, depth, etc.), date and time of collection, and sampler's initials.

5.5 Using the remaining portion of soil from the sampler, log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, layering, grain size, etc.).

5.6 If soil samples are to be composited in the field, then equal portions from selected locations will be placed on a clean plastic sheet and homogenized. Alternately, several samples may be submitted to the laboratory for compositing by weight. The method used is dependent upon regulatory requirements. Specific compositing procedures shall be approved by the appropriate regulatory agency and described in the work plan. Samples to be analyzed for VOCs will not be composited unless required by a regulatory agency.

5.7 After the sample has been collected, labeled, and logged in detail, it is placed in a zip-lock bag and stored in a cooler at 4°C.

5.8 A chain-of-custody form is completed for all samples collected. One copy is retained and two are sent with the samples in a zip-lock bag to the laboratory. A custody seal is placed on the cooler prior to shipment.

5.9 Samples collected from Monday to Friday are to be delivered to the laboratory within 24 hours of collection. If Saturday delivery is unavailable, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if any analytes require a shorter delivery time.

5.10 The field notebook and appropriate forms should include, but not be limited to the following: client name, site location, sample location, sample depth, sample identification, date and time collected, sampler's name, method of sample collection, number and type of containers, geologic description of material, description of decontamination procedures, etc. A site map should be prepared with exact measurements to each sample location in case follow-up sampling is necessary.

5.11 All reusable sampling equipment must be thoroughly cleaned in accordance with the decontamination SOP. Following the final decontamination (after all samples are collected) the sampling equipment is wrapped in aluminum foil. Discard any gloves, foil, plastic, etc. in an appropriate manner that is consistent with site conditions.

STANDARD OPERATING PROCEDURE 5.4 FOR SCREENING SOIL SAMPLES FOR VOLATILE ORGANIC VAPORS USING A PORTABLE PHOTOIONIZATION DETECTOR

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for screening soil samples for volatile organic vapors using a portable photoionization detector (PID). This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, and grab samples from stockpiled soils.

2.0 CONSIDERATIONS

The primary objective of photoionization screening of soil samples is to obtain a qualitative understanding of the distribution of volatile organic compounds (VOCs) in soil. The proper design of an organic vapor screening program requires an understanding of site hydrogeology, potential source areas, and potential constituents of concern. Sample locations and frequency must be fully defined in the work plan. The work plan should outline the type of lamp to be utilized in the PID based on the ionization potentials and response factors of the constituents of concern. The work plan must also clearly describe the heating or equilibration procedures to be employed if they differ from those described in this SOP. Regardless of the specific equilibration procedure employed, it is imperative that each sample be treated identically to allow the photoionization results from different locations to be compared. Observations such as water, clay, and organic content should be noted to facilitate interpretation of the data. Every effort should be made to collect a representative portion of soil from the sampling device.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines photoionization screening requirements.

b. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents [e.g., acetone, nitric acid, hexane, etc.], aluminum foil, plastic sheeting, etc.).

c. Field notebook, field form(s), maps, chain-of-custody forms.

d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

e. Stainless steel spoons or spatulas.

f. Disposable plastic spoons.

g. Plastic sheeting.

h. Aluminum foil.

i. Mason jars or driller's jars.

j. Water bath (hot plate, extension cord, water tray, thermometer).

k. Photoionization detector with charging unit.

l. Calibration gases with regulator.

m. Indelible marker.

n. Masking tape.

o. Disposable sampling gloves.

4.0 DECONTAMINATION

Where possible, thoroughly pre-cleaned and wrapped sampling equipment must be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and sample jars will be changed after each use and discarded in an appropriate manner. If only photoionization results are to be obtained, then split-spoon samples and hand augers may be cleaned with a soap and water wash and potable water rinse or steam cleaning, and a final distilled water rinse. However, if samples are to be collected concurrently for laboratory analytical results, then all reusable sampling equipment must be thoroughly decontaminated according to the SOP for decontamination of field equipment.

5.0 CALIBRATION

The PID must be calibrated according to the manufacturer's specifications at a minimum frequency of once per day prior to collecting photoionization readings. In addition, periodic checks (e.g., every 2 hours or every ten samples) with the standard gas will be conducted to confirm that the calibration has not drifted. The time, date, and calibration procedure must be clearly documented in the field notebook and the calibration log. If at any time the photoionization results appear erratic or inconsistent with field observations, then the unit must be recalibrated. If calibration is difficult to achieve, then the unit's lamp should be checked for dirt or moisture and cleaned, as necessary. During humid or wet conditions, the unit should be calibrated on a more frequent basis as determined by field personnel.

6.0 PROCEDURE

6.1 Extract the soil sample from the sampler, quickly measure the recovery, and separate the wash from the true sample by using a dedicated, stainless steel spatula. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

6.2 Place the sample in a pre-cleaned glass jar (as quickly as possible to avoid loss of VOCs) filling the jar half full. Place an aluminum foil seal between the glass and metal cap and screw tight.

6.3 Label jars with the boring number, depth of sample, date of collection and blow counts. In addition, the field personnel will ensure the following: samples are taken at appropriate depths; unrepresentative portions of the sample are discarded properly; that the sampler is decontaminated properly between use; and the driller uses proper methods during sample collection and does not use oil or grease on tools entering the borehole.

6.4 Log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, and layering).

6.5 After the sample has been collected, heat the sample under controlled conditions in a water bath for a 2 minute period.

6.6 Ensure that the PID has been calibrated and that the calibration information is documented in the field book. Pierce the aluminum foil seal with the probe from the PID and measure the relative concentration of VOCs in the headspace of the soil sample. The initial (peak) reading must be recorded.

6.7 Record the PID reading in the field notebook, on an appropriate field form, and on the base map, if appropriate.

6.8 Place any material not representative of the interval sampled in a pile with the other cuttings from the borehole.

6.9 If only photoionization results are to be obtained, then reusable sampling devices may be cleaned with a soap and water wash and a potable water rinse. The sampler will then be rinsed with distilled water, assembled and placed on plastic sheeting for reuse. A more rigorous decontamination procedure is required when samples are also being collected for laboratory analysis. Refer to the SOP for collection of soil samples for laboratory analysis for additional information.

STANDARD OPERATING PROCEDURE 6.1
FOR MEASURING pH OF WATER SAMPLES

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring the pH of water in the field. The pH is measured in the field using a pH meter which should have the ability to compensate for temperature (automatically or manually). The pH will be measured in standard units (SU) and can be recorded with or without the SU designation. The conventional means of recording a pH value is without a unit designation (e.g., 7.0); however, the SU designation may be used provided the term is defined as standard units when first referenced. The manufacturer's instrument manual for each particular pH meter, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

The pH is measured in the field to provide the pH of the water under ambient (in situ) conditions. The pH is a measure of acidic (<7.0) or basic (>7.0) nature of the water and is used to assist in evaluating the mobility of contaminants. In addition, pH measurements can be used during well purging to help determine when sufficient ground water has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer). The determination is made when pH readings have achieved stabilization or near-stabilization.

2.0 CALIBRATION

2.1 Calibration of the pH meter is to be performed at the beginning and end of each day's use in accordance with the manufacturer's specific instructions. Usual procedures are given below.

2.2 Recalibration must occur if: 1) the pH of the samples being measured is outside the previous calibration range; 2) the procedure or use conditions warrant frequent calibrations; 3) four or more hours have elapsed; or 4) the instrument has been moved from one area to another (e.g., offsite or out of the study area).

2.3 Two buffer calibrations bracketing the expected pH range of samples are to be performed prior to its use in a study. Three pH buffers (4.0, 7.0, and 10.0) are read after standardization at pH of 7.0 to evaluate the linearity and electrodes.

2.4 The measurements of sample and buffers are made while stirring. The samples and buffers are measured at the same temperature; therefore, the pH meter must be temperature compensated. If not, then record the temperature.

2.5 The following information is documented in the calibration logbook at the time of calibration:

- a. Date.
- b. pH meter identification.
- c. Calibration results using pH standards.
- d. Initials of the individual performing calibration.

3.0 PROCEDURE

3.1 A warm-up period may or may not be necessary for the instrument, depending on instrument requirements. The manufacturer's instrument manual must be followed.

3.2 The pH electrodes must be kept in good working order as follows:

- a. Proper levels of electrolyte solution are maintained. The electrolyte solution level should be at least 1 inch above the solution being measured.

b. The electrodes must be carefully rinsed with distilled or deionized water before each measurement.

3.3 The water sample (approximately 500 milliliters [ml]) is placed in a clean container and the temperature and pH are measured immediately.

3.4 The temperature of the sample is measured and the pH meter is compensated for the water temperature. If compensation is not possible, then record the temperature.

3.5 The electrodes are immersed in a water sample and stirred continuously until the pH reading equilibrates. The pH will be measured and recorded in increments of 0.1 or 0.1 SU.

3.6 Pertinent data are documented in the field notebook or appropriate field form, and initialed and dated.

3.7 The electrodes are rinsed with distilled or deionized water and the unit stored properly in accordance with the manufacturer's instructions (e.g., capping and storing in a buffer such as altex electrode storage solution). The electrodes are not to be stored in potable water, or distilled or deionized water.

STANDARD OPERATING PROCEDURE 6.2
FOR MEASURING THE CONDUCTIVITY OF WATER SAMPLES

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring the electrical conductance (conductivity) of water in the field. The conductivity is measured in the field using a conductivity meter which compensates for temperature (automatically or manually). Some conductivity meters measure directly in micromhos/ centimeter (µmhos/cm) while others have to be converted to this unit. Conductivity will be recorded in µmhos/cm. The manufacturer's instrument manual of each particular conductivity meter, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

The specific conductivity is measured in the field as a measure of the total dissolved solids (TDS) in the ground water or surface water. TDS data can then be used as a qualitative measure of contamination and to assist in evaluating electrical resistivity and borehole geophysical data. In addition, specific conductivity measurements can be used during well purging to help determine when sufficient ground water has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer). The determination is made when conductivity readings have achieved stabilization or near-stabilization.

2.0 CALIBRATION

2.1 Calibration is in accordance with the manufacturer's specific directions.

2.2 Calibration of the conductivity meter is to be performed at the beginning and end of each day's use.

2.3 Recalibration must occur if: 1) the specific conductivity of samples being measured is outside the calibration standard solution range; or 2) the instrument has been moved from one area to another (e.g., offsite or out of the study area).

2.4 Choose a conductivity calibration solution that is near the conductivity of the water samples to be measured.

2.5 Select the appropriate conductivity calibration solution and adjust the span on the instrument to the conductivity calibration solution value.

2.6 Rinse the probe in distilled or deionized water and store the probe according to the manufacturer's specifications (e.g., distilled or deionized water, or a buffer solution).

2.7 The following information is documented in the calibration logbook:

a. Date.

b. Conductivity meter identification.

c. Initials of individual performing calibration.

d. Calibration results.

3.0 PROCEDURE

3.1 The conductivity electrodes must be kept in good working order as specified by the manufacturer.

3.2 The water sample is placed in a clean, appropriate container(s) and the temperature and conductivity are measured immediately.

3.3 The temperature of the sample is taken and the conductivity meter is compensated for the water temperature.

3.4 The probe is immersed in a water sample until the meter equilibrates.

3.5 In reading the conductivity meter scale, one or more of the following may have to be considered:

a. The reading may have to be multiplied appropriately (e.g., the reading is expressed in micromhos/centimeter).

b. If the conductivity meter is not capable of compensating for temperature differences, then note that the conductance measurements are not temperature compensated and document the temperatures.

c. If the conductivity meter can be compensated for temperature, then adjust the temperature control before reading the conductance measurement. (Some meters automatically compensate for temperature, and this should be documented.)

3.6 Conductivity measurements are recorded in the field notebook and on the appropriate field form, and initialed and dated. Units of µmhos/cm are used to represent conductivity.

3.7 The probe will be cleaned with distilled or deionized water after each use and will be stored according to the manufacturer's specifications (e.g., conductivity cells may have to be stored in distilled or deionized water, or a buffer solution).

STANDARD OPERATING PROCEDURE 6.3
FOR MEASURING WATER TEMPERATURE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring water temperature in the field. Temperature measuring devices may include thermometers, and pH and/or conductivity meters equipped with a temperature probe. The temperature measuring device must be rapidly equilibrating, precision-grade, and meet or exceed National Bureau of Standards (NBS) specifications for accuracy. Temperature will be measured and recorded in degrees Celsius/Centigrade (° C). If the temperature measuring device is a meter, then the manufacturer's instrument manual, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

Temperature data is collected in the field to determine the temperature of the water sample under ambient (in situ) conditions. Temperature data can be used to evaluate the mobility of compounds in ground water and flow conditions. In addition, temperature measurements can be used during well purging to help determine when sufficient ground water has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer). The determination is made when temperature readings have achieved stabilization or near-stabilization.

2.0 CALIBRATION

2.1 Calibration of thermometers and temperature measuring meters will be performed before entering the field and checked upon return to the office.

2.2 Temperature measuring devices will be calibrated against a NBS-traceable thermometer.

2.3 If a thermometer is used to measure temperature, then the thermometer must read within 1° C to 1.5° C of the NBS-traceable thermometer. If the thermometer does not read within this range and the thermometer cannot be calibrated, then it will not be used for temperature measurements and will be disposed of in an appropriate manner. If the thermometer does not read within this range and the thermometer can be calibrated, then the thermometer will be calibrated to the NBS-traceable thermometer.

2.4 If a temperature measuring meter is used to measure temperature, then the meter must read within 1° C to 1.5° C of the NBS-traceable thermometer. If the meter does not read within this range and the meter cannot be calibrated, then it will not be used for temperature measurements and will be sent to the manufacturer for service and repair. If the meter does not read within this range and the meter can be calibrated, then the meter will be calibrated to the NBS-traceable thermometer.

2.5 The following information is documented in the calibration logbook at the time of calibration:

a. Date.

b. Thermometer and/or Meter identification.

c. Calibration results relative to NBS-traceable thermometer.

d. Initials of individual performing calibration.

3.0 PROCEDURE

3.1 The water sample (approximately 500 milliliters [ml]) is placed in a clean container and the temperature is measured immediately.

3.2 If a thermometer is used, then the thermometer is first rinsed with distilled or deionized water and is then immersed in water until the temperature equilibrates. The temperature is read in °C. The thermometer is rinsed again after measuring the temperature.

3.3 If a temperature measuring meter is used, then the probe is first carefully rinsed with distilled or deionized water. The probe is then immersed in water according to the manufacturer's specifications (e.g., specified submergence, stirred) until the temperature equilibrates. The temperature is read in °C. The probe is rinsed again after measuring the temperature.

3.4 Temperature data are recorded in the field notebook or appropriate field form, and initialed and dated.

STANDARD OPERATING PROCEDURE 9.1
FOR DECONTAMINATION OF FIELD EQUIPMENT

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for decontamination of all field equipment potentially exposed to contamination during drilling, and soil and water sampling. The objective of decontamination is to ensure that all drilling, and soil-sampling and water-sampling equipment is decontaminated (free of potential contaminants): 1) prior to being brought onsite to avoid the introduction of potential contaminants to the site; 2) between drilling and sampling events/activities onsite to eliminate the potential for cross-contamination between boreholes and/or wells; and 3) prior to the removal of equipment from the site to prevent the transportation of potentially contaminated equipment offsite.

In considering decontamination procedures, state and federal regulatory agency requirements must be considered because of potential variability between state and federal requirements and because of variability in the requirements of individual states. Decontamination procedures must be in compliance with state and/or federal protocols in order that regulatory agency(ies) scrutiny of the procedures and data collected do not result in non acceptance (invalidation) of the work undertaken and data collected.

2.0 PROCEDURE FOR DRILLING EQUIPMENT

The following is a minimum decontamination procedure for drilling equipment. Drilling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

2.1 The rig and all associated equipment should be properly decontaminated by the contractor before arriving at the test site.

2.2 The augers, drilling casings, rods, samplers, tools, rig, and any piece of equipment that can come in contact (directly or indirectly) with the soil, will be steam cleaned onsite prior to set up for drilling to ensure proper decontamination.

2.3 The same steam cleaning procedures will be followed between boreholes (at a fixed on-site location[s], if appropriate) and before leaving the site at the end of the study.

2.4 All on-site steam cleaning (decontamination) activities will be monitored and documented by a member(s) of the staff of Roux Associates, Inc.

2.5 If drilling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat drilling equipment, then special decontamination procedures may have to be utilized before steam cleaning (e.g., hexane scrub and wash).

2.6 Containment of decontamination fluids may be necessary (e.g., rinseate from steam cleaning) or will be required (e.g., hexane), and disposal must be in accordance with state and/or federal procedures.

3.0 PROCEDURE FOR SOIL-SAMPLING EQUIPMENT

The following is a minimum decontamination procedure for soil-sampling equipment (e.g., split spoons, stainless-steel spatulas). Soil-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

3.1 Wear disposable gloves while cleaning equipment to avoid cross-contamination and change gloves as needed.

3.2 Steam clean the sampler or rinse with potable water. If soil-sampling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat sampling equipment, then special decontamination procedures may have to be utilized before steam cleaning and washing in detergent solution (e.g., hexane scrub and wash).

3.3 Prepare a non-phosphate, laboratory-grade detergent solution and distilled or potable water in a clean bucket.

3.4 Disassemble the sampler, as necessary and immerse all parts and other sampling equipment in the solution.

3.5 Scrub all equipment in the bucket with a brush to remove any adhering particles.

3.6 Rinse all equipment with copious amounts of potable water followed by distilled or deionized water.

3.7 Place clean equipment on a clean plastic sheet (e.g., polyethylene)

3.8 Reassemble the cleaned sampler, as necessary.

3.9 Transfer the sampler to the driller (or helper) making sure that this individual is also wearing clean gloves, or wrap the equipment with a suitable material (e.g., plastic bag, aluminum foil.

As part of the decontamination procedure for soil-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

4.0 PROCEDURE FOR WATER-SAMPLING EQUIPMENT

The following is a decontamination procedure for water-sampling equipment (e.g., bailers, pumps). Water-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

4.1 Decontamination procedures for bailers follow:

a. Wear disposable gloves while cleaning bailer to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a bucket.

c. Disassemble bailer (if applicable) and discard cord in an appropriate manner, and scrub each part of the bailer with a brush and solution.

d. Rinse with potable water and reassemble bailer.

e. Rinse with copious amounts of distilled or deionized water.

f. Air dry.

g. Wrap equipment with a suitable material (e.g., clean plastic bag, aluminum foil).

h. Rinse bailer at least three times with distilled or deionized water before use.

4.2 Decontamination procedures for pumps follow:

a. Wear disposable gloves while cleaning pump to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a clean bucket, clean garbage can, or clean 55-gallon drum.

c. Flush the pump and discharge hose (if not disposable) with the detergent solution, and discard disposable tubing and/or cord in an appropriate manner.

d. Flush the pump and discharge hose (if not disposable) with potable water.

e. Place the pump on clear plastic sheeting.

f. Wipe any pump-related equipment (e.g., electrical lines, cables, discharge hose) that entered the well with a clean cloth and detergent solution, and rinse or wipe with a clean cloth and potable water.

g. Air dry.

h. Wrap equipment with a suitable material (e.g., clean plastic bag).

As part of the decontamination procedure for water-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

STANDARD OPERATING PROCEDURE 10.3
FOR SOIL BORING AND/OR MONITORING OR OBSERVATION WELL DRILLING, FORMATION SAMPLING AND BOREHOLE ABANDONMENT IN UNCONSOLIDATED FORMATIONS

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the considerations and procedures, and to establish the guidelines for drilling (soil borings, wells, or piezometers) and formation sampling activities in unconsolidated formations. There are several drilling techniques available which include hollow-stem auger, cable tool, hydraulic rotary, cased-hole rotary, and air rotary. Formation (sediment/soil) sample collection include disturbed (drill cuttings), intact (split-spoon), and undisturbed (Shelby-tube or Denison-core). Borehole abandonment (closure) procedures will also be addressed in this SOP.

The objective of drilling is to collect accurate subsurface information and to prepare a borehole for potential completion as a well or piezometer. Consequently, the lithologic data is the all important, most essential information that can be collected. The lithologic data characterizes subsurface conditions, describes hydrogeologic coefficients qualitatively and/or quantitatively, and identifies optimum locations for screen zones if wells are constructed.

Data can be obtained through the physical examination and testing of formation samples, as well as knowledge regarding ground-water levels. Thus, drill fluid mix, fluid loss, rate of drilling, lengths of split-spoon and Shelby-tube/Denison-core recovery, etc. must be monitored by the on-site hydrogeologist or geologist.

2.0 DRILLING TECHNIQUE-SELECTION

Verify that the drilling technique is the one specified in the investigation work plan, and that the drilling equipment mobilized by the driller is in good condition and proper working order. Do not permit the driller to use a drilling rig that appears to be substandard, in disrepair, etc., and/or is questionable as to whether or not the rig has the capabilities to accomplish the goals of the drilling program. The drilling rig must be capable of:

a. Penetration of all anticipated subsurface materials and formations at a desired rate, and construction of a borehole of desired diameter (for the anticipated well, if applicable, including the placement of a gravel or sand pack through a tremie pipe and necessary formation sealing material such as bentonite or cement).

b. Identification of lithology for development of a geologic log of all unconsolidated formations and materials penetrated, including physical characteristics and visual description of color, grain sizes, sorting and mineralogy.

c. Collection of samples of aquifer fluids during the drilling process and prior to well construction, while at the same time minimizing potential for cross-contamination. The method used should prevent cross-contamination between surface soils and ground water or between different hydrogeologic units.

d. Collection of intact and/or undisturbed soil samples from the center line or sidewall of the borehole. This objective requires the drilling to be halted while soil samples are taken from the bottom or side of the incomplete borehole.

e. Completion of the borehole into a well (monitoring or observation) or piezometer during the initial construction process (i.e., constructing a well or piezometer as the borehole is drilled, or constructing a well or piezometer in the borehole immediately after the drilling tools are removed).

f. Implementation of borehole geophysical logging (when applicable and possible) to enable more accurate vertical and horizontal extrapolation of borehole data to the lithology of the hydrogeologic system.

g. Completion of a well or piezometer, if applicable, in the borehole following a time lapse for interpretation of geologic or geophysical data from the borehole.

3.0 DRILLING TECHNIQUE - DESCRIPTION

3.1 Hollow-Stem Auger - This drilling method is rapid and extremely effective in most cohesive sediments but less so in loose sandy material. Penetration may be up to 150 feet below land surface (bls) depending on the size of the rig, drilling conditions, and the diameter of the auger flight; however, depths up to 250 feet bls have been achieved under compatible conditions. A major advantage of this technique is that normally no fluids are introduced into the formation. If the auger flights can be removed and the integrity of the borehole maintained, then electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run. If the auger flights must remain in the borehole, then only radiation geophysical logs can be run. Casing, screen, and sampling devices can then be lowered through the hollow stem by removing the removable plug at the bottom of the auger flights, and gravel packing and cementing can be accomplished within the hollow stem. However, this can be difficult especially below the water table. Auger flight outside diameters (OD) range from 5 inches (in.) to 12 in. The diameter of a well that can be constructed inside the hollow stem is limited, however, to about 4 in.

3.2 Cable Tool (Percussion) - This drilling method is slow because the borehole is advanced by lifting and dropping a heavy string of drilling tools. Cuttings accumulate in the drill casing and are removed by a sand bailer. A steel casing is driven in as the hole is deepened. Cable-tool rigs can be used in unconsolidated sediment and bedrock to depths of hundreds or thousands of feet and often employ telescoping techniques for drilling deep boreholes. Electrical geophysical logs cannot be run through the steel cased borehole, but radiation logs (e.g., gamma, neutron, etc.) can be run. Well casing and screen can be installed within the cased hole after which the outer casing is pulled back (removed). Because the boring is cased as it is being drilled, cross-contamination between various depths is practically eliminated. The method provides an excellent means to collect good, representative formation samples.

3.3 Hydraulic Rotary - This drilling method uses a rotating bit to drill (advance) the borehole. Drill cuttings are removed using a recirculating drilling fluid (mud or water). Although setting up the drilling equipment is slow, the drilling process is reasonably fast. In the mud-rotary method, drilling mud forms a cake on the borehole wall which prevents excessive loss of fluid to the formation being drilled. The hydrostatic pressure combined with the weight and density of the mud slurry keeps the hole open. This allows the drill rods to be removed from the borehole and geophysical logs (electric and radiation) to be run in the open borehole.

In reverse hydraulic rotary drilling, the drilling fluid moves downward through annular space and then upward inside the drill pipe. If the drilling fluid does not contain mud, then sufficient water flow is required as make-up water because the borehole wall is not sealed; therefore, significant water loss can occur to the formation being drilled. The borehole is held open by hydrostatic pressure only. A serious obstacle to this drilling method occurs when the static water level is less than 15 feet below land surface because of insufficient hydrostatic head difference between the borehole and the water table. However, the problems of excessive water loss and shallow depths to water may be overcome by using mud as the drilling fluid.

In mud-rotary drilling, the drilling fluid (mud) moves downward through the drill pipe and then upward through the annular space. Therefore, the borehole is held open by hydrostatic pressure and the mud cake lining the wall of the borehole. The mud-rotary method can be used to construct moderate to deep wells in unconsolidated (and consolidated material), while the reverse rotary technique can be used to construct moderate to deep wells in unconsolidated materials. The principal disadvantage may be the difficulty in removing mud cake from the formation at the screened zone. Extensive well development may be required to remove the mud cake.

