REMEDIAL INVESTIGATION/
FEASIBILITY STUDY WORK PLAN
QUANTA RESOURCES SITE
LONG ISLAND CITY, QUEENS, NEW YORK

Prepared for :

QUANTA SITE
ADMINISTRATIVE
GROUP

Prepared by :

Golder Associates

PROJECT No.
023-6151

SEPTEMBER 2002

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PROJECT No. 023-6151

SEPTEMBER 2002

New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 2
47-40 21ST Street, Long Island City, NY 11101-5407
Phone: (718) 482-4995 • **FAX:** (718) 482-6358
Website: www.dec.state.ny.us

Erin M. Crotty
Commissioner

By Fax (856) 616-8166

April 11, 2003

Mr. Randolph S. White, P.E.
Principal
Golder Associates Inc.
1951 Old Cuthbert Road, Suite 301
Cherry Hill, NJ 08034

Re: Quanta Resources Site, Site ID No. 241005
Draft Remedial Investigation/Feasibility Study Work Plan

Dear Mr. White:

The New York State Department of Environmental Conservation, Division of Environmental Remediation (Department) reviewed the following documents pertinent to the referenced site prepared by you company:

1) Draft Remedial Investigation / Feasibility (RI/FS) Study Work Plan for Phase I of the RI/FS, dated September 2002;

2) September 19, 2002 transmittal letter of the Draft RI/FS Work Plan;

3) January 22, 2002 Quality Assurance Manual of the Sampling and Analysis Plan;

4) December 19, 2002 transmittal letter of Quality Assurance Manual of the Sampling and Analysis Plan.

The Department has several comments on the Draft RI/FS Work Plan for Phase I of the RI/FS and Sampling and Analysis Plan / Quality Assurance Manual, which are attached to this letter. These comments, which include input from the Bureau of Environmental Exposure Investigation of the New York State Department of Health, must be addressed before Draft RI/FS Work Plan can be approved by the Department, and the revised RI/FS Work Plan shall be submitted to the Department for review and approval.

Also please note that effective of the date of this letter, Mr. Dave Harrington, P.E. in the Department's Central Office will be a DEC manager and a primary contact person for this project. In the future, please address all correspondence regarding this project to Mr. Harrington at the following address:

Mr. David Harrington, P.E.
Senior Environmental Engineer
NYSDEC
Division of Environmental Remediation
Remedial Bureau B, 12th Floor
625 Broadway, Albany, NY 12233-7016

From now on please send Mr. Harrington three copies of all submittals instead of one (with one unbound) and send me one copy instead of four copies. Please include me on a cc list for all your future correspondence to Mr. Harrington.

If you have any questions regarding this matter please contact me at (718) 482-4891 or Mr. Harrington at (518) 402-9774.

Respectfully,

Vadim Brevdo, P.E.
Environmental Engineer

attachment

cc (with attachment):
- Denise D'Ambrosio (NYSDEC, Tarrytown)
- Amar Nagi (NYSDEC, Region 2)
- Daniel Walsh (NYSDEC, Region 2)
- David Harrington (NYSDEC, Albany)

Attachment to the Department's April 11, 2003 letter

Comments on the Draft RI/FS Work Plan for Phase I of the RI/FS and Sampling and Analysis Plan / Quality Assurance Manual

1) **Section 2.1 (General Site Description), page 2 and Section 2.3.1 (Site Description), page 4** – The general site description should be expanded and include additional information about the surrounding properties, current site usage, site security measures in place and extent of trespassing. On March 13, 2003, staff from the New York State Department of Health and this Department visited the site and observed evidence of trespassing on the site involving one or more homeless persons taking up residence in the south end of an existing one-story concrete block building. Access to the site was easily attained through the southwest entrance shown on Figures 4, 7, and D-2. Based on the potential for direct contact exposure to site-related contaminants and the abundance of physical hazards, additional site security measures are warranted to address the on-going occupancy and trespassing problem.

According to the first paragraph in Section 2.3.1, the remaining on-site structures include 14 aboveground storage tanks (ASTs). However, according to Figures 4, 7 and D-2, a total of 15 ASTs exist on-site, please revise accordingly.

2) **Section 6.3.1.1 (Soil/Fill Investigation), Page 22** – For purposes of exposure assessment, surface soil samples should be collected from a depth of zero to three inches below ground surface in areas not subject to future disturbance or capping. These samples should be analyzed for full Target Compound List organic and inorganic constituents. Soil samples collected from a depth of zero to two feet should be referred to as "shallow" soil samples rather than "surface" soil.

3) **Section 6.3.1.3 (Light Non-Aqueous Phase Liquid Investigation)** - Golder Associates indicate on the top of Page 26 that "one or more of the proposed LNAPL wells may not be installed if previously installed monitoring wells (e.g., GW-1, GW-2, and/or GW-3) are located and are usable." Given the location of these wells in relation to the location of the proposed wells as shown on Figure 9, we suggest that the previously installed wells be used /sampled in addition to the wells proposed for installation if any are located and found to be usable.

4) **Appendix B** – According to the three figures at the end of Appendix B, an on-site lagoon area existed along the western property boundary of the site near the Long Island Railroad line. In addition, the same figures depict a discharge pipe along Newtown Creek that is labelled, "Quanta discharge pipe". Additional investigation and sampling of these features is warranted.

5) **Appendix C** – The Health and Safety Plan, as presented, pertains primarily to remedial workers and will need to be supplemented with community health and safety plans for protection of the surrounding community during investigative and remedial field activities. A community air monitoring plan should be included as an integral part of the community health and safety plan. I recommend that all applicable procedures be followed as outlined in NYSDOH's *Generic*

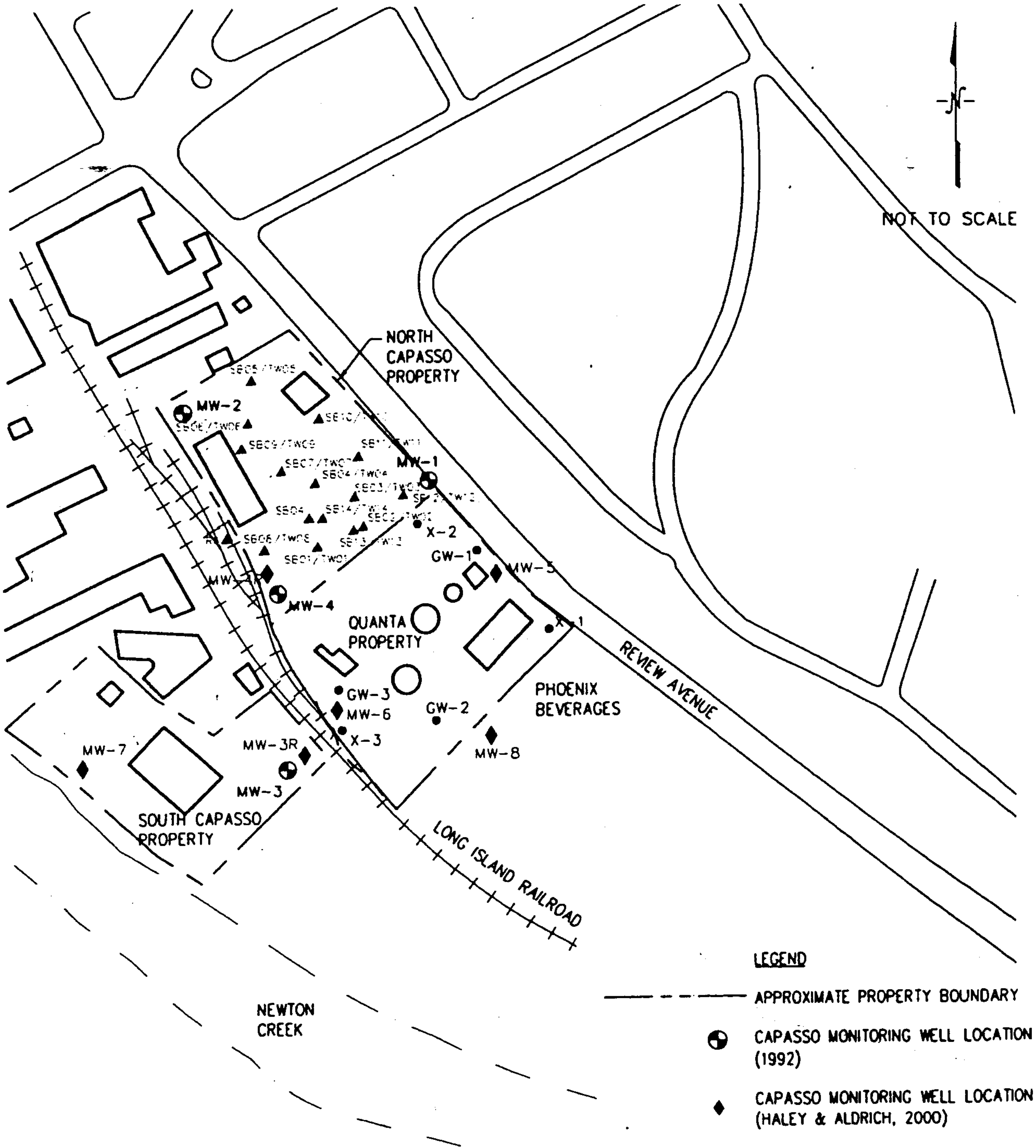
Community Air Monitoring Plan, a copy of which is enclosed. The community health and safety plan should be submitted to the NYSDOH for review and approval prior to the commencement of field activities.

6) **Appendix D (Sampling and Analysis Plan)**:

- Section D.2.10 (Analytical Method Requirements): This section lists the documentation that describes the methods to be used by the laboratories for sample analysis. While we have no problem with the references listed, the consultant should ensure that these methods conform to the latest NYSDEC Analytical Services Protocol documents (2000).

- Section D.3.1.1 (Surveillance): This section indicates that the Department will be providing oversight for specific sampling activities conducted in the field . We do not recollect that the Department committed to oversee specific sampling activities. Department will be deciding which activities to oversee based on the magnitude of their importance to this project and Department staff's schedule. If your recollection is different from ours please clarify which activities we agreed to oversee.

- Sections D.3.1.1 (Surveillance): and D.3.1.3.1 (Field Sampling Audit): These sections indicate that the Department only has an interest in observing sampling activities to be conducted at the site. Please be advised that the Department may wish to observe the soil boring and well installation activities conducted on-site in addition to the sampling activities mentioned.



LEGEND

— — — APPROXIMATE PROPERTY BOUNDARY

◐ CAPASSO MONITORING WELL LOCATION (1992)

◆ CAPASSO MONITORING WELL LOCATION (HALEY & ALDRICH, 2000)

● QUANTA MONITORING WELL LOCATION (1982-1990)

▲ SITE INVESTIGATION BORING LOCATION (LOCATION APPROXIMATE)

SOURCES: "PHASE II ENVIRONMENTAL ASSESSMENT, 37-30 REVIEW AVE., LONG ISLAND CITY, NEW YORK", MAY 1992 BY ERM-NORTHEAST, "REVISED REMEDIAL INSPECTION WORK PLAN, 37-30 TO 37-32 REVIEW AVE., 37-98 AND 38-20 RAILROAD AVE., 37-80 REVIEW AVE., LONG ISLAND CITY, NEW YORK". AUGUST 2000. BY HALEY & ALDRICH, INC.,"ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES. PHASE II INVESTIGATION. QUANTA RESOURCES SITE NO. 241005. LONG ISLAND CITY, QUEENS CO." MAY 1990 BY LAWLER, MATUSKY & SKELLY ENGINEERS.

REFERENCES

1.) MAP TAKEN FROM FIGURE TITLED "SITE PLAN WITH SITE INVESTIGATION BORING LOCATIONS", PROVIDED BY ENVIRON, DATED 9/27/00.

NOTES: UP TO EIGHT SOIL BORINGS WILL BE DRILLED AND 4 TO 5 MONITORING WELLS WILL BE INSTALLED. ALL WELL LOCATIONS SHOWN ARE APPROXIMATE.

Golder Associates
Philadelphia USA

SCALE	AS SHOWN	TITLE	ADJACENT PROPERTY MONITORING POINT LOCATIONS
DATE	08/28/02		
DESIGN	RSW		
CADD	AM		
FILE No. 0236151A004	CHECK SDn 7/1/02		
PROJECT No. 023-6151 REV. 0	REVIEW	QUANTA RESOURCES	FIGURE 6

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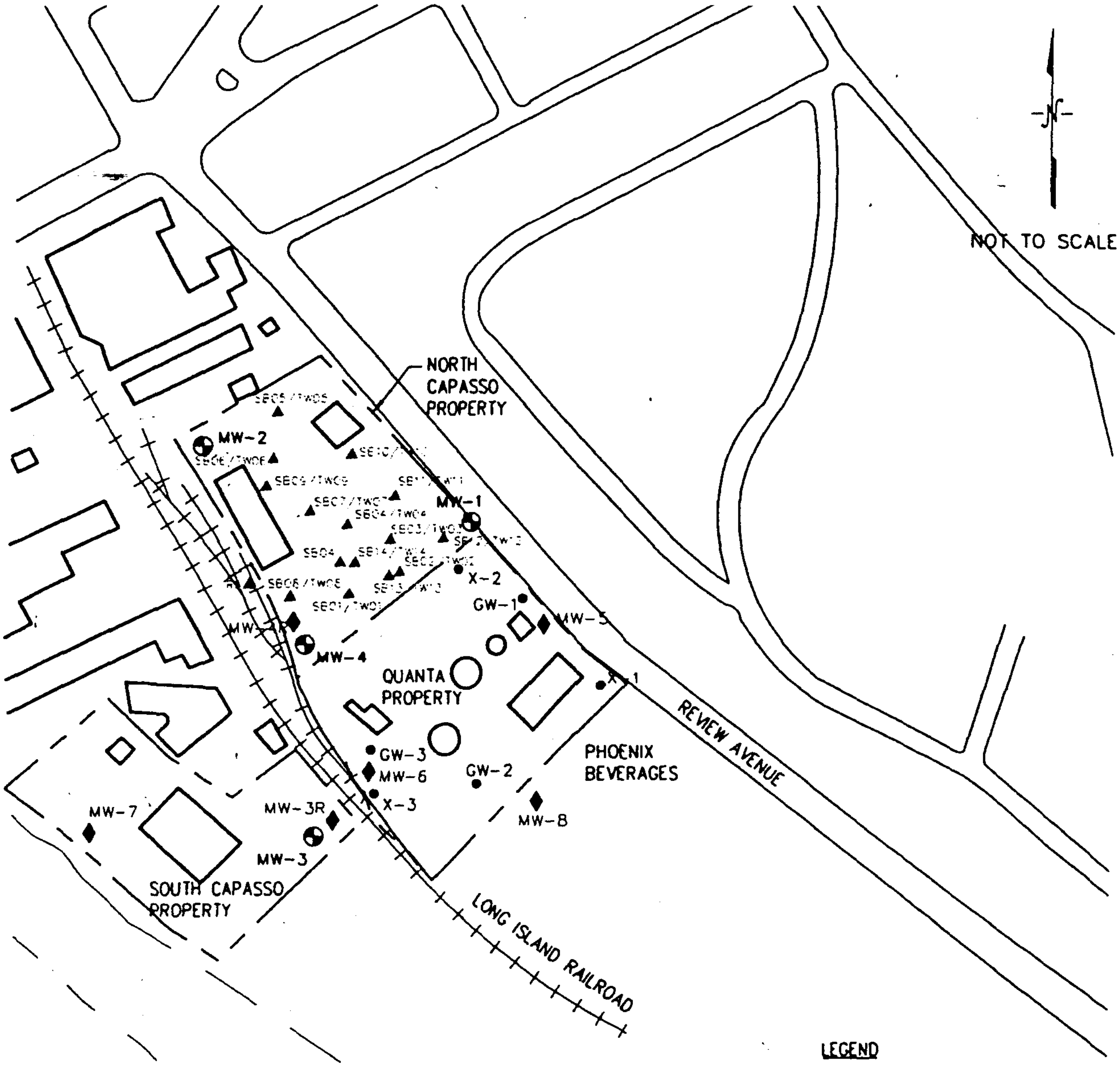

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Golder Associates Philadelphia USA	SCALE AS SHOWN	TITLE **ADJACENT PROPERTY MONITORING POINT LOCATIONS**
	DATE 08/28/02	
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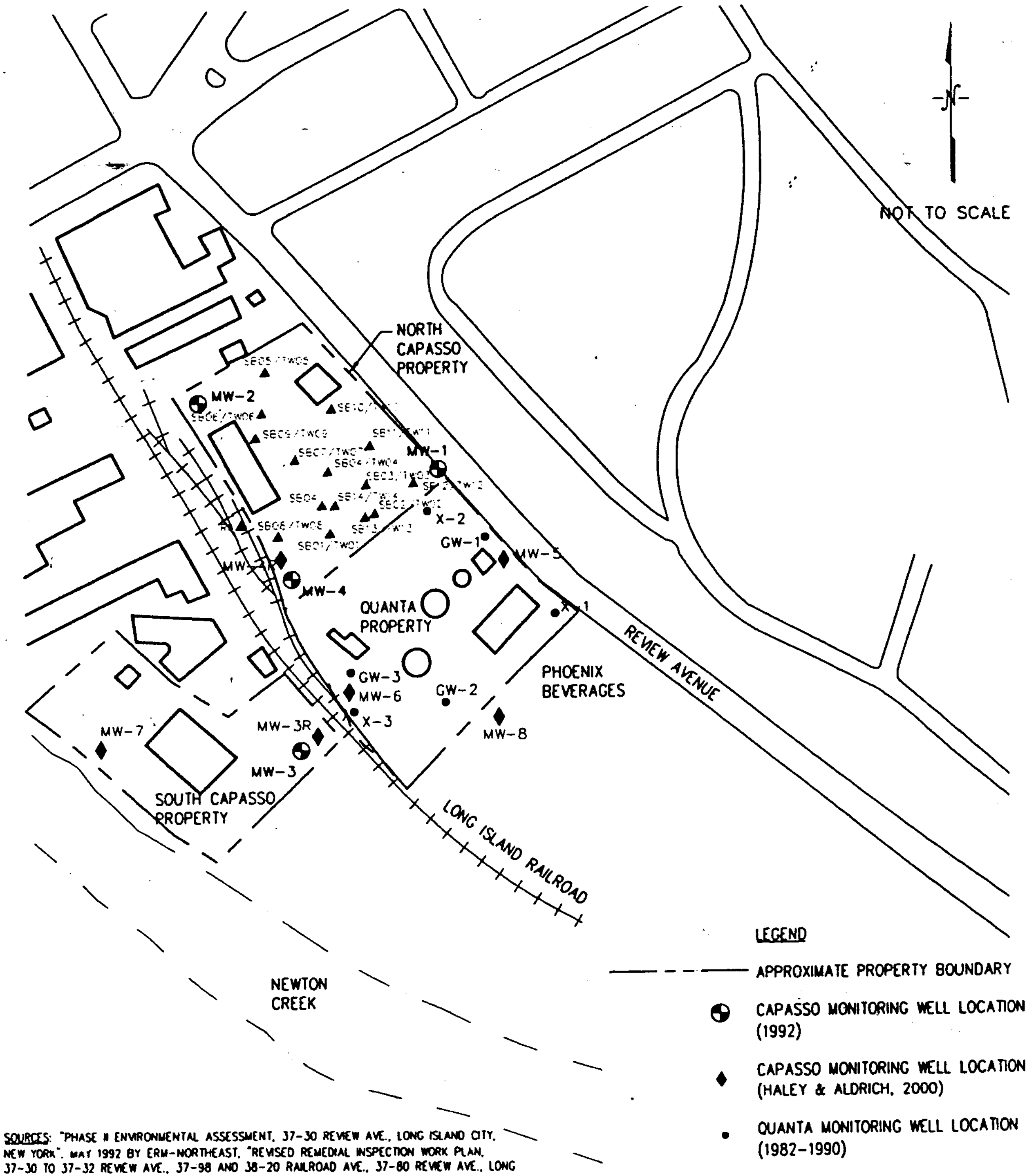
FILE No. 0236151A004	CHECK 7/11/02	QUANTA RESOURCES
PROJECT No. 023-6151 REV. 0	REVIEW	FIGURE 6



SOURCES: "PHASE II ENVIRONMENTAL ASSESSMENT, 37-30 REVIEW AVE., LONG ISLAND CITY, NEW YORK". MAY 1992 BY ERM-NORTHEAST. "REVISED REMEDIAL INSPECTION WORK PLAN, 37-30 TO 37-32 REVIEW AVE., 37-98 AND 38-20 RAILROAD AVE., 37-80 REVIEW AVE., LONG ISLAND CITY, NEW YORK". AUGUST 2000. BY HALEY & ALDRICH, INC.,"ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES. PHASE II INVESTIGATION. QUANTA RESOURCES SITE NO. 241005, LONG ISLAND CITY, QUEENS CO." MAY 1990 BY LAWLER, MATUSKY & SKELLY ENGINEERS.

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Golder Associates
Philadelphia USA

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FILE No. 0236151A004
PROJECT No. 023-6151 REV. 0

TITLE
ADJACENT PROPERTY MONITORING POINT LOCATIONS

QUANTA RESOURCES

FIGURE 6

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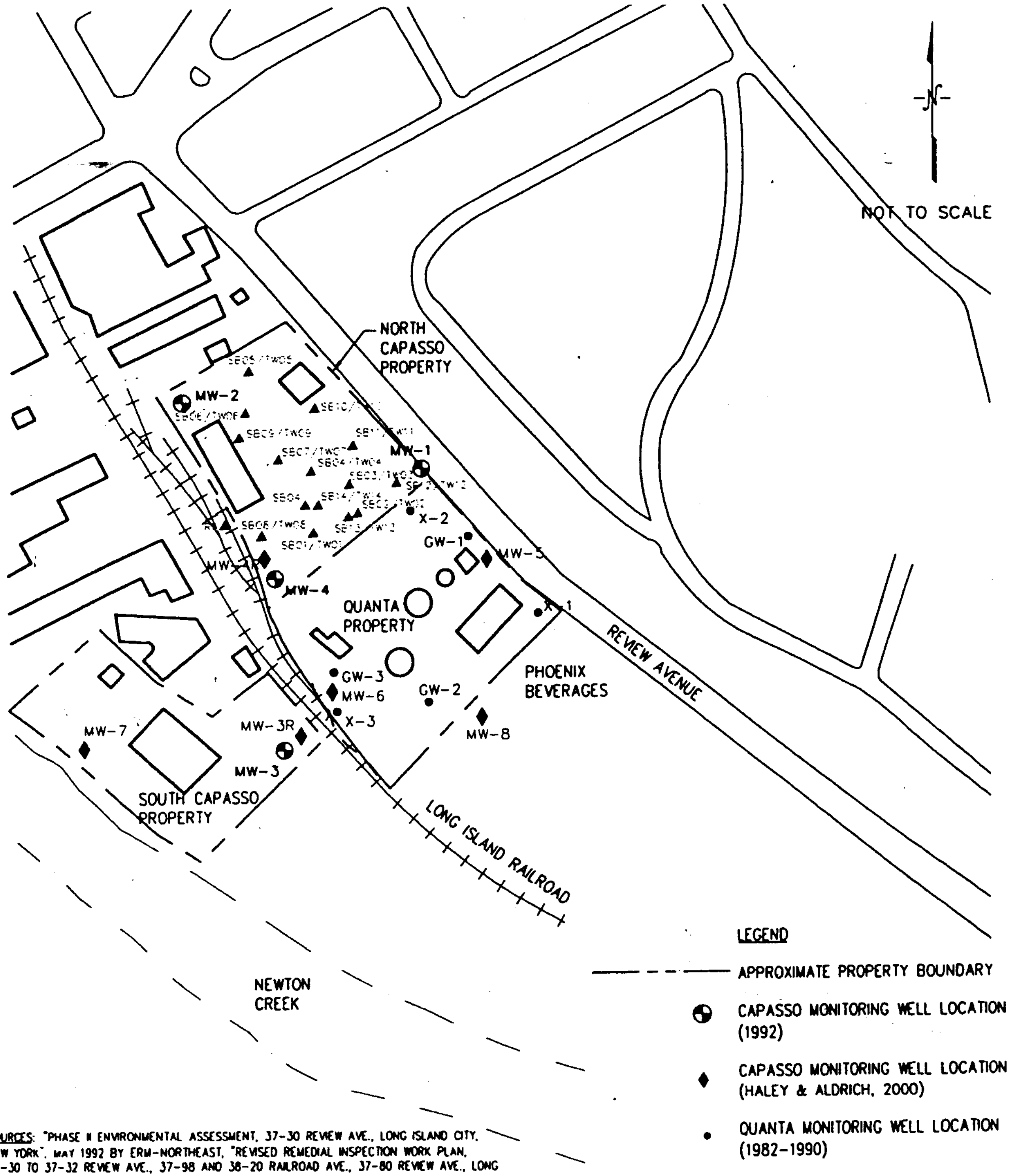

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Golder Associates
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REVIEW

TITLE
ADJACENT PROPERTY MONITORING POINT LOCATIONS

QUANTA RESOURCES

FIGURE 6

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Golder Associates Inc.

1951 Old Cuthbert Road, Suite 301
Cherry Hill, NJ 08034
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Fax (856) 616-1874

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORK PLAN
QUANTA RESOURCES SITE
LONG ISLAND CITY, QUEENS, NEW YORK

Prepared for:

Quanta Site Administrative Group

Prepared by:

Golder Associates Inc.
1951 Old Cuthbert Road, Suite 301
Cherry Hill, New Jersey

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DISTRIBUTION:

4 Copies	New York State Department of Environmental Conservation
1 Copy	New York State Department of Health
7 Copies	Quanta Site Administrative Group
1 Copy	McCusker, Anselmi, Rosen, Carvelli & Walsh
1 Copy	Environmental Liability Management, Inc.
2 Copies	Golder Associates Inc.

September 2002

Project No.: 023-6151

Golder Associates Inc.

1951 Old Cuthbert Road, Suite 301
Cherry Hill, NJ 08034
Telephone (856) 616-8166
Fax (856) 616-1874

Golder Associates

September 19, 2002

Project No.: 023-6151

NY State Dept. of Environmental Conservation
Division of Environmental Remediation
47-40 21st Street
Long Island City, NY 11101

Attn: Vadim Brevdo, P.E. - Project Manager

RE: SUBMITTAL OF REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN
QUANTA RESOURCES SITE
LONG ISLAND CITY, QUEENS, NEW YORK

Dear Mr. Brevdo:

On behalf of the Quanta Site Administrative Group (QSAG), Golder Associates Inc. (Golder) is pleased to submit four copies (one unbound) of the Remedial Investigation/Feasibility Study Work Plan (RI/FS Work Plan) for the Quanta Resources Site (Site). Copies of the RI/FS Work Plan have been sent to Mr. Gary Litwin (NYSDOH), Mr. David Harrington, P.E. (NYSDEC), and Ms. Denise D'Ambrosio, Esq. (NYSDEC) in addition to the others on the distribution below. This RI/FS Work Plan was prepared in accordance with Section II.B.1.(a) of the Order on Consent for the Site (NYSDEC Index No. W2-0915-03-06 for Site No. 2-41-005).

We appreciated the opportunity to meet with NYSDEC on September 5, 2002 to review our approach for the RI/FS. Your comments during the meeting were helpful. In accordance with our meeting discussion, this RI/FS Work Plan presents, amongst other things, a detailed scope of work for Phase I of the Remedial Investigation. As described in the RI/FS Work Plan, the scope of work for the Phase II Remedial Investigation will be proposed to NYSDEC as part of the Phase I Data Summary Report.

In addition, the Sampling and Analysis Plan (SAP), which includes the Quality Assurance Project Plan (QAPP) is referenced in the RI/FS Work Plan as Appendix D. A delay in the final selection of an analytical laboratory has caused a corresponding delay in the submission of the SAP/QAPP as part of this RI/FS Work Plan. Currently, the RI/FS Work Plan includes a Table of Contents of the SAP/QAPP. The QSAG is in the process of selecting an analytical laboratory and, when selected, Golder will complete the SAP/QAPP for insertion into the RI/FS Work Plan. A complete copy of the SAP/QAPP will be submitted to you on or before October 11, 2002.

Please do not hesitate to contact Pete Zimmermann, the Project Coordinator for QSAG, at (212) 308-3800 should any questions arise from your or your colleagues' review of this document.

Very truly yours,

GOLDER ASSOCIATES INC.

Randolph S. White, P.E.
Principal
NYS Professional Engineer License Number 062926-1

RSW/lrl
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cc: B. Bussa, Ford Motor Land Services Corp.
R. Mieszczak, Daimler Chrysler Corp.
P. Sheridan, United Technologies Corp.
A. Reiter, Esq. Sonnenschein Nath & Rosenthal
D. DeAngelis, Exxon Mobil Corporation
D. Smolensky, ARCADIS Geraghty & Miller
J. Davidson Esq./B. Kaufman, Esq. Hale & Dorr
P. Zimmermann, Environmental Liability Management
J. Walsh Esq., McCusker, Anselmi, Rosen, Carvelli & Walsh

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LIST OF ACRONYMS AND ABBREVIATIONS (in order of use)

RI/FS	Remedial Investigation/Feasibility Study
Golder	Golder Associates Inc.
QSAG	Quanta Site Administrative Group
NYSDEC	New York State Department of Environmental Conservation
COPC	Constituents of Potential Concern
SCGs	State Standards, Criteria and Guidelines
RAOs	Remedial Action Objectives
LIRR	Long Island Railroad
ROW	Right-of-Way
American	American Agricultural Chemical Company
Triplex Oil	Triplex Oil Refining Company
NYCDEP	New York City Department of Environmental Protection
OHM	OH Materials Corp
LNAPL	Light Nonaqueous Phase Liquid
LMS	Lawler, Matusky & Skelly
ASTs	Aboveground Storage Tanks
bgs	Below Ground Surface
MSL	Mean Sea Level
VOCs	Volatile Organic Compounds
SVOCs	Semi-Volatile Organic Compounds
O&G	Oil and Grease
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
1,2-DCE	1,2-Dichloroethylene
TCE	Trichloroethylene
PCE	Tetrachloroethylene
Al	Aluminum
As	Arsenic
Ba	Barium
Ca	Calcium
Cr	Chromium
Fe	Iron
Pb	Lead
Mn	Manganese
Va	Vanadium
Zn	Zinc
1,1,1-TCA	1,1,1-trichloroethane
CSM	Conceptual Site Model
ARARs/SCGs	Applicable or Relevant and Appropriate Requirements/New York State Standards, Criteria and Guidelines
TBC	To Be Considered
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
TAGM	Technical Assistance Guidance Memoranda
TOGs	Division of Water Technical and Operational Guidance Series
RCRA	Resource Conservation and Recovery Act
HSWA	Hazardous and Solid Waste Amendments
CP	Citizen Participation
HASP	Health and Safety Plan
SAP	Sampling and Analyses Plan
QAPP	Quality Assurance Project Plan

HSA	Hollow Stem Auger
PID	Photo-ionization Detector
USCS	United Soil Classification System
TCL	Target Compound List
TAL	Target Analyte List
TOC	Total Organic Carbon
SOP	Standard Operating Procedure
DUSR	Data Usability Summary Report
QC	Quality Control
PARCC	Precision and Accuracy Criteria
NCP	National Contingency Plan
TTWP	Treatability Testing Work Plan
FS Report	Feasibility Study Report
ELM	Environmental Liability Management
ADT	Aquifer Drilling and Testing Inc.
AOC	Administrative Order on Consent

1.0 INTRODUCTION

This Remedial Investigation/Feasibility Study (RI/FS) Work Plan has been prepared by Golder Associates Inc. (Golder) on behalf of the Quanta Site Administrative Group (QSAG). The RI/FS Work Plan is submitted pursuant to Section II.A, of the Order On Consent (Consent Order) executed by the New York State Department of Environmental Conservation (NYSDEC), NYSDEC Index No. W2-0915-03-06. The property located at 37-80 Review Avenue, Long Island City, New York (the Site), is currently listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York State as Site Number 2-41-005 with a Classification of "2" pursuant to ECL 27-1305.

The objectives of this RI/FS are as follows:

- Determine the nature and extent of constituents of potential concern (COPC) and potential impacts to the public health, welfare, or the environment caused by the release or potential release of COPC at or from the Site by conducting a Remedial Investigation; and,
- Determine and evaluate alternatives for remedial action, if any, to prevent, mitigate, or otherwise respond to or remedy a release or potential release of COPC at or from the Site by conducting a Feasibility Study.

This RI/FS Work Plan provides the framework for the activities to be conducted as part of the RI/FS for the Site as required by the Consent Order and includes the following key elements:

- The technical scoping completed for the preparation of the RI/FS Work Plan is presented in Section 2.0, which includes a description of the Site, its history, previous investigations and remedial actions completed, and its environmental setting and conditions;
- A Conceptual Site Model is presented in Section 3.0;
- Preliminary Applicable or Relevant and Appropriate Requirements/New York State Standards and Guidelines and preliminary Remedial Action Objectives are discussed in Section 4.0;
- The rationale and specific objectives for the RI/FS are discussed in Section 5.0;
- The Scope of Work for the separate RI/FS Work Plan tasks is presented in Section 6.0; and,
- A Project Management Plan is presented in Section 7.0, which includes a schedule of the work to be performed.

2.0 SITE DESCRIPTION [1]

2.1 General Site Description

The Site consists of an approximately 1.8-acre parcel of land at 37-80 Review Avenue, within a highly industrialized area of Long Island City, Queens, New York. Figure 1 provides the location of the Site on a USGS quadrangle map. Figure 2 shows an aerial photographic map (April 1994) of the Site that is bounded on the north by Review Avenue, on the south by the Southern Line of the Long Island Railroad (LIRR), and on the east and west by adjacent industrial properties. General zoning in this area is commercial and light industrial. Across Review Avenue to the north is Calvary Cemetery. Approximately 450 feet south of the LIRR right-of-way (ROW), is Newtown Creek.

2.2 Site History

2.2.1 Former Operations

According to the available information, the earliest record owner of the Site is American Agricultural Chemical Company ("American"). American transferred the property to Triplex Oil Refining Company ("Triplex Oil") in 1931. Triplex Oil operated the property for approximately 40 years. From approximately 1972 to 1980, the facility was operated by several different owners, including Pentalic Corporation, Sea Lion Corporation, Ag-Met Oil Service, Inc., Hudson Oil Refining Corp, and Portland Holding Corporation. Quanta Resources, which bought the Site from Portland Holding Corporation in July 1980, filed for bankruptcy on October 6, 1981, but still owned the Site.

Sanborn maps (The Sanborn Library, LLC) indicate that historical operations included the refining of used crank case oil. Quanta Resources' operations included recycling, processing and/or storing used and unused oils, solvents and miscellaneous waste materials. The Site was abandoned in November of 1981 after Quanta Resources filed for bankruptcy. Various waste materials were left behind in tanks and related structures leading to an initial investigation and subsequent Removal Action by New York City Department of Environmental Protection (NYCDEP) beginning in the summer of 1982. Figure 3 shows the layout of the Site prior to the Removal Action.

---

[1] The RI/FS Work Plan necessarily cites environmental data from previous investigations conducted at the Site as part of the Site description. Although we do not necessarily adopt these findings as reflecting current conditions at the Site, we find it necessary to refer to the findings in preparing this RI/FS Work Plan.

2.2.2 Remedial Action Completed

After the Site was abandoned, NYCDEP and NYSDEC personnel performed an investigation of materials left behind in tanks, vessels, building containment areas, and other structures. Reportedly, the investigations indicated that some of the remaining materials were flammable and that some contained solvents, PCBs, and heavy metals. As a result, in 1982, the NYCDEP contracted CH2M Hill, as the oversight engineer, and OH Materials Corp (OHM) as the remedial contractor to perform a Removal Action.

In total, OHM reported that it removed over 500,000 gallons of liquids and approximately 900 cubic yards of solids (from tanks, containment areas, separators, etc.), portions of which it reported were impacted with PCBs, chlorinated solvents, heavy metals and/or cyanide. OHM emphasized that it had searched for hidden or buried storage tanks that had not been previously discovered by NYCDEP personnel. A magnetometer was used to scan for underground tanks in suspect on-Site areas. A total of 106 aboveground and underground tanks were evaluated as described below. Following the removal, transportation, and off-Site disposal of the liquids and solids, on-Site storage tanks (including aboveground and underground tanks), piping, containment areas, and buildings were reported by OHM to have been emptied and decontaminated. A description of the work completed is presented in the report entitled Engineering Services Report, Quanta Resources Site Cleanup, prepared by CH2M Hill for the NYCDEP, dated December 29, 1982 and summarized below.

All tanks at the Site, including aboveground and underground tanks, were decontaminated and were certified as "gas free" by a licensed Marine Chemist from Marine Chemists Inc. of Hoboken, New Jersey. In addition, the dike areas and separators were decontaminated following the removal of all aqueous liquids, oils, and accumulated sludge. The cleaning and decontamination of the Site's extensive piping network and appurtenances lasted throughout the duration of the project. The piping was dismantled into workable sections and thoroughly cleaned with potable water using high pressure water lasers. The cleanup and decontamination of Building A required the cleaning of the 14 tanks within the building, decontamination of the walls, floors, and basement areas of the building which had accumulated approximately 3 feet of aqueous/oil waste and sludge. In addition to the 10 tanks within Building F, the floors and walls were decontaminated. The other buildings reportedly did not contain liquid waste materials.

2.2.3 Previous Investigations Completed

At the conclusion of the Removal Action, OHM conducted an environmental investigation on behalf of the NYCDEP and installed four on-Site monitoring wells and collected samples of groundwater, light nonaqueous phase liquid (LNAPL), and composite samples of soil/fill. The activities conducted and findings of the study are presented in the report entitled *Preliminary Hydrogeologic Assessment*, Quanta Resources, New York City, New York, prepared by OHM, January 7, 1983. The sample collection, handling, and analyses procedures were not well documented and the sampling locations are not fully known. Consequently, while these data were useful for scoping the subsequent investigation described below, the OHM data are not appropriate for use in this Remedial Investigation. Only general observations and some limited groundwater/LNAPL measurements from the OHM Study are discussed further in this RI/FS Work Plan.

The firm Lawler, Matusky & Skelly (LMS) conducted a Phase II Investigation from 1988 through 1990 on behalf of NYSDEC (*Engineering Investigations at Inactive Hazardous Waste Site, Phase II Investigation*, Quanta Resources Site No. 241005, May 1990). LMS reported that the soils, LNAPL, and groundwater contained constituents similar to those detected by OHM in the materials removed during the 1982 Removal Action. A summary of the environmental data collected by LMS is presented in Section 2.4.

