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Transmittal

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To: Thomas V. Danahy
Geraghty & Miller, Inc.
Environmental Services
201 West Passaic Street, 3rd Floor
Rochell Park, New Jersey 07662

Date: February 1, 1994

File: Tutu Wells Contamination

Re: Tutu Esso Site

FEB 1994
GERAGHTY & MILLER, INC.

We are sending you ____X____ herewith _____ under separate cover

_____ drawings _____ letters _____ other

If material received is not as listed, please notify us at once.

Quantity	Identifying Number	Title	Action*
2		Site Assessment Program, Tutu Esso Station (August 1993)	
2		Supplemental Site Assessment Program, Tutu Esso Station (October 1993)	

*Action letter code: R - reviewed N - reviewed and noted I - for your information
S - resubmit J - rejected Y - for your approval

Tom:

Attached please find the work programs for the Tutu Esso Station. Please note that three additional monitoring wells were installed that were not illustrated on Figure 2-2. One shallow well at the Lutheran Church, one shallow well at the God of Holiness Church, and one shallow well on the Esso Station. A revised well location map is being prepared. Please forward this information to EPA.

Very truly yours,

BLASLAND, BOUCK & LEE, INC.

Thomas F. Maguire

Thomas F. Maguire, C.P.G.
Principal Scientist

cc: Chris Gibson, Esq., Archer & Greiner (w/out attachments)
Robert Lehman, Esq., Archer & Greiner (w/out attachments)
William Stack, Esq., Exxon (w/out attachments)

TFM/bgm

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SITE ASSESSMENT PROGRAM
TUTU ESSO STATION
TUTU, ST. THOMAS, U.S.V.I.

AUGUST 1993

Prepared By:

Blasland & Bouck Engineers, P.C.
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SITE ASSESSMENT PROGRAM
TUTU ESSO STATION
TUTU, ST. THOMAS, U.S.V.I.

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Site Assessment Program
Tutu Esso Station
Tutu, St. Thomas, U.S.V.I.

Figures

Tables

1.0 INTRODUCTION

1.1 Existing Data

To date, a number of investigations, both site-specific and regional, have generated empirical data regarding the Tutu Esso station. These investigations include:

- sampling of sumps, storm drains and tanks from gasoline stations and auto body shops in Tutu St. Thomas (17 August 1987)
- a multi-site soil vapor investigation conducted by Geoscience Consultants, Ltd. with an accompanying report issued in December 1987
- a site-specific soil vapor investigation conducted by Belgodere & Associates with an accompanying report issued in June 1988
- a Preliminary Assessment Report for Tutu Esso, St. Thomas, prepared by NUS (24 March 1989)
- an underground storage tank removal and soil sampling program implemented by Soil Tech with findings reported in January 1990
- a multi-site soil vapor investigation conducted by Target Environmental with findings reported in February 1992
- a ground penetrating radar survey of the Esso station property conducted by Subsurface Detection Investigations, Incorporated (SDII) with a report prepared in February 1992
- ground-water sampling conducted by Caribbean Hydro-Tech from CHT-Series monitoring wells installed on the Four-Winds Plaza property (samples collected from February through December 1992 - data not reported)
- a combined ground penetrating radar and magnetometer investigation of an alleged subsurface anomaly at the Tutu station conducted by Blasland & Bouck Engineers, P.C. (Report April 1993)
- a site-specific Subsurface Investigation and Pipe Tracing Survey conducted by Blasland & Bouck Engineers, P.C. (Report - May 1993)
- the Tutu Environmental Investigation Committee (TEIC) investigation with findings reported by Geraghty & Miller in Technical Memorandum II (May 1993)

Based upon the data generated during these investigations (specifically Technical Memorandum II and the Caribbean Hydro-Tech ground-water sampling),

it is suspected that aromatic hydrocarbons and possibly phase-separated hydrocarbons have impacted the subsurface (both soils and ground water) beneath the Tutu Esso station from on-site and/or off-site sources. For this reason, a proposed supplemental, site-specific, investigation program has been developed to address any existing data voids and facilitate source remediation, if required.

