FINAL WORK PLAN

Supplemental Remedial Investigation/Feasibility Study Former Inland Fisher Guide Facility and Ley Creek Deferred Media

General Motors Corporation
Syracuse, New York

October 1999

O'BRIEN & GERE
ENGINEERS, INC.

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1. Introduction

1.1. Objectives and overview

The General Motors Corporation (GM) and the New York State Department of Environmental Conservation (NYSDEC) entered into an Administrative Order on Consent (Index # D-7-0001-97-06; Order) on September 25, 1997, for the development and implementation of a Remedial Investigation/Feasibility Study (RI/FS) at the Former Inland Fisher Guide (IFG) Facility and the Ley Creek Deferred Media (collectively designated the site) located in the Town of Salina, Onondaga County, New York. The Former IFG Facility is classified as a Class 2 site on NYSDEC's Registry of Inactive Hazardous Waste Disposal Sites (Site No. 7-34-057). The Ley Creek Deferred Media include ground water underlying the Ley Creek PCB Dredgings site, which is also a Class 2 site on NYSDEC's Registry (Site No. 7-34-044), as well as surface water and sediment in Ley Creek between Townline Road and Route 11. The Former IFG Facility and the Ley Creek PCB Dredgings sites were also designated as sub-sites of the Onondaga Lake National Priorities List (NPL) site by NYSDEC and United States Environmental Protection Agency (USEPA). The location of the site is presented on Figure 1.

A Preliminary RI/FS Report was developed by O'Brien & Gere Engineers, Inc. (O'Brien & Gere) on behalf of GM for the Former IFG Facility and Ley Creek Deferred Media. The Preliminary RI/FS Report was submitted to NYSDEC, consistent with the requirements of the Order, on October 24, 1997.

NYSDEC issued comments on the Preliminary RI/FS Report on March 13, 1998 (Benjamin 1998a). GM's responses were submitted to NYSDEC on May 18, 1998 (Hartnett 1998a). As a result of NYSDEC's comments regarding additional data needs, a Supplemental RI/FS is being conducted for the site. A Supplemental RI/FS Work Plan (Work Plan) was submitted to NYSDEC on June 29, 1998. This document presents the Final Work Plan which incorporates revisions to the June 28, 1998 Work Plan in response to NYSDEC's comments issued on October 15, 1998 (Benjamin, 1998b), May 20, 1999 (Hesler, 1999), July 26, 1999 (Benjamin, 1999a), and September 10, 1999 (Benjamin, 1999b), and GM's responses dated November 4, 1998

(Hartnett, 1998b), June 9, 1999 (Hartnett, 1999a), and August 11, 1999 (Hartnett 1999b). The work will be performed by O'Brien & Gere on behalf of GM. As required by the Order, the Supplemental RI/FS will be conducted in accordance with the provisions of the Order, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), the USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA 1988), the *National Oil and Hazardous Substances Pollution Contingency Plan* (40 CFR Part 300), and NYSDEC's revised *Technical and Administrative Guidance Memorandum on Selection of Remedial Actions at Inactive Hazardous Waste Sites* (NYSDEC 1990).

The Supplemental RI/FS is divided into the following tasks:

Task 1 - Inspection of existing well integrity
Task 2 - Redevelopment of existing wells
Task 3 - Monitoring well installation/development
Task 4 - *In situ* hydraulic conductivity testing
Task 5 - Ground water sampling/analysis
Task 6 - Soil/source area investigation
Task 7 - Sediment investigation
Task 8 - Surface water investigation
Task 9 - Surveying
Task 10 - Data validation
Task 11 - Analytical data summary report
Task 12 - Supplemental risk assessment
Task 13 - Supplemental Remedial Investigation Report
Task 14 - Supplemental feasibility study
Task 15 - Supplemental Feasibility Study Report.

This Work Plan is organized into seven sections. Section 1 is an introduction which presents the objectives and overview of the project. Section 2 presents information about the Work Plan, Health and Safety Plan, Field Sampling Plan, and Quality Assurance Project Plan. Section 3 presents an overview of information related to the site, its history, and environmental conditions at the site and surrounding areas. Section 4 presents data needs, rationale, and a general outline for implementation of the Work Plan. Section 5 presents the scope of work, methodology and output for each of the tasks to be conducted as part of the project. Section 6 presents a schedule for implementation of the Work Plan. Section 7 provides a description of project management issues.

2. Supplemental remedial investigation/feasibility study plans

2.1. Work plan

This Work Plan has been prepared per paragraph II of the Order. This document contains a description of each of the Supplemental RI/FS tasks and the rationale for performance of those tasks, as well as details regarding sample locations and analyses.

The following tasks comprise the Supplemental Remedial Investigation (SRI):

- Installation of new wells/inspection of existing wells
- Monitoring well development
- Installation of soil borings
- Installation of test trenches
- *In situ* hydraulic conductivity testing
- Field sampling and analysis of ground water, soil, sediment and surface water
- Surveying
- Data validation
- Analytical data summary report
- Supplemental ecological risk assessment
- Supplemental human health risk assessment
- SRI Report.

The following tasks comprise the Supplemental Feasibility Study (SFS):

- Development of alternatives
- Screening of alternatives
- SFS Screening Memorandum
- Detailed analysis of alternatives
- Recommendations
- SFS Report.

2.2. Field sampling plan

The SRI Field Sampling Plan (FSP) is presented as Appendix A. Field investigation efforts are described in the FSP. The FSP presents the sampling procedures for the surface and subsurface soil, ground water, sediment, and surface water samples. The field sampling and data collection methods are consistent with USEPA's *Compendium of Superfund Field Operations Methods* (USEPA 1987).

2.3. Quality assurance project plan

A Quality Assurance Project Plan (QAPP) has been prepared using guidance provided in USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA 1988), USEPA's *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations*, EPA QA/R-5 (USEPA 1994), and USEPA's *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (USEPA 1980). The QAPP describes protocols necessary to achieve the data quality objectives. Quality Assurance/Quality Control (QA/QC) protocols follow the NYSDEC *Analytical Services Protocol* (ASP) (NYSDEC 1995). The QAPP is included as Appendix B. Together, the FSP and the QAPP constitute the Sampling and Analysis (SAP).

2.4. Health and safety plan

A Health and Safety Plan (HASP) has been prepared in accordance with 29 CFR 1910.120. The plan specifies protective measures and procedures to be followed by investigators and site visitors to minimize exposure to site-related materials. The HASP for the site in included as Appendix C.

3. Site background and setting

3.1. Site description

A site location map is provided as Figure 1. This site includes both the Former IFG Facility and the Ley Creek Deferred Media. The Former IFG Facility comprises approximately 65 acres of property located at 1 General Motors Drive in the Town of Salina, Onondaga County, New York. Facility structures include the main manufacturing building, the attached administration building, the primary switch house, the powerhouse, the industrial waste treatment (IWT) plant, the mold storage (former tank farm) building and the bulk handling building. Various paved parking lots and undeveloped areas are present on the property. A facility plan is provided as Figure 2. The facility is bounded to the south by Conrail railroad tracks and a wood pallet recycling facility, to the east and northeast by GM Circle and Townline Road, to the west by a Niagara Mohawk Power Corporation (NMPC) electrical transfer station, and to the north by Factory Avenue and an undeveloped area adjacent to Ley Creek. The facility is located in an area zoned for industrial use in the Town of Salina; a small portion of the facility (entrance gate area and a portion of the parking lot) is located in the Town of DeWitt.

The area surrounding the facility can generally be characterized as highly urbanized. The area is also characterized by a high degree of industrial activity, as evidenced by the presence of manufacturing facilities such as Carrier Corporation, Syracuse China Corporation, New Process Gear and Bristol-Myers Squibb Company. Numerous small industrial businesses are present along Factory Avenue and in nearby areas of the City of Syracuse. Syracuse International Airport-Hancock Field is located approximately 1½ miles north of the facility.

The Ley Creek PCB Dredgings site is located directly north of the facility and Factory Avenue. The Ley Creek PCB Dredgings site is bounded by Factory Avenue on the south and Ley Creek to the north. The eastern limit of the Ley Creek PCB Dredgings site is Townline Road, and the western limit is located approximately 4,300 ft west of Townline Road. Ley Creek Deferred Media include ground water underlying the Ley Creek PCB

Dredgings site and surface water and sediment between Townline Road and Route 11.

3.2. Site history

The Former IFG Facility was constructed in 1952 by the Brown-Lipe Chapin Division of GM on undeveloped land as deeded to GM from Gilbert Mautz, Earl Henry Barton and Bessie Galster Hoffman on April 5, 1951. Historically, the facility was used for the manufacture of metal automotive trim components such as bumpers, grills, wheel disks and hubcaps. More recently, the facility was used for the manufacture of interior and exterior plastic trim components such as bumpers, grills and door panels. Operations conducted at the facility included metal die casting; nickel, chromium and copper cyanide electroplating; stamping; polishing; buffing; painting and machining.

In 1961 Brown-Lipe-Chapin merged with another GM division, Ternstedt, and subsequently became part of GM's Fisher Body Division in 1968. During the early 1960's injection molding operations were added to the existing metal operations. Metal finishing and die casting were subsequently reduced and replaced by injection molding by the early 1970's. The facility operated as the Fisher Body Division until 1984, when it became the Fisher Guide Division of GM until 1989. The facility then operated as the Inland Fisher Guide Division of GM from 1989 until the facility ceased manufacturing operations in December 1993. In 1992, prior to ceasing manufacturing operations, the facility was operating 127 injection molding machines. After the facility ceased manufacturing operations in 1993, the facility was reassigned to GM's North American Operations Property Management Group, which was later redesignated the Worldwide Facilities Group.

Historic manufacturing processes and facility features were described in detail in the October 1997 RI/FS Report, as supplemented by GM's May 18, 1998 responses to NYSDEC's March 13, 1998 comments on the RI/FS Report.

The Ley Creek Deferred Media include ground water underlying the Ley Creek PCB Dredgings site and Ley Creek surface water and sediment between Townline Road and Route 11. Ground water underlying the Ley Creek PCB Dredgings site, and surface water and sediment in the vicinity of the Ley Creek PCB Dredgings site, were originally investigated during the

RI/FS for the Ley Creek PCB Dredgings site. Because of continuing State Pollutant Discharge Elimination System (SPDES)-permitted discharges to Ley Creek from the Former IFG Facility and the hydraulic connection of the shallow ground water at the Ley Creek PCB Dredgings site with upgradient ground water at the Former IFG Facility, NYSDEC deferred decisions related to these media to this RI/FS. A conceptual scope of work for surface water and sediment investigation was included in the Order, and addresses surface water and sediment between Townline Road and Route 11.

3.3. Hydrogeologic conditions

3.3.1. Geologic setting

The site lies within the Erie-Ontario Lowlands Physiographic Province (Ontario Lowland) of New York State (Thompson 1966). The Ontario Lowland lies between Lake Ontario to the north and the Appalachian Upland Physiographic Province to the south, and is characterized by generally flat topography. The Ontario Lowland in Onondaga County consists of a lake plain covered with glaciolacustrine sediment, and drumlin fields underlain by molded lodgement till. The glaciolacustrine sediments consist of varved silt and clay and fine to medium grained sand. The lodgement till is generally a poorly-sorted mixture of rounded to sub-rounded cobbles and boulders embedded within a silt/clay matrix. The lake plain lies below an elevation of 450 ft above mean sea level (Winkley 1989).

Bedrock geology is characterized by the Vernon Shale which underlies much of the Ontario Lowland (Winkley 1989). The Vernon Shale is the oldest member of the Salina Group and was formed during the Upper Silurian period (approximately 400 million yrs ago). The Vernon Shale measures 500 to 600 ft thick and consists of predominantly red and green shale beds, although minor beds of dolostone, limestone, and sandstone occur locally (Mozola 1938).

3.3.2. Site geology

Site geology has been characterized by soil borings, trenches, and monitoring well borings. Materials encountered are consistent with the geologic setting of the site. The Former IFG Facility unconsolidated (overburden) geology consists of fill, glaciolacustrine deposits, and lodgement till underlain by a red shale bedrock, as presented in Figure 3.

Fill at the Former IFG Facility comprises a mixture of reworked native silt and fine sand (glaciolacustrine deposits), gravel backfill, organic matter, and anthropogenic debris (coal, wood, cinders, concrete, refuse). Fill is loose to dense and ranges in thickness from approximately 2 ft at upgradient well U-1D to greater than 16 ft in the vicinity of the on-site landfill area located in the northwestern area of the facility (boring BH2/HP2).

Glaciolacustrine deposits at the Former IFG Facility underlie the fill and consist predominantly of soft to stiff, brown-gray silt and fine sand, with discrete clay layers. Fine layering (or varves) of the silt and clay were clearly observed in trenching activities [EDI Engineering & Science (EDI) 1985a]. The thickness of the glaciolacustrine deposits increases to the northeast across the Former IFG Facility (EDI 1985a). The deposits range in thickness from 7 ft at well U-2D to 27 ft at well W-9D.

Lodgement till overlies the bedrock at the site. The till consists of a very dense to hard, red clayey silt with embedded fine to medium grained sub-rounded gravel. The till was fully penetrated at one location at the facility, well W-6D, where the thickness was approximately 4 ft. Although not fully penetrated, till thickness was at least 9 ft at well W-7D located in the northern portion of the facility which is consistent with findings at the adjacent Ley Creek PCB Dredgings site. Till thickness at the adjacent Ley Creek PCB Dredgings site ranged from 5 ft in MW-9D to 7 ft in OBG-3D.

3.3.3. Site hydrogeology

The saturated portions of the fill and glaciolacustrine units comprise the unconfined overburden aquifer. The overburden aquifer is underlain by the lodgement till unit which limits hydraulic connection between the overburden and bedrock. The approximate upper 10 ft of the saturated overburden has been designated the shallow overburden aquifer zone. This zone encompasses the saturated portion of fill and the upper glaciolacustrine unit. The deep aquifer zone is located in the lower glaciolacustrine unit that spans approximately 10 ft immediately above the lodgement till. The classifications were developed to evaluate ground water quality in the two zones and discuss variation in ground water flow regimes; however, the glaciolacustrine materials are considered a single hydrogeologic unit.

Shallow overburden zone. A ground water elevation map (Figure 4) was developed from ground water elevation data measured during the 1985 hydrogeological investigation (EDI 1985a). The shallow ground water flow direction is northeast across the site toward Ley Creek under an average hydraulic gradient of 0.015 ft/ft.

The shallow zone ground water elevation contours show an apparent trough located in the northern property boundary area. The trough is in the vicinity where the facility storm drains are routed. The trough suggests that shallow ground water flow direction converges to the north due to the storm drain effects on the shallow aquifer zone.

Horizontal hydraulic conductivity values in the shallow overburden aquifer zone, range from 7.51 x 10^{-3} ft/day to 6.24 x 10^{-1} ft/day (O'Brien & Gere 1989a). Based on the hydraulic conductivity values and an assumed effective porosity of 0.35, shallow zone ground water flows with an estimated velocity ranging from 3.22 x 10^{-4} ft/day to 2.67 x 10^{-2} ft/day.

Deep overburden zone. A ground water elevation map (Figure 5) was developed from ground water elevation data measured during the 1985 hydrogeological investigation (EDI 1985a). Similar to the shallow zone, the deep ground water flows northeast across the site toward Ley Creek under an average hydraulic gradient of 0.009 ft/ft.

Horizontal hydraulic conductivity values in the deep overburden aquifer zone range from 4.25 x 10^{-2} ft/day to 3.12 ft/day (O'Brien & Gere Engineers 1989a, EDI 1985a), which is consistent with values measured at the adjacent Ley Creek PCB Dredgings site. Based on the hydraulic conductivity values and an assumed effective porosity of 0.35, deep zone ground water flows with an estimated velocity ranging from 1.09 x 10^{-3} ft/day to 8.02 x 10^{-2} ft/day.

Glaciolacustrine vertical permeability values (ranging from 2.41 x 10^{-4} to 1.02 ft/day), as evaluated from triaxial tests for undisturbed soil boring samples from wells W-1D, W-2D, W-7D, and W-9D, range up to three orders of magnitude lower than the horizontal values (ranging from 4.25 x 10-2 to 1.3 ft/day). This trend is consistent with the varved and fine grained nature of the glaciolacustrine deposits and suggests that horizontal ground water flow at the site is the preferential flow path.