3.4 Cased-Hole Rotary - Several new rotary drilling techniques have been developed in which a steel casing is advanced with an air-rotary or mud-rotary drill. This technique is highly desirable for use in exploratory drilling at monitoring sites because water and soil samples may be collected under conditions which preclude contamination from shallower depths. Furthermore, this technique is extremely effective in boulder or cavernous zones which would inhibit or preclude drilling using other techniques. Drilling results are comparable to cable-tool drilling but with greatly enhanced speeds. In all the cased-hole techniques, the main benefit is that the only portion of the borehole which is open, is at the bottom of the drill casing; thus, no soil or water from shallower depths can move down and impact the depth drilled and/or sampled. Electrical geophysical logs cannot be run through the steel-cased borehole, however, radiation logs (e.g., gamma, neutron, etc.) can be run.

Presently, there are three cased-hole rotary techniques which include:

a. The drill-thru casing hammer technique in which the casing is advanced by percussion with a casing hammer or vibratory driver similar to the method used in a borehole drilled by the air-rotary method. The casing hammer can also pull out the casing (air drilling only).

b. The Odex™ Drilling System (European system) which "pulls" the casing using a fixture attached to an air-hammer type drill bit (air drilling only).

c. The Barber™ Drilling System in which drilling is done with a top-head drive and a rotary table that spins casing into the ground. Casing can be fitted with a carbide "shoe" to cut boulders and an air hammer can be used above the bit. Air or mud rotary can be used to lift cuttings.

Two potential problems may be encountered using the cased-hole rotary technique which include: 1) "sand heave" when drilling stops (which can be quickly drilled or bailed out) and 2) possible aeration of water in the cased borehole if volatiles are being tested (which can be overcome by pumping or bailing the standing water out before sampling). The minimum drill casing diameter is 6 inches and depth is limited to approximately 450 feet.

3.5 Air Rotary - This drilling method uses a rotating bit to drill, and high-velocity compressed air to remove cuttings from the borehole. A pneumatic down-hole hammer is often used to add percussion to the rotary drilling action. This drilling method is very fast and, although it is most suitable for penetrating hard bedrock, it can be used in unconsolidated formations. The borehole may be cased or uncased depending on geologic conditions. If an open borehole is drilled, then electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run. If a cased borehole is drilled, then only radiation geophysical logs can be run.

Four potential problems may be encountered when using the air-rotary technique:

a. When a prolific aquifer is tapped, the compressed air may not be able to lift the water to the surface.

b. Aeration of water in the borehole (and finished well) immediately prior to sampling can interfere with a number of inorganic and organic water-quality parameters.

c. Low yield water entry zones may not be identified because the air pressure prevents water from entering the borehole. Care should be taken to prevent overdrilling of the borehole.

d. Air rotary drilling can induce the migration of volatile organics to the surface or adjacent structures causing potential aesthetic or health and safety concerns.

If the air-rotary technique is used then the following special procedures will be implemented:

a. The type of air compressor and lubricating oil will be documented on an appropriate field form and in the field notebook and a 1-pint sample of the oil will be retained for characterization in the event organic compounds are detected in a well sample.

b. An air line oil filter will be required and changed per manufacturer's recommendations during operation with documentation of this maintenance on an appropriate field form and in the field notebook. More frequent oil filter changes will be made if oil is visibly detected in the filtered air.

c. The use of any additive will be prohibited, except approved water (e.g., potable water) for dust control and cuttings removal.

4.0 DECONTAMINATION

Drilling equipment decontamination procedures are outlined in the field equipment decontamination SOP. Proper decontamination in accordance with regulatory guidelines must be clearly documented in the field notebook.

5.0 PROCEDURE FOR DRILLING

5.1 Document all drilling-related activities (e.g., starting, stopping, footage, problems, decontamination, etc.) on the daily log form and in the field notebook. Record dates and times of activities, and names of Roux Associates personnel providing oversight.

5.2 Monitor and record drill fluid mix, speed of rotation, pressure on the drill fluid, rate of drilling, and length of drill rods or casing in the borehole.

5.3 Confirm that the drill rods and core barrel are straight, or discontinue drilling.

5.4 Pay particular attention to the advancement of the boring because differences in the rate of drilling may be indicative of differences in subsurface geologic conditions (e.g., sand and gravel versus clay).

5.5 Maintain a continuous dialogue with the driller to track and keep informed of all drilling activities (e.g., the speed of the drill and drilling pressure, difficult and easy drilling conditions, etc.).

5.6 Collect formation samples as described below in Section 6.0. Sample jars must be labeled appropriately (e.g., project number and name, site location, boring number, date, sample interval, blow counts, and initials of Roux Associates personnel collecting sample).

5.7 Record geologic information in the geologic log form and in the field notebook.

5.8 Handle and ship split-spoon sample jars carefully to avoid breakage and handle and ship tubes or cores carefully to prevent disturbance.

6.0 PROCEDURE FOR FORMATION SAMPLING

6.1 Intact formation sampling will be implemented using split-spoon samplers (which are driven), Shelby-tube samplers (which are pushed), or Denison-core samplers (which are rotated) depending on the drilling technique employed. Formation samples will be retained in suitable size (e.g., 1-pint or 0.5-pint) jars for physical descriptions and potential physical and chemical analysis. The appropriately labeled jars and tubes will be stored in a safe place to avoid breakage, agitation, and freezing. Intact formation samples will be collected as described in the work plan at specified intervals (e.g., at 5-foot increments below land surface) and at each major change in subsurface materials. Hydrogeologic information will be recorded on a geologic log form and in the field notebook. Detailed descriptions of the type(s) of intact sample(s) collected, sampling intervals and conditions, and objective(s) of the sample collection will be provided in the work plan.

6.2 Disturbed formation samples (drill cuttings) will be examined continuously throughout the entire depth of the borehole. If applicable to the study and/or stated in the work plan, borehole cuttings will be collected from the circulating auger flights which lift cuttings to land surface (hollow-stem auger technique), from the sand bailer (cable-tool technique), from the recirculating drilling fluid (mudflume) which transports cuttings to land surface (mud-rotary and related techniques), or from the compressed air used to carry cuttings to land surface (air-rotary and related techniques). Formation samples will be retained in appropriate size (e.g., 1-pint or 0.5-pint), properly labeled jars and stored in a safe place to avoid breakage, agitation, and freezing. Hydrogeologic data will be recorded on a geologic log form and in the field notebook.

6.3 The soil cores from the wells drilled at the site are used for lithologic identification. The first 18 inches of soil for each borehole will be collected intact using a split-spoon sample, Shelby-tube sampler, or Denison-core sampler. Split-spoon samples may be collected continuously from boreholes for cluster wells; single well and/or piezometer boreholes may be split-spooned throughout drilling or at specified intervals or changes in lithology. The conditions for sampling will be specified in the work plan.

6.4 Before collecting and retaining soil and/or sediments collected with the split-spoon sampler, the top several inches will be removed from the sampler and discarded to eliminate any sediment that may have caved into the bottom of the borehole.

6.5 Sediment sampling equipment such as split-spoon samplers, spatulas, etc. (but not including Shelby-tube or Denison-core samplers, which area not re-usable) will be decontaminated by steam cleaning and/or a non-phosphate, laboratory-grade and distilled/deionized wash followed by a distilled/deionized water rinse. (Refer to the SOP for Decontamination of Field Equipment for a detailed description of minimum and special decontamination procedures.) Decontamination of sediment sampling equipment will take place prior to the collection of the first sample and following the collection of each subsequent sample.

7.0 BOREHOLE ABANDONMENT OR CLOSURE

7.1 Upon the completion of the investigation, a determination will be made as whether to maintain the borehole (for a well or piezometer) or to close it (i.e., abandon and seal it). If the client and Roux Associates agree to abandon the borehole, then the state will be notified and a request will be presented for borehole abandonment. Upon state approval to seal the borehole, appropriate state borehole abandonment forms will be completed, if required. Following state approval, the abandonment of any borehole (or boring) will be in accordance with local, state and/or Federal regulations.

7.2 For each abandoned borehole, the procedure will be documented on an appropriate field form or in the study notebook. Documentation may include, where appropriate, the following:

a. Borehole designation.

b. Location with respect to the replacement borehole, if replaced (e.g., 30 ft north and 40 ft west of Borehole B-1). A location sketch should be prepared.

c. Open depth prior to grouting and any other relevant circumstances (e.g., formation collapse).

d. Drill casing left in the borehole by depth, size, and composition.

e. A copy of the geologic log.

f. A revised diagram of the abandoned borehole using a supplemental geologic log form.

g. Additional items left in hole by depth, description, and composition (e.g., lost tools, bailers, etc.).

h. A description and daily quantities of grout used to compensate for settlement.

i. The date of grouting.

j. The level of water or mud prior to grouting and the date and time measured.

k. Any other state or local well abandonment reporting requirements.

STANDARD OPERATING PROCEDURE 10.4 FOR CONSTRUCTION, DEVELOPMENT AND ABANDONMENT OF MONITORING OR OBSERVATION WELLS IN UNCONSOLIDATED FORMATIONS

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the considerations and procedures for constructing ground-water monitoring or observation wells in unconsolidated (e.g., gravel, sand, silt, and clay) formations. Well development and well abandonment (closure) procedures will also be addressed in this SOP. The United States Environmental Protection Agency (USEPA), the United States Geological Survey (USGS), and state regulatory agency procedures will be reviewed and considered in conjunction with the extensive experience of Roux Associates, Inc. (Roux Associates) to determine appropriate well construction and abandonment procedures. Discussions will be held with appropriate agencies to resolve conflicting procedures and finalize well construction or abandonment methods. The well construction plan and, if necessary, abandonment will be detailed in the work plan.

Monitoring wells will be completed in unconsolidated formations for the purposes of measuring ground-water levels and collecting ground-water samples. Ground-water level data will be used to calculate ground-water elevations which will be used, to construct water-level elevation and ground-water flow direction maps to illustrate head and flow relationships. Ground-water samples will be used to quantify water-quality conditions.

Observations wells will be completed in unconsolidated formations for the purpose of collecting water-level data from aquifer tests. Slug tests, step-drawdown tests, and constant-rate pumping tests (refer to the respective SOPs) may be conducted to qualitatively or quantitatively characterize flow system hydraulic parameters and/or intra-aquifer and inter-aquifer hydraulic connection.

2.0 PROCEDURE FOR WELL CONSTRUCTION

The installation of each unconsolidated well will begin immediately after borehole completion (and geophysical logging, if implemented). Once well installation has begun, no breaks in the process will be made until the well has been completed and secured against unauthorized access. In cases of unscheduled delays, such as personal injury, equipment breakdowns or sudden inclement weather, installation will be resumed as soon as practical.

2.1 The well will be constructed of appropriate type and diameter casing and screen (stainless steel and/or PVC) and will be at least 2 inches in diameter to accommodate most water-sampling and water-level measuring devices. However, if the well's purpose is multiple (pumping tests, remote sensing, water-level recorder station, etc.), a larger diameter monitoring well (4 inches, 6 inches, or greater) may be needed to accommodate pumps, floats, or sensors. The preferred minimum diameter for a well is 4 inches because larger diameter wells (greater than 2 inches) facilitate well purging and sampling procedures (e.g., they can accommodate pumps which 2-inch diameter wells may not).

2.2 Fittings (couplings) will not restrict the inside well diameter, as stainless steel casing will be welded and/or flush-joint threaded, and PVC joints will be internally threaded. Glues, solvents, or chemical cleaners will not be used in the construction of the wells. All casings, fittings, and screens will be new material. The well screens will be fabricated and have an inside diameter equal to the well casing. The lengths of casing and screen will be measured and recorded on an appropriate field form and in the field notebook by the field hydrogeologist prior to installation.

2.3 Wells in unconsolidated formations will be installed as described below unless depth to water or total depth require modifying the thickness of emplaced materials.

a. The screen and casing will be lowered into the borehole to the appropriate depth. Screen and casing materials may be either stainless steel or PVC. A bottom plug, well cap, and flush-joint sections will be used.

b. A gravel pack (quartz sand or pea gravel) will be filled in around the screen from a few feet below the bottom of the screen to several feet (approximately 5) above the screen to avoid applying the weight of the casing on the screen. The size of the uniformly graded gravel pack will be selected based on the grain size of the formation material in the screened interval. The placement of the gravel pack may require the use of a tremie pipe.

c. A 1-foot to 3-foot layer of clean, fine-grained silica sand may be placed above the selected gravel pack to isolate the coarse-grained gravel pack (below) from the fine-grained bentonite seal (above). Again, a tremie pipe may be used in the placement of the sand layer.

d. Several feet (approximately 1-3) of bentonite (powder or pellets) will be placed on top of the sand layer to seal the top of the gravel-packed screen zone.

e. The remainder of the annulus will be grouted to within a few feet of land surface. If PVC casing is used for the construction of deep wells, then extreme care must be taken in grouting the annular space in lifts (specified lengths) to avoid deformation of the PVC casing by the heat of curing and/or the weight of the grout. This is especially important if there are large voids which will serve as reservoirs for the grout.

f. A locking steel protective casing or curb box will be set over the well and cemented in place or welded to the steel casing to prevent water from ponding at the top of the well or directly entering the well, and safeguard the well from accidental damage or vandalism.

2.4 Each well will be properly identified with the appropriate information (e.g., local well number, state permit number [if applicable], etc.). The top of the well casing will serve as the measuring point (MP) for ground-water level measurements. The measuring point will be surveyed to the nearest 0.01 foot relative to a common datum (e.g., mean sea level) by trained Roux Associates personnel or a professional, state-licensed surveyor as defined in the work plan.

2.5 If required, well clusters will be constructed. A well cluster is defined as a group of two or more wells, located adjacent to or very near each other, which penetrate different depths of the aquifer or formation. Each well is screened at a different depth to obtain data defining the vertical distribution of water levels and quality in the aquifer or formation. In the event that a well cluster is drilled, then one large-diameter (e.g., 6-inch, 8-inch, 10-inch, etc.) borehole may be drilled and each well in the cluster will be individually cased within that one borehole; however, the preferred method is to drill individual boreholes for each well in the cluster.

2.6 Each well will have a location sketch, a well construction log, and a geologic log showing the casing placement and materials used to fill the annular space between the well casing and borehole. The appropriate log will show the depths of each casing material and discuss the geologic variability at the site. A description of the surface soils and unsaturated zone materials down to and including the water table is required.

The following information, if applicable, will be included on the well log:

a. Project number.

b. Date and initials of scientist documenting the well information.

c. Date and time of construction.

d. Well location.

e. Well and permit numbers.

f. Borehole diameter.

g. Well depth.

h. Casing material.

i. Screen material.

j. Screen slot size and length.

k. Gravel pack type and size (depths from _____ to _____).

l. Sand pack (depths from _____ to _____).

m. Bentonite pellets (depths from _____ to _____).

n. Bentonite grout (depths from _____ to _____).

o. Cement grout (depths from _____ to _____).

p. Ground-surface elevation.

q. Measuring point elevation.

r. Well height above or depth below land surface.

s. Depth where ground water was encountered.

3.0 DESCRIPTION OF WELL DEVELOPMENT

3.1 Before a newly constructed well can be used for water-quality sampling, measuring water levels, or aquifer testing, it must be developed. Well development refers to the procedure used to clear the well and formation around the screen of fine-grained materials (sands, silts, and clays) produced during drilling or naturally occurring in the formation. Well development continues until the well responds to water-level changes in the formation (i.e, a good hydraulic connection is established between the well and formation) and the well produces clear, sediment-free water to the extent practical.

3.2 Depending on the drilling technique used, composition of the formation screened, and well diameter and construction materials, well development may include one or more of the following techniques.

a. Bailing.

b. Pumping (centrifugal, submersible, or air).

c. Backwashing.

d. Surging (mechanical).

e. Jetting.

f. A combination of the above.

3.3 A 1-pint sample of the last water removed during development will be obtained and inspected by the field hydrogeologist for relative clarity to determine whether development is complete. A turbidimeter may be used to evaluate the clarity of the water removed from the well during development (and its use may also be stipulated by a regulatory agency). Well development procedures will be recorded on the well construction log form and in the field notebook.

3.4 Dispersing agents, acids, disinfectants, or other additives will not be used during development nor will they be introduced into the well at any other time unless specifically stipulated in the work plan. During development, water will be removed from the entire column of water standing in the well by periodically lowering and raising the pump intake. Well development will include the rinsing of the interior well casing above the water column in the well using only water from that well.

4.0 WELL ABANDONMENT OR CLOSURE

4.1 Upon the completion of the investigation, a determination will be made whether to maintain the well or to close it (i.e., abandon and seal it). If the client and Roux Associates agree to abandon the well, then the state will be notified and a request will be presented for well abandonment. Upon state approval to seal the well, appropriate state well abandonment forms will be completed. Following state approval, the abandonment of any well will be in accordance with local, state and/or Federal regulations.

4.2 For each abandoned well, the procedure will be documented on an appropriate field form and in the field notebook. Documentation may include, where appropriate, the following:

a. Well designation.

b. Location with respect to the replacement well, if replaced (e.g., 30 ft north and 40 ft west of Monitoring Well MW-1). A location sketch should be prepared.

c. Open depth prior to grouting and any other relevant circumstances (e.g., formation collapse).

d. Well casing left in the borehole by depth, size, and composition.

e. A copy of the geologic log.

f. A revised diagram of the abandoned well using the well construction log form.

g. Additional items left in hole by depth, description, and composition (e.g., lost tools, bailers, etc.).

h. A description and daily quantities of grout used to compensate for settlement.

i The date of grouting.

j. The level of water prior to grouting and the date and time measured.

k. The remaining casing, size, and composition above or below ground surface reported in depths or heights from ground surface.

l. Any other state or local well abandonment reporting requirements.

ATTACHMENT A-2

Field Forms

ROUX

CHAIN OF CUSTODY

№ 06777 **Y**

ROUX ASSOCIATES, INC.
Environmental Consulting
& Management

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ISLANDIA, NEW YORK 11749
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ANALYSES

PAGE OF

PROJECT NAME	PROJECT NUMBER
PROJECT LOCATION	
PROJECT MANAGER	SAMPLER(S)

SAMPLE DESIGNATION / LOCATION	DATE COLLECTED	TIME COLLECTED	SAMPLE MATRIX						TOTAL BOTTLES	NOTES

RELINQUISHED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N
RELINQUISHED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N
RELINQUISHED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N

DELIVERY METHOD	COMMENTS
ANALYTICAL LABORATORY	

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

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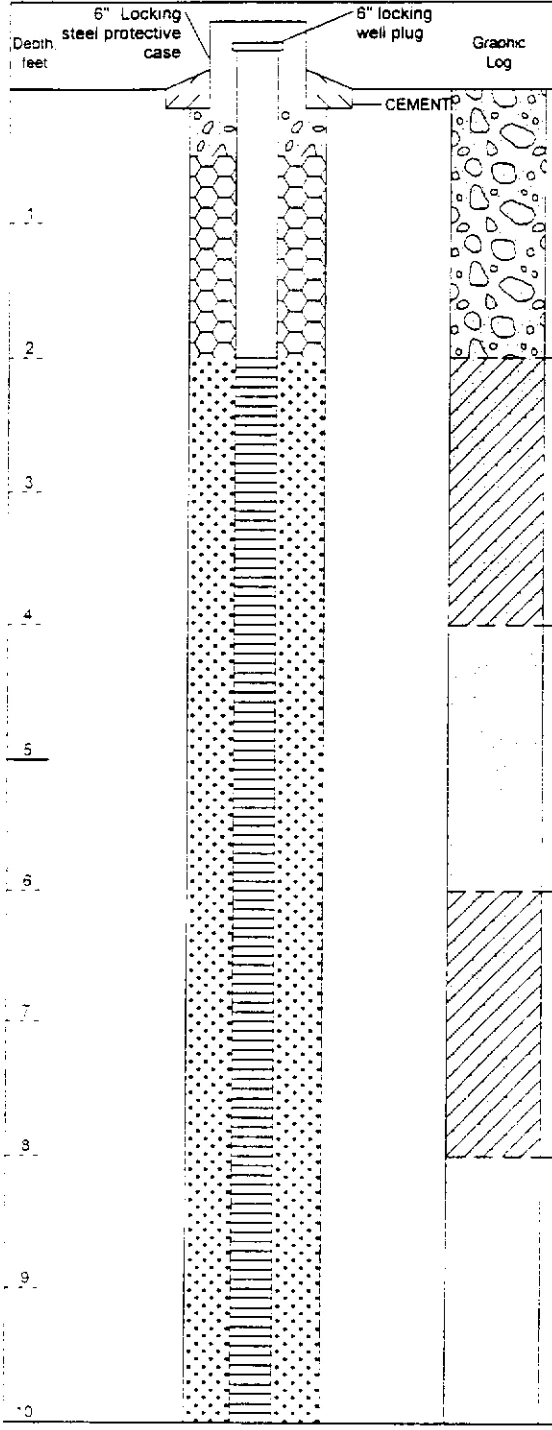
WELL CONSTRUCTION LOG

WELL NO. Test-1	NORTHING	EASTING	
PROJECT NO./NAME 5551212 / Any Project USA		LOCATION 555 Anystreet Anytown, Anycity	
APPROVED BY J. Doe	LOGGED BY J. Smith		
DRILLING CONTRACTOR/DRILLER Any Driller / R. Smith		GEOGRAPHIC AREA Northwest of area one, in former pool area	
DRILL BIT DIAMETER/TYPE 6.25-inches / Auger	BOREHOLE DIAMETER 2-inches	DRILLING EQUIPMENT/METHOD CME-550 / Geoprobe	SAMPLING METHOD / START-FINISH DATE 5/24/00-5/24/00
CASING MAT./DIA. PVC / 4-inch	SCREEN: TYPE Slotted	MAT. PVC	TOTAL LENGTH 5.0 DIA. 4-inch SLOT SIZE 10-Slot

ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GW SURFACE	GRAVEL PACK
			/		#0



Depth, feet	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
1 2	Brown fine to medium SANDY GRAVEL	2 4 6 8	14.7	
3 4	Brown to dark brown fine SANDY CLAY; Moist	6 9 3 2	13.2	
5 6	Brown fine SAND; Moist	2 5 6 4	15.9	
7 8	Brown fine SANDY CLAY; Moist	4 4 4 4	56.3	
9 10	Brown fine SAND; Wet	2 5 8 3	29.5	

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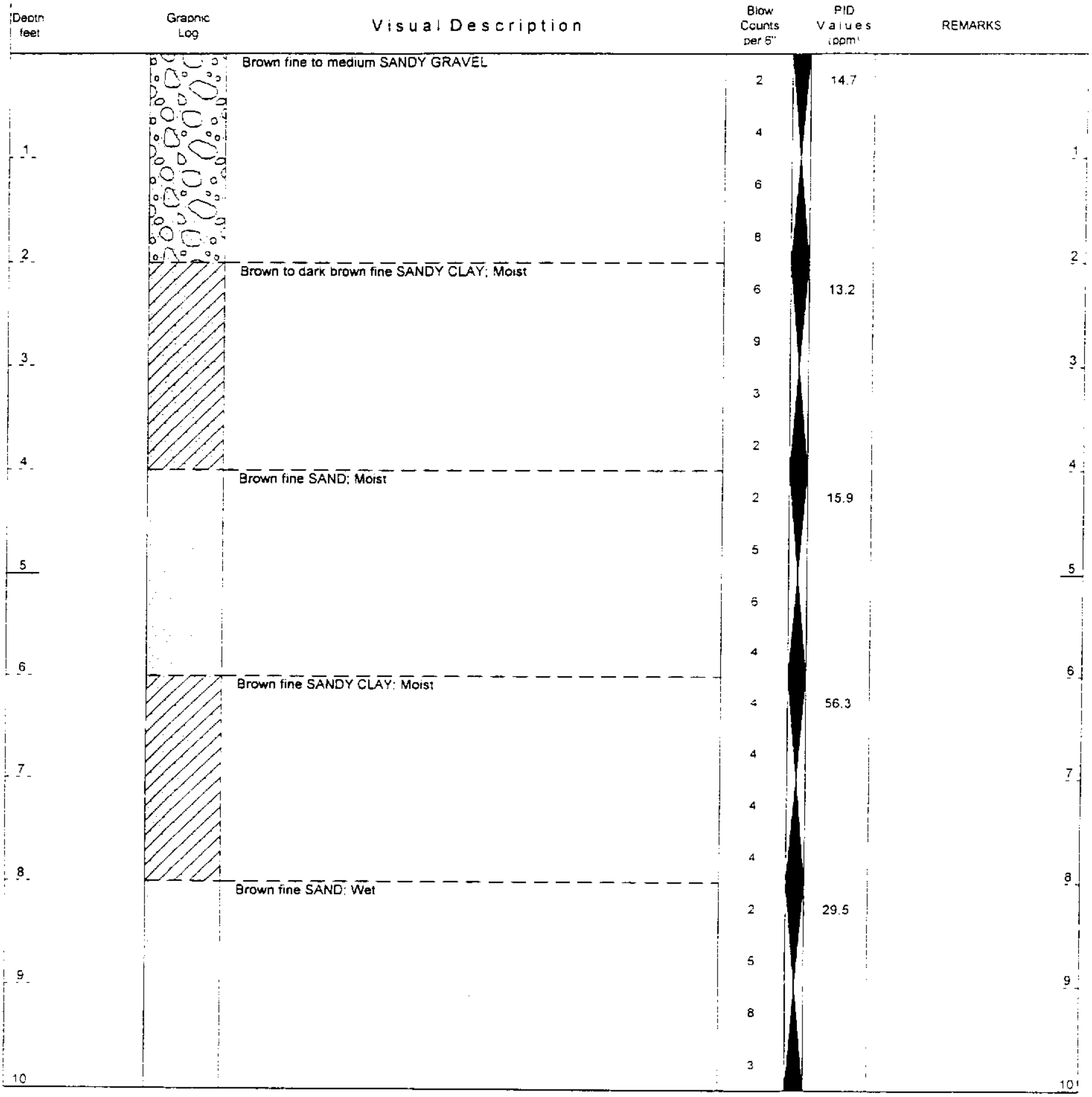
SOIL BORING LOG

WELL NO. Test-2	NORTHING	EASTING		
PROJECT NO./NAME 5551212 / Any Project USA		LOCATION 555 Anystreet Anytown, Anycity		
APPROVED BY J. Doe	LOGGED BY J. Smith			
DRILLING CONTRACTOR/DRILLER Any Driller / R. Smith		GEOGRAPHIC AREA Northwest of area one, in former pool area		
DRILL BIT DIAMETER/TYPE 2-inches / Auger	BOREHOLE DIAMETER 2-inches	DRILLING EQUIPMENT/METHOD CME-550 / Geoprobe	SAMPLING METHOD	START-FINISH DATE 5/24/00-5/24/00
LAND SURFACE ELEVATION (FT.)	DEPTH TO WATER (Feet BLS)	BACKFILL Cuttings		



Depth feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Brown fine to medium SANDY GRAVEL	2	14.7	
1			4		
			6		
2			8		
		Brown to dark brown fine SANDY CLAY; Moist	6	13.2	
3			9		
			3		
4			2		
		Brown fine SAND; Moist	2	15.9	
5			5		
			6		
6			4		
		Brown fine SANDY CLAY; Moist	4	56.3	
7			4		
			4		
8			4		
		Brown fine SAND; Wet	2	29.5	
9			5		
			8		
10			3		

CUSTODY SEAL

DATE ______________________

SIGNATURE ______________________

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APPENDIX B

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

Former Thypin Steel, Inc. Plant
Manorhaven, New York

Appendix B

September 26, 2000

Approvals:

Roux Associates, Inc.
Project Manager

Scott J. Glash

9/26/00
Date

Roux Associates, Inc.
Project Quality Assurance
Coordinator

Stephen Graham, Ph.D.