1.2 Investigation Objectives

Although additional investigation activities have been recommended for the Tutu area by Geraghty & Miller (Section 7 - Technical Memorandum II), site-specific investigations will be required at all probable off-site source areas. The necessity for individual site assessments is consistent with one of the objectives proposed by CERCLA PRP technical representatives.

The objectives of the proposed site investigation for the Tutu Esso station include:

- assess the potential impact of on-site ground-water quality (i.e., beneath the Esso station property) as a result of off-site sources
- investigate the potential that on-site equipment (i.e., the former and existing underground storage tank field, product lines, and pump island) have impacted ground water quality downgradient of the site (i.e., Caribbean Hydro-Tech well CHT-3)
- assess the potential that site activities have resulted in the presence of aromatic hydrocarbons and phase-separated hydrocarbons in wells MW-9 and MW-9S.
- assess the potential that off-site sources have resulted in the presence of aromatic hydrocarbons and phase-separated hydrocarbons in wells MW-9 and MW-9S.
- determine ground-water quality in both shallow and deep portions of the Tutu aquifer at the upgradient property boundary of the service station (i.e., adjacent to existing well MW-8)
- delineate aqueous phase volatile organic compound impact downgradient of the Tutu Esso station

- collect requisite data to evaluate/screen appropriate remedial technologies, if required, to address both shallow saturated and vadose zone contamination beneath the station

- screen appropriate remedial technologies, if required, to facilitate the implementation of interim remedial measures (IRM) and/or final remedial measures (FRM)

With these objectives in mind, a proposed work scope for the Tutu Esso station has been developed (Section 2). Sections 3 and 4 provide specific investigation methodologies and a tentative implementation schedule, respectively. It is important to stress that additional investigative activities (beyond those proposed for the Tutu Esso station) are required off-site, specifically at other potential source areas, to identify sources and delineate environmental impact from both aromatic hydrocarbons and chlorinated organic compounds.

