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RETEC

# PSA Addendum Work Plan

## Suffern MGP Site
## Middletown - Fulton Street MGP Site
## Haverstraw - Clove & Maple MGP Site
## Haverstraw - Maple & West MGP Site

**Prepared for:**

Orange & Rockland Utilities, Inc.
One Blue Hill Plaza
Pearl River, NY 10965

**Prepared by:**

Remediation Technologies, Inc.
3040 William Pitt Way
Pittsburgh, PA 15235
and
Remediation Technologies, Inc.
1001 W. Seneca St., Suite 204
Ithaca, NY 14850-3329

RETEC Project No.: 3-3523-000

**March 3, 1998**

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Ithaca, NY 14850-3329

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**Prepared by:**

Jim Edwards / AB

Jim Edwards, Geologist

**Technically Reviewed by:**

Alessandro Battaglia

Alessandro Battaglia, Ph.D., P.E., Senior Project Manager

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# 1 Introduction

## 1.1 Project Background

On behalf of Orange and Rockland Utilities, Inc. (O&R), Remediation Technologies Inc. (RETEC) has prepared this PSA Addendum Work Plan (Addendum) for additional environmental investigations at Manufactured Gas Plant (MGP) sites in Suffern, Middletown and Haverstraw, New York. The Addendum has been prepared in accordance with the New York State Department of Environmental Conservation (NYSDEC) Order on Consent (Index No. D3-0002-9412), which requires O&R to complete a Preliminary Site Assessment (PSA) at each of the sites.

O&R completed an initial phase of PSA work in May/June 1997. To guide the field work, a work plan document entitled "Preliminary Site Assessment Work Plan for Suffern, Middletown-Fulton Street and Haverstraw, New York Former Manufactured Gas Plant Sites," [RETEC, 1997a] was prepared by O&R and approved by NYSDEC in April 1997. Two separate companion documents were prepared to support field work at the sites; a Quality Assurance Project Plan (QAPP) [RETEC, 1997b] and a Site Specific Health and Safety Plan (HASP) [RETEC, 1997c]. PSA reports for the Suffern [RETEC, 1997d], Middletown [RETEC, 1997e] and Haverstraw Clove & Maple and Maple & West sites [RETEC, 1997f] were submitted to NYSDEC in September 1997.

NYSDEC requested that additional field work be performed at the MGP sites to better characterize environmental conditions. This request was documented in letters to O&R dated November 4, 1997, November 14, 1997, and December 24, 1997. This Addendum was prepared pursuant to NYSDEC's request in the above referenced letters.

In addition, the Addendum includes activities focused on obtaining information useful to evaluate and execute (if appropriate) potential interim remedial measures (IRM) and/or generate site-specific feasibility studies. Unless currently unforeseen conditions are encountered at the four MGP sites, the activities planned in this work plan are intended to provide finality to the investigation programs at the MGP sites.

## 1.2 Project Objectives

The overall goal of the Addendum is to further investigate potential areas of concern found during the initial phase of PSA field work. The project scope of work is based on:

- Additional field work suggested by RETEC in the PSA reports;
- Field work required to address specific concerns raised by NYSDEC; and

- Field work to be used for IRM evaluation and FS purposes.

Sections 2, 3, 4 and 5 of this addendum work plan provide sample collection strategies for the Suffern, Middletown- Fulton Street, Haverstraw- Clove & Maple and Haverstraw- Maple & West MGP sites, respectively. Section 6 provides a description of field procedures which will be used at the sites (only field procedures which vary from those described in the PSA Work Plan are discussed in the Addendum). Section 7 provides a project schedule. Section 8 provides a list of references.

# 2 Suffern MGP Site

The additional investigative work at the Suffern MGP site will be focused on three areas of potential environmental concern identified during PSA sampling. These areas, shown on Figure 2-1, include:

- the area of the eastern gas holder;
- the former gas-oil house; and
- the western gas holder foundation and propane plant area.

The proposed sampling plan is discussed below and is summarized in Table 2-1.

## 2.1 Eastern Gas Holder

The contents of the eastern gas holder were found to be a likely source of impacts to soil and groundwater from MGP residuals during the PSA investigation. Visibly impacted fill material, soil and groundwater were found to the north and west of the holder. Additional sampling will be conducted in the vicinity of the holder to further define the extent of the impacts to soil and groundwater. Investigative work will include:

- **Monitoring Well Installation-** A shallow (water table) monitoring well (MW5) will be installed at the western side of the former MGP operations site between MW2 and MW3. The objectives of the well will be to monitor groundwater (found to be impacted at SB12) as it leaves the site west of the eastern gas holder, and to further define the direction of the flow of groundwater as it leaves the area.

- **Deep Soil Boring-** A deep soil boring (SB6) will be completed to the west of the eastern gas holder. The objective of the boring will be to determine the extent, if any, of non-aqueous phase liquid (NAPL) accumulation with depth or at the bedrock surface. A monitoring well will be installed within the deep boring (MW6).

- **Deep Soil Boring- L1 Replacement-** A deep soil boring (SB7) will be completed in the vicinity of MW3 to investigate the presence of MGP residuals found during a previous soil boring completed in this area by ERM, and to determine if MGP residuals are present at the bedrock surface at this location. A monitoring well (MW7) will be installed within the boring.

# Table 2-1 Suffern MGP Site Proposed Sample Locations

| Sample Type and Designation | Sample Analysis | Sample Depth | Rationale |
|---|---|---|---|
| Eastern Gas Holder | | | |
| **Soil Borings** | | | |
| SB5/MW5 | MGP Indicators | most impacted sample | Shallow soil boring for monitoring well installation down gradient of eastern gas holder- recommended by RETEC [RETEC, 1997d, pg. 8-6] |
| SB6/MW6 | MGP Indicators | most impacted sample | Deep soil boring for monitoring well installation to investigate DNAPL impacts west of eastern gas holder- requested by NYSDEC [NYSDEC Comments, 1997a, pg.4] |
| SB7/MW7 | MGP Indicators | most impacted sample | Deep soil boring for monitoring well installation to investigate potential DNAPL impacts at location of abandoned well L1 [NYSDEC Comments, 1997a, pg. 4] |
| **Monitoring Wells** | | | |
| MW1 | MGP Indicators, Biodegradation parameters | water table | Up gradient water quality- resample existing monitoring well. |
| MW2 | MGP Indicators, Biodegradation parameters | water table | Down gradient of MGP- resample existing monitoring well. |
| MW3 | MGP Indicators, Biodegradation parameters | water table | Down gradient of eastern gas holder- resample existing monitoring well. |
| MW5 | MGP Indicators, Biodegradation parameters | water table | To test down gradient groundwater of SB12 and eastern gas holder- recommended by RETEC [RETEC, 1997d, pg 8-6] |
| MW6 | MGP Indicators, Biodegradation parameters | deep aquifer | Deep aquifer monitoring well- to be installed down gradient of eastern gas holder- requested by NYSDEC, [NYSDEC Comments, 1997a, pg. 4] |
| MW7 | MGP Indicators, Biodegradation parameters | deep aquifer | Deep aquifer monitoring well- to be installed to replace well L1- requested by NYSDEC, [NYSDEC Comments, 1997a, pg. 4] |
| **Surface Soil** | | | |
| SS5 | Hydrocarbon Identification | 0 to 0.5 feet bgs | To determine source of hydrocarbon product found at ground surface west of the eastern gas holder- recommended by RETEC [RETEC, 1997d, pg. 8-7] |
| **Test Pit** | | | |
| TP4 | Field Characterization | 0 to 12 feet bgs | To further delineate MGP residuals found in TP3, north of the eastern gas holder- recommended by RETEC [RETEC, 1997d, pg. 8-7] |

# Table 2-1 Suffern MGP Site Proposed Sample Locations (Continued)

| Sample Type and Designation | Sample Analysis | Sample Depth | Rationale |
|---|---|---|---|
| **Gas-Oil House** | | | |
| **Soil Borings** | | | |
| SB8/MW8 | MGP Indicators | most impacted sample | Deep soil boring for monitoring well installation to investigate potential leakage from gas-oil house foundation- requested by NYSDEC [NYSDEC Comments, 1997a, pg.4] |
| SG14 | Field Characterization | 0 to 12 feet bgs | To further define the contents of gas-oil house foundation- recommended by RETEC [RETEC, 1997d pg. 8-7] |
| SG15 | Field Characterization | 0 to 12 feet bgs | To investigate potential leakage from gas-oil house foundation- recommended by RETEC [RETEC, 1997d, pg.8-7] |
| SG16 | Field Characterization | 0 to 12 feet bgs | To investigate potential leakage from gas-oil house foundation- recommended by RETEC [RETEC, 1997d, pg.8-7] |
| SG17 | Field Characterization | 0 to 12 feet bgs | To investigate potential leakage from gas-oil house foundation- recommended by RETEC [RETEC, 1997d, pg.8-7] |
| **Geotechnical Borings** | | | |
| GTB1 | Geotechnical Data | 0 to 16 feet bgs | HSA boring to obtain geotechnical data for underpinning study - recommended by RETEC |
| GTB2 | Geotechnical Data | 0 to 16 feet bgs | HSA boring to obtain geotechnical data for underpinning study - recommended by RETEC |
| **Monitoring Well** | | | |
| MW8 | MGP Indicators, Biodegradation parameters | deep aquifer | To test deep aquifer groundwater quality down gradient of the gas-oil house foundation- requested by NYSDEC [NYSDEC Comments, 1997a, pg. 4] |
| **Test Pits** | | | |
| TP5 | Field Characterization | 0 to 12 feet bgs | To further investigate reports indicating coal gas tar products were stored east of the MGP [ERM, 1987,pg.1-19] |
| TP6 | Field Characterization | 0 to 12 feet bgs | To further investigate reports indicating coal gas tar products were stored east of the MGP [ERM, 1987,pg.1-19] |
| TP7 | Field Characterization | 0 to 12 feet bgs | To further investigate reports indicating coal gas tar products were stored east of the MGP [ERM, 1987,pg.1-19] |
| TP8 | Field Characterization | 0 to 12 feet bgs | To further investigate reports indicating coal gas tar products were stored east of the MGP [ERM, 1987,pg.1-19] |
| TP9 | Field Characterization | 0 to 12 feet bgs | To further investigate reports indicating coal gas tar products were stored east of the MGP [ERM, 1987,pg.1-19] |