9/26/00
Date

ROUX

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CONTENTS (Continued)

TABLES

TABLES (Continued)

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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) outlines the measures that will be taken to ensure that the data generated are of quality sufficient to meet the data quality objectives of precision, accuracy and completeness.

This QAPP presents the organization, objectives, functional activities and specific quality assurance (QA) and quality control (QC) activities associated with the sampling and analyses plan (SAP) prepared as part of the investigation. This QAPP also describes the specific protocols that will be followed for sampling, sample handling and storage, chain of custody, and laboratory and field analysis activities.

All QA/QC procedures have been developed and implemented in accordance with applicable professional technical standards, United States Environmental Protection Agency (USEPA) requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP was prepared in accordance with USEPA QAPP guidance documents, with content and format based upon the "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations" (EPA QA/R-5), and the "Guidance for the Data Quality Objectives Process" (EPA QA/G-4).

The primary objective of the QAPP is to provide a project specific "blueprint" for obtaining the type and quality of environmental data needed to accurately reflect actual conditions at the former Thypin Steel, Inc. Plant in Manorhaven, New York (Site). Deviations from expected conditions will be noted, and appropriate corrective measures will be taken to maintain quality in the sample collection and analysis program.

1.1 Contents

As provided in the USEPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, the elements presented in this QAPP include Project Management (Sections 2 and 3), Measurement/Data Acquisition (Sections 4 through 10), Assessment/Oversight (Sections 11 through 13) and Data Validation/Usability (Sections 14 and 15).

1.2 Project Description

Soil and groundwater samples will be collected as part of the investigation. The scope of work for each data gathering effort is described in more detail in the SAP prepared for this project (Appendix A).

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The overall management structure and a general summary of the responsibilities of project team members is presented below.

2.1 Field Management

The overall management structure for field activities is presented in an organizational chart (Figure B-1). A general discussion of the responsibilities of management and the field technical staff is provided below.

Project Manager

The Project Manager bears the primary responsibility for the successful completion of the work assignment within the budget and schedule. Provides overall management for the execution of the RI and directs the activities of the Site Manager and technical staff. Performs technical review of all field activities, data review and interpretation and the preparation of all investigation reports. Works closely with the analytical laboratory, data validation contractors, drillers, and surveyors during the execution of the field program. Activities of the Project Manager are supported by senior management, the Project Quality Assurance Coordinator, and support staff.

Site Manager

The Site Manager bears the primary responsibility for the successful execution of the field program. Directs the activities of technical staff in the field and assists in the interpretation of all physical and chemical data, and report preparation. Responsible for the management of technical staff including hydrogeologists and technicians, and subcontractors such as drillers and surveyors. In addition, works closely with the Site Health and Safety Officer to ensure compliance with the Health and Safety Plan (HASP).

Field Technical Staff

Field technical staff consists of hydrogeologists and technicians who will perform activities such as water-level measurements, soil and groundwater sampling, and preparation of any field documentation which may be necessary.

Laboratory Manager

The Laboratory Manager is responsible for sample container preparation, sample custody in the laboratory, and completion of the required analyses through oversight of the laboratory staff. The Laboratory Manager will ensure that quality assurance procedures are followed and that an acceptable laboratory report is prepared and submitted. The Laboratory Manager reports to the Project Manager.

Project Quality Assurance Coordinator

The Project Quality Assurance Coordinator (PQAC) is responsible for conducting reviews, inspections, and audits to assure that the data collection is conducted in accordance with the SAP. These responsibilities range from effective field equipment decontamination procedures, to proper sample collection, to review of all laboratory analytical data (including tentatively identified compounds, if analyzed) to ensure completeness and usefulness. The PQAC reports to the Project Manager.

3.0 PROJECT/TASK DESCRIPTIONS

Overall objectives for data generated as part of this investigation are described in the SAP (Appendix A). The SAP objectives that require collection of field data include the following:

- complete the lateral and/or vertical soil quality delineation at the former plating area and at former UST Area TP-9;
- perform confirmation soil sampling and analysis in the former leaching field;
- characterize soil quality in uninvestigated areas inside of the former building footprint;
- determine whether there is an onsite source of chlorinated volatile organic compounds (CVOCs) in groundwater;
- determine the lateral and vertical extent of CVOCs in groundwater;
- determine the base neutral compound (BN) groundwater impacts, if any at former UST Area at TP-9;
- verify the absence of a non-aqueous phase liquid (DNAPL);
- verify the direction of groundwater flow at the Site;
- determine the likelihood for human exposure to chemicals of potential concern identified in the soil and groundwater based on a future residential-use scenario; and
- determine whether phytoremediation and natural attenuation are viable remedial technologies for the removal and/or degradation of CVOCs in groundwater at the Site.

The field investigation will include the following activities:

- soil boring and sampling;
- groundwater sampling;
- water-level measurement; and
- DNAPL monitoring.

Groundwater samples will be analyzed for Target Compound List (TCL) Chlorinated VOCs (CVOCs), New York State Department of Environmental Conservation Spill Technology and Remediation Series (NYSDEC STARS list) base neutral compounds (BNs), Target Analyte List (TAL) metals plus cyanide, total dissolved solids (TDS), chloride and natural attenuation parameters. Soil samples will be analyzed for TCL volatile organic compounds (VOCs), TCL

CVOCs, TCL SVOCs, NYSDEC STARS list BNs, Target Analyte List (TAL) metals plus cyanide, and total petroleum hydrocarbons (TPH). The projected sample media, analytical parameters and frequencies of field sample collection are provided in Tables B-1 and B-2.

Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements used to develop a scientific and resource effective sampling design. As stated in the Guidance for the Data Quality Objectives Process (EPA QA/G-4), DQOs are derived from the outputs of each step of the DQO process that:

- classify the study objective;
- define the most appropriate type of data to collect;
- determine the most appropriate conditions from which to collect the data; and
- specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the decision (USEPA, 1994).

The objective of the sampling at the Site is to further assess the soil and groundwater quality conditions. A nonprobabilistic (judgmental) sampling approach will be used to select the specific sampling locations for potential areas of concern. A judgmental sampling design consists of directed samples at specific sampling locations to confirm the existence of contamination at these chosen locations based on visual or historical information.

Total study error is the combination of sampling and measurement error. Total study error is directly related to decision error. These decision errors can be controlled through the use of hypothesis testing. For this sampling, the null hypothesis (baseline condition) is that the parameter of interest exceeds the action level. This decision has the smallest degree of decision error. In addition, measurement error is reduced by analyzing individual samples using more precise laboratory methods. Analyses will be performed using Test Methods for Evaluating Solid Waste (SW-846) in accordance with the NYSDEC Analytical Services Protocol (ASP).

4.0 QUALITY ASSURANCE OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The overall QA objective is to develop and implement procedures for field sampling, chain of custody, laboratory analysis, and reporting that will provide results which maximize the likelihood that the data are collected, analyzed and documented such that it is defensible. Specific procedures for sampling, chain of custody, laboratory instruments calibration, laboratory analysis, data reporting, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP. The purpose of this section is to address the project specific objectives for precision, accuracy, representativeness, completeness, and comparability, known as the "PARCC" parameters.

4.1 Accuracy, Precision, and Sensitivity of Analysis

The fundamental QA objective with respect to accuracy, precision, and sensitivity of laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols.

Accuracy, precision and completeness requirements will be addressed for all the data generated. Accuracy, the ability to obtain a true value, is monitored through the use of field and method blanks, spikes, and standards, and compared to federal and state regulations and guidelines. This will reflect the impact of matrix interferences. Precision, the ability to replicate a value, is monitored through duplicate (replicate) samples. It is assessed for each matrix. Corrective actions and documentation for substandard recoveries, or substandard precision, must be performed by the laboratory.

Instrument sensitivity must be monitored to ensure the data quality through constant instrument performance. Method detection limits depend on instrument sensitivity and matrix effects. Monitoring of instrument sensitivity is performed through the analysis of reagent blanks, near detection limit standards and response factors.

Quality control criteria for laboratory and field analyses are provided in Table B-3. Required field and laboratory QC samples and frequencies are summarized in Tables B-4 and B-5, respectively.

4.2 Completeness, Representativeness and Comparability

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. It is expected that the laboratory will provide data meeting QC acceptance criteria for 95 percent or more for all samples tested using the ASP Routine Analytical Services (RAS) methods and 90 percent for other methods. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

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. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol. The sampling network was designed to provide data representative of Site conditions. During development of this network, consideration was given to past waste disposal practices, existing analytical data, and physical setting and processes. The rationale of the sampling network is discussed in detail in the Work Plan. Representativeness will be satisfied by ensuring that the SAP is followed, proper sampling techniques are used, proper analytical procedures are followed and holding times of the samples are not exceeded in the laboratory. Representativeness will be assessed in part by the analysis of field duplicate samples.

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in the QAPP, are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of difference in procedures and QA objectives.

5.0 SAMPLING PROCESS DESIGN AND METHOD REQUIREMENTS

Detailed sampling procedures in the SAP describe the sampling and data gathering methods. For the planned tasks (i.e., soil and groundwater sampling), the SAP includes the following:

- description of the source matrix and sampling procedures;
- description of containers, preservation, holding times, etc., used in sample collection, transport, and storage;
- procedures for decontamination of equipment; and
- chain of custody procedures.

Table B-6 presents a summary of sample containers, preservation, and holding times.

6.0 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

The possession and proper transfer of samples and sample-related information must be traceable from the time the samples are collected until the data have been accepted for analysis. The Work Plan describes the procedures for sample custody from the point where the sample is collected through the laboratory analysis. The following sections summarize the general aspects of custody and how they will be applied and managed during the course of the project.

A sample or sample-related information (sample or evidence file) is under your custody if it:

- is in your possession;
- is in your view, after being in your possession;
- is in your possession and you place them in a secured location; or
- is in a secured, designated place.

6.1 Field Chain of Custody Procedures

The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain of custody intact. The protocols for specific sample numbering and other sample designation documentation are included in the SAP (Appendix A).

6.1.1 Field Procedures

a) The field sampler is responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

b) All bottles will be labeled with the appropriate sample numbers and locations.

c) Sample labels are to be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample tag because the ball-point pen would not function in freezing weather.

d) The Field Team Leader will review all field activities to determine whether proper custody procedures were followed during the field work and decide if additional samples are required.

6.1.2 Field Logbooks/Documentation

Field logbooks will be used to document all data collecting activities performed in the field. As such, entries will be described in sufficient detail such that persons going to the Site could reconstruct a particular situation without reliance on memory. A summary of field documentation requirements is presented below.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the document control area when not in use. Each logbook will be identified by the project-specific document number.

The title page of each logbook will contain the following:

- person to whom the logbook is assigned;
- logbook number;
- project name;
- project start date; and
- end date.

At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered into the field logbook. The names of visitors to the Site, field sampling or investigation team personnel and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. All entries will be made in ink (if possible) and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark and initialed by the person making the correction. Whenever a sample is collected, or a measurement is made, a detailed description of the location of the station shall be recorded. The number of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in the SAP (Appendix A). The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, sample volume and number of containers. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description (in the field logbooks but not the chain of custody).

6.1.3 Transfer of Custody and Shipment Procedures

a) Samples will be accompanied by a properly completed chain of custody form. The sample numbers and locations will be listed on the chain of custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area.

b) Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate, signed custody record enclosed in or on each sample box or cooler. Shipping containers will be locked and secured with strapping tape and USEPA custody seals for shipment to the laboratory. The preferred procedure includes use of a custody seal attached to the front right and back left of the cooler. The custody seals are covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations.

c) Whenever samples are split with another source (e.g., a government agency), a separate sample receipt is prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency should request the representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the "Received By" space.

d) All shipments will be accompanied by the chain of custody record identifying the contents. The original record will accompany the shipment, and the pink and yellow copies will be retained by the sampler for returning to the sampling office. Photocopies of the original record should be made before shipment, if possible, to ensure that clean copies can be made later.

e) If the samples are sent by common carrier, a bill of lading (airbill) must be used. Receipts of bills of lading will be retained as part of the permanent documentation. If sent by mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside or on the outside of the sample cooler and the custody seals remain intact.

6.2 Laboratory Chain of Custody Procedures

Laboratory custody procedures for sample receiving and log-in, sample storage, tracking during sample preparation and analysis, and storage of data are described in the laboratory QA plan in Attachment B-1. All laboratory handling and custody procedures must conform to the ASP or USEPA requirements. A brief summary of the required laboratory custody and sample handling procedures is presented below.

The laboratory's QA officer will ensure that chain of custody records are filled out upon receipt of the samples and will note questions or observations concerning sample integrity. The laboratory's QA officer will also ensure that sample-tracking records are maintained. These records will follow each sample through all stages of laboratory processing. The sample tracking records must show the date of sample extraction or preparation and the date of instrument analysis. These records will be used, in part, to determine compliance with holding time requirements.

7.0 ANALYTICAL METHOD REQUIREMENTS

Analytical procedures for this project have been selected to generate data meeting the DQOs required for the scope of work. A summary of the methods chosen and the rationale for each method selected is presented below. These methods are summarized in Table B-3. Sampling methods and procedures applicable to health and safety (e.g., personnel monitoring) are described in the HASP (Appendix C).

7.1 Laboratory Parameters

Methods published by USEPA will be used as the basis for all analyses for which such methods exist. The methods specified in Table B-3 shall be followed for non-ASP analytical parameters. These methods have been chosen based on applicability to the investigation and the level of data quality provided by the method.

7.2 Field Parameters

The procedures for field measurement of turbidity, pH, specific conductance, temperature, and organic vapors (PID) are described in the Standard Operating Procedures (SOPs) in the SAP (Appendix A).

Portable probes operated according to the manufacturer's instructions and the Roux Associates' SOPs will be used for specific conductance, temperature, and pH. For these field measurements, groundwater will be collected and transferred into clean containers. The turbidity, separate specific conductance and temperature/pH probes will be inserted into the containers and allowed to equilibrate prior to recording the readings.

7.3 Analytical Quality Control

The analytical measurement QC for field and laboratory analyses will generally address the parameters of precision and accuracy. The required QC sample types, frequency and acceptance criteria for the laboratory and field measurements are summarized in Tables B-4 and B-5. Assessment of data quality based on the QC results is part of the data validation process and is discussed in Sections 14 and 15.

7.4 Proposed Analytical Laboratories

All analytical laboratories used for this work will meet the requirements of the laboratory QA plan and any other requirements for performing analyses to meet the required DQOs. The laboratory qualifications statement and/or QA plan can be submitted upon request.

7.5 Rationale for Analytical Method Selection

All analytical methods selected for use during this project have been chosen based upon the following criteria:

- ability of the method to meet the established data quality objective for the parameter;
- validity and reproducibility of the method;
- ability to report detection limits below the Contract Required Quantitation Limit (CRQL) for compounds with action levels below the CRQL;
- conformance of the method to standard USEPA methods and practices; and
- cost comparison between the method alternatives (if applicable).

After reviewing these criteria, the analytical methods summarized in Table B-3 were chosen for this project. The rationale for choosing the specific analysis method is presented below for field and laboratory analyses.

Physical Analysis of Water Samples

Water samples requiring analyses for pH, temperature, specific conductance and turbidity will be analyzed using Roux Associates' SOPs and/or manufacturer's specifications, which are based upon the published USEPA methods for water. These analyses will be performed to provide supplementary and background data for off-site laboratory analyses and to assist in the overall water quality characterization. Data generated through the use of these methods will meet or exceed the established task-specific data needs/uses.

Chemical Analysis of Water Samples

Water samples requiring chemical analyses for TCL CVOCs, NYSDEC STARS list BNs, and RCRA metals will be analyzed using ASP protocols. These analyses will be performed to provide information regarding the Site characterization, remedial alternatives, and exposure assessment. Data generated through the use of these methods will meet or exceed the established task-specific data needs/uses.

Chloride, TDS and natural attenuation parameters will be analyzed using the Standard Methods for the Examination of Water and Wastewater. These analyses will be performed to provide information regarding Site characterization and remedial alternatives. Data generated through the use of these methods will meet or exceed the established task-specific data needs/uses.

Chemical Analysis of Soil Samples

Soil samples requiring chemical analyses for TCL VOCs and CVOCs, TCL SVOCs, NYSDEC STARS list BNs, TPH and RCRA and TAL metals will be analyzed using ASP protocols. The analyses will be performed to provide information regarding Site characterization, remedial alternatives, and exposure assessment. Data generated through the use of these methods will meet or exceed the established task-specific data needs/uses.

8.0 QUALITY CONTROL CHECKS

The following sections describe the QC checks that are commonly applied to investigations and their definition and purpose. There are two main areas of the data gathering process which may be checked: the field procedures and the laboratory procedures. A summary of the various field and laboratory QC checks applicable to this project and their required frequencies are provided in Tables B-4 and B-5, respectively.

8.1 Field Generated Quality Control Checks

Field generated QC checks are samples sent to the laboratory from the field by either the field sampling team (internal) or by a third party (USEPA, state agency). These types of samples serve as checks on both the sampling and measurement systems, and assist in determining the overall data quality with regard to representativeness, accuracy and precision. The number and type of field QC samples submitted varies with the intended data use and the level of contamination (i.e., sample analyte concentrations) expected.

8.1.1 Internal Field Checks

Trip blank

Trip blanks generally pertain to volatile organic samples only. Trip blanks are prepared by filling a sample container with analyte-free water prior to the sampling event. The trip blanks are then transported to the field and are kept with the investigative samples throughout the sampling event. They are then packaged for shipment with the other samples and sent for analysis. There should be one trip blank included in each sample shipping container for shipments with aqueous samples. The samples are used to determine if any cross-contamination between sample containers occurs. At no time after their preparation are the trip blank sample containers opened before they reach the laboratory.

Field Blank

Field blanks (also called decontamination rinsate blanks) are defined as samples which are obtained by running analyte-free water through sample collection equipment (bailer, pump, auger, etc.) after decontamination, and placing it in the appropriate sample containers for analysis. These samples are used to determine if decontamination procedures are adequate.

Duplicates

Field duplicates (also called replicates or collocates) are individual portions of the same (replicates) or essentially the same (collocated) field sample. Collocates are independent samples collected in close proximity to one another such that they are essentially an equal representation of the parameter(s) of interest at a given point in space and time. Examples of collocated samples include: samples from two air quality analyzers sampling from a common sample manifold, two water samples collected at essentially the same time and place from the same source, and side-by-side soil core samples.

Collocated samples, when collected, processed, and analyzed by the same organization, provide intralaboratory precision information for the entire measurement system including sample acquisition, homogeneity, handling, shipping, storage, preparation and analysis. Collocated samples, when collected, processed and analyzed by different organizations, provide interlaboratory precision information for the entire measurement system.

Replicate samples are samples from the same sampling point that have been divided into two or more portions at some step in the measurement process after sample collection. An example of a field replicate sample would be a soil core sample that has been collected, split, and placed into two or more individual sample containers.

Replicate samples can be used to estimate the overall precision of a data collection activity. Sampling error can be estimated by the comparison of collocated and replicated results from the same sample. If a significant difference in precision between the two subsets is found, it may be attributed to sampling design error.

Blinds

Blind samples can be either internal or external field QC samples. Internal blind samples are samples of known (performance evaluation, reference) or unknown (field sample replicates) concentration sent to the laboratory as routine field samples to test laboratory performance.

Splits

Split samples can be either internal or external field QC samples. Split samples are usually replicate samples sent to different laboratories and subjected to the same environmental conditions and steps in the measurement process. They serve as an oversight function in assessing the analytical portion of the measurement system (particularly interlaboratory precision).

8.1.2 External Field Checks

Blinds

Blind samples can be either internal or external field QC samples. External blind samples are usually samples of known (performance evaluation, reference) concentration sent to the laboratory (usually by a regulatory agency) as routine field samples to test laboratory performance.

Splits

Split samples can be either internal or external field QC samples. External split samples are replicate samples sent to different laboratories and subjected to the same environmental conditions and steps in the measurement process. They serve as an oversight function in assessing the analytical portion of the measurement system (particularly interlaboratory precision). External split samples may be generated for regulatory agencies, local resident oversight groups, or other interested/responsible parties.

8.2 Laboratory Generated Quality Control Checks

Laboratory generated QC check samples are samples generated at the analytical laboratory by the laboratory personnel from the same (internal) or a different (external) laboratory. These types of samples serve as checks on the laboratory sampling and measurement systems and assist in determining the data quality with regard to laboratory accuracy and precision. The number and type of laboratory QC check samples varies with the intended data use and the level of contamination (i.e., sample analyte concentrations) expected.

Laboratory QC check samples may measure either method and/or instrument performance. Method (preparation) performance check samples collectively measure the entire laboratory analytical data generation process, from sample allocating in the laboratory through the analysis and data reduction. Instrument (analysis) check samples measure the laboratory performance from the point where analysis begins, generally excluding any preparation/extraction affects, through the analysis and data reduction.

8.2.1 Internal Laboratory Checks

Method Blank

Method blanks (also called preparation blanks) are usually aliquots of analyte free water which are processed through all procedures, materials, reagents, and labware used for sample preparation and analysis. However, a method blank may be an aliquot of a known low level analyte matrix (such as washed sand) in order to more appropriately match the matrix of interest. Method blanks are used to determine if contaminants are present in the reagents, laboratory preparation, or analysis systems.

Reagent Blank

A reagent blank is prepared in the same manner as a method blank but is not subjected to the preparation procedures (digestion and/or extraction). Reagent blanks are used to determine the purity of the reagents used in the preparation/extraction and to isolate other contamination present in the analysis system.

Matrix Spike Blanks

Matrix spike blanks (MSBs) are aliquots of reagent water spiked with known quantities of specific compounds and subjected to the entire analytical procedure. MSBs are used to determine the appropriateness of the spiking solution used for the matrix spikes/matrix spike duplicates (MS/MSDs).

Duplicates

Laboratory duplicate samples fall into two basic categories: samples run through the entire sample allocating, preparation and analysis method (method or matrix duplicates) and samples run through only the analysis method (analysis or instrument duplicates). In either case a "duplicate" is a second, additional aliquot of the same sample generated at either the pre-preparation or post-preparation step of the method and carried from that point on through the rest of the method as a routine sample. Duplicate samples are used to define either method (preparation plus instrument) or instrument precision. In some organic methods, two additional duplicate aliquots of the same sample are prepared and spiked (matrix spike and matrix spike duplicate) in lieu of a normal matrix duplicate.