2.0 PROPOSED INVESTIGATION PROGRAM

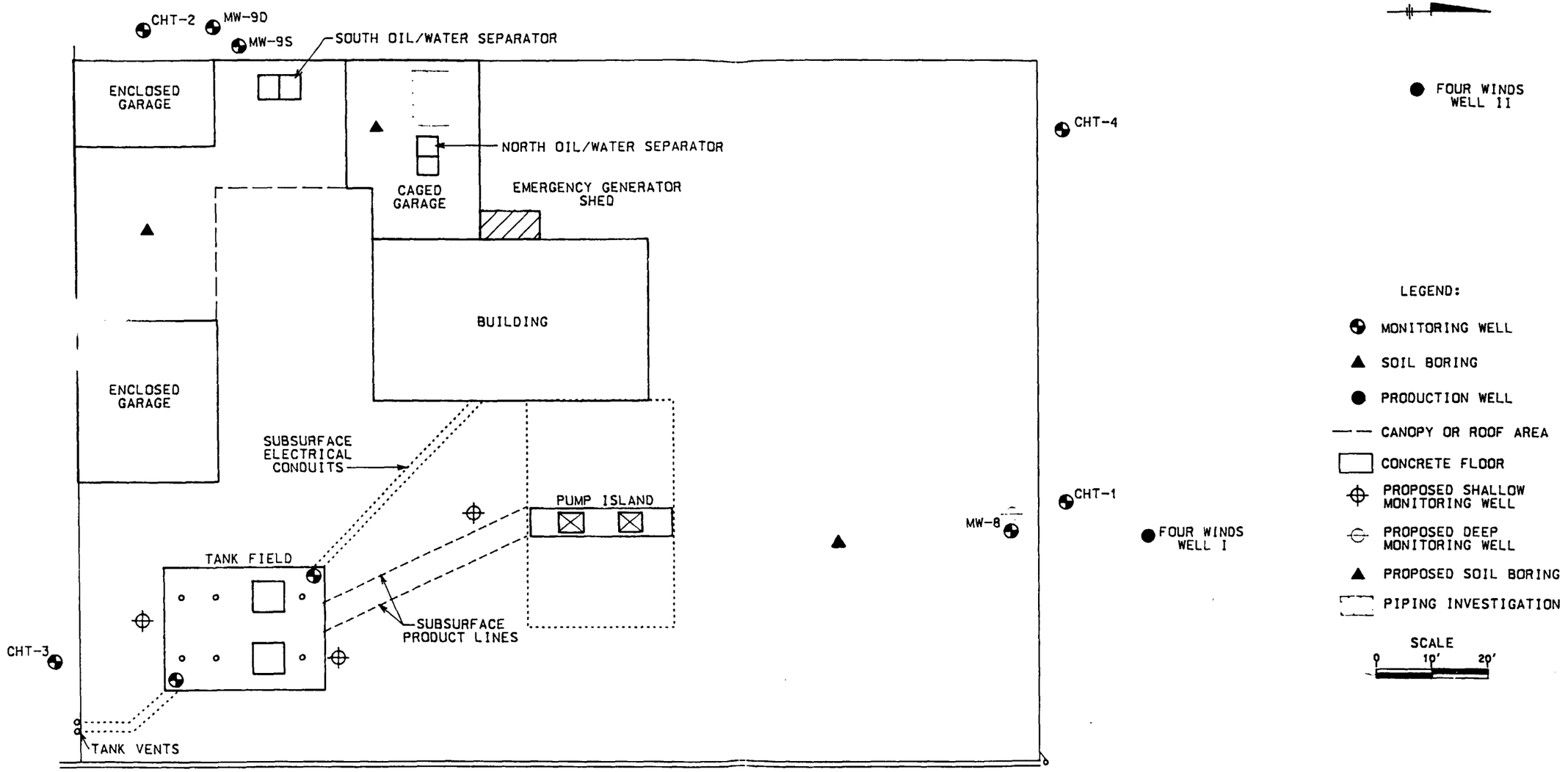
2.1 Vadose Zone Characterization

2.1.1 Potential Source Assessment

To determine if previous site operations adjacent to the north and south oil/water separators, and former hydraulic lifts have impacted subsurface soil quality, two soil borings have been proposed for these areas (Figure 2-1). It is presently anticipated that these borings can be facilitated through hollow-stem auger drilling techniques (Section 3.2). Due to limited access beneath the building roof, tripod drilling techniques and/or manual excavation may be required to access subsurface soils in these areas (Section 3.1). Two representative soil samples from each boring will be analyzed for volatile organic compounds, MTBE, poly-nuclear aromatic hydrocarbons, and total petroleum hydrocarbons. Should contamination be detected in the vadose zone soils extending down to the phreatic surface (water table) soil borings will be converted to a ground-water monitoring wells (Section 3.3).

Previous site investigations conducted by Blasland & Bouck Engineers have indicated that it is possible that, at some point in time, there may have been an active outfall from the north oil water separator. Pipe tracing techniques employed during the January 1993 investigation were successful in identifying an obstruction in the effluent pipe approximately ten feet from the oil/water separator. To further delineate the terminus of this pipe, two methodologies have been proposed:

1. attempt to trace the pipe through a non-intrusive methodology (electrical conductance) and implement a limited subsurface investigation at what is determined to be the pipe terminus; or



BLASLAND & BOUCK ENGINEERS, P.C.
ENGINEERS & SCIENTISTS

ESSO TUTU SERVICE STATION
ST. THOMAS, USVI

PROPOSED MONITORING WELL LOCATIONS

FIGURE 2-1

1,6,8,83 ON
8/17/93 BD-PGL
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2. in the event electrical conductance proves unsuccessful, employ a combined program of manual excavation and pipe tracing techniques to identify the ultimate outfall, if any, of this pipe.

Data generated during these tasks will be instrumental in addressing the question whether former operations at the Esso station are responsible for the presence of aqueous phase aromatic hydrocarbons and phase-separated hydrocarbons in wells MW-9 and MW-9S. (TEIC Investigation)

2.1.2 Alleged Geophysical Anomaly Investigation

Based upon a February 1992 Subsurface Detection Investigations, Incorporated (SDII) geophysical investigation of the Tutu station, an allegation was made regarding the suspect presence of a structure beneath the northeast corner of the Esso property. In response to this allegation, Blasland & Bouck Engineers implemented a combined ground penetrating radar/magnetometer and subsurface investigation in January 1993. Findings from these studies indicated the absence of a subsurface structure in the subject area.