# Table 2-1 Suffern MGP Site Proposed Sample Locations (Continued)

| Sample Type and Designation | Sample Analysis | Sample Depth | Rationale |
|---|---|---|---|
| Western Gas Holder and Propane Plant | | | |
| Soil Borings | | | |
| SB9/MW9 | MGP Indicators | most impacted sample | Shallow soil boring for monitoring well installation between area of reported MGP residuals by an O&R employee and Village of Suffern well #3- scope of work added by O&R |
| SB10/MW10 | MGP Indicators | most impacted sample | Shallow soil boring for monitoring well installation between area of known MGP residuals and Village of Suffern well #2- requested by NYSDEC [NYSDEC Comments, 1997a, pg.4] |
| SG18 | Field Characterization | 0 to 12 feet bgs | To investigate potential deposits of MGP residuals in area of western gas holder- NYSDEC Comments [NYSDEC, 1997a, pg. 4] |
| SG19 | Field Characterization | 0 to 12 feet bgs | To investigate potential deposits of MGP residuals in area of western gas holder- NYSDEC Comments [NYSDEC, 1997a, pg. 4] |
| SG20 | Field Characterization | 0 to 12 feet bgs | To investigate potential deposits of MGP residuals in area of western gas holder- NYSDEC Comments [NYSDEC, 1997a, pg. 4] |
| SG21 | Field Characterization | 0 to 12 feet bgs | To investigate potential deposits of MGP residuals in area of western gas holder- NYSDEC Comments [NYSDEC, 1997a, pg. 4] |
| SG22 | Field Characterization | 0 to 12 feet bgs | To investigate potential deposits of MGP residuals in area of western gas holder- NYSDEC Comments [NYSDEC, 1997a, pg. 4] |
| SG23 | Field Characterization | 0 to 12 feet bgs | To investigate potential deposits of MGP residuals in area of western gas holder- NYSDEC Comments [NYSDEC, 1997a, pg. 4] |
| SG24 | Field Characterization | 0 to 12 feet bgs | To investigate potential deposits of MGP residuals in area of the western gas holder - NYSDEC Comments [NYSDEC, 1997a, pg. 4] |
| SG25 | Field Characterization | 0 to 12 feet bgs | To investigate potential deposits of MGP residuals in propane plant deluge area - scope of work added by O&R following a report of residuals by O&R employee |
| SG26 | Field Characterization | 0 to 12 feet bgs | To investigate potential deposits of MGP residuals in propane plant deluge area - scope of work added by O&R following a report of residuals by O&R employee |
| SG27 | Field Characterization | 0 to 12 feet bgs | To investigate potential deposits of MGP residuals in propane plant deluge area - scope of work added by O&R following a report of residuals by O&R employee |
| SG28 | Field Characterization | 0 to 12 feet bgs | To investigate potential deposits of MGP residuals in propane plant deluge area - scope of work added by O&R following a report of residuals by O&R employee |
| SG29 | Field Characterization | 0 to 12 feet bgs | To investigate the extent of known MGP residuals in the propane plant vaporizer area- requested by NYSDEC [NYSDEC, 1997a, pg. 4] |

# Table 2-1 Suffern MGP Site Proposed Sample Locations (Continued)

| Sample Type and Designation | Sample Analysis | Sample Depth | Rationale |
|---|---|---|---|
| SG30 | Field Characterization | 0 to 12 feet bgs | To investigate the extent of known MGP residuals in the propane plant vaporizer area- requested by NYSDEC [NYSDEC, 1997a, pg. 4] |
| SG31 | Field Characterization | 0 to 12 feet bgs | To investigate the extent of known MGP residuals in the propane plant vaporizer area- requested by NYSDEC [NYSDEC, 1997a, pg. 4] |
| SG32 | Field Characterization | 0 to 12 feet bgs | To investigate the extent of known MGP residuals in the propane plant vaporizer area- requested by NYSDEC [NYSDEC, 1997a, pg. 4] |
| **Monitoring Wells** | | | |
| MW4 | MGP Indicators, Biodegradation parameters | water table | Re-sample existing well for MGP indicators- down gradient of western gas holder. |
| MW9 | MGP Indicators, Biodegradation parameters | water table | To test groundwater quality between area of potential MGP residuals in the deluge area and Village of Suffern well #3- scope of work added by O&R in response to report by employee |
| MW10 | MGP Indicators, Biodegradation parameters | water table | To test groundwater quality between area of known MGP residuals in the vaporizer area and Village of Suffern well #2- requested by NYSDEC [NYSDEC Comments, 1997a, pg.4] |
| **Test Pits** | | | |
| TP10 | Field Characterization | 0 to 12 feet bgs | To further delineate the extent of MGP residuals found at SS4- requested by NYSDEC [NYSDEC Comments, 1997a, pg.4] |
| TP11 | Field Characterization | 0 to 12 feet bgs | To investigate reports by an O&R employee that MGP residuals may have been found in the deluge area - scope of work added by O&R |
| TP12 | Field Characterization | 0 to 12 feet bgs | To further delineate the extent of MGP residuals found in the vaporizer area- requested by NYSDEC [NYSEC Comments, 1997a, pg.4] |
| TP13 | Field Characterization | 0 to 12 feet bgs | To further delineate the extent of MGP residuals found in the vaporizer area- requested by NYSDEC [NYSEC Comments, 1997a, pg.4] |
| TP14 | Field Characterization | 0 to 12 feet bgs | To further investigate the extent of MGP residuals in the propane peaking facility area if found - scope of work added by O&R |
| TP15 | Field Characterization | 0 to 12 feet bgs | To further investigate the extent of MGP residuals in the propane peaking facility area if found - scope of work added by O&R |
| TP16 | Field Characterization | 0 to 12 feet bgs | To further investigate the extent of MGP residuals in the propane peaking facility area if found - scope of work added by O&R |
| Two samples of tar-like material | Full RCRA Hazardous Waste Characteristics | Designated in the field | Two samples of tar-like materials (if found) will be collected during test pit excavation and analyzed for full RCRA hazardous waste characteristics |

# Table 2-1 Suffern MGP Site Proposed Sample Locations (Continued)

| Sample Type and Designation | Sample Analysis | Sample Depth | Rationale |
|---|---|---|---|
| **Surface Soil Samples** | | | |
| SS6 | MGP Indicators | 0 - 0.5 feet | To further investigate the extent of MGP residuals in surface soil - recommended by RETEC [RETEC, 1997d, pg. 8-7] |
| SS7 | MGP Indicators | 0 - 0.5 feet | To further investigate the extent of MGP residuals in surface soil - recommended by RETEC [RETEC, 1997d, pg. 8-7] |
| SS8 | MGP Indicators | 0 - 0.5 feet | To further investigate the extent of MGP residuals in surface soil - recommended by RETEC [RETEC, 1997d, pg. 8-7] |
| SS9 | MGP Indicators | 0 - 0.5 feet | To further investigate the extent of MGP residuals in surface soil - recommended by RETEC [RETEC, 1997d, pg. 8-7] |
| **Field QC samples** | | | |
| trip blanks | VOC | NA | one blank per cooler shipment |
| equipment blanks | VOC and PAH | NA | one blank for soil sampling equipment |
| field duplicates | MGP Indicators | NA | one duplicate soil and groundwater sample |

Notes: MGP Indicators include: VOC by 95-1, PAH by 95-2, total cyanide by CLP-M, TAL metals by CLP-M and weak acid dissociable cyanide by 4500 CN-I.

Biodegradation Parameters include electron receptors (nitrate, iron (total and $Fe^{2+}$), manganese, sulfate, sulfide) and dissolved gases (carbon dioxide, oxygen, nitrogen, methane).

Field Characterization includes: visual characterization- Unified Soil Classification System, visual and olfactory observations regarding the presence of MGP impacts and jar headspace screening with a photo-ionization detector. Note that, no field screening for soil gas will be done during the Addendum sampling.

- **Hydrocarbon Product Sample-** A sample (SS5) of the hydrocarbon product found at the ground surface near SS2 will be collected and analyzed to determine if the product is an MGP residual.

- **Test Pit-** A test pit (TP4) will be completed to the north of the eastern gas holder in the vicinity of TP3 to further delineate the extent of tar-like material found in the area. The test pit will be approximately 40 feet long (adjacent to the holder foundation) and will be 12 feet deep.

## 2.2 Gas-Oil House

Additional environmental data will be collected in, and around, the gas-oil house, a subsurface structure which was found to contain dense non-aqueous phase liquid (DNAPL) during PSA sampling. Investigative work will include:

- **Soil Borings-** A total of four shallow (direct push) soil borings (SG14-SG17) will be completed in, and around, the foundation to: 1) locate the footprint of the foundation; 2) further define the extent of DNAPL within the foundation; 3) determine if leakage has occurred from the foundation walls; and 4) to determine the relationship between the subsurface structure and the building. The actual locations of the borings for this task will be determined in the field and will be inside of the 1950s and 1960s building additions.

- **Geotechnical Soil Borings-** Two soil borings (GTB1 and GTB2) will be completed near the gas-oil house to obtain geotechnical data for an underpinning study.

- **Deep Soil Boring/Monitoring Well Installation-** A deep soil boring (SB8) will be completed in the vicinity of the gas-oil house to determine the maximum depth of DNAPL impacts (if any). The location of the boring, determined in the field, will be based on the results of the direct push soil borings. The deep boring will be completed as a monitoring well (MW8).

- **Test Pits-** A total of five test pits (TP5 to TP9) will be completed to the east and north of the gas-oil house foundation. The objective of the test pits will be to further investigate unconfirmed reports which suggest that MGP residuals may have been present to the east of the MGP [ERM, 1987].

## 2.3 Western Gas Holder and Propane Plant Area

### 2.3.1 Western Gas Holder Area

Additional sampling will be completed in the vicinity of the western gas holder foundation to further define the extent of MGP residuals (PAHs and cyanide) found at sample location SS4. Sampling will be completed using a test pit (TP10), seven direct push soil borings (SG18-SG24), and four surface soil samples (SS6-SS9) as shown on Figure 2-1. The sampling will follow an "inside out" approach starting at SS4 and moving north and west on a 60 foot spacing surrounding the holder until no visual, olfactory or photo-ionization detector evidence of impacts are found. The location of additional subsurface soil analytical samples will be determined in the field and will be taken: 1) from the two most impacted samples collected; and 2) from the perimeter areas around deposits, if any, of purifier box residuals. A total of four surface soil samples (SS6, SS7, SS8, and SS9) will be collected in the area of the western gas holder to further define the extent of surficial MGP residuals found at SS4.

### 2.3.2 Deluge Area- Propane Plant

According to information reported by an employee of O&R, MGP residuals may have been found within the deluge area (adjacent to the compressor house) of the propane plant in the early 1970s. An investigation will be conducted in this area to determine if MGP residuals are present. The investigation will include:

- **Test Pits-** One test pit (TP11) will be completed within the reported area to determine if MGP residuals are present.