Spikes

Laboratory spike samples fall into two basic categories: samples run through the entire sample allocating, preparation and analysis method (method or matrix spikes) and samples run through only the analysis method (analysis or instrument spikes). In either case a "spike" is a second, additional aliquot of the same sample generated at either the pre-preparation or post-preparation step of the method which is spiked (fortified) with a known quantity of analyte and carried from that point on through the rest of the method as a routine sample. Spiked samples are used to define either method (preparation plus instrument) or instrument accuracy.

System Monitoring Compounds

System monitoring compounds are similar to matrix spikes and generally apply only to organic parameters. System monitoring compounds are added to all samples and are used to measure the effect of the sample matrix on specific compound recoveries. System monitoring compounds generally do not effect the routine sample results since the surrogate compounds are isotopically labeled. Surrogates are used to help define accuracy.

Internal Standards

Internal standards are similar to analysis spikes and generally apply only to organic parameters and inorganic analyses by Inductively Coupled Plasma (ICP). Internal standards are added to all samples (after preparation/extraction) and are used to determine the amount of variance in a measurement system due to transport, spectral, and other affects. Since the internal standard is a known quantity of analyte(s) generally not found in the environment, the results of the other analytes may be corrected for measurement system effects based on the percent recovery of the internal standard.

Control Samples

Laboratory control samples fall into two basic categories: samples run through the entire sample allocating, preparation, and analysis method (method or matrix controls) and samples run through only the analysis method (analysis or instrument controls). In either case, control samples are samples of known or certified concentration which are introduced at either the pre-preparation or post-preparation step of the method and carried from that point on through the rest of the method as a routine sample. Control samples are used to define either method (preparation plus instrument) or instrument accuracy. Examples of laboratory control samples are standard reference materials (SRMs), performance evaluation (PE) samples, laboratory control samples (LCSs), and method control samples (MCSs).

Analytical Batch

An analytical batch is a group of field and associated QC samples which are prepared (and preferably analyzed) concurrently using the exact same method, techniques, materials, reagents, labware, etc. Generally, a laboratory analytical batch is defined as twenty or fewer field samples of the same matrix prepared and processed at the same time. All associated QC samples should be prepared concurrently, and in addition to, the twenty or fewer field samples.

8.2.2 External Laboratory Checks

Round Robin Samples

Round robin samples are samples generated at one laboratory and sent to other laboratories for confirmation analysis. The "true" sample concentration is determined based on the statistical analysis of the various results reported by each laboratory. These samples are usually used to gauge accuracy. Examples of these types of samples include interlaboratory confirmation samples, proficiency analytical testing samples (PATs), and in some cases PE samples (in order to assign "true" values for the PE sample).

Performance Evaluation Samples

Performance evaluation (PE) samples are samples of known or assumed (based on round robin analyses) known concentration which are submitted to the laboratories by certifying (e.g., American Industrial Hygiene Association) or contracting agencies (e.g., ASP). PE samples are used to test the laboratory's competence in sample analysis and/or data package documentation and assembly. In terms of data quality, the PE sample is used to measure accuracy.

8.3 Standards Preparation

Calibration standards are prepared in the laboratory by dissolving or mixing a known amount of nominally pure analyte in the appropriate matrix using volumetric containers. Calibration standards must be prepared from a standard source which is traceable to a certified primary reference material (National Institute of Standards and Technologies or other certifying agency). All calibration standards must be prepared so that the types and concentration of the reagents used in the standard preparation are equivalent to the types and concentration of the reagents used in preparing the samples to be analyzed. Calibration curves are then generated to quantify the field sample results by comparison of the field sample response against the calibration standard response.

8.4 Reagents Preparation

All reagents used for analysis must be documented to be free of significant analyte concentration (i.e., all analytes to be measured are present below required detection limits) during or prior to the use of the reagents for sample preparation or analysis. Reagent blanks or method blanks (as required by the specific method) and other associated QC samples must be prepared using the same reagent lot(s) used for the actual field sample preparation. All reagent lots used for sample and standard preparation and analysis must be documented so that any resulting contamination problems can be traced to the specific standards and samples which were prepared using the reagent lot(s).

8.5 Calibration Checks

Once the calibration of an analysis system has been established using calibration standards, it is necessary to check the analysis system initially and periodically to verify correct standard preparation and system performance. Important elements to verify before and during the course of sample analysis include the accuracy of the calibration across the range of concentrations to be measured, the sensitivity of the instrument during the specific analysis run, and other transient changes in instrument performance, such as drift and linearity. To accomplish this verification task, analytical protocols require the analysis of calibration QC samples which serve as instrument checks and as triggers for necessary corrective action.

Initial Calibration Verification Standards

The initial calibration verification standard (ICV) is usually prepared in the concentration range of greatest interest, using an agency supplied standard or an alternate standard source (i.e., a different standard manufacturer) than that used for the calibration standards. The ICV must be prepared utilizing the same reagents and reagent concentration used for both the calibration standards and field samples. The purpose of this standard is to verify the accuracy of the initial calibration before any samples are analyzed.

Continuing Calibration Verification Standards

The continuing calibration verification standard (CCV) is prepared in the same manner as the ICV, except that it generally may be from either the same source, or from an alternate source as the calibration standards. The purpose of the CCV is to provide a periodic check on the accuracy of the calibration curve during sample analysis.

Initial Calibration Blank

An initial calibration blank (ICB) is a reagent blank prepared utilizing the same reagent(s) and reagent concentration used for both the calibration standards and the field samples. The purpose of the ICB is to verify that the sensitivity of the instrument meets the required limit of quantification before any samples are analyzed.

Continuing Calibration Blank

The continuing calibration blank (CCB) is prepared in the same manner as the ICB. The purpose of the CCB is to verify both the lack of baseline drift and the instrument sensitivity during analysis.

Near Detection Limit Standard

This standard is a calibration standard prepared to be at or near the required limit of quantitation (detection limit) for the measurement system (typically at the required detection limit or two times the required detection limit). The purpose of this standard is to provide a gauge of the accuracy of the instrument/instrument calibration at or near the required limit of quantification.

Linear Range Verification Standard

The linear range verification standard is a calibration standard prepared at a concentration greater than any of the calibration standards. The purpose of this standard is to verify accuracy of the analytical system at analyte concentrations greater than the highest calibration standard. This standard is generally only applicable to analytical systems with wide ranges of linearity (typically three or more orders of magnitude), such as ICP, where calibration across the entire linear range is cumbersome or impractical.

Interference Check Sample

The interference check sample (ICS) is a standard material prepared by spiking (fortifying) a solution of analytes of interest (in the concentration range of interest) with interfering analytes of a much higher concentration. The purpose of this sample is to verify that the analytical system is free from interferences due to the interfering analytes at the concentrations of interfering analytes and analytes of interest present in the ICS.

8.6 Control Charts

Control charts are used to determine if acceptable method performance has been achieved. In general, control charts are developed for methods where a standard level of performance has yet to be established and/or set limits of performance have not been validated through multiple analyses and statistical manipulation.

The basis of a control chart is to determine an accepted mean result and the allowable variance around the accepted mean. Typically, the allowable variance is measured in terms of the "level of confidence" in a particular result. Based on a statistical analysis of the results obtained over a period of time, the mean and standard deviation of the measurements can be determined. Once these values are known, a control chart can be established using the mean as the "true" value and some multiple of the standard deviation (confidence level) as the allowable variance. For most control charts, the allowable variance is set at the 95 percent or 99 percent confidence level, meaning there is a 95 or 99 percent chance that the control sample value will fall within the range of the control window, if the method is performed correctly.

Where established limits of acceptability are not available for this project's analyses, a minimum criteria of ± 25 percent will be required for method accuracy in soil samples; and ± 35 relative percent difference (RPD) for soil samples will be required for method precision. Completeness will be established at 95 percent for ASP analyses and 90 percent for non-ASP analyses, based on the precision and accuracy criteria noted above. Table B-3 summarizes the required precision, accuracy and completeness requirements for the parameters anticipated for this project.

If no reference material with published acceptance limits meeting the criteria established above (for analyses without established limits of acceptability) is available for the specified analytical method, statistically valid control charts for the analytical method must be developed by the laboratory prior to analysis of any field samples. All field sample results reported from this analytical method must be concurrently prepared and analyzed with a laboratory generated control sample having a result within ± two standard deviations (95 percent confidence level) of the mean result established by the laboratory through the use of control charts.

8.7 Database/Electronic Media Quality Control Checks

For data entered into electronic media by laboratories and contractors other than Roux Associates, all electronic media will be verified through the data validation and authentication (if applicable) programs as described in Section 14. Hardcopy data from the laboratories and/or contractors will also be compared against the electronic media generated by these sources at the level and frequency specified in Section 14.

For data input into databases, or electronic media generated by Roux Associates, the quality of the data entry and output will be verified according to the Roux Associates' SOP for Project Quality Assurance/Quality Control Procedures included in Attachment B-2.

9.0 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE REQUIREMENTS

The preventative maintenance procedures described below are designed to prevent injury and loss of time and data due to faulty equipment/instrumentation. The purpose of preventative maintenance is to address potential problems before they occur and to help assure that equipment/measurement systems operate adequately when used for routine project activities.

9.1 Field Equipment/Instruments

The planned field instruments for this project include PID, water-level indicator, interface probe, pH meter, turbidity meter, specific conductance meter, and thermometer. Specific preventative maintenance procedures to be followed for this and other field equipment are those recommended by the manufacturer and described in the applicable Roux Associates' SOPs (SAP - Attachment A-1).

Table B-7 summarizes the relevant preventive maintenance procedures for specific pieces of field equipment to be used for sampling, monitoring, and documentation for this project.

Field instruments will be checked and calibrated in the office before they are shipped or carried to the field at the start of the project. These instruments will be checked and calibrated in the field on a daily basis before and after use. Calibration checks will be performed and will be documented in the field logbook.

9.2 Laboratory Instruments

As part of their QA/QC Program, the laboratory will conduct a routine preventative maintenance program to minimize the occurrence of instrument failure and other system malfunctions.

These procedures will be documented in the laboratory QA plan (Attachment B-1). Roux Associates will perform oversight of the laboratory maintenance program through the audit functions described in Section 13.

9.3 Documentation

Appropriate documentation of all equipment/instrument maintenance shall be maintained by the field and laboratory personnel and shall include what was done, date, time (if appropriate), next scheduled maintenance, equipment status, anomalies, and person performing maintenance. This documentation shall be entered into field logbooks, or into specific maintenance log forms for off-site maintenance activities.

10.0 INSTRUMENT CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of all measurements and measuring equipment which are used for conducting field tests and laboratory analyses. All equipment must be calibrated prior to each use and on a periodic basis.

10.1 Field Instruments/Equipment

Field instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. The calibration and use of field instruments are described in the SAP (Appendix A).

Equipment to be used during field sampling will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manual to ensure that all maintenance requirements are being observed. Backup instrumentation will be sent into the field where possible. Two thermometers will be sent to sampling locations where measurement of temperature is required, including those locations where a specific conductance probe/thermometer is required. Preventive maintenance will be conducted for equipment and instruments to ensure the accuracy of measurement systems, and to verify the availability of spare parts and backup systems (see Section 9.0).

Calibration of field instruments is governed by the specific SOP for the applicable field analysis method, and such procedures take precedence over the following general discussion.

Calibration of field instruments will be performed at the intervals specified by the manufacturer or more frequently as conditions dictate. Field instrumentation may include an Organic Vapor Meter (OVM) or PID, pH meter, turbidity meter, water-level indicator, interface probe, specific conductance meter, and thermometer for water analyses. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be removed from service until the problem is resolved.

10.2 Laboratory Instruments

The ASP calibration procedures and frequencies are specified in the ASP protocols. In all cases where analyses are conducted according to the ASP protocols, the calibration procedures and frequencies specified in the applicable ASP protocols will be followed.

Calibration of laboratory equipment for non-ASP analyses will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing QC activities. These records will be filed at the location where the work is performed and will be subject to QA audits. For all instruments, the laboratory will retain a factory-trained repair staff with in-house spare parts or will maintain service contracts with vendors.

The records of laboratory calibration will be kept as follows:

- if possible, each instrument will have a record of calibration permanently affixed with an assigned record number;
- a label will be affixed to each instrument showing description, manufacturer, model numbers, date of last calibration, by whom calibrated (signature), and due date of next calibration. Reports and compensation or correction figures will be maintained with the instrument;
- a written stepwise calibration procedure will be available for each piece of test and measurement equipment; and
- any instrument that is not calibrated with the manufacturer's original specification will display a warning tag to alert the analyst that the device carries only a "Limited Calibration."

More detailed information on the calibration of laboratory equipment is presented in Section 8.0 of this QAPP and in the laboratory QA plan included as Attachment B-1.

10.3 Standards/Calibration Solutions Preparation

The standards/calibration solutions preparation will be performed in accordance with the ASP protocols, if applicable, and using good laboratory practice (GLP) in all cases. More specific information on standards and reagent preparation is provided in Sections 8.3 and 8.4 of this QAPP.

11.0 ASSESSMENT AND RESPONSE ACTIONS

This section provides the types, frequencies and content of the various audits and audit functions to be applied to this project. Audits for the work generally consist of four types: management audits, data quality audits, technical systems audits and performance audits. These audits may be internal (performed by the same agency/organization generating the information) or external (performed by an outside agency/organization). The purpose of these audits is to establish and verify that the sampling and analysis activities are performed in accordance with the QAPP.

Project audits are intended to provide information regarding:

- on-going assessment of the data quality;
- identification of areas with a need for improvement;
- verification of QA program implementation;
- assessment of applied resources to complete the assigned tasks; and
- address changes and/or variances to procedures necessitated by the actual field or laboratory conditions.

Roux Associates is dedicated to confirmation of the specific and overall QA/QC objectives for this project through the use of management, performance and systems audits. The specific content and frequency of audits anticipated for this project are delineated below.

11.1 Management Audits

Management audits may be performed by Roux Associates personnel to determine whether the management functions and responsibilities related to environmental measurements are performed in accordance with Roux Associates' QA procedures. Management audits will include a review of the QAPP implementation for this project in order to evaluate:

- the level of management support;
- the field and analytical tracking systems;
- the procedures for developing the project DQOs;
- the procedures for developing, approving and reviewing the QAPP;
- the procedures for developing and approving SOPs; and

- the procedures and schedules for conducting audits.

Management audits are an on-going function of the Roux Associates' QA/QC procedures. Project-specific management audits for this project are the responsibility of the Project Manager and will be implemented as required for each management function. The Project Manager will review the management program and the other audit functions on a routine basis.

11.2 Data Quality Audits

Data quality audits will be performed by Roux Associates or Roux Associates' contractor personnel to determine whether data derived as part of the work are of known quality. Data quality audits will be supported by the data validation effort to determine whether or not sufficient information exists with the data set to support an assessment of data quality. Through the use of data validation and authentication (if applicable), information provided by Roux Associates and its contractors will be used to audit and evaluate:

- if a data set, or all the data sets of a particular project, met the DQOs;
- if the contractor collecting or reducing the data performed their own data quality assessment; and
- if the contractor identified deficiencies (if they existed) and corrected the cause(s), both technical and managerial.

For data generated by laboratories and contractors other than Roux Associates, all data will be verified through the data validation and authentication (if applicable) programs as described in Section 8. Hardcopy data from the laboratories and/or contractors will be checked for completeness and accuracy of data reduction at the level and frequency specified in this section. For data validation performed by Roux Associates' subcontractors, key data may be subject to additional Roux Associates validation based on its importance in decision making for the project.

For data generated by Roux Associates, the quality of the data entry and reduction will be verified according to the Roux Associates' Evaluation and Validation of Data SOP in Attachment B-3 and the Roux Associates' QA/QC procedures SOP included in Attachment B-2.

All data quality functions will be subject to Roux Associates oversight to verify the accuracy and completeness of the data reduction and validation efforts. Data quality is the responsibility of the PQAC and will be implemented as required for each type of data generating activity. At a minimum, the PQAC will review the data validation effort, perform spot checks on the quality of the data validation effort, and document his/her findings.

11.3 Technical Systems Audits

Technical systems audits will be performed to determine if the field and laboratory sampling and analytical systems specified in the SAP and QAPP are sufficient to generate data which will meet the stated DQOs. These audits will include the on-site examination of field and laboratory activities for quality and conformance to the SAP and QAPP. Both internal (performed by the same agency/organization generating the information) or external (performed by an outside agency/organization) audits will be performed for both the field and laboratory systems.

11.3.1 Field Audits - Internal

The internal field audits may be conducted, and if so, will include examination and review of field sampling records, field instrument operating records, sample collection, handling, packaging and shipping procedures, maintenance of QA procedures, chain of custody, etc. to determine conformity to the SAP and QAPP. Internal audits of field activities (sampling and measurements) will be conducted by the Roux Associates PQAC and/or Project Manager. Should any deficiencies be discovered during the course of the audit, the PQAC will have the authority to take any necessary action, including implementing a "stop work" order, to correct the deficiency.

These internal field audits will occur at the onset of the project to verify that all established procedures are followed. Follow-up audits to correct deficiencies, and to verify that QA procedures are maintained throughout the investigation, will be conducted on a routine basis. The specific contents of these audits will be based on Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) guidelines.

11.3.2 Field Audits - External

At this time it is not anticipated that external audits of the field activities will be necessary. However, if the internal audits determine that deficiencies exist which require an outside organization or agent to resolve the problem(s), Roux Associates will employ the services of an outside subcontractor to audit the field activities and make/suggest corrections to the problem.

11.3.3 Laboratory Audits - Internal

The internal laboratory system audits will be performed by the Laboratory QA Officer on at least an annual basis (at a minimum) and will include examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain of custody procedure, sample preparation and analysis, instrument operating records, etc. as described in the laboratory QA Plan (if applicable) or according to the guidelines set forth in the ASP Bid Package documentation regarding laboratory QA requirements.

11.3.4 Laboratory Audits - External

For this project it is anticipated that only laboratories currently meeting the criteria set forth for the ASP will be used for off-site sample analyses. These laboratories will have already been subject to a laboratory audit by NYSDEC/USEPA personnel and it is not anticipated that an additional audit by Roux Associates or Roux Associates' subcontractor personnel will be required. However, should any laboratory be selected which has not been audited by the ASP, or an equivalent audit (state or other federal agency) in the last 12 months, Roux Associates or its contractor personnel will perform a laboratory audit using the guidelines set forth in the ASP Bid Package documentation prior to that laboratory performing any field sample analyses.

11.4 Performance Evaluation Audits

The internal performance audits of the laboratory(ies) will be conducted by the Laboratory QA Officer. The performance audits will be conducted on at least a quarterly basis. Blind QC samples will be prepared and submitted along with project samples to the laboratory for analysis throughout the project. The Laboratory QA Officer will evaluate the analytical results of these blind performance samples to ensure the laboratories maintain a good performance.

External performance audits of the laboratories selected for the project will have already been performed by the NYSDEC/ASP for some or all of the analytes being tested. These performance evaluation audits may be supplemented by the use of field-generated blind QC samples (replicates) submitted by Roux Associates.

Internal performance evaluation audits of the field measurements performed by Roux Associates' personnel may be utilized if suitable reference solutions are available for the specific project activities. These types of checks could include analysis of "blind" calibration span gases for PID measurements, or analysis of USEPA Environmental Monitoring Systems Laboratory aqueous check samples for pH and specific conductance.

For laboratory checks, tolerance limits for the performance evaluation samples will be based on the accepted values supplied with the check sample/standard. For the field checks, the tolerance limits will also be based on the accepted values supplied with the check sample/standard, but may be modified as necessary to take into account the less quantitative (screening) nature of the field analytical measurements.

12.0 CORRECTIVE ACTIONS

Corrective action generally addresses the need to bring data generating systems back into conformance after some trigger or other criteria have shown the system to be out of conformance. The following paragraphs describe the mechanics of how corrective action will be managed and implemented during the course of this project.

Corrective actions may be required for two classes of problems: analytical and equipment functional problems, and noncompliance problems. Analytical and equipment functional problems may occur during sampling and sample handling, sample preparation, laboratory instrumental analysis, and data review. The need for laboratory analysis corrective actions is based on predetermined limits for acceptability (Section 4). By conducting system and performance audits, the Laboratory QA Officer will determine if the overall data generating systems are acceptable (Sections 14 and 15).

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the PQAC and/or Project Manager. If the problem is analytical in nature, information on these problems will be promptly communicated to the Laboratory QA Officer and method specific corrective actions will be implemented.

12.1 Field Corrective Action

Corrective actions will be implemented by field personnel and documented in the field record book. No staff member will initiate corrective action without notification through the proper channels. If corrective actions are insufficient, a stop-work order may be issued by the Project Manager.

Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformance, or suspected deficiencies of any activity (or issued document) by reporting the situation to the Project Manager or designee. The Project Manager will be responsible for assessing the suspected problems in consultation with the PQAC, and for making decisions based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable nonconformance and/or requires corrective action, then a nonconformance report will be initiated by the field personnel and submitted to the Project Manager for review.

The Project Manager will be responsible for ensuring that corrective action for nonconformances are initiated by:

- evaluating all reported nonconformances;
- controlling additional work on nonconforming items;
- determining disposition or action to be taken;
- maintaining a log of nonconformances;
- reviewing nonconformance reports and corrective actions taken; and
- ensuring nonconformance reports are included in the Site documentation project files.

If appropriate, the Project Manager will ensure that no additional work which is dependent on the nonconforming activity be performed until the corrective actions are completed.

Corrective action for field measurements may include the following:

- repeat the measurement to check the error;
- check for all proper adjustments for ambient conditions such as temperature;
- check the batteries;
- recalibration;
- check the calibration;
- replace the instrument or measurement devices; and
- stop work (if necessary).

The Project Manager or his/her designee is ultimately responsible for all Site activities. In this role, the Project Manager at times is required to adjust the Site programs to accommodate the Site program specific needs. The change in the program will be documented on the Field Change Request form (Attachment B-5) that will be signed by the initiators and the Project

Manager or designee. The Field Change Request shall be attached to the file copy of the affected document. The Project Manager and the PQAC must approve the change in writing or verbally prior to the field implementation, if feasible. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices and appropriate action will be taken by the Project Manager to document the significance of the problem.

The Project Manager is responsible for the controlling, tracking, and implementation of the identified changes. Reports on all changes will be distributed to all affected parties.

12.2 Laboratory Corrective Action

Corrective action is required whenever an out-of-control event or potential out-of-control event is noted. The corrective action taken will be somewhat dependent on the analysis and the event. These actions are to be implemented in accordance with the laboratory QA plan and the ASP protocols as appropriate and applicable.

13.0 REPORTS TO MANAGEMENT

Quality assurance reports serve the purpose of identifying, tracking and summarizing any field and laboratory activities which occur during the project. These reports provide a permanent record which addresses the adequacy of the QAPP, problems or deficiencies noted during audits, and resolution of the identified areas of concern. The following sections provide a summary of the report contents and frequency requirements for the writing and submission of QA reports.

13.1 Specific Quality Assurance Reports

In addition to the audit reports submitted to the Project Manager in accordance with Section 11, a QA progress report will be submitted periodically to the Project Manager by the PQAC which addresses the identification or resolution of all QA issues occurring over that time period. If a project lasts less than two months, only a final QA report will be submitted. The final QA report will be incorporated into the final project report and will contain QA progress report sections that summarize data quality information collected during the project.

Each periodic or final QA report will include the following types of information: purpose and scope of report, time frame covered, project status (overall and by task if applicable), results of any data quality or other audits conducted during the time period, problem identification/updates/resolution, QAPP changes, project-related training activities, visits by third party organizations, sources of additional information, and who receives the reports.

13.2 Quality Assurance Report Management

The Project Manager will be responsible for assuring that the frequency and content of the report(s) are met. Applicable sections of the report will be sent to the PQAC and the Health and Safety Manager for approval/disapproval. Any deficiencies found in the QA reports will be brought to the attention of the PQAC and will require correction within 14 days for periodic reports, or within one month for final reports.

The submission of QA reports will be included in the overall project management schedule as critical path points to assist in meeting the QA objectives for this project.

14.0 DATA REDUCTION, VALIDATION AND REPORTING

Applicable methods/procedures will be required for the reduction, validation and reporting of data generated during all phases of this project. Please note that unless requested by the NYSDEC, an independent validation will not be performed. Both the field and laboratory data will be subjected to a level of data validation commensurate with the required data quality level. If required by the NYSDEC, all data will be validated using either the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (February, 1994), the NYSDEC guide to preparing data usuability summary reports USEPA Region II CLP Organics Data Review and Preliminary Review (SOP No. HW-6, Revision 8), USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (February, 1994) and/or the Evaluation of Metals Data for the Contract Laboratory Program (SOP No. HW-2, Revision #11) or the same guidelines modified for non-ASP analyses. The level of complete transcription checks (raw data to reporting for calculation checks) shall nominally be 10 percent, but this percentage may be increased or decreased depending on the nature and significance of the individual results.

14.1 Data Reduction

Data reduction involves the generation, interpretation and calculation of results from the field and laboratory analyses performed as part of the data gathering effort. In order to make the appropriate decisions, it is necessary to verify that the reported values are correct, both in the way they have been generated (instrument calibration, etc.) and the way they are calculated and reported. Due to the different quantities of documentation and the different quality levels of data generated in the field and the laboratory, somewhat different levels of effort are required for reduction verification for these different data sources.