Although there is no empirical data to support the existence of an unknown structure beneath the northeast corner of the Esso property, to remove any doubt regarding the existence of a subsurface structure, one soil boring, extending to a depth of seven feet, has been proposed for this area (Figure 2-1).

2.2 Aromatic Hydrocarbon Plume Delineation

2.2.1 Monitoring Well Installations

To assess potential on-site sources (i.e., present/former tank field, product lines, and pump island), as well as, delineate the extent of aqueous phase aromatic hydrocarbons, possibly associated with the Esso property, six monitoring wells have been proposed (Figures 2-1 and 2-2):

- one shallow well downgradient of the pump island; SW 3
- one shallow well immediately upgradient of the tank field; SW2
- one shallow well immediately downgradient of the tank field; SW1
- one deep well paired with existing well MW-8; and DW1
- a shallow and deep well pair located approximately 200 feet downgradient of existing well MW-12D (Figure 2-2)

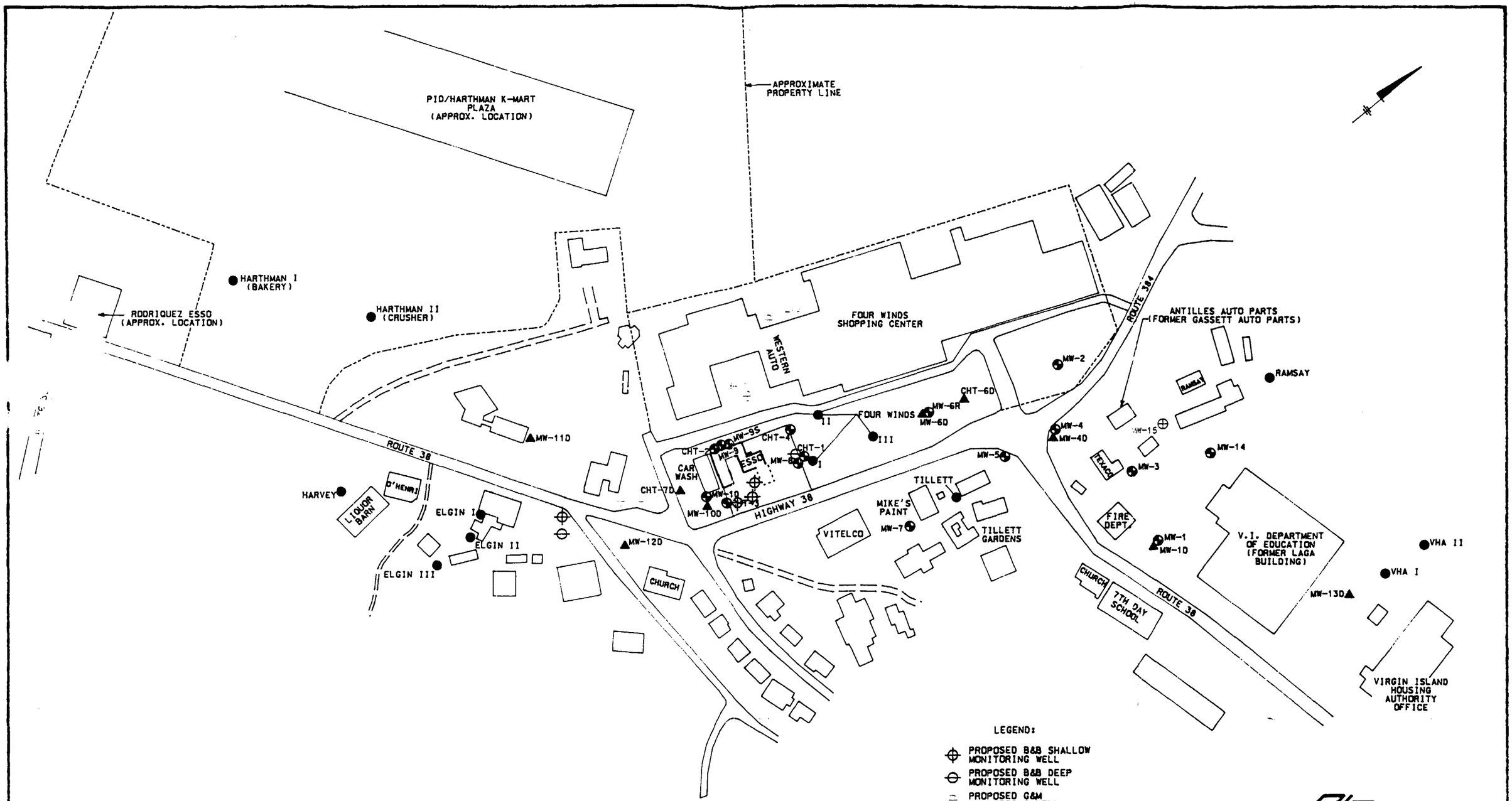
These proposed wells, in conjunction with the existing and proposed TEIC monitoring wells (Figure 2-2), will provide a comprehensive monitoring array designed to evaluate ground-water quality in both shallow and deep portions of the Tutu aquifer up- and downgradient of the Tutu Esso station.