2.3 Environmental Setting

2.3.1 Site Description

The Site currently exists on a small, approximately 1.8-acre property located in an old, highly industrialized section of Long Island City, Queens, New York. Figure 4 depicts the current condition of the Site. Most of the structures (buildings, tanks, and containment areas) have been demolished since the Site was abandoned in 1981. The remaining structures on the Site include a multi-story building that houses several empty tanks, and one aboveground tank containment area that includes 14 large empty steel aboveground storage tanks (ASTs). During its operation, most of the Site was reportedly covered by asphalt or concrete, and large portions of the southern area of the Site have since been covered with a variably thick layer of post-operational fill and debris. The northern portion of the Site is concurrently covered by asphalt or concrete pavement. A chain link and corrugated steel fence surrounds much of the Site. Piles of construction debris, remnants of buildings and steel tanks and boilers, tires, wood pallets, and associated junk, exists in piles at different areas of the Site including within the existing AST containment area and along the southeast portion of the Site as shown on Figure 4. While these structures and debris piles limit access to certain portions of the Site, there is sufficient access to initiate the Remedial Investigation.

Historically, the properties adjacent to the Site, including the area along Newtown Creek, have been used since the 19th century for a variety of industrial purposes, including coal storage, coal oil production, petroleum storage and refining, chemical and fertilizer production, fat rendering, and other types of industry. Diesel and freight trains have traveled the LIRR tracks along the southeast border of the Site for more than a century.

Newtown Creek is reported to be heavily impacted by historic industrial activities as well as current industrial loading. NYSDEC has issued four permits for Combined Sewer Overflows into the creek and five point source permits within a half-mile of the Site. A New York City Department of Sanitation Report, *Comprehensive Solid Waste Management Plan, Chapter 15: Environmental Review – Review Avenue Site*, October 2000 discusses the environmental condition of Newtown Creek in the vicinity of the Site as follows: "Natural Resources in the form of benthic invertebrates and fish are quite limited in Newtown Creek. Sediment contamination and organic loading prevent the development of a healthy benthic community; the communities present represent the opportunistic species and exhibit low diversity and high concentrations. Low or non-existent dissolved oxygen, particularly during the summer months, combined with lack of food sources, make the waterway unsuitable for passage or survival of most fish species."

The Solid Waste Management Plan, referenced above, identifies the classification of Newtown Creek as "Class SD." According to the New York State Environmental Conservation regulations (Part 701.14), these waters should be suitable for fish survival only, and that because of natural or man-made conditions, cannot meet the requirements for primary and secondary contact recreation and fish propagation.

2.3.2 Site Geology and Hydrogeology

The following presents a summary of the Site geology and hydrogeology. A detailed description of the Site area geology and hydrogeology is presented in Appendix A.

The topography and surficial geology in the vicinity of the Site is largely a reflection of man-made fill (consisting of ash, wood, brick, coal, etc.) that reportedly ranges in thickness from 5 to 19 feet. Unconsolidated deposits beneath the fill are composed primarily of stratified drift (sand and gravel deposits) with some till (an unsorted mixture of clay, silt, sand, gravel, cobbles, and boulders). Underlying these deposits may be proglacial lake deposits consisting of the Gardiners Clay, a confining unit with an average vertical hydraulic conductivity of about 0.001 ft/day. Bedrock is estimated to be between 50 and 100 feet below ground surface (bgs) within the Site area and consists of the Fordham Gneiss.

The Site is located between a local topographic high located northeast of the Site (local groundwater recharge area) and Newtown Creek (a local groundwater discharge area). Groundwater flow, in the relatively flat Site area, under natural conditions, would be expected to flow nearly horizontally south-southwest within the Upper Glacial Aquifer towards Newtown Creek[2]. The Upper Glacial Aquifer is anisotropic with the horizontal hydraulic conductivity estimated to be 10 times greater than the vertical conductivity. Vertical gradients in the vicinity of the Site are expected to be minimal or upward as a result of the high horizontal hydraulic conductivity of the Upper Glacier Aquifer and the presence of a groundwater discharge boundary located approximately 450 feet to the southwest of the Site (Newtown Creek). If vertical gradients are present, they would be expected to be upward, under natural conditions, particularly as groundwater approaches its discharge to Newtown Creek. Figure 5 presents a conceptual hydrogeologic model of the Site.

Public drinking and industrial water supplies for Queens County are supplied primarily by the New York City reservoir system. The area of Queens County that relies on groundwater as its source for potable water is located approximately 6 miles southeast of the Site. A regional groundwater divide is located between the Site and this portion of Queens County. In addition, according to the 1990 LMS report, only a small number of private wells are permitted by the New York City Department of Health for nonpotable uses. Therefore, any groundwater impacts at the Site would be expected to be confined to a thin surficial water bearing unit flowing in a southerly direction toward Newtown Creek, which would not impact any potable water supplies.

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[2] The OHM report discussed that the anticipated horizontal groundwater flow direction would be towards the southwest while the LMS report estimated a groundwater flow direction approximately south. However, these observations were made using fluid levels from wells containing LNAPL. Groundwater levels from wells not impacted by LNAPL are needed during the Remedial Investigation to verify the groundwater flow direction.

2.3.3 Surface Water Hydrology

The Site lies approximately 40 feet above mean sea level (MSL) with its highest elevation along Review Avenue. Calvary Cemetery, located northeast of the Site, on the opposite side of Review Avenue, is locally a topographic high with elevations ranging from approximately 50 to over 70 feet MSL. The area immediately surrounding the Site is relatively flat, having an average southwesterly gradient of approximately 2.5% towards Newtown Creek. Surface water runoff will generally follow topographic gradients, which are to the southwest toward Newtown Creek. Between the Site and Newtown Creek lies the LIRR ROW and industrial properties, which locally affect surface water drainage. Newtown Creek flows west-northwest into the East River.

2.4 Summary of Existing Environmental Data

This section discusses the existing on-Site environmental data primarily as presented in the LMS Phase II Investigation. Only limited information from the Preliminary Hydrogeologic Assessment (OHM, 1982) and available off-Site data were utilized. The relevant data tables and figures from the LMS Phase II Study are presented in Appendix B. A summary of the primary COPC reported by LMS in environmental media is presented on Figure 7.

2.4.1 Soil/Fill

Previous investigations encountered historic fill material across the Site ranging in thickness from 5 to 19 feet. The historic fill material reportedly consists primarily of cinders, wood, brick, coal, and coarse to fine grained sediments. In several areas the historic fill is overlain by a layer of rubble/debris placed subsequent to the termination of historic operations at the Site. Initial observations have indicated that, other than discrete locations of surface staining, this post-operational fill does not reflect characteristics representative of a release of hazardous substances. This observation will be confirmed as part of the Remedial Investigation.

Four surface samples of soil/fill or accumulated solids (SS-1 through SS-4) were collected by LMS at the approximate locations shown on Figure 7. Sample locations SS-1 and SS-4 were collected from solids accumulated within AST containment areas that, as LMS indicated, may have concrete bases and thus not represent actual soil conditions. Sample SS-3 was collected by LMS off-Site within the LIRR (ROW) materials.

The only on-Site surface soil/fill sample was collected by LMS at location SS-2 in an unpaved area of the Site. A summary of the primary COPC reportedly detected in LMS's samples is shown on Figure 7. LMS collected sample SS-2 from an area with characteristics differing from that for samples SS-1 and SS-4: thus direct comparison and interpretation of the reported concentrations was not appropriate. However, it is worth noting that the volatile organic compound (VOC) and semi-volatile organic compound (SVOC) constituents LMS reported in SS-1 and SS-4 were similar to those it reported in SS-2. These same constituents were also generally detected by LMS in LNAPL on-Site (see Section 2.4.2). PCBs were not detected by LMS in SS-1 or in its LNAPL samples, but were detected by LMS in soil collected from SS-2 and SS-4. Given the operational history and time frame for the Site and related potential release mechanisms for COPC reported by LMS, it is reasonable to conclude that investigation of soil/fill representative of the historical operation time frame should be sampled at selected locations across the Site to confirm the presence/absence of these COPC as originally reported by LMS.

Sample SS-3, collected by LMS off-Site within the LIRR ROW, differed from the on-Site samples by the type and magnitude of constituents reported. VOCs and SVOCs were reported by LMS in SS-3 at lower concentrations and PCBs were reported by LMS at a much higher concentration (60 mg/kg). The source(s) of these reported off-Site constituents is (are) unknown. However, it should be noted that railroad tracks in older industrial areas have been shown to be commonly contaminated with VOCs, SVOCs, metals and PCBs. Therefore, the detection of VOCs, SVOCs, and PCBs within the LIRR ROW is not necessarily connected to the Site.

The types and relative concentrations of metals detected in on-Site samples by LMS, while limited and not directly comparable, were generally similar; again indicating the potential for occurrence of these COPC across the Site. The sample results at off-Site sample SS-3 were considerably lower and somewhat disproportionate to the on-Site sample results.

Similar to the conclusion drawn with respect to VOCs, SVOCs and PCBs, the above findings and the historical use of the Site support the development of a Remedial Investigation scope that will assess the potential Site-wide distribution of COPC. The Remedial Investigation should also confirm the presence of historic fill placed at the Site.

2.4.2 Light Nonaqueous Phase Liquid

To confirm the presence of LNAPL identified during the OHM investigation, LMS installed three monitoring wells GW-1, GW-2, and GW-3 at the locations shown on Figure 7. While no soil boring or well construction logs were available, the following construction summary was taken from the text of the LMS report.

	LMS Monitoring Well No.		
LMS Measurements	**GW-1**	**GW-2**	**GW-3**
Depth of Fill	19 ft.	5 ft.	11 ft.
Bottom Depth of Borehole	39 ft.	29 ft	28 ft.
Evidence of LNAPL in Soil	6 ft, 24 to 29 ft. (1)	14 to 28 ft. (1)	14 to 16, 19 to 21 ft.
Bottom of Screen Interval	38 ft.	28 ft.	27 ft.
Top of Screen Interval	28 ft.	18 ft.	17 ft.
Top of LNAPL Layer	---	14.19 ft.	12.46 ft.
Top of LNAPL/Groundwater Interface	22.61 ft.	21.39 ft.	19.82 ft.
Apparent LNAPL Thickness (2)	Sheen(3)	7.20 ft.	7.36 ft.

(1) Drilling may have dragged or allowed LNAPL to penetrate depths below groundwater table.

(2) "Apparent" LNAPL thickness (not actual in-situ thickness of saturated/mobile LNAPL fraction) as reported by LMS.

(3) While no measurable thickness was reported, LMS inferred 2.61 ft. of LNAPL in well GW-1.

Studies conducted subsequent to the LMS Phase II Investigation (DMJ Associates, October 2000) identified the LNAPL as consisting of a "weathered, viscous, 10 weight lubricating oil."

Apparent Thickness

The measurements made by LMS indicate apparent LNAPL thicknesses of approximately 7 feet in wells GW-2 and GW-3. LMS stated that the measured apparent thickness approximated the actual thickness due to the observed coarse-grained nature of the sediments. However, grain size analyses were not performed to quantify the observations. Notably, USEPA states that LNAPL thickness measured in a monitoring well has been reported to typically exceed the actual LNAPL saturated formation thickness (i.e., potentially mobile fraction of LNAPL) by a factor of between approximately 2 and 10 (USEPA, *Groundwater Issues, Light Nonaqueous Phase Liquids*, EPA/540/5-95/5000). So while the LMS data indicate the presence of LNAPL, its actual saturated thickness and volume is in question and should be assessed as part of the Remedial Investigation. More important than thickness, however, is the mobility, distribution, and chemical make-up of the LNAPL. These parameters require examination during the Remedial Investigation in order to assess the potential risks that LNAPL might pose and, thus, the degree to which LNAPL needs to be addressed.

Mobility and Distribution

Any potential LNAPL releases to the subsurface at the Site (to the extent that they came from the Site) are likely to have ended at least 20 years ago as a result of the Removal Action completed by OHM in 1982 (CH2M Hill, 1982). Eventually, if it has not occurred already, the LNAPL will cease to move laterally as the resistive forces in the water-wet subsurface soils (within the saturated zone and capillary fringe) balance the lateral driving forces of the LNAPL lens. In addition, fluctuations in groundwater elevations will smear LNAPL vertically throughout the range of hydraulic variation, thus further trapping LNAPL via capillary forces in residual zones of saturation both above and below the groundwater surface. This, in turn, further decreases LNAPL mobility and migration potential (USEPA540/5-95-500). When immobile, the residual LNAPL presents a potential concern only as a source of dissolved groundwater and vapor-phase constituents. For the biodegradable components of the LNAPL (e.g., VOCs), the dissolved phase impacts will extend to the point where the rate of dissolution of the LNAPL components equilibrates with the rate of biodegradation. For the non-biodegradable components (e.g., metals), the downgradient extent is determined by the equilibrium between rate of dissolution and dispersion (*Evaluating Hydrocarbon Removal from Source Zones: Tools to Asses Concentration Reduction,* Report sponsored by The American Petroleum Institute, January 2001).

A preliminary assessment of the distribution of LNAPL at the Site has been made based on the data reported from studies conducted on adjacent properties.[3] While LNAPL has been detected in off-Site monitoring wells installed sidegradient to the reported south to southwest direction of groundwater flow (i.e., MW-4 on the adjacent west property and MW-8 on the adjacent east property, as shown on Figure 6), it has not been determined whether or not this off-Site LNAPL originated from former operations at the Site. Importantly, however, data from three monitoring wells installed hydraulically downgradient of the Site, i.e., MW-3, MW-3R, and MW-7 (see Figure 6), indicate that LNAPL has not migrated appreciably downgradient from the Site. Monitoring well MW-3 (installed by ERM in 1992) and replacement well MW-3R (installed by Haley and Aldrich in 2000) appear to be located approximately 100 feet (and possibly closer) from the southern Site boundary. LNAPL has reportedly not been detected in either of these two monitoring wells. Additionally, the monitoring well data from MW-7 (Haley and Aldrich, 2000 and DMJ Associates, 2000) also did not show the presence of LNAPL. Taken together, the

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[3] Studies conducted on adjacent properties include the following: ERM, 1990; ERM, 1992; Analytical Results Summary, Haley and Aldrich, Inc. by Chemtech, Project No. L1640LP, 2000; Analytical Results for Triegel and Associates, Inc. by IGLA Laboratories, project No. 9959, 2000; and Haley and Aldreich Inc., DMJ Data Summaries (Water Level Elevations, LNAPL Analyses and LNAPL Measurements), Fall 2000.

available data indicate that the on-Site LNAPL has not migrated far (or possibly not at all) from the Site towards Newtown Creek.

LNAPL Chemistry

Samples of the LNAPL were collected from monitoring wells GW-2 and GW-3 during the LMS investigation and were analyzed for VOCs and SVOCs, PCBs, metals, EP toxicity metals, oil and grease (O&G), and ignitibility. Samples from both the upper and lower portions of the LNAPL column were collected. A summary of the LMS findings is presented below.

- **VOCs** - The VOCs detected in the LMS LNAPL samples were similar to those detected in their soil/fill solids samples (Section 2.4.1) and groundwater samples (Section 2.4.3) and primarily consisted of benzene, toluene, ethylbenzene, and xylene (BTEX) compounds with lower concentrations of chlorinated VOCs (1,2-Dichloroethylene (1,2-DCE), chloroethane, and vinyl chloride). Noticeably absent were trichloroethylene (TCE) and tetrachloroethylene (PCE) as these compounds were detected by LMS in soil and are typically encountered in solvent waste materials particularly when potential biodegradation daughter products are detected (e.g., 1,2-DCE and vinyl chloride). Moreover, TCE and PCE were also not detected by LMS in the groundwater samples while (as with the LNAPL) potential biodegradation daughter products were detected. These findings indicate that either TCE or PCE were not initially present within LNAPL or that natural biological degradation processes had reduced their concentrations to non-detectable levels. The Remedial Investigation will confirm the absence/presence of PCE and TCE and assess natural biotransformations.

- **SVOCs** - The SVOCs detected by LMS in LNAPL were similar to those reported in groundwater and consist primarily of PAHs.

- **Inorganics** - Several metals were detected in the LMS LNAPL samples and include aluminum (Al), arsenic (As), barium (Ba), calcium (Ca), chromium (Cr), iron (Fe), lead (Pb), manganese (Mn), vanadium (Va), and zinc (Zn). The metals having the highest reported concentrations were Al, Ba, Ca, Fe, and Zn. The EP toxicity test results for As, Ba, Cr, Pb, and Hg (not detected) were all less than the regulatory limits by at least one order of magnitude. Cyanide was not detected in any of the LMS LNAPL samples.

- There does not appear to be separate phases of LNAPL as VOCs, SVOCs, and metal concentrations in the upper LNAPL portion were similar to those detected by LMS in the lower LNAPL portion. The marginal differences in concentration reported by LMS between the lower and upper LNAPL portions were likely due to age and weathering differences, not separate phase materials. In addition, while there were some differences in the concentrations of VOCs detected by LMS in LNAPL samples from GW-2 and GW-3, these differences are out-weighed by the similarities, which indicate that the LNAPL at both locations were similar in nature and were likely from related, commingled sources.

- **PCBs** - Low concentrations of PCBs were detected by LMS in the GW-3 LNAPL sample. PCBs were not detected by LMS in the GW-2 LNAPL sample.

- **Oil and Grease** - The oil and grease component of the LNAPL in GW-3 was reported by LMS to be 30%. The oil and grease analysis was not run for the GW-2 sample due to laboratory mishandling.

- **Ignitibility** - All LMS LNAPL samples exhibited a flash point greater than 212°F further indicating the LNAPL was of similar character.

2.4.3 Groundwater

As discussed previously, LNAPL was detected by LMS in all groundwater wells (reportedly, GW-1 had a sheen and GW-2 and GW-3 had approximately 7 feet of LNAPL). While it is assumed that the LMS sampling and laboratory protocols would have attempted to minimize the impact of LNAPL on the groundwater samples, it is possible that some degree of LNAPL impact inadvertently occurred. As a result, analytical results reported by LMS may overstate the concentration of constituents that had actually dissolved in groundwater. Therefore, one of the objectives of the Remedial Investigation is to install monitoring wells that allow collection of representative groundwater samples. A brief summary of the groundwater sample analyses results reported by LMS is provided below. Figure 7 shows the location of the LMS wells and a summary of the constituents detected by LMS.

- ***VOCs*** - Not surprisingly, the VOCs detected by LMS in groundwater were similar to those detected by LMS in LNAPL and included BTEX compounds and chlorinated VOCs. The chlorinated VOCs were typical daughter products from biological reductive dechlorination of PCE, TCE, and 1,1,1-trichloroethane (1,1,1-TCA), which were not detected by LMS in groundwater nor in LNAPL. As stated in Section 2.4.2, the reported absence of PCE, TCE, and 1,1,1-TCA is surprising and may indicate they had attenuated to not detectable levels. In addition, the reported dissolved phase concentrations of VOCs were several orders of magnitude lower than the concentrations of the same VOCs measured by LMS in LNAPL samples. This large concentration reduction from LNAPL to the dissolved phase was likely a result of the low effective solubility of the VOCs held within the hydrophobic LNAPL and/or the rapid biodegradation of VOCs once they become bioavailable (dissolved) in groundwater.

- ***SVOCs*** – Similar to the LMS LNAPL results, the primary SVOCs detected in groundwater were PAHs. The potential for LNAPL to have been inadvertedly collected in the LMS groundwater samples may have contributed to these PAH levels.

- ***Pesticides/PCBs*** - Neither pesticides nor PCBs were detected in any of the groundwater samples.

- ***Inorganics*** - The primary metals detected by LMS in groundwater were antimony, barium, iron, and manganese.

As stated in the LMS report, the highest concentrations of iron and manganese reported in the 1990 data occurred in the upgradient well GW-1 indicating a non-Site-specific source and/or natural conditions. Cyanide was not detected by LMS in any of the monitoring well samples.

2.0 SITE DESCRIPTION [1]

2.1 General Site Description

The Site consists of an approximately 1.8-acre parcel of land at 37-80 Review Avenue, within a highly industrialized area of Long Island City, Queens, New York. Figure 1 provides the location of the Site on a USGS quadrangle map. Figure 2 shows an aerial photographic map (April 1994) of the Site that is bounded on the north by Review Avenue, on the south by the Southern Line of the Long Island Railroad (LIRR), and on the east and west by adjacent industrial properties. General zoning in this area is commercial and light industrial. Across Review Avenue to the north is Calvary Cemetery. Approximately 450 feet south of the LIRR right-of-way (ROW), is Newtown Creek.

2.2 Site History

2.2.1 Former Operations

According to the available information, the earliest record owner of the Site is American Agricultural Chemical Company ("American"). American transferred the property to Triplex Oil Refining Company ("Triplex Oil") in 1931. Triplex Oil operated the property for approximately 40 years. From approximately 1972 to 1980, the facility was operated by several different owners, including Pentalic Corporation, Sea Lion Corporation, Ag-Met Oil Service, Inc., Hudson Oil Refining Corp, and Portland Holding Corporation. Quanta Resources, which bought the Site from Portland Holding Corporation in July 1980, filed for bankruptcy on October 6, 1981, but still owned the Site.

Sanborn maps (The Sanborn Library, LLC) indicate that historical operations included the refining of used crank case oil. Quanta Resources' operations included recycling, processing and/or storing used and unused oils, solvents and miscellaneous waste materials. The Site was abandoned in November of 1981 after Quanta Resources filed for bankruptcy. Various waste materials were left behind in tanks and related structures leading to an initial investigation and subsequent Removal Action by New York City Department of Environmental Protection (NYCDEP) beginning in the summer of 1982. Figure 3 shows the layout of the Site prior to the Removal Action.

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[1] The RI/FS Work Plan necessarily cites environmental data from previous investigations conducted at the Site as part of the Site description. Although we do not necessarily adopt these findings as reflecting current conditions at the Site,

2.2.2 Remedial Action Completed

After the Site was abandoned, NYCDEP and NYSDEC personnel performed an investigation of materials left behind in tanks, vessels, building containment areas, and other structures. Reportedly, the investigations indicated that some of the remaining materials were flammable and that some contained solvents, PCBs, and heavy metals. As a result, in 1982, the NYCDEP contracted CH2M Hill, as the oversight engineer, and OH Materials Corp (OHM) as the remedial contractor to perform a Removal Action.

In total, OHM reported that it removed over 500,000 gallons of liquids and approximately 900 cubic yards of solids (from tanks, containment areas, separators, etc.), portions of which it reported were impacted with PCBs, chlorinated solvents, heavy metals and/or cyanide. OHM emphasized that it had searched for hidden or buried storage tanks that had not been previously discovered by NYCDEP personnel. A magnetometer was used to scan for underground tanks in suspect on-Site areas. A total of 106 aboveground and underground tanks were evaluated as described below. Following the removal, transportation, and off-Site disposal of the liquids and solids, on-Site storage tanks (including aboveground and underground tanks), piping, containment areas, and buildings were reported by OHM to have been emptied and decontaminated. A description of the work completed is presented in the report entitled Engineering Services Report, Quanta Resources Site Cleanup, prepared by CH2M Hill for the NYCDEP, dated December 29, 1982 and summarized below.

All tanks at the Site, including aboveground and underground tanks, were decontaminated and were certified as "gas free" by a licensed Marine Chemist from Marine Chemists Inc. of Hoboken, New Jersey. In addition, the dike areas and separators were decontaminated following the removal of all aqueous liquids, oils, and accumulated sludge. The cleaning and decontamination of the Site's extensive piping network and appurtenances lasted throughout the duration of the project. The piping was dismantled into workable sections and thoroughly cleaned with potable water using high pressure water lasers. The cleanup and decontamination of Building A required the cleaning of the 14 tanks within the building, decontamination of the walls, floors, and basement areas of the building which had accumulated approximately 3 feet of

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we find it necessary to refer to the findings in preparing this RI/FS Work Plan.

aqueous/oil waste and sludge. In addition to the 10 tanks within Building F, the floors and walls were decontaminated. The other buildings reportedly did not contain liquid waste materials.

2.2.3 Previous Investigations Completed

At the conclusion of the Removal Action, OHM conducted an environmental investigation on behalf of the NYCDEP and installed four on-Site monitoring wells and collected samples of groundwater, light nonaqueous phase liquid (LNAPL), and composite samples of soil/fill. The activities conducted and findings of the study are presented in the report entitled *Preliminary Hydrogeologic Assessment*, Quanta Resources, New York City, New York, prepared by OHM, January 7, 1983. The sample collection, handling, and analyses procedures were not well documented and the sampling locations are not fully known. Consequently, while these data were useful for scoping the subsequent investigation described below, the OHM data are not appropriate for use in this Remedial Investigation. Only general observations and some limited groundwater/LNAPL measurements from the OHM Study are discussed further in this RI/FS Work Plan.

The firm Lawler, Matusky & Skelly (LMS) conducted a Phase II Investigation from 1988 through 1990 on behalf of NYSDEC (*Engineering Investigations at Inactive Hazardous Waste Site, Phase II Investigation*, Quanta Resources Site No. 241005, May 1990). LMS reported that the soils, LNAPL, and groundwater contained constituents similar to those detected by OHM in the materials removed during the 1982 Removal Action. A summary of the environmental data collected by LMS is presented in Section 2.4.

2.3 Environmental Setting

2.3.1 Site Description

The Site currently exists on a small, approximately 1.8-acre property located in an old, highly industrialized section of Long Island City, Queens, New York. Figure 4 depicts the current condition of the Site. Most of the structures (buildings, tanks, and containment areas) have been demolished since the Site was abandoned in 1981. The remaining structures on the Site include a multi-story building that houses several empty tanks, and one aboveground tank containment area that includes 14 large empty steel aboveground storage tanks (ASTs). During its operation, most of the Site was reportedly covered by asphalt or concrete, and large portions of the southern area of the Site have since been covered with a variably thick layer of post-operational fill and debris.

The northern portion of the Site is concurrently covered by asphalt or concrete pavement. A chain link and corrugated steel fence surrounds much of the Site. Piles of construction debris, remnants of buildings and steel tanks and boilers, tires, wood pallets, and associated junk, exists in piles at different areas of the Site including within the existing AST containment area and along the southeast portion of the Site as shown on Figure 4. While these structures and debris piles limit access to certain portions of the Site, there is sufficient access to initiate the Remedial Investigation.

Historically, the properties adjacent to the Site, including the area along Newtown Creek, have been used since the 19th century for a variety of industrial purposes, including coal storage, coal oil production, petroleum storage and refining, chemical and fertilizer production, fat rendering, and other types of industry. Diesel and freight trains have traveled the LIRR tracks along the southeast border of the Site for more than a century.

Newtown Creek is reported to be heavily impacted by historic industrial activities as well as current industrial loading. NYSDEC has issued four permits for Combined Sewer Overflows into the creek and five point source permits within a half-mile of the Site. A New York City Department of Sanitation Report, *Comprehensive Solid Waste Management Plan, Chapter 15: Environmental Review – Review Avenue Site,* October 2000 discusses the environmental condition of Newtown Creek in the vicinity of the Site as follows: "Natural Resources in the form of benthic invertebrates and fish are quite limited in Newtown Creek. Sediment contamination and organic loading prevent the development of a healthy benthic community; the communities present represent the opportunistic species and exhibit low diversity and high concentrations. Low or non-existent dissolved oxygen, particularly during the summer months, combined with lack of food sources, make the waterway unsuitable for passage or survival of most fish species."

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The Site is located between a local topographic high located northeast of the Site (local groundwater recharge area) and Newtown Creek (a local groundwater discharge area). Groundwater flow, in the relatively flat Site area, under natural conditions, would be expected to flow nearly horizontally south-southwest within the Upper Glacial Aquifer towards Newtown Creek[2]. The Upper Glacial Aquifer is anisotropic with the horizontal hydraulic conductivity estimated to be 10 times greater than the vertical conductivity. Vertical gradients in the vicinity of the Site are expected to be minimal or upward as a result of the high horizontal hydraulic conductivity of the Upper Glacier Aquifer and the presence of a groundwater discharge boundary located approximately 450 feet to the southwest of the Site (Newtown Creek). If vertical gradients are present, they would be expected to be upward, under natural conditions, particularly as groundwater approaches its discharge to Newtown Creek. Figure 5 presents a conceptual hydrogeologic model of the Site.

Public drinking and industrial water supplies for Queens County are supplied primarily by the New York City reservoir system. The area of Queens County that relies on groundwater as its source for potable water is located approximately 6 miles southeast of the Site. A regional groundwater divide is located between the Site and this portion of Queens County. In addition,

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according to the 1990 LMS report, only a small number of private wells are permitted by the New York City Department of Health for nonpotable uses. Therefore, any groundwater impacts at the Site would be expected to be confined to a thin surficial water bearing unit flowing in a southerly direction toward Newtown Creek, which would not impact any potable water supplies.

2.3.3 Surface Water Hydrology

The Site lies approximately 40 feet above mean sea level (MSL) with its highest elevation along Review Avenue. Calvary Cemetery, located northeast of the Site, on the opposite side of Review Avenue, is locally a topographic high with elevations ranging from approximately 50 to over 70 feet MSL. The area immediately surrounding the Site is relatively flat, having an average southwesterly gradient of approximately 2.5% towards Newtown Creek. Surface water runoff will generally follow topographic gradients, which are to the southwest toward Newtown Creek. Between the Site and Newtown Creek lies the LIRR ROW and industrial properties, which locally affect surface water drainage. Newtown Creek flows west-northwest into the East River.

2.4 Summary of Existing Environmental Data

This section discusses the existing on-Site environmental data primarily as presented in the LMS Phase II Investigation. Only limited information from the Preliminary Hydrogeologic Assessment (OHM, 1982) and available off-Site data were utilized. The relevant data tables and figures from the LMS Phase II Study are presented in Appendix B. A summary of the primary COPC reported by LMS in environmental media is presented on Figure 7.

2.4.1 Soil/Fill

Previous investigations encountered historic fill material across the Site ranging in thickness from 5 to 19 feet. The historic fill material reportedly consists primarily of cinders, wood, brick, coal, and coarse to fine grained sediments. In several areas the historic fill is overlain by a layer of rubble/debris placed subsequent to the termination of historic operations at the Site. Initial observations have indicated that, other than discrete locations of surface staining, this post-operational fill does not reflect characteristics representative of a release of hazardous substances. This observation will be confirmed as part of the Remedial Investigation.

Four surface samples of soil/fill or accumulated solids (SS-1 through SS-4) were collected by LMS at the approximate locations shown on Figure 7. Sample locations SS-1 and SS-4 were collected from solids accumulated within AST containment areas that, as LMS indicated, may have concrete bases and thus not represent actual soil conditions. Sample SS-3 was collected by LMS off-Site within the LIRR (ROW) materials.

The only on-Site surface soil/fill sample was collected by LMS at location SS-2 in an unpaved area of the Site. A summary of the primary COPC reportedly detected in LMS's samples is shown on Figure 7. LMS collected sample SS-2 from an area with characteristics differing from that for samples SS-1 and SS-4: thus direct comparison and interpretation of the reported concentrations was not appropriate. However, it is worth noting that the volatile organic compound (VOC) and semi-volatile organic compound (SVOC) constituents LMS reported in SS-1 and SS-4 were similar to those it reported in SS-2. These same constituents were also generally detected by LMS in LNAPL on-Site (see Section 2.4.2). PCBs were not detected by LMS in SS-1 or in its LNAPL samples, but were detected by LMS in soil collected from SS-2 and SS-4. Given the operational history and time frame for the Site and related potential release mechanisms for COPC reported by LMS, it is reasonable to conclude that investigation of soil/fill representative of the historical operation time frame should be sampled at selected locations across the Site to confirm the presence/absence of these COPC as originally reported by LMS.

Sample SS-3, collected by LMS off-Site within the LIRR ROW, differed from the on-Site samples by the type and magnitude of constituents reported. VOCs and SVOCs were reported by LMS in SS-3 at lower concentrations and PCBs were reported by LMS at a much higher concentration (60 mg/kg). The source(s) of these reported off-Site constituents is (are) unknown. However, it should be noted that railroad tracks in older industrial areas have been shown to be commonly contaminated with VOCs, SVOCs, metals and PCBs. Therefore, the detection of VOCs, SVOCs, and PCBs within the LIRR ROW is not necessarily connected to the Site.

The types and relative concentrations of metals detected in on-Site samples by LMS, while limited and not directly comparable, were generally similar; again indicating the potential for occurrence of these COPC across the Site. The sample results at off-Site sample SS-3 were considerably lower and somewhat disproportionate to the on-Site sample results.

Similar to the conclusion drawn with respect to VOCs, SVOCs and PCBs, the above findings and the historical use of the Site support the development of a Remedial Investigation scope that will assess the potential Site-wide distribution of COPC. The Remedial Investigation should also confirm the presence of historic fill placed at the Site.

2.4.2 Light Nonaqueous Phase Liquid

To confirm the presence of LNAPL identified during the OHM investigation, LMS installed three monitoring wells GW-1, GW-2, and GW-3 at the locations shown on Figure 7. While no soil boring or well construction logs were available, the following construction summary was taken from the text of the LMS report.

	LMS Monitoring Well No.		
LMS Measurements	**GW-1**	**GW-2**	**GW-3**
Depth of Fill	19 ft.	5 ft.	11 ft.
Bottom Depth of Borehole	39 ft.	29 ft	28 ft.
Evidence of LNAPL in Soil	6 ft, 24 to 29 ft. (1)	14 to 28 ft. (1)	14 to 16, 19 to 21 ft.
Bottom of Screen Interval	38 ft.	28 ft.	27 ft.
Top of Screen Interval	28 ft.	18 ft.	17 ft.
Top of LNAPL Layer	---	14.19 ft.	12.46 ft.
Top of LNAPL/Groundwater Interface	22.61 ft.	21.39 ft.	19.82 ft.
Apparent LNAPL Thickness (2)	Sheen(3)	7.20 ft.	7.36 ft.

(1) Drilling may have dragged or allowed LNAPL to penetrate depths below groundwater table.

(2) "Apparent" LNAPL thickness (not actual in-situ thickness of saturated/mobile LNAPL fraction) as reported by LMS.

(3) While no measurable thickness was reported, LMS inferred 2.61 ft. of LNAPL in well GW-1.

Studies conducted subsequent to the LMS Phase II Investigation (DMJ Associates, October 2000) identified the LNAPL as consisting of a "weathered, viscous, 10 weight lubricating oil."

Apparent Thickness

The measurements made by LMS indicate apparent LNAPL thicknesses of approximately 7 feet in wells GW-2 and GW-3. LMS stated that the measured apparent thickness approximated the actual thickness due to the observed coarse-grained nature of the sediments. However, grain size analyses were not performed to quantify the observations. Notably, USEPA states that LNAPL thickness measured in a monitoring well has been reported to typically exceed the actual LNAPL saturated formation thickness (i.e., potentially mobile fraction of LNAPL) by a factor of between approximately 2 and 10 (USEPA, *Groundwater Issues, Light Nonaqueous Phase Liquids*, EPA/540/5-95/5000). So while the LMS data indicate the presence of LNAPL, its actual saturated thickness and volume is in question and should be assessed as part of the Remedial Investigation. More important than thickness, however, is the mobility, distribution, and chemical make-up of the LNAPL. These parameters require examination during the Remedial

Investigation in order to assess the potential risks that LNAPL might pose and, thus, the degree to which LNAPL needs to be addressed.

Mobility and Distribution

Any potential LNAPL releases to the subsurface at the Site (to the extent that they came from the Site) are likely to have ended at least 20 years ago as a result of the Removal Action completed by OHM in 1982 (CH2M Hill, 1982). Eventually, if it has not occurred already, the LNAPL will cease to move laterally as the resistive forces in the water-wet subsurface soils (within the saturated zone and capillary fringe) balance the lateral driving forces of the LNAPL lens. In addition, fluctuations in groundwater elevations will smear LNAPL vertically throughout the range of hydraulic variation, thus further trapping LNAPL via capillary forces in residual zones of saturation both above and below the groundwater surface. This, in turn, further decreases LNAPL mobility and migration potential (USEPA540/5-95-500). When immobile, the residual LNAPL presents a potential concern only as a source of dissolved groundwater and vapor-phase constituents. For the biodegradable components of the LNAPL (e.g., VOCs), the dissolved phase impacts will extend to the point where the rate of dissolution of the LNAPL components equilibrates with the rate of biodegradation. For the non-biodegradable components (e.g., metals), the downgradient extent is determined by the equilibrium between rate of dissolution and dispersion (*Evaluating Hydrocarbon Removal from Source Zones: Tools to Asses Concentration Reduction,* Report sponsored by The American Petroleum Institute, January 2001).

A preliminary assessment of the distribution of LNAPL at the Site has been made based on the data reported from studies conducted on adjacent properties.[3] While LNAPL has been detected in off-Site monitoring wells installed sidegradient to the reported south to southwest direction of groundwater flow (i.e., MW-4 on the adjacent west property and MW-8 on the adjacent east property, as shown on Figure 6), it has not been determined whether or not this off-Site LNAPL originated from former operations at the Site. Importantly, however, data from three monitoring wells installed hydraulically downgradient of the Site, i.e., MW-3, MW-3R, and MW-7 (see Figure 6), indicate that LNAPL has not migrated appreciably downgradient from the Site. Monitoring well MW-3 (installed by ERM in 1992) and replacement well MW-3R (installed by Haley and Aldrich in 2000) appear to be located approximately 100 feet (and possibly closer)

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[3] Studies conducted on adjacent properties include the following: ERM, 1990; ERM, 1992; Analytical Results Summary, Haley and Aldrich, Inc. by Chemtech, Project No. L1640LP, 2000; Analytical Results for Triegel and Associates, Inc. by IGLA Laboratories, project No. 9959, 2000; and Haley and Aldreich Inc., DMJ Data Summaries (Water Level Elevations, LNAPL Analyses and LNAPL Measurements), Fall 2000.

from the southern Site boundary. LNAPL has reportedly not been detected in either of these two monitoring wells. Additionally, the monitoring well data from MW-7 (Haley and Aldrich, 2000 and DMJ Associates, 2000) also did not show the presence of LNAPL. Taken together, the available data indicate that the on-Site LNAPL has not migrated far (or possibly not at all) from the Site towards Newtown Creek.

LNAPL Chemistry

Samples of the LNAPL were collected from monitoring wells GW-2 and GW-3 during the LMS investigation and were analyzed for VOCs and SVOCs, PCBs, metals, EP toxicity metals, oil and grease (O&G), and ignitibility. Samples from both the upper and lower portions of the LNAPL column were collected. A summary of the LMS findings is presented below.

- **VOCs** - The VOCs detected in the LMS LNAPL samples were similar to those detected in their soil/fill solids samples (Section 2.4.1) and groundwater samples (Section 2.4.3) and primarily consisted of benzene, toluene, ethylbenzene, and xylene (BTEX) compounds with lower concentrations of chlorinated VOCs (1,2-Dichloroethylene (1,2-DCE), chloroethane, and vinyl chloride). Noticeably absent were trichloroethylene (TCE) and tetrachloroethylene (PCE) as these compounds were detected by LMS in soil and are typically encountered in solvent waste materials particularly when potential biodegradation daughter products are detected (e.g., 1,2-DCE and vinyl chloride). Moreover, TCE and PCE were also not detected by LMS in the groundwater samples while (as with the LNAPL) potential biodegradation daughter products were detected. These findings indicate that either TCE or PCE were not initially present within LNAPL or that natural biological degradation processes had reduced their concentrations to non-detectable levels. The Remedial Investigation will confirm the absence/presence of PCE and TCE and assess natural biotransformations.