14.1.1 Field Data Reduction

Raw data from field measurements and sample collection activities will be appropriately recorded in the field logbook. If the data are to be used in the project reports, they will be documented in the report. All measurement data recorded in field logbooks or field forms will be reviewed by the Project Manager for completeness and clarity. Any discrepancies noted will be resolved by the Project Manager. All calculation equations shall also be verified by the Project Manager and individual calculations will be verified at a minimum frequency of

30 percent by the PQAC. Any field information entered into data systems will be subject to the Roux Associates QA/QC procedures (Attachment B-2).

14.1.2 Laboratory Data Reduction

The off-site laboratory will perform in-house analytical data reduction and validation under the direction of the Laboratory QA Officer. The Laboratory QA Officer is responsible for assessing data quality and advising of any data which were rated "preliminary" or "unacceptable" or other notations which would caution the data user of possible unreliability. Data reduction, validation, and reporting by the laboratory will be conducted as follows:

- raw data produced by the analyst is turned over to the respective area supervisor;
- the area supervisor reviews the data for attainment of QC criteria as outlined in ASP protocols and/or established USEPA methods and for overall reasonableness;
- upon acceptance of the raw data by the area supervisor, a computerized report is generated and sent to the Laboratory QA Officer;
- the Laboratory QA Officer will complete a thorough audit of reports at a frequency of one in ten, and an audit of every report for consistency;
- the Laboratory QA Officer and area supervisors will decide whether any sample re-analysis is required; and
- upon acceptance of the preliminary reports by the Laboratory QA Officer, final reports will be generated and signed by the Laboratory Project Manager. The laboratory package shall be presented in the same order in which the samples were analyzed.

Data reduction reporting procedures will be those specified in the ASP protocols for inorganic and organic analyses.

Laboratories will prepare and retain full analytical and QC documentation the same as (ASP analyses) or similar to that (non-ASP analyses) required by the ASP protocols.

The laboratory will report the data in chronological order along with all pertinent QC data. Laboratories will provide the following information to the prime contractor in each analytical data package submitted.

1. Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis.
2. Tabulated results of inorganic and organic compounds identified and quantified.
3. Analytical results for QC samples, spikes, sample duplicates, initial and continuing calibration verification standards and blanks, standard procedural (method) blanks, laboratory control samples, and Inductively Coupled Plasma (ICP) interference check samples.
4. Tabulation of instrument detection limits determined in pure water.
5. Raw data system printouts (or legible photocopies) identifying: date of analyses, analyst, parameter(s) determined, calibration curve, calibration verifications, method blanks, sample and any dilutions, sample duplicates, spikes and control samples.
6. Sample preparation/extraction/analysis logs including weights, volumes and dilutions.

14.2 Field Data Validation

Field data assessment will be accomplished by the efforts of the PQAC and/or Project Manager. The data assessment by the Project Manager or his/her designee will be based on the criteria that the sample was properly collected and handled according to the SAP (Appendix A) and Section 6.

14.3 Laboratory Data Validation

Validation of laboratory generated data may be performed by Roux Associates or a Roux Associates' subcontractor. The Contractor data reviewer will conduct a systematic review of the data for compliance with the established QC criteria based on the spike, duplicate and blank results provided by the laboratory. An evaluation of data accuracy, precision, representativeness and completeness, based on criteria in Section 4, will be performed and presented in the summary report.

The data reviewer will identify any out-of-control data points and data omissions and interact with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project.

Data validation for laboratory data will be performed in accordance with the NYSDEC Guidelines for Preparing a Data Usability Summary Report. Non-ASP analysis data will also be validated using the functional guidelines, but use of the guidelines will be modified according to the applicable method and required QA/QC. It is anticipated that all laboratory data will be validated (i.e., complete transcription checks, calculation checks, etc.) by the laboratory.

14.4 Data Reporting

All data generated for the Site will be computerized in a database format organized to facilitate data review and evaluation. The computerized data set will include the data flags provided in accordance with the USEPA Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses and Inorganic Analyses, as well as additional comments of the data reviewer for ASP analyses. For non-ASP analysis, the data will include appropriate flags based on the data validation functional guidelines. The data flags will include such items as: 1) concentration below required detection limit, 2) estimated concentration due to poor recovery below required detection limit, 3) estimated concentration due to poor spike recovery, and 4) concentration of chemical also found in laboratory blank. Selected data reviewer comments will also become part of the database in order to indicate whether the data are usable as a quantitative concentration, usable with caution as an estimated concentration, or unusable due to out-of-control QC results.

The Site data set(s) will be available for controlled access by the Project Manager, and authorized personnel. The complete data set(s) will be incorporated into the report.

15.0 SPECIFIC AND ROUTINE PROCEDURES TO ASSESS DATA QUALITY OBJECTIVES

This section will describe the specific methods and equations used to assess the quality of the data with regard to precision, accuracy and completeness. Previous sections in the QAPP have defined the terms of the PARCC parameters, described the types and frequencies of the various audit activities and described the methods of data reduction and validation (see Sections 4, 11 and 14).

The procedures used to assess the DQOs as outlined in this QAPP were developed to generate data which meets the specific needs of the project. Through the use of a systematic method of data assessment, data of known quality will be produced and applied to the project needs based on the actual data quality.

By subjecting the data to standard calculations and validation guidelines, the usability of the data are enhanced when comparison against past, present or future data is necessary. Actual use of any data for specific project purposes will be determined by the Project Manager in coordination with the PQAC, based on the required data quality needs for a particular data set (e.g., matrix type, concentration level, intended data use, quantification accuracy and precision needs, etc.).

15.1 Specific Assessment Parameters

The following sections list the parameters that will be assessed and the calculations applicable to the specific measurement. The acceptable limits for the individual parameters (for both field and laboratory analyses) are discussed in Sections 4.0 and 7.0.

Accuracy

Accuracy of laboratory results will be assessed using the analytical results of method blanks, reagent blanks, matrix spikes, field blanks, near detection limit and linear range standards, etc. The percent recovery (%R) of analysis and matrix spike samples will be calculated using the following equation:

$$\%R = \frac{A - B}{C} X\ 100$$

Where: A = The analyte concentration determined experimentally in the spiked sample;

B = The analyte concentration determined by a separate analysis of the unspiked sample; and

C = The amount of analyte added in the spike.

Precision

Precision will be assessed by calculating the relative percent difference (RPD) between the field and/or laboratory duplicate samples (e.g., field duplicates and/or splits, laboratory matrix spike/matrix spike duplicate [MS/MSD] for organic analysis, and laboratory duplicate analyses for inorganic analysis). The RPD will be calculated for each pair of duplicates using the following equation:

$$RPD = \frac{S - D}{(S + D)/2} X 100$$

Where: S = First sample value (original or MS value)

D = Second sample value (duplicate or MSD value)

Completeness

Completeness measures of the amount of valid data obtained from a measurement system compared to the amount of data expected to be obtained under normal conditions. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{Completeness} = \frac{\text{Valid Data Obtained}}{\text{Total Data Planned}} \text{ X } 100$$

Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, and parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol. The sampling network for this project was designed to provide data representative of Site conditions. During development of the sampling network, consideration was given to past waste disposal practices, existing analytical data, and physical setting and processes.

Representativeness of the data will be assessed by the Project Manager and the PQAC through review and comparison of the applicable data (field and laboratory duplicates, splits, spikes, PE samples, etc.) and by verifying that the design set forth in the Work Plan was followed for all data generated during the project activities.

Comparability

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends in part on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in the QAPP, are expected to provide comparable data for these project activities (i.e., intra-project comparison). These new analytical data, however, may not be directly comparable to existing data because of differences in procedures and QA objectives.

Assessment of statistical comparability will be based primarily on the use of field splits and internal and external PE samples. Specifics regarding the assessment of comparability within sample sets can be found in the Roux Associates' Evaluation and Validation of Data SOP in Attachment A-3.

Required Limit of Quantitation (Detection Limit):

The required limits of quantitation for the various analyses are found in Table B-3. For ASP analyses, these detection limits shall be arrived at using the methodology set forth in the specific statement of work for that parameter. For non-ASP analyses, the detection limit(s) shall be arrived at using either the SW-486 methodology (as applied to a particular analysis other than the specified methods) or using a "standard" method based on the general guidelines presented below.

- The limit of quantitation shall be based on the variability of the blank response for the complete analytical procedure, or the variability for the signal-to-background response in a processed sample when there is not a detectable blank response. The detection limit will be established as three times the standard deviation of the blank or background response, adjusted for the amount of sample typically extracted and the final extract volume of the method (i.e., all dilutions and sample weight variables must be included in the calculation).

- Best professional judgment shall be used to adjust the limit of detection upward in cases where the transient occurrence of high instrument precision (i.e., low variability) results in a calculated limit of detection less than the absolute sensitivity of the analytical instrument. When no significant blank response is detectable, the limit of detection shall be estimated based on the standard deviation of low-level standard (concentrations at or near the expected instrument detection limit) responses.

15.2 Management of DQO Assessment

Assessment of the on-going ability to generate data of a known quality will be the primary responsibility of the PQAC and will be overseen by the Project Manager. As discussed previously in Sections 11 and 14, Roux Associates will be responsible for performing audits for technical systems and data quality on an on-going basis.

16.0 REFERENCES

USEPA. 1994. Guidance for the Data Quality Objectives Process. September 1994, EPA QA/G-4.

Table B-1.Sample Types/Analyses by Task, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Task	Media	Field Analyses	Laboratory Analyses
Task 1: Soil Boring and Sampling -	Soil	PID(1) Screening	
Former Plating Area			TPH, TAL metals plus cyanide
Former UST Area at TP-9			BNs
Former Leaching Field			VOCs, SVOCs, TAL metals plus cyanide
Inside Former Building Footprint			VOCs, SVOCs, TAL metals plus cyanide
Task 3: Water-Level Measurements and Groundwater Sampling	Water	Field Parameters(2)	CVOCs, TDS, TAL metals plus cyanide, chloride, natural attenuation parameters(3), BNs
Task 4: Geoprobe™ Groundwater Sampling	Water	DNAPL Monitoring	CVOCs
Task 5. Exposure Assessment (Soil Sampling)	Soil	PID(1) Screening	CVOCs, TAL metals plus cyanide
Task 6: Phytoremediation Pilot Study	Soil Water		Agronomic analyses CVOCs

(1) Photoionization Detector - screens for volatile organic compounds (vapor phase).

(2) Field Parameters include turbidity, pH, specific conductivity and temperature.

(3) Natural attenuation parameters include dissolved oxygen, carbon dioxide, alkalinity, sulfate, nitrite, dissolved iron/reduced iron, dissolved manganese/reduced manganese, ethane, and ethene.

VOCs	Volatile Organic Compounds
CVOCs	Chlorinated Volatile Organic Compounds
SVOCs	Semivolatile Organic Compounds
TPH	Total Petroleum Hydrocarbons
BNs	Base Neutral Compounds
TDS	Total Dissolved Solids
TAL	Target Analyte List

Table B-2. Projected Number of Field Samples, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Task	Parameter	Field Samples	Field Duplicates	Field Blanks[a]	Trip Blanks[b]	MS/MSD[c] (Extra Volume)	Total Laboratory Samples
1. Soil Boring and Sampling							
Soil	Former Plating Area						
	TPH	3	NA	1	NA	NA	4
	TAL metals plus cyanide	1	NA	1	NA	NA	2
	Former UST Area at TP-9						
	BNs	3	1	1	NA	NA	5
	Former Leaching Field						
	VOCs	3	NA	1	1	NA	5
	SVOCs	3	NA	1	NA	NA	4
	TAL metals plus cyanide	3	NA	1	NA	NA	4
	Inside Former Building Footprint						
	VOCs	9	1	1	1	1	13
	SVOCs	9	1	1	NA	1	12
	TAL metals plus cyanide	9	1	1	NA	1	12
3. Water-Level Measurements and Groundwater Sampling							
Groundwater	CVOCs	9	1	3	3	1	17
	TDS	9	NA	NA	NA	NA	9
	Chloride	9	NA	NA	NA	NA	9
	Natural Attenuation Parameters [d]	9	NA	NA	NA	NA	9
	TAL metals (Filtered/Unfiltered) plus cyanide	4	2	2	NA	2	10
	BNs	1	1	1	NA	1	4
4. Geoprobe™ Groundwater Sampling							
Groundwater	CVOCs	8	1	NA	1	1	11
5. Exposure Assessment (Soil Sampling)							
Soil	CVOCs	12	1	1	1	1	16
	TAL metals plus cyanide	12	1	1	NA	1	15

Table B-2. Projected Number of Field Samples, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Task	Parameter	Field Samples	Field Duplicates	Field Blanks[a]	Trip Blanks[b]	MS/MSD[c] (Extra Volume)	Total Laboratory Samples
6. Phytoremediation Pilot Study							
Soil	Agronomic Analyses	2	NA	NA	NA	NA	2
Water	CVOCs	12	2	6	6	NA	26

[a] Field blank frequency estimates based on one per twenty, or one per day minimum, whichever is more frequent.

[b] The number of trip blanks is estimated due to requirement of one trip blank per cooler.

[c] Frequency estimates based on one per twenty, where applicable.

[d] Natural attenuation parameters include dissolved oxygen, carbon dioxide, alkalinity, sulfate, nitrite, dissolved iron/reduced iron, dissolved manganese/reduced manganese, ethane, and ethene.

VOCs	Volatile Organic Compounds
CVOCs	Chlorinated Volatile Organic Compounds
SVOCs	Semivolatile Organic Compounds
TPH	Total Petroleum Hydrocarbons
BNs	Base Neutral Compounds
TDS	Total Dissolved Solids
NA	Not Applicable
MS/MSD	Matrix Spike/Matrix Spike Duplicate
TAL	Target Analyte List

Table B-3. Project Quality Control Summary, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Parameter	Matrix	Quantitation Limit[a]	Estimated Accuracy	Estimated Precision	Completeness	Analysis Method[b]
VOCs and CVOCs	Soil	0.01 mg/kg[c]	75-125%[d]	35 RPD[e]	95%	USEPA 8260
SVOCs	Soil	0.33 to 0.83 mg/kg	75-125%	50 RPD	95%	USEPA 8270
TAL metals plus cyanide	Soil	0.0002 to 5 mg/kg	75-125%	35 RPD	95%	USEPA 6000/7000 Series
TPH	Soil	17 mg/kg	75-125%	NA	90%	USEPA 8015
BNs	Soil	0.33 to 0.83 mg/kg	75-125%	50 RPD	90%	USEPA 8270[f]
CVOCs	Water	0.01 mg/L	75-125%	24 RPD	95%	USEPA 8260
TDS	Water	10 mg/L	NA	NA	90%	USEPA 160.1
Chloride	Water	2 mg/L	75-125%	15 RPD	90%	USEPA 325.2
Natural Attenuation Parameters[g]	Water	NA	NA	NA	95%	SW-846
TAL metals plus cyanide	Water	0.0002 to 5 mg/L	75-125%	20 RPD	95%	USEPA 6000/7000 Series
BNs	Water	0.01 to 0.050 mg/L	10-111%	50 RPD	95%	USEPA 8270[f]

[a] Quantitation limits are based on Contract Laboratory Program Statement of Work (CLP SOW) 3/90 requirements (where applicable) or on method references.

[b] Test Methods for Evaluating Solid Waste (SW-846).

[c] Limits are based on nominal wet weight of sample. Dry weight limits will be higher.

[d] Actual limits for matrix spikes, surrogates and laboratory control samples are provided in the CLP SOW.

[e] Actual limits for relative percent difference (RPD) of matrix spike duplicates are provided in the CLP SOW.

[f] New York State Department of Environmental Conservation Spill Technology and Remediation Series List.

[g] Natural attenuation parameters include dissolved oxygen, carbon dioxide, alkalinity, sulfate, nitrite, dissolved iron/reduced iron, dissolved manganese/reduced manganese, ethane, and ethene.

USEPA	United States Environmental Protection Agency
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NA	Not applicable
VOCs	Volatile Organic Compounds
CVOCs	Chlorinated Volatile Organic Compounds
SVOCs	Semivolatile Organic Compounds
TPH	Total Petroleum Hydrocarbons
BNs	Base Neutral Compounds
TDS	Total Dissolved Solids
TAL	Target Analyte List

Table B-4. Field Quality Control Sample Frequency, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Parameters	Media	Trip Blank[a]	Field Blank[b]	Field Duplicates[c]
VOCs and CVOCs	Soil	1/20	1/20	1/20
SVOCs	Soil	NA	1/20	1/20
TAL metals plus cyanide	Soil	NA	1/20	1/20
TPH	Soil	NA	NA	NA
BNs	Soil	NA	1/20	1/20
CVOCs	Water	1/20	1/20	1/20
TDS	Water	NA	NA	NA
Chloride	Water	NA	NA	NA
Natural Attenuation Parameters[d]	Water	NA	NA	NA
BNs	Water	NA	1/20	1/20
TAL metals plus cyanide	Water	NA	1/20	1/20

[a] Where applicable, one per twenty or fewer field samples, or one per shipment container (VOC only).

[b] Where applicable, one per twenty or fewer field samples, or one per day, whichever is most frequent.

[c] Where applicable, one per twenty or fewer field samples.

[d] Natural attenuation parameters include dissolved oxygen, carbon dioxide, alkalinity, sulfate, nitrite, dissolved iron/reduced iron, dissolved manganese/reduced manganese, ethane, and ethene.

NA	Not Applicable
VOCs	Volatile Organic Compounds
SVOCs	Semivolatile Organic Compounds
CVOCs	Chlorinated Volatile Organic Compounds
TPH	Total Petroleum Hydrocarbons
BNs	Base Neutral Compounds
TDS	Total Dissolved Solids
TAL	Target Analyte List

Table B-5. Laboratory Quality Control Sample Frequency, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Parameter	Matrix	Method Blank(a)	Matrix Spikes or MS/MSD(a)	Laboratory Replicates(a)	Analysis Methods(b)
VOCs and CVOCs	Soil	1/20	1/20	1/20	USEPA 8260 + 10 TICs
SVOCs	Soil	1/20	1/20	1/20	USEPA 8270 + 20 TICs
TAL metals plus cyanide	Soil	1/20	1/20	1/20	USEPA 6000-7000 Series
TPH	Soil	1/20	NA	1/20	USEPA 8015
BNs	Soils	1/20	NA	1/20	USEPA 8270 + 20 TICs(c)
CVOCs	Water	1/20	1/20	1/20	USEPA 8260 + 10 TICs
TDS	Water	1/20	NA	1/20	USEPA 160.1
Chloride	Water	1/20	NA	1/20	USEPA 325.1
Natural Attenuation Parameters(d)	Water	NA	NA	1/20	--
BNs	Water	1/20	1/20	1/20	USEAP 8270(c) + 20 TICs
TAL metals plus cyanide	Water	1/20	1/20	1/20	USEPA 6000-7000 Series

(a) Where applicable, one per twenty or fewer field samples, or one per analytical batch, whichever is more frequent

(b) Actual analysis method (CLP SOW) version will be dependent on contract held by laboratory

(c) New York State Department of Environmental Conservation Spill Technology and Remediation Series List

(d) Natural attenuation parameters include dissolved oxygen, carbon dioxide, alkalinity, sulfate, nitrite, dissolved iron/reduced iron, dissolved manganese/reduced manganese, ethane, and ethene.

USEPA	United States Environmental Protection Agency
MS/MSD	Matrix Spike/Matrix Spike Duplicate
VOCs	Volatile Organic Compounds
CVOCs	Chlorinated Volatile Organic Compounds
SVOCs	Semivolatile Organic Compounds
TPH	Total Petroleum Hydrocarbons
BNs	Base Neutral Compounds
TDS	Total Dissolved Solids
NA	Not Applicable
TAL	Target Analyte List
TICs	Tentatively Identified Compounds

Table B-6. Field Equipment Calibration Requirements and Maintenance Schedule, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Equipment Type	Calibration Requirements	Maintenance Schedule
Photoionization Detector (PID)	Attachment A-1	Recharge or replace battery. Regularly clean lamp window. Regularly clean and maintain the instrument and accessories.
Turbidity Meter	Attachment A-1	See Manual
pH, Specific Conductivity and Temperature Meter	Attachment A-1	See Manual
Personal Protective Equipment	Not Applicable	Integrity/function test prior to donning equipment. Visual inspection for defects/leakage for all reusable gear.

Table B-7. Preservation, Holding Times and Sample Containers, Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Parameter	Preservation	Holding Time[a]	Containers
Soil VOCs and CVOCs	4°C until extraction and analysis	[b]	4 oz jar w/teflon lined lid
Soil SVOCs	4°C until extraction and analysis	40 days[c]	8 oz jar w/teflon lined lid
Soil TAL metals plus cyanide	4°C until extraction and analysis	180 days[d] Hg - 26 days	8 oz jar w/teflon lined lid
Soil TPH	4°C until extraction and analysis	14 days[f]	4 oz jar w/teflon lined lid
Soil BNs	4°C until extraction and analysis	40 days[c]	8 oz jar w/teflon lined lid
Water CVOCs	4°C until extraction and analysis, add HCl pH<2	[b]	4 oz jar w/teflon lined lid
Water TDS	4°C until extraction and analysis	7 days	8 oz jar w/teflon lined lid
Water Chloride	NA	26 days	50 ml glass jar
Water Natural Attenuation Parameters[e]	NA	NA	NA
Water BNs	4°C until extraction and analysis	40 days[c]	1 liter amber jar
Water TAL metals plus cyanide	4°C until extraction and analysis	180 days [c] Hg - 26 days	1 liter plastic

[a] From collection until analysis unless otherwise specified

[b] 7 days for unpreserved samples and 10 days for preserved samples

[c] 5 days to preparative extraction/40 days from preparative extraction to analysis

[d] 180 days from field to extraction/180 days from extraction to analysis

[e] Natural attenuation parameters include dissolved oxygen, carbon dioxide, alkalinity, sulfate, nitrite, dissolved iron/reduced iron, dissolved manganese/reduced manganese, ethane, and ethene.

[f] 14 days from field to extraction/14 days from extraction to analysis

VOCs	Volatile Organic Compounds
CVOCs	Chlorinated Volatile Organic Compounds
SVOCs	Semivolatile Organic Compounds
BNs	Base Neutral Compounds
TPH	Total Petroleum Hydrocarbons
TDS	Total Dissolved Solids
NA	Not Applicable
HCL	Hydrochloric Acid
TAL	Target Analyte List

FIELD ORGANIZATION CHART

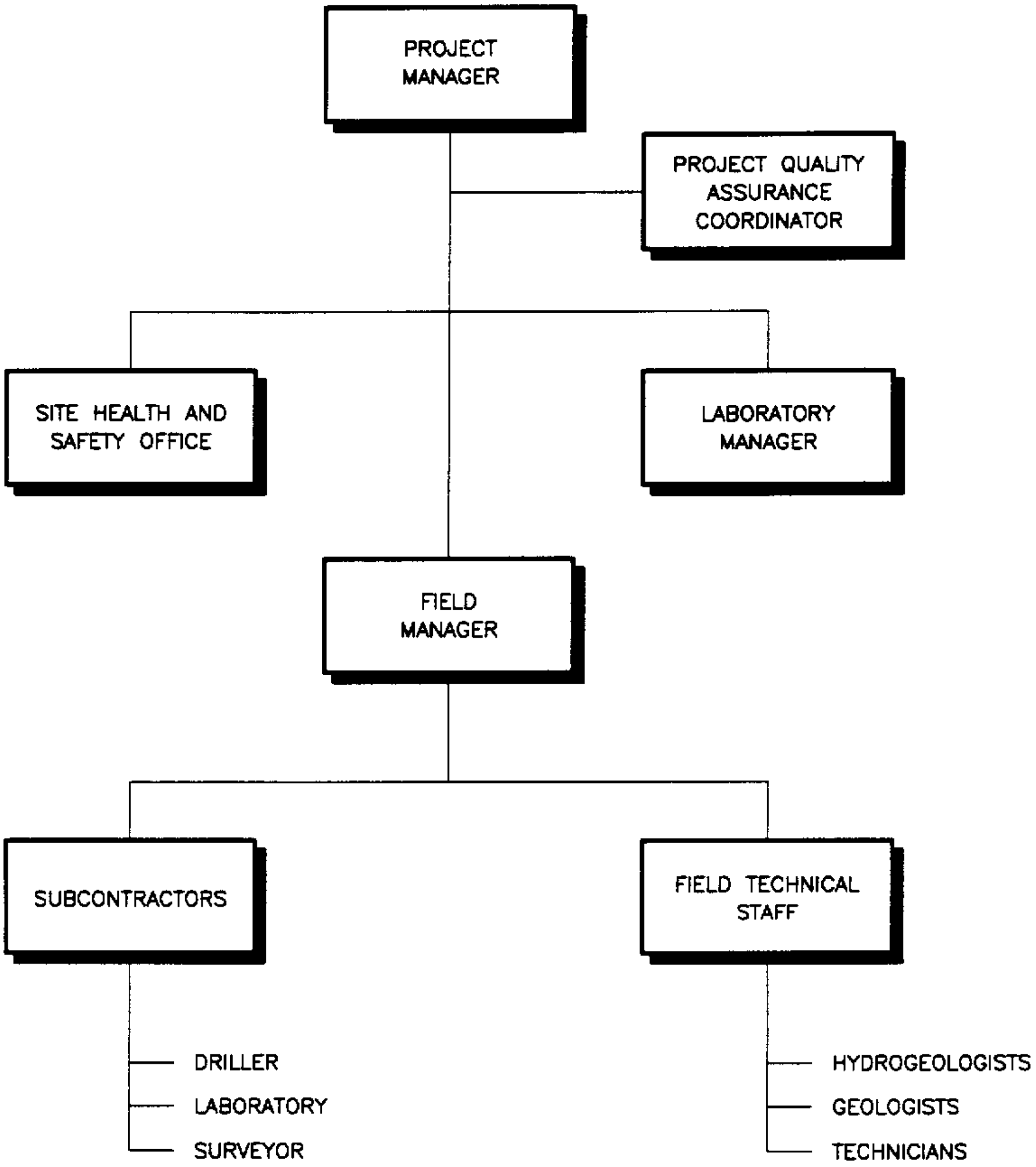


FIGURE B-1

ATTACHMENT B-1

Analytical Laboratory
(Severn Trent Laboratories)
Quality Assurance Plan
(Upon Request)

ATTACHMENT B-2

Roux Associates, Inc.
Standard Operating Procedure
for Field Record Keeping
and Quality Assurance/Quality Control

STANDARD OPERATING PROCEDURE 3.2 FOR FIELD RECORD KEEPING AND QUALITY ASSURANCE/QUALITY CONTROL

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide procedures and standards for record keeping and maintenance, for all field activities conducted by Roux Associates, Inc. (Roux Associates).