An approximation of ground water discharge at the site boundary is presented based on the existing hydrogeologic data. Assuming the horizontal extent of the downgradient property boundary is 2000 ft, and an average saturated thickness of the glaciolacustrine unit is 25 ft, the estimated range of ground water discharge rates at the property boundary have been calculated as follows:

Ground water discharge rate $Q=VA$

where:

Q = discharge (ft^3/day)
V = calculated velocity range (upper and lower glaciolacustrine units)
A = cross sectional area (2000 ft horizontal distance) multiplied by 25 ft (saturated thickness)

Q = 161 to 4010 ft^3/day (1204 to 29,995 gal/day)

Lodgement till. Lodgement till vertical permeability was evaluated by laboratory triaxial testing of three relatively undisturbed till samples. Vertical permeability values ranged from 1.42 x 10^{-4} ft/day to 7.09 x 10^{-5} ft/day (EDI 1985a). The vertical permeability values of the lodgement till range from 1 to 4 orders of magnitude lower than the vertical permeability values identified for the glaciolacustrine unit. The relative difference in vertical permeability values suggest that the lodgement till layer behaves as an aquitard in the vicinity of the site.

At the Ley Creek PCB Dredgings site, monitoring wells OBG-3D and MW-9D were installed to the top of bedrock, sealed from the overlying glaciolacustrine unit. These wells exhibited an upward flow potential with the hydraulic head in OBG-3D approximately 5 ft higher than in the adjacent shallow monitoring well OBG-3. Well MW-9D exhibited artesian conditions with water flowing from the top of the well casing. These conditions further corroborate the assessment that the lodgement till layer observed at the Ley Creek PCB Dredgings site behaves as an aquitard.

3.4. Previous investigations

Twenty four environmental investigations, the majority conducted in accordance with regulatory programs, have been conducted at or near the site. These site investigations, which have been conducted from approximately 1983 to the present, have included the sampling and analysis of soil, ground water, surface water, storm water, sludge, sediment, and fish. Investigation scopes and data from the following investigations were presented in the October 1997 Preliminary RI/FS Report:

- 1983 - Thomsen Associates and Empire Soils Investigations, Inc. (Empire Soils) Hydrogeological Investigation (Thomsen Associates and Empire Soils 1983) and monthly ground water monitoring, which continued until 1997

- 1985 EDI Hydrogeological Investigation (1985a)

- 1985 EDI Phase II Hydrogeological Investigation (EDI 1986a)

- 1985 EDI Ley Creek sampling program (EDI 1985b)

- 1985-1986 - EDI Solvent Spill Hydrogeological Investigation/Remedial Action Plan (EDI 1986b) and bi-weekly ground water monitoring, which continued until 1997

- 1986-1987 O'Brien & Gere Engineers Hydrogeologic Investigation of Fill Area Along Ley Creek (O'Brien & Gere 1987a)

- 1987 O'Brien & Gere Engineers Storm Outfall Assessment (O'Brien & Gere 1987b)

- 1989 O'Brien & Gere Engineers Storm Sewer Sampling Study (O'Brien & Gere 1989c)

- 1988-1989 - O'Brien & Gere Engineers Surface Impoundment Post-Closure Ground Water Monitoring Program (O'Brien & Gere 1992), which continued until 1997.

- 1988-1989 O'Brien & Gere Engineers Ley Creek Dredged Material Area Field Investigation (O'Brien & Gere 1989b)

- 1990-1991 O'Brien & Gere Engineers Ley Creek Relief Interceptor Sewer Area Interim Remedial Measure (IRM) Sampling Program (O'Brien & Gere 1990, 1991)

- 1991 Onondaga County Ley Creek Relief Interceptor Sewer Area Sampling Program (Onondaga County 1991)

- 1992 O'Brien & Gere Engineers Ley Creek Dredged Material Area RI (O'Brien & Gere 1993)

- 1993 O'Brien & Gere Engineers storage cell confirmation sampling program (O'Brien & Gere 1994)

- 1994 Entrix, Inc. (Entrix) Phase I Environmental Site Assessment (ESA)
- 1995-1996 Conestoga-Rovers & Associates (CRA) Phase II ESA (Hartnett 1996)
- 1996 Niagara Mohawk Power Company (NiMo) Factory Avenue soil sampling (NiMo 1996)
- 1996 O'Brien & Gere Engineers utility pole location sampling program (O'Brien & Gere 1996a)
- 1995-1996 O'Brien & Gere Engineers Outfall 004 sewer line sampling program.

The following additional pertinent investigatory programs were conducted by NYSDEC:

- 1987 Former Ley Creek Bed Sampling (Momberger 1987)
- 1989-1990 Rotating Intensive Basin Studies (RIBS) Sampling (NYSDEC 1992)
- 1993 Salina Town Landfill Preliminary Site Assessment (PSA) Sampling (Ecology and Environment 1994)
- 1995 NYSDEC Passive *In Situ* Concentration Extraction Sampler (PISCES) Sampling
- 1996 NYSDEC Sampling.

The following subsections summarize the environmental conditions at the site as characterized by the investigations listed above.

3.4.1. Soil investigative results

Soil data generated by investigations listed above are described with respect to the following areas at the site: manufacturing building subsurface, southeast property area, IWT plant area, former thinner tanks area, northeast property area, and the northern property area. New York State (NYS) soil cleanup objectives presented in NYSDEC's Technical and Administrative Guidance Memorandum (TAGM) 4046, *Determination of Soil Cleanup Objectives and Cleanup Levels* (NYSDEC 1995), were used as screening values for comparison to soil concentrations. It should be noted that soil background values were not used during screening.

The following text is a discussion of soil data with respect to the constituents which were detected above screening values. A more detailed description of the parameters analyzed for and the constituents detected is presented in the October 1997 Preliminary RI/FS Report.

Manufacturing building subsurface. Polychlorinated biphenyls (PCBs) were detected in soil beneath the manufacturing building above the 10 mg/kg screening level, in the vicinity of the abandoned underground oil collection sumps and tanks and one branch of the abandoned storm sewer trenches beneath the facility floor, at concentrations up to 4300 mg/kg. Petroleum hydrocarbons (identified as SAE 30W oil) were detected in soil at the base of the bedding material within approximately 3 ft of the abandoned underground oil collection sumps and tanks at concentrations up to 80,000 mg/kg. Concentrations of chromium (10 to 120 mg/kg), nickel (8.3 to 4000 mg/kg), and copper (8 to 43 mg/kg) were above screening levels (10, 13, and 25 mg/kg, respectively) at the fill/native soil interface at locations adjacent to former electroplating sumps. Trichloroethene (TCE), toluene, acetone, and 1,2-dichloroethene (1,2-DCE) concentrations were above screening levels (0.7, 1.5, 0.2, and 0.3(trans-1,2-DCE) mg/kg, respectively) at varying depths in the vicinity of the paint room, with detected concentrations ranging as follows: TCE (0.28 to 150 mg/kg), toluene (less than detectable to 0.21 mg/kg), acetone (0.014 to 0.021 mg/kg), and 1,2-DCE (0.14 to 1 mg/kg). Toluene and xylene were detected at concentrations of 720 and 1.9 mg/kg, respectively, above screening levels of 1.5 and 1.2 mg/kg, respectively, in the former compactor area at 6 to 7 ft depth in native clay and sand.

Soil samples collected in the vicinity of the former PCB oil underground storage tanks (USTs) at the approximate tank depth and the loading dock leveler sumps at the top of the ground water table did not contain constituents at concentrations above soil screening levels.

Southeast property area. Chromium was detected above the 10 mg/kg screening level at two locations (17J and 20J mg/kg) in the general storage area at the top of the ground water table.

Industrial waste treatment plant area. Oil and grease concentrations ranged from 80 mg/kg to 440 mg/kg in the IWT plant area soils at depths ranging from 1 to 10 ft. Chromium was detected (20J mg/kg) above its 10 mg/kg screening level in the former liquid waste incinerator area. Chromium, copper and nickel were detected slightly above screening levels (10, 25, and 13 mg/kg, respectively) in the vicinity of the SO_2 scrubber at concentrations of 44J, 37J, and 32J mg/kg, respectively.

Soil samples collected in the vicinity of the electroplating wastewater treatment plant from native soil above the ground water table did not contain constituents at concentrations above soil screening levels.

Former thinner tanks area. Concentrations of toluene, ethylbenzene and/or xylene were detected above screening levels (1.5, 5.5, and 1.2 mg/kg, respectively) in soil in the former thinner tanks area. The highest concentrations were generally observed at depths between 7 and 11 ft below ground surface. Detected concentrations of toluene ranged from 0.010 to 5.9 mg/kg; detected ethylbenzene concentrations ranged from 0.047 to 61 mg/kg; and detected xylene concentrations ranged from 0.020 to 330 mg/kg.

Northeast property area. Sample data for one soil boring installed near the acid-alkali bunker indicated chromium and nickel concentrations (15 mg/kg and 16 mg/kg, respectively) slightly above screening levels of 10 and 13 mg/kg, respectively in native soil above the ground water table.

Northern property area. PCBs were detected above the 10 mg/kg subsurface screening level in the general northern property area at concentrations up to 25 mg/kg. PCBs were also detected above the screening level in the vicinity of a former drainage swale at concentrations up to 9600 mg/kg. The highest concentration (9600 mg/kg) was in the soil removed as part of the Ley Creek Relief Interceptor Sewer IRM. In general, the higher concentrations of PCBs were present within the upper 8 ft of soil, but were not concentrated at one soil horizon.

PCB concentrations in surface soil samples collected between the Former IFG Facility fence line and Factory Avenue, following installation of the Ley Creek Relief Interceptor sewer, indicated PCB concentrations up to 130 mg/kg, which exceed the 1 mg/kg surface soil screening level. Surface soil samples collected in the former footprint of the soil storage cell located near the northwestern corner of GM's property indicated PCBs ranging from 1.3 to 6.3 mg/kg.

Subsurface soil samples collected within the suspected location of the landfill indicated arsenic (1.9 to 48 mg/kg), chromium (23 to 2900 mg/kg), copper (37 to 6600 mg/kg), nickel (23 to 1300 mg/kg), and selenium (0.87 to 2.3 mg/kg) concentrations above screening levels (7.5, 10, 25, 13, and 2 mg/kg, respectively) in one fill material sample and two samples from the native soil above the ground water table. The highest metals concentrations were observed in a fill material sample.

3.4.2. Ground water investigative results

The following text is a discussion of ground water data with respect to constituents present above Class GA standards. A more detailed discussion of previous investigations and parameters analyzed for is presented in the October 1997 RI/FS Report.

Benzene, toluene, ethylbenzene and xylene(BTEX) constituents. Ground water data from 1985 and 1986 indicated total BTEX concentrations at the facility ranging from less than detectable to 224,700 μg/L. BTEX constituent concentrations were greater than NYS Class GA standards in twenty-five of seventy-one wells sampled. The majority of BTEX in facility ground water has been detected in the vicinity of the former thinner underground storage tanks (USTs). Routine monitoring conducted in the former thinner tanks area at 19 monitoring wells indicated total BTEX concentrations ranging from less than detectable to 172,800 μg/L in April 1998. The data indicate that the plume is contained by the ground water recovery trenches in this area (see Section 3.5). In general, xylene contributed to greater than 75% of the total BTEX concentrations in this area.

BTEX constituents are have been found to be less than detectable during routine monitoring of the ten surface impoundment monitoring wells.

Chlorinated hydrocarbons. Concentrations of chlorinated hydrocarbons above NYS Class GA standards have been detected at the facility in both shallow and deep overburden wells and consist predominantly of TCE and 1,2-DCE.

Detections above the NYS Class GA standards were observed at various locations at the facility. The highest concentrations were detected between the IWT plant and the manufacturing building and near the administration building, and in the vicinity of the closed surface impoundments. Samples collected from fifty-one monitoring wells at the facility in 1985 indicated total chlorinated hydrocarbon concentrations at the site ranging from less than detectable to 78,111 μg/L. Concentrations of chlorinated hydrocarbons above NYS Class GA standards were detected in twenty-four of the fifty-one wells installed.

Initial sampling of the ten surface impoundment monitoring wells in 1988 indicated chlorinated hydrocarbon concentrations above NYS Class GA standards ranging from 6.0 to 6058 μg/L in five of the ten wells installed. The highest chlorinated hydrocarbon concentrations were found in two deep overburden wells. Routine monitoring of the surface impoundment monitoring wells in April 1998 indicated total chlorinated hydrocarbons (predominantly TCE and 1,2-DCE) above the NYS Class GA standards in four deep overburden wells at concentrations ranging from 470 to 30,200 μg/L. Increases in chlorinated hydrocarbon concentrations in monitoring wells MW-2D to MW-5D have been observed over the past five years.

PCBs. PCB concentrations above the NYS Class GA standard detected at the site in both shallow and deep overburden wells consist mainly of Aroclors 1242 and 1248. Sampling of ten deep overburden monitoring wells at the facility in 1985 indicated the presence of PCBs in two deep overburden wells at concentrations above the 0.1μg/l NYS Class GA standard (3.7 μg/L and 2.0 μg/L).

Initial sampling of the ten surface impoundment monitoring wells in 1988 indicated PCB concentrations above the NYS Class GA standard in nine of ten wells, ranging from 0.3 to 3600 μg/L. Routine monitoring of surface impoundment wells in April 1998 indicated total PCB concentrations above the NYS Class GA standard in four of the ten wells, ranging from 0.3 to 920 μg/L. PCB concentrations have remained generally consistent with minor fluctuations in the surface impoundment area, with the exception of recently increased PCB concentrations at MW-2S. It is a possibility that the source of PCBs in this well is from the portion of the former surface impoundment which was covered by the 1974 building addition, because the well is believed to be screened in former impoundment materials.

PCB concentrations in seventeen monitoring wells at the Ley Creek PCB Dredgings site between 1986 and 1992 showed PCB concentrations above the NYS Class GA standard ranging from 0.18 to 8.9 μg/L. From 1986 to 1992, PCB concentrations decreased in each of the wells except for one. During the 1992 RI, PCBs were detected in nine of sixteen wells sampled, at concentrations at or above the NYS Class GA standard.

Inorganics. Metal concentrations in the ground water at the facility above the NYS Class GA standard were primarily in the vicinity of the landfill and former coal pile. Antimony, lead, and zinc concentrations each once exceeded NYS Class GA standards in a different deep well. A filtered Hydropunch® sample collected in the landfill area, which was analyzed for metals in 1996, showed concentrations above NYS Class GA standards for arsenic, chromium, mercury, lead and selenium (400, 2400, 18, 1400, and 35J μg/L, respectively).

Initial sampling of the ten surface impoundment monitoring wells in 1988 indicated the presence of the following metals above NYS Class GA standards: lead, copper, and zinc. June 1997 monthly monitoring in the former surface impoundments area indicated no metal concentrations above NYS Class GA standards, which is consistent with previous routine sampling data in this area. Metals are consequently not included in the current surface impoundment monitoring program. Routine monitoring for iron conducted in the former coal pile area until September 1997 consistently indicated iron concentrations in excess of the NYS Class GA standard (*e.g.*, 6220 μg/L in September 1997). The former coal pile was removed in 1996; hence the Order and September 25, 1997 SPDES permit do not require continued coal pile area monitoring.

3.4.3. Storm water investigative results

The storm sewer system at the facility includes piping associated with surface water discharge outfalls designated 003 and 004. The storm sewer system in the immediate vicinity of the manufacturing building and in the majority of the northern property area drains to Outfall 003. The storm sewer system collects precipitation runoff from the facility ground and roof. Since September 25, 1997, the effective date of the new SPDES permit, the main IWT plant treated effluent is also discharged via Outfall 003. The southeastern corner of the property and portions of the parking lot areas east of the facility drain to Outfall 004. Both Outfalls 003 and 004 discharge to Ley Creek under the terms of the September 25, 1997 SPDES permit.

The following is a summary discussion of constituents detected in the storm sewer systems. A more detailed description of the analyses performed is presented in the October 1997 Preliminary RI/FS Report.

Outfall 003 storm sewer system. Constituents detected in the storm sewer system tributary to Outfall 003 in 1987 included PCBs, volatile organic compounds (VOCs) (TCE and 1,2-DCE), metals (lead, copper and zinc) and phthalates. A first-flush pattern to storm water pollutant loadings during rain events was observed during the 1987 study.

A 1989 storm sewer sampling program indicated a potential source of PCBs to the storm sewer system on the southwestern corner of the facility, and a PCB contribution to Outfall 003 from the section of storm sewer serving the middle of the facility. The data did not rule out the potential of a source of PCBs along the west and northwest sides of the building. It was also concluded that little or no PCBs were originating from off-site, and that there were no influxes of PCBs into the new sections of storm sewer along the west side of the manufacturing building. Contributions of TCE within the Outfall 003 storm sewer system were generally observed on the west side of the manufacturing building.

Routine SPDES monitoring of Outfall 003 since January 1994 has indicated TCE consistently below its discharge limit (prior to the September 25, 1997 permit) of 160μg/l, at concentrations ranging from less than detectable to 53μg/L. The Order contains an interim effluent limit for TCE of 160 μg/L. The September 25, 1997 SPDES permit contains a final action level for TCE of 5μg/L for Outfall 003, to become effective three years from the effective date of the Order and SPDES permit. Since the effective date of the SPDES permit, TCE concentrations have ranged from 12 to 16 μg/L.