- **Soil Borings-** A total of four direct push soil borings (SG25-SG28) will be completed using an "inside out" approach to determine the areal extent, if any, of MGP residuals found.

- **Monitoring Well Installation-** One monitoring well (MW9) will be installed between the investigation area and the Village of Suffern Well #3 to determine if there is potential for MGP residuals (if found) to impact the well.

- **RCRA Hazardous Waste Sampling-** One sample will be collected during test pit activities for analysis of full RCRA hazardous waste characterization. The sample location will be determined in the field and will represent the most impacted sample (if any) found.

### 2.3.3 Vaporizer Area- Propane Plant

During recent, post-PSA, construction activities within the propane peaking facility, a deposit of tar-like material was discovered. A sample of the tar was sent to RETEC's

Pittsburgh laboratory for hydrocarbon identification. The results of the analysis indicate that the tar-like material is an MGP residual. An investigation will be completed in the area of the tar accumulation. The investigation will include:

- **Test Pits-** A total of two test pits (TP12 and TP13) will be completed adjacent to the vaporizers as shown in Figure 2.1. The objective of the test pits is to determine the nature and depth of the tar-like materials.

- **Soil Borings-** Five direct push soil borings (SG29-SG32) will be completed using an "inside out" approach to determine the areal extent of the accumulation of tar-like material. Note that, for health and safety concerns within the facility, some borings may be completed by hand augering methods.

- **Monitoring Well Installation-** The results of the soil boring program will be used to locate an additional monitoring well (MW10). The objective of the well will be to determine whether the deposits of tar-like material have impacted site groundwater and if so, whether there is potential that Village of Suffern Well #2 may be impacted.

- **Additional Test Pits-** Three test pits (TP14, TP15 and TP16) will be completed along the rail spur between the MGP and the propane plant. The objective of the test pits will be to further define the presence of MGP residuals found at the propane peaking facility.

- **RCRA Hazardous Waste Sampling-** One sample will be collected during test pit activities for analysis of full RCRA hazardous waste characterization. The sample location will be determined in the field.

## 2.4 Groundwater Testing

After the new monitoring wells have been developed, a complete round of depth to water measurements will be taken for all new and existing site wells. The data will be used to update the PSA site wide map of groundwater flow. All the new wells and previously installed monitoring wells will then be purged and sampled for MGP indicators and for intrinsic biodegradation parameters which are described in Section 6.6.

Additional water level measurements will be collected at the site to assess the effects of groundwater pumping by the Village of Suffern water wells on flow direction from the former MGP. Water levels will be obtained when: 1) no village wells are pumping (if possible); 2) municipal well #3 is pumping; and 3) when municipal well #2 is pumping. The water level measurements will be taken when the aquifer has reached steady-state flow conditions under these flow regimes. Additional rounds of water level

measurements will be made to confirm the steady-state conditions. This work will be closely coordinated with the Village of Suffern Water Department.

## 2.5 Site Survey

A survey will be performed for the Suffern MGP site at the conclusion of Addendum field activities. The survey will be completed by O&R personnel. O&R's surveyors are licenced by the State of New York to perform this work. The survey will include the following:

- The location, elevation of ground surface, elevation of top of outer casing, and elevation of PVC well riser (reference elevation) for each monitoring well (previously installed and new).

- The location of important site features such as buildings, roadways, and MGP structures where present, etc.

- The location of the property boundary.

The data will be tied into the nearest site USGS benchmark to ensure all groundwater elevation data is Mean Seal Level datum. Additional survey data will be transferred in the form of a digital computer file and used to update existing PSA base maps for the site.

# 3 Middletown- Fulton Street MGP Site

Additional PSA work at the Middletown- Fulton Street MGP site will be completed within, and downgradient of, the former MGP and former Holder B foundation as shown on Figure 3-1. Visibly impacted fill and soil, DNAPL, impacted groundwater and tar-like materials were found in these areas. Addendum activities are described in the following sections. The sampling plan is summarized in Table 3-1.

## 3.1 Historical Records Review

During the 1970s, an urban renewal project was undertaken by the City of Middletown which widened Fulton Street into the area of the former MGP. A records review will be completed to determine if contact with MGP residuals was noted by persons completing the construction of the roadbed or during the installation of subsurface utilities. The review will include a search of relevant written records and interviews (if possible) with persons with direct knowledge of the construction. Engineering drawings for the reconstruction of the street and underground utilities will also be reviewed, if available.

## 3.2 Former MGP Building

Additional environmental data will be collected from within, and downgradient of, the former MGP building (and former tank area). PSA sampling found tar-like material and impacted fill within the footprint of the former MGP meter room (SG9) and at the tank location (SG8). Investigation work will include:

- **Soil Borings-** A total of two additional direct push soil borings (SG14 and SG15) will be completed along Canal Street to determine whether MGP residuals are present at this location.

- **Test Pit-** A test pit (TP1) will be completed at the location shown on Figure 3-1 to further delineate the MGP residuals found at SG9. The test pit will start at the intersection of Fulton and Canal Streets and extend to the location of the former generator building. At the conclusion of the test pit activities, the modern landscaping along Fulton Street will be restored by O&R.

- **Monitoring Well Installation-** A shallow (water table) monitoring well (MW8) will be installed downgradient of the former meter room to further define impacts found in SG9. The well will be located within the median of Fulton Street. If drilling is restricted at this location, the well will be installed across Fulton Street on the road way right-of-way.

# Table 3-1 Middletown-Fulton Street Gas Plant Site Proposed Sample Locations (Continued)

| Sample Type and Designation | Sample Analysis | Sample Depth | Rationale |
|---|---|---|---|
| **Monitoring Wells** | | | |
| MW9 | MGP Indicators | water table | To investigate impacts down gradient of MW6- recommended by RETEC [RETEC, 1997e, pg.8-6] |
| MW10 | MGP Indicators | deep aquifer | To investigate groundwater quality at deeper aquifer depths- requested by NYSDEC [NYSDEC, 1997b, pg.4] |
| **Site Monitoring Wells** | | | |
| MW1 to MW7 | MGP Indicators | water table | Resample existing monitoring wells to confirm PSA results- requested by NYSDEC [NYSDEC, Comments, 1997b, pg. 4] for well MW6. |
| **Utility Samples** | | | |
| U1 | MGP Indicators | NA | Soil sample taken to investigate potential MGP residuals in water line bedding material- recommended by RETEC [RETEC, 1997e, pg.8-6 ]. |
| U2 | MGP Indicators | NA | Soil sample taken to investigate potential MGP residuals in water line bedding material- recommended by RETEC [RETEC, 1997e, pg.8-6 ]. |
| U3 | MGP Indicators | NA | Soil sample taken to investigate potential MGP residuals in water line bedding material- recommended by RETEC [RETEC, 1997e, pg.8-6]. |
| U4 | MGP Indicators | NA | Water sample taken to investigate potential MGP residuals in storm sewer at up gradient location- recommended by RETEC [RETEC, 1997e, pg.8-6 ]. |
| U5 | MGP Indicators | NA | Water sample taken to investigate potential MGP residuals in storm sewer line at down gradient location- recommended by RETEC [RETEC, 1997e, pg.8-6] |
| U6 | MGP Indicators | NA | Water sample taken at up gradient location to investigate surface water quality entering Mohegan Brook Culvert- recommended by RETEC [RETEC, 1997e, pg.8-6] |
| U7 | MGP Indicators | NA | Water sample taken at down gradient location to investigate potential MGP residuals entering Mohegan Brook Culvert- recommended by RETEC [RETEC, 1997e, pg.8-6] |
| U8 | MGP Indicators | NA | Sediment sample taken at down gradient location (where culvert meets surface) to investigate potential MGP residuals in Mohegan Brook Culvert-requested by NYSDEC [NYSDEC, 1997b, pg. 4] |
| **Field QC Samples** | | | |
| trip blanks | VOC | NA | one blank per cooler shipment |
| equipment blanks | VOC and PAH | NA | one blank for soil sampling |
| field duplicates | MGP Indicators | NA | one duplicate soil and groundwater sample |

Notes: MGP Indicators include: VOC by 95-1, PAH by 95-2, total cyanide by CLP-M, TAL metals by CLP-M and weak acid dissociable cyanide by 4500 CNI.

Field Characterization includes: visual characterization- Unified Soil Classification System, visual and olfactory observations regarding the presence of MGP impacts and jar headspace screening with a photo-ionization detector. Note that, no field screening for soil gas will be done during the Addendum sampling.

## 3.3 Holder B

An investigation of soil and groundwater quality downgradient of Holder B will be completed to further delineate hydrocarbon product found in soil and impacted groundwater in this area. The investigation will include the following:

- **Direct Push Soil Borings-** Two soil borings will be completed south of Holder B to further assess conditions immediately adjacent to (SG16), and downgradient of (SG17), the holder foundation.

- **Geotechnical Soil Borings-** Two soil borings (GTB1 and GTB2) will be completed near Holder B to obtain geotechnical data for an underpinning study.

- **Test Pit-** A test pit (TP2) will be completed in the grassy strip adjacent to the Fulton Street sidewalk as shown on Figure 3-1. The objective of the test pit will be to further delineate the presence of MGP residuals in this area and to obtain additional information regarding the presence of MGP residuals in the glacial till unit. At the conclusion of the test pit activities, the modern landscape will be restored by O&R.

- **Deep Soil Boring-** A deeper soil boring (SB10) will be completed in the vicinity of MW6 to investigate the depth of MGP impacts at this location and to further investigate the nature of the glacial till unit.

- **Monitoring Well Installation-** One water table monitoring well (MW9) will be installed downgradient of the impacted soil and groundwater found in MW6. The well will be located in the median in Fulton Street. If drilling is restricted at this location, the well will be installed across Fulton Street on the roadway right-of-way. A monitoring well (MW10) will also be installed within the deep soil boring adjacent to MW6.

## 3.4 Underground Utilities Sampling

Subsurface utilities which run adjacent to, and beneath, Fulton Street will be sampled (if possible) to determine if MGP residuals are migrating off-site via utility lines or bedding materials.

- **Water Line-** The water line bedding material, which runs beneath the sidewalk adjacent to Fulton Street, will be sampled, if possible, to determine if MGP residuals are present (samples U1, U2 and U3). Hand augering techniques only will be used for this task. The work will be closely coordinated with the City of Middletown. Note that, this work may be

combined with test pit excavation in the adjacent grassy strip along the Fulton Street sidewalk.

- **Storm Sewer-** The storm sewer line which carries storm water beneath Fulton Street will be sampled (if possible) to determine if the sewer is a potential receptor of impacted groundwater (samples U4 and U5).