Strict quality assurance/quality control (QA/QC) is necessary to properly and accurately document and preserve all project-related information. Quality assurance is implemented to corroborate that quality control procedures are followed. Quality control provides a means to monitor investigation activities (e.g., sampling and laboratory performance) as a check on the quality of the data.

Valid data and information are integral to all aspects of Roux Associates' field activities. These aspects include, but are not necessarily limited to, activities that involve: drilling; sediment, sludge, and soil sampling (lithologic, and soil-quality and analysis); well construction and development; aquifer testing and analysis; water-quality sampling and analysis (surface water and ground water); free-product sampling and analysis; air-quality sampling and analysis; geophysical testing; demolition activities; waste removal operations; engineering installations; etc. The data will be confirmed by QA/QC methods established and set forth in the work plan/scope of work. Without checks on the field and analytical procedures, the potential exists for contradictory results, and associated incomplete or incorrect results from the interpretation of potentially questionable data.

Documentation will be entered in the field notebook and must be transcribed with extreme care, in a clear and concise manner, as the information recorded will become part of the permanent legal record. Because field notes are the legal record of site activities, they must be taken in a standard and consistent manner. If abbreviations are used, then they must first be spelled out for clarity (i.e., to avoid ambiguity and misunderstanding). All entries must be dated and initialed, and the time (military time) of the entry included. Field notebooks and forms must be assigned to an individual project and properly identified (i.e., client name, project number, location and name of site, individual recording information, dates, times, etc.). Change of possession of field notebooks or forms must be documented with the date and time, and initialed by both individuals. Following each day's entries, the field notebook or form must be photocopied in the event that the original documentation is lost or stolen. All field notebooks must have the company name and address legibly printed in indelible ink along with the message "If found, then please forward to Roux Associates, Inc. at the above address - REWARD OFFERED."

Information must be recorded while onsite because it may be difficult to recall details at a later date. Furthermore, information must be documented immediately as it provides unbiased information which will be used for writing the report when the field activities are completed. Project-related documentation is an irreplaceable, important record for other individuals who may become involved in the project, and provides the project manager with a complete history of project-related activities. Written information must be accompanied by maps, sketches, and photographs where appropriate, especially if these supplemental sources of information assist in the documentation process. A new page must be used in the field notebook for each new day's entries (i.e., unused portions of a previous page must have an "X" placed through it). The end of the day's records must be initialed and dated.

As part of record keeping and QA/QC activities, state and federal regulatory agencies should be contacted to check if special or different protocols are required and/or if particular or unconventional methods are required for the given field activity. Thus, the record keeping and QA/QC activities implemented by Roux Associates are based on technically sound standard practices and incorporate Roux Associates own, extensive experience in conducting hydrogeologic field activities.

2.0 MATERIALS

In order to track investigation activities, specific materials are required. These materials include the following:

a. A bound, waterproof field notebook.

b. Appropriate Roux Associates' forms (e.g., daily log, geologic log, monitoring well construction log, well sampling data form, location sketch, chain of custody, telephone conversation record, meeting notes, etc.).

c. Appropriate labels (e.g., sample, Roux Associates' Custody Seal, etc.)

d. Work plan/scope of work.

e. Health and safety plan (HASP).

f. Appropriate Roux Associates' SOPs.

g. Black pens, and indelible markers.

h. Camera and film.

3.0 DOCUMENTATION

3.1 Before the Roux Associates personnel leave the field, they must ensure that their field notes include comprehensive descriptions of the hydrogeologic conditions, and all investigation-related activities and results (onsite and offsite). This will safeguard against the inability to reconstruct and comprehend all aspects of the field investigation after its completion, and will serve to facilitate the writing of an accurate report. Properly documented information provides the QA/QC tracking (back-up) required for all Roux Associates' projects. General types of information that must be recorded (where pertinent to the investigation being conducted) include, but may not necessarily be limited to, the following:

a. List of Roux Associates personnel on site.

b. Name, date, and time of arrival on site by Roux Associates personnel, including temporary departures from, and returns to, the site during the work day.

c. Client and project number.

d. Name and location of study area.

e. Date and time of arrival on site by non-Roux Associates personnel (names and affiliation) and equipment (e.g., subcontractors and facility personnel, and drilling equipment, respectively, etc.), including temporary departures from, and returns to, the site during the work day, and departure at the end of the work day.

f. List of non-Roux Associates personnel on site.

g. Weather conditions at the beginning of the day as well as any changes in weather that occur during the working day.

h. Health and safety procedures including level of protection, monitoring of vital signs, frequency of air monitoring, and any change (i.e., downgrade or upgrade) in the level of protection for Roux Associates and other on-site personnel (e.g., subcontractors, facility personnel, etc.).

i. Health and safety procedures not in compliance with the HASP (for all on-site personnel).

j. Site reconnaissance information (e.g., topographic features, geologic features, surface-water bodies, seeps, areas of apparent contamination, facility/plant structures, etc.).

k. Air monitoring results (i.e., photoionization detector [PID], etc. measurements).

l. Task designation and work progress.

m. Work-related and site-related discussions with subcontractors, regulatory agency personnel, plant personnel, the general public, and Roux Associates personnel.

n. Delays, unusual situations, problems and accidents.

o. Field work not conducted in accordance with the work plan/scope of work, and rationale and justification for any change(s) in field procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

p. QA/QC procedures not conducted in accordance with the QA/QC procedures established in the work plan/scope of work and rationale and justification for any change(s) in QA/QC procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

q. Equipment and instrument problems.

r. Decontamination and calibration procedures.

s. Activities in and around the site and work area by any and all on-site personnel which may impact field activities.

t. Sketches, maps, and/or photographs (with dates and times) of the site, structures, equipment, etc. that would facilitate explanations of site conditions.

u. Contamination evidenced as a result of work-related activities (e.g., visible contaminants [sheen] in drilling fluids or on drilling equipment; sheen on, or staining of, sediments; color of, or separate [nonaqueous] phase on, water from borehole or well; vapors or odors emanating from a borehole or well; etc.); make all observations as objectively as possible (e.g., grey-blue, oil-like sheen; black and orange, rust-like stain; fuel-like odor; etc.) and avoid using nontechnical or negative-sounding terms (e.g., slimy, goopy, foul-smelling).

v. Date and time of final departure from the site of all personnel at the end of the work day.

3.2 In addition to the general types of information that must be recorded (as presented in Section 3.1), task-specific information must also be properly documented. Task-specific information which is required is provided in each respective task-oriented SOP, and the documentation procedures outlined in each SOP must be followed.

ATTACHMENT B-3

Data Validator's Qualifications Statement

JUDY V. HARRY
Post Office Box 208
120 Cobble Creek Road
North Creek, New York 12853

Occupation:	Data Validator / Environmental Technical Consultant
Years Experience:	24
Education:	B.S., Chemistry, Magna cum laude, 1976, Phi Beta Kappa
Certifications:	New York State Woman-Owned Business Enterprise (WBE)

Relevant Work History:

Data Validation Services: September 1989 – present

Sole proprietor of Data Validation Services, providing consultation / validation services to various regulatory and commercial clients.

These services include the review of analytical laboratory data for compliance with respect to various protocols, accuracy and defensibility of data, verification of reported values, and evaluation of quality parameters for analytical usability of results. Approved by NYSDEC NJDEP, and NYCDEP as a data validator for projects contracted through the Division of Hazardous Waste Remediation, Division of Solid Waste, and Division of Water Quality. Has also performed validation and usability determinations for data pertaining to USEPA Superfund and lead sites.

Performed validation for compliance with protocols including 1989 / 1991 / 1995 NYSDEC ASPs, 1987 NYSDEC CLP, USEPA OLM, USEPA OLC, USEPA ILM, USEPA DFLM, USEPA SOW 3/90, USEPA SOW 7/87 CLP, USEPA SOW 2/88 CLP, USEPA SW846, RCRA, AFCEE, Part 360, 40 CFR, and Air analysis methods. Performed validation according to the NYSDEC Validation Scope of Work, USEPA National, Region I, and Region III Functional Guidelines, USEPA Region II HW SOPs, AFCEE, and NJDEP Division of Hazardous Site Mitigation / Publicly Funded Site Remediation SOPs.

Performed validation for USEPA Superfund Sites including Salem Acres, York Oil, Port Washington L-4 Landfill, BROS, and OTIS AFB; and for USEPA lead sites including SJ&J Piconne, Maska, Bowe System, and Syossett Landfill, involving CLP, RAS, and SAS protocols.

Contracted for NYSDEC Superfund Standby Contracts with LMS Engineers, Camp Dresser & McKee, Malcolm-Pirnie, and EC Jordan, involving samples collected at NYS Superfund Sites and analyzed under the NYSDEC ASP.

Validated data for NYSDEC Phase II remedial investigations, RI/FS projects, and PRP over-sight projects for hazardous waste sites. Was the primary contractor for Lawler, Matusky & Skelly Engineers during fifth and sixth round Phase II investigation, reviewing results for TCL/TAL analyses performed according to EPA CLP and 1989 NYSDEC ASP. Provided data validation for Phase II investigations for Gibbs & Hill, Inc, reviewing results from TCL/TAL analyses performed according to 1989 NYSDEC ASP.

Performed validation services for clients conducting RI/FS activities involving samples of many matrices, including waste, air, sludges, leachates, solids / sediments, aqueous, and biota; clients have included Barton & Loguidice, Blasland Bouck & Lee, Camp Dresser & McKee, C&S Consulting Engineers, Clough Harbour & Associates, Columbia Analytical Services, C.T. Male, Dames & Moore, Ecology & Environment, EC Jordan, Fanning Phillips & Molnar, FluorDaniel GTI, Foster Wheeler, Frontier Technical, Galson Consultants, H2M Group, Lockwood, Kessler & Bartlett, LMS Engineers, Malcolm-Pirnie, Metcalf & Eddy, O'Brien & Gere, Parsons Engineering-Science, P. W. Grosser, Rizzo Associates, Roux Associates, Sear Brown Group, ThermoRemediation Inc., URS Consultants, Wehran Emcon, Weston, and YEC.

Validated sample data pertaining to numerous landfill site investigations for TCL/TAL and NYS Part 360 analytes.

Validated data for NYSDEC and NJDEP sites for samples analyzed according to EPA CLP SOPs, with validation performed according to NJDEP validation procedures.

Provided consultation services to laboratories regarding analytical procedures and protocol interpretation, and to law firms for litigation support.

Provided services to firms involving audits of environmental analytical laboratories to determine analytical capability, particularly for compliance with NYSDEC ASP and AFCEE requirements.

Guest speaker on a panel discussing Data Review / Compliance and Usability, for an analysts workshop for the New York Association of Approved Environmental Laboratories, 1993.

Adirondack Environmental Services: June 1987 – August 1989

Senior mass spectroscopist for AES. Responsible for GC/MS analyses of environmental samples; development of the GC/MS laboratory, initiating the instrumental and computer operations from the point of installation; and for implementing the procedures and methodologies for Contract Laboratory Protocol.

CompuChem Laboratories: May 1982 – January 1987

Managed a GC/MS laboratory; developed, implemented, and supervised QA/QC criteria at three different levels of review; and was responsible for the development and production of environmental and clinical samples. Directed a staff of 23 technical and clerical personnel, and managed the extraction, GC/MS, and data review labs.

Research Triangle Institute: December 1979 – May 1982

Worked as an analytical research chemist responsible for development of analytical methods for the EPA Federal Register at RTI. This involved analysis of biological and environmental samples for priority pollutants, primarily relating to wastewaters and to human sampling studies. Method development included modification and interfacing of volatile purge apparatus to GC/MS, analysis and resolution / identification of individual PCB congeners by capillary column by mass spectra.

Guardsman Chemical Company: February 1977 – November 1979

Performed all quality control functions for the manufacturing plant. Performed research and development on coatings and dyes.

Almay Cosmetics: May 1976 – December 1976

Product evaluation chemist. Responsible for analytical QC of manufactured products.

ATTACHMENT B-4

Roux Associates, Inc.
Standard Operating Procedure
for Evaluation and Validation of Data

STANDARD OPERATING PROCEDURE 3.4
FOR EVALUATION AND VALIDATION OF DATA

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish the criteria to be followed for the evaluation of data quality and for data validation. Because valid media-quality data are integral to environmental investigations that characterize site conditions, the quality of the data generated by a laboratory is extremely important to the successful completion of a project. The level of data evaluation and validation required is determined by the project data quality objectives and must be outlined in the work plan/scope of work. Data collected to establish qualitative trends, for example, do not require the same level of validation as data generated to support litigation.

The data evaluation procedure described in Section 2.0 of this SOP is designed to provide a measure of comparability regarding quality control (QC) samples, i.e., between duplicate or replicate samples and to detect any contamination or bias in analyses of blanks. They may be used for both intra-laboratory and inter-laboratory comparisons.

The data validation procedure described in Section 3.0 of this SOP is designed to provide a stringent review of analytical chemical data with respect to sample receipt and handling, analytical methods used, and data reporting and deliverables.

Prior to performing any data evaluation or validation, it is crucial that all appropriate regulatory agencies be contacted and their data validation requirements be determined, as these requirements vary from agency to agency and may vary among different Regions of the United States Environmental Protection Agency (USEPA).

2.0 PROCEDURE FOR EVALUATION OF DATA

2.1 Not all analytical data packages will require a full data validation procedure as described in Section 3.0. The procedures described in this section provide an initial screening to help decide if full data validation is warranted. These data evaluation procedures are used as a quality assurance (QA) check for water-quality data, and are not generally applicable to soil-quality data. They are to be used when a full data validation procedure (described in Section 3.0) is not required.

2.2 Primary/Replicate, Primary Split and Primary/Laboratory Duplicate Comparisons

X = primary sample concentration

Y = replicate/split/laboratory duplicate sample concentration

Z = $\{(X-Y)/[(X+Y)/2]\} \times 100$

IDC = initial concentration requiring dilution, if samples have been diluted. If samples did not require dilution, then use the first range (i.e., QL-10[QL]).

QL = Quantitation Limit(1)

Organic Constituents

Range	Quantitative	Qualitative	Unusable
QL - 10(QL)	$Z \leq 60\%$	$100\% > Z > 60\%$	$Z \geq 100\%$
10(QL) - IDC	$Z \leq 40\%$	$100\% > Z > 40\%$	$Z \geq 100\%$
X or Y > IDC	$Z \leq 60\%$	$100\% > Z > 60\%$	$Z \geq 100\%$

Inorganic Constituents

Analytical Method	Quantitative	Qualitative	Unusable
Wet Chemistry testing	$Z \leq 60\%$	$100\% > Z > 60\%$	$Z \geq 100\%$
Atomic Absorption (AA)	$Z \leq 40\%$	$100\% > Z > 40\%$	$Z \geq 100\%$
Inductively Coupled Plasma (ICP)	$Z \leq 40\%$	$100\% > Z > 40\%$	$Z \geq 100\%$

2.3 Comparison of Blanks

X = primary sample concentration(2)

D = highest concentration in associated blank(s)

Y = X/dilution factor

	Quantitative	Qualitative	Unusable
Field Blank	$D \leq 0.1X$	$0.5X > D > 0.1X$	$D \geq 0.5X$
Trip Blank	$D \leq 0.1X$	$0.5X > D > 0.1X$	$D \geq 0.5X$
Lab Blank	$D \leq 0.1Y$	$0.5Y > D > 0.1Y$	$D \geq 0.5Y$

(1)The quantitation limit will be dependent upon the specific methodology and the matrix, and will be either the minimum detection limit (MDL) or the practical quantitation limit (PQL).

(2)Results reported as BDL (below the detection limit) will be considered Quantitative because the primary samples have not been affected by the bias(es) which resulted in concentrations reported in the blank sample(s).

3.0 PROCEDURE FOR DATA VALIDATION

3.1 Determine study-specific data quality needs and pertinent regulatory agency data validation requirements.

3.2 Contact the appropriate regulatory agency(ies) to obtain their data validation procedure manual. This manual will indicate acceptable ranges for QC parameters to be investigated and procedures to follow for data which do not meet these requirements.

3.3 For inorganic compounds, the requirements that will be examined during the validation process are:

a. Holding times.
b. Instrument calibration, including initial and continuing calibration verification.
c. Blank(s).
d. Laboratory control sample(s).
e. Inductively Coupled Plasma (ICP) interference check samples.
f. Duplicate sample(s).
g. Matrix spike sample(s).
h. Furnace atomic absorption QC.
i. ICP serial dilution(s).

j. Sample result verifications.
k. Field duplicates.
l. General data assessment.

3.4 For organic compounds, the requirements that will be examined during the validation process are:

a. Holding times.
b. Gas Chromatograph/Mass Spectrometer (GC/MS) tuning.
c. GC calibration, initial and continuing.
d. Blanks.
e. Surrogate recoveries.
f. Matrix spike/matrix spike duplicates.
g. Internal standards performances.
h. Target Compounds List (TCL) compound identifications.
i. Reported detection limits.
j. Tentatively identified compounds (TICs).
k. Overall system performance.
l. General data assessment.

3.5 The parameters which do not conform to requirements are then listed and the data are qualified according to the guidelines provided in the appropriate regulatory agency's data validation procedure manual. The qualified data package is then reviewed and the project data reviewer, the project geochemist and/or the project manager makes a professional judgement concerning the validity of the data package, and its usability for the project.

ATTACHMENT B-5

Field Change Request Form

FIELD CHANGE REQUEST FORM

DATE: ______________________ FIELD CHANGE #: ______________________

PERSON REQUESTING CHANGE: ______________________

COMPANY/TITLE: ______________________

FIELD CHANGE: ______________________

____

____

____

REASON FOR FIELD CHANGE: ______________________

____

____

____

____

ACKNOWLEDGEMENT: ______________________

WORK PLAN ADDENDUM REQUIRED (Y/N): ______________________

ADDENDUM SUBMITTED TO: ______________________

ADDENDUM SUBMITTED TO: ______________________

APPENDIX C

Health and Safety Plan

HEALTH AND SAFETY PLAN

Former Thypin Steel Inc. Plant
Manorhaven, New York

Appendix C

September 26, 2000

Approvals:

Roux Associates, Inc.
Project Manager
Scott J Glash
Scott J. Glash
9/26/00
Date

Roux Associates, Inc.
Office Health and Safety
Manager
Thomas Dwyer SJG
Thomas R. Dwyer
9-26-00
Date

Roux Associates, Inc.
Site Health and Safety
Manager

Date

CONTENTS

CONTENTS (Continued)

TABLES

FIGURES

ATTACHMENTS

1.0 GENERAL

This site-specific Health and Safety Plan (HASP) has been prepared in accordance with 29 CFR 1910.120 Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER), and Roux Associates, Inc. (Roux Associates) Standard Operating Procedures (SOPs). It addresses all activities to be performed during the investigation and remediation at the Former Thypin Steel, Inc. Plant, Manorhaven, New York (Site). The HASP will be implemented by the designated Site Health and Safety Officer (SHSO) during work at the Site.

Compliance with this HASP is required for all Roux Associates employees and third parties who enter the Site. Assistance in implementing this HASP can be obtained from Roux Associates' Office Health and Safety Manager (OHSM). The content of this HASP may undergo revision based upon additional information made available. Any changes proposed must be reviewed and approved by Roux Associates' OHSM or his designee.

Scope of Work

The Scope of Work will include implementation of the following activities:

- Soil Boring and Sampling;
- Groundwater Sampling;
- Water-Level Measurements;
- Monitoring Well Installation; and
- Dense Non-Aqueous Phase Liquid (DNAPL) Monitoring.

These activities are described in detail in Appendix A of the Work Plan.

2.0 EMERGENCY INFORMATION

Multiple emergency services may be obtained from 911. More specific numbers for local services are listed below.

Type	Name	Telephone Numbers
Police	Sands Point Police Department	(516)883-3100
Fire	Port Washington Fire Department	(516)883-0224
Hospital	North Shore University Hospital	(516)829-9666
National Response Center		(800) 424-8802
Poison Control Center	Phelps Memorial Hospital	(914)366-3030
Roux Associates' Office Health and Safety Manager	Thomas R. Dwyer	(631) 232-2600 (During Normal Business Hours)

The route to North Shore University Hospital is shown in Figure C-1.

3.0 HEALTH AND SAFETY PERSONNEL DESIGNATIONS

Roux Associates has designated health and safety personnel to be responsible for the implementation of this HASP for Roux Associates employees, and to provide assistance to the contractor for health and safety related issues.

Personnel Designation	Responsibilities
Office Health and Safety Manager (OHSM)	Assists in implementation and modification of the HASP.
Project Manager (PM)	Provides adequate resources for field health and safety personnel. Ensures that field personnel are trained and aware of Site conditions. Schedules adequate personnel and equipment to perform job safely.
Site Health and Safety Officer (SHSO)/ Site Emergency Coordinator	Conducts safety briefings and worker awareness meetings. Ensures compliance with HASP. Notifies PM and OHSM of accidents/ incidents. Coordinates health and safety activities. Makes contact with local emergency groups prior to beginning work on-site. Responsible for evacuation, emergency treatment, and emergency transport of personnel.
Field Crew Personnel	Report unsafe or hazardous conditions to SHSO. Understand the information contained in this HASP.

4.0 SITE HISTORY AND PHYSICAL DESCRIPTION

This section provides a brief summary of the history and physical description of Site.

4.1 Location

The Site is located at 5 Sagamore Hill Drive in the village of Manorhaven, New York (Figure 1 of the Work Plan). The Site is bordered to the north by Yennicock Avenue, to the south by Thomas Point Lane, to the east by Sagamore Hill Drive and to the west by Manhasset Bay. The property is approximately 11 acres in size, and is currently vacant (i.e., no buildings are present).

4.2 Site History

The Site was historically used for airplane and metal heater manufacturing, which ceased in the 1950s. About that time, Thypin Steel purchased the Site for the storage of steel products. In the 1960s, portions of the Site were leased for the manufacturing of various large steel and plastic vessels used in the food and drug industries. The Site has been vacant since the late 1960s, and the buildings were demolished in the early 1990s. The Site history was developed based on Mr. Richard Thypin's (MBA-Manorhaven, LLC) knowledge of the Site and the interpretation of fire insurance maps (i.e., Sanborn Maps) and aerial photographs. The Site history, which includes a list of the past and current owners and operators of the Site, is provided in Tables 1 and 2 of the Work Plan.

5.0 HAZARD ASSESSMENT

The potential hazards associated with the anticipated investigation activities include chemical and physical hazards. There is little potential for encountering biological hazards due to the nature of the work location and the activities to be conducted.

5.1 Chemical Hazards

Previous investigations have shown the presence of various organic compounds and metals at the Site. The toxicological, physical, and chemical properties of these potential contaminants are presented in Table C-1. This table includes action levels (permissible exposure levels) that will establish the level of protection. The potential for encountering these contaminants exists during intrusive activities such as drilling.

5.2 Physical Hazards

A variety of physical hazards may be present during the Site activities. These hazards are similar to those associated with any construction-type project. These physical hazards are due to motor vehicle and heavy equipment operation, the use of power and hand tools, hazardous working surfaces, and handling and storage of fuels. These hazards are not unique and are generally familiar to most field personnel. Additional task-specific requirements will be covered during safety briefings.

5.2.1 Noise

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps, and generators. High noise operations will be evaluated at the discretion of the SHSO. Personnel with 8-hour time-weighted-average exposures exceeding 85 dBA must be included in a hearing conservation program in accordance with 29 CFR 1910.95.

5.2.2 Heat Stress

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of personal protective equipment (PPE) in hot weather environments.