PCB Aroclors 1242 and 1248 have also been consistently detected below their respective discharge limits (prior to the September 25, 1997 permit) of 2 and 4 μg/L, since January 1994, at concentrations ranging from less than detectable to 1 μg/L and less than detectable to 2 μg/L, respectively. The Order contains interim discharge limitations of 2 μg/L per Aroclor, and the September 25, 1997 SPDES permit contains final discharge limitations of 0.3 μg/l per Aroclor, with a discharge goal of non-detect at the higher of 0.065 μg/l or the site-specific method detection limit. The Order requires that the Outfall 003 discharge meet final discharge limitations within three years from the effective date of the Order. Since the effective date of the Order, Aroclor 1242 and 1248 concentrations have ranged from less than 0.05 μg/L to 1.10 μg/L and from less than 0.05 μg/L to 1.1 μg/L, respectively.

Total xylenes have periodically been present in this outfall as well, at concentrations up to 16.7 μg/L in December 1996. The source of the xylenes is likely impacted ground water from the former thinner tanks area on the west side of the facility, which potentially seeps into the storm sewer system. The Order contains an interim action level for total xylenes of 100 μg/L for Outfall 003. The September 25, 1997 SPDES permit contains a final action level for xylenes of 5μg/l for Outfall 003, to become effective three years from the effective date of the Order and SPDES permit. Since the effective date of the Order, xylene concentrations in Outfall 003 have been less than 1μg/l, except in March 1998, when 6.6 μg/l total xylenes were detected.

Potential contaminant contributions to the main storm sewer system include ground water infiltration, surface runoff, and IWT plant effluent.

Outfall 004 storm sewer system. Constituents detected within the storm sewer system leading to Outfall 004 in 1987 included PCBs, lead, copper, zinc, cyanide (one sample event only), cis-1,2-DCE (one sample event only), tetrachloroethene (one sample event only, at the upstream sample point), naphthalene and phthalates.

Televising of the Outfall 004 sewer line for integrity in 1992 showed the Outfall 004 line was not subject to significant ground water infiltration. Sampling of Outfall 004 and portions of the associated storm sewer system in 1995 and 1996 indicated that PCBs are infrequently present in the Outfall 004 discharge. The Order contains an interim effluent requirement of monitoring for PCBs in Outfall 004. The September 25, 1997, SPDES permit contains final effluent limitations of 0.3 μg/L per Aroclor, to become effective three years from the effective date of the Order and SPDES permit. Since the effective date of the Order, Aroclor 1242 concentrations in Outfall 004 have ranged from less than 0.05 μg/L to 0.27 μg/L, detected in 14 out of 26 weeks. Aroclor 1248 was detected one week at 0.21 μg/L. Manhole sampling to date has not indicated the source of detections of PCBs in the Outfall 004 discharge.

3.4.4. Ley Creek surface water and sediment investigative results

The following is a general discussion of Ley Creek surface water and sediment quality. A detailed description of surface water and sediment data is presented in the October 1997 Preliminary RI/FS Report.

Surface water. PCBs above the NYS Class B standard were detected in Ley Creek surface water downstream of Outfall 003. VOCs were also detected downstream of Outfall 003 at concentrations consistent with upstream detections.

NYSDEC data related to PISCES surface water sampling in Ley Creek indicated that PCB concentrations were generally higher downstream of Outfall 003 in the main branch of Ley Creek than in the south branch (upstream of site) or Sanders Creek (upstream of site). Data were not available for the north branch of Ley Creek (upstream of site). Homolog data indicated that PCB homolog distributions in the vicinity of the site were different from PCB homolog distributions upstream and downstream of the site.

Sediment. PCB concentrations in Ley Creek sediment in the vicinity of the site were variable over the course of three sampling events between 1985 and 1992. 1992 concentrations generally were lower or similar to previous measured concentrations, and were less than 1 mg/kg.

Freon extractable oil concentrations in sediment in the vicinity of the site in 1985 generally decreased with depth and ranged from less than detectable to 4690 mg/kg upstream of Outfall 003, and from less than detectable to 9520 mg/kg downstream of Outfall 003.

NYSDEC data related to sediment in Ley Creek indicated that PCB concentrations in sediment in the vicinity of the site were generally lower than those in the south branch of Ley Creek (upstream) or the lower main branch of Ley Creek between Rt. 11 and Onondaga Lake (downstream). PCB concentrations in sediment in the vicinity of the site were generally higher than those in the north branch of Ley Creek and in Sanders Creek (upstream).

NYSDEC data also indicated that VOC concentrations in sediment in the vicinity of the site were generally lower than the north branch of Ley Creek, the south branch of Ley Creek, and Sanders Creek (upstream) and the lower main branch of Ley Creek between Rt. 11 and Onondaga Lake (downstream). SVOC concentrations in sediment in the vicinity of the site were generally lower than the south branch of Ley Creek (upstream) or the lower main branch of Ley Creek between Rt. 11 and Onondaga Lake (downstream). SVOC concentrations in sediment in the vicinity of the site were generally higher than those in the north branch of Ley Creek and in Sanders Creek (upstream). Inorganic concentrations in sediment in the vicinity of the site were generally lower than the north branch of Ley Creek, the south branch of Ley Creek, and Sanders Creek (upstream) and the lower main branch of Ley Creek between Rt. 11 and Onondaga Lake (downstream).

3.5. Previous remedial actions

GM conducted several remedial efforts at the facility, generally in conjunction with either a NYSDEC Consent Order or RCRA closure program. The remedial efforts are listed as follows:

Installation and operation of an oil/water collection system. During the 1980s, oil was discovered in the facility's storm water discharge to Ley Creek and within the existing underground storm sewer system beneath the manufacturing building. It was suspected that the oil had originated from the underground sumps and tanks associated with the historic injection molding operations. In response to these findings, GM implemented a program to remove the building roof drainage from the underground system and replace it with an overhead system to minimize the release of oils which may have been trapped within the underground system during rain events. The new overhead system was installed in two phases in 1986 and 1988. In conjunction with the abandonment of the underground system, oil/water collection sumps were installed in 1986 in order to capture residual oil/water which may have been present within the lines. The sumps are generally located around the perimeter of the manufacturing building. The sumps operate on a passive collection basis and pump the collected oil/water to the IWT plant for treatment and discharge.

Storm sewer rehabilitation. Storm sewers located outside the facility buildings were rehabilitated in two phases in 1986 and 1988. The rehabilitated sewers were those associated with Outfall 003. Sewer rehabilitation efforts included the installation of new sections of sewer on the west side of the facility, abandonment of certain sewers, sliplining of some portions of the sewer and installation of a cured in place liner in a section on the west side of the facility.

Installation and operation of a ground water recovery system. GM discovered a localized area of ground water that was impacted by toluene, ethyl benzene and xylene in an area where three thinner USTs had been removed. In 1987, two ground water collection trenches were installed. The trenches were designed to intercept the shallow ground water flow from the former tanks area and the downgradient area. Water collected in the trenches is pumped to the IWT plant for treatment.

Surface impoundment closure. In 1989, the two surface impoundments located north of the facility buildings were closed under a RCRA closure and post-closure monitoring program. The closure program consisted of the removal and disposal of impacted sediment from the two impoundments. A post closure monitoring program was also implemented.

Ley Creek relief interceptor sewer area IRM program. During installation of a new sewer line along GM's northern property boundary, a concern was noted with respect to soil and ground water quality in the general area. In response, GM entered into a Consent Order with NYSDEC to develop and implement an IRM program to address soil and ground water potentially impacted by PCBs present along the proposed location of the new sewer line. In 1991, soil was excavated by Onondaga County's subcontractor and was stock piled in lined storage cells on GM's property pending characterization and disposal. Soil excavation activities were performed in conjunction with the installation of sheet piling and bentonite mixture cut-off walls at designated perimeter locations.

4. Work plan rationale

As described in Section 1, a Preliminary RI/FS Report was completed in 1997 for the Former IFG Facility and the Ley Creek Deferred Media (O'Brien & Gere 1997). The Preliminary RI/FS Report presented historical information collected during extensive field investigations conducted at the site, including:

- surface and subsurface soil data collected from 1985 to 1996
- ground water data collected from 1983 to 1997
- ground water level measurements performed from 1983 to 1997
- vertical permeability measurements conducted in 1985
- *in situ* hydraulic conductivity measurements conducted in 1983 to 1988
- storm water data collected from 1985 to 1992
- Ley Creek surface water data from 1985 to 1996
- Ley Creek sediment data collected from 1985 to 1996
- Ley Creek fish data from 1985 to 1992.

Following submittal of the RI/FS report, NYSDEC issued comments in a March 13, 1998 letter to GM (Benjamin 1998a). GM submitted responses to NYSDEC's comments on May 18, 1998 (Hartnett 1998a). Subsequent to issuance of the comment letter, GM and NYSDEC held meetings on June 9, 1998 and June 16, 1998, during which additional comments and SRI scoping were discussed. The comments identify potential data needs for the site. The rationale for tasks to be included in this Work Plan is based on the comments issued by NYSDEC, subsequent discussions, and previous investigation data. Table 1 summarizes the NYSDEC comments related to data needs and corresponding field tasks to be included as SRI field activities.

Specific data needs as they relate to individual areas at the site, as well as corresponding field activities, are discussed in the following subsections. The rationale for the field activities is described in Table 2. The rationale for not addressing specific NYSDEC comments with a corresponding field investigatory task or for proposing an alternate investigatory approach is discussed in the following subsections.

The SRI field tasks will include sampling of surface and subsurface soil, ground water, sediment, and surface water. In addition, the presence of light non-aqueous phase liquid (LNAPL) and dense non-aqueous phase liquid (DNAPL) will also be investigated. The data will be used to evaluate the nature and extent of contamination, to conduct a human health risk assessment and an ecological risk assessment, and to provide information for development, evaluation, and selection of remedial actions to be documented in the SFS. The SRI Report will document the field activities, and the SFS Report will document the identification and evaluation of remedial alternatives.

4.2. Former IFG Facility data needs

General potential data needs identified by NYSDEC for the Former IFG facility include:

- horizontal and vertical extent of ground water contamination at the site
- characteristics of ground water flow within the glacial till (unless it can be demonstrated, with the available data, that ground water contamination does not exist within that unit)
- current ground water data for evaluation of construction worker direct contact exposure pathways
- adequate analytical results (VOCs, semivolatile organic compounds (SVOCs), PCBs/pesticides, inorganics) for site wide ground water
- background off-site ground water conditions
- migration pathways presented by subsurface utilities
- presence of PCB NAPL and solvent DNAPL
- background surface and subsurface soil data
- investigation of solid waste management units (SWMUs) identified in NYSDEC's 1991 draft Part 373 hazardous waste management permit
- subsurface soil VOC data for risk assessment
- surface soil data for risk assessment
- conduct of comprehensive sampling for metals in ground water across site
- evaluation of potential presence of PCBs in ground water in several major portions of site.

In response to these identified data needs, GM is including the following tasks as part of the SRI to be conducted at the facility:

- redevelopment of existing monitoring wells, including five wells at the Ley Creek PCB Dredgings Site
- installation of new monitoring wells

- analysis of ground water samples for VOCs, SVOCs, PCBs, site-related metals and cyanide (CN), including five samples from Ley Creek PCB Dredgings Site ground water
- installation of a background monitoring well nest
- collection of background subsurface and surface soil samples
- installation of soil borings in various areas to investigate potential presence of DNAPL at site
- installation of temporary piezometers along sewer lines leading to oil/water collection sumps #1, 4, and 5 to evaluate presence of PCB NAPL
- installation of soil borings upgradient of oil/water collection sumps #2, 3, 6, 7, and 8 to investigate inactive storm sewer backfill material
- installation of soil borings in various SWMUs
- collection of subsurface and surface soil samples in various SWMUs
- analysis of soil samples for VOCs, SVOCs, PCBs, site-related metals, and CN where appropriate based on past data and area use.

Site-related metals include arsenic, chromium, copper, lead, nickel, and zinc. Based on historic Former IFG Facility data presented in the October 1997 Preliminary RI/FS Report, a metal was identified as site-related if it was associated with historic process operations, or was detected in ground water above NYS Class GA standards, in soil above NYS TAGM 4046 soil cleanup objectives, or in storm sewer water. Frequency of detections was also considered to exclude metals (*i.e.*, antimony, mercury, and selenium) which had a very low frequency of detection in Former IFG Facility media.

NYSDEC comments related to general data needs which are not being addressed by specific field activities include:

- pesticide data for ground water
- investigation of each SWMU identified in NYSDEC's 1991 draft Part 373 hazardous waste management permit.

Pesticides will not be included in the analytical suite for ground samples collected during the SRI because these constituents are not anticipated to be site-related constituents of concern based on past site activities.

Investigation of SWMUs is incorporated as appropriate into the site-wide investigation program. Many SWMUs have been or are being addressed through facility decommissioning activities, or are above ground features which are no longer present at the facility. Appendix D contains a description of the status of each SWMU.

The following subsections provide the detailed comments and corresponding field activities for each individual area of the site. The rationale for each individual field activity is described in Table 2.

4.2.1. Manufacturing building subsurface

Ground water. Specific data needs identified by NYSDEC for ground water at the manufacturing building included:

- extent of PCBs, heavy metals, CN and VOCs beneath the building in ground water
- nature and extent of contamination in footprint of manufacturing building
- evaluation of extent of BTEX plume beneath the manufacturing building.

GM is including the following tasks in the SRI to address these data needs:

- resampling of existing monitoring wells
- installation and sampling of new shallow and deep overburden monitoring wells
- analysis of ground water samples for VOCs, SVOCs, PCBs, site-related metals and CN
- installation of one or two temporary shallow overburden wells in the manufacturing building to evaluate the extent of the BTEX plume beneath the building, and completion of one permanent well
- analysis of BTEX plume temporary well samples for VOCs.

Soil. Specific data needs identified by NYSDEC for soil beneath the manufacturing building included:

- extent of soil contamination associated with abandoned storm sewers (and their associated backfill materials), the sumps, trenches, and pits used for the manufacturing operations, the "oil sumps," the paint room, and preferential pathways beneath the building
- extent of soil contamination in other areas of the plant where hydraulic fluids with PCBs were used (unless integrity of the former sumps and trenches can be proven)
- extent of PCBs, heavy metals, CN and VOCs beneath the building in soil (including within/near former trenches, pits, sumps)
- nature and extent of contamination within the footprint of the manufacturing building.

GM is including the following tasks in the SRI to address these data needs:

- installation of temporary piezometers along sewer lines leading to oil/water collection sumps #1, 4, and 5 to evaluate the extent of PCB NAPL

- installation of soil borings upgradient of sumps 2, 3, 6, 7, and 8
- installation of soil borings in and around paint room
- collection of subsurface soil samples in and around the paint room, and analysis for VOCs, SVOCs, PCBs, site-related metals and CN.

NYSDEC comments related to manufacturing building subsurface data needs which are not being addressed by specific field activities include:

- extent of soil contamination associated with sumps, trenches, and pits used for the manufacturing operations, and the "oil sumps"
- extent of soil contamination in other areas of the plant where hydraulic fluids with PCBs were used (unless integrity of the former sumps and trenches can be proven)
- extent of PCBs, heavy metals, CN and VOCs beneath the building in soil (including within/near former trenches, pits, sumps)
- nature and extent of contamination within the footprint of the manufacturing building.

Investigatory activities to evaluate extent of soil contamination associated with sumps, trenches, pits, and oil sumps used in manufacturing operations, as well as areas where hydraulic fluids were used, are not proposed as part of the SRI. Hydraulic oil and plating sumps were each investigated during the 1995-1996 Phase II ESA, as described in the October 1997 Preliminary RI/FS Report. Trenches associated with plating, die casting, and injection molding operations were shallow (up to 1.5 ft deep), and cut or formed into the reinforced concrete floor; trenches are therefore not believed to have been in communication with the subsurface. Pits associated with die casting operations (approximate 10 ft deep) and press lines (up to approximately 14 ft deep) were constructed of reinforced concrete, and contained sumps which were not connected to subsurface sewers, but were pumped out when necessary. These pits are also therefore not believed to have been in communication with the subsurface. Areas where hydraulic fluids were used are not proposed for investigation, because potential areas of subsurface releases have already been investigated during the Phase II ESA (*i.e.*, hydraulic oil sumps and tanks, former PCB oil underground storage tanks (USTs), and dock leveler sumps).