2.2.2 Sampling

To define ground-water quality both up- and downgradient of the Tutu Esso station an array of monitoring wells will be employed. Wells included in this array are:

- the six (on-site and off-site) monitoring wells proposed in this investigation;
- Caribbean Hydro-Tech wells CHT-2, CHT-3, CHT-4, and CHT-7D;
- existing TEIC wells MW-8, MW-9S, MW-9, MW-10, MW-10D, and MW-12D; and
- proposed TEIC well MW-18.

Presently it is anticipated that ground-water samples will be collected, on a synoptic basis, from the six proposed monitoring wells and the CHT wells on two separate occasion. The necessity to sample the TEIC wells will be evaluated subsequent to receipt and review of the second round of ground-water quality data from the TEIC investigation. Samples will be analyzed for volatile organic compounds, MTBE, poly-nuclear aromatic hydrocarbons, total petroleum hydrocarbons, and dissolved oxygen/carbon dioxide. In addition to water quality



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ENGINEERS & SCIENTISTS

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PROPOSED MONITORING WELL LOCATIONS - TUTU AREA

FIGURE 2-2

1,6,8,9,11 ON
8/17/93 SD-PGL
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parameters, select on-site wells will be sampled for treatability analysis (i.e., major ion content, specifically iron, suspended solids, and pH).

2.3 Data Collection in Support of Remedial Technology Screening

Based upon available evidence and consistent with the terms of the Administrative Consent Order entered into by Esso, site remediation, if required, will be implemented to address an ongoing source for ground-water contamination and establish hydraulic control over a contaminant migration. Requisite, preliminary, data are required to assess the applicability, feasibility, and cost-effective nature of certain remedial technologies. Based upon available data, two general remediation technologies appear to be applicable to site conditions, soil vapor extraction and some form of ground-water extraction/treatment (pump and treat). The following subsections identify supplemental data requirements to further assess the applicability of these technologies.

2.3.1 Soil Vapor Extraction

In conjunction with monitoring well and soil boring installations, soil samples will be collected at 2-foot intervals to delineate the magnitude of aromatic hydrocarbon impact on vadose zone soils, if any, adjacent to the tank field, pump island, former hydraulic lifts and oil/water separators. Soil samples will be analyzed for volatile organic compounds, MTBE, poly-nuclear aromatic hydrocarbons, total petroleum hydrocarbons, grain size distribution and moisture content. Existing soil gas survey data, soil quality analyses, and water quality data will be utilized to identify the spatial distribution of aromatic hydrocarbons in the vadose zone. In addition to soil sampling, vacuum tests will be preformed on select monitoring wells to determine the relationship between extraction rates/area of vapor influence and the concentration of VOCs in the air

stream. The later two parameters directly relate to the selection and sizing of an appropriate and efficient vapor treatment technology (i.e., granular activated carbon (GAC) or catalytic combustion).

2.3.2 Pump-and-Treat Remedial System

To determine the hydraulic characteristics of the shallow aquifer beneath and within the immediate area of the Esso station, a series of individual hydraulic conductivity test (slug tests) and/or a limited pump test will be conducted. This information will be instrumental in defining, required extraction rates, area of influence, capture zone dimensions, and treatment technologies for any ground-water extraction program, if required.