- **Monhegan Brook Culvert-** Prior to the early 1960s, the Monhegan Brook and an unnamed steam to the west flowed across the Post Office Property in a concrete box culvert. During a urban renewal project in the 1960s, the flow was diverted from the culvert into the storm sewer system beneath Fulton Street. A video inspection of the culvert was performed by Wehran Engineers [Wehran, 1992] during a Phase II investigation of the Post Office site. The inspection found that sand, gravel and cobbles were present in the box culvert in varying thicknesses. No surface water flow was noted in the Wehran report. No indications of elevated organic vapor levels (photo-ionization detector) or odors were detected at the entry point for the investigation (a borehole in the top of the culvert near the southeast corner of the Post Office Building). To further determine if the culvert is a potential receptor of contaminated groundwater or NAPL, three utility samples will be collected during Addendum field activities. The samples include: 1) a water sample (U6) collected upstream of the site (Wawyanda Avenue area); 2) a water sample (U7) collected down steam of the site; and 3) a sediment sample (U8) collected from the culvert as it leaves the site or reaches the surface. Note that, since the culvert is abandoned, access points for sampling and surface water flow may be limited. Additional information regarding access points and abandonment of the culvert will be requested from the City during the historical records review.

## 3.5 Groundwater Testing

New wells installed at the site will be developed and allowed to stabilize. A complete round of depth to water measurements will be collected followed by purging and sampling of the new wells and all of the existing site wells.

## 3.6 Site Survey

A survey will be performed for the Middletown- Fulton Street MGP site at the conclusion of Addendum field activities. The survey will be completed by O&R personnel. O&R's surveyors are licenced by the State of New York to perform this work. The survey will include the following:

- The location, elevation of ground surface, elevation of top of outer casing, and elevation of PVC well riser (reference elevation) for each monitoring well (previously installed and new).

- The location of important site features such as buildings, roadways, and MGP structures where present, etc.

- The location of the property boundary.

The data will be tied into the nearest site USGS benchmark to ensure all groundwater elevation data is Mean Seal Level datum. Additional survey data will be transferred in the form of a digital computer file and used to update existing PSA base maps for the site.

# 4 Haverstraw- Clove & Maple MGP Site

Additional PSA investigation work at the Clove & Maple MGP site will focus on the tar well area, the gas holder foundation area, and the iron oil tank area, as shown in Figure 4-1. Visibly impacted soil, groundwater and DNAPL were found in these areas during the initial phase of the PSA investigation. The Addendum work is discussed below and is summarized in Table 4-1.

## 4.1 Former Tar Well

The areas of the former tar well was found to be impacted with MGP residuals during the PSA investigation. Additional sampling will be completed to further define the extent of the impacts. Investigative work will include:

- **Test Pit-** A test pit (TP1) will be excavated within the footprint of the former tar well to further investigate the presence of subsurface structures, if any, and to determine the extent of hydrocarbon product found in subsurface soil.

- **Soil Borings-** Two direct push soil borings (SG9 and SG10) will be completed downgradient of the tar well location to determine the extent of MGP residuals at the site property line.

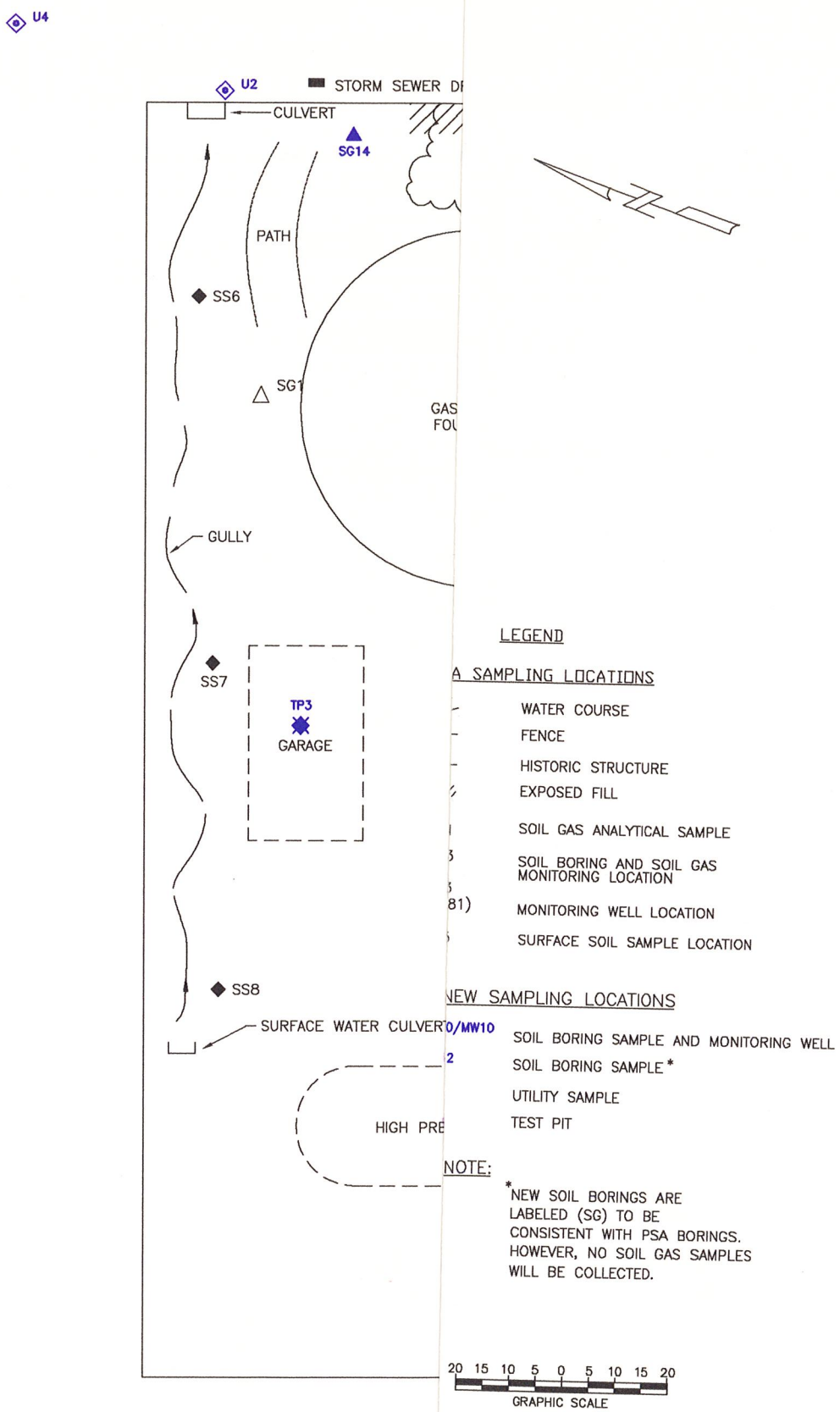
- **Monitoring Well Installation-** The results of the soil borings will be used to locate a water table monitoring well (MW5) to determine if impacted groundwater is present at the site property line (along Maple Avenue).

## 4.2 Iron Oil Tank

Additional environmental data will be collected in the area of the former iron oil tank, an area found to be impacted with DNAPL during the PSA investigation. Investigation activities will include:

- **Test Pit-** A test pit (TP2) will be excavated within the footprint of the former iron oil tank to further investigate the presence of subsurface structures, if any, and to determine the extent DNAPL found at this location.

- **Soil Borings-** Two direct push soil borings (SG11 and SG12) will be downgradient of the former tank to determine if DNAPL is present at the site property boundary along Maple Avenue.




| REFERENCE DWG | DESCRIPTION | NO | DRWN |
|---|---|---|---|
| | | 6 | |
| | | 5 | |
| | | 4 | |
| | | 3 | |
| | | 2 | IGZ |
| | | 1 | IGZ |
| | | 1 | RLL |

**FIGURE 4-1**
LAN AND SAMPLING LOCATIONS
RAW – CLOVE & MAPLE MGP SITE

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# Table 4-1 Haverstraw- Clove & Maple MGP Site Proposed Sample Locations (Continued)

| Sample Type and Designation | Sample Analysis | Sample Depth | Rationale |
|---|---|---|---|
| **Test Pit** | | | |
| TP2 | Field Characterization | 0 to 12 feet bgs | To further delineate DNAPL found at MW2- recommended by RETEC [RETEC, 1997f, pg. 10-7] |
| **Monitoring Wells** | | | |
| MW6 | MGP Indicators | water table | To sample groundwater quality down gradient of the Iron Oil Tank location-recommended by RETEC [RETEC, 1997f, pg. 10-8] |
| MW7 | MGP Indicators | deep aquifer | To determine the depths of groundwater impacts down gradient of the Iron Oil Tank- recommended by RETEC [RETEC, 1997f, pg. 10-7] |
| **Former Gas Holder Location** | | | |
| **Soil Borings** | | | |
| SG13 | Field Characterization | 0 to 12 feet bgs | To investigate soil and groundwater quality down gradient of the gas holder foundation- requested by NYSDEC [NYSDEC Comments, 1997c, pg.4] |
| SG14 | Field Characterization | 0 to 12 feet bgs | To investigate soil and groundwater quality down gradient of the gas holder foundation- requested by NYSDEC [NYSDEC Comments, 1997c, pg.4] |
| SB4/MW4 | MGP Indicators | Most Impacted Interval | Soil boring for monitoring well installation to further investigate impacts down gradient of MW3- - recommended by RETEC [RETEC, 1997f, pg.10-6 ]. |
| **Monitoring Well** | | | |
| MW4 | MGP Indicators | water table | To determine if MGP residuals have impacted down gradient groundwater in the vicinity of the former gas holder- requested by NYSDEC [NYSDEC, 1997c, pg.3] |
| **Monitoring Wells- South Property Boundary** | | | |
| SB8/MW8 | MGP Indicators - Soil and Groundwater | water table and most impacted soil sample | To determine if impacted groundwater is present at site property boundary- Scope of work added by O&R. |
| SB9/MW9 | MGP Indicators - Soil and Groundwater | water table and most impacted soil sample | To determine if impacted groundwater is present at site property boundary- Scope of work added by O&R. |
| SB10/MW10 | MGP Indicators - Soil and Groundwater | water table and most impacted soil sample | To determine if impacted groundwater is present at site property boundary- Scope of work added by O&R. |
| **Existing Monitoring Wells** | | | |
| MW1 to MW3 | MGP Indicators | water table | Resample existing monitoring wells for MGP Indicators to confirm PSA results- recommended by RETEC [RETEC, 1997f, pg. 10-6] |

## Table 4-1 Haverstraw- Clove & Maple MGP Site Proposed Sample Locations (Continued)

| Sample Type and Designation | Sample Analysis | Sample Depth | Rationale |
|---|---|---|---|
| **Utility Samples** | | | |
| U1 | MGP Indicators | NA | Water sample collected up gradient of the site within storm sewer system- requested by NYSDEC [NYSDEC, 1997, pg. 3] |
| U2 | MGP Indicators | NA | Water sample collected down gradient of the site within storm sewer system- requested by NYSDEC [NYSDEC, 1997, pg. 3] |
| U3 | MGP Indicators | NA | Soil sample collected from bedding material around storm sewer to determine if MGP residuals are migrating off site via subsurface utilities- requested by NYSDEC [NYSDEC, 1997, pg. 3] |
| U4 | MGP Indicators | NA | Sediment sample from storm sewer system outfall to determine if MGP residuals are migrating off site via the storm sewer system- requested by NYSDEC [NYSDEC, 1997, pg. 3] |
| **Garage** | | | |
| TP3 | Field Characterization | 0 to 12 feet bgs | Test pit excavation to investigate environmental condition within the footprint of the former garage- scope of work added by O&R. |
| **High Pressure Holder** | | | |
| TP4 | Field Characterization | 0 to 12 feet bgs | Test pit excavation to investigate environmental condition within the footprint of the former above-ground high pressure holder- scope of work added by O&R. |
| **Quality Control Samples** | | | |
| Trip blanks | VOC | NA | one sample per cooler shipment |
| Field Blanks | VOC and PAH | NA | one soil sampling equipment |
| Field Duplicates | MGP Indicators | NA | one soil and one water sample |

Notes: MGP Indicators include: VOC by 95-1, PAH by 95-2, total cyanide by CLP-M, TAL metals by CLP-M and weak acid dissociable cyanide by 4500 CNI.