Evaluation of abandoned storm sewer trenches is focused on the lines leading to oil/water collection sumps #1, 4, and 5 based on water quality conditions observed in each of the oil/water collection sumps which intercept the abandoned storm sewer lines. Oil/water collection sump water was sampled in November 1997, and the data were provided to NYSDEC in GM's January 1998 monthly progress report for December 1997. NAPL was observed in three of the eight sumps, # 1, 4, and 5, and was sampled in January and February 1998, and found to contain PCBs at 48 mg/l, 17 mg/l, and >2,000 mg/l, respectively (data are presented in Table 5). The lines leading to these sumps and the backfill materials associated with these lines are believed to be potential pathways of migration for subsurface PCB NAPL originating from the hydraulic oil sump leakage. Soil borings will be installed upgradient of the remaining five oil/water collection sumps #2, 3, 6, 7, and 8, and soil samples will be collected to confirm that these abandoned storm sewer trenches are not contaminant migration pathways.

Additional investigatory activities to define the extent of contamination in the manufacturing subsurface are not proposed, because significant investigatory activities have been performed which indicate the presence of petroleum hydrocarbon and PCB contamination at various locations in fill material under the manufacturing building subsurface, and further investigatory efforts are proposed to evaluate the extent of NAPL and VOC contamination in the paint room area.

The specific rationale for individual field activities is included in Table 2.

4.2.2. Southeast property area

Ground water. Specific data needs identified by NYSDEC for ground water at the southeast property area include:

- ground water quality data to confirm current levels of contamination in this area.

GM is including the following tasks in the SRI to address these data needs:

- resampling of existing monitoring wells
- installation and sampling of new monitoring well
- analysis of ground water samples for VOCs, SVOCs, PCBs, site-related metals, and CN.

Soil. Specific data needs identified by NYSDEC for soil in the southeast property area included:

- shallow/surface soil data in the area around the storage pad
- soil data beneath the parking lot to document clean conditions for potential future redevelopment.

GM is including the following tasks in the SRI to address these data needs:

- collection of surface soil samples on each side of the storage pad
- analysis of surface soil samples for VOCs, PCBs, site-related metals, and CN and one surface soil sample for Target Compound List/Target Analyte List (TCL/TAL) constituents

- installation of soil borings and collection of subsurface soil samples from parking lot area
- analysis of subsurface soil samples from parking lot area for VOCs, SVOCs, PCBs, site-related metals and CN.

The specific rationale for individual field activities is included in Table 2.

4.2.3. Industrial waste treatment plant area

Ground water. Specific data needs identified by NYSDEC for ground water at the IWT plant area include:
- PCB concentrations in WT wells
- extent of contamination in the area.

GM is including the following tasks in the SRI to address these data needs:
- resampling of existing monitoring wells
- installation and sampling of new monitoring wells
- analysis of ground water samples for VOCs, SVOCs, PCBs, site-related metals and CN.

Soil. Specific data needs identified by NYSDEC for soil in the IWT plant area included:
- PCB surface soil data for risk assessment
- surface/soil data in incinerator area
- VOCs in vicinity of TCE storage area
- soil data near the former fuel oil USTs located east of the IWT plant, if confirmatory sampling was not done when tanks were removed
- extent of surface soil contamination in the area
- investigation and cleaning of RCRA SWMUs in this area, or documentation, along with methodology, that such has been satisfactorily performed
- dioxins and furans data in incinerator area due to the possible nature of the waste incinerated.

GM is including the following tasks in the SRI to address these data needs and general data needs related to the potential presence of DNAPL:
- collection of surface soil samples in Incinerator Area
- analysis of surface soil samples from Incinerator Area for VOCs, SVOCs, PCBs, site-related metals, CN, and a fraction of surface soil samples for chlorinated dioxins and furans and one surface soil sample for TCL/TAL constituents
- installation of soil borings in TCE storage area, one to lodgement till to evaluate the potential presence of DNAPL

- analysis of subsurface soil samples from TCE storage area for VOCs, SVOCs, PCBs, site-related metals, and CN
- installation of soil borings in vicinity of Former Fuel Oil Tanks
- analysis of subsurface soil samples from vicinity of Former Fuel Oil Tanks for VOCs, SVOCs, PCBs, site-related metals, and CN
- installation of soil boring associated with one new deep overburden monitoring well to lodgement till to evaluate potential presence of DNAPL
- if potential presence of DNAPL is observed, collection of one subsurface soil sample to evaluate the vertical extent of contamination, and installation of soil borings downgradient of the potential source of DNAPL to evaluate the horizontal extent of contamination.

Investigation and cleaning of each RCRA SWMU in the IWT plant area is not proposed in the SRI. SWMUs in the IWT plant area fall into one of three categories, as detailed in Appendix D:

- unit will be addressed as part of facility decommissioning/demolition
- unit has been removed, and was previously aboveground and not expected to have been a source of subsurface contamination
- unit was previously investigated as part of 1995-1996 Phase II ESA
- unit will be investigated as part of Supplemental RI.

The specific rationale for individual field activities is included in Table 2.

4.2.4. Southwest property area

Ground water. Specific data needs identified by NYSDEC for ground water at the southwest property area include:

- evaluation of extent of ground water contamination in mold storage building area.

GM is including the following tasks in the SRI to address these data needs:

- installation and sampling of new monitoring wells
- analysis of ground water samples for VOCs, SVOCs, PCBs, site-related metals and CN.

Soil. Specific data needs identified by NYSDEC for soil beneath the southwest property area included:

- evaluation of mold storage building area and soil to evaluate the presence of contamination and source of ground water contamination
- incorporation of closure plan contents for storage pad area into SRI.

GM is including the following tasks in the SRI to address these data needs and general data needs related to SWMUs and the potential presence of DNAPL:

- installation of soil borings in mold storage building area in vicinity of trench which historically discharged to ground surface outside building, both to lodgement till to evaluate potential presence of DNAPL
- if potential presence of DNAPL is observed, collection of one subsurface soil sample to evaluate the vertical extent of contamination, and soil borings downgradient of the potential source of DNAPL to evaluate the horizontal extent of contamination.
- analysis of subsurface soil samples from mold storage building area borings for VOCs, SVOCs, PCBs, site-related metals, and CN
- installation of soil borings in storage pad area
- analysis of subsurface soil samples from storage pad area for VOCs, SVOCs, PCBs, site-related metals, and CN.
- collection of surface soil samples around storage pad area
- analysis of surface soil samples from storage pad area for VOCs, SVOCs, PCBs, site-related metals, and CN, and one surface soil sample for TCL/TAL constituents.

The specific rationale for individual field activities is included in Table 2.

4.2.5. Former thinner tanks area

Ground water. Specific data needs identified by NYSDEC for ground water at the former thinner tanks area include:

- evaluation of extent of the BTEX plume (*i.e.*, beneath the building)
- evaluation of contamination potentially present in ground water in the area of the switch house and transformers.

GM is including the following tasks in the SRI to address these data needs:

- resampling of existing monitoring wells
- analysis of ground water sample for VOCs, SVOCs, PCBs, site-related metals and CN.

Soil. Specific data needs identified by NYSDEC for soil beneath the former thinner tanks area include:

- investigation of contamination potentially present in the area of the switch house and transformers.

GM is including the following tasks in the SRI to address these data needs and risk assessment data needs:

- installation of soil borings in transformer/switch house area

- analysis of subsurface soil samples from transformer/switch house area for PCBs and SVOCs
- collection of a surface soil sample
- analysis of surface soil sample for TCL/TAL constituents.

The specific rationale for individual field activities is included in Table 2.

4.2.6. Northeast property area

Ground water. Specific data needs identified by NYSDEC for ground water at the northeast property area include:

- evaluation of PCBs in ground water.

GM is including the following tasks in the SRI to address these data needs:

- resampling of existing monitoring wells
- installation and sampling of new monitoring wells
- analysis of ground water samples for VOCs, SVOCs, PCBs, site-related metals, and CN.

Soil. No data needs were identified for this area by NYSDEC. However, GM is including the following tasks in the SRI to address risk assessment data needs and general data needs related to the potential presence of DNAPL:

- collection of surface soil samples in unpaved areas
- analysis of surface soil samples for PCBs, VOCs, SVOCs, site-related metals, and CN and one surface soil sample for TCL/TAL constituents
- installation of soil boring and collection of subsurface soil samples from parking lot area
- analysis of subsurface soil samples from parking lot area for VOCs, SVOCs, PCBs, site-related metals and CN
- installation of two soil borings to glacial till for evaluation of the potential presence of DNAPL
- if potential presence of DNAPL is observed, collection of one subsurface soil sample to evaluate the vertical extent of contamination, and installation of soil borings downgradient of the potential source of DNAPL to evaluate horizontal extent of contamination.

The specific rationale for individual field activities is included in Table 2.

4.2.7. Northern property area

Ground water. Specific data needs identified by NYSDEC for ground water at the northern property area include:

- identification of the downgradient edge of the elevated ground water VOC concentrations in the surface impoundment area
- characterization of the nature and extent of contamination at, and in the vicinity of, the landfill
- further investigation of metals concentrations in vicinity of landfill
- characterization of the nature and extent of contamination in the northern property area
- ground water sampling in the more upstream portion of the swale system
- evaluation of SVOC and metals concentrations in ground water in the surface impoundment monitoring wells.

GM is including the following tasks in the SRI to address these data needs:

- resampling of existing monitoring wells
- installation and sampling of new monitoring wells
- analysis of ground water samples for VOCs, SVOCs, PCBs, site-related metals, and CN.

The surface impoundment monitoring wells (MW-1S/1D through MW-5S/5D) are not included in the ground water sampling proposed for the SRI. These 10 wells are sampled semi-annually under the Order for analysis for VOCs and PCBs. It is proposed that the timing of the SRI ground water sampling program and the semi-annual surface impoundment monitoring event (as well as the quarterly thinner area ground water monitoring event) be coordinated to allow for concurrent sampling. Analytical data for the coordinated routine monitoring event will be presented in the SRI Report. SVOC and metals analyses are not proposed for the surface impoundment monitoring wells because historic post-closure surface impoundment ground water monitoring indicated that these constituents were not of concern. Analyses for lead and mercury were discontinued during the course of the post-closure surface impoundment monitoring program after a series of non-detections. Further, continued analyses for arsenic, nickel, chromium, and zinc indicated only low detections, generally below NYS Class GA standards. Metals were consequently not included in the semi-annual surface impoundment ground water monitoring program under the Order. Finally, SVOCs were not detected in annual analyses for constituents in Appendix IX of 40 CFR Part 261 conducted during the post-closure monitoring program.

Soil. Specific data needs identified by NYSDEC for soil at the northern property area included:

- collection of PCB surface soil data for risk assessment
- conduct additional soil sampling for PCBs, metals, and VOCs along the full length of the swale
- evaluation of the source of increased VOC concentrations in ground water in surface impoundment area
- evaluation of whether the area of the former impoundment now covered by the building has contamination present, and if it may be a continuing source for contamination to the ground water
- evaluation of potential presence of PCB oil NAPL in vicinity of surface impoundment monitoring well MW-2S
- conduct additional soil sampling within the footprint of, and in the vicinity of, the landfill in order to better characterize the nature and extent of contamination and to identify contaminant sources
- characterization of the nature and extent of contamination and identification of contaminant sources which may exist here
- evaluation of the general filling which occurred in the northern portion of the facility
- inclusion of soil sampling in the more upstream portion of the swale system.

GM is including the following tasks in the SRI to address these data needs and general data needs related to the potential presence of DNAPL:

- installation of soil borings in general fill area
- analysis of subsurface soil samples for PCBs, VOCs, site-related metals, and CN
- installation of soil boring in former Impoundment #1 area
- collection of subsurface soil samples in former Impoundment #1 area and analysis for PCBs, VOCs, site-related metals, and CN
- collection of surface soil samples in former landfill area
- analysis of surface soil samples in former landfill area for VOCs, SVOCs, PCBs, site-related metals, mercury, and CN and one surface soil sample for TCL/TAL constituents
- installation of test trenches in former landfill area
- analysis of landfill material samples for VOCs, SVOCs, PCBs, site-related metals, CN, and mercury
- TCL/TAL analysis for two selected landfill material samples
- installation of test trenches in former drainage swale area
- analysis of subsurface soil samples from former drainage swale area for PCBs, VOCs, site-related metals, and CN
- installation of two soil borings to glacial till for evaluation of the potential presence of DNAPL
- if potential presence of DNAPL is observed, collection of one subsurface soil sample to evaluate the vertical extent of contamination, and

installation of soil borings downgradient of the potential source of DNAPL to evaluate horizontal extent of contamination.

The specific rationale for individual field activities is included in Table 2.

4.3. Ley Creek Deferred Media data needs

Data needs and field activities proposed to address them for Ley Creek surface water and sediment are discussed in the following subsections. The other component of the Ley Creek Deferred Media, ground water beneath the Ley Creek PCB Dredgings site, was addressed with Former IFG Facility ground water in Section 4.2.

4.3.1. Ley Creek surface water

The following data needs for Ley Creek surface water were identified by NYSDEC in the Order:

- surface water conditions downstream of Outfalls 003 and 004 and at the Route 11 bridge
- VOC, PCB and metals data for surface water
- TAL and TCL analysis in selected surface water samples.

GM is including the following tasks in the SRI to address these data needs and risk assessment data needs.

- collection of upstream surface water samples
- collection of surface water samples downstream of Outfalls 003 and 004 and at the Route 11 bridge
- collection of samples at both low and high flow conditions
- analysis of collected samples for VOCs, SVOCs, PCBs, CN, and site-related metals
- TCL/TAL analysis in selected surface water samples.

Though a specific comment was not issued regarding upstream sampling, GM will collect upstream samples to evaluate background surface water conditions. The specific rationale for the sampling activities is included in Table 2.

4.3.2. Ley Creek sediment

The following data needs for Ley Creek sediment were identified by NYSDEC in the Order:

- identification of depositional areas between Townline Road and Route 11
- VOC, PCBs, total organic carbon (TOC) and metals data in surface sediments (0 to 6 in) and in selected subsurface 6-in intervals
- TAL and TCL analytes in selected sediment samples.

GM is including the following tasks in the SRI to address these data needs and risk assessment data needs:

- sediment probing to identify sediment depositional areas
- sediment sampling in depositional areas between Townline Road and Route 11, and in upstream locations
- analysis of surface sediment and selected subsurface sediment samples for VOC, PCBs, TOC, and site-related metals
- TCL/TAL and chlorinated dioxins/furans analysis in selected sediment samples.

Though a specific comment was not issued regarding sampling of upstream sediment, GM will collect upstream sediment samples to evaluate background sediment conditions. The specific rationale for the sampling activities is included in Table 2.

5. Supplemental remedial investigation/feasibility study tasks

The following subsections describe the tasks to be performed during the Supplemental RI/FS. Table 3 provides a summary of the field activities to be completed at the site. Table 4 provides a summary of the analytical samples and parameters to be used for samples collected during the field program.

5.1. Task 1 - Inspection of existing well integrity

Ground water monitoring wells have been installed at the site as part of numerous previous investigations. The nineteen existing wells which are proposed to be sampled as part of the SRI are indicated in Figure 6. Although one well nest (W-6S/W-6D) was not located during a site survey in 1998 , additional attempts will be made to locate these wells because they were located during a well location search in September 1996. If they are not located, new monitoring wells will be installed to replace them.

Many of these wells have not been sampled in several years. In order to evaluate the usability of these existing wells for the current investigation, located wells which are proposed to be sampled will be inspected as part of the SRI field activities. A well integrity checklist (included in Appendix E) will be used and completed based on physical inspection. If necessary and feasible, damaged wells will be repaired. If a damaged well can not be repaired, it will either be replaced with a new well, or substituted by a nearby existing well, with the concurrence of NYSDEC.

5.2. Task 2 - Redevelopment of existing wells

Following location and inspection of existing ground water monitoring wells, the existing wells will be developed. Procedures for well development are described in Section 6 of the FSP (Appendix A).

5.3. Task 3 - Monitoring well installation/development

The objective of this task is to refine the nature and extent of ground water contamination at the site. A total of twenty six monitoring wells will be installed at the site. Six shallow/deep overburden well nests will be installed in key locations where historic wells were not previously installed. Three shallow/deep overburden well nests will be installed in locations where previous wells could not be located. Three deep overburden wells will be installed adjacent to existing shallow overburden wells. One shallow overburden well will be installed in the manufacturing building in the vicinity of the BTEX plume. Upgradient ground water conditions will be evaluated through installation of one shallow/deep overburden and top of bedrock well nest and one new top of bedrock well in the vicinity of existing upgradient shallow/deep overburden well nest U-1S/U-1D. Proposed monitoring well locations are presented in Figure 6. The shallow overburden wells will be constructed with 10 ft screens and installed to screen across the water table. The deep overburden wells will be constructed with 5 ft screens and will be set to the top of the lodgement till layer. The top of the bedrock wells will be constructed with 5 ft screens and will be set to the top of bedrock.