- **SVOCs** - The SVOCs detected by LMS in LNAPL were similar to those reported in groundwater and consist primarily of PAHs.

- **Inorganics** - Several metals were detected in the LMS LNAPL samples and include aluminum (Al), arsenic (As), barium (Ba), calcium (Ca), chromium (Cr), iron (Fe), lead (Pb), manganese (Mn), vanadium (Va), and zinc (Zn). The metals having the highest reported concentrations were Al, Ba, Ca, Fe, and Zn. The EP toxicity test results for As, Ba, Cr, Pb, and Hg (not detected) were all less than the regulatory limits by at least one order of magnitude. Cyanide was not detected in any of the LMS LNAPL samples.

- There does not appear to be separate phases of LNAPL as VOCs, SVOCs, and metal concentrations in the upper LNAPL portion were similar to those detected by LMS in the lower LNAPL portion. The marginal differences in concentration reported by LMS between the lower and upper LNAPL portions were likely due to age and weathering differences, not separate phase materials. In addition, while there were some differences in the concentrations of VOCs detected by LMS in LNAPL samples from GW-2 and GW-3, these differences are out-weighed by the similarities, which indicate that the

LNAPL at both locations were similar in nature and were likely from related, commingled sources.

- **PCBs** - Low concentrations of PCBs were detected by LMS in the GW-3 LNAPL sample. PCBs were not detected by LMS in the GW-2 LNAPL sample.

- **Oil and Grease** - The oil and grease component of the LNAPL in GW-3 was reported by LMS to be 30%. The oil and grease analysis was not run for the GW-2 sample due to laboratory mishandling.

- **Ignitibility** - All LMS LNAPL samples exhibited a flash point greater than 212°F further indicating the LNAPL was of similar character.

2.4.3 Groundwater

As discussed previously, LNAPL was detected by LMS in all groundwater wells (reportedly, GW-1 had a sheen and GW-2 and GW-3 had approximately 7 feet of LNAPL). While it is assumed that the LMS sampling and laboratory protocols would have attempted to minimize the impact of LNAPL on the groundwater samples, it is possible that some degree of LNAPL impact inadvertently occurred. As a result, analytical results reported by LMS may overstate the concentration of constituents that had actually dissolved in groundwater. Therefore, one of the objectives of the Remedial Investigation is to install monitoring wells that allow collection of representative groundwater samples. A brief summary of the groundwater sample analyses results reported by LMS is provided below. Figure 7 shows the location of the LMS wells and a summary of the constituents detected by LMS.

- ***VOCs*** - Not surprisingly, the VOCs detected by LMS in groundwater were similar to those detected by LMS in LNAPL and included BTEX compounds and chlorinated VOCs. The chlorinated VOCs were typical daughter products from biological reductive dechlorination of PCE, TCE, and 1,1,1-trichloroethane (1,1,1-TCA), which were not detected by LMS in groundwater nor in LNAPL. As stated in Section 2.4.2, the reported absence of PCE, TCE, and 1,1,1-TCA is surprising and may indicate they had attenuated to not detectable levels. In addition, the reported dissolved phase concentrations of VOCs were several orders of magnitude lower than the concentrations of the same VOCs measured by LMS in LNAPL samples. This large concentration reduction from LNAPL to the dissolved phase was likely a result of the low effective solubility of the VOCs held within the hydrophobic LNAPL and/or the rapid biodegradation of VOCs once they become bioavailable (dissolved) in groundwater.

- ***SVOCs*** – Similar to the LMS LNAPL results, the primary SVOCs detected in groundwater were PAHs. The potential for LNAPL to have been inadvertedly collected in the LMS groundwater samples may have contributed to these PAH levels.

- ***Pesticides/PCBs*** - Neither pesticides nor PCBs were detected in any of the groundwater samples.

- ***Inorganics*** - The primary metals detected by LMS in groundwater were antimony, barium, iron, and manganese.

  As stated in the LMS report, the highest concentrations of iron and manganese reported in the 1990 data occurred in the upgradient well GW-1 indicating a non-Site-specific source and/or natural conditions. Cyanide was not detected by LMS in any of the monitoring well samples.

3.0 CONCEPTUAL SITE MODEL

The Conceptual Site Model (CSM) ties together relevant factors and existing data identified in Section 2.0. Based on these factors and data, there is a low probability that exposure pathways extend beyond the Site boundary to any potential receptors. This analysis is the rationale for conducting the first phase of the Remedial Investigation on the Site. The CSM was prepared in accordance with NYSDEC guidance and further details this rationale along with the discussion below.

The entire Site and surrounding properties have been used for a variety of industrial purposes since the late 19th century. The Site overlies glacial deposits and a mixture of man-made historic fill (ranging in thickness from 5 to 19 feet). Sands with some limited fine texture deposits dominate the glacial deposits near the surface at the Site and throughout most of Queens County. The Jameco gravel unit may be present locally beneath the glacial sand unit. Proglacial lake deposits consisting of the Gardiners Clay possibly underlie the near surface sands and overlie the Fordham Gneiss bedrock. Only the near surface glacial deposits are considered in detail in the CSM because of the limited potential for downward hydraulic gradients that would be predicted, given the high horizontal hydraulic conductivity and close proximity of the Site to a major groundwater discharge point, Newtown Creek. Also, there have been no reported observations of DNAPL at the Site. Newtown Creek is approximately 450 feet southwest of the Site.

As a result of NYCDEP Removal Action activities at the Site, all primary sources have reportedly been removed. Secondary sources are primarily limited to the relatively low concentrations of COPC in oil residuals that are adsorbed to soils/fill and distributed as LNAPL in the vicinity of the water table across portions of the Site. These secondary sources may pose no significant threat to human health or ecological receptors based on the lack of exposure points, the lack of mobility of the secondary sources, and current or anticipated land use. However, additional data will be collected to characterize potential direct contact exposure scenarios and volatilization risks from VOC movement into commercial/industrial buildings, as part of the assessment of future Site use risks. Figure 8 presents a graphical depiction of the CSM.

Groundwater is not known to be used for any purpose in the vicinity of the Site. Based on the LMS study results, minimal leaching of COPC to groundwater has occurred. In addition, the extended period that the Site has been inactive has provided a significant time period for natural attenuation processes to reduce and sequester the potentially mobile chemicals at the Site.

Considerable natural attenuation is predicted based on the relatively high degradability of the organic COPC beneath the Site. These factors support the preliminary view that Site-related COPC are likely limited to the soils and shallow groundwater beneath the Site area and do not pose a significant threat to off-Site human or ecological receptors.

Off-Site, differential infiltration of water and contaminants from other downgradient sources, along the rail lines and other properties likely influence off-Site groundwater flow and water quality. In addition, Newtown Creek has been significantly degraded by many decades of past-unpermitted discharges upstream and downstream of the Site. Consequently, further characterization and assessment of Site-related COPC (horizontally and vertically) is needed to further confirm the CSM and establish the gradients of decline of COPC concentrations from the Site prior to undertaking any off-Site assessment.

4.0 PRELIMINARY ARARS/SCGS AND REMEDIAL ACTION OBJECTIVES

The selection of potential Applicable or Relevant and Appropriate Requirements/New York State Standards, Criteria and Guidelines (ARARs/SCGs), and criteria To Be Considered (TBCs) for the Site will be consistent with the requirements of the National Contingency Plan (Section 300.400(g)) and EPA Guidance (CERCLA Compliance with Other Laws Manual: Interim Final, August 1988). In addition, New York State regulatory guidance such as relevant Technical Assistance Guidance Memoranda (TAGM - 6NYRR Chapter IV, Part 375) and the Division of Water Technical and Operational Guidance Series (TOGs - 6NYRR Chapter 10), will also be included in the evaluation/selection process. This information will be evaluated in a manner consistent with the National Contingency Plan (NCP) (Sections 300.400(g) and 300.430(f)) and relevant USEPA and NYSDEC guidance.

The approach for identifying the potential ARARs/SCGs begins during the Remedial Investigation. ARARs/SCGs can be categorized as chemical-specific, action-specific, or location-specific requirements. Chemical-specific ARARs/SCGs are health-based or risk-based numerical values that may define acceptable exposure levels and be used in establishing remediation goals. Based on the information available at the Site, potential chemical specific ARARs/SCGs may include standards developed under the Resource Conservation and Recovery Act (RCRA), the Clean Water Act, or the Toxic Substances Control Act for the treatment or disposal of VOCs, SVOCs, PCBs, or metals reportedly found in soils and groundwater.

Location-specific ARARs/SCGs are restrictions based on the concentrations of hazardous substances or the conduct of activities in a specific area. Potential location-specific requirements can be established under a number of different environmental statutes, such as RCRA or CWA. For example, certain limitations on on-Site treatment, storage or disposal may be required under RCRA or the Hazardous and Solid Waste Amendments (HSWA) may be identified as potential ARARs/SCGs.

Action-specific ARARs/SCGs are technology- or activity-based requirements or limitations on actions to be taken with respect to hazardous substances. These requirements are triggered by particular cleanup activities selected as the remedy. A preliminary list of action-specific requirements will be developed according to the type of remedial technologies that are evaluated throughout the RI/FS.

Because of the iterative nature of the RI/FS process, the identification of ARARs/SCGS, TBCs and remedial technologies will continue throughout the RI/FS as a better understanding of the Site conditions, COPC, and potential remedial technologies evolve. Using this approach, appropriate risk-based remedial action objectives for soils and groundwater at the Site will be determined.

5.0 WORK PLAN RATIONALE

5.1 Remedial Investigation Approach

5.1.1 Phased Approach

The Remedial Investigation will be conducted in a phased manner. The Phase I Remedial Investigation will initiate the characterization of on-Site conditions and will assess the condition and availability of off-Site monitoring points for use in the next phase. A review of available off-Site data will also be conducted during the Phase I Remedial Investigation. The Phase II Remedial Investigation will be designed to complete the on-Site characterization as well as assess off-Site impacts (if any) and potential off-Site exposure pathways indicated by the Phase I results. The Phase II Remedial Investigation will utilize appropriate off-Site data and the sampling of off-Site monitoring wells. The scope of the Phase II Remedial Investigation will be determined at the conclusion of the Phase I Remedial Investigation.

5.1.2 Investigation Rationale

A review of historical operations at the Site (see Section 2.2), the Site environmental setting (see Section 2.3), and the previously reported distribution of COPC at the Site (see Section 2.4) has been completed as part of the Scope of Work development. This work has indicated the following general characteristics:

- As shown on Figure 3, former operations at the Site were complex and crowded onto a small approximately 1.8-acre property. Numerous tanks, vessels, buildings, separators, and appurtenances were operated in overlapping areas across the Site.
- COPC at the Site have potentially commingled as a result of past practices as well as more recent disturbances. Similar constituents occur in all Site media and may have been dispersed across the Site by former operations and subsequent Site grading activities;
- Site decontamination/decommissioning activities conducted by OHM on behalf of the NYCDEP reportedly removed hazardous substances from all operational tanks, vessels, piping, buildings, etc. In addition, the majority of the Site structures have been removed; and,
- Historic fill is present across the Site that potentially contains COPC.

Based on the above, the Remedial Investigation will focus on defining the essential characteristics and extent of the LNAPL mass, which has apparently been detected at the Site, and the COPC in impacted soil/fill, groundwater, as well as LNAPL at the Site. In all cases, the investigation program and subsequent results will be evaluated with respect to relevant current and potential future exposure pathways. The specific objectives of the work with respect to the foregoing rationale are provided below.

As a practical matter, it is proposed that the Remedial Investigation should be managed in a Site-wide manner that encompasses potential operations that may have impacted soil/fill and groundwater. This Site-wide Remedial Investigation approach is not only necessitated by the conditions described above, but is consistent with the Site risk management and redevelopment strategy.

5.2 RI/FS Objectives

This section lists specific objectives of the RI/FS for the Site. The following objectives are based on the relevant factors associated with the Site conditions, the CSM and preliminary ARARs/SCGs presented herein:

- Objective 1: Estimate spatial distribution, mobility, and perform a chemical characterization of LNAPL.
- Objective 2: Establish concentration distribution and gradient of COPC within soil, groundwater, and LNAPL along exposure pathways.
- Objective 3: Define important hydrogeologic parameters needed to assess COPC fate and transport, such as groundwater flow direction and gradients.
- Objective 4: Assess COPC fate and transport based on empirical data and literature.
- Objective 5: Assess potential contributions of COPC from other properties to groundwater (upgradient, sidegradient and downgradient areas).
- Objective 6: Determine potential exposure pathways and potential receptors to COPC originating from the Site.
- Objective 7: Evaluate potential threats to human health and the environment.
- Objective 8: Identify a range of remedial alternatives that eliminate the significant threats to human health and the environment in accordance with 6 NYCRR Part 375-1.4(b)(1)-(13) and evaluate those remedial alternatives in the context of the Site setting and redevelopment options.

6.0 RI/FS TASKS

This section presents the scope of work for the various tasks proposed to complete the RI/FS at the Site.

6.1 Task 1: Scoping the RI/FS

The scoping process, conducted for the purpose of identifying and defining the specific RI/FS tasks described below, has been completed and consisted of the following activities:

- Visits to the Site and surrounding areas;
- Review of the Consent Order requirements and relevant State and Federal guidance documents;
- Compilation of existing studies and information on the Site, adjacent properties and surrounding area; and,
- Evaluation of the compiled available data.

The information used during the scoping process is referenced throughout this Work Plan and is listed in Section 8.0.

6.2 Task 2: Citizen Participation Plan

A Citizen Participation (CP) Plan will be followed in accordance with New York Environmental Conservation Law, hazardous waste site regulations (6 NYCRR Part 375) and Citizen's Participation in New York's Hazardous Waste Site Remediation Program: A Guidebook (NYSDEC, DER, 1998). The overall objectives of the Citizen Participation Plan, as stated in the NYSDEC guidebook, are as follows:

- Inform the affected/interested public about the Site, its environmental impacts, and planned and ongoing actions to investigate or remediate the Site;
- Establish opportunities for the public to provide meaningful input into the Site's remedial decision making process; and
- Help to factor the public's input, as appropriate, into remedial decisions.

The QSAG understands the following actions will be undertaken by NYSDEC during the RI/FS to meet the requirements of the NYSDEC Citizen Participation Program:

- Citizen Participation Record This document will list the required CP activities and identify issues and information that are important to the community. The record will also help to identify any additional CP activities that might be necessary.

- Contact List This list will include contact information for any residents that are adjacent to the Site, government officials, local media, businesses, or other groups or organizations affected by or interested in the Site.

- Document Repository A document repository will be set up in the NYSDEC Region II office in Hunter's Point Plaza in Long Island City. An additional repository will be set up in a publicly accessible location (such as a library) near the Site.

- Fact Sheet A fact sheet will be prepared and mailed to all parties listed on the Contact List. The fact sheet will announce the availability of the final draft RI/FS Work Plan and will provide a brief summary of information and the decision process at various milestones reached during the project such as at the conclusion of the Remedial Investigation and during the evaluation and selection of remedial alternatives.

6.3 Task 3: Phase I Environmental Investigation

This section discusses the proposed scope of work for the Phase I Remedial Investigation. As discussed in Sections 5.1.1 and 6.6, the scope of the Phase II Remedial Investigation will be developed at the conclusion of the Phase I Remedial Investigation and will be proposed to NYSDEC as part of the Phase I Data Summary Report.

6.3.1 Task 3.1: Field Investigation

Field work will be performed in accordance with the requirements and protocols described in the Health and Safety Plan (HASP) provided in Appendix C. All field sampling and laboratory analyses will be performed in accordance with the requirements and protocols described in the Sampling and Analyses Plan (SAP), which includes a Quality Assurance Project Plan (QAPP) provided in Appendix D.

6.3.1.1 Soil/Fill Investigation

The specific objectives of the soil/fill investigation are:

- Determine the magnitude and distribution of COPC in surface and subsurface soil/fill;

- Assess physical characteristics of the soil/fill;

- Assist in the assessment of the distribution of LNAPL; and,
- Assess the distribution, and characteristics of historic fill placed at the Site.

In order to meet these objectives, a total of ten soil borings, SB-05 through SB-14, are proposed at the approximate locations shown on Figure 9. The locations of the borings were selected to provide a spatial distribution across the Site with adjustments considering physical access, locations where COPC were previously reported, and areas of previous industrial activity. In addition, three borings used to install the proposed monitoring wells (described in Section 6.3.1.2) will be incorporated into the soil/fill investigation (i.e., SB-01 through SB-03). Further, the off-Site boring, which will be used to install the upgradient monitoring well (SB-04), will be used for the collection of background data. In summary, the soil/fill investigation will include a total of 13 on-Site borings and one off-Site boring.

The borings will be advanced using hollow stem auger (HSA) drilling methods with continuous split spoon sampling (as per ASTM D-1586-84). The borings will extend through the LNAPL smear zone (where present) and down to the phreatic surface. Monitoring of VOCs in the breathing zone during drilling will be performed using a photo-ionization detector (PID). Each soil/fill split spoon sample will be visually examined and classified with respect to the United Soil Classification System (USCS) and described in regards to the sample texture, composition, color, consistency, percent recovery and moisture content. Additionally, the potential presence of odors, staining, and LNAPL will be noted.

Samples for physical and analytical testing will be collected from each of the ten boreholes and four monitoring well borings at 5-foot intervals (0 to 2 feet, 5 to 7 feet, 10 to 12 feet, and 15 to 17 feet) as follows. Samples from all of 5 to 7 foot and 10 to 12 foot intervals in each boring will be submitted for laboratory analyses. A 0 to 2 foot surface soil sample will not be analyzed at locations where there is obvious fill/debris that had been placed subsequent to the termination of Site-related operations (i.e., post-operational fill) or where the surface debris will likely be moved/removed at a future date and thus not represent future direct contact exposures. It is estimated that these conditions will exist in about half of the soil borings. Samples deeper than the 10 to 12 foot interval will be collected to provide vertical delineation if field screening impacts are observed at or below the 10-12-foot interval (substantial staining, odors or PID readings). Similar to the collection of surface soil samples, it its assumed that samples deeper than the 10 to 12 foot interval will be collected in about one half of the on-Site borings.

Background soil samples will be collected for laboratory analyses from the off-Site boring at the following intervals; 0 to 2 feet below pavement structure, 5 to 7 feet, 10 to 12 feet, and 15 to 17 feet (if above groundwater).

Notably, continuous split-spoon soil sampling will be conducted in each of the soil borings to provide a continuous log of physical characteristics, soil descriptions, and field screening results. Three-inch split spoons will be utilized to improve sample recovery, particularly within the historic fill. Soil/fill samples for laboratory analysis will be collected at predetermined intervals in order to provide a consistent cross-sectional interpretation of subsurface soil impacts.

Samples will be analyzed in a laboratory for Target Compound List (TCL) organic compounds (minus pesticides) and Target Analyte List (TAL) inorganic constituents. Pesticides are not included as they have not been identified in previous reports as COPC at the Site. In addition, a total of ten samples will be tested for grain size distribution and total organic carbon (TOC) to physically characterize subsurface materials. Table 1 provides a summary of the soil sampling program.

6.3.1.2 Groundwater Investigation

The specific objectives of the groundwater investigation are:

- Install monitoring wells screened below the LNAPL smear zone in order to collect representative shallow groundwater samples and to provide an accurate measurement of the phreatic surface;
- Assess the presence and magnitude of COPC dissolved in groundwater;
- Assess the biological and abiotic natural attenuation of dissolved groundwater COPC;
- Determine aquifer parameters such as hydraulic conductivity, gradients, and estimates of porosity; and,
- Assess the usability of existing on-Site and off-Site monitoring wells.

In order to meet these objectives, three on-Site groundwater monitoring wells (GA-1, GA-2 and GA-3) will be screened below the LNAPL smear zone and one off-Site monitoring well (GA-4) will be installed upgradient at the approximate locations shown on Figure 9. Off-Site access will be required for upgradient well GA-4 that will likely be located in the sidewalk on the opposite side of Review Avenue (north of the Site).

The monitoring wells will be installed using HSA drilling techniques. Soil samples will be collected from each well boring as described above for the soil/fill investigation. If LNAPL is observed, double casing will be installed to the base of the LNAPL smear zone to minimize potential groundwater impacts. The top of the well screens will be installed approximately 10 feet below the LNAPL smear zone to isolate the screen interval from potential LNAPL impacts due to future groundwater fluctuations. Once the LNAPL zone is cased off, the monitoring wells will be cased and screened using flush joint threaded 2-inch diameter schedule 40 PVC with 0.020 slot screen. Each well screen will be 10 feet in length.

Following installation, each well will be surveyed by a NYS licensed surveyor. The wells will be developed no sooner than 24-hours after installation as per NYSDEC guidance and sampled no sooner than seven days upon completion of development. All wells will be purged and sampled following the USEPA Region II procedure for Low Flow Purge and Sampling (USEPA Region II, March 1998). Prior to sampling, a round of water levels will be collected from all on-Site wells and the off-Site background well. The groundwater samples will be analyzed for TCL organic compounds (minus pesticides), TAL metals and the following natural attenuation parameters; light hydrocarbons, chloride, alkalinity, TOC, DOC, TDS, nitrate, sulfate, and CO_2. Table 1 provides a summary of the groundwater sampling program.

In addition to the activities described above, an assessment of existing on-Site and nearby off-Site monitoring wells will be conducted. Off-Site access agreements will need to be obtained for the inspection of off-Site monitoring wells. If present and if access is granted, each will be inspected and sounded. Existing on-Site wells will be surveyed. Consideration will be given to surveying off-Site wells if detailed logs are not available. A well search (1/2 mile) will be conducted to assess whether or not any potential anthropogenic hydrogeologic stresses exist nearby and whether any other nearby monitoring wells exist.

A short-term (1-hour or less), constant low rate pump test (including recovery) and/or slug tests (analyzed using the van der Kamp method for high conductivity aquifer conditions) will be conducted at two locations to determine the hydraulic conductivity of the Upper Glacial Aquifer at the Site. The specific method will be based on the field conditions encountered. This testing approach will minimize the potential to lower the LNAPL (if present) into the well screen. Transducers will be installed in two monitoring wells to assess potential tidal effects on water levels. The transducers will be placed in the wells approximately one week prior to the pump/recovery tests.

6.3.1.3 Light Nonaqueous Phase Liquid Investigation

The specific objectives of the LNAPL investigation are:

- Install monitoring wells specifically designed to monitor LNAPL;
- Assess the physical characteristics of subsurface materials at the groundwater/LNAPL interface;
- Assess LNAPL physical characteristics;
- Assess thickness, distribution, and mobility of the LNAPL; and,
- Determine the presence and magnitude of COPC within the LNAPL.

The extent of LNAPL on the Site will be initially assessed as part of the soil boring and monitoring well installation programs described above. A total of three on-Site LNAPL monitoring wells, GA-5, GA-6 and GA-7, will be installed using HSA drilling methods at the locations and depths selected based on the findings of these investigations. Preliminary locations of the LNAPL motoring wells are shown on Figure 9. The approximate mid-point of the well screens will be installed across the groundwater/LNAPL interface. This configuration may vary depending on the location of the groundwater/LNAPL interface versus the thickness and position of the smear zone. The monitoring wells will be cased and screened using 4-inch diameter schedule 40 flush-joint threaded PVC with 0.020 slot screen. Each well screen will be 10 feet in length. Longer screen lengths may be used depending on the height of the LNAPL smear zone.

Following installation of the LNAPL wells, an oil-water interface probe will be used to measure apparent LNAPL thickness and the groundwater/LNAPL interface. A bail down test will be conducted in each on-Site LNAPL well to help assess the LNAPL thickness, mobility and effective conductivity. Samples of the LNAPL will be collected and analyzed in the laboratory for TCL VOCs, SVOCs, PCBs, TAL metals, chemical fingerprint, and select conventional parameters (specific gravity, viscosity, total organic halides (TOX), sulfur, % solids, flash point, and BTU) as summarized in Table 1. Pesticides and cyanide were not detected by LMS in LNAPL. Samples of the subsurface sediments in the vicinity of the groundwater/LNAPL interface will be collected for possible grain size distribution analysis.

As discussed in Section 6.3.1.2 above, a Site reconnaissance will be initially conducted to locate and assess the condition of existing monitoring wells. One or more of the proposed LNAPL wells may not be installed if previously installed monitoring wells (e.g., GW-1, GW-2, and/or GW-3) are located and are useable.

6.3.1.4 Soil Gas

While a soil gas study has not been specifically proposed as part of the Phase I Remedial Investigation, consideration of a soil gas study will be given following the characterization of the LNAPL distribution on the Site. The details of the soil gas study, if appropriate, will be proposed to NYSDEC as part of the Phase I Data Report discussed below.

6.3.1.5 Site Base Map

A base map will be created for the Site. The base map will include topography, key features (i.e., buildings, tanks, and debris piles) and a metes and bounds survey by a NYS licensed surveyor. The location of all boreholes and monitoring wells (including elevations) installed as part of the Phase I Remedial Investigation will be surveyed and included on the base map. Additionally, existing on-Site wells installed during previous investigations (if found and useable) will also be surveyed and included on the base map.

6.3.1.6 Off-Site Source Evaluation

Several properties adjacent to the Site have conducted environmental investigations. While some off-Site study results were viewed as part of the scoping of this RI/FS Work Plan, a more comprehensive review of data collected from these investigations and other investigations, if available, will be conducted to supplement the Phase I Remedial Investigation data, as appropriate. In addition, off-Site monitoring wells will be inspected and sounded for potential use during the Phase II Remedial Investigation.

6.3.2 Data Analysis and Data Management

All samples will be analyzed in accordance with the analytical methods listed in Table 1. The chemistry data will be transferred by the laboratory and maintained by Golder Associates in database format (i.e., Microsoft Access). The analytical laboratory will provide an Electronic Data Deliverable, which will be uploaded directly into the database without modification. All changes to the database are made in the raw data files as well as the database querying and reporting files. All database reports are version controlled to ensure that only the most up-to-date data are used.

For all analytical samples associated with this project, the laboratory will produce CLP-type or SW846 data packages that will contain all information needed for formal validation of the data. Data validation will be performed on 100% of the data in accordance with the USEPA Region II Standard Operating Procedures (SOPs) HW-6, Revision 11 (TCL Organics data) and HW-2, Revision 11 (TAL Inorganics data). These procedures are specific with regard to evaluation of holding time, surrogate and spike recoveries, precision of duplicate measurements, calibration and instrument performance, blank contamination, compound identification, and compound quantification. Data will be qualified as necessary in accordance with the SOPs and any qualification will be explained in a data usability summary report (DUSR).

Non-TCL/TAL data will be evaluated, using the USEPA data validation SOPs and the appropriate NYSDEC guidance documents, based upon holding times, blank results, and quality control (QC) results assessing accuracy and precision. All analytical data packages will be reviewed for completeness and QC summaries will be evaluated and compared to the appropriate precision and accuracy criteria (PARCC). The PARCC criteria and criteria specified in other applicable guidelines may not always be achievable. Professional judgment, in conjunction with the USEPA data validation SOPs and the appropriate NYSDEC guidance documents, will be used to determine data usability. Any qualification of non-TCL/TAL data will also be explained in the DUSR.

All analytical data will be supplied electronically by the laboratory and will be uploaded directly into a project database. Any qualifiers that are applied to the results during the validation process will be manually entered into the database. Qualified results will be tabulated directly from the database. All results and qualifiers are then checked to confirm accuracy.

6.3.3 Site Characterization Deliverables

Upon completion of the field activities and laboratory analyses, the field data will be compiled, tabulated, and evaluated; laboratory analyses results will be validated and tabulated, and the geologic, hydrogeologic, and CSM will be refined. The results of the validated data will be compared to historical data and NYS SCGs to approximate a spatial and temporal understanding of the nature, extent and fate of COPC. The results of the Phase I Remedial Investigation will be presented in a Phase I Data Summary Report, which will include a proposal for a Phase II Remedial Investigation, for submittal to NYSDEC. The Phase I Data Summary Report will include a discussion of the results sufficient to support the proposal of the proposed Phase II activities. It is envisioned that a comprehensive Remedial Investigation Report would be prepared following the completion of the Phase II Remedial Investigation and would present the results and comprehensive evaluation of both investigations including a human health and environmental exposure assessment.

6.4 Task 4: Sampling and Analysis Plan

The SAP includes the QAPP and is provided in Appendix D.

6.5 Task 5: Health and Safety Plan

The Health and Safety Plan prepared for use during the project is presented in Appendix C.

6.6 Task 6: Evaluation of Data Gaps and Refining RI/FS Objectives

During the course of the RI/FS, the collected project information will be compiled and evaluated to assess whether or not any data gaps remain or new data gaps arise that require additional information to meet the RI/FS objectives. While this is an ongoing task, the first stage of the project where data gaps and RI/FS objectives will be formally assessed is at the conclusion of the Phase I Remedial Investigation activities as currently scoped in this RI/FS Work Plan. As discussed above in Section 6.3.3, the Phase I Remedial Investigation data will be compiled and evaluated and any remaining data gaps (or new data gaps) will be identified and presented in the Phase I Data Summary Report. This report will include a proposal for the collection of additional information during the Phase II Remedial Investigation needed to address these data gaps and meet the RI/FS objectives. This process will be formally repeated at the conclusion of the Phase II Remedial Investigation, and during the preparation of the Final Remedial Investigation Report, which will assess the need to gather additional information or to conduct treatability studies for the purpose of completing the evaluation of remedial alternatives as discussed in Section 6.10 below.

6.7 Task 7: Human Health Risk Assessment

Under NYCRR, Chapter IV, Part 375, remedial action selection must be consistent with the Federal NCP of 1990 and under Part 375-1.4 remedial actions address *significant threats to the* *environment*. In addition, the NYSDEC has issued TAGMs on the determination of soil cleanup objectives and cleanup levels. Similarly for groundwater, NYSDEC Division of Water has issued a TOGs on the determination of groundwater cleanup objectives and levels. Attainment of these generic soil cleanup objectives, for example, will eliminate all significant threats to human health and/or the environment posed by an inactive hazardous waste Site located anywhere in the State of New York (TAGM #4046). However, the NYSDEC recognizes that final Site-specific soil and groundwater cleanup levels are subject to Site-specific factors that are evaluated in part during the Remedial Investigation and in detail in the Feasibility Study.

To evaluate potential risks posed by residual COPC and LNAPL at the Site, the following steps will be employed:

1. Preparation and refinement of the Site Conceptual Model, emphasizing the identification of potentially complete exposure pathways and potential exposure points.
2. Identification of COPC based on the TAGM soil criteria and additional toxicity assessment if needed.
3. Completion of a Site-specific Exposure Assessment, based on empirical data, fate and transport evaluation and vapor intrusion modeling, as necessary.
4. Preparation of an Exposure Assessment Report, including a risk characterization of COPC and identification of significant threats to the environment (NYCRR Part 375-1.4).

All work will be conducted in a manner consistent with the NCP and relevant CERCLA guidance. The Exposure Assessment Report and the significant threats identified in the report will be the basis of the risk analysis in the subsequent FS activities that will be directed at establishing remedial goals. Since there is no groundwater use at the Site, emphasis will be placed on the direct contact threats and vapor intrusion into buildings, on the Site, and surrounding area. Fate and transport modeling and empirical data will be utilized to characterize potential risks to off-Site receptors, if warranted.

6.8 Task 8: Treatability Studies

No treatability studies are envisioned at this time. The need for treatability studies will be reassessed at the conclusion of the Remedial Investigation.

6.9 Task 9: Remedial Investigation Report

Once sufficient information is collected to complete the Remedial Investigation and address the Remedial Investigation objectives as described in Section 5.0, then a Remedial Investigation Report will be prepared and submitted to NYSDEC for review. The Remedial Investigation Report will be prepared in accordance with the Consent Order and with applicable USEPA and NYSDEC guidance.

6.10 Task 10: Feasibility Study

Consistent with the Consent Order, the Feasibility Study will be performed in accordance with USEPA and NYSDEC guidelines. The Feasibility Study will include the development of alternatives that are appropriate for assessment under CERCLAand the NCP and appropriate NYSDEC TAGMS. The Feasibility Study will be performed and submitted in a phased approach as described in the following sections.

6.10.1 Task 10.1: Technical Memorandum

A Technical Memorandum will be prepared and submitted to the NYSDEC for the purpose of obtaining NYSDEC concurrence on a "short-list" of remedial alternatives prior to conducting the detailed analyses. In this manner, Feasibility Study efforts will be streamlined and a decision with respect to a preferred remedial action can be reached in a more efficient manner and a shorter timeframe. RAOs will be established based on the results of the Risk Assessment, the potential future use for the Site, and an analysis of ARARs/New York State SCGs. Based on the results of the Remedial Investigation and using the established RAOs, technologies (including institutional controls) will be identified and screened. The various technologies will then be assembled into combinations of Site-wide remedial alternatives. Once assembled, the potential remedial action alternatives will be screened in accordance with EPA's guidance (based on overall protection, implementability and cost). A "No Action" alternative will be included to comply with the requirements of the NCP. The development of a "short-list" of remedial action alternatives will then be completed selecting the most promising and feasible Site-wide alternatives that are able to provide adequate protection of human health and the environment and able to comply with ARARs/SCGs with or without a justified waiver. The results of this analysis will be presented to NYSDEC in the Technical Memorandum. Notably, NYSDEC TAGM #4030 indicates that when a remedial action alternative is apparent for a site it is not necessarily beneficial to go through the entire remedial alternative selection process. The timing for submittal of the Technical Memorandum may vary depending on the status of the Site characterization and risk assessment.

Requirements for Site-specific treatability studies shall be considered for each technology utilized in the short-list of Site-wide alternatives and if treatability studies are warranted they will be proposed as part of the Technical Memorandum. A Treatability Testing Work Plan (TTWP) together with the required schedule extension, may be completed and submitted to NYSDEC for review and approval, if the most promising candidate technology requires such a study.

6.10.2 Task 10.2: Detailed Analysis of Alternatives

A detailed analysis will be performed for each of the remedial action alternatives identified in the Technical Memorandum. The analysis of each remedial alternative will be based on an evaluation of the nine criteria established in the NCP. Two of the nine NCP criteria (state acceptance and community acceptance) will be evaluated as follows. State acceptance will be achieved based upon NYSDEC's concurrence with the eventual selection of the remedial action. Community acceptance will be evaluated from the public comments received from solicitation of public comment on NYSDEC's recommended alternative as part of the implementation of the Citizens Participation Program (see Section 6.2). The remaining seven criteria that will be used for the detailed analyses of alternatives, in accordance with the NCP and NYSDEC TAGM #4030, are as follows:

- Overall protection of human health and the environment;
- Compliance with ARARs/SCGs;
- Short-term effectiveness and performance;
- Reduction of toxicity, mobility and volume;
- Implementability; and,
- Cost effectiveness.

NYSDEC TAGM #4030 provides a description of each of these criteria. Once the detailed analysis of each alternative is completed, a comparative analysis of all alternatives will be completed. The detailed and comparative analysis of remedial alternatives will focus on the ability of alternatives 1) to provide meaningful risk reduction; 2) to meet ARARs/SCGs and waivers of such ARARs/SCGs appropriate for the Site's environmental setting; 3) to be technically consistent with likely Site beneficial reuse scenarios; and, 4) to have Operation and Maintenance requirements compatible with future Site uses.

6.10.3 Task 10.3: Feasibility Study Report

A Feasibility Study Report (FS Report) will be prepared following completion of the detailed and comparative analysis evaluation of each remedial action alternative. The FS Report will summarize the results of Tasks 10.1 and 10.2 above and will provide detailed information for each alternative to facilitate the identification of a preferred remedial approach for the Site consistent with beneficial Site reuse.

7.0 PROJECT MANAGEMENT PLAN

7.1 Project Organization

Figure 10 presents the RI/FS Organization Chart. The NYSDEC Remedial Project Manager, Vadim Brevdo, will serve as the primary contact with QSAG's Project Coordinator, Peter Zimmermann of Environmental Liability Management, Inc. (ELM). The Project Coordinator will act as a liaison between the Agency and QSAG. Golder Associates Inc. will serve as the RI/FS contractor. Mr. Randolph White, P.E. of Golder Associates Inc. (New York State Licensed Professional Engineer No. 062926-1) will provide overall management of Golder Associates activities related to the RI/FS. Mr. White will be assisted by Mr. Stuart Mitchell and Mr. Robert Illes of Golder Associates who will serve as the Remedial Investigation Task Manager and the Feasibility Study Task Manager, respectively and by Mr. Peter Brussock of ELM who will manage the Risk Assessment task.

Golder Associates will utilize various specialty subcontractors during the Remedial Investigation for surveying, drilling and analytical laboratory services. A New York State certified analytical laboratory will be utilized for all chemical sample analyses, except for light hydrocarbons, which will be analyzed by Microseeps of Pittsburgh, Pennsylvania. Aquifer Drilling and Testing Inc. (ADT) of New Hyde Park, New York will provide well drilling services and the surveying subcontractor will be GEOD Corporation of Newfoundland, New Jersey. Both ADT and GEOD are licensed in the State of New York. Treatability study laboratories/contractors may also be employed should the need arise to conduct treatability studies.

7.2 Project Schedule

The proposed schedule to conduct the Phase I Remedial Investigation is provided on Figure 11. The schedule begins with the submittal of this RI/FS Work Plan and ends at the conclusion of the Phase I Remedial Investigation program (i.e., submittal of the Phase I Data Summary Report and Phase II Remedial Investigation Proposal). Timeframes for NYSDEC review of submittals are not included in the schedule.

Forecasting future RI/FS activities at this stage in the project is neither practical nor beneficial at this time until a better understanding of Site conditions is achieved and the scope of the Phase II Remedial Investigation and Feasibility Study are identified. The schedule will be periodically updated during the project with the first update occurring following the completion of the Phase I Remedial Investigation.