Heat cramps are brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body resulting in painful muscle cramps. The signs and symptoms of heat cramps are as follows:

- severe muscle cramps, usually in the legs and abdomen;
- exhaustion, often to the point of collapse; and
- dizziness or periods of faintness.

First aid treatment includes shade, rest and electrolyte fluid replacement therapy. Normally, the individual should recover within one-half hour. If the individual has not recovered within 30 minutes and the temperature has not decreased, the individual should be transported to a hospital for medical attention.

Heat exhaustion may occur in a healthy individual who has been exposed to excessive heat while working. The circulatory system of the individual fails as blood collects near the skin in an effort to rid the body of excess heat. The signs and symptoms of heat exhaustion are as follows:

- rapid and shallow breathing;
- weak pulse;
- cold and clammy skin with heavy perspiration;
- skin appears pale;
- fatigue and weakness;
- dizziness; and
- elevated body temperature.

First aid treatment includes cooling the victim, elevating the feet, and replacing fluids and electrolytes. If the individual has not recovered within 30 minutes and the temperature has not decreased, the individual should be transported to the hospital for medical attention.

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a **MEDICAL EMERGENCY**, requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- dry, hot, red skin;
- body temperature approaching or above 105°F;
- large (dilated) pupils; and
- loss of consciousness - the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility.

Heat stress (heat cramps, heat exhaustion, and heat stroke) is a significant hazard if any type of PPE (semipermeable or impermeable) which prevents evaporative cooling is worn in hot weather environments. Local weather conditions may require restricted work schedules in order to adequately protect personnel. The use of work/rest cycles (including working in the cooler periods of the day or evening) and training on the signs and symptoms of heat stress should help prevent heat-related illnesses from occurring. Work/rest cycles will depend on the work load required to perform each task, type of protective equipment, temperature, and humidity. In general, when the temperature exceeds 88°F, a 15 minute rest cycle will be initiated once every two hours. In addition, potable water and fluids containing electrolytes (e.g., Gatorade) will be available to replace lost body fluids.

5.2.3 Cold Stress

Cold stress is a danger at low temperatures and when the wind-chill factor is low. Prevention of cold-related illnesses is a function of whole-body protection. Adequate insulating clothing must be used when the air temperature is below 40°F. In addition, reduced work periods followed by rest in a warm area may be necessary in extreme conditions. Training on the signs and symptoms of cold stress should prevent cold-related illnesses from occurring. The signs and symptoms of cold stress include the following:

- severe shivering;
- abnormal behavior;

- slowing;
- weakness;
- stumbling or repeated falling;
- inability to walk;
- collapse; and/or
- unconsciousness.

First aid requires removing the victim from the cold environment and seeking medical attention immediately. Also, prevent further body heat loss by covering the victim lightly with blankets. Do not cover the victim's face. If the victim is still conscious, administer hot drinks, and encourage activity, such as walking wrapped in a blanket.

6.0 TRAINING REQUIREMENTS

The HAZWOPER Rule (29 CFR 1910.120) requires that all personnel be trained to recognize on-site hazards, understand the provisions of this HASP, and be made aware of the responsible health and safety personnel. This section discusses the means to meet these requirements.

6.1 Basic Training

All Site personnel who will perform work in areas where the potential for toxic exposure exists will be health and safety-trained prior to performing work on-site, per OSHA 29 CFR 1910.120(e). Training records will be submitted to and maintained by the SHSO onsite, as described in Section 6.4.

6.2 Site-Specific Training

Health and safety-related training that will specifically address the activities, procedures, monitoring and equipment for the Site operations will be provided to all personnel and visitors by the SHSO. It will include the Site and facility layout, hazards, emergency services, and will detail all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand, and to reinforce their responsibilities regarding safety and operations for their particular activity. Site specific training will be documented and kept as part of the project records.

6.3 Safety Briefings

Project personnel will be given briefings by the SHSO on an as-needed basis to further assist them in conducting their activities safely. Safety briefings will be held when new operations are to be conducted, whenever changes in work practices must be implemented, before work is begun at each location, and each Monday morning. Records of safety briefings will be kept as part of the project records.

6.4 Record Keeping Requirements

All record keeping requirements mandated by OSHA 29 CFR 1910.120 will be strictly followed. Specifically, all personnel training records, injury/incident reports, medical examination records and exposure monitoring records will be maintained by Roux Associates and each contractor for a period of at least thirty years after the employment termination date of each employee. Pertinent health and safety training and medical certifications will be kept onsite during the field operations. The SHSO shall maintain a daily written log of all health and safety monitoring activities, and monitoring results shall become part of the project records.

7.0 MONITORING PROCEDURES FOR SITE OPERATIONS

The SHSO will record wind direction and temperature in the logbook. All monitoring equipment will be calibrated per the owner's manual which will be kept onsite, or at least monthly according to the Site's inspection rules.

7.1 Intrusive Operations

Data from previous investigations have identified the presence of organic compounds and metals in fill material. Air monitoring will be performed to establish the concentrations of the organic constituents during intrusive activities (e.g., drilling) using a photoionization detector (PID).

The SHSO will monitor the breathing zone with the PID in continuous operating mode and with the alarm activated. The alarm will be set at 5 parts per million (ppm), which is below the permissible exposure level (PEL) for all constituents of concern. If the PID indicates that total vapor exceeds the 5 ppm level, the SHSO will order cessation of the activity until all personnel within the work zone have donned a full face air purifying respirator, or until the nature of the hazard has been more thoroughly evaluated.

Dräeger tubes will be used to provide direct readings to establish the levels of benzene if the PID indicates that total vapor exceeds the 5 ppm level, to determine that personal protection is adequate. The Dräeger tubes will be chemical-specific to benzene, but will be conservatively biased high, and the readings will enable the SHSO to make an immediate decision on the level of protection. If any detections of benzene are noted based upon the Dräeger tube readings, the SHSO will order cessation of the work activity until:

- all potentially exposed personnel have donned Level C respiratory protection (full face, dual organic vapor/particulate cartridge respirator);
- the benzene levels are not detectable by the Dräeger tubes; or
- the nature of the hazard has been more thoroughly evaluated and it has been determined that the measured compound(s) was not benzene.

Particulate monitoring will be performed during intrusive activities. In addition to particulate monitoring, the following techniques may be employed to mitigate the generation and migration of dust during construction activities:

- misting equipment and excavation faces;
- covering excavated areas and material after excavation activity ceases;
- hauling materials in tarped or watertight containers; and
- applying water to haul roads.

Particulate monitoring will be performed downwind of the intrusive activity with a portable particulate monitor that will have the alarm set at 150 micrograms per cubic meter ($\mu g/m^3$). If the downwind particulate levels exceed 120 $\mu g/m^3$ over 15 minutes, the particulate levels upwind of the activity will be measured. If the downwind level is more than 80 $\mu g/m^3$ greater than the upwind particulate level, work will be stopped and corrective action will be taken (i.e., misting).

7.2 Non-Intrusive Operations

Based on the current understanding of Site conditions, monitoring may be performed using Dräeger tubes on the first day of non-intrusive operations, and periodically thereafter if the PID readings indicate a more accurate assessment is warranted.

8.0 MEDICAL SURVEILLANCE REQUIREMENTS

Medical surveillance specifies any special medical monitoring and examination requirements as well as stipulates that all Roux Associates personnel and contractors are required to pass the medical surveillance examination or equivalent for hazardous waste work required by 29 CFR 1910.120. As a minimum, the examination will include:

- complete medical and work histories;
- EKG;
- urinalysis;
- physical exam;
- eye exam;
- blood chemistry;
- pulmonary function test; and
- audiometry.

The examination will be taken annually, at a minimum, and upon termination of employment with the company if the employee desires. Additional medical testing may be required by the OHSM in consultation with the company physician, and the SHSO if an overt exposure or accident occurs, or if other Site conditions warrant further medical surveillance.

9.0 ZONES, PROTECTION AND COMMUNICATIONS

Work zones, levels of personal protection, and means of communication are described below.

9.1 Site Zones

Roux Associates may employ the following three zone approach to Site operations.

- the Work Zone;
- the Contamination Reduction Zone; and
- the Support Zone.

9.1.1 Work Zone

The Work Zone is the area where work will be conducted. The Work Zone will be designated by a temporary barrier consisting of red barricade tape. No personnel shall work in the Work Zone without a buddy. All workers within the Work Zone shall wear the proper PPE (see Section 9.2). No unauthorized persons will be allowed in the Work Zone during Site activities.

No personnel are allowed in the Work Zone without:

- a buddy;
- the proper PPE;
- medical authorization; and
- training certification.

9.1.2 Contamination Reduction Zone

A Contamination Reduction Zone (CRZ) will be established between the Work Zone and the Support Zone. The CRZ will provide for full personnel and portable equipment decontamination (Section 9.3). The CRZ will also contain safety and emergency equipment such as first aid equipment (bandages, blankets, eye wash) and containment equipment (adsorbent, fire extinguisher).

9.1.3 Support Zone

The Support Zone is considered the uncontaminated area and will provide for team communications and emergency response. Appropriate safety and support equipment will be located in this zone. The Support Zone will be located upwind of Site operations, if possible and may be used as a potential evacuation point. No potentially contaminated personnel or materials are allowed in this zone except appropriately packaged/decontaminated and labeled samples, and drummed wastes.

9.2 Personal Protection

This section describes the levels of protection that will be required by on-site personnel during the remediation activities.

9.2.1 General

The level of protection to be worn by field personnel and visitors will be defined and controlled by the SHSO with approval of the OHSM and PM. Where more than one hazard area is indicated, further definition shall be provided by review of Site hazards, conditions, and operational requirements and by monitoring at the particular operation being conducted.

During intrusive activities, continuous monitoring will be performed using the PID. Dräeger tubes will also be used for initial and periodic real-time measurements of benzene. The use of Dräeger tubes for benzene will allow the SHSO to make an immediate decision on the adequacy of protection against this compound. Should the PID or Dräeger tubes indicate that the PEL for benzene has been exceeded, work will cease in this area until:

- workers have donned a full face air purifying respirator; or
- the concentration levels for benzene are below the Dräeger tube detection levels.

Protection may be upgraded or downgraded by the SHSO in conjunction with the OHSM based upon the PID instrument and Dräeger tube results.

9.2.2 Respiratory Protection and Clothing

Three levels of protective equipment are discussed below including Level D, Level C, and Level B.

Level D Protection

1. PPE:
   - Cotton coveralls or long pants and long sleeved shirt
   - Cotton or leather gloves
   - Boots/shoes, leather or chemical-resistant, steel toe and shank
   - Boots (outer), chemical-resistant (disposable) (optional)
   - Safety glasses or chemical splash goggles
   - reflective traffic safety vest
   - Hard hat
   - Escape mask (optional)

2. Criteria for selection

   PID readings in the breathing zone are less than 5 ppm, and benzene is not detected using Dräeger tubes. Work functions preclude splashes, immersion, or potential for unexpected inhalation of any chemicals.

NOTE: Modifications of Level D will be used to increase the level of skin protection during activities which increase the degree of contact with chemical hazards. These modifications include the use of chemical/corrosion resistant coveralls, and chemical resistant gloves.

Level C Protection

1. PPE:
   - Full face, air purifying, cartridge-equipped respirator (Mine Safety and Health Administration [MSHA]/National Institute for Occupational Safety and Health [NIOSH] approved)
   - Chemical-resistant clothing (coverall; hooded, two-piece chemical splash suit; chemical-resistant hood and apron; disposable chemical-resistant coveralls)
   - Cotton or synthetic coveralls*

   Gloves (inner), chemical-resistant - latex

- Gloves (outer), chemical-resistant - nitriles
- Boots (inner), chemical-resistant, steel toe and shank
- Boots (outer), chemical-resistant (disposable)
- Hard hat (face shield)
- Escape mask
- 2-Way radio communications (intrinsically safe)*

*Optional

2. Criteria for selection
   - Continuous total vapor readings register between 5 ppm and 25 ppm on PID, and benzene is not detected with Dräeger tubes.
   - Measured air concentrations of identified substances (organic vapors) will be reduced by the respirator to at or below the substance's exposure limit, and the concentration is within the service limit of the canister.
   - Atmospheric contaminant concentrations do not exceed Immediately Dangerous to Life and Health (IDLH) levels.
   - Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect the small area of skin left unprotected by chemical-resistant clothing.
   - Job functions have been determined not to require self-contained breathing apparatus.

<u>Level B Protection</u>

1. PPE:
   - Pressure-demand, self-contained breathing apparatus (MSHA/NIOSH approved)
   - Chemical-resistant clothing (overall and long-sleeved jacket; coveralls; hooded, one or two-piece chemical-splash suit; disposable chemical-resistant coveralls)
   - Coveralls
   - Gloves (inner), chemical-resistant - latex
   - Gloves (outer), chemical-resistant - nitriles
   - Boots (inner), chemical-resistant, steel toe and shank
   - Boots (outer), chemical-resistant (disposable)
   - Hard hat (face shield)

- 2-way radio communications (intrinsically safe)

2. Criteria for Selection

   Meeting any one of these criteria warrants use of Level B protection:

   - PID readings in the breathing zone are greater than 25 ppm and less than 500 ppm, or benzene is detected, but less than 100 ppm utilizing Dräeger tubes.
   - The type(s) and atmospheric concentration(s) of toxic substance(s) have been identified and require the highest level of respiratory protection, but a lower level of skin and eye protection. These would be atmospheres:
     - -- with IDLH concentrations

       or
     - -- exceeding limits of protection afforded by a full face, air purifying mask

       or
     - -- containing substances requiring air-supplied equipment, but substances and/or concentrations do not represent a serious skin hazard.
   - The atmosphere contains less than 19.5% oxygen.
   - Operations at the Site make it highly unlikely that the small, unprotected arc of the head or neck will be contacted by splashes of extremely hazardous substances.
   - If work is performed in an enclosed space.

It is anticipated that work will be conducted during the spring and summer months in wooded and/or densely vegetated areas where ticks may be present. Therefore, all personnel working in the above-referenced areas are advised to wear the following:

- light colored hat/cap;
- light colored pants; and
- light colored, long sleeved shirt.

Additionally, all personnel are advised to apply insect repellant to clothing prior to entering wooded and/or densely vegetated areas.

9.3 Decontamination Procedures

A steam cleaner will be utilized to decontaminate heavy equipment used in drilling. Personnel should exercise caution when using a steam cleaner. The high pressure steam can cause burns. Protective gloves, face shields, hard hats, steel-toed boots, and Tyvek suits or rain gear will be worn when using steam cleaners.

9.3.1 Contamination Prevention

Adequate contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include the following:

Personnel

- Do not walk through areas of obvious or known contamination;
- Do not handle contaminated materials directly;
- Make sure all PPE has no cuts or tears prior to donning;
- Fasten all closures on suits, covering with tape, if necessary;
- Take particular care to protect any skin injuries;
- Stay upwind of airborne contaminants;
- Do not carry cigarettes, gum, etc., into contaminated areas; and
- Use disposables to cover nondisposable equipment when contact is probable.

Sampling/Monitoring

- When required by the SHSO, cover instruments with clear plastic, leaving opening for sampling and exhaust ports; and
- Bag sample containers prior to the placement of sample material.

Heavy Equipment

- Care should be taken to limit the amount of contamination that comes in contact with heavy equipment;
- If contaminated tools are to be placed on non-contaminated equipment for transport to the decontamination pad, plastic should be used to keep the equipment clean; and
- Excavated soils should be contained and kept out of the way of workers.

9.3.2 Decontamination

All personnel and equipment exiting the Work Zone shall be thoroughly decontaminated. Figures C-2, C-3 and C-4 illustrate decontamination procedures for Levels D, C and B, respectively. Safety briefings shall explain the decontamination procedures for personnel and portable equipment for the various levels of protection. Heavy equipment will be decontaminated with a steam cleaner.

9.3.3 Disposal Procedures

All discarded materials, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left at the Site. All potentially contaminated materials (e.g., soil, clothing, gloves, etc.) will be bagged or drummed, as necessary, and segregated for disposal. All contaminated materials shall be disposed of in accordance with appropriate regulations. All non-contaminated materials shall be collected and bagged for appropriate disposal as normal domestic waste. All waste disposal operations conducted by Roux Associates will be monitored by the SHSO and carried out under the appropriate level of personal protection.

9.4 Standard Operating Procedures/Safe Work Practices

This section discusses safe work practices to be used during all activities. In addition, non-monitoring safety-related procedures are described.

9.4.1 Communications

- Telephones -- A telephone will be available for communication with emergency support services/facilities.
- Hand Signals -- To be employed by personnel required to have Level C protection. They shall be known by the entire field team before operations commence and covered during Site specific training.

The following hand signals will be used, if needed:

Signal	Meaning
Hand gripping throat	Out of air, can't breath
Grip partner's wrist	Leave area immediately
Hands on top of head	Need assistance
Thumbs up	I'm all right, okay
Thumbs down	No, negative

9.4.2 Traffic Safety Practices

When performing field work at locations where the possibility of vehicular traffic exists (e.g., roads, road shoulders, parking lots, driveways) the following traffic safety procedures must be followed:

- Fluorescent vests and hard hats, as well as any other applicable PPE specified in the HASP, must be worn at all times.
- The worker's vehicle should be positioned, to the fullest extent possible, to form a barrier between the worker(s) and oncoming traffic. In addition, each work vehicle will be equipped with a minimum of four high visibility traffic cones. All traffic cones will be placed as necessary to alert traffic of ongoing activities.
- In high volume traffic areas or areas with unpredictable traffic patterns, a traffic watchman or police detail should be utilized. The traffic watchman must be equipped with a warning flag and remain alert and focused on traffic conditions at all times. The need for a traffic watchman or police detail should be discussed with the Project Manager and client prior to deployment.
- Notify the local police of the work location, dates of work and the anticipated work times when work is to be conducted in a public roadway.
- Additional requirements of local transportation, highway, public safety and police departments must also be followed when work is performed in a public roadway.

- Any time work is initiated or there is a change in the type of work or location of work, the SHSO should consider the potential traffic safety hazards. If appropriate, implement protective measures in addition to those described above.
- Daily safety briefings should include a discussion of traffic safety as it relates to the activities planned for that day.
- All Roux Associates subcontractors performing work at the Site must also adhere to the above safety procedures.

9.4.3 General Safe Work Practices

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand to mouth contact and ingestion of material is prohibited onsite except in lunch room or designated office areas.
- Hands must be washed thoroughly upon leaving the Work Zone or before eating, drinking, or any other activities.
- Contaminated protective equipment shall not be removed from the Site until it has been decontaminated and properly packaged and labeled.
- Portable eyewash stations shall be located in the decontamination staging area in the Support Zone.
- No facial hair, which interferes with a satisfactory fit of respiratory equipment, will be allowed on personnel that may be required to wear respiratory protective equipment.
- An emergency first aid kit and fire extinguisher shall be onsite in the Support Zone at all times.
- All respiratory protection selected to be used onsite shall meet MSHA/NIOSH requirements for the existing contaminants.
- Any skin contact with surface and ground water shall be avoided.
- No contact lenses may be worn.

9.4.4 Waste Disposal

All waste disposal operations shall be monitored by the SHSO and performed using the appropriate level of personal protection. Personnel shall wear the prescribed clothing, especially eye protection and chemical resistant gloves, when handling or drumming waste materials. Contamination avoidance shall be practiced at all times.

9.4.5 Heavy Equipment and Drill Rig Safety

Typical machinery to be found at this site may include pumps, compressors, generators, portable lighting systems, fork lifts, trucks, dozers, backhoes, and drill rigs. From a safety standpoint, it is important for all site workers to be continually aware of the equipment around them. It poses a serious hazard if not operated properly, or if personnel near machinery cannot be seen by operators.

Drilling crews are confronted with all of these heavy equipment hazards. They must be responsible for housekeeping around the rig because of the rods, auger sections, rope, and hand tools cluttering the operation. Maintenance is a constant requirement. Overhead and buried utilities require special precautions because of electrical and natural gas hazards. Electrical storms may seek out a standing derrick. The hoist or cathead rope poses specific hazards that must be respected. A clean, dry, sound rope should always be used. Hands should be kept away from the test hammer. Hearing loss, while not an immediate danger, is considerable over time. Hearing protection must be worn.

9.4.6 Confined Space Entry

The scope of work does not require personnel to enter any confined space during the conduct of this project. Confined space is defined as having limited or restricted means of entry or exit, is large enough for an employee to enter and perform assigned work, and is not designed for continuous occupancy by the employee. These spaces include, but are not limited to, underground vaults, tanks, storage bins, pits and diked areas, vessels, and silos.

A permit-required confined space is one that meets the definition of confined space, and has one or more of the following characteristics:

- contains or has the potential to contain a hazardous atmosphere;
- contains a material that has the potential for engulfing an entrant;
- has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section; and/or
- contains any other recognized serious safety or health hazards.

10.0 EMERGENCY PLAN

As a result of the hazards onsite and the conditions under which operations are conducted, the possibility of an emergency exists. An emergency plan is required by OSHA 29 CFR 1910.120 to be available for use and is included below. A copy of this plan shall be posted in the Support Zone at each work site.

10.1 Site Emergency Coordinator(s)

The SHSO shall act as the Site Emergency Coordinator to make contact with the local fire, police and other emergency units prior to beginning work onsite. In these contacts, the SHSO will inform the emergency units about the nature and duration of work expected at the Site and the type of contaminants and possible health or safety effects of emergencies involving these contaminants.

The SHSO or his designee shall implement this emergency plan whenever conditions at the Site warrant such action. The coordinator(s) will be responsible for assuring the evacuation, emergency treatment, emergency transport of personnel as necessary, and notification of emergency response units and the appropriate management staff.

10.2 Evacuation

In the event of an emergency situation, such as fire, explosion, significant release of particulates, etc., an air horn or other appropriate device will be sounded by the SHSO for approximately ten seconds indicating the initiation of evacuation procedures. All persons in both the restricted and non-restricted areas will evacuate and assemble near the Support Zone or other safe area as identified in advance by the SHSO. Under no circumstances will incoming personnel or visitors be allowed to proceed into the evacuated area once the emergency signal has been given. The SHSO must see that access for emergency equipment is provided and that all combustible apparatus has been shutdown once the alarm has been sounded. Once the safety of all personnel is established, the fire department and other emergency response groups will be notified by telephone of the emergency. The hospital route will be posted onsite (Figure C-1). Any other excavation routes will be specified by the appropriate emergency personnel.

10.3 Potential or Actual Fire or Explosion

If the potential for a fire exists or if an actual fire or explosion occurs, the following procedure will be implemented:

- immediately evacuate the Work Zone as described above (Section 10.2); and
- notify fire department and security.

10.4 Environmental Incident (Release or Spread of Contamination)

The SHSO shall instruct a person onsite to immediately contact police and fire authorities to inform them of the possible or immediate need for nearby evacuation. If a significant release (above the reportable quantity as described in 40 CFR 302) has occurred, the National Response Center and other appropriate groups should be contacted. Those groups will alert National or Regional Response Teams as necessary. The personnel listed below shall be notified as necessary.

Name	Type	Telephone #
Fire Department	Port Washington Fire Department	(516)883-0224
Hazardous Material Emergency Response		911
Police Department	Sands Point Police Department	(516)883-3100
Ambulance		911
Poison Control Center	Phelps Memorial Hospital	(914)366-3030
Hospital	North Shore University Hospital	(516)829-9666
National Response Center (Release or Spill)		(800) 424-8802
Site Health and Safety Officer		On-Site
Office Health and Safety Manager	Thomas R. Dwyer	(631) 232-2600 (During Normal Business Hours)
Project Manager	Scott Glash	(631) 232-2600 (During Normal Business Hours)

10.5 Personal Injury

Emergency first aid shall be applied onsite as deemed necessary to stabilize the patient. Notify the emergency units as deemed necessary.

10.6 Overt Personnel Exposure

If an overt exposure to toxic materials should occur, the exposed person shall be treated onsite as follows:

Skin Contact:	Wash/rinse affected area thoroughly with copious amounts of soap and water, then provide appropriate medical attention. An eyewash and/or emergency shower or drench system will be provided onsite at the CRZ and/or support zone, as appropriate. Eyes should be rinsed for at least fifteen (15) minutes upon chemical contamination.
Inhalation:	Move to fresh air and/or if necessary, decontaminate and transport to the hospital.
Ingestion:	Decontaminate and transport to emergency medical facility.
Puncture Wound or Laceration	Decontaminate and transport to emergency medical facility. SHSO will provide medical data sheets to medical personnel as requested. The on-site first aid kit will include sterile materials to control bleeding en-route to the hospital.

10.7 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO will determine if work can continue without sacrificing the health and safety of field workers. Some of the items to be considered prior to determining if work should continue are:

- heavy rainfall;
- potential for heat stress;
- potential for cold stress and cold-related injuries;
- limited visibility;
- potential for electrical storms;
- potential for malfunction of health and safety monitoring equipment or gear; and
- potential for accidents.

11.0 AUTHORIZATIONS

Personnel authorized to enter the Site while operations are being conducted must be approved by the SHSO and the Project Manager. This document will be completed when the subcontractors have assigned trained personnel for the Site. Authorization will require completion of appropriate training courses, medical examination requirements as specified by OSHA 29 CFR 1910.120, and review and sign-off of this HASP.