A typical monitoring well schematic is presented as Figure 19. If DNAPL is observed during drilling, the well construction will be modified to include a 1 ft section of solid casing below the well screen to serve as a sump. Monitoring well installation procedures and equipment decontamination procedures are contained in Sections 4 and 6 of the FSP (Appendix A). Health and safety measures related to installation and development of ground water monitoring wells are included in the HASP (Appendix C).

5.4. Task 4 - *In situ* hydraulic conductivity testing

In order to augment existing data for the site, up to ten *in situ* hydraulic conductivity tests will be conducted during the SRI field program. Procedures for conducting *in situ* hydraulic conductivity testing are included in Section 8 of the FSP. Health and safety measures related to *in situ* hydraulic conductivity testing are included in the HASP (Appendix C).

5.5. Task 5 - Ground water sampling/analysis

Forty five to forty six ground water samples will be collected at the site in order to refine the nature and extent of ground water contamination. Of the existing wells at the site, nineteen were selected for sampling along with the twenty six new wells to be installed, in order to collect a relatively even distribution of samples across the site and include areas of historic ground water contamination. The remaining existing wells at the site were excluded because other existing wells in the vicinity were selected for sampling. In addition, the quarterly monitoring event for monitoring wells in the thinner spill area (i.e., T-1, T-2, T-3, T-4, T-5, T-10, T-13, T-15, T-18, T-21, T-24, T-26, T-29, T-33B, and P-9) and the semi-annual monitoring event for monitoring wells in the surface impoundment area (i.e., MW-1S/1D, MW-2S/2D, MW-3S/3D, MW-4S/4D, and MW-5S/5D) will coincide with the site-wide ground water sampling.

Of the forty five to forty six, a total of five wells will be sampled at the Ley Creek PCB Dredgings site, four from shallow overburden wells and one from a top of bedrock well. A total of thirty four to thirty five wells will be sampled at the Former IFG Facility, nineteen to twenty from shallow overburden wells and fifteen from deep overburden wells. Additionally, two well nests (six wells) will be sampled upgradient of the facility. Proposed ground water sample locations are indicated on Figure 6.

Ground water elevations will be measured in each well prior to sampling. At this time, ground water elevations will also be measured in piezometers installed in the manufacturing building.

As summarized in Table 3, the ground water samples will be analyzed for the presence of VOCs, SVOCs, PCBs, site-related metals, and CN. Details related to ground water sampling and analysis are presented in Section 10 of the FSP (Appendix A) and Sections 9 and 11 of the QAPP (Appendix B). Health and safety measures to be taken during ground water sampling activities are described in the HASP (Appendix C).

5.6. Task 6 - Soil/source area investigation

The objective of this task is to evaluate contaminant migration and exposure pathways and to refine the nature and extent of soil contamination. The soil/source area investigation will include installation and sampling of thirty four soil borings, collection of at least one hundred eight subsurface soil samples, and collection of forty one surface soil samples.

With the exception of borings installed to investigate the potential presence of solvent DNAPL, as discussed below, and if no contamination is observed or suspected during field screening, then soil borings will extend up to 2 ft into the top of native material or to the top of the ground water table (based on field observations or data from nearby monitoring wells), whichever is deeper. If there is field screening evidence of contamination and no NAPL is observed or suspected, then the soil boring will continue to the base of the contamination or to the top of bedrock, whichever is shallower. If NAPL is observed or suspected during field screening, then the boring will be terminated at the next geologic interface, such as the interface between the fill and the native material. GM and the NYSDEC will then evaluate the site data and decide if additional vertical delineation is necessary and how such delineation should proceed.

At a minimum, in borings in unpaved areas, three soil samples will be collected and submitted for laboratory analysis. One sample will be collected at the surface (0-1 ft), a second sample will be collected immediately above the top of the water table, and a third sample will be selected by field screening results. In addition, if a soil boring extends below the ground water table, one additional saturated soil sample will be selected for analysis based on field screening data. Ten soil borings associated with the following locations are anticipated to be in unpaved areas: northern property area general fill area, southwest property area outside of mold storage building, former thinner tanks area in transformer/switch house area, and the background location.

In borings in paved areas, a minimum of two subsurface soil samples will be collected. One sample will be collected immediately above the top of the water table, and a second sample between the surface and the water table will be selected by field screening results. In addition, if a soil boring extends below the ground water table, one additional saturated soil sample will be selected for analysis based on field screening data. Soil borings associated with the following locations are anticipated to be in paved areas: interior of manufacturing building, southeast property area parking lot, IWT plant area, southwest property area storage pad, northeast property area parking lot, and northern property area former impoundment #1 area.

Soil borings will also be completed in four specific areas of the site to evaluate the presence of solvent DNAPL. These areas are the IWT plant area, the mold storage building, the northeast property area, and the surface impoundment area. Boring placements, shown on Figure 14, as well as Figures 9, 10, 12, and 13, for the sub-areas, are based on the top of lodgement till contour map (Figure 14) as well as historical operations and previously detected ground water concentrations. In the IWT plant area, the DNAPL evaluation borings will coincide with one of the deep overburden wells to be installed in that area, and one of the borings to be installed in the TCE storage area. In the southwest property area, the DNAPL evaluation borings will coincide with the two borings to be installed in the mold storage building area.

Subsurface soils from these DNAPL evaluation borings will be screened for DNAPL using an ultraviolet (UV) light. If a positive response is not observed, soil borings will be completed to the top of the lodgement till and up to three soil samples will be selected based on field screening for analysis for VOCs and PCBs. If a positive response is observed, the boring will continue to a depth where DNAPL is no longer encountered, and a confirmatory sample will be collected for analysis for VOCs and PCBs, provided that the boring does not extend below the bottom of the geologic unit in which the DNAPL was observed, such as the interface between the fill and native material. To evaluate the horizontal extent of DNAPL, additional borings will be installed in a downgradient direction from the potential source until DNAPL is not observed. When DNAPL is not observed, up to three soil samples will be selected based on field screening for analysis for VOCs and PCBs.

The investigation will be conducted at each of the Former IFG Facility property areas discussed in the following sections. A summary of the number of samples and corresponding analytical parameters is presented in Table 3. Details related to soil borings and surface/subsurface soil sampling are described in Sections 5 and 11 of the FSP (Appendix A). Specific details related to soil sample analysis are included in Sections 9 and 11 of the QAPP (Appendix B). Health and safety measures to be taken during soil boring installation and soil sample collection activities are described in the HASP (Appendix C).

5.6.1. Manufacturing building subsurface

In the manufacturing building, temporary piezometers will be installed to investigate the presence of oil in the sewer system (7 to 12 ft below surface). The piezometers will be located along sewer lines leading to oil/water collection sumps # 1, 4, and 5. Each temporary piezometer will be installed within the backfill to a depth of approximately 7 to 12 ft or to the top of the water table. Seventeen proposed temporary piezometers are located at approximate 100 ft intervals along each of these lines, as shown on Figure 7. The actual number and locations of temporary piezometers will be dependent on the extent of observed NAPL, in the field with NYSDEC concurrence. Each piezometer will be observed for the presence of NAPL. If present, the thickness of the NAPL layer will be measured and recorded.

A typical flushmount piezometer schematic is presented as Figure 18. Piezometer installation and equipment decontamination procedures are contained in Sections 4 and 7 of the FSP (Appendix A). Health and safety procedures are included in the HASP (Appendix C).

Although NAPL was not previously detected in sumps 2, 3, 6, 7, and 8, one soil boring will be installed upgradient of each of the five oil/water collection sumps, as shown on Figure 7. The soil borings will penetrate through the sewer backfill material to a depth of one foot below the sewer backfill materials. Visual and UV light screening of the backfill/soil materials will be performed to evaluate the presence of NAPL. If NAPL is not observed, samples of the backfill/soil materials will be collected at 2-ft intervals down to 1 ft below the sewer backfill materials. Samples will be analyzed for VOCs, SVOCs, PCBs, and site-related metals in accordance with the QAPP (included as Appendix B) to confirm that the backfill materials are not serving as contaminant migration pathways. If NAPL is observed, a flushmount piezometer will be installed at the boring location, and the thickness of the NAPL will be measured and recorded. The piezometer will be screened through the backfill material. Also, additional soil borings will be installed in an upgradient direction along the sewer line, at 100-ft intervals, with visual and UV light screening, until the extent of NAPL along the sewer line trench is identified. The soil borings will then be grouted, and the surface will be restored.

For the purpose of evaluating the extent of the thinner spill plume beneath the manufacturing building and ultimately installing one water table monitoring well, limited soil borings will be installed in the southwest portion of the 1974-1975 building addition to a depth of 10 to 15 ft using Hydropunch or Geoprobe methodology. Borings will be installed along a northeast-southwest line to identify the edge of the plume. Each soil boring will be observed for staining and odors and field screened with a photoionization detector (PID).

Depending on the results of the field observation and screening, additional borings will be installed northeast or southwest of the first boring until the edge of contamination is generally identified. One or two temporary wells will be installed in the boring(s) at the observed edge of contamination. Ground water sample(s) will be collected from the temporary well(s) for VOC analysis. Based on the results of the analyses, one temporary well will be completed as a permanent flushmount shallow monitoring well. Other temporary wells, if any, will be removed and grouted, and the concrete surface will be restored.

Additionally, eight soil samples will be collected from four soil borings to be installed in and around the paint room and analyzed for VOCs, SVOCs, PCBs, cyanide, and site-related metals. Proposed soil boring locations are presented on Figure 7.

5.6.2. Southeast property area

Four surface soil samples (0 - 1 ft) will be collected from the southeast property area. The samples will be taken from each side of the storage pad. Three samples will be analyzed for the presence of VOCs, SVOCs, PCBs, site-related metals, and CN, and one sample will be analyzed for TCL/TAL constituents.

In addition, two soil borings will be installed to the top of the water table in the parking lot area. Four subsurface samples will be collected from these two soil borings and analyzed for VOCs, SVOCs, PCBs, site-related metals, and CN. Proposed surface and subsurface soil sample locations are presented on Figure 8.

5.6.3. Industrial waste treatment plant area

In the IWT plant area, two soil borings will be installed in the TCE storage area, and two soil borings will be installed in the vicinity of the former fuel oil tanks. The four subsurface soil samples obtained from the TCE storage tank area and the four subsurface soil samples obtained in the vicinity of the former fuel oil tanks will be analyzed for the presence of VOCs, SVOCs, PCBs, site-related metals, and CN.

One of the borings in the TCE storage area and one of the borings to be completed as a deep overburden well in the IWT plant area will be installed for the purpose of evaluating the potential presence of solvent DNAPL. These borings will be screened using a UV light. If a positive response is not observed, soil borings will be completed to the top of the lodgement till and up to three soil samples will be selected based on field screening for analysis for VOCs and PCBs. If a positive response to the UV light is observed, the boring will continue to a depth where DNAPL is no longer encountered, and a confirmatory sample will be collected for analysis for VOCs and PCBs, provided that the boring does not extend below the bottom of the geologic unit in which the DNAPL was observed, such as the interface between the fill and native material. To evaluate the horizontal extent of DNAPL, additional borings will be installed in a downgradient direction from the potential source until DNAPL is not observed. When DNAPL is not observed, up to three soil samples will be selected based on field screening for analysis for VOCs and PCBs.

Additionally, ten surface soil samples (0 - 1 ft) will be taken in unpaved areas around the IWT plant. Nine of these surface soil samples will be analyzed for VOCs, SVOCs, PCBs, site-related metals, and CN, and one sample will be analyzed for TCL/TAL constituents. Five of the surface samples will also be analyzed for chlorinated dioxins and furans. Proposed sampling locations are presented in Figure 9.

5.6.4. Southwest property area

In the southwest property area, four subsurface samples and two surface soil samples will be collected from two soil borings to be installed outside the mold storage building in the vicinity of a former building trench which discharged to the ground surface. One surface soil sample will be analyzed for TCL/TAL constituents. Samples from these two borings will be analyzed for VOCs, SVOCs, PCBs, site-related metals, and CN.

Four subsurface soil samples will be collected from two soil borings to be installed in the storage pad area, historically used for hazardous waste solvent and degreaser storage. Samples from the storage pad area will be analyzed for VOCs, SVOCs, PCBs, site-related metals, and CN. In addition to the soil borings in the vicinity of the storage pad, four surface soil samples will be collected and analyzed for VOCs, SVOCs, PCBs, site-related metals, and CN.

The two borings in this area to be installed outside the mold storage building will be installed to also evaluate the potential presence of solvent DNAPL. These borings will be screened using a UV light. If a positive response is not observed, soil borings will be completed to the top of the lodgement till and up to three soil samples will be selected based on field screening for analysis for VOCs and PCBs. If a positive response is observed to the UV light, the boring will continue to a depth where DNAPL is no longer encountered, and a confirmatory sample will be collected for analysis for VOCs and PCBs, provided that the boring does not extend below the bottom of the geologic unit in which the DNAPL was observed, such as the interface between the fill and native material. To evaluate the horizontal extent of DNAPL, additional borings will be installed in a downgradient direction from the potential source until DNAPL is not observed. When DNAPL is not observed, up to three soil samples will be selected based on field screening for analysis for VOCs and PCBs. Proposed soil sample locations are presented in Figure 10.

5.6.5. Former thinner tanks area

Six subsurface soil samples and three surface soil samples will be collected from three soil borings to be installed in the transformer/switch house area. The samples will be tested for the presence of SVOCs and PCBs.

One surface soil sample will also be collected from an unpaved area in the former thinner tanks area and analyzed for TCL/TAL constituents. Proposed sampling locations are presented in Figure 11.

5.6.6. Northeast property area

In the northeast property area, four surface soil samples (0 - 1 ft) will be collected from unpaved areas around the administration building. Three samples will be analyzed for VOCs, SVOCs, PCBs, site-related metals, and CN, and one sample will be analyzed for TCL/TAL constituents. One soil boring will be installed in the parking lot in the northeast property area. Two subsurface soil samples will be collected for analysis for VOCs, SVOCs, PCBs, site-related metals, and CN.

In addition, two soil borings will be installed in this area for the purposes of evaluating the potential presence of solvent DNAPL. These borings will be screened using a UV light. If a positive response is not observed, soil borings will be completed to the top of the lodgement till and up to three soil samples will be selected based on field screening for analysis for VOCs and PCBs. If a positive response is observed to the UV light, the boring will continue to a depth where NAPL is no longer encountered, and a confirmatory sample will be collected for analysis for VOCs and PCBs, provided that the boring does not extend below the bottom of the geologic unit in which the DNAPL was observed, such as the interface between the fill and native material. To evaluate the horizontal extent of DNAPL, additional borings will be installed in a downgradient direction from the potential source until DNAPL is not observed. When DNAPL is not observed, up to three soil samples will be selected based on field screening for analysis for VOCs and PCBs. Proposed sample locations are presented in Figure 12.

5.6.7. Northern property area

Twenty four samples will be collected from four soil borings to be installed in the general fill area in the northern property area south of the fence and east of the former drainage swale. Samples will be collected from the soil borings at the surface (0 - 1 ft) and at subsequent two ft intervals until the top of the water table (assumed to be 10 ft below surface). Samples will be analyzed for PCBs, VOCs, site-related metals, and CN. Proposed sample locations are presented on Figure 13.

Eight surface soil samples will be collected in the historic landfill area northwest of the manufacturing building addition. Seven surface soil samples collected from the the historic landfill area will be analyzed for PCBs, VOCs, SVOCs, site-related metals, mercury, and CN, and one surface soil sample will be analyzed for TCL/TAL constituents. Proposed sample locations are presented on Figure 13.

Two samples will be collected from one soil boring to be installed in the former surface impoundment #1 area, as indicated on Figure 13, and analyzed for PCBs, VOCs, site-related metals, and CN.

Two soil borings will be installed in the vicinity of the closed Impoundment #2 to evaluate the potential presence of solvent DNAPL. Subsurface soil samples will be sampled continuously and screened for the presence of DNAPL using a UV light. If a positive response is not observed, soil borings will be completed to the top of the lodgement till and up to three soil samples will be selected based on field screening for analysis for VOCs and PCBs. If a positive response is observed to the UV light, the boring will continue to a depth where NAPL is no longer encountered, and a confirmatory sample will be collected for VOCs and PCBs analysis, provided that the boring does not extend below the bottom of the geologic unit in which the DNAPL was observed, such as the interface between the fill and native material. To evaluate the horizontal extent of DNAPL, additional borings will be installed in a downgradient direction from the potential source until DNAPL is not observed. When DNAPL is not observed, up to three soil samples will be selected based on field screening for analysis for VOCs and PCBs. Proposed sample locations are indicated on Figure 13.