8.0 REFERENCES

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TABLE 1
REMEDIAL INVESTIGATION SAMPLING AND ANALYSIS PLAN SUMMARY
QUANTA RESOURCES SUPERFUND SITE
LONG ISLAND CITY, QUEENS COUNTY, NEW YORK

Analysis	Analytical Method	Primary	Field Duplicates	Matrix Spikes	Matrix Spike Dups	Field Blanks	Trip Blanks
SOIL - SB-01 through SB-14 (see Note 1)							
TCL VOCs	SW-846 8260B	42	2	2	2	2	
TCL SVOCs	SW-846 8270C	42	2	2	2	2	
PCBs	SW-846 8082	42	2	2	2	2	
TAL Metals	SW-846 6010/7471	42	2	2	2	2	
Cyanide	SW-846 9012	42	2	2	2	2	
TOC	SW-846 9060	10	1				
Grain Size	ASTM D422	10					
GROUNDWATER - Monitoring Wells GA-1 through GA-4							
TCL VOCs	SW-846 8260B	4	1	1	1	1	1
TCL SVOCs	SW-846 8270C	4	1	1	1	1	
PCBs	SW-846 8082	4	1	1	1	1	
TAL Metals	SW-846 6010/7470	4	1	1	1	1	
Light Hydrocarbons	AM20GAX (2)	4	1	1	1		
Alkalinity	EPA 310.1	4	1	1	1	1	
TOC	SW-846 9060	4	1	1	1	1	
DOC	SW-846 9060	4	1	1	1	1	
Nitrate	EPA 353.2	4	1	1	1	1	
Sulfate	EPA 375.4	4	1	1	1	1	
CO2	EPA 310.1	4	1	1	1	1	
Chloride	SM4500 CLB	4	1	1	1	1	
TDS	EPA 160.1	4	1			1	
LIGHT NON-AQUEOUS PHASE LIQUID (LNAPL)							
TCL VOCs	SW-846 8260B	3	1				1 (3)
TCL SVOCs	SW-846 8270C	3	1				
TAL Metals	SW-846 6010B	3	1				
PCBs	SW-846 8082	3	1				
Sp Gravity	ASTM D854	3	1				
TOX	SW-846 9020	3	1				
% Sulfur	ASTM D 129 (or equivalent)	3	1				
%Seds	ASTM D 1796 (or equivalent)	3	1				
Viscosity	ASTM D 445 (or equivalent)	3	1				
Flash point	SW-846 1010	3	1				
BTU	ASTM D 240 (or equivalent)	3	1				
GC Fingerprint	SW-846 8015 (modified)	3					

Notes:

(1) *A total of 42 primary soil samples will be collected from 14 soil boring locations. Sample depths include the following:* 0-2 feet - 6 on-site locations and 1 background location (GA-4); 5-7 feet - 13 on-site and one background; 10-12 feet - 13 on-site and one background; and, below 10-12 feet - 6 on-site locations and one background.

(2) This is a laboratory-specific Standard Operating Procedure.

(3) A trip blank will be shipped along with the LNAPL VOC samples and if any of the samples are less than 10% solid it will be analyzed as an aqueous sample and the trip blank will be analyzed.

REFERENCES

1.) MAP TAKEN FROM U.S.G.S. 7.5 MINUTE QUADRANGLE OF BROOKLYN, NEW YORK, DATED 1979.

1000 0 1000
SCALE FEET

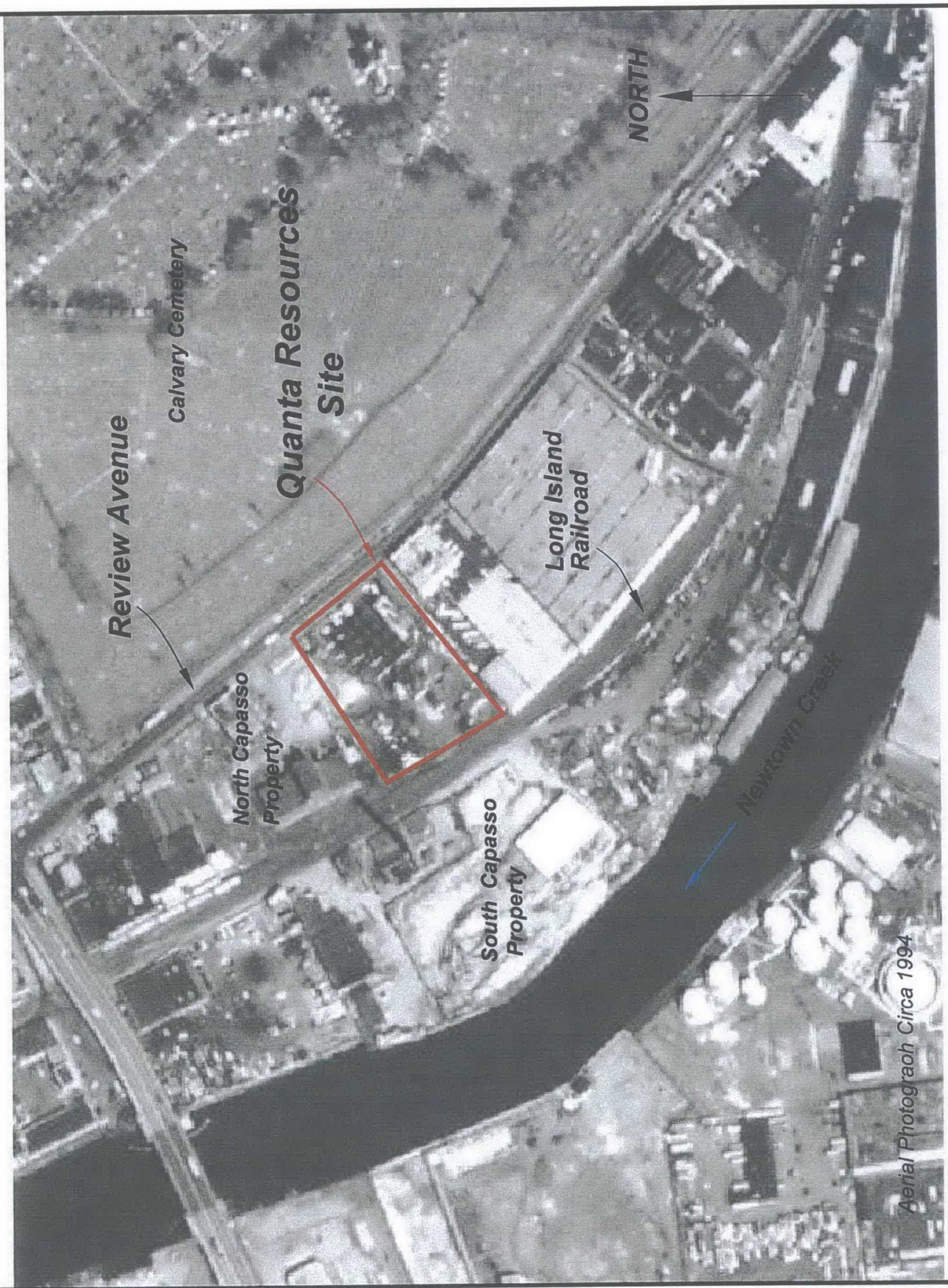
Golder Associates
Philadelphia USA

SCALE	AS SHOWN	TITLE	SITE LOCATION MAP
DATE	08/28/02		
DESIGN	AM		
CADD	AM		
FILE No.	0236151A002	CHECK	SDM 9/19/02
PROJECT No.	023-6151 REV. 0	REVIEW	RSW 9/19/02

QUANTA RESOURCES

FIGURE 1

Drawing file: 0236151A002.dwg Sep 19, 2002 - 12:20pm



Golder Associates
Philadelphia USA

FILE No.	0236151A008
PROJECT No.	023-6151
REV.	0
SCALE	AS SHOWN
DATE	09/19/02
DESIGN	RSW
CADD	AM
CHECK	SDM 9/19/02
REVIEW	RSW 9/19/02

TITLE

QUANTA RESOURCES SITE (1994)

QUANTA RESOURCES

FIGURE 2

Drawing file: 0236151A008.dwg Sep 19, 2002 - 11:05am

Existing AST Containment Area
(See Figure 4)

Existing Building
(See Figure 4)

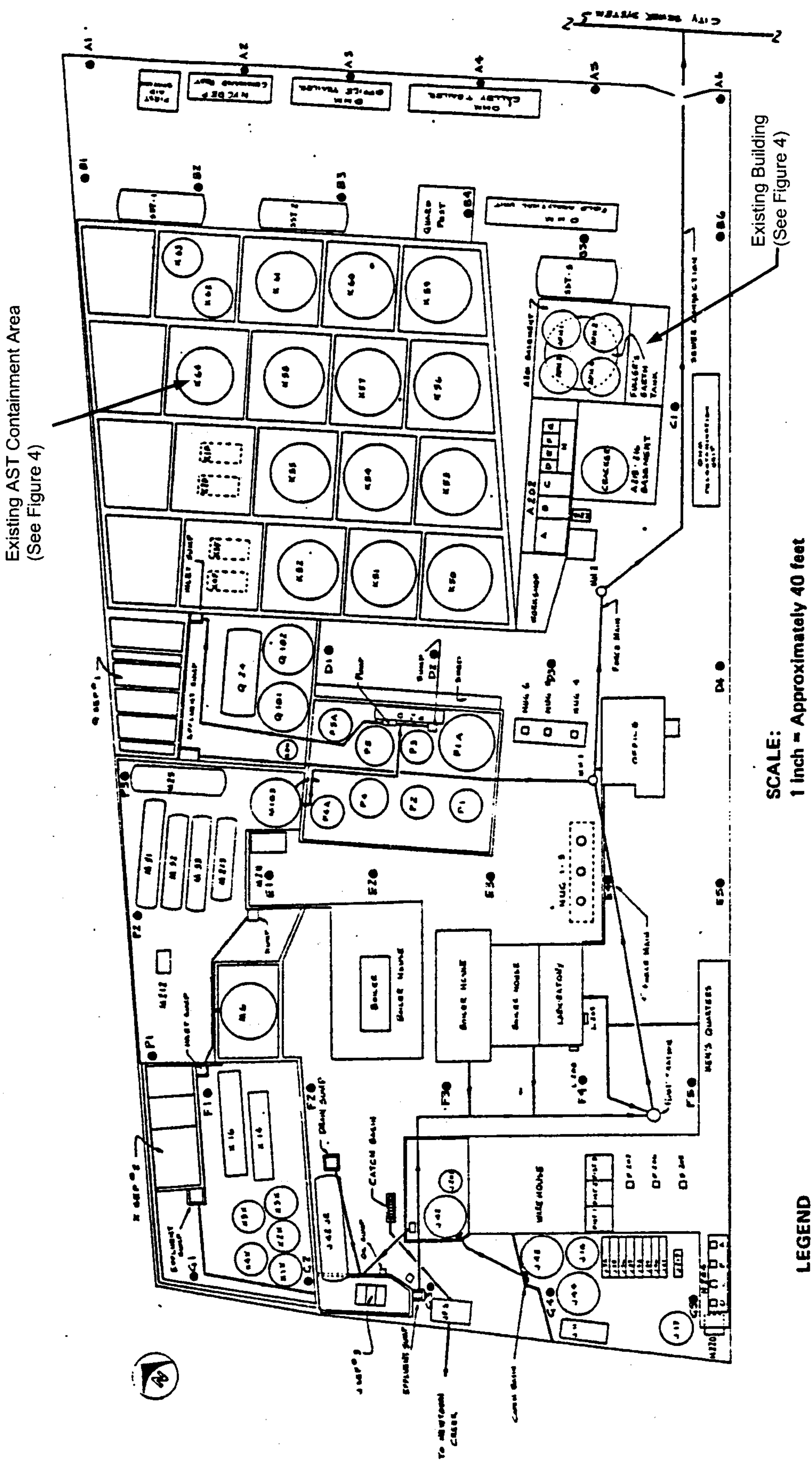


Figure II–2
Quanta Facility Prior to Cleaning Operations

SCALE:
1 inch = Approximately 40 feet

LEGEND

(K50)	**Tank and Site Identification Number**
C1 ●	**Air Monitoring Stations**

SOURCE: O.H. Materials

REFERENCES

1.) MAP TAKEN FROM FIGURE TITLED "QUANTA FACILITY PRIOR TO CLEANING OPERATIONS", PROVIDED BY OHM.

Drawing file: 0236151A003.dwg   Sep 18, 2002 – 1:14pm

Golder Associates
Philadelphia USA

FILE No.	0236151A003		
PROJECT No.	023–6151	REV.	0

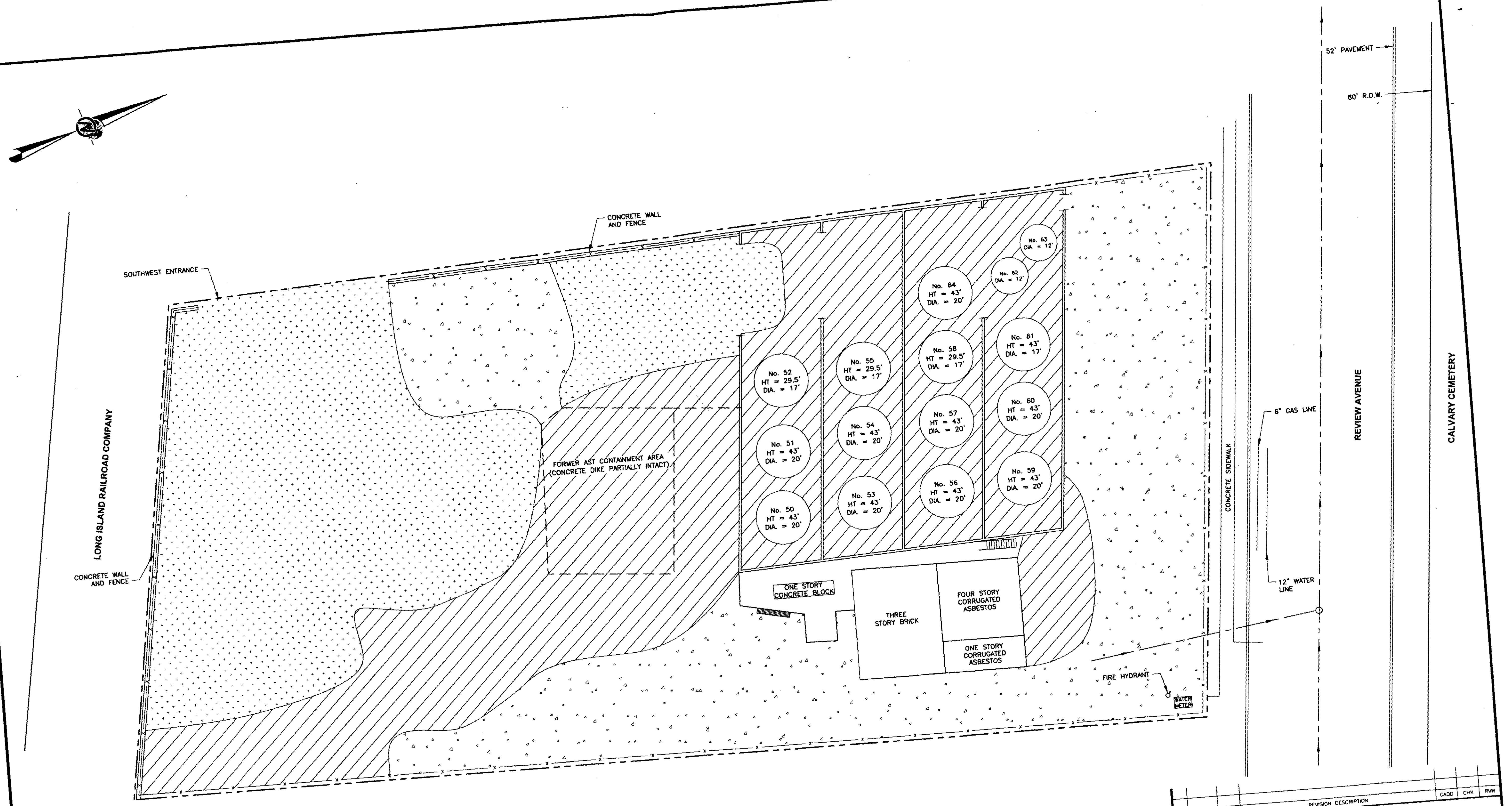
SCALE	AS SHOWN
DATE	09/18/02
DESIGN	RSW
CADD	AM
CHECK	Sun 9/19/02
REVIEW	[illegible]

TITLE

LAYOUT OF QUANTA RESOURCES SITE PRIOR TO REMOVAL ACTION

QUANTA RESOURCES

FIGURE 3



16 0 16 32
SCALE FEET

LEGEND

▨	DEBRIS, TIRES, REMNANT STRUCTURES, AND/OR POST-OPERATIONAL FILL (PILES OF VARIABLE HEIGHT)
⁘	SMOOTH GRADED POST-OPERATIONAL FILL (THICKNESS VARIABLE)
◻	ASPHALT/CONCRETE PAVEMENT ON SURFACE
— — —	APPROXIMATE PROPERTY BOUNDARY
—x—	FENCE LINE

NOTES

1.) LOCATIONS OF GROUND COVER FEATURES ARE APPROXIMATE.

REFERENCES

1.) MAP DIGITIZED FROM FIGURE TITLED " TOPOGRAPHIC SURVEY", PREPARED BY STRAUBING & RUBIN CONSULTING ENGINEERS, DATED 12/29/80 AS EDITED TO SHOW CURRENT CONDITIONS.

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

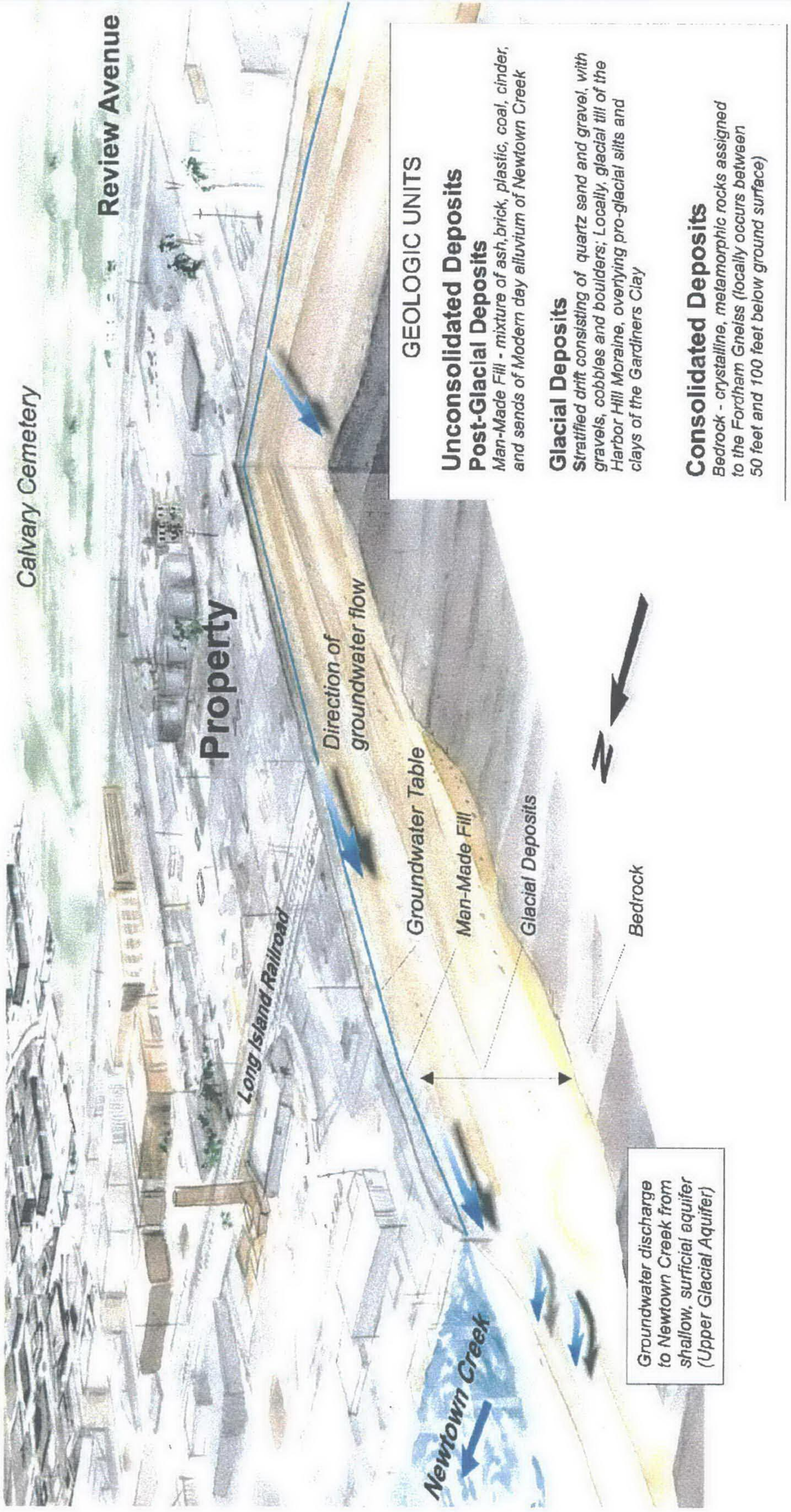
PROJECT
QUANTA RESOURCES
RI/FS WORKPLAN
QUEENS, NEW YORK

TITLE
CURRENT SITE CONDITIONS

Golder Associates
Philadelphia USA

PROJECT No.		023-6151	FILE No.	0236151A001
DESIGN	SDM	08/13/02	SCALE AS SHOWN	REV. 0
CADD	AM	09/18/02	FIGURE 4	
CHECK	SDM	9/19/02		
REVIEW	RSW	9/11/02		

Drawing file: 0236151A001.dwg Sep 19, 2002 - 11:48am



Drawing file: 0236151A009.dwg Sep 19, 2002 - 11:49am

Golder Associates
Philadelphia USA

FILE No.	0236151A009		
PROJECT No.	023-6151	REV.	0

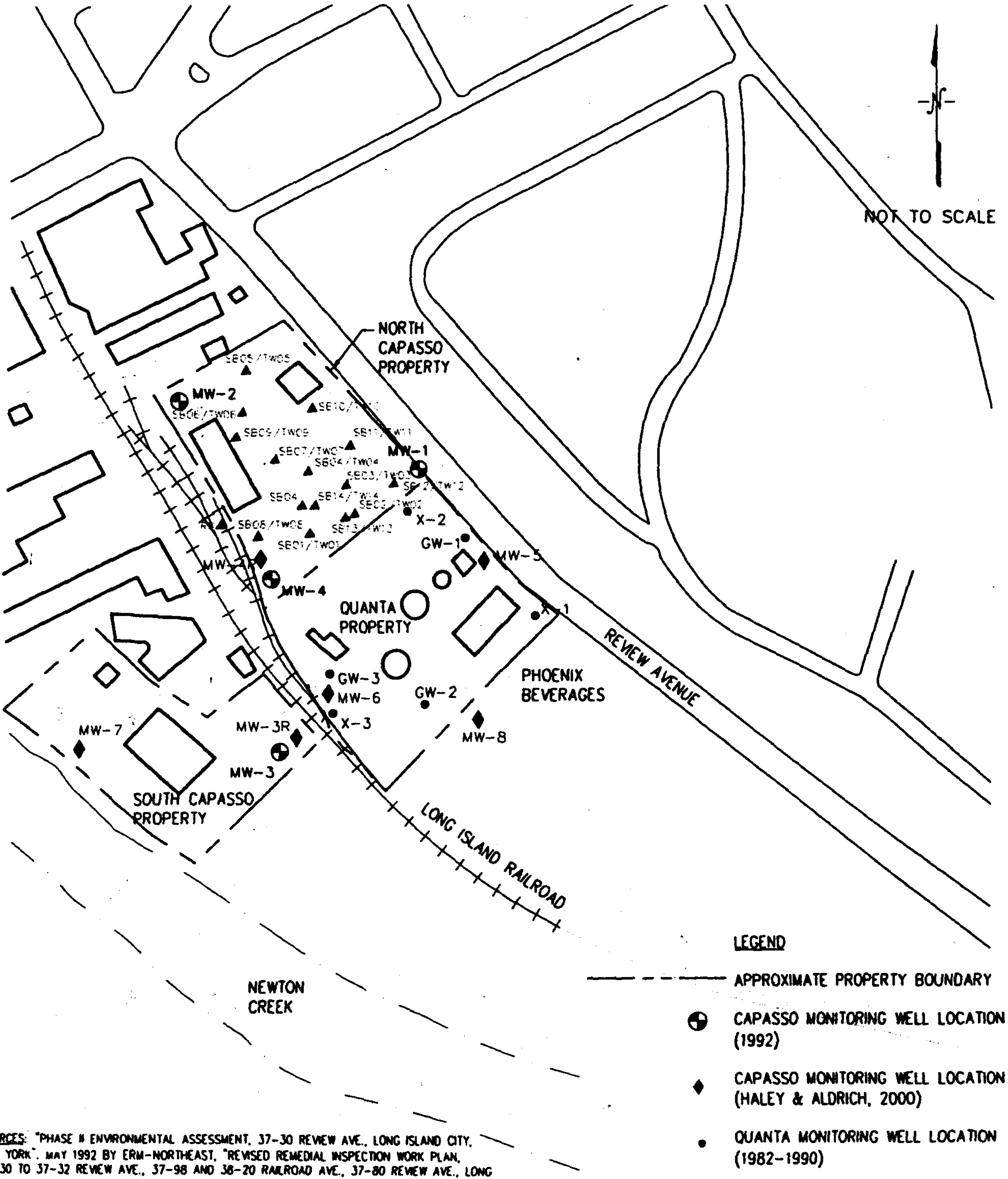
SCALE AS SHOWN
DATE 08/28/02
DESIGN RSW
CADD AM
CHECK SDM 9/19/02
REVIEW RSW 9/19/02

TITLE

CONCEPTUAL SITE HYDROGEOLOGIC MODEL

QUANTA RESOURCES

FIGURE 5



LEGEND

APPROXIMATE PROPERTY BOUNDARY

CAPASSO MONITORING WELL LOCATION (1992)

♦ CAPASSO MONITORING WELL LOCATION (HALEY & ALDRICH, 2000)

● QUANTA MONITORING WELL LOCATION (1982-1990)

▲ SITE INVESTIGATION BORING LOCATION (LOCATION APPROXIMATE)

SOURCES: "PHASE II ENVIRONMENTAL ASSESSMENT, 37-30 REVIEW AVE., LONG ISLAND CITY, NEW YORK". MAY 1992 BY ERM-NORTHEAST. "REVISED REMEDIAL INSPECTION WORK PLAN, 37-30 TO 37-32 REVIEW AVE., 37-98 AND 38-20 RAILROAD AVE., 37-80 REVIEW AVE., LONG ISLAND CITY, NEW YORK". AUGUST 2000. BY HALEY & ALDRICH, INC.,"ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES. PHASE II INVESTIGATION. QUANTA RESOURCES SITE NO. 241005, LONG ISLAND CITY, QUEENS CO." MAY 1990 BY LAWLER, MATUSKY & SKELLY ENGINEERS.

REFERENCES

1.) MAP TAKEN FROM FIGURE TITLED "SITE PLAN WITH SITE INVESTIGATION BORING LOCATIONS", PROVIDED BY ENVIRON, DATED 9/27/00.

NOTES: UP TO EIGHT SOIL BORINGS WILL BE DRILLED AND 4 TO 5 MONITORING WELLS WILL BE INSTALLED. ALL WELL LOCATIONS SHOWN ARE APPROXIMATE.

Drawing file: 0236151A004.dwg Aug 28, 2002 - 10:32am

Golder Associates
Philadelphia USA

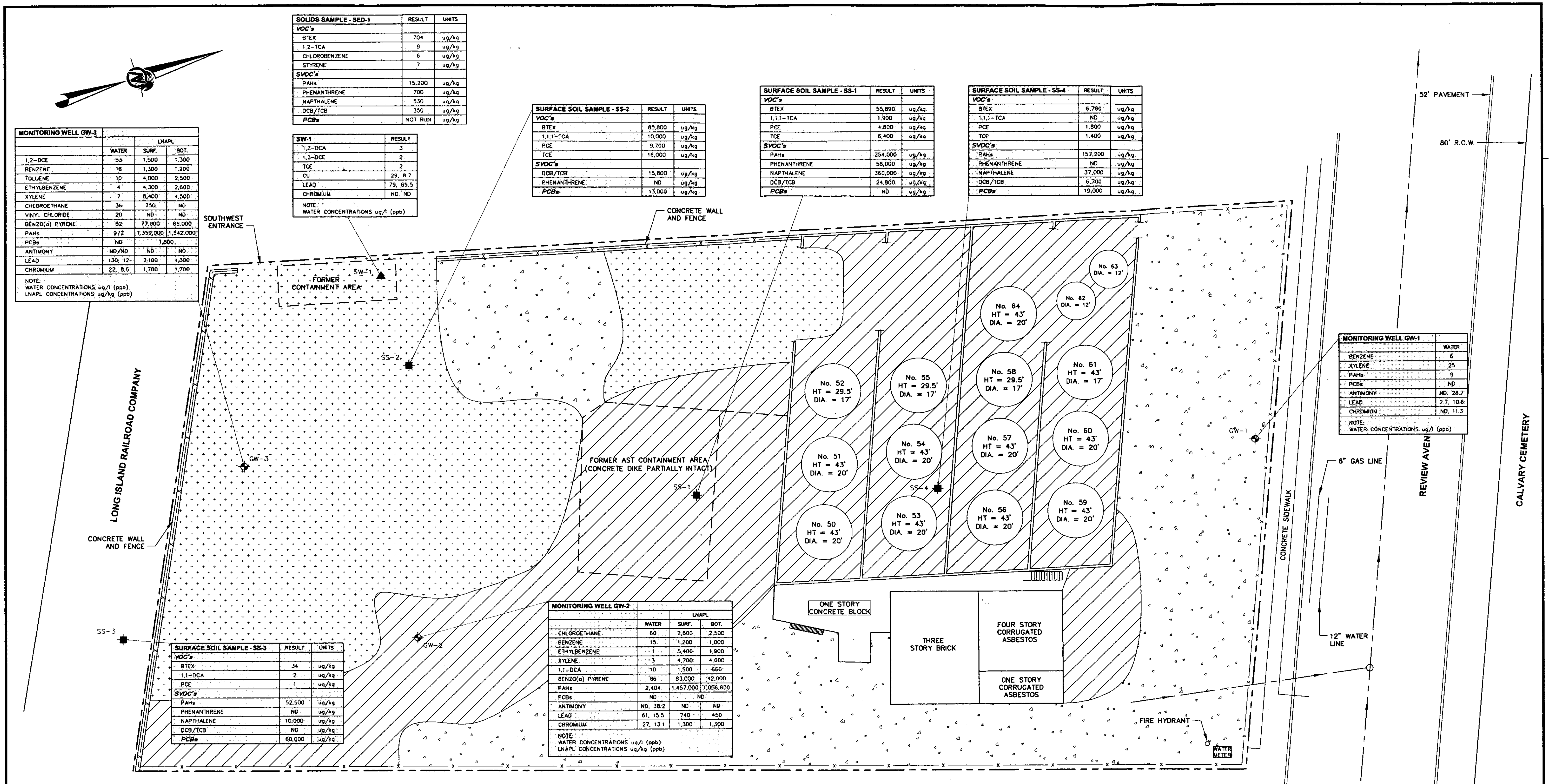
FILE No. 0236151A004
PROJECT No. 023-6151 REV. 0

SCALE AS SHOWN
DATE 08/28/02
DESIGN RSW
CADD AM
CHECK SDm 9/13/02
REVIEW

TITLE
ADJACENT PROPERTY MONITORING POINT LOCATIONS

QUANTA RESOURCES

FIGURE 6



MONITORING WELL GW-3			
		LNAPL	
	WATER	SURF.	BOT.
1,2-DCE	53	1,500	1,300
BENZENE	18	1,300	1,200
TOLUENE	10	4,000	2,500
ETHYLBENZENE	4	4,300	2,600
XYLENE	7	8,400	4,500
CHLOROETHANE	36	750	ND
VINYL CHLORIDE	20	ND	ND
BENZO(a) PYRENE	62	77,000	65,000
PAHs	972	1,359,000	1,542,000
PCBs	ND	1,800	
ANTIMONY	ND/ND	ND	ND
LEAD	130, 12	2,100	1,300
CHROMIUM	22, 8.6	1,700	1,700

NOTE:
WATER CONCENTRATIONS ug/l (ppb)
LNAPL CONCENTRATIONS ug/kg (ppb)

SOLIDS SAMPLE - SED-1	RESULT	UNITS
VOC's		
BTEX	704	ug/kg
1,2-TCA	9	ug/kg
CHLOROBENZENE	6	ug/kg
STYRENE	7	ug/kg
SVOC's		
PAHs	15,200	ug/kg
PHENANTHRENE	700	ug/kg
NAPTHALENE	530	ug/kg
DCB/TCB	350	ug/kg
PCBs	NOT RUN	ug/kg

SW-1	RESULT
1,2-DCA	3
1,2-DCE	2
TCE	2
CU	29, 8.7
LEAD	79, 69.5
CHROMIUM	ND, ND

NOTE:
WATER CONCENTRATIONS ug/l (ppb)

SURFACE SOIL SAMPLE - SS-2	RESULT	UNITS
VOC's		
BTEX	85,800	ug/kg
1,1,1-TCA	10,000	ug/kg
PCE	9,700	ug/kg
TCE	16,000	ug/kg
SVOC's		
DCB/TCB	15,800	ug/kg
PHENANTHRENE	ND	ug/kg
PCBs	13,000	ug/kg

SURFACE SOIL SAMPLE - SS-1	RESULT	UNITS
VOC's		
BTEX	55,890	ug/kg
1,1,1-TCA	1,900	ug/kg
PCE	4,800	ug/kg
TCE	6,400	ug/kg
SVOC's		
PAHs	254,000	ug/kg
PHENANTHRENE	56,000	ug/kg
NAPTHALENE	360,000	ug/kg
DCB/TCB	24,800	ug/kg
PCBs	ND	ug/kg

SURFACE SOIL SAMPLE - SS-4	RESULT	UNITS
VOC's		
BTEX	6,780	ug/kg
1,1,1-TCA	ND	ug/kg
PCE	1,800	ug/kg
TCE	1,400	ug/kg
SVOC's		
PAHs	157,200	ug/kg
PHENANTHRENE	ND	ug/kg
NAPTHALENE	37,000	ug/kg
DCB/TCB	6,700	ug/kg
PCBs	19,000	ug/kg

MONITORING WELL GW-1	
	WATER
BENZENE	6
XYLENE	25
PAHs	9
PCBs	ND
ANTIMONY	ND, 28.7
LEAD	2.7, 10.6
CHROMIUM	ND, 11.3

NOTE:
WATER CONCENTRATIONS ug/l (ppb)

SURFACE SOIL SAMPLE - SS-3	RESULT	UNITS
VOC's		
BTEX	34	ug/kg
1,1-DCA	2	ug/kg
PCE	1	ug/kg
SVOC's		
PAHs	52,500	ug/kg
PHENANTHRENE	ND	ug/kg
NAPTHALENE	10,000	ug/kg
DCB/TCB	ND	ug/kg
PCBs	60,000	ug/kg

MONITORING WELL GW-2			
		LNAPL	
	WATER	SURF.	BOT.
CHLOROETHANE	60	2,600	2,500
BENZENE	15	1,200	1,000
ETHYLBENZENE	1	5,400	1,900
XYLENE	3	4,700	4,000
1,1-DCA	10	1,500	660
BENZO(a) PYRENE	86	83,000	42,000
PAHs	2,404	1,457,000	1,056,600
PCBs	ND	ND	
ANTIMONY	ND, 38.2	ND	ND
LEAD	61, 15.5	740	450
CHROMIUM	27, 13.1	1,300	1,300

NOTE:
WATER CONCENTRATIONS ug/l (ppb)
LNAPL CONCENTRATIONS ug/kg (ppb)

LEGEND

▨	DEBRIS, TIRES, REMNANT STRUCTURES, AND/OR POST-OPERATIONAL FILL (PILES OF VARIABLE HEIGHT)
⁘	SMOOTH GRADED POST-OPERATIONAL FILL (THICKNESS VARIABLE)
◻	ASPHALT/CONCRETE PAVEMENT
— — —	APPROXIMATE PROPERTY BOUNDARY
—x—	FENCE LINE
⌖	MONITORING WELL INSTALLED BY LMS (1988-1990)
■	SURFACE SOIL SAMPLE LOCATION BY LMS (1988-1990)
▲	SURFACE WATER AND SEDIMENT SAMPLE LOCATION BY LMS

NOTES

1.) LOCATIONS OF MONITORING POINTS AND GROUND COVER FEATURES ARE APPROXIMATE.

2.) THE PRIMARY LMS DATA ARE SUMMARIZED IN CHEMISTRY BOXES. A COMPLETE LIST OF RESULTS IS PROVIDED IN THE LMS REPORT REFERENCED BELOW AND IN APPENDIX A.

3.) TWO VALUES UNDER METALS FOR METALS WATER RESULTS ARE FOR 12/88 AND 12/90, RESPECTIVELY. THE 12/88 RESULTS FOR LEAD ARE BELIEVED ELEVATED DUE TO QA/QC ISSUES.

4.) METALS RESULTS FOR SOIL ARE NOT SUMMARIZED DUE TO QA/QC XXXXXXXXX.

REFERENCES

1.) MAP DIGITIZED FROM FIGURE TITLED " TOPOGRAPHIC SURVEY", PREPARED BY STRAUBING & RUBIN CONSULTING ENGINEERS, DATED 12/29/80 AS EDITED TO SHOW CURRENT CONDITIONS.

2.) LOCATIONS OF MONITORING POINTS APPROXIMATED FROM O.H. MATERIALS CO. PRELIMINARY HYDROGEOLOGIC ASSESSMENT REPORT, JANUARY 1983 AND THE LAWLER, MATUSKY AND SKELLY ENGINEERS PHASE II INVESTIGATION REPORT, 1990.