2.4 IRM/FRM Feasibility Analysis

Subsequent to the collection of requisite site empirical data, should site remediation be required, a preliminary evaluation of IRM/FRM technologies will be conducted. Presently, it is anticipated that this screening process will address the following issues:

- the necessity and applicability of pump and treat technology to achieve source control
- the necessity and applicability of pump and treat technology to establish hydraulic control over a specified portion of the shallow Tutu aquifer
- the necessity and applicability of vapor extraction technology to achieve source control
- the necessity and most appropriate means of NAPL mitigation (i.e., dynamic multi-phase extraction from a recovery well, passive extraction from existing recovery wells through manual bailing or mechanical skimming, and/or dynamic/passive extraction from an interceptor trench)
- the optimum number, location and extraction rates for vapor extraction points, should soil vapor extraction be required
- preliminary selection of vapor phase treatment technologies (i.e., granular activated carbon or catalytic combustion)

- the optimum number, location, and extraction rates for ground-water recovery wells, should ground-water extraction be required

- preliminary selection of aqueous phase treatment technologies (i.e., Air Stripping or granular activated carbon) based upon permitting requirements, influent VOC concentrations, throughput, biofouling potential, inorganic fouling potential, and operation/maintenance costs

- applicability and utility of enhanced bioremediation for vapor, aqueous and non-aqueous phase contaminants

- applicability and utility of sparging technology for aqueous phase contaminants

3.0 INVESTIGATION METHODOLOGY

To the extent that it is possible, EPA approved methodologies, such as those implemented by Geraghty & Miller during the TEIC investigation, will be employed. Some specific procedures have been outlined in the subsequent subsections.

3.1 Surface/Near-Surface Soil Sampling

Any surface and shallow (less than three feet below grade) soil samples collected in conjunction with the vadose zone characterization program will be collected with a decontaminated trowel and hand auger, respectively. To insure the collection of representative data, samples will be obtained in accordance with EPA protocol.

Each sample will be screened with an organic vapor analyzer (OVA) and characterized with respect to color, grain size, degree of sorting, and presence/absence of staining. This data will be documented in a field log book by the site geologist. Following collection, samples will be placed in laboratory prepared sample bottles, labeled, logged on a chain of custody form, and preserved on ice for transit to the analytical laboratory.

Sampling equipment will be decontaminated prior to obtaining each sample by implementing the following procedures:

- tap water rinse to remove residual soil;
- wash with a laboratory-grade detergent solution;
- tap water rinse;
- methanol rinse; and
- distilled water rinse

3.2 Soil Borings and Split-Spoon Sampling

At those locations where vadose zone characterization has been proposed and/or where soil sampling is required greater than three feet below ground

surface, split-spoon soil sampling techniques will be employed. Split-spoon soil sampling, when required, will be facilitated through hollow-stem auger drilling and/or tripod drilling techniques. The split spoons will be advanced ahead of the auger flights to ensure the collection of representative (undisturbed) soil samples. Samples will be collected continuously (at two-foot intervals) until intersecting the water table or auger refusal, which ever is encountered first.

Once collected, the soil core within the split-spoon sampler will be scanned with an organic vapor analyzer (OVA) to document the presence or absence of volatile organic compounds. Discrete soil samples will be extracted from cores exhibiting elevated OVA readings. These samples will be collected in accordance with EPA protocol. Subsequent to collection, select samples will be placed in laboratory prepared sample jars, labeled, logged on a chain of custody form and preserved on ice. In addition to the collection of samples for laboratory analysis, soil samples will be characterized with respect to color, grain size, degree of sorting and presence/absence of staining. This information in conjunction with OVA readings will be documented on a soil boring log.

Split-spoon samplers will be decontaminated prior to obtaining each sample by implementing the following procedures:

- tap water rinse to remove residual soil;
- wash with a laboratory-grade detergent solution;
- tap water rinse;
- methanol rinse; and
- distilled water rinse.

The back of the drill rig and the auger flights will be decontaminated by pressure washing prior to entering onto the subject site and between borings at each site.

3.3 Monitoring Well Installations

In addition to those locations where monitoring wells are proposed, should elevated OVA readings extend through vadose zone deposits into the water table during soil boring advancement, the soil boring will be converted to a ground-water monitoring well. The decision to install a monitoring well will be made in the field based upon empirical field data (i.e., OVA readings) and field observations.