Test trenches will be installed in the northern property area in order to evaluate subsurface conditions in the location of the former drainage swale and the historical landfill area. Specifically, eight test trenches are planned for the former drainage swale area and up to eight soil samples will be collected from these test trenches. Four test trenches are planned for the former landfill area and up to a total of twelve soil or waste material samples will be collected from these test trenches. Test trench locations are indicated on Figure 13. Test trenching will extend to the top of native materials or to the maximum reach of the trenching equipment. The width of the trench will be based on the width of the trenching equipment and the side wall stability of the trench. Samples of soil or waste materials from the trenching will be collected in the same manner as the surface soil samples. Samples will be collected from the excavated material. Soil and waste material samples will be collected for screening purposes during the test trench program, based on visual observation, field screening, and concurrence with a NYSDEC representative on site. The samples collected from the historic landfill area will be analyzed for VOCs, SVOCs, PCBs, site-related metals, mercury, and CN, with the exception of two samples of landfill material, which will be analyzed for TCL/TAL analytes. The samples from the former drainage swale area will be analyzed for VOCs, PCBs, site-related metals, and CN.

Should site conditions limit the feasibility of test trenching (*e.g.*, large quantities of concrete, presence of drums), test trenching operations will cease. A revised approach will then be developed with NYSDEC's concurrence. If waste material extends to a depth greater than the maximum reach of the trenching equipment, then a soil boring approach will be developed with NYSDEC's concurrence.

Test trench installation procedures and equipment decontamination procedures are included in Section 9 of the FSP (Appendix A). Details regarding sample analysis are discussed in Sections 9 and 11 of the QAPP (Appendix B). Health and safety measures related to test trench installation and sampling are included in the HASP (Appendix C).

5.6.8. Background soil investigation

Soil samples will be collected during installation of one upgradient monitoring well in the new upgradient well nest. Samples will be collected from the surface (0 - 1 ft) and subsequent 2 ft intervals to the top of ground water (assumed to be 10 ft below surface). The samples will be analyzed for site-related metals.

5.7. Task 7 - Sediment investigation

The objective of this task is to characterize sediment quality in depositional areas of Ley Creek upstream and downstream of the Former IFG Facility. The sediment investigation will consist of substrate probing to identify depositional areas, evaluate sediment depth, and establish locations for subsequent sampling of sediments in depositional areas.

The sampling area and potential sample locations, based on one every 500 ft, are shown on Figure 15. Actual sediment sample locations will be based on depositional area locations, but no less than once every 500 ft, with concurrence of on-site NYSDEC staff. Upstream, or background, sample locations will be selected in the field, with concurrence of NYSDEC staff, based on visual sediment similarity to sediment found on site. Physical characteristics of site and background sediment samples will be matched to the extent possible. Use of upgradient sample data as background data will be reviewed by GM and NYSDEC.

Upstream sample locations will be selected in the North Branch, South Branch, Sanders Creek, and between the confluence of the North and South Branch and Outfall 003. Downstream sample locations will also be selected between Outfall 003 and Route 11, at least one per 500 linear feet. Ten upstream locations will be sampled, and up to sixteen locations will be sampled downstream. Upstream surface water and sediment sample locations were selected to evaluate upstream water and sediment quality that could contribute to constituent concentrations in site media. Two sediment samples are proposed to be collected from depositional areas within each of the three upstream reaches (i.e., North Branch, South Branch, and Sanders Creek) to provide a range of background constituent concentrations rather than a single characterization sample.

Sediment cores will be collected to a depth of refusal. Discrete surface and subsurface samples will be collected at 6 in intervals. The surface sediment samples and up to six subsurface sediment samples (up to thirty two total) will be analyzed for SVOCs, VOCs, PCBs, TOC, CN, and heavy metals (antimony, arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc) with the exception of two selected downstream sediment samples (one surface sample and one subsurface sample), which will be analyzed for target compound list (TCL) and target analyte list (TAL) analytes. In addition, selected samples will be analyzed for chlorinated dioxins and furans. Four surface sediment samples and two subsurface sediment samples will be collected from the upstream sample locations between Townline Road and the confluence of the North and South Branches of Ley Creek. These samples will be analyzed to characterize anthropogenic background chlorinated dioxin and furan concentrations. The number of analyses will be based on the depositional characteristics of sediments in the reach. For four downstream depositional areas, four surface sediment samples and two subsurface sediment samples will be analyzed for chlorinated dioxins and furans.

Sediment sampling and analysis procedures are described in the Section 12 of the FSP and Sections 9 and 11 of the QAPP. Health and safety measures related to sediment sampling are described in the HASP (Appendix C).

5.8. Task 8 - Surface water investigation

The objective of this task is to characterize surface water quality of Ley Creek upstream and downstream of the Former IFG Facility during high flow and low flow conditions. Upstream samples will be taken from the North Branch, South Branch, Sanders Creek, and between the confluence of North and South Branch and Outfall 003. Samples will also be taken downstream of Outfall 003, downstream of Outfall 004, and at the Route 11 bridge. A total of four samples will be collected upstream, and three samples will be collected downstream of the site during each of two sampling rounds. Sample locations are shown on Figure 15. Samples will be collected once during low flow conditions and once during high flow conditions, based on United States Geological Survey (USGS) data for Ley Creek, as discussed in Section 12 of the FSP. Samples will be analyzed for VOCs, SVOCs, PCBs, CN, and heavy metals (antimony, arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc). Also, analysis for TCL and TAL analytes will be done on two selected samples.

Surface water sampling and analysis procedures are described in Section 12 of the FSP (Appendix A) and Sections 9 and 11 of the QAPP (Appendix B). Health and safety measures to be taken during surface water sampling are described in the HASP (Appendix C).

5.9. Task 9 - Surveying

Each of the temporary piezometer, monitoring well, soil boring, surface soil sample, sediment sample, and surface water sample locations will be surveyed for horizontal and vertical control. The ground surface at each location will be surveyed to the nearest 0.1 ft. Monitoring wells will be surveyed to the nearest 0.01 ft at the top of the well casing and the top of the protective casing. Survey coordinates for each sample location will be reported in NYSP or UTM coordinates.

5.10. Task 10 - Data validation

SRI analytical data will be validated in accordance with USEPA Region II guidelines, as described in Section 22 of the QAPP (Appendix B).

5.11. Task 11 - Analytical summary report

Within ninety days of the last sample collection associated with a discrete sampling event, an analytical summary report will be submitted to the NYSDEC as required by the Order. The summary report will describe the scope of the sampling addressed in the report, reference sampling or testing issues associated with the sampling event, and include the relevant lab data sheets. Interpretation of the sampling data will be reserved for the SRI Report.

Analytical data will be provided to NYSDEC both in hard copy and electronic format. Two copies of each data file will be submitted in either a PC-based spreadsheet (*e.g.*, *.wk1 files) or a database format (*e.g.*, *.dbf or *.db files). The files will include available sample description and location information in one table, laboratory results in another table, and will be linkable by a sample identification code. Specific information to be included in data files is listed in Appendix F .

5.12. Task 12 - Supplemental risk assessment

A technical meeting to discuss the supplemental risk assessment was held on June 16, 1998. Representatives of NYSDEC, USEPA, and GM agreed to modify the risk assessment deliverables required by the Order. It was agreed that a risk assessment screening document would be submitted to NYSDEC and USEPA by July 24, 1998. The risk assessment screening documents (O'Brien & Gere, 1998; 1999) formally documented the screening steps which were outlined in an O'Brien & Gere June 12, 1998 submittal and discussed at the June 16, 1998 meeting. The human health screening steps which were performed included the following items required by the Order for the Risk Assessment Memorandum: identification of preliminary constituents of concern, potential exposure pathways, assumptions, and methods of calculating exposure point concentrations. For the ecological risk assessment, the screening assessment and problem formulation steps were performed to satisfy the Pre-RI Work Plan steps of the NYSDEC Generic Ecological Risk Assessment Guidance for Onondaga Lake Sites dated April 7, 1998.

Following completion of validation of SRI analytical data, the risk assessment screening will be revisited to incorporate the new data. Future direction from that point with respect to the risk assessment will be the focus of a Scientific Management Decision Point, based on the revised screening. If necessary based on the Scientific Management Decision Point, collection of biota samples and performance of toxicity testing would be outlined in a risk assessment work plan for submittal to NYSDEC and USEPA. The risk assessment would subsequently be conducted in accordance with the approved risk assessment work plan, and documented in a risk assessment report.

5.13. Task 13- Supplemental remedial investigation report

The objective of this task is to prepare a report which presents the results of the 1998 SRI, incorporating NYSDEC's comments to the October 1997 Preliminary RI/FS Report, with Tasks 1 through 11 of this Work Plan. Discussions, evaluations, summaries, and conclusions contained in the SRI Report will be based on available SRI and historic site-related data. The following format will be used for the development of the SRI Report.

1. Introduction
2. Site conditions
3. Field investigation activities
4. Field investigation results
5. Nature and extent of contamination
6. Contaminant fate and transport
7. Summary and conclusions.

Remedial action objectives (RAO's) will be included in the SRI Report as part of the summary and conclusions if the human health and ecological risk assessments are completed at that time.

5.14. Task 14 - Supplemental feasibility study

5.14.1. Objective

The objective of this task is to develop, screen and evaluate remedial alternatives for the site in order to present sufficient information for decision makers to compare alternatives and select a remedy. The FS documented in the October 1997 Preliminary RI/FS Report will be updated and revised as appropriate, based on the data collected and conclusions reached in the SRI.

The completion of the SFS will be in accordance with the provisions of CERCLA as amended by SARA, the NCP (NCP 1990), USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA 1988), and NYSDEC revised TAGM on Selection of Remedial Actions at Inactive Hazardous Waste Sites (NYSDEC 1990).

5.14.2. Development of alternatives

The first phase in the SFS is the development, in a manner consistent with the above referenced regulations, of a range of remedial alternatives that are reflective of appropriate waste management options and which are protective of public health and the environment. The development of alternatives encompases the following steps:

Development of remedial objectives. Remedial action objectives identify the contaminants and media of interest, pathways of exposure, and preliminary remediation goals. Remedial action objectives, standards, criteria and guidance will be based on public health and environmental concerns identified in the SRI, and on NYS Standard Criteria and Guidelines (SCGs) and Federal requirements that are either potentially applicable or relevant and appropriate (ARARs) given the conditions at the site. The identification of SCGs (and ARARs) is an iterative process which continues throughout the Supplemental RI/FS. SCGs (and ARARs) will be identified and modified throughout the Supplemental RI/FS as a better understanding of site conditions, contaminants, and remedial action alternatives is gained.

SCGs (and ARARs) are identified as chemical-specific, location-specific, or action-specific. Chemical-specific SCGs (and ARARs) are usually health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to the ambient environment. Location-specific SCGs (and ARARs) set restrictions on activities based on the characteristics of the site or immediate environs. Action-specific SCGs (and ARARs) set controls or restrictions on particular types of actions related to management of hazardous substances, pollutants, or contaminants.

Development of general response actions. General response actions are medium-specific actions (e.g. containment, treatment) which satisfy the remedial action objectives.

Identification of volumes or areas of media. The volumes or areas of contaminated media will be identified based on the site conditions defined by the RI, the nature and extent of contamination, potential exposure routes, and the level of protectiveness specified by the remedial action objectives.

Identification and screening of remedial technologies and process options. Remedial technology types and process options which address the site-specific problems will be identified and screened on the basis of technical Implementability. Site contaminant information and physical characteristics will be used to evaluate the technical feasibility of identified process options. Infeasible process options will not be considered further.

Evaluation of process options. Each of the process options remaining after the initial screening will be evaluated in greater detail based on the following criteria:

- Effectiveness - the evaluation of effectiveness addresses the potential effectiveness of process options in handling the estimated areas or volumes of contaminated media and meeting the pertinent remedial action objectives, the effectiveness of process options in protecting human health and the environment during construction and implementation, and how proven and reliable the process options are relative to site conditions.

- Implementability - the evaluation of Implementability includes the technical and administrative feasibility of implementing a process option under such institutional constraints as the availability of treatment, storage, and disposal services, special permitting requirements, and the need and availability of equipment and skilled workers.

- Cost - the capital and operation and maintenance costs of each process option will be evaluated relative to the other process options of each technology type.

Assembly of remedial alternatives. In this phase, general response actions and technology process options which passed the screening will be assembled into alternatives such that the site impacts are addressed. The alternatives will be developed to represent a range of treatment and containment combinations. For source control actions, a range of alternatives will be developed that utilize, as their principal element, treatment technologies which reduce the toxicity, mobility, or volume of materials. Alternatives which primarily involve containment with little or no treatment will also be developed. For ground water response actions, if appropriate, a range of alternatives will be developed which attain site-specific remediation levels within varying time frames using one or more technologies. In addition, a no action alternative will be developed. The results of the development of alternatives will be documented in the SFS Screening Memorandum and the SFS Report. The assembled remedial alternatives will then be screened as detailed in the following section.

5.14.3. Screening of alternatives

The second phase of the SFS will be the screening of alternatives. The objective of this task will be to screen the remedial alternatives developed during the development of alternatives such that a refined range of the most promising alternatives is identified.

It should be noted that, since the intent of this task is to reduce the range of alternatives to a manageable number prior to the detailed analysis of alternatives, this task may not be necessary if the number of alternatives assembled during the development of alternatives is reasonable. The screening of alternatives consists of three steps. The first step will be the refinement of the alternatives as appropriate by incorporating updated information generated in the SRI. In the second step, the alternatives will be screened utilizing the following criteria:

- Effectiveness - this criterion relates to the protectiveness an alternative will provide for human health and the environment, both in the short-term and long-term, and the reductions in toxicity, mobility or volume of hazardous constituents shall be considered more effective than those that do not accomplis permanent reductions. Alternatives which would result in an increase in the toxicity, mobility or volume of hazardous constituents will not be considered further.

- Implementability - this criterion relates to the technical and administrative feasibility of implementing the remedial alternative. Technical feasibility involves the ability to construct, operate and maintain the alternative, as well as monitoring of technical components of an alternative. Administrative feasibility refers to the ability to obtain approvals; the availability of treatment, storage, and disposal services; and the requirements for and availability of equipment and specialists.

- Cost - estimates will be developed for each of the alternatives. The cost estimates will include capital, operation and maintenance, and present worth costs. An alternative whose cost far exceeds that of other alternatives which proved similar results would be eliminated from further consideration. Cost will not be used as the sole deciding factor when comparing alternatives which provide very different health or environmental results.

If any of the alternatives require the acquisition of additional data in order to be evaluated, such as treatability data, the data will be generated at that time. It is difficult at this time to predict what treatability investigations, if any, might be needed for this SFS. Therefore, for the purposes of this Work Plan, it is assumed that no treatability investigation will be necessary.

Remedial alternatives with favorable evaluations will be analyzed in detail as outlined in the next section. The alternatives selected for further analysis should preserve, if possible, the range of treatment and containment alternatives developed initially. Alternatives with one or more innovative treatment technologies will be carried through to the detailed analysis if there is reasonable belief that they offer potential for better treatment performance or implementability, fewer or lesser impacts than other available approaches, or lower costs for similar levels of performance than demonstrated treatment technologies.

The screening of alternatives process, as well as the rationale for eliminating any alternatives during the screening process, will be documented in the SFS Screening Memorandum and the SFS Report.

5.14.4. Supplemental feasibility study screening memorandum

Within 45 days of the NYSDEC written approval of the risk assessment, a SFS Screening Memorandum will be submitted. The memorandum will include the methods, rationale, and results of the development and screening of remedial action alternatives for the site.

5.14.5. Detailed analysis of alternatives

The objective of this task is to evaluate the most promising remedial alternatives in detail to provide the basis for selection of a remedy. The detailed evaluation will include a technical and statutory assessment and a cost analysis, as presented below. Prior to the evaluation of alternatives, a detailed description of each alternative will be prepared, including any refinements to the alternatives resulting from the acquisition of additional data.

The alternatives will be evaluated based on specific regulatory requirements, technical, cost, and institutional considerations, and community and support agency acceptance. The detailed evaluation will consist of an assessment of each alternative against the evaluation criteria described below. The evaluation will also include a comparative analysis identifying the relative performance of each alternative against the criteria. The following criteria will be used to evaluate the alternatives in detail:

Overall protection of human health and the environment. The analysis of each alternative with respect to overall protection of human health and the environment will provide an evaluation of whether each alternative achieves and maintains adequate protection of human health and the environment and a description of how site risks are eliminated, reduced, or controlled through treatment, engineering, or institutional controls.

Compliance with SCGs and ARARs. Each alternative will be evaluated to determine whether it will attain federal and state SCGs and ARARs. If an alternative does not attain ARARs, a rationale for invoking one of the waivers provided by SARA will be presented.