KEY

BTEX - BENZENE, TOLUENE, ETHYLBENZENE AND XYLENE
1,1-DCA - 1,1-DICHLOROETHANE
1,1,1-TCA - 1,1,1-TRICHLOROETHANE
PCE - TETRACHLOROETHYLENE
TCE - TRICHLOROETHYLENE
PAH - POLYNUCLEAR AROMATIC HYDROCARBONS
PCB - POLYCHLORINATED BIPHENYLS
DCB/TCB - DI AND TRI CHLOROBENZENES

16 0 16 32
SCALE FEET

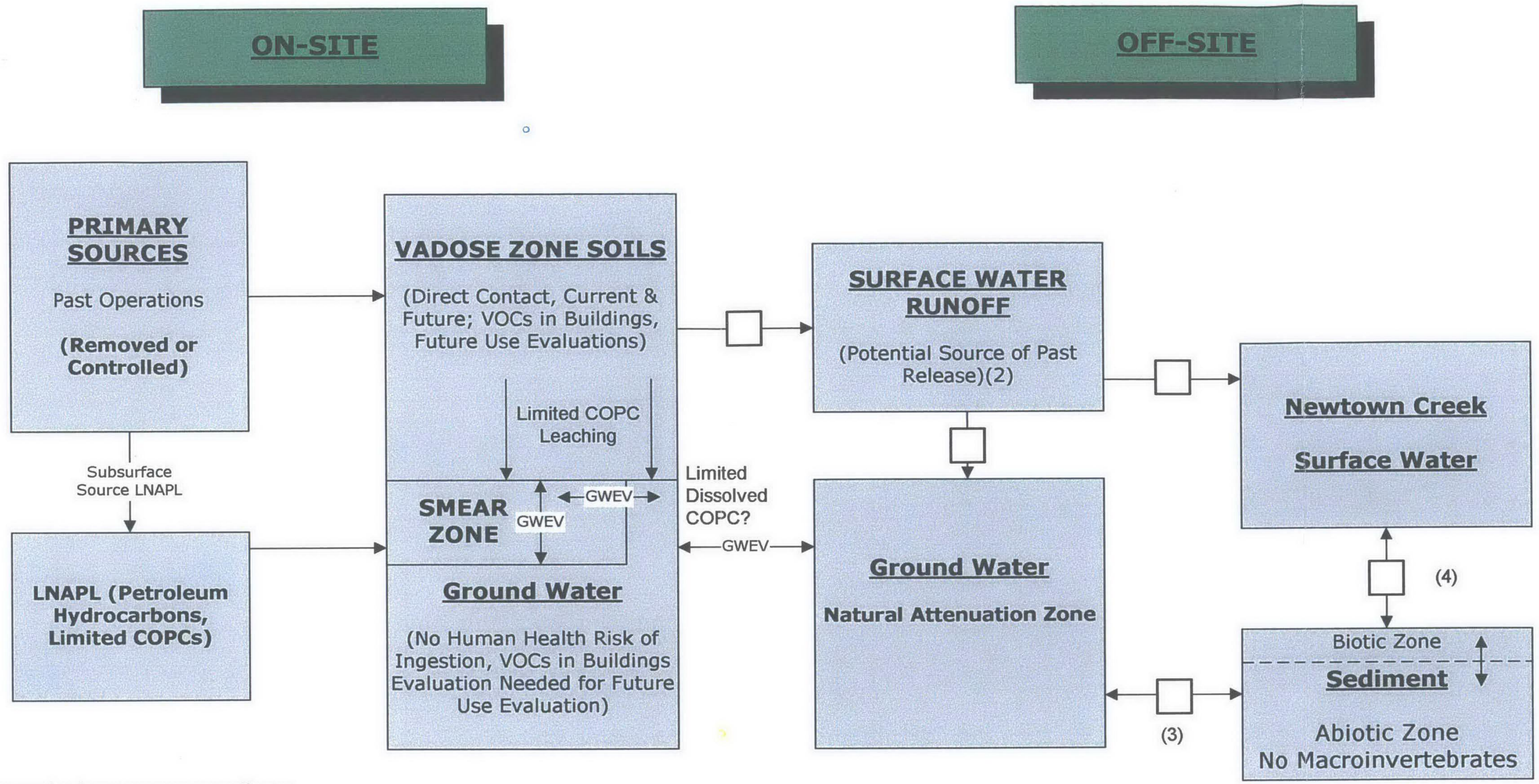
REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
QUANTA RESOURCES
RI/FS WORKPLAN
QUEENS, NEW YORK

TITLE
SUMMARY OF ENVIRONMENTAL DATA FROM LMS PHASE II REPORT

Golder Associates
Philadelphia USA

PROJECT No.		023-6151	FILE No.	0236151A005
DESIGN	SDM	08/13/02	SCALE AS SHOWN	REV. 0
CADD	AM	09/19/02	**FIGURE 7**	
CHECK	Som	9/19/02		
REVIEW	KS	9/19/02		



LEGEND

→ Potential transport mechanism or exposure pathway

☐ Indicates that source removed, transport mechanism does not exist or exposure pathway eliminated

COPC = Chemicals of Potential Concern

GWEV = Ground Water Elevation Variation
(Question mark refers to a potential incomplete pathway from the property that requires verification during RI)

NOTES

1) Risks associated with hazardous substances in the environment are dependent upon complete exposure pathways. When the exposure pathway is not complete, there are no risks associated with the hazardous substances for that particular exposure scenario/pathway. Where an exposure pathway is potentially complete, the magnitude of the risks and the need for risk reduction are determined through a more detailed analysis of site-specific factors.
2) Differential infiltration of water and contaminants from other downgradient sources along the rail lines and other properties likely influence off-property ground water flow and water quality.
3) At the Quanta Site, the COPC have a low probability of reaching Newtown Creek and causing adverse ecological impacts.
4) COPC must pass through sediment to reach surface water.

TITLE:
FIGURE 8
GENERALIZED CONCEPTUAL SITE MODEL
QUANTA RESOURCES SITE (1)

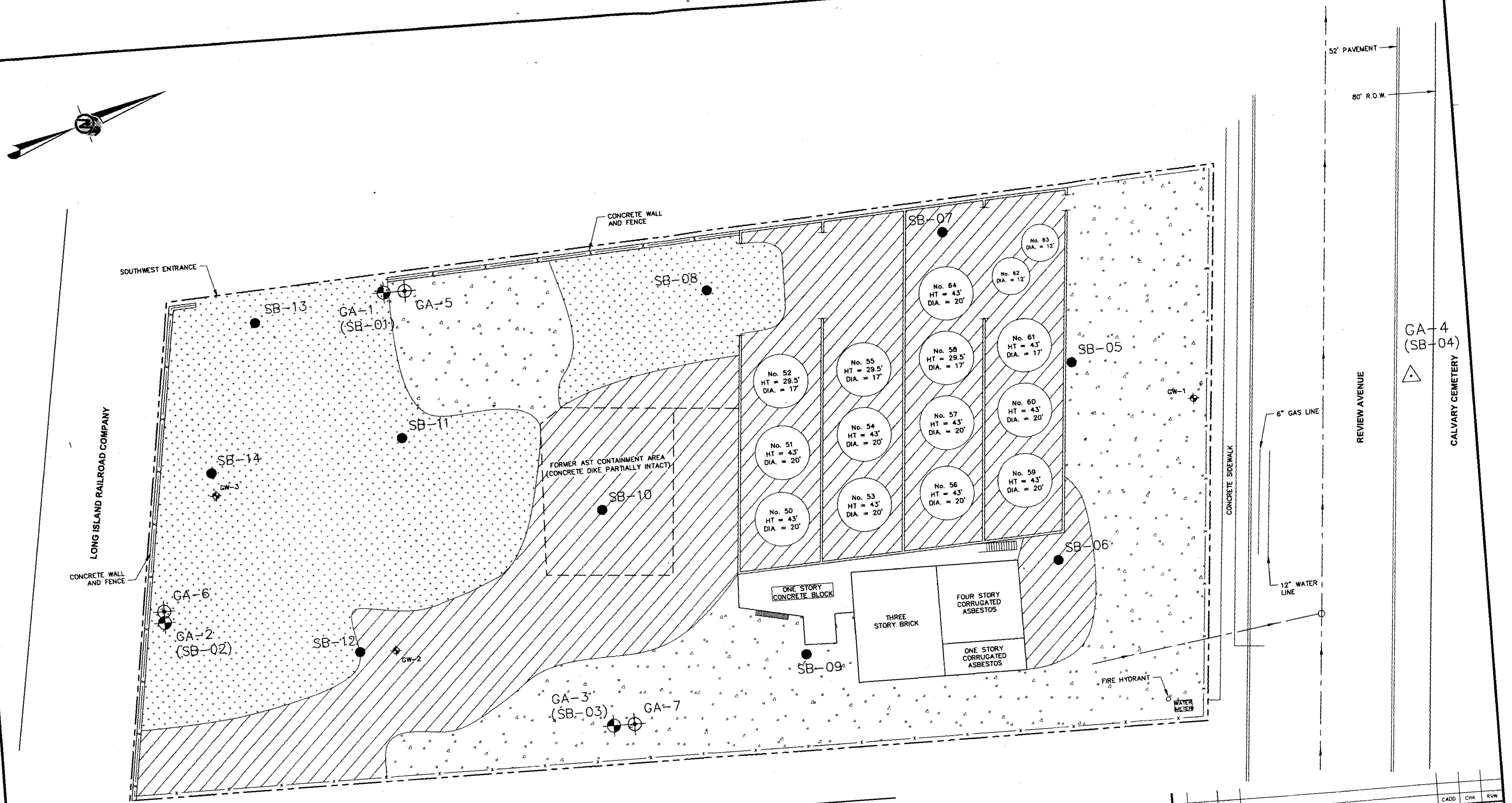
LOCATION:
37- 80 REVIEW AVENUE
LONG ISLAND CITY,
NEW YORK 11101

DATE: 8/28/02

PROJECT NO.: 202160

FILENAME: 202160\CSM\quanta_csm_rev2.vsd

ENVIRONMENTAL LIABILITY MANAGEMENT, INC.
218 Wall Street, Research Park, Princeton, NJ 08540
4920 York Road, Ste. 2CC2, P.O. Box 306, Holicong, PA 18928
612 Main Street, 2nd Floor, Boonton, NJ 07005



16 0 16 32
FEET
SCALE

LEGEND

▨	DEBRIS, TIRES, REMNANT STRUCTURES, AND/OR POST-OPERATIONAL FILL (PILES OF VARIABLE HEIGHT)
⁘	SMOOTH GRADED POST-OPERATIONAL FILL (THICKNESS VARIABLE)
△	ASPHALT/CONCRETE PAVEMENT
— — —	APPROXIMATE PROPERTY BOUNDARY
—x—	FENCE LINE
⊕	PROPOSED GROUNDWATER MONITORING WELL LOCATION
⊕	PROPOSED LNAPL MONITORING WELL LOCATION
△	PROPOSED BACKGROUND MONITORING WELL
●	PROPOSED SOIL BORING LOCATION
✧	EXISTING MONITORING WELL LOCATION (LMS, 1990)

NOTES

1.) LOCATION OF MONITORING POINTS AND PHYSICAL FEATURES ARE APPROXIMATE.

2.) ACCESS FOR GA-4 TO BE DETERMINED.

REFERENCES

1.) MAP DIGITIZED FROM FIGURE TITLED " TOPOGRAPHIC SURVEY", PREPARED BY STRAUBING & RUBIN CONSULTING ENGINEERS, DATED 12/29/80 AS EDITED TO SHOW CURRENT CONDITIONS.

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
QUANTA RESOURCES
RI/FS WORKPLAN
QUEENS, NEW YORK

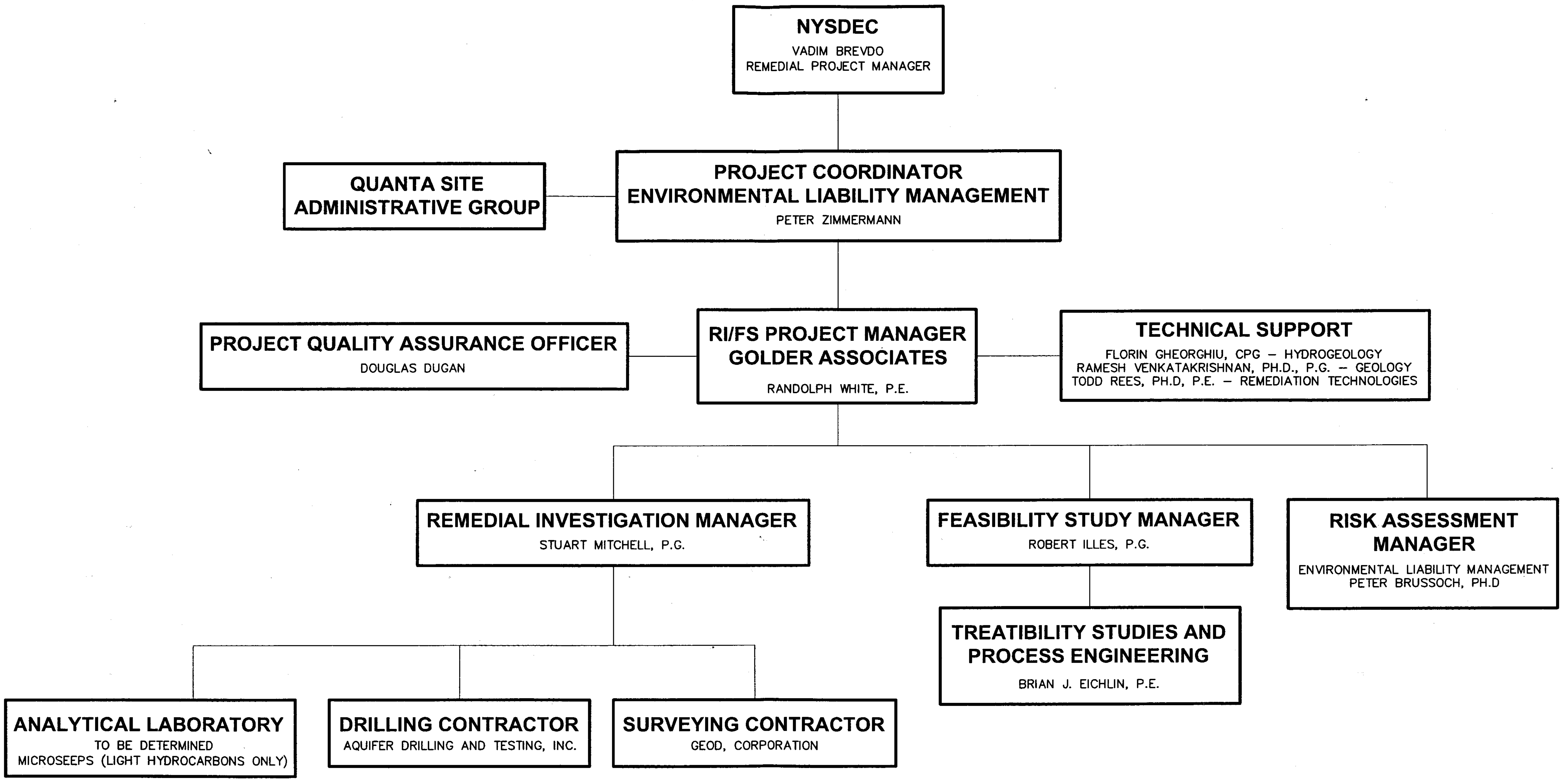
TITLE
PROPOSED REMEDIAL INVESTIGATION MONITORING LOCATIONS

Golder Associates
Philadelphia USA

PROJECT No.		023-6151
DESIGN	SDM	08/13/02
CADD	AM	09/19/02
CHECK	SDM	9/19/02
REVIEW		9/19/02

FILE No. 0236151A007
SCALE AS SHOWN
REV. 0

FIGURE 9



JOB No.:	023-6151	SCALE:	AS SHOWN
CAD BY:	AM	DATE:	09/19/02
CHK BY:	K Som 9/19/02	FILE No.:	0236151A006
REV BY:	KSW 9/19/02	DR SUBTITLE:	A

Golder Associates

RI/FS PROJECT ORGANIZATION CHART

QUANTA RESOURCES

FIGURE 10

FIGURE 11
PROJECTED SCHEDULE - PHASE I REMEDIAL INVESTIGATION (1), (2)
QUANTA RESOURCES SITE
RI/FS WORK PLAN

ID	Task Name	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
1	Submit RI/FS Work Plan	*											
2	Respond to NYSDEC Comments	▨	▨										
3	Phase I RI Field Work (3)			▨	▨	▨							
4	Phase I Laboratory Analyses					▨	▨						
5	Phase I Data Summary Report and Phase II Proposal						▨	▨	▨	▨			

(1) The projected schedule does not include Agency review times.

(2) The schedule for the Phase II Remedial Investigation will be developed at the conclusion of the Phase I Remedial Investigation and will be submitted to NYSDEC as part of the Phase I Date Summary Report and Phase II Proposal. Similarly the schedule for the completion of the Feasibility Study will be provided to NYSDEC as part of the Remedial Investigation Report.

(3) The schedule for completing field related activities is necessarily dependent upon a number of factors outside the control of Golder Associates and QSAG including, but not limited to, weather conditions, access or other unforeseen events.

Appendix A

APPENDIX A

SITE AREA GEOLOGY AND HYDROGEOLOGY

APPENDIX A

SITE AREA GEOLOGY AND HYDROGEOLOGY

This description of the Site area geology and hydrogeology is based on the following published literature:

- Water-Table and Potentiometirc Surface Altitudes of the Upper Glacial, Magothy and Lloyd Aquifers on Long Island, New York in March-April 2000, with a Summary of Hydrogeologic Conditions (USGS, Water Resources Investigation Report 01-4165).
- Simulation of Ground-Water Flow and Pumpage in Kings and Queens Counties, Long Island, New York (USGS, Water-Resources Investigation Report 98-4071); and,
- Brooklyn-Queens Aquifer System (USEPA, Region 2, 1983).

Physiography

The topography and surficial geology in the vicinity of the Site is largely a reflection of man-made fill (reportedly consisting of ash, wood, brick, coal, etc., and ranging in thickness from 5 to 19 feet) and unconsolidated deposits related to the Wisconsin stage glaciation. Two prominent features of Long Island consist of two east-west trending morainal ridges (Ronkonkoma and Harbor Hill moraines). The Site is located just north of the Harbor Hill moraine with surficial deposits composed primarily of stratified drift (sand and gravel deposits) with some till (an unsorted mixture of clay, silt, sand, gravel, cobbles, and boulders). South of the Harbor Hill moraine surficial deposits consist primarily of outwash (sand and gravel). More recent deposits within the Site area consist primarily of man made material (historic fill).

The bedrock in the area was eroded to a peneplain before the overlying Cretaceous sediments were deposited. Bedrock outcrops in northwestern Queens County near the East River and slopes gently southward at about eighty feet per mile. Consequently, the overlying formations form a southward-dipping wedge that attains a maximum thickness of about 1,050 feet in the southeast corner of Queens County (Brooklyn-Queens Aquifer System, USEPA Region 2, 1983). Bedrock is estimated to be between 50 and 100 feet below ground surface within the Site area.

Site Area Stratigraphy

Based on published literature cited above and data collected from previous investigations at the Site, the stratigraphic sequence within the Site area from the youngest to the oldest geologic units can generally be subdivided as follows:

Unconsolidated Deposits

- Post-Glacial Deposits: Man-Made Fill (approximately 5 to 19 feet thick) consisting of a mixture of ash, wood, brick, coal and coarse to fine grained sediments overlying alluvium; and,
- Glacial Deposits: stratified drift consisting of quartzose sand, fine to coarse, and gravel, pebble to boulder size. Some deposits of till (poorly sorted mixture of clay, sand, gravel and boulders) may also be present. On-site these materials have been described as fairly homogenous sands with fine gravel and cobbles relatively free of fine-grained sediments. Underlying these deposits may be proglacial lake deposits consisting of the Gardiners Clay, a confining unit with an average vertical hydraulic conductivity of about 0.001 ft/day.

Consolidated Deposits

- Bedrock: metasedimentary rocks consisting of the Fordham Gneiss.

Site Area Hydrogeology

The Long Island groundwater system consists of three major aquifers (upper glacial, Magothy, and Lloyd aquifers) and two smaller aquifers (Jameco and Port Washington aguifers) of only local importance and two regional confining units (Raritan confining unit and Gardiners clay). Based on published literature cited above, the following unconsolidated hydrogeologic units (from top to bottom) are believed to be present in the Site area:

- Upper Glacial Aquifer: This aquifer is the uppermost unit and contains the water table throughout most of Queens County except where bedrock crops out in northwestern Queens County. In the area of the Site the upper glacial aquifer is believed to consist primarily stratified drift deposits consisting of fine to very coarse quartzose sand and pebbles to boulder-sized gravel. The average horizontal hydraulic conductivity of these deposits is estimated to be approximately 270 ft/day.
- Jameco Aquifer: A relatively thin portion of the Jameco gravel unit may be locally present in the area and would underlie the upper glacial aquifer. This unit generally consists of fine to very coarse sand and pebble size gravel with few layers of clay and silt. The average horizontal hydraulic conductivity is 200 to 300 ft/day.
- Gardiners Clay: A portion of the Gardiners Clay (confining unit) may be present in the Site area. This confining unit consists of clay and silt with few layers of sand and gravel. The average vertical hydraulic conductivity is estimated to be 0.001 ft/day.

The Site is located between a local topographic high, located northeast of the Site (local groundwater recharge area), and Newtown Creek (a regional groundwater discharge area). Groundwater flow, in the relatively flat Site area, under natural conditions, would be expected to flow nearly horizontally south-southwest within the Upper Glacial Aquifer towards Newtown Creek[1]. The Upper Glacial Aquifer is anisotropic with the horizontal hydraulic conductivity estimated to be 10 times greater than the vertical conductivity. Vertical gradients in the vicinity of the Site are expected to be minimal or upward as a result of the high conductivity of the Upper Glacier Aquifer and the presence of a groundwater discharge boundary located approximately 450 feet to the southwest of the Site (Newtown Creek). If vertical gradients are present, they would be expected to be upward, under natural conditions, particularly as groundwater approaches its discharge to Newtown Creek. Figure 5 presents a conceptual hydrogeologic model of the Site.

The Upper Glacial Aquifer was previously the principal source of water supply throughout Long Island. However, chemical impacts in many areas since the 1940's have resulted in this aquifer no longer being used as a water supply for Kings and most of Queens counties (Bursciolano). Public drinking and industrial water supplies for Queens County are supplied primarily by the New York City reservoir system. The area of Queens County that relies on groundwater as its source for potable water is located approximately 6 miles southeast of the Site. A regional groundwater divide is located between the Site and this portion of Queens County. In addition, according to the 1990 LMS report, only a small number of private wells are permitted by the New York City Department of Health for nonpotable uses. Therefore, any groundwater impacts at the Site would be expected to be confined to a thin surficial water-bearing unit flowing in the direction of Newtown Creek, which would not impact any potable water supplies.

Local influences on groundwater flow at the Site potentially could include the following:

- Off-Site Pumping: While it is not expected, at this time, it is not known whether there is any nearby pumping that would influence the direction and gradients of groundwater flow; and,
- Tidal Fluctuations in Newtown Creek: While the LMS Study indicated a potential for tidal effects, a subsequent, more comprehensive study (DMJ Associates, Fall 2000) provided continuous water level data indicating that off-Site wells located between the Site and Newtown Creek (MW-3, MW-3R, and MW-7) as shown on Figure 6 did not reflect any appreciable tidal influence. Furthermore, according to the Comprehensive Solid Waste Management Plan prepared for the New York City Department of Sanitation, the shoreline of Newtown Creek consists almost completely of bulkheads, which would dampen any tidal effects.

---

[1] The OHM report discussed that the anticipated horizontal groundwater flow direction would be towards the southwest while the LMS report calculated a groundwater flow direction approximately south. However, these observations were made using fluid levels from wells containing LNAPL. Groundwater levels from wells not impacted by LNAPL are needed during the Remedial Investigation to verify the groundwater flow direction.

Appendix B

APPENDIX B

ENVIRONMENTAL SAMPLE ANALYSES RESULTS
LMS PHASE II STUDY

TABLE 4-2 (Page 1 of 2)

DECEMBER 1988 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	FIELD BLANK	GW-1	GW-2	GW-3	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STD.	NATURAL GW AMBIENT RANGE (r)
METALS							
Aluminum	[30]	1060	10500	10600	NS	NS	<5.0 - 1000
Antimony	ND	ND	ND	ND	3 GV	NS	-
Arsenic	ND N	[3.6] N	[7.6] N	24 N	25 (d)	50 P (d)	1.0 - 30
Barium	ND	313	928	1260	1000	1000 P	10 - 500
Beryllium	ND	ND	[1.9]	ND	3 GV (a)	NS	<10.0
Cadmium	ND	ND	ND	ND	10 (a)	10 P (a)	<1.0
Calcium	[302]	64800	253000	184000	NS	NS	1000 - 150000
Chromium	ND	ND	27	22	NS	50 P (a)	<1.0 - 5.0
Cobalt	ND	ND	ND	[18]	NS	NS	<10.0
Copper	[8.0] R	29 R	41 R	76 R	1000 (a)	1000 S (a)	<1.0 - 30
Iron	[6.8] R	44000 R	52100 R	54000 R	300	300 S	10.0 - 10000
Lead	79	[2.7]	61	130	25 (a)	50 P (a)	<15.0
Magnesium	ND	18100	41500	47700	35000 GV	NS	1000 - 50000
Manganese	ND	1800	3420	2760	300	300 S	<1.0 - 1000
Mercury	ND	ND	ND	ND	2	2 P	<1.0
Nickel	ND	ND	[31]	[32]	NS	NS	<10.0 - 50.0
Potassium	ND	11000	50400	205000	NS	NS	1000 - 10000
Selenium	ND N	ND N	ND N E	ND N E	20 (a)	10 P (a)	<1.0 - 10
Silver	ND	ND	ND	ND	50	50 P	<5.0
Sodium	ND	28100	140000	197000	NS	NDL S	500 - 120000
Thallium	ND	ND	ND	ND	4 GV (a)	NS	-
Vanadium	ND	[3.6]	[31]	62	NS	NS	<1.0 - 10.0
Zinc	[4.8]	31	112	119	5000 (a)	5000 S (a)	<10.0 - 2000
Cyanide	ND	ND	ND	ND	200	NS	-

All data in ug/L

[ ] - Greater than or equal to the instrument detection limit, but below contract-required detection limit.
E - Value estimated due to interference.
N - Spiked sample recovery is not within control limits.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NS - No standard.
R - Duplicate analysis not within control limits.

(a) - Acid soluble.
(d) - Dissolved.
(r) - Ref. No. 9, Appendix A.
GV - Guidance value.
NDL - No designated limit.
NS - No standard.
P - Primary drinking water standard.
S - Secondary drinking water standard.

TABLE 4-2 (Page 2 of 2)

DECEMBER 1988 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	TRIP BLANK	GW-1	GW-2	GW-3
OIL & GREASE (mg/l)	NR	250	120	NR
SPECIFIC CONDUCTANCE (umhos/cm)	NR	700	2100	2300
PESTICIDES/PCBs (ug/l)	ND	ND	NR	ND

ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run due to laboratory mishandling.

TABLE 4-3 (Page 1 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-2	GW-3	FIELD BLANK	TRIP BLANK	METHOD BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STDS.
VOLATILE ORGANICS								
Vinyl chloride	ND	ND	20	ND	ND	ND	5	2.0
Chloroethane	ND	60	36	ND	ND	ND	NS	5.0
Methylene chloride	3 bJ	4 bJ	4 J	2 bJ	2 bJ	2 J	50 GV	5.0
Acetone	ND	ND	9 J	ND	ND	ND	NS	50.0
1,1 Dichloroethane	ND	10	21	ND	ND	ND	50 GV	5.0
1,2 Dichloroethene (total)	3 J	ND	53	ND	ND	ND	NS	5.0
1,2-Dichloropropane	2 J	ND	ND	ND	ND	ND	50 GV	5.0
1,2-Dichloroethane	ND	ND	2 J	ND	ND	ND	0.8 GV	5.0
Benzene	6	15	18	ND	ND	ND	ND	5.0
Toluene	ND	ND	10	ND	ND	ND	50 GV	5.0
Ethylbenzene	ND	1 J	4 J	ND	ND	ND	50 GV	5.0
Total xylenes	25	3 J	7	ND	ND	ND	50 GV	5.0
Tentatively Identified Compounds								
Unknown	ND	6.0 J	ND	ND	ND	ND	NS	50 (c)
Unknown hydrocarbon	ND	ND	15 J	ND	ND	ND	NS	50 (c)
Benzene, 1-ethyl-2-methyl-	7.0 J	9.0 J	ND	ND	ND	ND	NS	50 (c)
Benzene, 1,2,3-trimethyl-	ND	5.0 J	ND	ND	ND	ND	NS	50 (c)
Benzene, propyl-	ND	6.0 J	ND	ND	ND	ND	NS	50 (c)
Propane, 2-(ethylthio)-	7 J	ND	ND	ND	ND	ND	NS	50 (c)
Trimethylbenzene	89 J (2)	ND	ND	ND	ND	ND	NS	50 (c)
Hexane, 2,5-dimethyl-	ND	ND	18 J	ND	ND	ND	NS	50 (c)
Heptane, 3-methyl	ND	ND	23 J	ND	ND	ND	NS	50 (c)
Cyclohexane	20 J	ND	ND	ND	ND	ND	NS	50 (c)
Cyclohexane, ethyl-	12 J	ND	ND	ND	ND	ND	NS	50 (c)
Cyclohexane, methyl-	45 J	12 J	39 J	ND	ND	ND	NS	50 (c)
Cyclohexane, 1,3-dimethyl-,cl	9.0 J	ND	ND	ND	ND	ND	NS	50 (c)
Ethylmethylcyclohexane + unknown	ND	ND	14 J	ND	ND	ND	NS	50 (c)
Substituted cyclohexane	9.0 J	ND	11 J	ND	ND	ND	NS	50 (c)
Nonane, 2,6-dimethyl-	ND	ND	13 J	ND	ND	ND	NS	50 (c)
Nonane, 3-methyl-	ND	ND	15 J	ND	ND	ND	NS	50 (c)
Nonane, 4-methyl-	14 J	ND	25 J	ND	ND	ND	NS	50 (c)
Octane, 2,6-dimethyl-	ND	ND	18 J	ND	ND	ND	NS	50 (c)

All data in ug/l.
( ) - *Number of unknown compounds in total.*
(c) - The criterion of 50 ug/l is for unspecified organic contaminants (UOC).
b - Found in method blank.
J - Estimated concentration; compound present below method detection limit.
GV - Guidance value.

ND - Not detected at analytical detection limit;
see Appendix I for detection limit.
NS - No standard.

TABLE 4-3 (Page 2 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-1 RE	GW-2	GW-3	GW-3 DL	FIELD BLANK	TRIP BLANK	METHOD BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STDS.
SEMIVOLATILES					[Dil.: 10.0]					
1,2 Dichlorobenzene	ND	ND	ND	4 j	ND	ND	ND	ND	4.7	50
2-Methylphenol	ND	ND	ND	6 j	ND	ND	ND	ND	NS	50
Naphthalene	ND	ND	ND	29	ND	ND	ND	ND	10 GV	50
2-Methylnaphthalene	3 j	ND	ND	38	22 j	ND	ND	ND	NS	50
Acenaphthene	ND	ND	47	28	21 j	ND	ND	ND	20 GV	50
Fluorene	ND	ND	71	32	37 j	ND	ND	ND	50 GV	50
Phenanthrene	6 j	ND	430	230	160	ND	ND	ND	50 GV	50
Anthracene	3 j	ND	170	58	51 j	ND	ND	ND	50 GV	50
Fluoranthene	4 j	ND	110	100	49 j	ND	ND	ND	50 GV	50
Pyrene	14	3 j	440	310	100	ND	ND	ND	50 GV	50
Benzo(a)anthracene	15	3 j	330	290	170	ND	ND	ND	0.002 GV	50
Chrysene	19	3 j	500	240	220	ND	ND	ND	0.002 GV	50
Bis(2-ethylhexyl)phthalate	6 bj	4 j	ND	ND	ND	ND	ND	16	4200	50
Benzo(b)fluoranthene	3 jx	ND	110 x	53 x	51 jx	ND	ND	ND	0.002 GV	50
Benzo(k)fluoranthene	3 jx	ND	110 x	53 x	51 jx	ND	ND	ND	0.002 GV	50
Benzo(a)pyrene	3 j	ND	86	62	62 j	ND	ND	ND	ND	50
Indeno(1,2,3-cd)pyrene	ND	ND	ND	12	ND	ND	ND	ND	0.002 GV	50
Dibenzo(a,h)anthracene	ND	ND	ND	28	ND	ND	ND	ND	NS	50
Benzo(g,h,i)perylene	ND	ND	ND	32	ND	ND	ND	ND	NS	50

All data in ug/l.

b - Found in method blank.
j - Estimated concentration; compound present below method detection limit.
x - Value represents the coelution of indistinguishable isomers.
DL - Diluted sample analysis.
GV - Guidance value.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NS - No standard.
RE - Reextracted analysis.

TABLE 4-3 (Page 3 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-1 RE	GW-2	GW-3	GW-3 DL	FIELD BLANK	TRIP BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STDS.
SEMIVOLATILES (con't)					[Dil.: 10.0]				
Tentatively Identified Compounds									
Unknown	408 j (10)	130 j (5)	22600 j (9)	8460 j (9)	21400 j (16)	ND	ND	NS	50 (c)
Solvent contaminant	ND	58 bj (2)	ND	ND	ND	54 bj (2)	ND	NS	50 (c)
VOA TCL	ND	12 j	ND	ND	ND	ND	ND	NS	50 (c)
Unknown hydrocarbon	ND	ND	11000 j (4)	7920 j (6)	3700 j (4)	ND	ND	NS	50 (c)
Unknown cyclic hydrocarbon	32 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Unknown PAH	82 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Caprolactam	110 j	120 j	ND	ND	ND	ND	ND	NS	50 (c)
Dimethyl undecane	ND	ND	ND	560 j	ND	ND	ND	NS	50 (c)
Heptadecane	54 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Dimethyl heptadecane	58 j	ND	15300 j (4)	ND	ND	ND	ND	NS	50 (c)
Trimethyl decane	ND	ND	4400 j	ND	ND	ND	ND	NS	50 (c)
Trimethyl dodecane	66 j	ND	1800 j	760 j	ND	ND	ND	NS	50 (c)
Dimethylnaphthalene	ND	ND	ND	1000 j	ND	ND	ND	NS	50 (c)
Trimethylnaphthalene + unknown	ND	ND	ND	400 j	ND	ND	ND	NS	50 (c)
Methylnaphthalene + unknown	ND	ND	ND	680 j	ND	ND	ND	NS	50 (c)
Methyl anthracene + unknown	ND	ND	2000 j	ND	ND	ND	ND	NS	50 (c)
Methylbenzene acetic acid	ND	80 j (2)	ND	ND	ND	ND	ND	NS	50 (c)
Benzene acetic acid,.alpha.-	66 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Benzene acetic acid + unknown	72 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Alkyl benzene	ND	14 j	ND	ND	ND	ND	ND	NS	50 (c)
Methylpropenylbenzene + unknown	42 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Benzene, 1,2,4-trimethyl-	ND	20 j	ND	ND	ND	ND	ND	NS	50 (c)
Benzene, 1,3,5-trimethyl-	ND	12 j	ND	ND	ND	ND	ND	NS	50 (c)
Trimethylbenzene	28 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
PESTICIDES/PCBs	ND	NR	ND	ND	NR	ND	NR		

All data in ug/l.
( ) - Number of unknown compounds in total.
(c) - The criterion of 50 ug/l is for unspecified organic contaminants (UOC).
b - Found in method blank.
j - Estimated concentration; compound present below method detection limit.
RE - Reextracted analysis.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
DL - Diluted sample analysis.
NR - Not run.
NS - No standard.

TABLE 4-3 (Page 4 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-2	GW-3	FIELD BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STD.	NATURAL GW AMBIENT RANGE (r)
METALS							
Aluminum	4130	2450	3220	ND	NS	NS	<5.0 - 1000
Antimony	28.7 B	38.2 B	ND	ND	3 GV	NS	
Arsenic	3.7 B N	ND N	3.0 B N	ND N	25 (d)	60 P (d)	1.0 - 30
Barium	200 B	927	881	ND	1000	1000 P	10 - 600
Beryllium	ND	ND	ND	ND	3 GV (a)	NS	<10.0
Cadmium	ND	ND	ND	ND	10 (a)	10 P (a)	<1.0
Calcium	85600	269000	188000	36.3 B	NS	NS	1000 - 150000
Chromium	11.3	13.1	8.6 B	ND	NS	60 P (a)	<1.0 - 5.0
Cobalt	19.8 B	10.4 B	6.0 B	10.7 B	NS	NS	<10.0
Copper	31.7	ND	ND	ND	1000 (a)	1000 S (a)	<1.0 - 30
Iron	62400 R	18400 R	22900 R	20.1 B R	300	300 S	10.0 - 10000
Lead	10.6 N	15.5 N	12.0 SA N	ND N	25 (a)	50 P (a)	<15.0
Magnesium	27100	40000	46700	ND	35000 GV	NS	1000 - 50000
Manganese	2550	2260	2130	3.0 B	300	300 S	<1.0 - 1000
Mercury	ND	ND	ND	ND	2	2 P	<1.0
Nickel	ND	ND	ND	ND	NS	NS	<10.0 - 50.0
Potassium	3030 B	47000	144000	ND	NS	NS	1000 - 10000
Selenium	ND E N	ND E N	ND E N	ND N	20 (a)	10 P (a)	<1.0 - 10
Silver	ND	5.7 B	ND	ND	50	50 P	<6.0
Sodium	42400	89600	147000	ND	NS	NDL S	500 - 120000
Thallium	ND W N	ND N W	ND W N	ND N	4 GV (a)	NS	
Vanadium	21.7 B	23.6 B	21.5 B	8.2 B	NS	NS	<1.0 - 10.0
Zinc	55.3	34.9	44.0	9.9 B	5000 (a)	5000 S (a)	<10.0 - 2000
Cyanide	ND	ND	ND	ND	200	NS	

All data in ug/l.

B	- Value is less than the contract-required detection limit, but greater than the instrument detection limit.	(a)	- Acid soluble.
E	- Value estimated due to interference.	(d)	- Dissolved.
N	- Spiked sample recovery is not within control limits.	(r)	- Ref. No. 9, Appendix A.
ND	- Not detected at analytical detection limit; see Appendix I for detection limit.	GV	- Guidance value.
R	- Duplicate analysis not within control limits.	NDL	- No designated limit.
SA	- Value determined by the method of standard addition.	NS	- No standard.
W	- Post-digestion spike out of control limits; sample absorbance is less than 50% of spike absorbance.	**P**	- Primary drinking water standard.
		S	- Secondary drinking water standard.

TABLE 4-2 (Pa of 2)

DECEMBER 1988 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	FIELD BLANK	GW-1	GW-2	GW-3	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STD.	NATURAL GW AMBIENT RANGE (r)
METALS							
Aluminum	[30]	1060	10500	10600	NS	NS	<5.0 - 1000
Antimony	ND	ND	ND	ND	3 GV	NS	-
Arsenic	ND N	[3.6] N	[7.6] N	24 N	25 (d)	50 P (d)	1.0 - 30
Barium	ND	313	928	1260	1000	1000 P	10 - 500
Beryllium	ND	ND	[1.9]	ND	3 GV (a)	NS	<10.0
Cadmium	ND	ND	ND	ND	10 (a)	10 P (a)	<1.0
Calcium	[302]	64800	253000	184000	NS	NS	1000 - 150000
Chromium	ND	ND	27	22	NS	50 P (a)	<1.0 - 5.0
Cobalt	ND	ND	ND	[18]	NS	NS	<10.0
Copper	[8.0] R	29 R	41 R	76 R	1000 (a)	1000 S (a)	<1.0 - 30
Iron	[6.8] R	44000 R	52100 R	54000 R	300	300 S	10.0 - 10000
Lead	79	[2.7]	61	130	25 (a)	50 P (a)	<15.0
Magnesium	ND	18100	41500	47700	35000 GV	NS	1000 - 50000
Manganese	ND	1800	3420	2760	300	300 S	<1.0 - 1000
Mercury	ND	ND	ND	ND	2	2 P	<1.0
Nickel	ND	ND	[31]	[32]	NS	NS	<10.0 - 50.0
Potassium	ND	11000	50400	205000	NS	NS	1000 - 10000
Selenium	ND N	ND N	ND N E	ND N E	20 (a)	10 P (a)	<1.0 - 10
Silver	ND	ND	ND	ND	50	50 P	<5.0
Sodium	ND	28100	140000	197000	NS	NDL S	500 - 120000
Thallium	ND	ND	ND	ND	4 GV (a)	NS	-
Vanadium	ND	[3.6]	[31]	62	NS	NS	<1.0 - 10.0
Zinc	[4.8]	31	112	119	5000 (a)	5000 S (a)	<10.0 - 2000
Cyanide	ND	ND	ND	ND	200	NS	-

All data in ug/l.