Field Characterization includes: visual characterization- Unified Soil Classification System, visual and olfactory observations regarding the presence of MGP impacts and jar headspace screening with a photo-ionization detector. Note that, no field screening for soil gas will be done during the Addendum sampling.

## 4.7 Utility Line Sampling

The subsurface utility lines beneath Maple Avenue will be investigated to determine if lines (U1 and U2) or bedding material (U3) is acting as a potential receptor of contaminated groundwater or DNAPL at the site. The storm sewer line beneath Maple Avenue will be sampled (if possible) at an upgradient (U1) and downgradient (U2) locations for storm water and/or sediments. An investigation into the location of additional utility lines will be undertaken in close coordination with the Village of Haverstraw and the Underground Facilities Protection Organization.

## 4.8 Site Survey

A survey will be performed for the Haverstraw- Clove & Maple MGP site at the conclusion of Addendum field activities. The survey will be completed by O&R personnel. O&R's surveyors are licenced by the State of New York to perform this work. The survey will include the following:

- The location, elevation of ground surface, elevation of top of outer casing, and elevation of PVC well riser (reference elevation) for each monitoring well (previously installed and new).
- The location of important site features such as buildings, roadways, and MGP structures where present, etc.
- The location of the property boundary.

The data will be tied into the nearest site USGS benchmark to ensure all groundwater elevation data is Mean Seal Level datum. Additional survey data will be transferred in the form of a digital computer file and used to update existing PSA base maps for the site.

# 5 Haverstraw- Maple & West MGP Site

Additional work planned for the Haverstraw- Maple & West site will target the area to the north and east of the former gas holder location, as shown in Figure 5-1. Visibly impacted soil and groundwater were found in these areas. The Addendum field work is discussed below and summarized in Table 5-1.

## 5.1 Field Work

Investigative work will include:

- **Test Pits-** A total of three test pits will be excavated at the site. Test pit TP2 will be completed near SG1. Test pit TP3 will be completed to confirm the location and contents of the former gas holder and TP4 will be completed near MW1 to further investigate the presence of impacted soil and groundwater at this location.

- **Soil Borings-** A total of two direct push soil borings (SG8 and SG9) will be completed to further delineate the extent of impacted soil at the eastern boundary of the site. Note that, the borings may be completed to the east of the site in the alley.

- **Monitoring Well Installation-** The results of the direct push borings will be used to locate water table monitoring well MW3. Due to the small size of the site, it will be necessary to install this well to the east in the alley. An additional well (MW2) will be installed in the north western portion of the site, as shown on Figure 5-1, to determine the flow direction of groundwater across the site.

## 5.2 Groundwater Testing

After the new monitoring wells have been developed, a complete round of depth to water measurements will be taken for the site wells. The data will be used to complete a site wide map of groundwater flow. The new wells and the previously installed monitoring well will then be purged and sampled for MGP indicators and for intrinsic biodegradation parameters which are described in Section 6.6.

# Table 5-1 Haverstraw-Maple & West MGP Site Proposed Sample Locations (Continued)

Notes: MGP Indicators include: VOC by 95-1, PAH by 95-2, total cyanide by CLP-M, TAL metals by CLP-M and weak acid dissociable cyanide by 4500 CNI.

Biodegradation Parameters include electron receptors (nitrate, iron (total and $Fe^{2+}$), manganese, sulfate, sulfide) and dissolved gases (carbon dioxide, oxygen, nitrogen, methane).

Field Characterization includes: visual characterization- Unified Soil Classification System, visual and olfactory observations regarding the presence of MGP impacts and jar headspace screening with a photo-ionization detector. Note that, no field screening for soil gas will be done during the Addendum sampling.

## 5.2 Site Survey

A survey will be performed for the Haverstraw- Maple & West MGP site at the conclusion of Addendum field activities. The survey will be completed by O&R personnel. O&R's surveyors are licenced by the State of New York to perform this work. The survey will include the following:

- The location, elevation of ground surface, elevation of top of outer casing, and elevation of PVC well riser (reference elevation) for each monitoring well (previously installed and new).

- The location of important site features such as buildings, roadways, and MGP structures where present, etc.

- The location of the property boundary.

The data will be tied into the nearest site USGS benchmark to ensure all groundwater elevation data is Mean Seal Level datum. Additional survey data will be transferred in the form of a digital computer file and used to update existing PSA base maps for the site.

# 6 Field and Analytical Sampling Procedures

This section describes the field and analytical sampling procedures which will be used during the Addendum work at the sites. The field work described in this section is concerned with methods to be employed for deeper drilling, not originally described in the PSA Work Plan. Additional information regarding field methods is provided in RETEC's Standard Operating Procedures in the PSA Work Plan and in the project QAPP. The soil and groundwater sampling to assess the MGP indicator parameters will follow the same analytical program regarding data quality objectives (DQOs), analytical methods, and quality assurance/quality control (QA/QC) as outlined in the PSA Work Plan. In addition, biological indicator parameters will be measured, and these procedures are outlined in this section of the PSA Addendum Work Plan.

## 6.1 Test Pits

A rubber-tired backhoe will be utilized to investigate the environmental condition of subsurface soil or subsurface structures. Test pits will be completed as follows:

- The backhoe bucket will be used to excavate a trench approximately 12 to 14 feet below ground surface at the designated locations.
- Soil samples will be collected continuously from ground surface to the final depth within each test pit.
- Soil samples will be either collected directly from the backhoe bucket or from the trench wall if proper safety protocols are followed.
- The samples will be visually characterized using the Unified Soil Classification System and screened for the presence of organic vapors with a photoionization detector (PID) using the "jar headspace" method of analysis.
- Groundwater samples from the test pits will be collected, if possible, and screened using the PID and the jar headspace method.
- All soil will then be returned to the test pit excavations using a "last out/first in" procedure to ensure that no visually contaminated material is left exposed at ground surface.

- The backhoe bucket will be cleaned with a hot-water pressure washer in a designated decontamination area.

## 6.2 Subsurface Soil Borings

Deeper drilling conducted at each site will follow a phased approach. Initially, direct push soil borings will be advanced to define the nature and extent of the contamination at specific locations. Based on the results of the direct push borings, deeper soil borings will be advanced to further delineate DNAPL source areas and to define stratigraphic controls on the movement and distribution of the DNAPL. Great care will be exercised during the drilling of these soil borings to avoid causing the downward movement of DNAPL or DNAPL contaminated soil. Borings will be advanced as follows:

- Hollow stem auger (HSA) drilling techniques will initially be used to advance the deeper soil borings.

- If DNAPL is encountered in a boring, field methods will be modified to ensure that shallow contaminated zones are isolated from deeper zones.

- HSA methods will be used to advance the borehole until the next barrier layer is encountered.

- A surface casing will then be placed into the borehole and extended into the barrier layer a minimum of two feet.

- The boring will then be advanced through the surface casing to the total depth.

- The boring will be finished as a monitoring well installation or be abandoned by grouting. Note that, for the well installations, the surface casing will be grouted in place prior to well installation and/or advancing the borehole to deeper depths.

## 6.3 Well Installation

Wells installed using HSA techniques will follow procedures described in the PSA Work Plan. Procedures for wells installed in casings will modified as follows:

- The surface casing will be grouted by the tremie method from the bottom of the borehole to within 2 feet of the ground surface. The tremie will be placed in the annular space on the outside of the casing.

- A minimum of 24 hours will be allowed for the grout to cure prior to additional subsurface work.

- Spring loaded stainless-steel centralizers will be used to center the screen and well casing within the deeper boreholes (deeper than 50 feet). At a minimum, the centralizers will be placed at the bottom of the screen and near the top of the well. The centralizers will be aligned on the well casing to facilitate the subsequent insertion of the tremie pipe to the bottom of the hole for placement of well materials.

- Wells will then be constructed and developed according to SOPs found in the PSA Work Plan. As appropriate, well screen slot size will be modified to a 20 slot screen to allow for optimal collection of DNAPL over the interval of interest.

## 6.4 Borehole Abandonment

Each deep borehole not used for a well installation will be grouted immediately following the completion of the soil sampling to prevent cross-contamination of permeable zones. The boreholes will be grouted with a cement/bentonite grout mixture with the following specifications:

- Bentonite will be powdered sodium montmorillonite furnished in moisture resistant sacks without additives.

- Cement shall be a low-alkaline Portland cement, Type I in conformance with ASTM C-150 and without additives.

The cement/bentonite grout mixture shall be to the following proportion:

- one sack (94 pounds) of Type I Portland cement;
- 5 percent bentonite by weight; and
- 8.5 gallons of water.

The cement will be mechanically mixed, above ground, with water from an appropriate (potable water) source. Bentonite will be added to ensure a lump-free consistency. The mixture will be pumped through a tremie pipe placed approximately six inches above the bottom of the borehole as the drill is being withdrawn.

## 6.5 Geotechnical Evaluation

Geotechnical testing will be performed in the vicinity of the Suffern MGP gas-oil house and the bodyshop building at Middletown. Standard penetration testing will be

performed to obtain blow counts from soil borings in the areas around the structures which may be disturbed by remedial excavations. Soil samples will be collected for classification, and depth to groundwater will be determined. Additional laboratory tests to assess engineering characteristics of the soil may be performed if cohesive soils are encountered which may influence the foundation stability (none are expected, however, based on existing subsurface logs). The soil boring data will be used to evaluate whether the gas-oil house at Suffern and Holder B at Middletown can be excavated to remove the MGP residuals inside without compromising the foundation and structural stability of the site buildings.