Long-term effectiveness and permanence. The evaluation of long-term effectiveness and permanence will address the magnitude of residual risk remaining at the site after alternative implementation from untreated material or treatment residuals and the adequacy and reliability of controls used to manage untreated materials or treatment residuals. The magnitude of residual risks remaining after the implementation of a remedial alternative will be assessed in terms of the amounts and concentrations of the remaining hazardous materials, considering the persistence, toxicity and mobility of the hazardous substances. Long-term management controls include engineering controls, (*e.g.*, containment technologies), institutional controls, monitoring, and operation and maintenance. The potential need for replacement of the remedy will also be evaluated.

Reduction of toxicity, mobility or volume. The degree to which the alternatives employ treatment that reduces toxicity, mobility or volume of the hazardous materials will be evaluated. The factors that will be considered include:

- The treatment technologies utilized and the materials they would treat
- The amount of hazardous materials that would be destroyed or treated
- The expected degree of reduction in toxicity, mobility, or volume of the hazardous materials
- The degree to which treatment is irreversible
- The type and quantity of residuals that would remain following treatment of hazardous materials. This will include consideration of the persistence, toxicity and mobility of the residuals.

Short term effectiveness. The short-term effectiveness of each alternative will be evaluated with respect to the protection of workers and the community during construction and implementation of the alternative, environmental effects resulting from implementation of the alternative, and the time required to achieve remedial objectives.

Implementability. The ease or difficulty of implementing each alternative will be evaluated. The following factors will be considered:

- The degree or difficulty in constructing the technologies associated with the alternative
- The expected reliability of the technologies associated with the alternative
- The need to coordinate with or obtain permits and approvals from government agencies in order to implement the alternative
- The availability of necessary equipment and specialists
- The available capacity and location of treatment, storage and disposal services necessary for implementation
- The availability of prospective technologies that are under consideration
- The ability to monitor the effectiveness of the remedy
- The ease of undertaking additional remedial actions, if required.

Cost. The costs that will be evaluated include:

- Capital costs
- Operation and maintenance costs
- Present worth of capital costs and operation and maintenance costs.

Community acceptance. Community positions on specific alternatives that are documented during conduct of the Supplemental RI/FS will be addressed during the detailed analysis of alternatives.

Regulatory acceptance. Regulatory acceptance will be addressed by NYSDEC in the Record of Decision (ROD) following the public comment period.

The detailed analysis of each of the alternatives will be compiled and the alternatives will be compared to each other based on the evaluation criteria. The results of the detailed analysis of alternatives will be documented in the SFS Report.

5.14.6 Recommendations

One alternative will be identified which is preferred over the others. In accordance with SARA, the preferred alternatives must be protective of human health and the environment, be cost-effective, and utilize permanent solutions and alternative technologies or resource recovery technologies to the maximum extent practicable. The recommended alternative will be documented in the SFS Report.

5.15. Task 15 - Supplemental feasibility study report

The objective of this task is to compile the results of the SFS. The following format will be used to complete the SFS Report.

1. Introduction
2. Risk assessment conclusions
3. Remedial investigation conclusions
4. Nature and extent of contamination
5. Development of remedial alternatives
6. Screening of remedial alternatives (if needed)
7 Detailed analysis of remedial alternatives
9. Conclusions and recommendations.

6. Schedule

The anticipated schedule for the Supplemental RI/FS is presented in Figure 16. The schedule is dependent on NYSDEC approval of the Work Plan and seasonal delays.

7. Project management

A project management team has been assembled to coordinate and implement the Supplemental RI/FS tasks. The project organization chart is included as Figure 17.

The project coordinator will routinely report project progress to GM. GM will report monthly project progress to NYSDEC in its monthly progress reports. On-site NYSDEC representatives will be included in daily field personnel meetings/health and safety meetings, and will be kept apprised of progress.

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Table 1. *Summary of identified data needs and corresponding field activity.*

NYSDEC Comment (data need)	Field activity
Ground water general • evaluate horizontal and vertical extent of groundwater contamination at the site • address groundwater flow within the glacial till (unless it can be demonstrated, with the available data, that groundwater contamination does not exist within that unit) • collect adequate analytical results (VOCS, SVOCS, PCBs/Pesticides, Inorganics) for site wide groundwater are evaluated in the Supplemental RI report • conduct comprehensive sampling for metals in ground water across site • evaluate potential presence of PCBs in ground water in several major portions of the site • evaluate background off-site ground water data • evaluate subsurface utilities as a potential migration pathway • evaluate potential PCB NAPL and solvent DNAPL • collect current ground water data for evaluation of construction worker direct contact exposure pathway	*Ground water field activities* • redevelopment and resampling of existing shallow and deep overburden monitoring wells at Former IFG Facility, Ley Creek PCB Dredgings Site • installation of additional monitoring wells at Former IFG Facility • analysis of ground water samples for VOCs, SVOCs, PCBs, site-related metals and CN • installation of background monitoring well nest (shallow overburden, deep overburden, and top of bedrock) and one top of bedrock monitoring well in existing background well nest
Soil/potential source areas general • collect background surface and subsurface soil data • investigate SWMUs identified in NYSDECs 1991 draft Part 373 permit • collect subsurface soil VOC data for risk assessment • collect surface soil data for risk assessment • evaluate potential presence of solvent DNAPL and PCB oil NAPL	*Soil/potential source area field activities* • installation of one background soil boring • collection of background subsurface and surface soil samples • installation of soil borings in various SWMUs, as applicable • collection of subsurface and surface soil samples in various SWMUs, as applicable • analysis of soil samples for VOCs, SVOCs, PCBs, site-related metals, and CN where appropriate based on past data and area use • installation of piezometers to evaluate NAPL in abandoned storm sewer lines leading to oil/water collection sumps #1, 4, 5 • installation of soil borings to evaluate abandoned storm sewer lines leading to oi/water collection sumps #2, 3, 6, 7, and 8 • installation of soil borings to evaluate potential solvent DNAPL

Table 1. *Summary of identified data needs and corresponding field activity.*

NYSDEC Comment (data need)	Field activity
Manufacturing building subsurface *Ground water* • evaluate extent of PCBs, heavy metals, cyanide and VOCs beneath the building in ground water • characterize the nature and extent of contamination in footprint of manufacturing building • evaluation of extent of BTEX plume beneath the manufacturing building	*Manufacturing building subsurface* *Ground water* • installation and sampling of new shallow and deep overburden monitoring wells • resampling of existing monitoring well • analysis of ground water samples for VOCs, SVOCs, PCBs, site-related metals and CN • installation of one or two temporary, shallow overburden wells in the manufacturing building to evaluate the extent of the BTEX plume beneath the building, and completion of one permanent well • analysis of BTEX plume temporary well samples for VOCs
Soil • evaluate the abandoned storm sewers (and their associated backfill materials), the sumps, trenches, and pits used for the manufacturing operations, the "oil sumps", the Paint Room, and preferential pathways beneath the building • evaluate other areas of the plant where hydraulic fluids with PCBs were used (unless integrity of the former sumps and trenches can be proven) • evaluate extent of PCBs, heavy metals, cyanide and VOCs beneath the building in soil (including within/near former trenches, pits, sumps) • characterize the nature and extent of contamination within the footprint of the Main Manufacturing Building	*Soil* • installation of temporary piezometers along sewer lines leading to oil/water collection sumps #1, 4, and 5 • installation of soil borings upgradient of oil/water collection sumps #2, 3, 6, 7, and 8 • installation of soil borings in and around the paint room • analysis of subsurface soil samples in paint room area for VOCs, SVOCs, PCBs, site-related metals, and CN
Southeast property area *Ground water* • collect ground water data to confirm current levels of contamination in this area	*Southeast property area* *Ground water* • resampling of existing monitoring wells • installation and sampling of new monitoring wells • analysis of ground water samples for VOCs, SVOCs, PCBs, site-related metals, and CN
Soil • collect shallow and surface soil samples in the area around the storage pad to identify contamination that may have spilled from the area • collect subsurface soil data in the parking lot area to document clean conditions for potential future redevelopment	*Soil* • collection of surface soil samples on each side of the storage pad • analysis of surface soil samples for VOCs, PCBs, site-related metals, and CN and one sample for TCL/TAL • installation of soil borings and collection of subsurface soil samples in parking lot area • analysis of subsurface soil samples from parking lot area for VOCs, SVOCs, PCBs, site-related metals, and CN

Table 1. *Summary of identified data needs and corresponding field activity.*

NYSDEC Comment (data need)	Field activity
IWTP area *Ground water* • evaluate PCBs in WT wells • determine extent of contamination in the area	*IWTP area* *Ground water* • resampling of existing monitoring wells • installation and sampling of new monitoring wells • analysis of ground water samples for VOCs, SVOCs, PCBs, site-related metals and CN
Soil • collect PCB surface soil data for risk assessment • collect surface/shallow samples in incinerator area • evaluate VOCs in vicinity of TCE storage area • conduct sampling near the former fuel oil USTs located east of the IWT plant, if confirmatory sampling was not done when tanks were removed • evaluate extent of surface soil contamination in the area • investigate and clean RCRA SWMUs in this area, or provide documentation, along with methodology, that such has been satisfactorily performed • conduct sampling for dioxins and furans in incinerator area due to the possible nature of the waste incinerated	*Soil* • collection of surface soil samples in incinerator area • analysis of surface soil samples from incinerator area for VOCs, SVOCs, PCBs, site-related metals, CN, chlorinated dioxins and furans, and one sample for TCL/TAL • installation of soil borings in TCE storage area, one to lodgement till to evaluate potential presence of solvent DNAPL • analysis of subsurface soil samples from TCE storage area for VOCs, SVOCs, PCBs, site-related metals, and CN • installation of soil borings in vicinity of former fuel oil tanks • analysis of subsurface soil samples from vicinity of former fuel oil tanks for VOCs, SVOCs, PCBs, site-related metals, and CN • installation of one soil boring associated with one new deep overburden well to evaluate potential presence of solvent DNAPL • if potential DNAPL observed, collection of one soil sample for VOC and PCB analysis to evaluate the vertical extent of contamination, and installation of soil borings downgradient of the potential source of DNAPL to evaluate the horizontal extent of contamination.
Southwest property area *Ground water* • evaluate extent of ground water contamination in mold storage building area	*Southwest property area* *Ground water* • installation and sampling of new monitoring well nest • analysis of ground water samples for VOCs, SVOCs, PCBs, site-related metals and CN

Table 1. *Summary of identified data needs and corresponding field activity.*

NYSDEC Comment (data need)	Field activity
Soil • evaluate mold storage building area and soil to determine presence of contamination and source of ground water contamination • revisit SMWU closure plan pending prior to Order and conduct appropriate investigatory work (Storage Pad)	*Soil* • installation of soil borings in mold storage building area, both to lodgement till to evaluate potential presence of solvent DNAPL • if potential presence of DNAPL is observed, collection of one subsurface soil sample for VOC and PCB analysis to evaluate the vertical extent of contamination, and installation of soil borings downgradient of the potential source of DNAPL to evaluate horizontal extent of contamination. • analysis of subsurface soil samples from the mold storage building area for VOCs, SVOCs, PCBs, site-related metals, and CN • installation of soil borings in storage pad area • analysis of subsurface soil samples from the storage pad area for SVOCs, VOCs, PCBs, site-related metals, and CN. • collection of surface soil samples around storage pad area • analysis of surface soil samples from storage pad area for VOCs, SVOCs, PCBs, site-related metals, and CN and one sample for TCL/TAL
Former thinner tanks area *Ground water* • evaluate extent of the BTEX plume (i.e. beneath the building) • evaluate contamination potentially present in groundwater in the area of the switch house and transformers	*Former thinner tanks area* *Ground water* • resampling of existing monitoring well • analysis of ground water sample for VOCs, SVOCs, PCBs, site-related metals and CN
Soil • investigate contamination potentially present in the area of the switch house and transformers	*Soil* • installation of soil borings in transformer/switch house area • analysis of subsurface soil samples from transformer/switch house area for PCBs and SVOCs. • collection of surface soil sample • analysis of surface soil sample for TCL/TAL
Northeast property area *Ground water* • evaluate PCBs in ground water	*Northeast property area* *Ground water* • resampling of existing monitoring well nest • installation and sampling of new monitoring well nest • analysis of ground water samples for VOCs, SVOCs, PCBs, site-related metals, and CN

Table 1. *Summary of identified data needs and corresponding field activity.*

NYSDEC Comment (data need)	Field activity
Soil	*Soil*
• no data needs identified by NYSDEC, however, historically the highest concentrations of solvents have been observed in this area. • collect subsurface soil data from parking lot to document clean conditions for potential future redevelopment	• collection of surface soil samples in unpaved areas for risk assessment • analysis of surface soil samples for PCBs, VOCs, SVOCs, site-related metals, and CN and one sample for TCL/TAL • installation of soil boring in parking lot area • analysis of subsurface soil samples from parking lot area for VOCs, SVOCs, PCBs, site-related metals, and CN • installation of two soil borings to lodgement till to evaluate potential presence of solvent DNAPL • if potential DNAPL observed, collection of one soil sample for VOC and PCB analysis to evaluate the vertical extent of contamination, and installation of soil borings downgradient of the potential source of DNAPL to evaluate the horizontal extent of contamination.
Northern property area *Ground water*	*Northern property area* *Ground water*
• identify the down gradient edge of the increased VOC concentrations in surface impoundment area • characterize the nature and extent of contamination at, and in the vicinity of, the landfill • further investigate metals concentrations in landfill area • characterize the nature and extent of contamination in the northern property area • groundwater sampling in the more upstream portion of the swale system • evaluate SVOC and metals data in the surface impoundment monitoring wells	• resampling of existing monitoring wells • installation and sampling of new monitoring wells • analysis of ground water samples for VOCs, SVOCs, PCBs, site-related metals, and CN

Table 1. *Summary of identified data needs and corresponding field activity.*

NYSDEC Comment (data need)	Field activity
Soil	*Soil*
• collect PCB surface soil data for risk assessment • conduct additional soil sampling for PCBs, metals, and VOCs along the full length of the swale • evaluate source of increased VOC concentrations in ground water in surface impoundment area • evaluate whether area of the former impoundment now covered by the building has contamination present, and if it may be a continuing source for contamination to the groundwater • evaluate potential presence of PCB oil NAPL in vicinity of surface impoundment monitoring well MW-2S • conduct additional soil sampling within the footprint of, and in the vicinity of, the landfill in order to better characterize the nature and extent of contamination and to identify all contaminant sources • characterize the nature and extent of contamination and identify any contaminant sources which may exist here • address the general filling which occurred in the northern portion of the facility • include soil sampling in the more upstream portion of the swale system	• installation of soil borings in general fill area • analysis of subsurface soil samples in general fill area for PCBs, VOCs, site-related metals, and CN • collection of surface soil samples in former landfill area • analysis of surface soil samples in former landfill area for PCBs, VOCs, SVOCs, site-related metals, mercury, and CN and one sample for TCL/TAL • installation of test trenches in former drainage swale area • installation of test trenches in former landfill area • analysis of subsurface soil samples from former drainage swale area for PCBs, VOCs, site-related metals, and CN • analysis of landfill material samples for VOCs, SVOCs, site-related metals, mercury, and CN. • TAL/TCL analysis for selected landfill material samples. • installation of soil boring in former surface impoundment #1 area • analysis of subsurface soil samples from former surface impoundment #1 area for PCBs, VOCs, site-related metals, and CN • installation of two borings to lodgement till to evaluate potential presence of solvent DNAPL in vicinity of former surface impoundment #2 • if potential DNAPL observed, collection of one soil sample for VOC and PCB analysis to evaluate the vertical extent of contamination, and installation of soil borings downgradient of the potential source of DNAPL to evaluate the horizontal extent of contamination.

Note:
Data needs identified by NYSDEC in March 13, 1998 comment letter to Mr. James Hartnett of GM.
Site-related metals include: arsenic, chromium, copper, lead, nickel, and zinc.