[ ] - Greater than or equal to the instrument detection limit, but below contract-required detection limit.
E - Value estimated due to interference.
N - Spiked sample recovery is not within control limits.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NS - No standard.
R - Duplicate analysis not within control limits.

(a) - Acid soluble.
(d) - Dissolved.
(r) - Ref. No. 9, Appendix A.
GV - Guidance value.
NDL - No designated limit.
NS - No standard.
P - Primary drinking water standard.
S - Secondary drinking water standard.

TABLE 4-2 (Page 2 of 2)

DECEMBER 1988 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	TRIP BLANK	GW-1	GW-2	GW-3
OIL & GREASE (mg/l)	NR	250	120	NR
SPECIFIC CONDUCTANCE (umhos/cm)	NR	700	2100	2300
PESTICIDES/PCBs (ug/l)	ND	ND	NR	ND

ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run due to laboratory mishandling.

TABLE 4-3 (Page 1 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-2	GW-3	FIELD BLANK	TRIP BLANK	METHOD BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STDS.
VOLATILE ORGANICS								
Vinyl chloride	ND	ND	20	ND	ND	ND	5	2.0
Chloroethane	ND	60	36	ND	ND	ND	NS	5.0
Methylene chloride	3 bj	4 bj	4 j	2 bj	2 bj	2 j	50 GV	5.0
Acetone	ND	ND	9 j	ND	ND	ND	NS	50.0
1,1 Dichloroethane	ND	10	21	ND	ND	ND	50 GV	5.0
1,2 Dichloroethene (total)	3 j	ND	53	ND	ND	ND	NS	5.0
1,2-Dichloropropane	2 j	ND	ND	ND	ND	ND	50 GV	5.0
1,2-Dichloroethane	ND	ND	2 j	ND	ND	ND	0.8 GV	5.0
Benzene	6	15	18	ND	ND	ND	ND	5.0
Toluene	ND	ND	10	ND	ND	ND	50 GV	5.0
Ethylbenzene	ND	1 j	4 j	ND	ND	ND	50 GV	5.0
Total xylenes	25	3 j	7	ND	ND	ND	50 GV	5.0
Tentatively Identified Compounds								
Unknown	ND	6.0 j	ND	ND	ND	ND	NS	50 (c)
Unknown hydrocarbon	ND	ND	15 j	ND	ND	ND	NS	50 (c)
Benzene, 1-ethyl-2-methyl-	7.0 j	9.0 j	ND	ND	ND	ND	NS	50 (c)
Benzene, 1,2,3-trimethyl-	ND	5.0 j	ND	ND	ND	ND	NS	50 (c)
Benzene, propyl-	ND	6.0 j	ND	ND	ND	ND	NS	50 (c)
Propane, 2-(ethylthio)-	7 j	ND	ND	ND	ND	ND	NS	50 (c)
Trimethylbenzene	89 j (2)	ND	ND	ND	ND	ND	NS	50 (c)
Hexane, 2,5-dimethyl-	ND	ND	18 j	ND	ND	ND	NS	50 (c)
Heptane, 3-methyl	ND	ND	23 j	ND	ND	ND	NS	50 (c)
Cyclohexane	20 j	ND	ND	ND	ND	ND	NS	50 (c)
Cyclohexane, ethyl-	12 j	ND	ND	ND	ND	ND	NS	50 (c)
Cyclohexane, methyl-	45 j	12 j	39 j	ND	ND	ND	NS	50 (c)
Cyclohexane, 1,3-dimethyl-,cl	9.0 j	ND	ND	ND	ND	ND	NS	50 (c)
Ethylmethylcyclohexane + unknown	ND	ND	14 j	ND	ND	ND	NS	50 (c)
Substituted cyclohexane	9.0 j	ND	11 j	ND	ND	ND	NS	50 (c)
Nonane, 2,6-dimethyl-	ND	ND	13 j	ND	ND	ND	NS	50 (c)
Nonane, 3-methyl-	ND	ND	15 j	ND	ND	ND	NS	50 (c)
Nonane, 4-methyl-	14 j	ND	25 j	ND	ND	ND	NS	50 (c)
Octane, 2,6-dimethyl-	*ND*	*ND*	*18 j*	*ND*	*ND*	*ND*	NS	50 (c)

All data in ug/l.

( ) - Number of unknown compounds in total.

(c) - The criterion of 50 ug/l is for unspecified organic contaminants (UOC).

b - Found in method blank.

j - Estimated concentration; compound present below method detection limit.

GV - Guidance value.

ND - Not detected at analytical detection limit; see Appendix I for detection limit.

NS - No standard.

TABLE 4-3 (Page 2 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-1 RE	GW-2	GW-3	GW-3 DL	FIELD BLANK	TRIP BLANK	METHOD BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STDS.
SEMIVOLATILES					[Dil.: 10.0]					
1,2 Dichlorobenzene	ND	ND	ND	4 J	ND	ND	ND	ND	4.7	50
2-Methylphenol	ND	ND	ND	6 J	ND	ND	ND	ND	NS	50
Naphthalene	ND	ND	ND	29	ND	ND	ND	ND	10 GV	50
2-Methylnaphthalene	3 J	ND	ND	38	22 J	ND	ND	ND	NS	50
Acenaphthene	ND	ND	47	28	21 J	ND	ND	ND	20 GV	50
Fluorene	ND	ND	71	32	37 J	ND	ND	ND	50 GV	50
Phenanthrene	6 J	ND	430	230	160	ND	ND	ND	50 GV	50
Anthracene	3 J	ND	170	58	51 J	ND	ND	ND	50 GV	50
Fluoranthene	4 J	ND	110	100	49 J	ND	ND	ND	50 GV	50
Pyrene	14	3 J	440	310	100	ND	ND	ND	50 GV	50
Benzo(a)anthracene	15	3 J	330	290	170	ND	ND	ND	0.002 GV	50
Chrysene	19	3 J	500	240	220	ND	ND	ND	0.002 GV	50
Bis(2-ethylhexyl)phthalate	6 bJ	4 J	ND	ND	ND	ND	ND	16	4200	50
Benzo(b)fluoranthene	3 Jx	ND	110 x	53 x	51 Jx	ND	ND	ND	0.002 GV	50
Benzo(k)fluoranthene	3 Jx	ND	110 x	53 x	51 Jx	ND	ND	ND	0.002 GV	50
Benzo(a)pyrene	3 J	ND	86	62	62 J	ND	ND	ND	ND	50
Indeno(1,2,3-cd)pyrene	ND	ND	ND	12	ND	ND	ND	ND	0.002 GV	50
Dibenzo(a,h)anthracene	ND	ND	ND	28	ND	ND	ND	ND	NS	50
Benzo(g,h,i)perylene	ND	ND	ND	32	ND	ND	ND	ND	NS	50

All data in ug/l.

b - Found in method blank.
J - Estimated concentration; compound present below method detection limit.
x - Value represents the coelution of indistinguishable isomers.
DL - Diluted sample analysis.
GV - Guidance value.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NS - No standard.
RE - Reextracted analysis.

TABLE 4-3 (Page 3 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-1 RE	GW-2	GW-3	GW-3 DL	FIELD BLANK	TRIP BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STDS.
SEMIVOLATILES (con't)					[Dil.: 10.0]				
Tentatively Identified Compounds									
Unknown	408 j (10)	130 j (5)	22600 j (9)	8460 j (9)	21400 j (16)	ND	ND	NS	50 (c)
Solvent contaminant	ND	58 bj (2)	ND	ND	ND	54 bj (2)	ND	NS	50 (c)
VOA TCL	ND	12 j	ND	ND	ND	ND	ND	NS	50 (c)
Unknown hydrocarbon	ND	ND	11000 j (4)	7920 j (6)	3700 j (4)	ND	ND	NS	50 (c)
Unknown cyclic hydrocarbon	32 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Unknown PAH	82 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Caprolactam	110 j	120 j	ND	ND	ND	ND	ND	NS	50 (c)
Dimethyl undecane	ND	ND	ND	560 j	ND	ND	ND	NS	50 (c)
Heptadecane	54 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Dimethyl heptadecane	58 j	ND	15300 j (4)	ND	ND	ND	ND	NS	50 (c)
Trimethyl decane	ND	ND	4400 j	ND	ND	ND	ND	NS	50 (c)
Trimethyl dodecane	66 j	ND	1800 j	760 j	ND	ND	ND	NS	50 (c)
Dimethylnaphthalene	ND	ND	ND	1000 j	ND	ND	ND	NS	50 (c)
Trimethylnaphthalene + unknown	ND	ND	ND	400 j	ND	ND	ND	NS	50 (c)
Methylnaphthalene + unknown	ND	ND	ND	680 j	ND	ND	ND	NS	50 (c)
Methyl anthracene + unknown	ND	ND	2000 j	ND	ND	ND	ND	NS	50 (c)
Methylbenzene acetic acid	ND	80 j (2)	ND	ND	ND	ND	ND	NS	50 (c)
Benzene acetic acid,.alpha.-	66 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Benzene acetic acid + unknown	72 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Alkyl benzene	ND	14 j	ND	ND	ND	ND	ND	NS	50 (c)
Methylpropenylbenzene + unknown	42 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
Benzene, 1,2,4-trimethyl-	ND	20 j	ND	ND	ND	ND	ND	NS	50 (c)
Benzene, 1,3,5-trimethyl-	ND	12 j	ND	ND	ND	ND	ND	NS	50 (c)
Trimethylbenzene	28 j	ND	ND	ND	ND	ND	ND	NS	50 (c)
PESTICIDES/PCBs	ND	NR	ND	ND	NR	ND	NR		

ll data in ug/l.

) - Number of unknown compounds in total.

c) - The criterion of 50 ug/l is for unspecified organic contaminants (UOC).

- Found in method blank.

- Estimated concentration; compound present below method detection limit.

RE - Reextracted analysis.

ND - Not detected at analytical detection limit; see Appendix I for detection limit.

DL - Diluted sample analysis.

NR - Not run.

NS - No standard.

TABLE 4-3 (Page 4 of 4)

FEBRUARY 1990 GROUNDWATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-1	GW-2	GW-3	FIELD BLANK	NYS GW CLASS GA STDS.	NYSDOH DRINKING WATER STD.	NATURAL GW AMBIENT RANGE (r)
METALS							
Aluminum	4130	2450	3220	ND	NS	NS	<5.0 - 1000
Antimony	28.7 B	38.2 B	ND	ND	3 GV	NS	
Arsenic	3.7 B N	ND N	3.0 B N	ND N	25 (d)	50 P (d)	1.0 - 30
Barium	200 B	927	881	ND	1000	1000 P	10 - 600
Beryllium	ND	ND	ND	ND	3 GV (a)	NS	<10.0
Cadmium	ND	ND	ND	ND	10 (a)	10 P (a)	<1.0
Calcium	85600	269000	188000	36.3 B	NS	NS	1000 - 150000
Chromium	11.3	13.1	8.6 B	ND	NS	50 P (a)	<1.0 - 5.0
Cobalt	19.8 B	10.4 B	6.0 B	10.7 B	NS	NS	<10.0
Copper	31.7	ND	ND	ND	1000 (a)	1000 S (a)	<1.0 - 30
Iron	62400 R	18400 R	22900 R	20.1 B R	300	300 S	10.0 - 10000
Lead	10.6 N	15.5 N	12.0 SA N	ND N	25 (a)	50 P (a)	<15.0
Magnesium	27100	40000	46700	ND	35000 GV	NS	1000 - 50000
Manganese	2550	2260	2130	3.0 B	300	300 S	<1.0 - 1000
Mercury	ND	ND	ND	ND	2	2 P	<1.0
Nickel	ND	ND	ND	ND	NS	NS	<10.0 - 50.0
Potassium	3030 B	47000	144000	ND	NS	NS	1000 - 10000
Selenium	ND E N	ND E N	ND E N	ND N	20 (a)	10 P (a)	<1.0 - 10
Silver	ND	5.7 B	ND	ND	50	50 P	<5.0
Sodium	42400	89600	147000	ND	NS	NDL S	500 - 120000
Thallium	ND W N	ND N W	ND W N	ND N	4 GV (a)	NS	
Vanadium	21.7 B	23.6 B	21.5 B	8.2 B	NS	NS	<1.0 - 18.5
Zinc	55.3	34.9	44.0	9.9 B	5000 (a)	5000 S (a)	<10.0 - 2000
Cyanide	ND	ND	ND	ND	200	NS	

All data in ug/l.

B - Value is less than the contract-required detection limit, but greater than the instrument detection limit.

E - Value estimated due to interference.

N - Spiked sample recovery is not within control limits.

ND - Not detected at analytical detection limit; see Appendix I for detection limit.

R - Duplicate analysis not within control limits.

SA - Value determined by the method of standard addition.

W - Post-digestion spike out of control limits; sample absorbance is less than 50% of spike absorbance.

(a) - Acid soluble.

(d) - Dissolved.

(r) - Ref. No. 9, Appendix A.

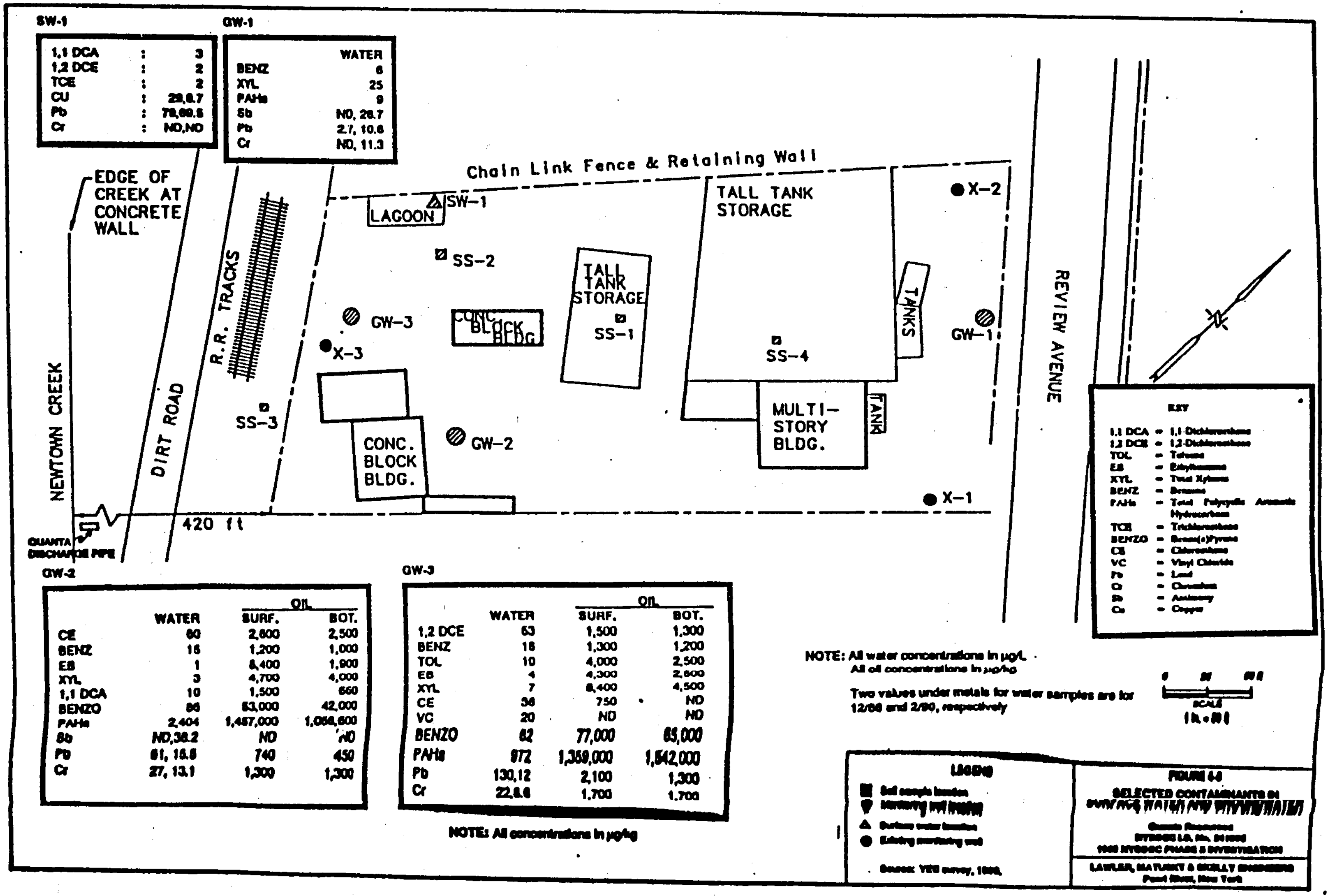
GV - Guidance value.

NDL - No designated limit.

NS - No standard.

P - Primary drinking water standard.

S - Secondary drinking water standard.



SW-1

1,1 DCA	:	3
1,2 DCE	:	2
TCE	:	2
CU	:	29,8.7
Pb	:	78,69.5
Cr	:	ND,ND

GW-1

	WATER
BENZ	6
XYL	25
PAHs	9
Sb	ND, 26.7
Pb	2.7, 10.6
Cr	ND, 11.3

GW-2

		OIL	
	WATER	SURF.	BOT.
CE	60	2,600	2,500
BENZ	16	1,200	1,000
EB	1	8,400	1,900
XYL	3	4,700	4,000
1,1 DCA	10	1,500	660
BENZO	86	53,000	42,000
PAHs	2,404	1,457,000	1,056,600
Sb	ND,38.2	ND	ND
Pb	61, 16.6	740	450
Cr	27, 13.1	1,300	1,300

GW-3

		OIL	
	WATER	SURF.	BOT.
1,2 DCE	63	1,500	1,300
BENZ	18	1,300	1,200
TOL	10	4,000	2,500
EB	4	4,300	2,600
XYL	7	8,400	4,500
CE	36	750	ND
VC	20	ND	ND
BENZO	62	77,000	65,000
PAHs	972	1,359,000	1,642,000
Pb	130,12	2,100	1,300
Cr	22,8.6	1,700	1,700

NOTE: All concentrations in µg/kg

KEY

1,1 DCA = 1,1-Dichloroethane
1,2 DCE = 1,2-Dichloroethene
TOL = Toluene
EB = Ethylbenzene
XYL = Total Xylenes
BENZ = Benzene
PAHs = Total Polycyclic Aromatic Hydrocarbons
TCE = Trichloroethene
BENZO = Benzo(a)Pyrene
CE = Chloroethane
VC = Vinyl Chloride
Pb = Lead
Cr = Chromium
Sb = Antimony
Cu = Copper

NOTE: All water concentrations in µg/L.
All oil concentrations in µg/kg

Two values under metals for water samples are for 12/89 and 2/90, respectively

LEGEND

- ▨ Soil sample location
- ▼ Monitoring well location
- △ Surface water location
- ● Existing monitoring well

Source: YEC survey, 1990.

FIGURE [illegible]

SELECTED CONTAMINANTS IN SURFACE WATER AND GROUNDWATER

Quanta Resources
NYSDEC I.D. No. [illegible]
1990 NYSDEC PHASE II INVESTIGATION

LAWLER, MATUSKY & SKELLY ENGINEERS
Pearl River, New York

TABLE 4-4

DECEMBER 1988 SURFACE WATER SEDIMENT, OIL, AND DRUM SAMPLES DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SED-1	GW-2 OIL	GW-3 OIL	DRUM CUT	DRUM DECON	EPA MAXIMUM CONCENTRATION
EP TOXICITY METALS (ug/l)						
Arsenic, total	[3]	[6.3]	11	31	NR	5,000
Barium, total	[161]	[133]	[171]	233	NR	100,000
Chromium, total	ND	ND	ND	47	NR	1,000
Lead, total	429	[1.9]	[1.9]	281	NR	5,000
Mercury, total	ND	ND	ND	0.71	NR	5,000
OIL & GREASE (mg/kg)	NR	NR	300,000	NR	NR	
IGNITABILITY (deg. F)	NR	>212•	>212•	>212•	NR	
PCB (ug/kg)						
Aroclor-1242	NR	ND	1800	ND	ND	

> - Greater than instrument detection limit.
[ ] - Greater than or equal to the instrument detection limit but below contract-required detection limit.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run due to laboratory mishandling.

TABLE 4-5 (Page 1 of 3)

FEBRUARY 1990 OIL SAMPLE DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-2 P BOTTOM	GW-2 P SURFACE	GW-2 P SURFACE RE	GW-3 P BOTTOM	GW-3 P BOTTOM MS	GW-3 P BOTTOM MSD	GW-3 P SURFACE	GW-3 P SURFACE RE
VOLATILE ORGANICS								
Chloroethane	2500	2900	2600	ND	ND	ND	790 J	750 J
Methylene chloride	470 bJ	350 bJ	2700 b	1500 b	1600 b	1600 b	1200 bJ	1000 bJ
Acetone	ND	ND	1100 J	ND	ND	ND	ND	ND
1,1 Dichloroethane	660 J	1500	1500	740 J	1200 J	1200 J	780 J	640 J
1,2 Dichloroethene (total)	ND	ND	ND	1300	2000	2200	1900	1500
Trichloroethene	ND	ND	ND	ND	ND	ND	320 J	ND
Benzene	1000 J	1200 J	1200 J	1200 J	ND	ND	1700	1300
Tetrachloroethene	ND	ND	ND	ND	ND	ND	300 J	270 J
Toluene	500 J	830 J	720 J	2500	ND	ND	5700	4000
Ethylbenzene	1900	7200	5400	2600	4200	4700	5100	4300
Total xylenes	4000	6200	4700	4500	7200	7900	10000	8400
Tentatively Identified Compounds								
Unknown	24000 J (2)	57000 J (2)	13000 J	54000 J (3)	NR	NR	30000 J	105000 J (4)
Unknown alkane	ND	17000 J	ND	ND	NR	NR	ND	ND
Unknown alkene	9300 J	ND	ND	ND	NR	NR	ND	ND
Unknown hydrocarbon	21000 J	ND	15000 J	17000 J	NR	NR	ND	ND
Hydrocarbon + unknown	ND	ND	14000 J	ND	NR	NR	ND	ND
Substituted benzene	ND	ND	ND	ND	NR	NR	35000 J (2)	ND
Benzene, propyl-	15000 J	30000 J	21000 J	18000 J	NR	NR	ND	23000 J
Ethylmethylbenzene	28000 J (2)	38000 J (2)	26000 J (2)	ND	NR	NR	ND	ND
Trimethylbenzene	15000 J	18000 J	13000 J	ND	NR	NR	ND	ND
Hexane, 2,5-dimethyl-	ND	ND	ND	ND	NR	NR	21000 J	21000 J
Hexane, 3-methyl-	ND	ND	ND	ND	NR	NR	23000 J	ND
Cyclohexane, ethyl-	35000 J	38000 J	30000 J	48000 J	NR	NR	50000 J	55000 J
Cyclohexane, methyl-	28000 J	24000 J	19000 J	45000 J	NR	NR	50000 J	43000 J
Cyclohexane, 1-ethyl-4-methyl	ND	ND	ND	ND	NR	NR	ND	28000 J
Cyclohexane, 1,3-dimethyl-,cl	ND	ND	ND	ND	NR	NR	25000 J	ND
Dimethylcyclohexane	ND	ND	ND	24000 J	NR	NR	ND	ND
Ethylmethylcyclohexane	ND	23000 J	21000 J	ND	NR	NR	ND	ND
Ethylmethylcyclohexane + unknown	ND	ND	ND	24000 J	NR	NR	ND	ND
Cyclohexane, propyl-	ND	ND	ND	ND	NR	NR	ND	38000 J
2-Hexene,3,4,4-trimethyl-	ND	ND	ND	ND	NR	NR	18000 J	ND
Heptane	ND	ND	ND	15000 J	NR	NR	16000 J	ND

All data in ug/kg.

( )	- Number of unknown compounds in total.
b	- Found in method blank.
J	- Estimated concentration; compound present below method detection limit.
MS	- Matrix spike.
MSD	- Matrix spike duplicate.
ND	- Not detected at analytical detection limit; see Appendix I for detection limit.
NR	- Not run.
RE	- *Reextracted analysis; initial analysis outside QA/QC limits.*

TABLE 4-5 (Page 3 of 3)

FEBRUARY 1990 OIL SAMPLE DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	GW-2 P BOTTOM	GW-2 P BOTTOM DUP.	GW-2 P SURFACE	GW-3 P BOTTOM	GW-3 P SURFACE
METALS					
Aluminum	8.5 B	9.7 B	7.6 B	12.7 B	9.9 B
Antimony	ND	ND	ND	ND	ND
Arsenic	1.2 B W	1.6 B	1.8 B SA	ND SA	1.7 B SA
Barium	1.0 B	1.2 B	1.3 B	3.2 B	4.2 B
Beryllium	ND	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND	ND
Calcium	33.4 B	16.0 B	20.9 B	39.7 B	43.3 B
Chromium	1.3 B	ND	1.3 B	1.7 B	1.7 B
Cobalt	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND
Iron	12.1 B	8.5 B	7.8 B	13.2 B	13.4 B
Lead	0.45 B W	0.49 B	0.74	1.3	2.1
Magnesium	ND	ND	ND	ND	ND
Manganese	0.36 B	0.57 B	ND	1.9 B	2.1 B
Mercury	ND N	ND	ND N	ND N	ND N
Nickel	ND	ND	ND	ND	ND
Potassium	ND	ND	ND	ND	ND
Selenium	ND E N	ND	ND E N	ND E N	ND E N
Silver	ND	ND	ND	ND	ND
Sodium	ND	ND	ND	ND	ND
Thallium	ND	ND	ND W	ND	ND
Vanadium	2.8 B	2.8 B	3.0 B	2.1 B	3.3 B
Zinc	4.3	4.9	3.3 B	7.2	4.7
Cyanide	ND	ND	ND	ND	ND

All data in mg/kg.

B - Value is less than the contract-required detection limit, but greater than the instrument detection limit.
E - Value estimated due to interference.
N - Spiked sample recovery is not within control limits.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
SA - Value determined by the method of standard addition.
W - Post-digestion spike out of control limits; sample absorbance is less than 50% of spike absorbance.

TABLE 4-6 (Page 2 of 2)

DECEMBER 1988 SURFACE WATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SW-1	SW-1 MS	SW-1 MSD
OIL & GREASE (mg/l)	1.3	NR	NR
SPECIFIC CONDUCTANCE (umhos/cm)	470	NR	NR
PESTICIDES/PCBs (ug/l)	ND	ND	ND

MS - Matrix spike.
MSD - Matrix spike duplicate.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run.

TABLE 4-7 (Page 1 of 2)

FEBRUARY 1990 SURFACE WATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SW-1	SW-1 MS	SW-1 MSD	CLASS SD SW STDS.
VOLATILE ORGANICS				
Methylene chloride	ND	ND	1 j	NS
Acetone	6 j	5 j	5 j	NS
1,1 Dichloroethane	3 j	3 j	3 j	NS
1,2 Dichloroethene (total)	2 j	2 j	2 j	NS
Trichloroethene	2 j	ND	ND	NS
Tentatively Identified Compounds	ND	NR	NR	
SEMIVOLATILES				
Benzoic acid	ND	ND	10 j	NS
Bis(2-ethylhexyl)phthalate	3 bj	ND	2 bj	NS
Tentatively Identified Compounds				
Solvent contaminant	ND	NR	NR	NS
Unknown	8 j	NR	NR	NS
PESTICIDES/PCBs	ND	ND	ND	

All data in ug/l.
b - Found in method blank.
j - Estimated concentration; compound present below method detection limit.
MS - Matrix spike.
MSD - Matrix spike duplicate.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run.
NS - No standard.

TABLE 4-7 (Page 2 of 2)

FEBRUARY 1990 SURFACE WATER DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SW-1	SW-1 DUP.	CLASS SD SW STDS.
METALS			
Aluminum	475	447	NS
Antimony	ND	ND	NS
Arsenic	ND N	ND	120
Barium	101 B	98 B	NS
Beryllium	ND	ND	NS
Cadmium	ND	ND	NS
Calcium	88300	87700	NS
Chromium	ND	ND	NS
Cobalt	3.3 B	ND	NS
Copper	8.7 B	ND	3.2
Iron	1140 R	852 R	NS
Lead	69.5 SA N	61.9	220
Magnesium	8760	8700	NS
Manganese	27.4	25.7	NS
Mercury	ND	ND	NS
Nickel	ND	ND	140
Potassium	23000	20600	NS
Selenium	ND W N	ND	NS
Silver	ND	ND	2.3
Sodium	14200	13700	NS
Thallium	ND W N	ND	NS
Vanadium	4.1 B	ND	NS
Zinc	113	123	170
Cyanide	ND	ND	1.0

All data in ug/l.

B	- Value is less than the contract-required detection limit, but greater than the instrument detection limit.
N	- Spiked sample recovery is not within control limits.
ND	- Not detected at analytical detection limit; see Appendix I for detection limit.
NS	- No standard.
R	- Duplicate analysis not within control limits.
SA	- Value determined by the method of standard addition.
W	- Post-digestion spike out of control limits; sample absorbance is less than 50% of spike absorbance.

TABLE 4-8 (Page 1 of 4)

DECEMBER 1988 SEDIMENT AND SOIL DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SED-1	SS-1	SS-2	SS-2 MS	SS-2 MSD	SS-3	SS-3 MS	SS-3 MSD	SS-4	BACKGROUND SOIL DATA (g)
VOLATILE ORGANICS										
Methylene chloride	44 b	1500 bj	1200 b	950 b	940 b	13 b	17 b	18 b	720 bj	BU
Acetone	210 b	ND	1000 bj	1200 J	1400 J	55 b	78 b	67 b	ND	BU
Carbon disulfide	5 J	ND	ND	ND	ND	ND	ND	ND	ND	BU
1,1-Dichloroethane	9 J	ND	1300	1000	1200	2 J	2 J	2 J	ND	BU
1,2-Dichloroethene (total)	ND	ND	650 J	570 J	600 J	ND	ND	1 J	ND	BU
Chloroform	ND	ND	ND	ND	ND	2 J	1 J	1 J	ND	BU
2-Butanone	ND	ND	ND	ND	ND	ND	12	ND	ND	BU
1,1,1 Trichloroethane	ND	1900 J	10000	8500	9100	ND	ND	ND	ND	BU
Trichloroethene	ND	6400	16000	ND	ND	ND	ND	ND	1400	BU
Benzene	4 J	890 J	600 J	ND	ND	2 bJ	ND	ND	220	BU
4-Methyl-2-pentanone	ND	ND	13000	9700	11000	ND	ND	ND	ND	BU
Tetrachloroethene	ND	4800	9700	8900	9900	1 J	2 J	2 J	1800	BU
Toluene	9 J	11000	32000	ND	ND	4 J	ND	ND	1400	BU
Chlorobenzene	6 J	ND	ND	ND	ND	3 J	ND	ND	ND	BU
Ethylbenzene	340	11000	9200	8200	8900	3 J	4 J	3 J	560 J	BU
Styrene	7 J	76000	ND	ND	ND	ND	ND	ND	ND	BU
Total xylenes	360	33000	44000	37000	40000	25	32	32	4600	BU
Tentatively Identified Compounds										
Unknown cyclic alkane	ND	ND	1000 J	NR	NR	ND	NR	NR	ND	BU
Unknown	ND	ND	6500 J	NR	NR	ND	NR	NR	4400 J (2)	BU
Ethane, 1,1,2-trichloro-1,2,2-trifluoro-	ND	ND	830 J	NR	NR	ND	NR	NR	ND	BU
Unknown alcohol	ND	ND	1000 J	NR	NR	ND	NR	NR	ND	BU
Instrument artifact	ND	ND	4000 J	NR	NR	ND	NR	NR	4000 J	BU
Ethane,1,2-dichloro-1,1,2-trifluoro-	29 J	ND	ND	NR	NR	ND	NR	NR	ND	BU

All data in ug/kg.

( )	- Number of unknown compounds in total.
(g)	- Ref. 9, Appendix A.
b	- Found in method blank.
J	- Estimated concentration; compound present below method detection limit.
BU	- Background unknown; in general, natural soils would not have organic contamination.
MS	- Matrix spike.
MSD	- Matrix spike duplicate.
ND	- Not detected at analytical detection limit; see Appendix I for detection limit.
NR	- Not run.

TABLE 4-8 (Page 2 of 4)

DECEMBER 1988 SEDIMENT AND SOIL DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SED-1	SED-1 MS	SED-1 MSD	SS-1	SS-2	SS-2 MS	SS-2 MSD	SS-3	SS-4	SS-4 RE	BACKGROUND SOIL DATA (g)
SEMIVOLATILES											
Phenol	ND	ND	ND	42000	ND	ND	ND	ND	ND	(f) ND	BU
1,2-Dichlorobenzene	350 j	550 j	420 j	17000 j	11000 j	10000 j	9700 j	ND	9800 j	6700 j	BU
4-Methylphenol	ND	590 j	ND	14000 j	ND	ND	ND	ND	ND	ND	BU
Benzoic acid	ND	310 j	1200 j	ND	ND	ND	ND	ND	ND	ND	BU
1,2,4-Trichlorobenzene	ND	ND	ND	7800 j	4000 j	ND	ND	ND	3800 j	ND	BU
Naphthalene	530 j	900 j	700 j	110000	58000	47000	48000	5000 j	24000 j	16000 j	BU
2-Methylnaphthalene	360 j	630 j	460 j	250000	71000	50000	60000	5000 j	49000	21000 j	BU
Acenaphthylene	ND	ND	210 j	8300 j	3500 j	ND	ND	ND	11000 j	9600 j	BU
Acenaphthene	ND	ND	ND	14000 j	30000	ND	ND	6400 j	5300 j	ND	BU
Dibenzofuran	ND	ND	ND	11000 j	14000 j	9900 j	11000 j	ND	3600 j	ND	BU
Fluorene	ND	350 j	380 j	25000 j	21000	11000 j	13000 j	6200 j	10000 j	8100 j	BU
Phenanthrene	700 j	1300 j	830 j	58000	59000	38000	34000	5700 j	29000 j	27000 j	BU
Anthracene	ND	ND	310 j	ND	17000 j	9300 j	8100 J	ND	8400 j	10000 j	BU
Di-n-butyl phthalate	ND	ND	ND	6200 j	ND	ND	ND	3900 j	ND	4800 j	BU
Fluoranthene	1500 j	2200	1800 j	22000 j	32000	20000 j	21000 j	5800 j	12000 j	11000 j	BU
Pyrene	2600	ND	ND	24000 j	21000 j	ND	ND	10000 j	16000 j	14000 j	BU
Benzo (a) anthracene	860 j	1100 j	1200 j	10000 j	ND	8700 j	7900 j	ND	13000 j	7700 j	BU
Chrysene	1300 j	1800 j	2500 j	20000 j	16000 j	11000 j	9900 j	4400 j	13000 j	12000 j	BU
bis(2-ethylhexyl)phthalate	14000 j	19000 b	19000	61000	ND	61000	75000	16000 j	29000 J	15000 j	BU
Di-n-octyl phthalate	ND	400 j	ND	ND	ND	ND	8900 j	ND	ND	ND	BU
Benzo(b)fluoranthene	2500 j	4200 x	5300 x	22000 jx	8500 jx	9700 jx	9700 jx	7000 jx	19000 jx	7200 jx	BU
Benzo(k)fluoranthene	2500 j	4200 x	5300 x	22000 jx	8500 jx	9700 jx	9700 jx	7000 jx	19000 jx	7200 jx	BU
Benzo(a)pyrene	1100 j	1900	1100 j	13000 j	8700 j	4900 j	5200 j	ND	13000 j	6400 j	BU
Indeno(1,2,3-cd)pyrene	880 j	1200 j	740 j	6500 j	ND	ND	ND	ND	ND	ND	BU
Dibenzo(a,h)anthracene	ND	640 j	470 j	ND	ND	ND	ND	ND	ND	ND	BU
Benzo(g,h,i)perylene	1600 j	2100	1200 j	10000 j	ND	ND	ND	ND	ND	4000 j	BU

All data in ug/kg.

(f) - Results of the reextraction and reanalysis of SS-4 due to a failed acid surrogate recovery (below 10%).
(g) - Ref. 9, Appendix A.
b - Found in method blank.
j - Estimated concentration; compound present below method detection limit.
x - Coelution of isomers.

BU - Background unknown; In general, natural soils would not have organic contamination.
MS - Matrix spike.
MSD - Matrix spike duplicate.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
RE - Reextracted analysis.

TABLE 4-8 (Page 3 of 4)

DECEMBER 1988 SEDIMENT AND SOIL DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SED-1	SS-1	SS-2	SS-2 MS	SS-2 MSD	SS-3	SS-3 MS	SS-3 MSD	SS-4	SS-4 RE	BACK-GROUND SOIL DATA
SEMIVOLATILES (con't)											
Tentatively Identified Compounds										(f)	(g)
1-Octanol, 2-butyl-	ND	ND	ND	NR	NR	ND	NR	NR	ND	280000 J	BU
Benzene, 1,1'-(1,2-cyclobuta	ND	680000 J	ND	NR	NR	ND	NR	NR	ND	ND	BU
Bicyclo [4.2.0] octa-1,3,5-tri	ND	370000 J	ND	NR	NR	ND	NR	NR	ND	ND	BU
Decane, 2,3,4-trimethyl-	ND	ND	ND	NR	NR	ND	NR	NR	ND	300000 J	BU
Docosane	ND	ND	ND	NR	NR	ND	NR	NR	ND	170000 J	BU
Dodecane, 2,6,11-trimethyl-	ND	ND	ND	NR	NR	ND	NR	NR	ND	220000 J	BU
Heptadecane	ND	ND	ND	NR	NR	ND	NR	NR	110000 J	ND	BU
Heptadecane, 2,6-dimethyl-	ND	1020000 (3)	ND	NR	NR	ND	NR	NR	ND	ND	BU
Hexatriacontane	ND	ND	ND	NR	NR	ND	NR	NR	230000 J	ND	BU
Naphthalene, 1,8-dimethyl-	ND	110000 J	ND	NR	NR	ND	NR	NR	ND	ND	BU
Pentacosane	ND	1420000 J (3)	ND	NR	NR	ND	NR	NR	ND	ND	BU
Pentane, 3-ethyl-2, 3-dimethyl	ND	ND	ND	NR	NR	ND	NR	NR	ND	160000 J	BU
Tetradecane	ND	140000 J	ND	NR	NR	ND	NR	NR	230000 J	ND	BU
Undecane, 3,9-dimethyl-	ND	ND	ND	NR	NR	ND	NR	NR	ND	160000 J	BU
Undecane, 4,7-dimethyl-	ND	ND	ND	NR	NR	ND	NR	NR	ND	160000 J	BU
Unknown	1773000 J (14)	580000 J	2040000 J (12)	NR	NR	1751000 J (18)	NR	NR	4340000 J (17)	3330000 J (13)	BU
Unknown aromatic	ND	2520000 J (4)	ND	NR	NR	ND	NR	NR	ND	ND	BU
Unknown hydrocarbon	790000 J (6)	2250000 J (5)	1180000 J (8)	NR	NR	109000 J (2)	NR	NR	ND	ND	BU
PESTICIDES/PCBs											BU
Aroclor-1260	NR	ND	13000 c	18000	20000	(a)	(a)	(a)	19000 c	ND	BU

All data in ug/kg.