## 6.6 Soil and Groundwater Sampling for Monitoring of MGP Indicator Parameters

Soil and groundwater samples will be collected for analysis of the following constituents:

- Volatile Organic Carbons (VOCs) by New York State ASP 95-1;
- Polynuclear Aromatic Hydrocarbons (PAHs) by New York State ASP 95-2;
- Target Analytical List (TAL) Metals by New York State ASP CLP-M;
- Total Cyanide by New York State ASP CLP-M; and
- Weak Acid Dissociable Cyanide by Standard Methods, 18th Edition, Method 4500 CN-I.

The soil and groundwater sampling and decontamination procedures, DQOs, field QC samples, sample designations, and sample handling and chain-of-custody methods are outlined in the PSA Work Plan, Section 5. Soil samples will be containerized as outlined in the PSA Work Plan. Groundwater samples will be containerized as indicated in Table 6-1.

## 6.7 Groundwater Sampling For Monitoring of Intrinsic Biodegradation

### 6.7.1 Well Purging

Before groundwater samples are collected each well will be purged. The purpose of purging the well is to insure that the analytical results of the samples collected are representative of the aquifer surrounding the well. Water will be purged with a peristaltic pump equipped with ½-inch inner diameter (ID) polyethylene tubing. The inlet of the tubing will be lowered to six inches below the static water level in the well. Water will then be pumped from the well at a low flow rate, so that fine-grained soil is not disturbed in the well casing, sandpack, or surrounding formation. During purging, the maximum sustainable pumping rate will be measured for reference during sampling.

## Table 6-1 MGP Indicator Sample Containerization

| Analysis | Bottle Type | Preservation | Holding Time |
|---|---|---|---|
| BTEX | 3 - 40 ml glass vials | HCl to pH <2, cool to 4°C | 7 days |
| PAH | 2 - 1000 ml amber glass | cool to 4°C | 5 days to extraction |
| Metals (including manganese and total iron) | 1 - 1000 ml plastic | $HNO_3$ to pH < 2, cool to 4°C | 28 days |
| Total Cyanide | 1 - 1000 ml plastic | NaOH to pH > 12, cool to 4°C | 14 days |
| Weak Acid Dissociable Cyanide | 1 - 1000 ml plastic | NaOH to pH > 12, cool to 4°C | 14 days |

The maximum sustainable pumping rate will be defined as the rate which does not lower the water level in the well by more than six inches.

At the ground surface, the water will pass through a sealed chamber containing probes which will measure the water temperature, pH, conductivity, oxidation-reduction potential, and dissolved oxygen. At regular intervals grab samples will be obtained from the outlet of the chamber for turbidity measurements using a field meter. After passing through this chamber, the water will be discharged to a calibrated five-gallon bucket where the pumping rate will be measured with a watch. When this bucket is full, the water will be poured into a 55-gallon drum or tank where it will be stored at the site for future disposal.

Groundwater analytical samples will be collected when the change between successive readings of temperature, pH and conductivity is less than 10%, and turbidity is reduced to 5 NTU or less. This may occur prior to removal of three well volumes. Stabilization of groundwater measurements will be indicative of sampling of fresh formation water and is a more reliable indicator of purging than removal of a standard volume of water.

### 6.7.2 Groundwater Sampling of Biological Indicator Parameters

Laboratory samples will be obtained following the completion of purging. Samples will be placed into laboratory supplied bottles as specified in Table 6-2. To obtain the samples, the polyethylene tubing will be lowered in the well to the midpoint of the well screen, and the pumping rate lowered to less than or equal to the maximum sustainable pumping rate. Two one-liter amber glass sample jars for PAH analysis will be filled

## Table 6-2 Biological Indicator Sample Containerization

| Analysis | Bottle Type | Preservation | Holding Time |
|---|---|---|---|
| Ferrous Iron | 1 - 500 ml plastic | HCl to pH < 2, cool to 4°C | ASAP* |
| Total Iron | 1 - 1000 ml plastic | $HNO_3$ to pH < 2, cool to 4°C | 6 months |
| Nitrate | 1 - 250 ml plastic | $H_2SO_4$ | 28 Days |
| Sulfate | 1 - 500 ml plastic | untreated | 28 Days |
| Sulfide | 1 - 500 ml plastic | NaOH + ZnAOC | 7 Days |
| Carbon Dioxide Oxygen, Nitrogen | 2 - 40 ml VOA vials with lined septum | untreated | 14 Days |
| Methane | 2 - 40 ml glass vials with aluminum-lined septum cap | cool to 4°C | ASAP* |

* Specialized analytical method with no published holding time; analysis should be performed as soon as possible following receipt by laboratory.

directly from the outlet of the sampling pump, followed by a one-liter plastic bottle preserved with nitric acid for the total metals analysis. Samples will also be collected for analysis of total ferrous iron and dissolved methane.

After sampling using the pump is complete, the polyethylene tubing will be removed from the well and a bailer will be used to collect a water sample for BTEX analysis. Three 40-ml VOC vials with Teflon lined septa caps and HCl preservative will be filled directly from the bailer. The VOC vials will be overfilled so a convex meniscus forms at the top of the container. The cap will then be tightened so the Teflon septa expands beyond the top of the cap. Care will be taken to ensure that no bubbles are in the sample vials.

A set of trip blanks will accompany the samples to the laboratory to be analyzed for volatile organic compounds.

### 6.7.3 Laboratory Analyses for Biological Indicator Parameters

Groundwater samples will be analyzed for constituents which would be indicative of the natural biodegradation of organic MGP residuals at the site. Analyses of biological indicator parameters will be performed by Lancaster Laboratories of Lancaster, Pennsylvania and Microseeps of Pittsburgh, Pennsylvania, as indicated below.

Routine monitoring of biological activity will be performed using the field measurements and by laboratory analysis of the following potential electron acceptors or metabolic by-products using the designated methods:

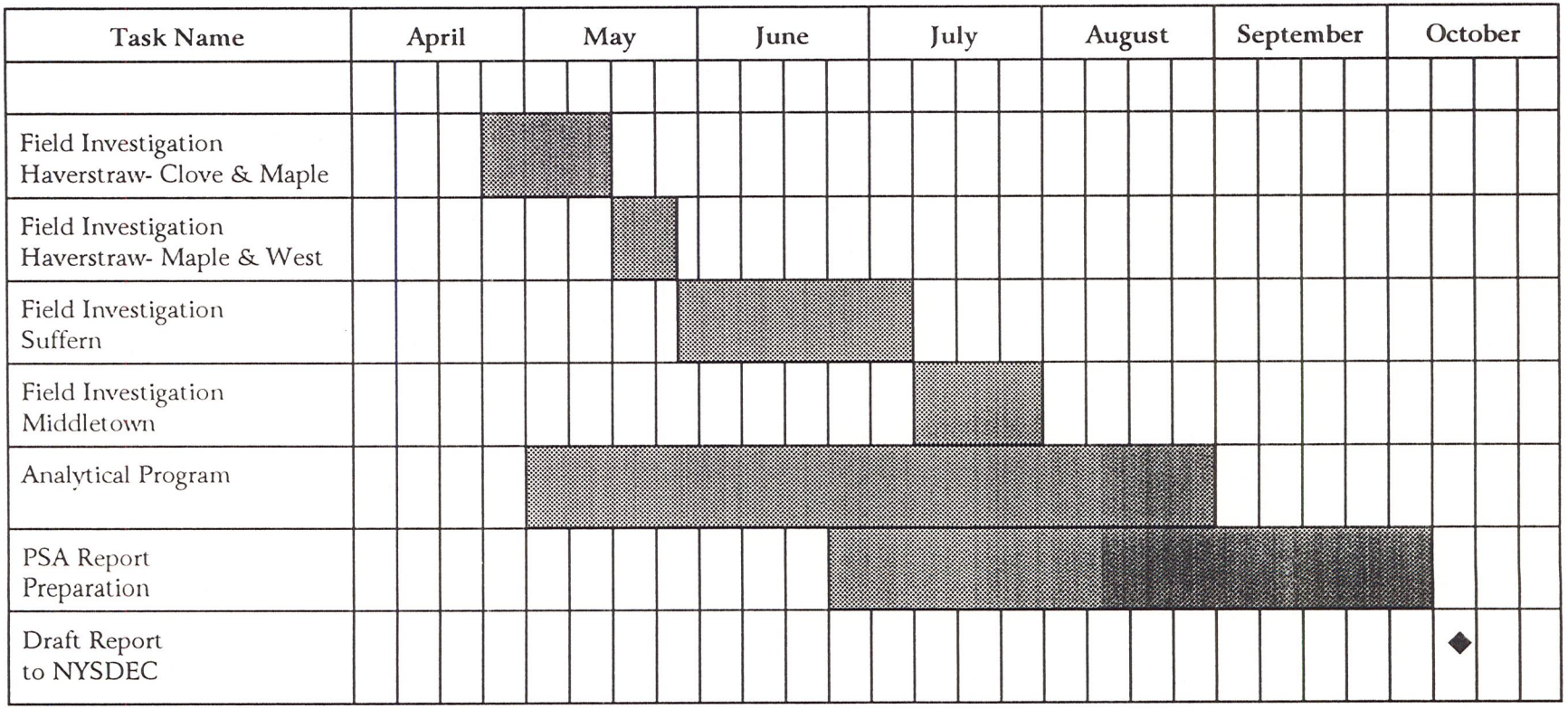
- Electron receptors (to be analyzed by Lancaster Laboratories)
  - nitrate (EPA 353.2);
  - total iron (EPA 200.7);
  - ferrous iron - $Fe^{+2}$ (Standard Methods, 18th Edition, Method 3500-Fe-D);
  - manganese (EPA 200.7);
  - sulfate (EPA 375.4); and
  - sulfide (EPA 377.1).

- Dissolved gases (by GC) (to be analyzed by Microseeps)
  - carbon dioxide;
  - oxygen;
  - nitrogen; and
  - methane.

# 7 Project Schedule

A schedule of project activities with milestones is presented as a bar chart in Figure 7-1.

## Figure 7-1 Project Schedule
## Orange & Rockland Utilities, Inc.
## Suffern, Middletown, and Haverstraw MGP Sites



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RETEC, 1997e, Preliminary Site Assessment Report for Middletown, New York, Former Manufactured Gas Plant Site, Orange & Rockland Utilities, Inc., August 1997.