Both shallow and deep monitoring wells will be installed through a combination of hollow-stem auger and air hammer/rotary drilling techniques. Shallow monitoring wells (approximate completion depth of 30 - 40 feet) will be constructed in accordance with the following procedures:

- 4-inch diameter, schedule 40, threaded PVC screen and casing sections will be steam cleaned prior to installation
- screen sections will be assembled without adhesives to extend approximately fifteen feet below and ten feet above the water table, where applicable
- casing sections will be assembled without adhesives to extend from the top of the screen interval to ground surface
- the well annulus, to a height approximately two feet above the screen interval, will be packed with clean silica sand
- a bentonite seal with a minimum thickness of one foot and a maximum thickness of two feet will be constructed above the sand pack
- the remainder of the well annulus will be filled with a cement bentonite slurry to ground surface
- the well head will be completed with either a flush mounted road box or protective casing extending approximately three feet above grade.

Deep monitoring wells (approximate completion depth of 80 - 100 feet) will be cased and sealed (as indicated above) into competent bedrock and completed as open-hole wells. Bedrock coring will be conducted in conjunction with the

installation of both deep wells to ascertain the location of bedrock fracture zones.

Following installation and prior to the collection of ground-water quality samples, each well will be developed through a surge and evacuation technique. This methodology minimizes the volume of water generated while insuring complete development of the well. Well development will be continued until extracted water is free of appreciable quantities of suspended sediments. Water generated as a result of well development will either be treated through the use of portable granular activated carbon (GAC) units and discharged to the storm sewer system or containerized for off-site treatment and disposal.

3.4 Ground-Water Sampling

Both hydraulic and ground-water quality data will be obtained from all identified monitoring wells a minimum of fourteen days subsequent to well development. A second synoptic round of ground-water sampling will be conducted a minimum of eight weeks subsequent to the first. The procedures for obtaining this data are presented below.

- Prior to sampling each monitoring well, ground-water elevation data will be obtained to delineate local hydraulic gradients and calculate required purge volumes.

- A minimum of three well volumes will be purged from each well. During well evacuation, purge water will be monitored for temperature, pH, and conductivity. This data will be recorded in the field log book and utilized to identify equilibration between the well volume and the aquifer. Purge water will either be treated with by GAC and discharged to the storm sewer or containerized for off-site treatment and disposal.

- Subsequent to purging, wells will be sampled with either dedicated disposable bailers or decontaminated stainless steel bailers. The decontamination procedure for stainless steel bailers will incorporate: a detergent (laboratory-grade) wash; tap water rinse; methanol rinse; and distilled water rinse.

3.5 Laboratory Analytes

All ground water and soil samples will be analyzed by an EPA approved laboratory employing EPA approved methodologies. A requisite number of blank and quality control samples will be submitted in conjunction with environmental samples to compile laboratory deliverable packages, thereby facilitating an appropriate level of Quality Assurance/Quality Control (QA/QC) review.

4.0 TENTATIVE INVESTIGATION SCHEDULE

It is presently anticipated that the proposed work program can be implemented in accordance with the tentative schedule outlined in Table 4-1. Reasonable efforts will be made to achieve this tentative schedule and, under certain circumstances, some tasks may be expedited. It is important to note that the schedule is initiated at the point in time that EPA approval of the work scope is obtained.

TABLE 4-1

INVESTIGATIVE TASK	WEEKS AFTER * PROJECT INITIATION
Permit Acquisition	0 - 4
Drilling Contractor Mobilization	0 - 6
Soil Boring Installation	7
Laboratory Analysis of Soil Samples	8 - 16
Monitoring Well Installations/Development/Surveying	7 - 9
Pipe Tracing Investigation	9 - 10
Monitoring Well Equilibration Period	10 - 11
First Round of Ground Water Sampling	12 - 13
Hydraulic Conductivity Testing of Select Wells	12 - 13
Vacuum Testing of Select Wells	13 - 14
Laboratory Analysis of First-Round Ground Water Samples	14 - 22
Second Round of Ground Water Sampling	22
Laboratory Analysis of Second-Round Ground Water Samples	23 - 31
IRM/FRM Screening Analysis	22 - 35
Report Preparation	31 - 35

* Project initiation subsequent to EPA approval of work program