( ) - Number of unknown compounds in total.
(a) - Data unusable due to QA/QC reasons; see Appendix J.
(f) - Results of the reextraction and reanalysis of SS-4 due to a failed acid surrogate recovery (below 10%).
(g) - Ref. 9, Appendix A.
c - Value confirmed by GC/MS analysis.
J - Estimated concentration; compound present below method detection limit.
BU - Background unknown; in general, natural soils would not have organic contamination.
MS - Matrix spike.
MSD - Matrix spike duplicate.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run.
RE - Reextracted analysis.

TABLE 4-8 (Page 4 of 4)

DECEMBER 1988 SEDIMENT AND SOIL DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SED-1	SS-1	SS-2	SS-3	SS-4	BACKGROUND SOIL DATA (g)
METALS						
Aluminum	7,930	18,800	9,490	4,190	9,320	10,000-300,000
Antimony	ND N	ND N	ND N	ND N	[17] N	0.6-10
Arsenic	8.9	[17]	[16]	29	[23]	1.0-40
Barium	655 N	1,570 N	1,650 N	768 N	3,490 N	100-3500
Beryllium	[1.6]	[0.52]	[0.94]	[0.88]	[0.63]	0.01-40
Cadmium	5.6 N	14 N	11 N	5.3 N	12 N	0.01-7.0
Calcium	110,000	13,500	129,000	28,900	161,000	100-400,000
Chromium	138	108	417	35	96	5.0-3000
Cobalt	[11]	[12]	19	[9.0]	[10]	1.0-40
Copper	254 E	1,070	561	312	634	2.0-100
Iron	18,900	48,000	23,500	18,000	24,200	7000-550,000
Lead	8,000 R	116,000 R	27,000 R	2,000 R	16,600 R	2.0-200
Magnesium	8,490 E	1,750 E	10,300 E	13,700 E	11,700 E	600-6000
Manganese	282 N	197 N	315 N	125 N	201 N	100-4000
Mercury	0.62 N	1.9 N	0.74 N	1.1 N	1.6 N	0.01-0.08
Nickel	84	65	188	28	55	5.0-1000
Potassium	[1,800]	ND	3,340	ND	ND	400-30,000
Silver	ND	ND	[2.0]	ND	ND	0.1-5.0
Sodium	ND	ND	[514]	ND	ND	750-7500
Thallium	[1.2]	ND	[1.0]	ND	[2.0]	0.1-12
Vanadium	41	143 E	51 E	52 E	37 E	20-500
Zinc	1,050	2,270	2,190	988	1,170	10-300
Cyanide	NR	2.2 R N	4.8 R N	ND R N	5.0 R N	
Percent solids (%)	35	76	75	86	63	

All data in mg/kg.

[ ] - Greater than or equal to the instrument detection limit but below contract-required detection limit.
(g) - Ref. 9, Appendix A.
E - Value estimated due to interference.
N - Spiked sample recovery is not within control limits.
ND - Not detected at analytical detection limit; see Appendix I for detection limit.
NR - Not run.
R - Duplicate analysis not within control limits.

TABLE 4-9

FEBRUARY 1990 SEDIMENT AND SOIL SAMPLE DATA SUMMARY

Quanta Resources NYSDEC I.D. No. 241005

PARAMETER	SED-1	SED-1 MS	SED-1 MSD	SS-3
PESTICIDES/PCBs				
Aroclor-1260	6700	51000	43000	60000 c

All data in ug/kg.
c - Value confirmed by GC/MS analysis.
MS - Matrix spike.
MSD - Matrix spike duplicate.

TABLE 4-9

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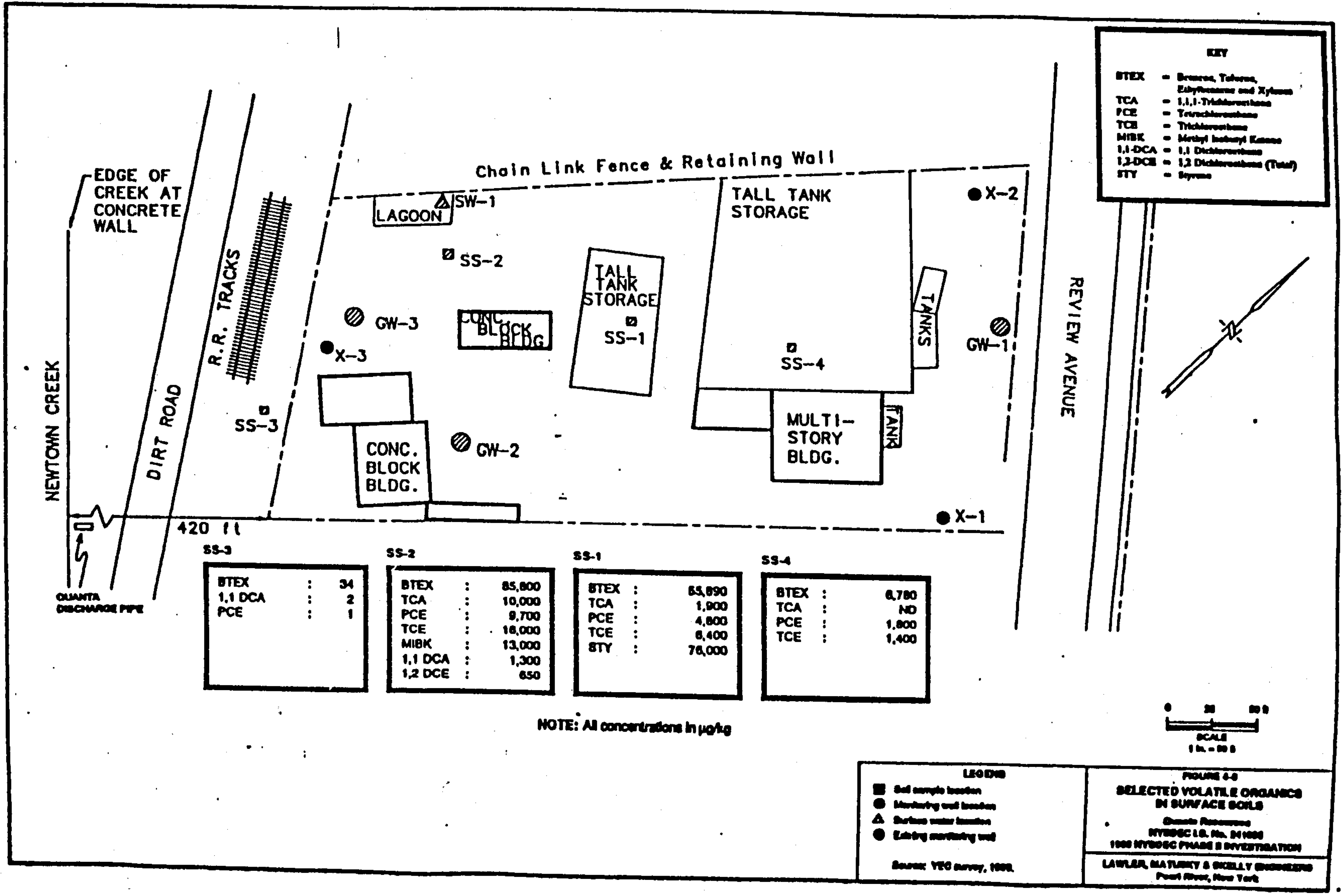


KEY

BTEX = Benzene, Toluene, Ethylbenzene and Xylenes
TCA = 1,1,1-Trichloroethane
PCE = Tetrachloroethene
TCE = Trichloroethene
MIBK = Methyl Isobutyl Ketone
1,1-DCA = 1,1 Dichloroethane
1,2-DCE = 1,2 Dichloroethene (Total)
STY = Styrene

SS-3

BTEX	:	34
1,1 DCA	:	2
PCE	:	1

SS-2

BTEX	:	85,800
TCA	:	10,000
PCE	:	9,700
TCE	:	16,000
MIBK	:	13,000
1,1 DCA	:	1,300
1,2 DCE	:	650

SS-1

BTEX	:	55,890
TCA	:	1,900
PCE	:	4,800
TCE	:	6,400
STY	:	76,000

SS-4

BTEX	:	6,780
TCA	:	ND
PCE	:	1,800
TCE	:	1,400

NOTE: All concentrations in µg/kg

LEGEND

- ▨ Soil sample location
- ● Monitoring well location
- △ Surface water location
- ● Existing monitoring well

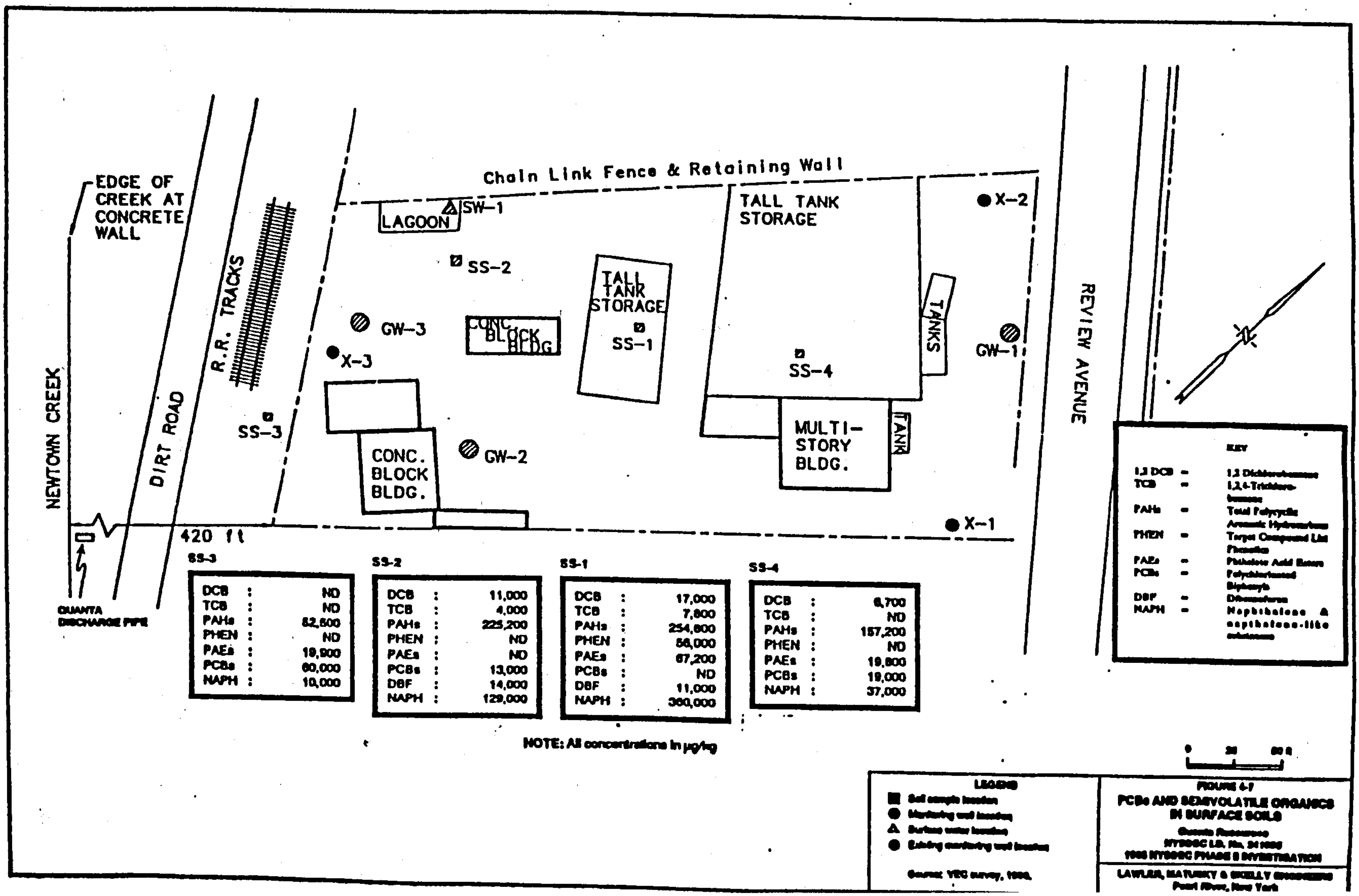
Source: YEC survey, 1990.

FIGURE 4-6

SELECTED VOLATILE ORGANICS
IN SURFACE SOILS

Quanta Resources
NYSDEC I.D. No. 241005
1990 NYSDEC PHASE II INVESTIGATION

LAWLER, MATUSKY & SKELLY ENGINEERS
Pearl River, New York



SS-3

DCB	:	ND
TCB	:	ND
PAHs	:	82,500
PHEN	:	ND
PAEs	:	19,900
PCBs	:	60,000
NAPH	:	10,000

SS-2

DCB	:	11,000
TCB	:	4,000
PAHs	:	225,200
PHEN	:	ND
PAEs	:	ND
PCBs	:	13,000
DBF	:	14,000
NAPH	:	129,000

SS-1

DCB	:	17,000
TCB	:	7,800
PAHs	:	254,800
PHEN	:	56,000
PAEs	:	67,200
PCBs	:	ND
DBF	:	11,000
NAPH	:	360,000

SS-4

DCB	:	6,700
TCB	:	ND
PAHs	:	157,200
PHEN	:	ND
PAEs	:	19,800
PCBs	:	19,000
NAPH	:	37,000

NOTE: All concentrations in µg/kg

KEY

1,2 DCB = 1,2 Dichlorobenzene
TCB = 1,2,4-Trichlorobenzene
PAHs = Total Polycyclic Aromatic Hydrocarbons
PHEN = Target Compound List Phenolics
PAEs = Phthalate Acid Esters
PCBs = Polychlorinated Biphenyls
DBF = Dibenzofuran
NAPH = Naphthalene & napthalene-like compounds

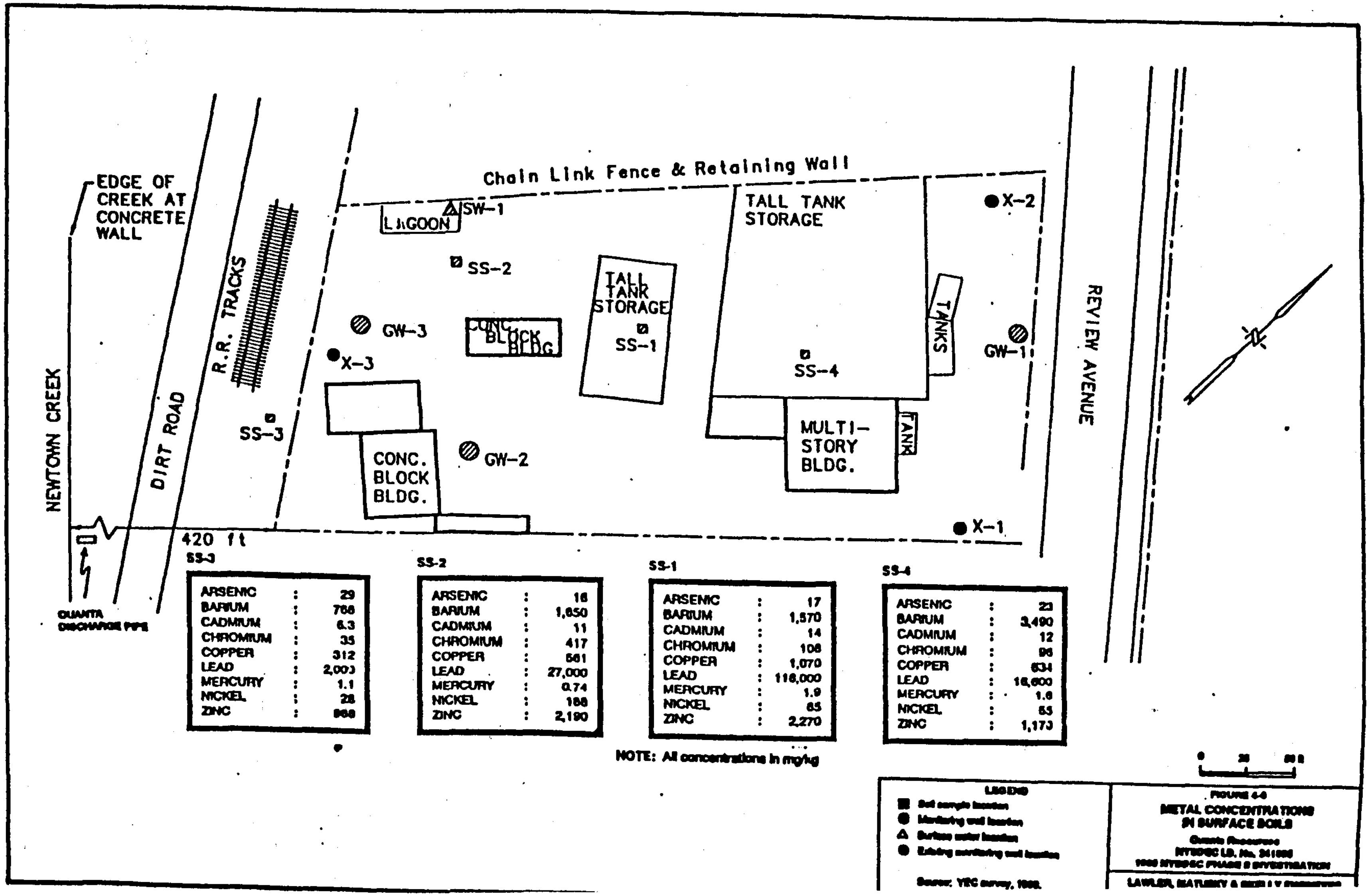
LEGEND

- ■ Soil sample location
- ● Monitoring well location
- △ Surface water location
- ● Existing monitoring well location

Source: YEC survey, [illegible]

FIGURE 4-7
PCBs AND SEMIVOLATILE ORGANICS IN SURFACE SOILS
Quanta Resources
NYSDEC I.D. No. 241005
[illegible] NYSDEC PHASE II INVESTIGATION

LAWLER, MATUSKY & SKELLY ENGINEERS
Pearl River, New York



SS-3

ARSENIC	:	29
BARIUM	:	768
CADMIUM	:	6.3
CHROMIUM	:	35
COPPER	:	312
LEAD	:	2,003
MERCURY	:	1.1
NICKEL	:	28
ZINC	:	868

SS-2

ARSENIC	:	16
BARIUM	:	1,650
CADMIUM	:	11
CHROMIUM	:	417
COPPER	:	561
LEAD	:	27,000
MERCURY	:	0.74
NICKEL	:	188
ZINC	:	2,190

SS-1

ARSENIC	:	17
BARIUM	:	1,570
CADMIUM	:	14
CHROMIUM	:	108
COPPER	:	1,070
LEAD	:	116,000
MERCURY	:	1.9
NICKEL	:	65
ZINC	:	2,270

SS-4

ARSENIC	:	23
BARIUM	:	3,490
CADMIUM	:	12
CHROMIUM	:	96
COPPER	:	634
LEAD	:	16,600
MERCURY	:	1.6
NICKEL	:	65
ZINC	:	1,173

NOTE: All concentrations in mg/kg

Source: YEC survey, 1993.

FIGURE 4-6
METAL CONCENTRATIONS IN SURFACE SOILS
Quanta Resources
NYSDEC I.D. No. 241005
1993 NYSDEC PHASE II INVESTIGATION
LAWLER, MATUSKY & SKELLY ENGINEERS

Appendix C

APPENDIX C

HEALTH AND SAFETY PLAN

Golder Associates Inc.

1951 Old Cuthbert Road, Suite 301
Cherry Hill, NJ 08034
Telephone (856) 616-8166
Fax (856) 616-1874

APPENDIX C

HEALTH AND SAFETY PLAN FOR THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN QUANTA RESOURCES SITE LONG ISLAND CITY, QUEENS, NEW YORK

Prepared for:

Quanta Site Administrative Group

Prepared by:

Golder Associates Inc.
1951 Old Cuthbert Road, Suite 301
Cherry Hill, New Jersey 08034

September 2002

Project No.: 023-6151

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ACRONYMS AND DEFINITIONS

Terms used in the HASP, are as follows:

ACGIH - American Conference of Governmental Industrial Hygienists

Authorized Personnel - Person, including task-specific personnel, project personnel, oversight personnel, contractors and consultants whose presence is authorized.

Breathing Zone - The worker's breathing zone is an imaginary sphere of 2-foot radius surrounding the head.

Contamination-Reduction Zone - The area designated as required for removal of contaminants from personnel and equipment. This area is adjacent to the Exclusion Zone.

Contaminant of Potential Concern – The constituents that have been identified at the Site that are expected to cause the greatest concern for chemical safety risks.

Contractor/Consultant - Person or firm, retained or hired by the Client and/or their contractors, to carry out and/or supervise portions of the activities conducted at the Site.

CPR – Cardiopulmonary Resuscitation

Exclusion Zone - The area to which all personnel entering must be directly involved in the ongoing work, have designated personal protective equipment (PPE), and meet training and medical monitoring requirements. The Exclusion Zone will be defined as required by an approximate 25-foot radius around the work area, which will be suitably marked.

FS – Feasibility Study

HASP - Health and Safety Plan

HSC – On-Site Health and Safety Coordinator

HSO - Health and Safety Officer

IDLH - Immediate Danger to Life and Health

IDW – Investigation Derived Waste

MSDS - Material Safety Data Sheets, which provide information on the physical, chemical, and hazardous properties of chemical compounds.

NBR – Nitrile butadiene rubber

NIOSH - National Institute of Occupational Safety and Health

NYSDEC – New York State Department of Conservation

OSHA - Occupational Safety and Health Administration

Oversight Personnel - Any person, designated by the state or federal government, who is assigned to carry out oversight work.

PEL - Permissible Exposure Limit

PID – Photoionization Detector

PPE - Personal Protective Equipment

PPM - Parts per million; expressed as ppm(v) for gases and vapors.

REL - Recommended Exposure Limit

RI – Remedial Investigation

RI/FS Work Plan – Remedial Investigation/Feasibility Study Work Plan

SAP - Sampling and Analysis Plan

Site - The Lightman Drum Company Superfund Site in Winslow Township, New Jersey.

Support Zone - The area outside the Exclusion Zone that is considered clean for the purpose of the HASP. It is used for transfer of equipment and materials into the work Site (i.e., support) and providing communications between the various zones.

SVOCs – Semi-Volatile Organic Compounds

TLV - Threshold Limit Value

USCG – United States Coast Guard

VOCs – Volatile Organic Compounds

C.1.0 GENERAL INFORMATION AND SCOPE OF WORK

C.1.1 Project Description

This Health and Safety Plan (HASP or Plan) has been prepared in support of the Remedial Investigation/Feasibility Study Work Plan (RI/FS Work Plan) for performance of the Remedial Investigation (RI) and Feasibility Study (FS) on behalf of the Quanta Site Administrative Group (QSAG). This Plan was prepared in accordance with "Guidance for Conducting Remedial Investigations and Feasibility Studies (RI/FS) under CERCLA" and the NIOSH/OSHA/USCG/EPA "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities" as well as 29 CFR 1910.120, 29 CFR 1926 and applicable Federal and state regulations and guidelines. The Plan will be reviewed as appropriate when field and/or laboratory data becomes available and amended to maintain the proper level(s) of protection. This Plan covers projected RI/FS field activities including drilling, hydrogeologic testing, and soil, groundwater and light non-aqueous liquids (LNAPL) sampling and applies to all on- and off-Site activities as described in the RI/FS Work Plan.

C.1.2 General Site Description

Section 2.0 of the RI/FS Work Plan provides a description of the Site.

For the purpose of preparing this Plan, we have assumed the accuracy of prior reports that volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), metals, and cyanide have been detected during previous investigations at the Site (see Section 2.0 of the RI/FS Work Plan) in Site soil, groundwater and LNAPL. Golder Associates Inc. (Golder) has been retained to implement a Remedial Investigation designed to, amongst other things, characterize the nature and extent of these constituents.

C.1.3 Project Safety Requirements

The level of protection and the procedures specified in this HASP are based on the information currently available and represent the minimum health and safety requirements to be observed by all Site personnel engaged in the RI. Unknown conditions at the Site may exist and known conditions may change. Should any situation arise which is beyond the scope of the personal protection and decontamination procedures specified herein, work activities shall be immediately halted pending discussion between the on-Site Health and Safety Coordinator (HSC), the Health and Safety Officer (HSO), and/or Project Manager, and revision of the specified health and safety procedures, as needed. Any revision of the health and safety procedures will be recorded in the Field Procedure Change Authorization Form, shown in Attachment C-1, and will require authorization from the HSO and the Project Manager.

All Site personnel engaged in any of the project activities listed in Section B.1.1 must read this HASP and relevant portions of the RI/FS Work Plan carefully and complete the Site Health and Safety Plan Acknowledgement Form in Attachment C-2. Personnel who have any questions or concerns regarding implementation of this Plan are encouraged to request clarification from the HSO or HSC. All personnel must follow the designated health and safety procedures, be alert to the hazards associated with working close to vehicles and equipment, and above all else, use common sense and exercise reasonable caution at all times.

C.1.3.1 Designated Safety Personnel and Chain of Command

Currently designated personnel responsible for implementing this HASP include the following:

Timothy Richards	Golder Associates On-Site Health and Safety Coordinator
Douglas Dugan	Golder Associates Cherry Hill, New Jersey Office Health and Safety Officer
Charles C. Haury, CIH, CSP	Golder Associates Corporate Health and Safety Officer
Stuart D. Mitchell, P.G.	Remedial Investigation Manager
Randolph White, P.E.	Golder Associates Project Manager

Each subcontractor will have a designated HSC. HSCs are responsible for assuring that the designated procedures are implemented in the field. The Golder Associates HSC is responsible for coordinating Site safety activities and has the authority to stop work for health and safety reasons.

The HSO has overall responsibility for establishing appropriate health and safety procedures for the project and will have the requisite authority to implement those procedures including, if necessary, the authority to temporarily suspend field activities for health and safety reasons.

The Project Manager also has the authority to take whatever actions may be necessary, based on the advice and direction of the HSC and/or HSO, to provide a safe working environment for all project personnel.

The ultimate responsibility for the health and safety of the individual employee rests with the employee, and his or her colleagues. Each employee is responsible for exercising the utmost care and good judgment in protecting his or her own health and safety and that of fellow employees. Should any employee observe a potentially unsafe condition or situation, it is the responsibility of that employee to immediately bring the observed condition to the attention of the appropriate health and safety personnel as designated above, and to follow-up the verbal notification by completing the "Unsafe Conditions and Practices" report form provided in Attachment C-3.

Should an employee find himself or herself in a potentially hazardous situation, the employee should immediately discontinue the hazardous procedure(s) and either personally affect appropriate preventive or corrective measures, or immediately notify the HSC or Project Manager of the nature of the hazard. In the event of an immediately dangerous or life-threatening situation, any employee always has "stop work" authority.

Unsafe work practices or procedures are never justified by "extenuating circumstances" such as budget or time constraints, equipment breakdown, changing or unexpected conditions, etc. In fact, the opposite is true. Under stressful circumstances all project personnel must be mindful of the potential to consciously or unconsciously compromise health and safety standards, and be especially safety conscious. All Site personnel are required to consider "safety first" at all times.

C.1.3.2 Medical Surveillance and Training

All personnel engaged in field activities on this project must have baseline physical examinations and be participants in their employer's medical surveillance program. This program meets, at a minimum, the requirements of 29 CFR 1910.120(f). Procedures beyond baseline physical and routine medical surveillance are not planned for the tasks listed in Section B.1.1 of this HASP.

All project personnel, who have potential to contact contaminated soil, water, and/or air, must be trained in hazardous waste site investigation health and safety in accordance with 29 CFR 1910.120(e) including respiratory protection, personal protective clothing, decontamination, hazard recognition and the proper calibration and use of a photoionization detector (PID), and colorimetric detector tubes. Personnel must have appropriate refresher courses as detailed in 29 CFR 1910.120(e).

Personnel who operate specialized equipment (e.g., drill rigs, forklifts) shall be trained by their employer(s) to operate such equipment.

These training requirements apply to all employees unless the employer can demonstrate that the operation does not involve employee exposure, or the reasonable possibility for employee exposure, to safety and health hazards. Some non-intrusive activities (e.g. supply delivery, limited surveying activities) may meet this exemption. In that Site conditions are subject to change, the training requirements for non-intrusive activities will be reviewed on a case-by-case basis. The HSC will make the determination on the case by case basis and will consult the HSO as necessary.

C.1.3.3 First Aid

A first aid kit shall be available in all field vehicles and in the Site trailer, if applicable, during all Site activities. This kit shall be of an appropriate size in relation to the number of personnel on-Site and shall include at a minimum two pairs of latex gloves, CPR barrier and eye wash solution, in addition to first aid supplies (e.g., bandages, first aid cream, antiseptic). See Section B.5.1 of this document for emergency response procedures.

C.1.3.4 Communications

Mobile phones will be located in all field vehicles. All mobile phones will be checked for coverage at the beginning of each phase of the project to ensure good satellite coverage. Note that mobile phones operating outside of their original territory may not contact the proper (i.e., local) emergency response authorities. Mobile phone users would be better served by dialing the full appropriate emergency response numbers listed in Table C-1.

Additionally, if field operations require that two or more field teams work at the Site, but beyond visual/aural range, the "Buddy System" will be used. Workers or field teams that are not in the line of sight of each other may be equipped with two-way radios to maintain communication. Workers will also provide each other with assistance in checking the integrity of each other's personnel protective equipment (PPE), and will notify the HSO in case of emergency.

The protective equipment requirements for some tasks may necessitate the use of respiratory protection, which could adversely affect communications. In such instances, the field team will review basic hand signal communications during a safety briefing prior to donning respiratory protection equipment.

C.1.4 General Hygiene and Conduct Guidelines

The following general personal hygiene and work practice guidelines are intended to prevent injuries and adverse health effects. These guidelines represent the minimum standard procedures for reducing potential risks associated with various aspects of this project and are to be followed by all Site personnel at all times.

- If the HSC deems that a respirator is necessary, any facial hair that would interfere with the proper fit of such equipment will not be worn.
- A multi-purpose dry chemical fire extinguisher, a complete field first aid kit, and a bottle of emergency eye wash solution shall be maintained in every field vehicle.
- Do not handle waste samples or any other potentially contaminated items unless wearing NBR (nitrile butadiene rubber) or neoprene rubber gloves, or equivalent, as a minimum. Employees should treat all unknown soil and water as if it were contaminated. Always make an effort to approach any potentially contaminated feature from upwind.
- Thoroughly wash hands and face before eating or putting anything in your mouth (i.e., avoid hand to mouth contamination).
- Eating, drinking, chewing gum or tobacco and smoking are permitted only in areas designated by the HSC. Under no circumstances will these activities be permitted in the immediate vicinity of any intrusive activities (e.g., drilling).
- Be alert to potentially changing exposure conditions, for example, as evidenced by perceptible odors or oily sheen on water.
- Do not, under any circumstances, enter or ride in or on any backhoe bucket, materials hoist, or any other similar device not specifically designed for carrying human passengers.
- Be alert to the symptoms of fatigue and heat/cold stress and their affects on the normal caution and judgment of personnel.
- Noise may pose a health and safety hazard, particularly during drilling and construction activities. A good rule of thumb is if it is necessary to shout to communicate at a distance of three feet in steady state (continuous) noise, hearing protection should be worn. Likewise, any impact noises from activities (e.g., driving casing on a drilling operation), which is loud enough to cause discomfort, would also indicate the need for hearing protection. Hearing protection is available and is included in the standard field kit along with hardhat and safety glasses.

- Always use an appropriate level of personal protection. Reduced levels of protection can result in preventable exposure; excessive levels of safety equipment can impair efficiency and increase the potential for accidents to occur.

- Be aware of the effect that inclement weather (rain, snow, ice, lightning) has on Site safety. Be prepared to suspend activities as conditions warrant.

- Extreme caution must be used when drilling, or other activities, that occur near overhead utility lines. The National Drilling Federation recommends a minimum distance of 20 feet between the lines and drill rig. Contact the local power company if you have any questions regarding utility line status or voltage. In addition, underground utilities <u>must</u> be positively located and marked prior to intrusive activities.

- All personnel are required to wear orange colored vests when working in the proximity of public rights-of-way and/or parking areas. Additionally, traffic cones and other warning devices may be required if the public rights-of-way are obstructed.

C.1.5 Site Safety Meetings

The HSC shall conduct a Site safety briefing for all personnel and subcontractors directly involved in implementing the RI field activities on their initial arrival at Site. Personnel will be required to read this HASP and will be required to sign the declaration in Attachment C-2 before conducting any work on-Site. The HSC shall indicate where the Material Safety Data Sheets (MSDS) will be located during Site activities so that they are readily available to the Site field investigation team and subcontractors.

The HSC or his/her designee shall conduct and document the date, time, content and attendees of these meetings, which will be held as needed. The topics to be covered are determined by the task activities, and should include:

- Weather and traffic related safety issues.
- Hazards specific to the task(s) and protective equipment.
- Unusual Site conditions/areas.
- Safety problems and issues.
- Changes to the materials being used by Site field investigation team or subcontractors (i.e., additional MSDS available).
- Changes in the HASP.

C.2.0 HAZARD EVALUATION

Potential Site hazards include chemical hazards, physical hazards, and biological hazards. Each of these groups of potential hazards is addressed in Table C-2.

C.2.1 Potential Chemical Hazards

Results of previous investigations at the Site indicate that there are chemical impacts to the soil groundwater and LNAPL. Table C-3 lists the Chemicals of Potential Concern (COPC) selected for the Site and associated exposure hazard information. The COPC selected include VOCs, SVOCs, PCBs, and metals based on their reported detection (by others at the Site) and their potential toxicity. Table C-4 summarizes the airborne exposure limits for these COPC. The chemical hazard associated with the reported chemical concentrations in the groundwater and soil is toxicity. Potential hazards include:

(1) Inhalation of organic vapors due to the presence of VOCs in the soil and groundwater;

(2) Inadvertent ingestion of potentially toxic substances via hand to mouth contact or deliberate ingestion of materials inadvertently contaminated with potentially toxic materials; and,

(3) Dermal exposure and possible percutaneous (skin) absorption of certain lipophilic (readily absorbed through the skin) organic chemicals including benzene.

Exposure via the ingestion route can be controlled effectively by the means of good personal hygiene habits, and prohibition of smoking, eating, drinking and chewing in contaminated areas. Similarly, good personal hygiene and appropriate clothing can control dermal exposure. Inhalation hazards are addressed in Section B.4.3.

C.2.2 Potential Physical Hazards

C.2.2.1 Heat Stress

Working in protective clothing can greatly increase the likelihood of developing heat stress. Heat stress can result in health effects ranging from transient heat fatigue to serious illness or death. The signs and symptoms of heat stress are presented in Section B.2.4. Workers shall monitor themselves and others for signs of heat stress when ambient temperatures exceed 70°F.

C.2.2.2 Cold Stress

Personnel exposed to cold temperatures (especially during windy conditions) may be subjected to cold stress in the form of frost nip, frostbite or hypothermia. Signs and symptoms of cold stress are described in Section B.2.4. Workers shall monitor themselves and others for signs of cold stress when ambient temperatures are 40°F or less. Extra caution will be exercised when working in windy conditions and/or when clothing becomes wet.

C.2.2.3 Confined Space Hazards

No confined space work is anticipated during the RI. Should such work become necessary, a Confined Space Entry Permit will be completed and an addendum to this HASP will be prepared. Written authorization by the Project Manager will be required prior to conducting any confined space work. The Project Manager will consult with the HSO prior to providing written authorization.

C.2.2.4 Other Physical Hazards

Under no circumstance shall any Field personnel enter any building, tank, or structure at the Site unless given written authorization from the Golder Site HSC.

All Field personnel must take note of physical hazards which are identified during Site safety briefings. These hazards include, but are not limited to: steep slopes, soft sediments, muck, creeks (trips, falls, and drowning); sharp debris from underbrush or debris scattered around the Site (puncture wound); overhead utilities, public traffic, over-exposure to the sun and slippery and/or congested walking surfaces (falls). Orange vests will be worn when working near public rights-of-way. Work areas such as drilling must be delineated using high visibility caution tape.

During drilling activities no more than two lengths of drill rod may extend above the top of the rig derrick at any time.

Field personnel must be alert to the hazards associated with Site vehicles, drill rig operation, heavy equipment, and powered hand-held equipment operations. These hazards include noise, crushing injuries, overhead hazards, and pinch points. Personnel must be alert to weather-related hazards (e.g., lightning) or the possibility of increased hazard due to weather (e.g., slipping on mud or ice).

C.2.3 Potential Biological Hazards

Contact with waste materials can lead to infected cuts. Personnel shall follow the guidelines for general hygiene in Section B.1.4 and follow first aid procedures for disinfection of cuts and abrasions in Section B.5.3.

The Site area may contain ticks, which can transmit Rocky Mountain Spotted Fever and Lyme Disease. During tick season (March to November), Site employees will check for ticks. Light colored clothing should be worn and any openings (shirt and pant cuffs) should be secured to inhibit tick movement from clothing to skin. The use of insect repellents should be considered if its use will not interfere with sampling activities. Personnel must check with their Project Manager before using repellents. Field personnel will acquaint themselves with the symptoms of tick-borne diseases detailed below and will contact a physician as well as the HSO if a disease is suspected.

The Site area may contain poison ivy, that can be recognized by an oily sheen on the leaf and/or three leaflets together, or similar vegetation. The active substances can be transmitted by direct skin contact and via contact with contaminated clothing. Field personnel should avoid contact with any vegetation that can irritate the skin.

C.2.4 Signs and Symptoms of Exposure

C.2.4.1 Chemical Exposure

The health effects associated with the COPC reportedly present at the Site are varied. Personnel who experience any of the following symptoms should report the occurrence to the HSC promptly:

- skin, eye, or respiratory system irritations;
- skin rashes/burns;
- headaches/dizziness;
- nausea/gastrointestinal tract problems;
- muscle spasms/tremors;
- chills; and/or
- fatigue.

Note that the above symptoms are not necessarily caused by chemical exposure. Any serious medical problem should be promptly referred to professional medical care. If personnel experience any of the above symptoms, the HSC shall evacuate the area (upwind if possible) if necessary and evaluate affected personnel for signs and symptoms of exposure. Appropriate first aid measures shall be taken. The activity will not resume until the atmospheric conditions are evaluated using monitoring instruments by personnel wearing Level C (or B, if Level C was utilized when the incident occurred) PPE. Atmospheric conditions will be evaluated by monitoring for concentrations of VOCs and dust (as necessary) as described in Section B.3.0.