RETEC, 1997f, Preliminary Site Assessment Report for Two Former Manufactured Gas Plant Sites, Haverstraw, New York, Orange & Rockland Utilities, Inc., August 1997.

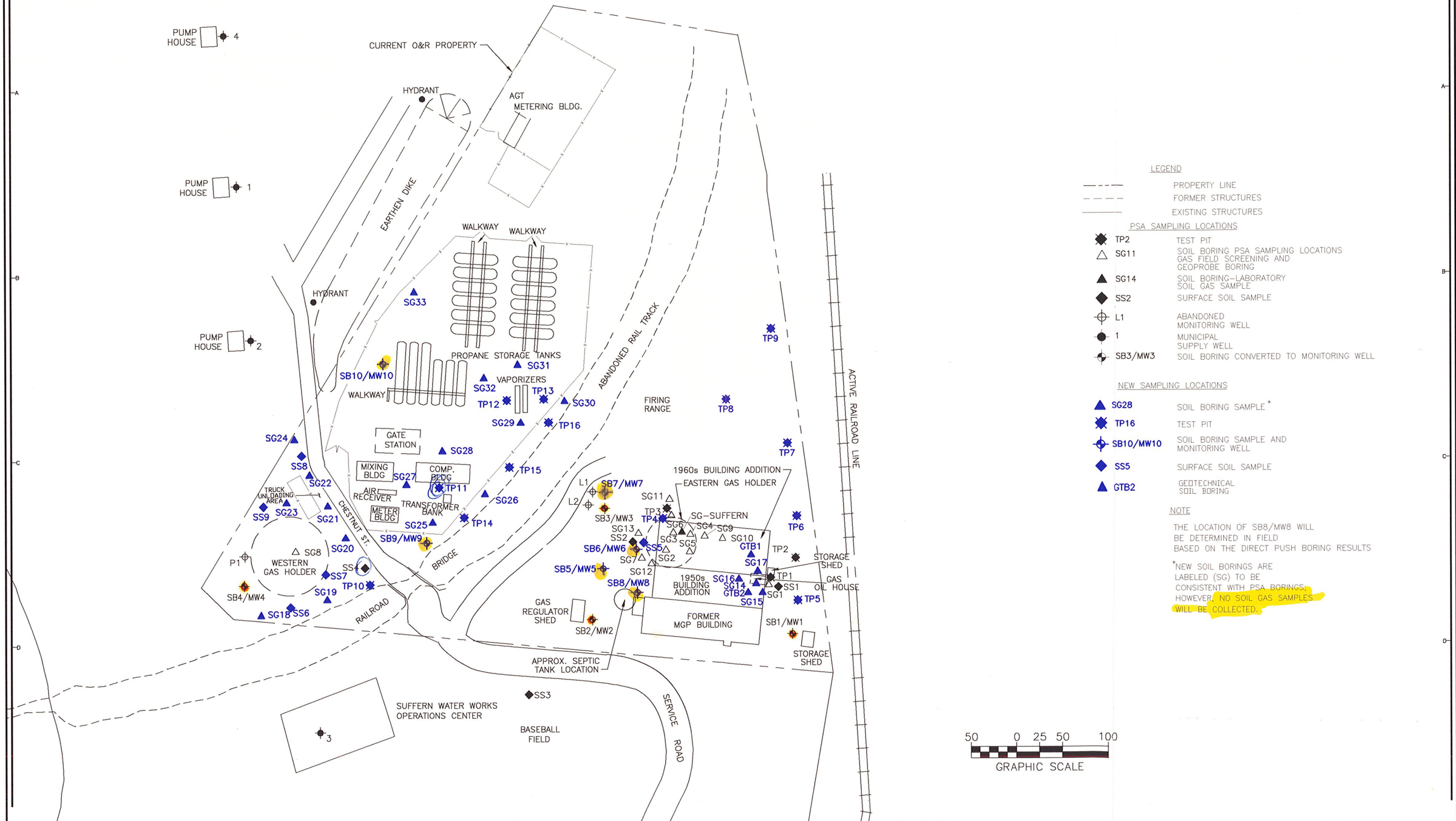
Wehran - New York, Inc., 1992. "Phase II Hazardous Materials Site Assessment, USPS-Fulton Street Middletown, New York.

# Table 3-1 Middletown-Fulton Street MGP Site Proposed Sample Locations

| Sample Type and Designation | Sample Analysis | Sample Depth | Rationale |
|---|---|---|---|
| **Former MGP Building** | | | |
| **Soil Borings** | | | |
| SB8/MW8 | MGP Indicators | most impacted sample | Shallow soil boring for monitoring well installation down gradient of former MGP building- recommended by RETEC [RETEC, 1997e, pg. 8-5] |
| SG14 | Field Characterization | 0 to 12 feet bgs | To determine the areal extent of MGP residuals adjacent to Canal Street- recommended by RETEC [RETEC, 1997e, pg. 8-5] |
| SG15 | Field Characterization | 0 to 12 feet bgs | To determine the areal extent of MGP residuals adjacent to Canal Street- recommended by RETEC [RETEC, 1997e, pg. 8-5] |
| **Test Pit** | | | |
| TP1 | Field Characterization | 0 to 12 feet bgs | To further delineate MGP residuals found in SG9 and down gradient of the former tank location (SG8)- recommended by RETEC [RETEC, 1997e, pg. 8-6] |
| **Monitoring Well** | | | |
| MW8 | MGP Indicators | water table | To test groundwater down gradient of SG9- recommended by RETEC [RETEC, 1997e, pg 8-6] |
| **Holder B** | | | |
| **Soil Borings** | | | |
| SG16 | Field Characterization | 0.0 to 12 feet bgs | To further delineate MGP residuals found in soil and groundwater adjacent to Holder B- recommended by RETEC [RETEC, 1997e, pg. 8-6] |
| SG17 | Field Characterization | 0.0 to 12 feet bgs | To further delineate MGP residuals found in soil and groundwater down gradient of Holder B- recommended by RETEC [RETEC, 1997e, pg. 8-6] |
| SB9/MW9 | MGP Indicators | most impacted interval | To investigate presence of impacted soil and groundwater down gradient of MW6- recommended by RETEC [RETEC, 1997e, pg. 8-6] |
| SB10/MW10 | MGP Indicators | Most Impacted Interval | Deep boring for monitoring well installation to further delineate depth of MGP residuals in the vicinity of MW6- requested by NYSDEC [NYSDEC Comments, 1997b, pg. 4] |
| **Geotechnical Borings** | | | |
| GTB1 | Geotechnical Data | 0 to 16 feet bgs | HSA boring to obtain geotechnical data for underpinning study - recommended by RETEC |
| GTB2 | Geotechnical Data | 0 to 16 feet bgs | HSA boring to obtain geotechnical data for underpinning study - recommended by RETEC |
| **Test Pit** | | | |
| TP2 | Field Characterization | 0 to 12 feet bgs | To further delineate MGP residuals found in soil and groundwater down gradient of Holder B- recommended by RETEC [RETEC, 1997e, pg. 8-6] |

# Table 5-1 Haverstraw-Maple & West MGP Site Proposed Sample Locations

| Sample Type and Designation | Sample Analysis | Sample Depth | Rationale |
|---|---|---|---|
| **Soil Borings** | | | |
| SG8 | Field Characterization | 0 to 12 feet bgs | To further delineate hydrocarbon impacted soil to the east of MW1-recommended by RETEC [RETEC, 1997f, pg.10-8] |
| SG9 | Field Characterization | 0 to 12 feet bgs | To further delineate hydrocarbon impacted soil to the east of MW1- recommended by RETEC [RETEC, 1997f, pg.10-8] |
| SB2/MW2 | MGP Indicators | Most Impacted Interval | Shallow soil boring for monitoring well installation up gradient holder for groundwater flow direction and up gradient groundwater quality- recommended by RETEC [RETEC, 1997f, pg.10-8] |
| SB3/MW3 | MGP Indicators | Most Impacted Interval | Shallow soil boring for monitoring well installation down gradient of site-recommended by RETEC [RETEC, 1997f, pg.10-8] |
| **Monitoring Wells** | | | |
| MW1 | MGP Indicators, Biodegradation parameters | Water Table | Resample existing well- recommended by RETEC [RETEC, 1997f, pg. 10-8] |
| MW2 | MGP Indicators, Biodegradation parameters | Water Table | To establish site groundwater flow direction and to test groundwater quality-recommended by RETEC [RETEC, 1997f, pg.10-8] |
| MW3 | MGP Indicators, Biodegradation parameters | Water Table | To establish site groundwater flow direction and to test groundwater quality-recommended by RETEC [RETEC, 1997f, pg.10-8] |
| **Test Pits** | | | |
| TP2 | Field Characterization | 0 to 12 feet bgs | To further investigate impacts found at SG1 and to investigate subsurface conditions adjacent to the holder foundation-recommended by RETEC [RETEC, 1997f, pg. 10-8] |
| TP3 | Field Characterization | 0 to 12 feet bgs | To further investigate the holder subsurface structure- recommended by RETEC [RETEC, 1997f, pg 10-8] |
| TP4 | Field Characterization | 0 to 12 feet bgs | To further investigate the subsurface conditions in the area of MW1-recommended by RETEC [RETEC, 1997f, pg.10-8] |




LEGEND

PROPERTY LINE
FORMER STRUCTURES
EXISTING STRUCTURES

PSA SAMPLING LOCATIONS

| | |
|---|---|
| TP2 | TEST PIT |
| SG11 | SOIL BORING PSA SAMPLING LOCATIONS GAS FIELD SCREENING AND GEOPROBE BORING |
| SG14 | SOIL BORING–LABORATORY SOIL GAS SAMPLE |
| SS2 | SURFACE SOIL SAMPLE |
| L1 | ABANDONED MONITORING WELL |
| 1 | MUNICIPAL SUPPLY WELL |
| SB3/MW3 | SOIL BORING CONVERTED TO MONITORING WELL |

NEW SAMPLING LOCATIONS

| | |
|---|---|
| SG28 | SOIL BORING SAMPLE * |
| TP16 | TEST PIT |
| SB10/MW10 | SOIL BORING SAMPLE AND MONITORING WELL |
| SS5 | SURFACE SOIL SAMPLE |
| GTB2 | GEOTECHNICAL SOIL BORING |

NOTE

THE LOCATION OF SB8/MW8 WILL BE DETERMINED IN FIELD BASED ON THE DIRECT PUSH BORING RESULTS

*NEW SOIL BORINGS ARE LABELED (SG) TO BE CONSISTENT WITH PSA BORINGS; HOWEVER, NO SOIL GAS SAMPLES WILL BE COLLECTED.