The following Roux Associates personnel are authorized to perform work onsite:

1. Scott Glash
2. Joseph Duminuco
3. James Wissing
4. Robert Tweeddale
5. Eric Kramer
6. Peter Barczak

Other personnel authorized to enter the Site are:

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

12.0 FIELD TEAM REVIEW

Each person entering the Site and each field member shall sign this section after site-specific training is completed and before being permitted to work onsite.

I have read and understand this Site Specific Health and Safety Plan. I will comply with the provision contained therein.

Site/Task:____

Name Printed	Signature	Date

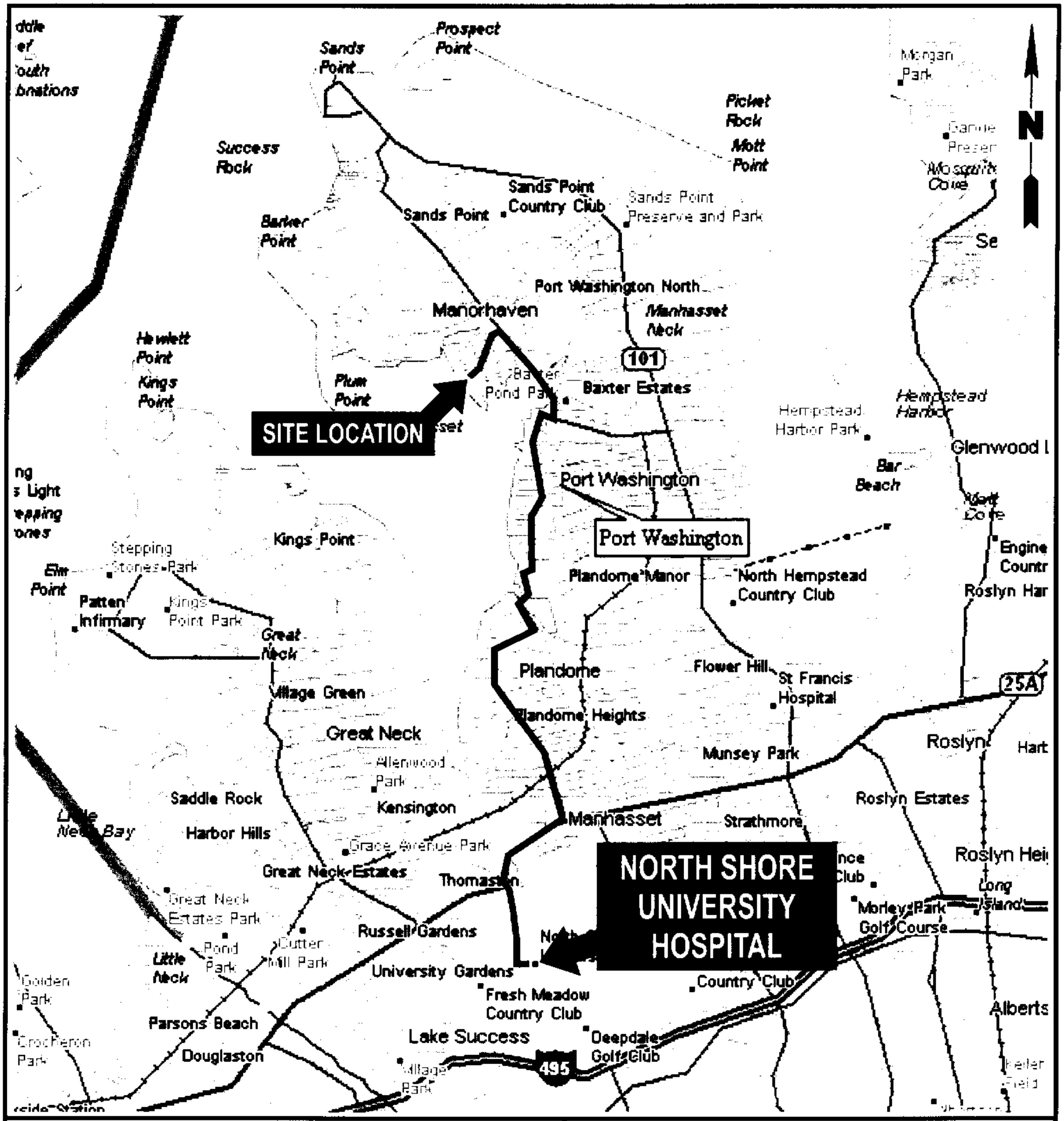
Table C-1. **Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Former Thypin Steel, Inc. Plant, Manorhaven, New York.**

Compound	CAS#	TLV	IDLH (ppm)	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Tetrachloroethene	127-18-4	339* 50 ppm	150 ppm	170* 25 ppm	Dermal; inhalation; ingestion	CNS depressant Sensory irritant Narcosis	eyes, skin, liver, resp system	Liquid BP = 250°F FP = NA°F
Trichloroethene	79-01-6	269* 50 ppm	1000 ppm	270* 50 ppm	Dermal; inhalation; ingestion	Irritate eyes, skin, Head, tremor, nausea, vomiting	eyes, skin, rep system, heart, liver	Liquid BP = 189°F Flammable LEL = 8.0% UEL = 10.5%
Trichloroethane	79-00-5	55* 10 ppm	100 ppm	45* 10 ppm	Dermal; inhalation; ingestion	CNS depressant Liver damage Kidney damage Defatting of skin	CNS liver kidney eyes	Liquid sweet odor BP = 237°C Flammable LEL = 6% UEL = 15.5%
Dichloroethene	540-59-0	793* 200 ppm	1000 ppm	790* 200 ppm	Dermal; inhalation; ingestion	Irrit eyes Resp sys CNS depres	CNS eyes resp system	Liquid Flammable BP = 118-140°F FP = 36-39°F
Dichloroethane	75-34-3	810* 200 ppm	3000	400* 100 ppm	Dermal; inhalation; ingestion	Irrit eyes Resp sys Muc memb	Liver Kidneys lungs skin	Colorless liquid BP = 135°F UEL = 11.4% LEL = 5.4% Flammable
Dichlorobenzene	95-50-1	None	200	None	Dermal; inhalation; ingestion	Kidney damage Eyes, skin, Blisters, nose	liver kidneys lungs skin	Colorless liquid Combustible BP = 357°F UEL = 9.2% LEL = 2.2%

Table C-1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Former Thypin Steel, Inc. Plant, Manorhaven, New York.

Compound	CAS#	TLV	IDLH (ppm)	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Vinyl Chloride	75-01-4	None	NA	None	Dermal; inhalation	Abdom pain frostbite enlarged liver	liver CNS Blood resp system	Colorless gas BP = 7°F UEL = 33.0% LEL = 3.6%
Carbon Tetrachloride	56-23-5	31* 5 ppm	200 ppm	12.6* 2 ppm	Inhalation; Ingestion Dermal	Irrit eyes, CNS, Depress, Naus, Vomit, Drow, dizzy	CNS eyes Lungs liver kidneys	Colorless liquid BP = 170°F UEL = NA LEL = NA
Chromium	7440-47-3	0.5 mg/m^3	None	1 mg/m^3	Dermal; Inhalation; Ingestion	Decreased pulmonary function; Sensory irritant	Lung Skin Eyes	Steel grey metal
Beryllium	7440-41-7	0.0005 mg/m^3	10 mg/m^3	0.002 mg/m^3	Inhalation	Resp System Weight Loss	Lungs Skin Eyes	Hard, brittle grey solid BP = 4532°F
Zinc	7440-66-6	10 mg/m^3	None	10 mg/m^3	Dermal; Inhalation; Ingestion	Skin irritant Cough	Skin Eyes	Bluish-white metallic element BP = 908°F

TLV - Threshold Limit Value - must not be exceeded over 8 hour shift
IDLH - Immediately Dangerous to Life and Health - maximum concentration from which one could escape in 30 minutes without a respirator
PEL - Permissible Exposure Limit - must not be exceeded over 8 hour shift
mg/m^3 - milligrams per cubic meter
ppm - Part Per Million
CNS - Central Nervous System
CVS - Cardiovascular System
GI tract - Gastrointestinal tract
BP - Boiling Point
FP - Flash Point
UEL - Upper Explosive Limit
LEL - Lower Explosive Limit
°F - degrees Fahrenheit
°C - degrees Celsius
* - mg/m^3



DIRECTIONS TO HOSPITAL

- From site, travel north on Sagamore Hill Drive.
- Turn right onto Manhasset Avenue.
- Turn right onto Main Street (Becomes Plandome Road).
- Turn right onto Northern Boulevard.
- Turn left onto Community Drive.
- North Shore Community Hospital is on left side.

Title:

HOSPITAL ROUTE MAP

NORTH SHORE UNIVERSITY HOSPITAL
MANHASSET, NEW YORK

Prepared for:

FORMER THYPIN STEEL, INC. PLANT
MANORHAVEN, NEW YORK

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: E.K.	Date: 18MAR00	FIGURE C-1
Prepared by: B.H.CICIO	Scale: AS SHOWN	
Project Mgr.: S.G.	Office: NY	
File No.: MBA0110208.CDR	Project No.: 77101Y	

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TYPICAL DECONTAMINATION LAYOUT
LEVEL D DECONTAMINATION PROCEDURES

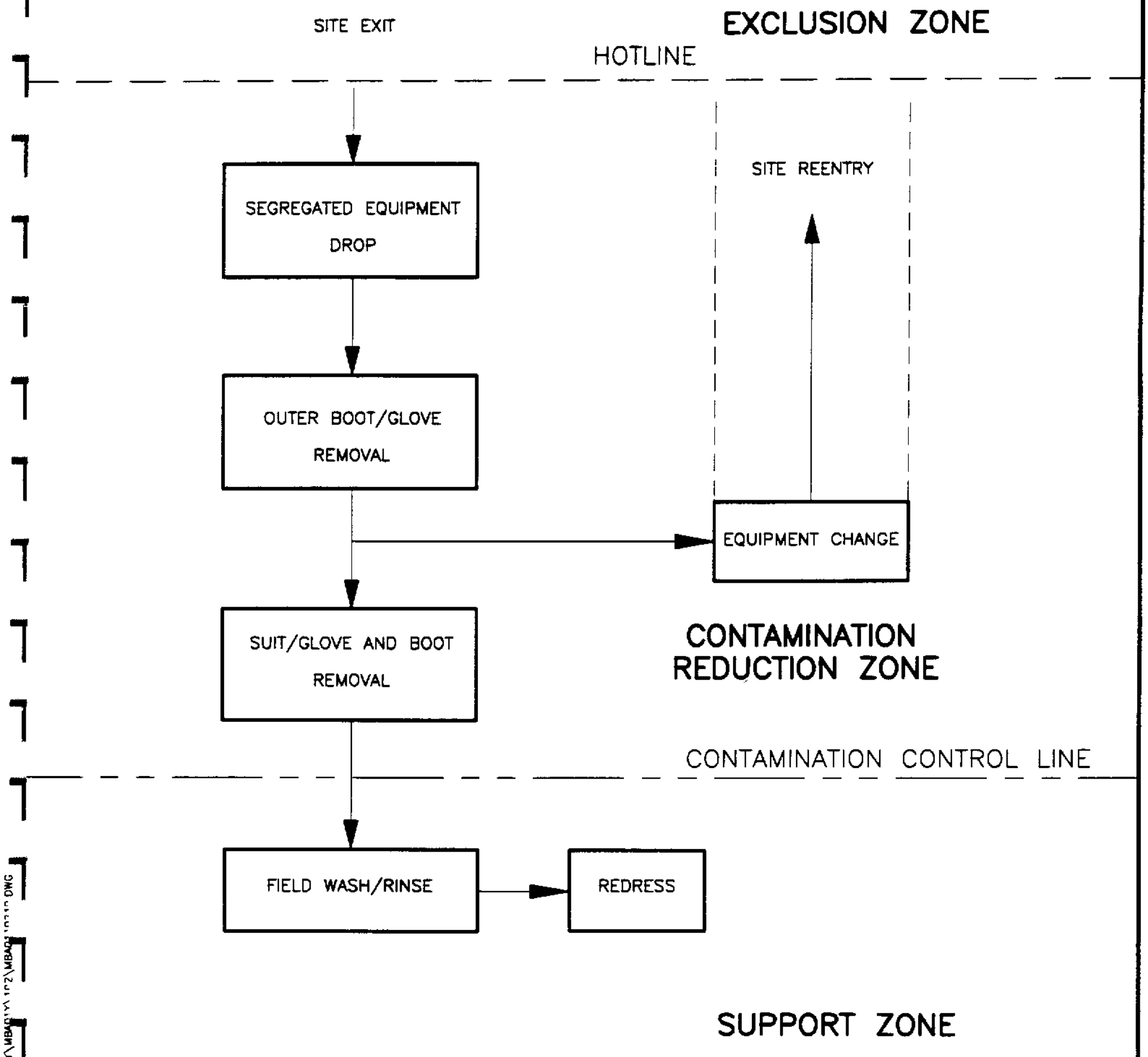

FIGURE C-2

TYPICAL DECONTAMINATION LAYOUT
LEVEL C PROTECTION

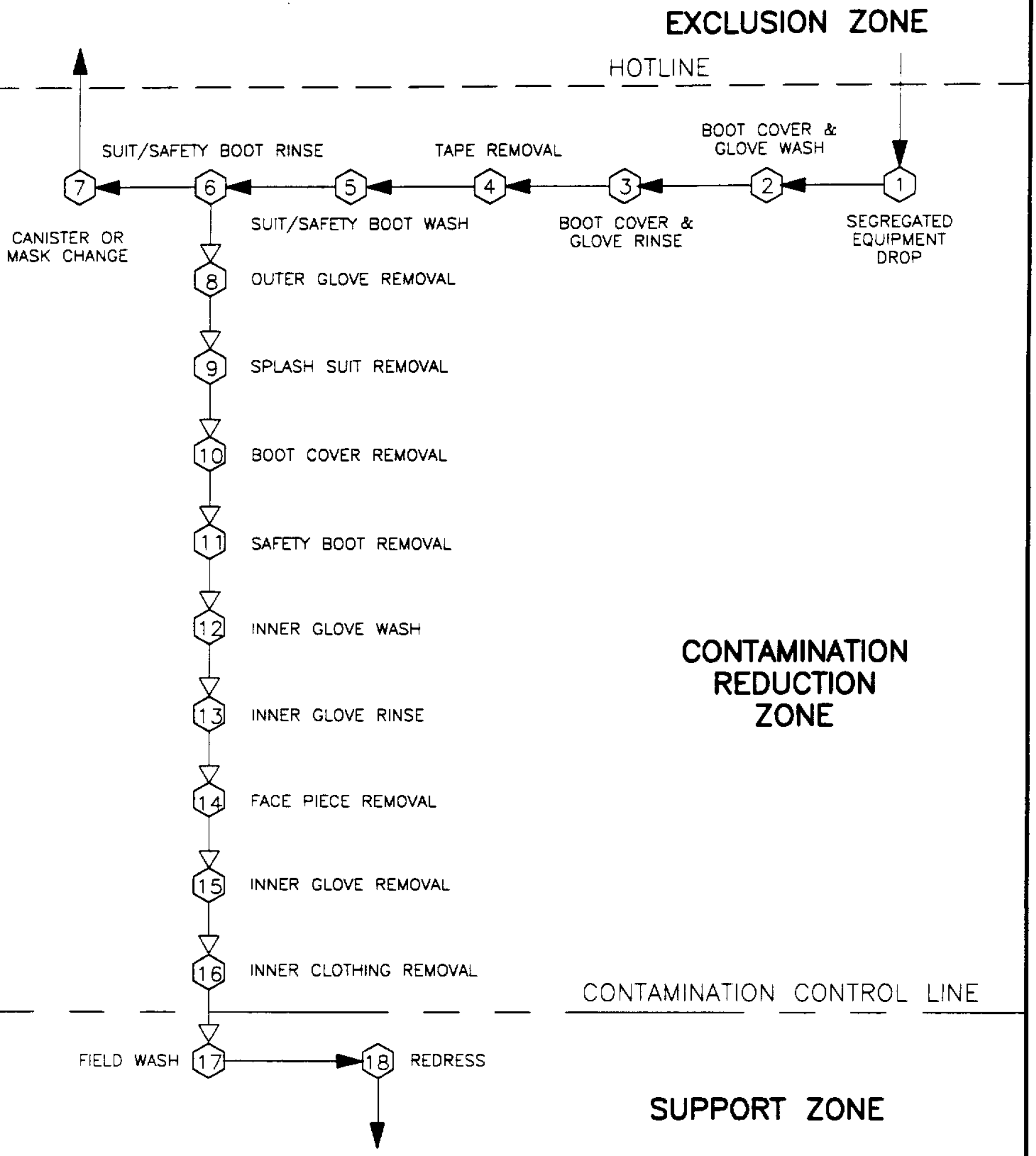

FIGURE C-3

TYPICAL DECONTAMINATION LAYOUT
LEVEL B PROTECTION

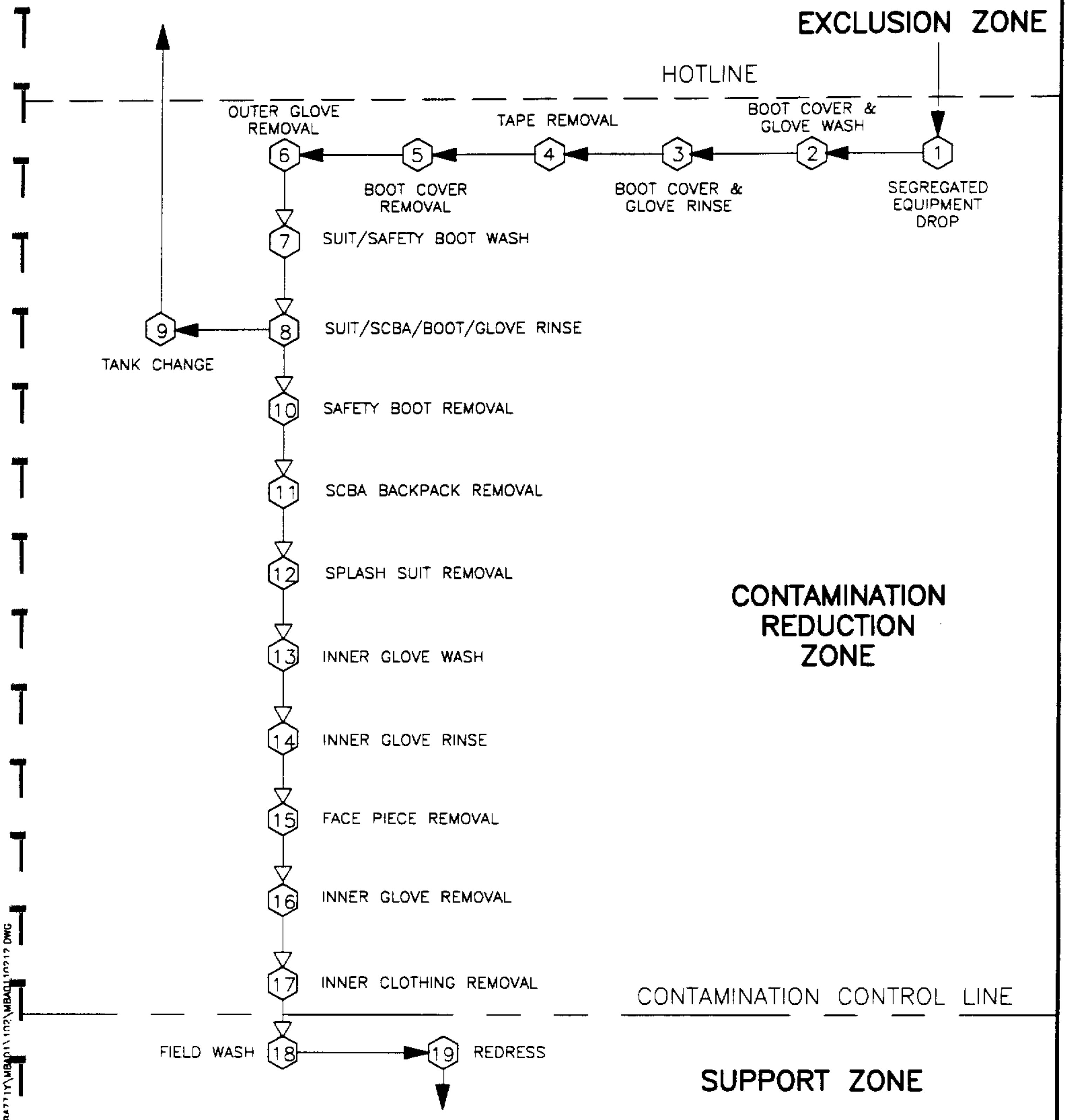

FIGURE C-4

ATTACHMENT C-1

Incident Report

INCIDENT REPORT

Project # ______________________________

Project Name ______________________________ **Date** ____________________

Site Location ____

Report Prepared By ____

Name Printed Title

Incident Category (Check all that apply)

______ **Injury**[1]
______ **Near Miss**
______ **Motor Vehicle**
______ **Mechanical**
______ **Illness**
______ **On-Site Equipment**
______ **Fire**
______ **Other**
______ **Property Damage**
______ **Chemical Exposure**
______ **Electrical**

Date and Time of Incident: ____

Names of Persons Injured (see Injury Report for details) ______________________________

____

____

____

____

NARRATIVE REPORT OF INCIDENT

(Provide sufficient detail so that the reader may fully understand the actions leading to or contributing to the incident, the incident occurrence, and actions following the incident. Append additional sheets of paper if necessary.)

____

____

____

____

---

[1] For an injury, complete Injury Report Form

Project # ____________________
Project Name: ____________________
Location: ____________________
Date: ____________________

WITNESSES TO INCIDENT

1. Name Company

Address ____

Telephone No. ____________________________________

2. Name ____________________ Company ____________________

Address ____

Telephone No. ____________________________________

PROPERTY DAMAGE

Brief Description of Property Damage ______________________________

Estimate of Damage ____________________________________

INCIDENT LOCATION

INCIDENT ANALYSIS

Causative agent most directly related to accident (object, substance, material, machinery, equipment, conditions): ______________________________

Project # ______________________
Project Name: ______________________
Location: ______________________
Date: ______________________

INCIDENT REPORT

Page 3 of 4

Was weather a factor? ______________________

Unsafe mechanical/physical/environmental condition at time of incident (be specific) ______________________

Unsafe act by injured and/or others contributing to the incident (be specific, must be answered) ______________________

Personal factors (improper attitude, lack of knowledge or skill, slow reaction, fatigue) ______________________

ON-SITE INCIDENTS

Level of personal protection equipment required in Site Safety Plan ______________________

Modifications ______________________

Was injured using required equipment? ______________________

INCIDENT REPORT
Page 4 of 4

Project # __________
Project Name: __________
Location: __________
Date: __________

INCIDENT FOLLOW-UP

Date of Incident __________

Site __________

Brief Description of Incident __________

Outcome of Incident __________

Physician's Recommendations (if any) __________

Date Injured Returned to Work __________

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

ATTACHMENT C-2

Site Safety Follow-Up Report

Project # ____________________

Project Name: ____________________

Location: ____________________

Date: ____________________

SITE SAFETY FOLLOW-UP REPORT

This section must be filled out and returned to the Site Safety Officer after each site visit or task.

Person Responsible for Follow-up Report ____________________

Actual Date of Work ____________________

ACTUAL SITE INVESTIGATION TEAM

Roux Personnel	Responsibility

Other Interested Parties	Affiliation	Purpose of Visit

Project # ______________________
Project Name: ______________________
Location: ______________________
Date: ______________________

PERSONAL PROTECTIVE EQUIPMENT

Level of Respiratory Protection Used	Activity Performed

Field Dress	Activity

MONITORING EQUIPMENT

HNU/OVA/CGI

- Background reading
  - Readings above background? ______________________
  - Location of high readings ______________________

Radiation

- Readings above background? _____ Yes _____ No
- If yes, specify where readings were found and what action was taken

Project # ____________________
Project Name: ____________________
Location: ____________________
Date: ____________________

GENERAL SAFETY

Were any safety problems encountered while on site? Explain

____
____
____
____

ACCIDENT REPORT INFORMATION

Did Any Team Member Report	Yes	No
- Chemical exposure	______	______
- Illness, discomfort, or unusual symptoms	______	______
- Environmental problems (heat, cold, etc.)	______	______

Explain ____
____
____
____
____

Was an Employee Exposure/Injury Incident Report Completed? _____ Yes _____ No

ATTACHMENT C-3

Health and Safety
Field Change Request Form

Project # ______________________
Project Name: ______________________
Location: ______________________
Date: ______________________

FIELD CHANGE REQUEST

SITE SAFETY REVIEW – CHANGES AND OVERALL EVALUATION
(To Be Completed For Each Field Change In Plan)

Was the Safety Plan Followed as presented ____ Yes ____ No

Describe, in detail, all changes to the Safety Plan

____

____

____

____

____

Reason for changes

____

____

____

____

Follow-up, Review and Evaluation Prepared by: ______________________ Date __________

Discipline ____

Approved by: Site Manager ______________________ Date __________

Site Safety Officer ______________________ Date __________

Office Health & Safety Supervisor ______________________ Date __________

Evaluation of Site Safety Plan:

Was the Safety Plan adequate? ____ Yes ____ No

What changes would you recommend?

____

____

____

____