C.2.4.2 Physical Exposure

The signs of heat fatigue are as follows:

- Heat rash may result from continuous exposure to heat or humid air.
- Heat cramps caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:
  - ◊ muscle spasms; and
  - ◊ pain in hands, feet, and abdomen.

Heat exhaustion results from increased stress on various body organs, including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:

- pale, cool, moist skin;
- heavy sweating;
- dizziness;
- nausea; and
- fainting.

Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are:

- red, hot, usually dry skin;
- lack of or reduced perspiration;
- nausea;
- dizziness and confusion;
- strong, rapid pulse; and
- coma.

Working in protective clothing can greatly increase the likelihood of heat fatigue, heat exhaustion, and heat stroke, the latter being a life threatening condition. When working in ambient temperatures greater than 70°F, employees shall use the 'buddy system' to monitor each other's pulse rate at the start of each rest period. A rest period shall consist of a continuous time period of at least five (5) minutes preferably in a shaded area. The personnel will not be assigned to other work during this rest period. If the pulse rate exceeds 110 beats per minute, the employee shall take his or her oral temperature with a clean disposable calorimetric oral thermometer. If the oral temperature exceeds 99.6°F, the next work period shall be shortened by one third. The pulse rate and oral temperature shall be monitored again at the beginning of the next rest period; and if the oral temperature exceeds 99.6°F, the work period shall again be shortened by one third, etc., until the oral temperature is below 99.6°F.

All employees are to be alert to the possibility and symptoms of heat stress. If heat stress is suspected the employee will leave the work area, rest, cool off, and drink plenty of cool water/Gatorade/Squelcher or equivalent. Sufficient cool potable water and clean disposable cups shall be maintained at all times on-Site. If the symptoms do not subside after a reasonable rest period, the employee shall notify the HSC and seek medical assistance.

Signs of cold stress include yellow or white patches of skin on the fingertips, nose and ears. These areas will be numb. The affected parts will be rewarmed gently and the patient will not return to work until additional protection (e.g., gloves, hard hat liner) is obtained. It is essential to prevent frostbite, as the person may become susceptible to future cold-related medical problems. Personnel are encouraged to change into dry socks after the lunch break as perspiration held by the socks prompts cooling of the feet. Should clothing become wet, it is imperative that the people change into dry clothes before resuming work. Wet clothing can lead to hypothermia. Symptoms of hypothermia include uncontrollable shivering, decreased physical and mental capabilities, and lowered body temperature. Persons exhibiting symptoms of cold stress or hypothermia will not return to work without the approval of the HSC.

C.2.4.3 Biological Exposure

Since the bite of a tick has the potential to cause Rocky Mountain Spotty Fever, personnel should be aware that the symptoms include fever chills, headache, abdominal, muscle pain, and nausea.

A red rash develops at the wrist and ankles two to five days after exposure. Symptoms develop two to fourteen days after exposure.

Also spread by ticks is Lyme Disease. Symptoms include fatigue, stiffness (particularly in the neck). There may be a red circular rash. Fever may be present. Symptoms develop a few days to two years after exposure.

Personnel exhibiting symptoms of Rocky Mountain Spotted Fever or Lyme Disease should consult a medical professional immediately. Personnel bitten by a snake or any other wildlife will immediately clean the wound and proceed to the hospital for medical evaluation.

Skin-sensitizing (poisonous) vegetation produces a bumpy, swollen rash at the point of contact. This rash is easily spread if the oil gets on the fingers. Wash affected area(s) including tools, as soon as possible. Use over-the-counter medications to reduce the irritation. Avoid scratching the rash. Cover the affected area(s) with clean dressings. Severe exposure may necessitate evaluation by a medical professional.

If personnel are in need of immediate first aid, the guidelines outlined in Section B.5.1 for emergency medical procedures will be followed.

C.2.5 Task Risk Analysis

Table C-5 presents a comparative risk analysis based on anticipated field activities and hazards. All personnel will be aware that specific hazards and the associated potential severity may be influenced by weather, season, and fatigue.

C.3.0 SITE MONITORING AND ACTION LEVELS

Air monitoring is required during intrusive tasks. The requirements for air monitoring and associated action levels for each Site activity are detailed in Table C-6. The monitoring methods involved and their interpretation are discussed in the following sections. Intrusive activities have the potential for exposures to VOCs.

C.3.1 VOC Monitoring

VOCs that are of most concern from an inhalation standpoint are those that are moderately to highly toxic and have odor thresholds higher than their corresponding TLV. Vinyl chloride falls into this category. Since benzene is the COPC that has the lowest OSHA PEL (TWA 0.1 ppm), and since the ionization potentials for this compound is 9.24 eV, the Photo Ionization Detector (PID) that is used to monitor air quality will be equipped with at least a 10.6 eV lamp to detect for the presence of these compounds.

The designated HSC shall have a PID on-Site at all times during intrusive and groundwater sampling activities until such time it can be demonstrated that such monitoring is not necessary. Calibration of the instrument must be checked daily prior to each day of use and then at least every four hours during use by introducing a known concentration of isobutylene gas in accordance with the manufacturer's instructions. Background levels must be established well upwind of any excavation, borehole, spoils pile, etc. During drilling/split spoon activity, the HSC shall monitor the borehole, split spoon samples, and employee breathing zone initially at the start of each task, then periodically as indicated by initial results, or whenever there is any indication that concentrations may have changed (odors, visible gases, appearance of drill cuttings, etc.) since the last measurement.

If a constant reading of >1 and ≤ 5 ppm above background level is detected for more than 5 minutes in the breathing zone, a detector tube for benzene shall be used to determine airborne concentrations. If the benzene concentration is less than 1 ppm in the breathing zone, and the total VOC concentration does not exceed 5 ppm for more than five minutes in the breathing zone, the PPE shall be Level "D". If a consistent reading > 5 ppm above background is detected for more than 5 minutes in the breathing zone or any peak > 25 ppm above background level in the breathing zone is detected, the PPE shall be upgraded to Level "C". If at any time the concentration of benzene exceeds 1 ppm in the breathing zone, the level of PPE shall be upgraded to Level "C". Furthermore, PPE should be upgraded to Level "B" if PID readings are consistently greater than 25 ppm, readings show frequent peaks greater than 50 ppm, or the concentration of benzene exceeds 100 ppm[1] in the breathing zone. Engineering or administrative control such as portable fans may be used to reduce exposure to or generation of VOC concentrations and possibly eliminate the need for respiratory protection. The HSO must be advised of conditions that warrant a change in the level of PPE and approve the revised procedures.

Given the rapid "break through" time of some substances, cartridges will be replaced after each day of use or immediately upon an indication of "break through" (perceptible odors inside of the mask), whichever is less. High humidity situations (>80% relative humidity) may require cartridge replacement at a more frequent rate (every 4 hours).

Engineering controls such as positioning activities upwind, covers, or additional ventilation may be used in place of respiratory protection if it is demonstrated through monitoring that the engineering controls are effective in reducing airborne concentrations.

C.3.2 Nuisance Dust Monitoring

Nuisance dust and metals have the potential for becoming a problem during disruptive or intrusive activities such as drilling. The specific metal concentrations are variable through the Site. Activities that could generate dust may require engineering controls (e.g., water misting of the air and surrounding soil) before and during the activities. The on-Site HSC will require that Level C respiratory protections be utilized should engineering controls be ineffective as evidenced by chronic visible airborne dust. Additionally, real time aerosol monitoring using an MIE PDM-3 miniram or equivalent will be conducted and the airborne metal concentration will be estimated using prior worst case soil concentration data for metals. The MIE PDM-3 miniram will be calibrated according to manufacturer's instructions prior to field use. Calibration will be performed at least weekly, or before and after sampling each day that the instrument is used if high concentrations of dusts are being measured.

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[1] Concentration based on a qualitative respirator fit test and the use of full-face respirator.

When collecting measurements using the MIE PDM-3 miniram or equivalent, the readings will be taken over a minimum period of ten minutes in an area or areas representative of worker's breathing zone. The HSC will record the average result for the interval. This strategy accounts of variability in the concentration with time and avoids the situation where a decision to change PPE is made based on one instantaneous measurement.

C.4.0 ON-SITE CONTROL

C.4.1 Site Communication System

Personnel will operate using the "buddy system." No Field personnel will work alone at the Site. Each individual shall maintain visual/aural contact with another individual or group at all times. If more than one group is working at a facility and the groups are not within visual/aural communication range, two-way radios may be necessary to maintain communications.

C.4.2 Site Safety Zone and Access Control

No on-Site safety zones are required for non-intrusive activities. During intrusive activities (e.g., drilling), an Exclusion Zone will be established by the on-Site HSC, as required. The Exclusion Zone will generally be a 25-foot radius from the boreholes. Monitoring will be periodically conducted at the downwind perimeters to assure that the concentrations are similar to background concentrations. If perimeter concentrations are greater than background concentrations for more than five minutes, the downwind perimeter shall be extended, where practical, or engineering controls will be implemented such that downwind and background concentrations are similar. Exposed materials such as cuttings will be contained or covered and perimeter monitoring will continue until ambient air concentrations upwind and downwind of the Exclusion Zone are equal. The limits of the Exclusion Zone will be marked with high visibility flagging tape or four or more traffic cones or similar devices.

The Exclusion Zone will be accessed through a marked Contamination Reduction Zone (CRZ). The CRZ shall be used for gross decontamination of both personnel and equipment items. It shall be configured to allow the decontamination of the field crew while upwind of the Exclusion Zone. The HSC or his/her designee will assure that all personnel entering the Exclusion Zone wear the required protective equipment and that upgraded level of protection equipment is readily available.

A temporary decontamination area will be set up at the Site (as needed) where intrusive sampling activities will be performed. All decontamination materials and liquids from all areas will be properly collected until proper disposal occurs.

C.4.3 Personal Protective Clothing and Respiratory Protection

The following scheme will be used to designate the required level(s) of personal protective equipment and respiratory protection: the alphabetical designations "B", "C", and "D" shall refer specifically to levels of respiratory protection, namely pressure-demand air supplying respirators with escape provisions, air purifying respirators, and no respiratory protection, respectively. Since potential dermal exposure hazards may require a wide variety of personal protective clothing without regard to the required level of respiratory protection, the numerical designations "1", "2", and "3" will be used to specify the level of protective clothing that is to be employed in addition to the designated level of respiratory protection as described below (i.e., the level of protective equipment can be completely defined by a designation of "D-1", "D-2", etc.). The required levels of protective equipment and upgrade criteria for each work task are specified in Table C-6. All equipment and clothing shall be inspected by the wearer prior to use. All suspect protective equipment will be rejected and disposed of as non-contaminated waste.

The initial level of personal protective clothing required during Site activities will be D-1 which consists of the following:

LEVEL D-1, PROTECTIVE CLOTHING

1. Standard work clothes (long pants and sleeved shirt);
2. Steel-toed boots;
3. Safety glasses;
4. Orange safety vests (when working near public traffic);
5. Hard hats (when an overhead hazard is possible) and;
6. Hearing protection (during drilling and other noise producing activities).

Protective clothing will be upgraded during sampling activities and will consist of the following:

LEVEL D-1, MODIFIED PROTECTIVE CLOTHING

1. Level 1 protective clothing;
2. Inner latex gloves; and
3. Outer NBR gloves.

LEVEL D-2, PROTECTIVE CLOTHING

1. Level 1 protective clothing;
2. Inner latex gloves;
3. Outer NBR gloves; and
4. Polycoated Tyvek or Tyvek coveralls with taped openings.

LEVEL C PROTECTION

1. Full face air-purifying respirator[2];
2. Polycoated tyvek;
3. Boots: chemical protective, steel toed;
4. Chemical protective inner and outer gloves; and,
5. Hardhat (when overhead hazard is possible).

LEVEL B PROTECTION

1. Level C protective clothing; and,
2. Supplied air (open or closed circuit).

Field personnel may upgrade to Polycoated Tyvek or Tyvek coveralls (D-2) where it is probable that there will be substantial contact with subsurface soils or groundwater containing elevated levels of COPC. Polycoated Tyvek or Tyvek coveralls might also be worn when working in muddy conditions.

If conditions are found which are beyond the required Level(s) of Protection, personnel are to leave the area immediately and obtain the required protective equipment. Should the personnel suspect an inhalation hazard (e.g., unusual and continuous odors, dizziness, or respiratory irritation), they are to immediately move upwind from the area and promptly notify the HSC. Work will not proceed in these areas until air monitoring has assessed the nature of the hazard and additional protective measures are employed to the satisfaction of the HSC. Re-entry will be from an upwind position (when possible). Monitoring will precede re-entry. Personnel who experienced symptoms will not re-enter the area until symptoms have subsided and additional equipment/precautions are employed as determined by the monitoring. An examination by a physician may be prudent depending on the symptoms and duration.

C.4.4 Decontamination

Decontamination will involve two phases. Gross decontamination of personnel and equipment, comprising removal of mud by dry brushing or scraping, will take place in the CRZ established at the Site of each intrusive activity. Soil removed in this way will be backfilled into the borehole or collected and secured in a fenced storage area. All personnel and equipment will undergo gross decontamination prior to moving to a new investigation location. Prior to leaving the Site,

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[2] *Prior to use, Site personnel must have a qualitative respirator fit test.*

personnel and equipment will undergo full decontamination at the temporary decontamination pad.

Decontamination Procedures

All personnel involved in intrusive activities and/or contaminated personnel shall decontaminate prior to leaving the Site. The Decontamination Pad area shall have plastic sheeting on the ground of sufficient size to contain the personnel, hand held equipment and decontamination materials required. A typical Decontamination Area will require:

- 2 wash tubs (1 wash, 1 rinse);
- several scrub brushes;
- disposable towels and plastic bags;
- decontamination solution (e.g. Alconox);
- hand soap;
- skin wash water source; and
- special rinse solutions for hand sampling tools (see SAP).

Personnel will follow the decontamination procedure below. At a minimum all personnel will wash their hands and face prior to eating, smoking or leaving the Site. The HSC shall inspect personnel and non-disposable protective equipment for cleanliness prior to release from the Site.

Step 1: Equipment Drop
Deposit equipment used on-Site (hand tools, sampling devices and containers, monitoring instruments, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool down station may be set up.

Step 2: Outer Garment, Boots, and Gloves Wash and Rinse
Scrub boots, outer gloves and splash garments (if worn) with decontamination solution. Rinse off with water.

Step 3: Outer Glove Removal
Remove outer gloves (if worn). Deposit in container with plastic liner.

Step 4: Cartridge or Respirator Change (if applicable)
If worker leaves exclusion zone to change cartridges (or respirator), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves donned, joints taped, and worker returns to duty.

Step 5: Boot, Gloves and Inner Garment Removal (if applicable)
Boots, protective suit, inner gloves (if worn) removed and deposited in disposal containers.

Step 6: Respirator Removal (if applicable)
Respirator is removed. Avoid touching face with fingers, respirator deposited on plastic sheet.

Step 7: Field Wash
Hands and face are thoroughly washed. Shower as soon as possible.

Monitoring equipment and hand tools shall be retrieved and decontaminated using methods appropriate for the type of equipment. The HSC shall inspect the equipment for cleanliness.

Certain sampling equipment (e.g., hand sampling tools) may require specific decontamination procedures and/or chemicals. Site personnel are to refer to the SAP for this information.

All chemicals brought to the Site will have the appropriate MSDS provided to the HSC. This requirement also applies to drilling materials. The MSDS will be maintained in the field files at a location accessible to the Site field investigation team members and subcontractors. Any additional materials brought on Site will be accompanied by the appropriate MSDS, which will be provided to the HSC.

All disposable personal protective equipment will be double bagged in plastic bags and disposed of as municipal wastes. All decontamination materials will be drummed in 55-gallon drums. The solids and liquids will be separated and subsequently disposed as Investigation Derived Waste (IDW).

C.5.0 CONTINGENCY AND EMERGENCY RESPONSE PLANS

If an unanticipated, potentially hazardous situation arises as indicated by visible contamination, unusual or excessive odors, Site personnel shall temporarily cease operations, move away to a safe area, and contact the HSC. The following procedures have been established to deal with emergency situations that might occur during field activities. Prior to starting work at the Site, the local emergency response services will be contacted and informed that field activities will be in progress. Site personnel will familiarize themselves with the location of the nearest pay phones (in case there is no satellite coverage for mobile phones) and medical facilities on arrival at the Site. In the event of a serious emergency situation (e.g. medical problems beyond routine first aid, explosive gas concentrations, or fire beyond incipient stage), Site personnel shall contact the New York City Police Department, inform them of the nature of the emergency, and then notify the HSO. When help arrives, Site personnel shall defer all emergency response authority to appropriate responding agency personnel. Emergency notification information is summarized in Table C-1.

C.5.1 Medical Emergency Response Plan

The nature of chemical contamination on this project is not anticipated to present an immediate threat to human health. Other than removal of outer protective garments and gross contamination (e.g., mud), immediate emergency treatment of injuries should therefore generally take precedence over personal decontamination.

Should any person be injured or become ill during implementation of the field activities, initiate the following emergency response plan and notify the HSC as soon as possible:

1. If able, the injured person should proceed to the nearest available source of first aid. If the injured party is extremely muddy, remove outer garments and if necessary, wash the injured area with soap and water. If the "injury" involves a potential overexposure to hazardous gases or vapors, (headache, dizziness, nausea, disorientation), get the victim to fresh air and take him or her to New York City Woodhull Medical Center, 706 Broadway Brooklyn, New York 11206, for a complete physical examination as soon as possible. Figure C-2 provides directions from the Site to the hospital.

   If the injury involves foreign material in the eyes, immediately flush the eyes with emergency eye wash solution and/or rinse with copious amounts of potable water. Obtain or administer first aid as required. If further medical treatment is required, seek professional medical assistance as discussed below.

Appropriate measures should be taken to protect the privacy of workers in connection with putting on and taking off of protective clothing. First aid providers shall wear latex gloves when providing any first aid. Severe injuries involving large quantities of blood require that first aid providers don Tyvek coveralls and safety glasses in addition to gloves.

2. If the victim is unconscious or unable to move, or if there is any evidence of spinal injury, do not move the injured person unless absolutely necessary to save his or her life, until the nature of the injury has been determined. Administer rescue breathing using a CPR barrier if the victim is not breathing, control severe bleeding and immediately seek medical assistance as discussed below.

3. If further medical treatment is required and

   a. the injury is not severe, contact New York City Woodhull Medical Center at (718) 963-8000 and take the injured party to the hospital by private automobile.

      Directions to the Hospital from the Site (see Figure C-2):
      - Make left out of Site onto Review Ave
      - Turn left onto Greenpoint Ave
      - Turn left onto McGuiness Ave
      - Bear right onto Humboldt St
      - Bear right onto Sumner Pl
      - Make left onto Broadway
      - Arrive 760 Broadway

   b. If the injury is severe, immediately call the 78th Precinct of the New York City Police Department at (718) 636-6411 or 911 using a standard phone.

   In both cases, if decontamination is not undertaken, appropriate precautions should be taken to avoid transfer of contaminants to vehicles and other facilities. This can be done by using plastic sheeting or the exposure blanket contained in the first aid kit.

4. Any injured person taken to the hospital shall be accompanied by an individual designated by the HSC to ensure prompt and proper medical attention. After proper medical treatment has been obtained, the designated companion should notify the HSO and prepare a written report. Site personnel shall maintain their medical insurance identification whenever they are on Site.

   In the event that any personnel are injured at a particular facility during any phase of the Investigation, all available technical information and supporting documentation shall be provided to any treating physicians, or treating health care workers or facilities.

C.5.2 Fire and Explosions

Dry chemical fire extinguishers are effective for fires involving ordinary combustibles such as wood, grass, flammable liquids, and electrical equipment. They are appropriate for small, localized fires such as a drum of burning refuse, a small burning gasoline spill, a vehicle engine fire, etc. No attempt should be made to use these extinguishers for well established fires or large areas or volumes of flammable liquids.

In the case of fire, prevention is the best contingency plan. There will be no smoking at the Site except in pre-designated areas. In the event of a fire, personnel shall attempt to extinguish the fire with on-Site fire extinguishers. If a fire cannot be controlled in this manner, personnel shall notify the HSC and follow the procedure outlined below.

Catalytic converters on the underside of vehicles are sufficiently hot to ignite dry grass. Personnel should avoid driving over dry grass that is higher than the ground clearance of the vehicle, and be aware of the potential fire hazard posed by the catalytic converter, at all times. Never allow a running vehicle to sit in a stationary position over dry grass or other combustible materials.

In the event of a fire or explosion:

1. If the situation can be readily controlled with available resources without jeopardizing the health and safety of Site personnel, take immediate action to do so. If not:
2. Isolate the fire to prevent spreading, if possible.
3. Clear the area of all personnel working in the immediate vicinity.
4. Immediately notify Site emergency personnel and the New York City Fire Department by dialing 911 using a standard phone.

C.5.3 Chemical Exposure First Aid

In an event of exposure to chemicals through inhalation:

1. Move the victim to an up-wind location for fresh air.
2. Signal for help.
3. Initiate CPR to revive the victim, if necessary.
4. Contact the Cheiselhurst Police Department, if necessary.

For exposure through dermal route (including eyes):

1. Wash the affected area with copious fluids for at least fifteen (15) minutes (Signal for help if necessary).
2. If irritation persists, seek professional medical care.

For ingestion:

1. Drink a large amount of water to dilute the contaminant(s).
2. Transport the victim to the hospital. Take a copy of this HASP to the hospital.

If decontamination is not undertaken prior to transporting the victim to the hospital, appropriate precautions should be taken to avoid transfer of contaminants to vehicles and other Site.

C.5.4 Unforeseen Circumstances

The health and safety procedures specified in this Plan are based on the information available at the time. Unknown conditions may exist, and known conditions may change. This plan cannot account for every unknown or anticipate every contingency. Should personnel suspect or encounter areas of substantially higher levels of contamination, or should any situation arise which is obviously beyond the scope of the safety procedures specified herein, work activities shall be modified (such as by moving to another location) or halted pending discussions with the HSO and implementation of appropriate protective measures.

C.5.5 Accident and Incident Reports

If an incident or accident occurs, the HSO and Project Manager shall be notified and the Incident Report (shown in Attachment C-4) shall be completed. The report shall be completed by an eye witness (if possible) along with assistance from the HSC. The report will be forwarded to the HSO as soon as possible for further investigation or follow-up.

C.5.6 Emergency Contacts

Emergency notification information is summarized in Table C-1.

TABLE C-1

EMERGENCY RESPONSE NUMBERS

Golder Associates Inc	856-616-8166
Site Location Address	37-80 Review Ave, Long Island City, Queens, NY
Mobile telephone located in	Field vehicles

Emergency (New York City PD)	(718) 636-6411 or 911 using a standard phone
Ambulance (New York City FD)	(718) 636-6411 or 911 using a standard phone
Fire (New York City FD)	911 if using standard phone
Police (New York City PD)	(718) 636-6411 or 911 using a standard phone
Hospital Name	New York Woodhull Medical Center
Hospital Phone Number	(718) 963-8000
Golder Project Manager	Randolph S. White, P.E. (856-616-8166 ext. 1477)
Golder Site Health and Safety Coordinator	Timothy Richards (973-621-0777 ext 1454)
Golder Health and Safety Officer	Douglas Dugan (856-616-8166 ext. 1458)
Client Contact (Project Coordinator)	Pete Zimmerman (ELM) (212-308-3800)
State Agency, NYSDEC Spill Hot Line	800-457-7362
Poison Control Center	800-962-1253

TABLE C-2

POTENTIAL SITE HAZARDS *

Hazard	Drilling	Site Walk	Groundwater/ Sampling	Soil Sampling	LNAPL Sampling
Contaminants of Potential Concern Exposure	X		X	X	X
Mechanical Equipment/Construction	X	X	X	X	X
Lifting and Material Handling	X		X	X	X
Slip/Trip/Fall	X	X	X	X	X
Electrical	X		X	X	X
Fire and Explosion	X	X	X	X	X
Heat/Cold Stress	X	X	X	X	X
Vehicular Traffic	X	X	X	X	X
Noise	X				
Exposure to sun	X	X	X	X	X
Poisonous Plants	X	X	X	X	X
Snakes/Spiders/Insects	X	X	X	X	X

* No field personnel shall enter any on-site structure, building, or tank for any reason.

Table C-3
Airborne Exposure Limits

	NIOSH REL		OSHA PEL				ACGIH TLV	IDLH	Ionization Potential
Chemical	TWA	STEL	TWA	STEL	Ceiling	max peak			(eVolts)
Benzene	0.1 ppm*	1 ppm	1 ppm	5ppm	NE	NE	0.5 ppm (TWA)	500 ppm*	9.24
Ethylbenzene	100 ppm	125 ppm	100 ppm	NE	NE	NE	100 ppm (TWA)/125 ppm (STEL)	800 ppm	8.76
Toluene	100 ppm	150	200 ppm	NE	300 ppm	500 ppm (10 min)	50 ppm (TWA)	500 ppm	8.82
Xylenes	100 ppm	150	100 ppm	NE	NE	NE	100 ppm (TWA)/150 ppm (STEL)	900 ppm	8.56
Lead	0.05 mg/m3	NE	0.05 mg/m3	NE	NE	NE	0.05 mg/m3 (TWA)	100 mg/m3	NA

Notes:

All concentrations are expressed in ppm with the exception of IP which is presented in eV.

NIOSH REL - National Institute of Occupational Safety and Health Recommended Exposure Limit

NIOSH TWA - refers to the Time weighted average concentrations for up to a 10-hour workday during a 40-hour work week.

OSHA PEL - Occupational Safety and Health Adminstration Permissable Exposure Limit

OSHA TWA - refers to concentrations that must not be exceeded during any 8-hour workshift of a 40-hour workweek.

STEL - for both NIOSH and OSHA refers to the short-term exposure limit 15-minute TWA exposure that should not be exceeded at any time during a workday

max peak - refers to the amount of exposure above the ceiling value that is acceptable for the indicated time in minutes within a established period of time in a 8-hour workday. The amount of exposure should never exceed the maximum peak.

Ceiling REL - refers to the exposure concentration that should not be exceeded at any time.

ACGIH TLV - American Conference of Governmental Industrial Hygienists Threshold Limit Value

IDLH - Immediately Dangerous to Life or Health concentrations

minimize - minimize exposure to the lowest achievable concentration.

*** or Ca** - indicates that NIOSH considers the chemical to be a potential occupational carcinogen and the exposure limit is considered the lowest achievable exposure.

NE - none established

Table C-4
Comparative Risk Analysis

This table details site activities and anticipated associated risks by class: Biologial, Chemical, or Physical. Personal Protective Equipment level, weather, air temperature and season may effect the magnitude of some types of risk. Site personnel shall use prudent judgement at all times.

Task/Activity	**Hazard**		
	Biological	**Chemical**	**Physical**
Walk Through	L-M	L-M	L-H *
Groundwater Sampling	L-M	L-M	L-M
Soil Sampling	L-M	L-M	L-M
Free Phase Liquid Sampling	L-M	M	L-M
Drilling	L-M	L-M	L-H

Many of the chemicals identified in the on site media can enter through the skin. This route of entry must be protected whenever skin contact is probable.

L: Low
M: Moderate
H: High
* No field personnel shall enter any structure, building, or tank for any reason.

Table C-5
Air Monitoring and Associated Action Level Requirements

Task	Initial Level of Protection	Air Monitoring Equipment	Upgrade Criteria	Upgraded Level of Protection	Remarks (See footnote 1)
Walk Through	D-1	NA	Condition Dependent	Condition Dependent	
Soil Sampling **Groundwater Sampling** **Free Phase Liquid Sampling**	Modified D-1 or D-2(2)	PID	VOCs continuously > than 5 ppm for more than 5 minutes above background or any peak > than 25 ppm above background	C	**Section B3.3**
		PID/Draeger Tube - Benzene	VOCs continuously > 1 ppm and < or = to 5 ppm above background level for more than 5 minutes, a detector tube for benzene shall be used to determine airborne concentrations.	Benzene > 1ppm Temporarily cease work until concentration subsides and evacuate immediate area or C2	
		PID/Draeger Tube - Benzene	Continuously greater than 25 ppm, or frequent peaks > than 50 ppm, or benzene concentrations > 100 ppm	Temporarily cease work until concentration subsides and evacuate immediate area or B2	
Drilling/Well Installation and Development	D-1 or D-2(2)	PID	VOCs continuously > than 5 ppm for more than 5 minutes above background or any peak > than 25 ppm above background	C	**Section B3.3**
		PID/Draeger Tube - Benzene	VOCs continuously > 1 ppm and < or = to 5 ppm above background level for more than 5 minutes, a detector tube for benzene shall be used to determine airborne concentrations.	Benzene > 1ppm Temporarily cease work until concentration subsides and evacuate immediate area or C	
		PID/Draeger Tube - Benzene	Continuously greater than 25 ppm, or frequent peaks > than 50 ppm, or benzene concentrations > 100 ppm	Temporarily cease work until concentration subsides and evacuate immediate area or B	
		MIE PDM-3 miniram (or equivalent)	<2 mg/m^3 above background	Wear Level D-1(2) PPE	
			>2mg/m^3 to 100 mg/m^3 sustained for 10 minutes or peaks > 25 mg/m^3	Use wet methods (water spray) or other engineering controls to reduce levels Use Level C PPE if water spray fails to reduce dust concentrations	
			> 100 mg/m^3 peak or sustained	Cease work and contact the HSO	
Drill Rig/ Equipment Decontamination	D-2	NA	NA	NA	

Notes:

(1) **The HSO must be advised of conditions that warrant a change in PPE and approve the revised procedure.**

(2) Field personnel may upgrade to polycoated Tyvek or Tyvek coveralls where it is probable that there will be substantial contact with subsurface soils or groundwater containing elevated levles of site-related constituents.

Condition Dependent: Personnel are to use prudent judgement and select additional PPE based on current Site conditions (e.g., wet or muddy) to prevent unnecessary contamination.

Site personnel are permitted, with HSO approval , to substitute protective aprons and/or gauntlets when exposure to water/sediment samples is readily controlled. This substitution is permitted to reduce the possibility of heat stress caused by working in full coverall protection.

REFERENCES

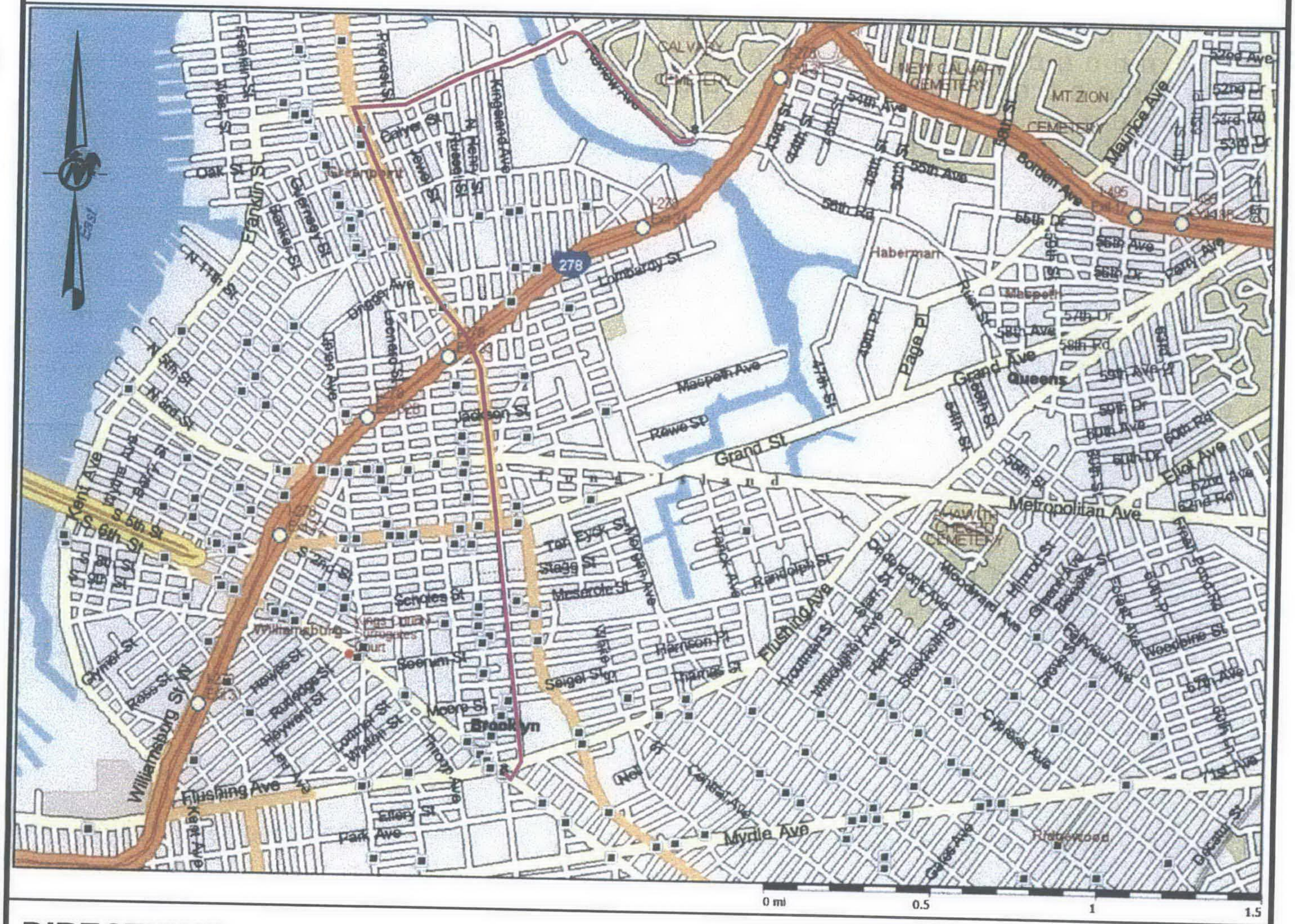
1.) MAP TAKEN FROM U.S.G.S. 7.5 MINUTE QUADRANGLE OF BROOKLYN, NEW YORK, DATED 1979.

1000 0 1000
SCALE FEET

Golder Associates
Philadelphia USA

SCALE	AS SHOWN	TITLE	
DATE	09/19/02		
DESIGN	AM	**SITE LOCATION MAP**	
CADD	AM		
FILE No. 0236151A010	CHECK SOM 9/19/02		
PROJECT No. 023-6151 REV. 0	REVIEW RSW 9/19/02	QUANTA RESOURCES	FIGURE C-1

Drawing file: 0236151A010.dwg Sep 19, 2002 - 12:20pm



DIRECTIONS

1.) DEPART SITE AND MAKE LEFT ONTO REVIEW AVE.

2.) TURN LEFT ONTO GREENPOINT AVE.

3.) TURN LEFT ONTO McGUINESS BLVD.

4.) BEAR RIGHT ONTO HUMBOLDT ST.

5.) BEAR RIGHT ONTO SUMNER PL.

6.) ARRIVE 760 BROADWAY

REFERENCES

1.) MAP TAKEN FROM MICROSOFT STREETS & TRIPS.

Drawing file: 0236151A011.dwg Sep 19, 2002 - 12:19pm

Golder Associates
Philadelphia USA

SCALE	AS SHOWN
DATE	09/19/02
DESIGN	AM
CADD	AM
CHECK	SDM 9/19/02
REVIEW	RSW 9/19/02

FILE No. 0236151A011

PROJECT No. 023-6151 REV. 0

TITLE

HOSPITAL ROUTE MAP

QUANTA RESOURCES

FIGURE C-2

ATTACHMENT C-1

FIELD PROCEDURE CHANGE AUTHORIZATION FORM

ATTACHMENT C-1

FIELD PROCEDURES CHANGE AUTHORIZATION

Instruction Number: ______ Date:_______

Duration of Authorization Requested ___ Today only

___ Duration of Task

Description of Procedures Modification:

Justification:

Person Requesting Change: Verbal Authorization Received From:

Name	Name	Time
Title	Title	
Signature	Approved By	

(Signature of person named above to be obtained
within 48 hours of verbal authorization)

ATTACHMENT C-2

SITE HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT

ATTACHMENT C-2

SITE HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT

I have read understand and agree to follow the provisions detailed in the Health and Safety Plan for the Quanta Resources Site.

I am aware of emergency procedures, equipment locations, and emergency telephone numbers.

I understand that my failure to comply with these provisions may lead to disciplinary actions and/or my dismissal from the Site.

Printed Name	Organization	Signature	Date

This form is to be kept on file on Site. Copies should be made available to personnel from all companies involved with Site work.

ATTACHMENT C-3

REPORT FORM FOR UNSAFE CONDITIONS AND PRACTICES

ATTACHMENT C-3

REPORT FORM FOR UNSAFE CONDITIONS AND PRACTICES

DESCRIPTION OF UNSAFE CONDITION OR PRACTICE ______________________

____

____

____

____

DESCRIPTION OF CIRCUMSTANCES SURROUNDING UNSAFE CONDITION OR PRACTICE ____

____

____

____

____

IS THIS AN EXISTING CONDITION OR POTENTIAL HAZARD? ________________

REPORTED TO ____

REPORTED BY __________________ **DATE** __________________

COMMENTS ____

____

____

____

____

REPORT RECEIVED BY _________________________**(Health and Safety Officer)**

DATE ________________ ____________________________________

(Signed)

ATTACHMENT C-4

INCIDENT REPORT FORM

ATTACHMENT C-4

INCIDENT REPORT FORM

In the event of any injury, accident or illness requiring medical attention beyond minor first aid, please complete this form. Retain two copies for your files and send the original to Linda Laganella in the Cherry Hill, NJ office.

Employee's office mailing address: Location of office (if different):

________________________________ ________________________________

________________________________ ________________________________

________________________________ ________________________________

________________________________ ________________________________

EMPLOYEE INFORMATION:

Employee's name:______________________________________

Length of time with Employer:______________________________

S.S.#:_____-_____-_____ Sex: M F Birth Date:______________________

Home address:

____

____

____

Occupation:____

Department or group:____

PROJECT INFORMATION:

Project Manager: ____________________

Field Supervisor: ____________________

Project Description (briefly describe the project, location, employee's role, etc.):

____

____

____

____

____

ACCIDENT/EXPOSURE INFORMATION:

Description of accident/incident (briefly describe how the accident/incident occurred, what task the employee was working on at the time, working conditions, etc.)

INJURY/ILLNESS INFORMATION:

Description of injury/illness (please describe the nature of the injury/illness, body part(s) affected, and the object/agent which caused the injury/illness):

Name and address of attending physician:

Name and address of hospital (if admitted):

Report prepared by:__________________________________

Title:____

Date:______________________

Appendix D

APPENDIX D

SAMPLING AND ANALYSIS PLAN
(INCLUDES QUALITY ASSURANCE PROJECT PLAN)

TO BE SUBMITTED

TABLE OF CONTENTS