50 0 25 50 100
GRAPHIC SCALE

| REFERENCE DWG | DESCRIPTION | NO | DRWN | DATE | REVISION | CHKD | DATE | APPVD | DATE |
|---|---|---|---|---|---|---|---|---|---|
| | | 6 | | | | | | | |
| | | 5 | | | | | | | |
| | | 4 | | | | | | | |
| | | 3 | | | | | | | |
| | | 2 | | | | | | | |
| | | 1 | IGZ | 2/26/98 | GENERAL REVISION | | | | |
| | | 0 | IGZ | 2/13/98 | INITIAL ISSUE | | | | |

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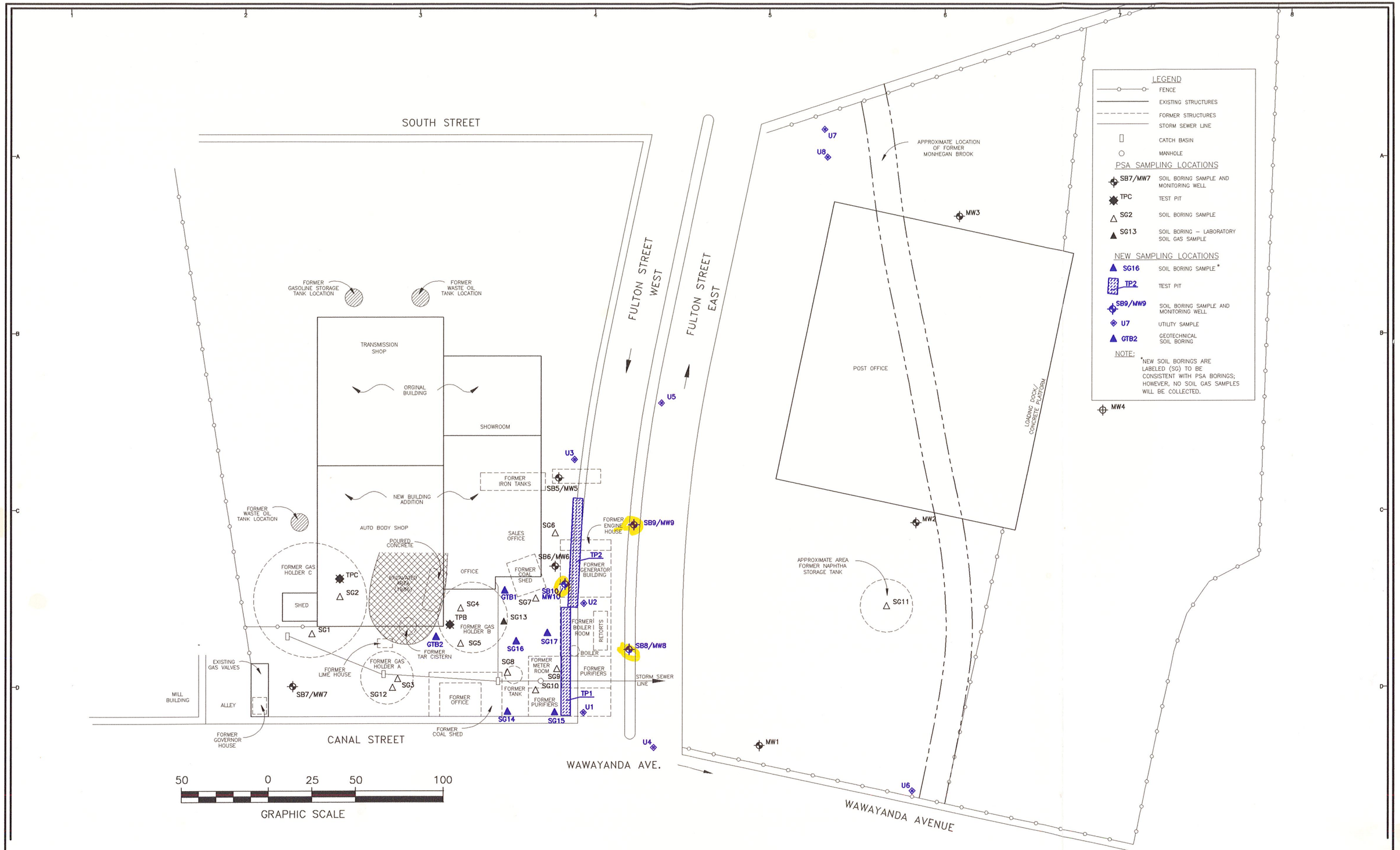
**FIGURE 2-1**
SITE PLAN AND SAMPLING LOCATIONS

SUFFERN – MGP SITE

RETEC
REMEDIATION TECHNOLOGIES INC

DRAWING NO. 3523SA02 REV 2




| REFERENCE DWG | DESCRIPTION | NO | DRWN | DATE | REVISION | CHKD | DATE | APPVD | DATE |
|---|---|---|---|---|---|---|---|---|---|
| | | 6 | | | | | | | |
| | | 5 | | | | | | | |
| | | 4 | | | | | | | |
| | | 3 | | | | | | | |
| | | 2 | IGZ | 2/26/98 | GENERAL REVISION | | | | |
| | | 1 | IGZ | 2/13/98 | SAMPLING LOCATIONS | | | | |
| | | 1 | RLL | 07/24/97 | DRAFT | | | | |

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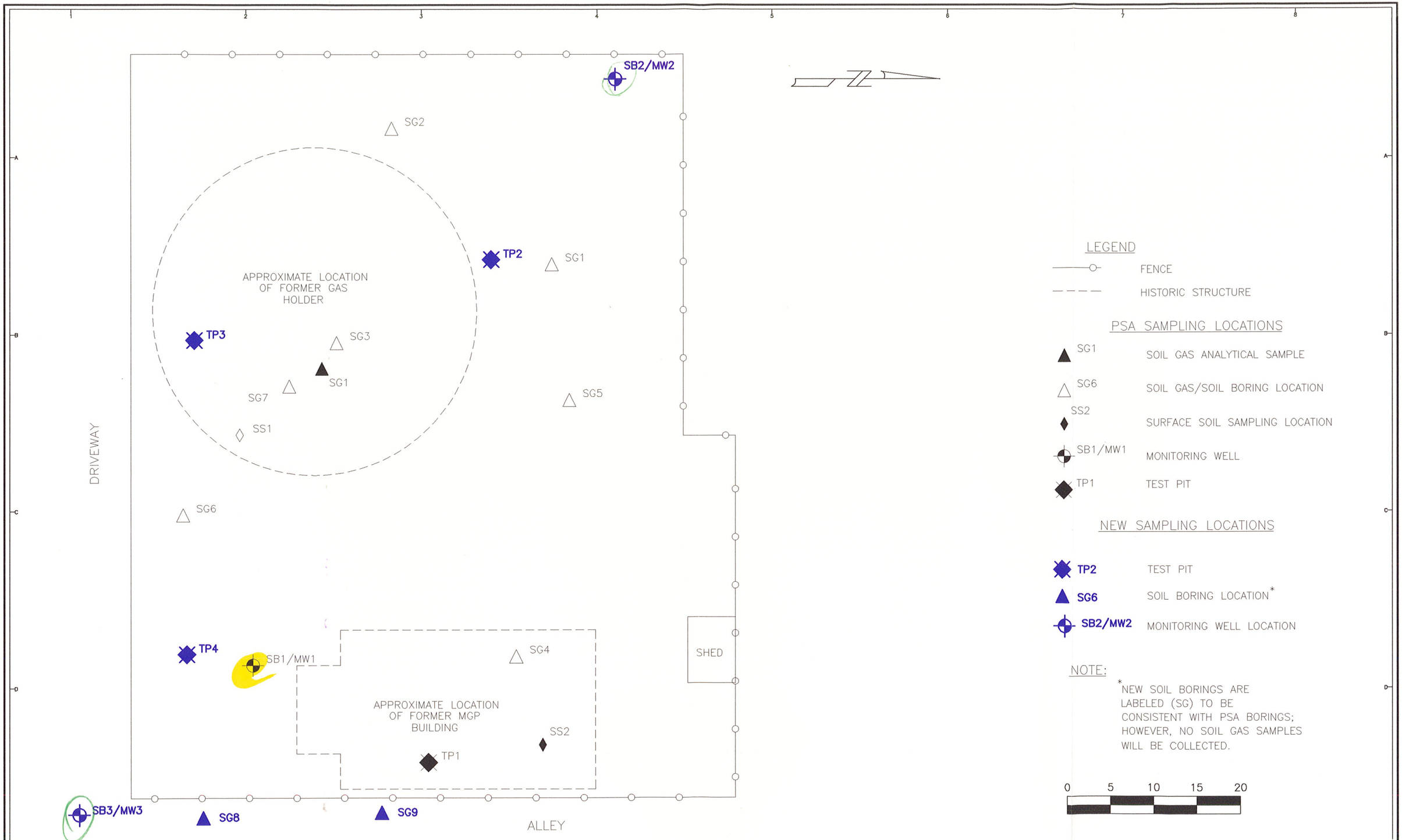
**FIGURE 3-1**

SITE PLAN AND SAMPLING LOCATIONS

MIDDLETOWN – FULTON ST. MGP SITE

REMEDIATION TECHNOLOGIES INC

DRAWING NO. 3523SA03 REV. 2




LEGEND

FENCE

HISTORIC STRUCTURE

PSA SAMPLING LOCATIONS

SG1 — SOIL GAS ANALYTICAL SAMPLE

SG6 — SOIL GAS/SOIL BORING LOCATION

SS2 — SURFACE SOIL SAMPLING LOCATION

SB1/MW1 — MONITORING WELL

TP1 — TEST PIT

NEW SAMPLING LOCATIONS

TP2 — TEST PIT

SG6 — SOIL BORING LOCATION*

SB2/MW2 — MONITORING WELL LOCATION

NOTE:

*NEW SOIL BORINGS ARE LABELED (SG) TO BE CONSISTENT WITH PSA BORINGS; HOWEVER, NO SOIL GAS SAMPLES WILL BE COLLECTED.

0 5 10 15 20

| NO | DRWN | DATE | REVISION | CHKD | DATE | APPVD | DATE |
|---|---|---|---|---|---|---|---|
| 1 | IGZ | 2/26/98 | INITIAL ISSUE | | | | |

REFERENCE DWG | DESCRIPTION

ORANGE & ROCKLAND UTILITIES

3-3523-000

CURRENT DATE: 2/26/98 | CAD FILE 3523SA05

**FIGURE 5-1**
SITE PLAN AND SAMPLING LOCATIONS
HAVERSTRAW - MAPLE & WEST MGP SITE

REMEDIATION TECHNOLOGIES INC

DRAWING NO. 3523SA05 | REV. 2