Table 2. *Work plan rationale,*

Location/Item	Rationale
Background	
New shallow/deep overburden top of bedrock well nest	Evaluate background ground water conditions in different ground water zones present at the site. Collect soil samples from one bore hole to evaluate background metals in subsurface soil.
New top of bedrock well and resample existing upgradient monitoring wells	Evaluate background ground water conditions in the top of bedrock ground water unit to complement data for existing shallow/deep overburden background well nest U-1S/U-1D.
Facility-wide	
Resample existing monitoring wells and install/sample new monitoring wells	Evaluate site-wide ground water conditions at up to forty six locations to provide updated site-wide data.
Soil borings	Install soil borings in four locations at the site in order to evaluate the potential presence of solvent DNAPL. The locations for these borings were identified based on a surface contour map of the underlying lodgement till and the location of potential solvent use areas (solvent storage areas, etc.) or elevated solvent concentrations.
Manufacturing building	
New shallow/deep overburden monitoring wells and resample existing monitoring well	Install three shallow/deep overburden well nests to evaluate ground water conditions beneath the manufacturing building. The southernmost new monitoring well nest is located in the vicinity of the elevated petroleum hydrocarbon concentrations in the abandoned storm sewer line leading to oil/water collection sump #5. The northernmost new monitoring well nest is located in the vicinity of the abandoned storm sewer line leading to oil/water collection sump #4, in the vicinity of the process sewer line leading to the acid/alkali bunker, and downgradient of the paint room. The westernmost new monitoring well nest is located downgradient of the mold storage building and upgradient of the paint room and administration building, to assess the presence of a continuous solvent plume. Monitoring well WT-3 and the new nested deep overburden well are located outside the manufacturing building just downstream of the abandoned storm sewer line leading to oil/water collection #5.
Soil borings/samples in vicinity of paint room	Evaluate extent of subsurface VOCs concentrations detected in soil which may have resulted from past operation of the paint room located within the manufacturing building using four soil borings to be installed in and around the paint room.
Temporary piezometers along abandoned storm sewer system	Observe/measure the presence of PCB NAPL using temporary piezometers along three of the abandoned storm sewer lines (leading to oil/water collection sumps #1, 4, and 5) beneath the manufacturing building. Hydraulic oils in the sewer system are believed to have originated from historic operation of underground sumps and tanks associated with injection molding operations in the manufacturing building. Seventeen proposed piezometers are located at approximately 100 ft intervals along each of these abandoned sewer lines. The actual number and location of piezometers will be dependent on the extent of observed NAPL.

Table 2. *Work plan rationale.*

Location/Item	Rationale
Soil borings along abandoned sewer system	Evaluate whether the bedding materials associated with inactive storm sewers leading to oil/water collection sumps # 2, 3, 6, 7, and 8 are contaminant migration pathways beneath the manufacturing building. One soil boring will be installed upgradient of each sump.
Thinner spill area monitoring well	Identify the edge of the thinner spill plume beneath the 1974-75 building addition. Soil borings will be performed, and soil will be field screened to identify edge of subsurface contamination. Temporary well or wells will be installed in vicinity of plume edge, and ground water sample(s) will be collected for VOC analysis. Permanent shallow overburden well will be installed at approximate edge of plume.
Southeast property area	
New top of bedrock monitoring well and resample existing monitoring wells	Install one top of bedrock monitoring well in the general storage area. Together with data from resampling of two adjacent existing monitoring wells, the new well data will be used to evaluate ground water conditions in this area, and likely obtain background data.
Surface soil samples	Collect four surface soil samples around the general storage area to evaluate surface soil contamination which may have resulted from the storage of facility equipment in this area.
Soil borings/samples	Install two soil borings to evaluate subsurface conditions beneath the parking lot to document clean conditions beneath the parking lot to document clean conditions for potential future redevelopment, since sampling has not been conducted in this area.
Industrial waste treatment plant	
New deep overburden monitoring wells and resample existing shallow overburden wells	Install two deep overburden monitoring wells in the vicinity of two shallow overburden wells in the industrial waste treatment plant. Data from these four wells will be used to evaluate possible ground water contamination which may have originated from operation of the industrial waste treatment plant. The presence of DNAPL will be evaluated in one of the well borings.
Soil borings/samples	Install two soil borings in the vicinity of the former TCE storage area to evaluate VOC, SVOC, PCB, metals, and CN concentrations in the subsurface related to this potential source area. Two soil borings will be installed in the vicinity of the former fuel oil tanks to evaluate subsurface VOC, SVOC, PCB, metals, and CN conditions possibly related to this potential source area. The potential presence of DNAPL will be evaluated in one of the soil borings in the TCE storage area.
Surface soil samples	Collect ten surface soil samples from unpaved areas around the industrial waste treatment plant. These will be evaluated for VOCs, SVOCs, PCBs, metals and CN (as well as TCL/TAL for one sample) to evaluate conditions possibly related to past operations of an incinerator and other waste treatment plant processes in this area. Five of these samples will also be used to evaluate if chlorinated dioxins and furans, possibly formed in association with the incinerator operation, are present in surface soils in this area at concentrations above typical industrial background.
Southwest property area	
New shallow/deep overburden monitoring wells	Install one shallow/deep overburden monitoring well nest in the vicinity of the mold storage building and hazardous waste storage area in order to evaluate ground water conditions as they may relate to past storage of TCE and plating chemicals (mold storage building) and hazardous wastes including solvents and degreasers (storage area).

Table 2. *Work plan rationale.*

Location/Item	Rationale
Soil borings/samples	Install two soil borings to evaluate subsurface conditions in the vicinity of a trench in the former mold storage building, which discharged to the ground surface where TCE and plating related chemicals were stored. Two soil borings will be installed to evaluate subsurface conditions in the vicinity of the hazardous waste storage area. The potential presence of DNAPL will be evaluated in the two soil borings outside the mold storage building.
Surface soil samples	Collect four surface soil samples to evaluate surface VOC, SVOC, PCB, metals, and CN (as well as TCL/TAL in one sample) conditions in the vicinity of the hazardous waste storage area.
Former thinner tanks area	
Resample existing wells	Given the large number of wells present and routinely sampled in the vicinity of the former thinner tanks, and the presence of solvent recovery trenches in this area, ground water investigation in this area is limited to one existing shallow overburden monitoring well.
Soil borings/samples	Install three soil borings in the vicinity of former transformer/switch area to evaluate potential subsurface PCB and SVOC contamination.
Surface soil samples	Collect one surface soil sample from the vicinity of the former thinner tanks area to provide risk assessment data.
Northeast property area	
New monitoring wells	Install one shallow/deep overburden well nest north of the manufacturing building. Data from these and data from one existing shallow/deep overburden well nest will be used to evaluate ground water conditions that may be related to former activities in the manufacturing building.
Surface soil samples	Collect four surface soil samples from the vicinity of the administrative building to provide risk assessment data.
Soil boring/samples	Install two borings to evaluate the potential presence of DNAPL in the area of historic elevated TCE in ground water near the Administrative Building. Install one soil boring to evaluate subsurface conditions beneath the parking lot to document clean conditions for potential future redevelopment, since sampling has not been conducted in this area.
Northern property area	
New monitoring wells and resample existing monitoring wells	Four new monitoring well nests will be installed. These wells and one existing shallow/deep overburden well nest and two existing shallow overburden wells will be sampled to evaluate ground water conditions in the northern property area. New monitoring well nests along the property boundary, well nest , W-6S/W-6D, and and well P-5 will potentially provide plume boundary data. One new monitoring well nest is downgradient of the former surface impoundments, where elevated PCB and solvent concentrations have recently been observed. Monitoring well P-7 and one new well nest are in the vicinity of the former drainage swale and the main storm sewer leading to Outfall 003. One new monitoring well nest is downgradient of the former landfill.

Table 2. *Work plan rationale.*

Location/Item	Rationale
Soil borings/samples	Install four soil borings and sample at 2 ft intervals in the general fill area to evaluate subsurface conditions resulting from fill activities in this area. Install two soil borings to evaluate the potential presence of DNAPL in the vicinity of former Impoundment No. 1.
Soil boring/samples in vicinity of former Impoundment No. 1	Evaluate subsurface conditions in the area of former Impoundment No. 1, for which the portion beneath the building received unknown closure. Specifically, the presence of PCB NAPL will be evaluated as well as the presence of PCBs, VOCs, site-related metals and CN. The location of this boring has been located outside of the building due to accessibility constraints within the building in this area.
Surface soil samples	Eight surface soil samples will be collected from the former landfill area in order to characterize surface conditions in this area for risk assessment purposes.
.Test trenches/soil and waste samples	Install four test trenches in the former landfill area in order to evaluate the physical extent of the landfill and to evaluate the contents of the landfill. Up to twenty samples will also be collected from these trenches. Install eight test trenches in the former drainage swale location in order to evaluate the physical location of the former swale and evaluate the subsurface conditions in this area. The test trenches were positioned at approximately 100 ft intervals along the anticipated pathway of the former drainage swale.
Ley Creek	
Surface water samples	Surface water samples will be collected at upgradient and downgradient locations in Ley Creek to evaluate potential site impacts to creek surface water.
Sediment samples	Sediment samples will be collected at upgradient and downgradient depositional area locations in Ley Creek to evaluate potential site impacts to creek sediments.

Table 3. *Summary of field activities.*

Field activity	**Quantity**
Monitoring wells to be installed	26
Shallow overburden well (thinner area)	1
Shallow/deep overburden well nests (2 wells each)	9
Deep overburden wells	3
Shallow overburden/deep overburden/top of bedrock well nests (3 wells each)	1
Top of bedrock wells	1
Inspection of existing well integrity	19
Redevelopment of existing wells	19
In situ hydraulic conductivity testing of wells	10
Sampling of monitoring wells	45-46 + Total
Upgradient shallow overburden/deep overburden/top of bedrock wells nests (3 wells each)	2
Ley Creek PCB Dredgings Site shallow overburden wells	4
Ley Creek PCB Dredgings Site top of bedrock wells	1
Former IFG Facility shallow overburden wells	19
Former IFG Facility shallow overburden temporary wells	0-1
Former IFG Facility deep overburden wells	15
Temporary piezometers	To be determined in field (estimated 17)
Soil borings	34+ Total
Manufacturing Building (Storm Sewers)	5
Manufacturing Building (Paint Room)	4
Manufacturing Building (Thinner Spill Area)	To be determined in field
Southeast Property Area (Parking Lot)	2
Industrial Waste Treatment Plant Area (TCE Storage Area and DNAPL investigation (1))	2
Industrial Waste Treatment Plant Area (Former Fuel Oil Tanks)	2
Industrial Waste Treatment Plan Area (DNAPL investigation; will be completed as a deep overburden monitoring well)	1
Southwest Property Area (Mold Storage Building + DNAPL investigation)	2
Southwest Property Area (Storage Pad)	2
Former Thinner Tanks Area (Transformer/Switch House)	3
Northeast Property Area (Parking lot)	1

Table 3. *Summary of field activities.*

Field activity	Quantity
Northeast Property Area (DNAPL investigation)	2
Northern Property Area (General Fill Area)	4
Northern Property Area (Former Surface Impoundment)	1
Northern Property Area (DNAPL investigation)	2
Background (will be completed as a background monitoring well)	1
Test trench installation	
Northern Property Area (Former Drainage Swale Area)	8
Northern Property Area (Former Landfill Area)	4
Subsurface soil samples	108 * Total
Manufacturing Building (storm sewers)	To be determined in field based on boring depth (estimated 25)
Manufacturing Building (Paint Room)	8
Southeast Property Area (Parking Lot)	4
Industrial Waste Treatment Plant Area (TCE Storage Area)	4
Industrial Waste Treatment Plant Area (Former Fuel Oil Tanks)	4
Southwest Property Area (Mold Storage Building)	4
Southwest Property Area (Storage Pad)	4
Former Thinner Tanks Area (Transformer/Switch House)	6
Northeast Property Area (Parking Lot)	2
Northern Property Area (General Fill Area)	20
Northern Property Area soil or waste samples (Landfill Area, from test trenches)	12
Northern Property Area (Former Surface Impoundment)	2
Northern Property Area (Former Drainage Swale Area, from test trenches)	8
DNAPL investigation	To be determined in field **
Background	5

Table 3. *Summary of field activities.*

Field activity	Quantity
Surface soil samples	41 Total
Southeast Property Area	4
Industrial Waste Treatment Plant Area (Unpaved areas)	10
Southwest Property Area soil borings (Mold Storage Building)	2
Southwest Property Area (Around Storage Pad)	4
Former Thinner Tanks Area soil borings (Transformer/Switch House)	3
Former Thinner Tanks Area (Unpaved area)	1
Northeast Property Area (Unpaved areas)	4
Northern Property Area soil borings (general fill area)	4
Northern Property Area (Former landfill area)	8
Background soil boring	1
Surface water samples	14 Total
Upstream samples (two rounds)	8
Downstream samples (two rounds)	6
Sediment samples	32 Total
Upstream samples (10 locations)	13
Downstream samples (16 locations)	19

Notes:
Up to two subsurface soil samples taken for each soil boring location in addition to surface soil sample (only where surface unpaved), with exception of DNAPL borings (1-3 samples) and storm sewer borings (samples each 2ft interval).
* Total dependent on number of DNAPL soil samples, to be determined in field.
** To be determined based on positive response during DNAPL screening using ultraviolet light.

Table 4. *Sample and analysis summary.*

Media/Location	Number of Environmental Samples	Analytes
Ground water	**45-46 Total**	
Upgradient shallow overburden/deep overburden/top of bedrock wells	6	VOCs, SVOCs, PBCs, site related metals, CN
Ley Creek PCB Dredgings Site shallow overburden wells	4	VOCs, SVOCs, PBCs, site related metals, CN
Ley Creek PCB Dredgings Site top of bedrock wells	1	VOCs, SVOCs, PBCs, site related metals, CN
Former IFG Facility shallow overburden wells	19	VOCs, SVOCs, PBCs, site related metals, CN
Former IFG Facility deep overburden wells	15	VOCs, SVOCs, PBCs, site related metals, CN
Former IFG Facility thinner area temporary overburden well(s)	0-1	VOCs
Subsurface soil samples	**108* Estimated Total**	
Manufacturing Building (Storm Sewers)	To be determined in the field based on boring depth (estimated 25)	VOCs, SVOCs, PCBs, site-related metals
Manufacturing Building (Paint Room)	8	PCBs, VOCs, SVOCs, site-related metals, and CN
Southeast Property Area (Parking Lot)	4	PCBs, VOCs, SVOCs, site-related metals, and CN
Industrial Waste Treatment Plant Area (TCE Storage Area)	4	VOCs, SVOCs, PCBs, site-related metals, and CN
Industrial Waste Treatment Plant Area subsurface soil samples (Former Fuel Oil Tanks)	4	VOCs, SVOCs, PCBs, site-related metals, and CN
Southwest Property Area (Mold Storage Building)	4	VOCs, SVOCs, PCBs, site-related metals and CN
Southwest Property Area (Storage Pad)	4	VOCs, SVOCs, PCBs, site-related metals, and CN
Former Thinner Tanks Area (Transformer/Switch House)	6	PCBs and SVOCs
Northeast Property Area (Parking Lot)	2	PCBs, VOCs, SVOCs, site-related metals and CN
Northern Property Area (General Fill Area)	20	PCBs, VOCs, site-related metals, and CN
Northern Property Area (Former Surface Impoundment)	2	PCBs, VOCs, site-related metals, and CN

Table 4. *Sample and analysis summary.*

Media/Location	**Number of Environmental Samples**	**Analytes**
Northern Property Area soil or waste samples (Landfill Area, from test trenches)	10	VOCs, SVOCs, PCBs, site-related metals, mercury, and CN
	2	TCL/TAL
Northern Property Area (Former Drainage Swale Area, from test trenches)	8	PCBs, VOCs, site-related metals, and CN
DNAPL investigation	To be determined in the field *	VOCs, PCBs
Background	5	site-related metals
Surface soil samples	**41 Total**	
Southeast Property Area	3	VOCs, PCBs, site-related metals, and CN
	1	TCL/TAL
Industrial Waste Treatment Plant Area (Unpaved areas)	4	VOCs, SVOCs, PCBs, site-related metals, and CN
	5	VOCs, PCBs, site-related metals, CN, chlorinated dioxins and furans
	1	TCL/TAL
Southwest Property Area soil borings (Mold Storage Building)	2	VOCs, SVOCs, PCBs, site-related metals, and CN
Southwest Property Area (around Storage Pad)	3	VOCs, SVOCs, PCBs, site-related metals, and CN
	1	TCL/TAL
Former Thinner Tanks Area soil borings (Transformer/Switch House)	3	PCBs, SVOCs
Former Thinner Tanks Area (Unpaved Areas)	1	TCL/TAL
Northeast Property Area (Unpaved areas)	3	PCBs, VOCs, SVOCs, site-related metals, and CN
	1	TCL/TAL
Northern Property Area soil borings (General Fill Area)	4	PCBs, VOCs, site-related metals, and CN
Northern Property Area (Former Landfill area)	7	PCBs, VOCs, site-related metals, mercury, and CN
	1	TCL/TAL
Background soil boring	1	site-related metals

Table 4. *Sample and analysis summary.*

Media/Location	Number of Environmental Samples	Analytes
Sediment samples	**32 Total ****	
Upstream sediment samples (10 locations)	6 surface	VOCs, SVOCs, PCBs, TOC, heavy metals, and CN
	4 surface***	VOCs, SVOCs, PCBs, TOC, heavy metals, CN, chlorinated dioxins and furans
	1 subsurface	VOCs, SVOCs, PCBs, TOC, heavy metals, and CN
	2 subsurface***	VOCs, SVOCs, PCBs, TOC, heavy metals, CN, chlorinated dioxins and furans
Downstream sediment samples (16 locations)	1 surface	TCL/TAL, TOC
	4 surface	VOCs, SVOCs, PCBs, TOC, heavy metals, CN, chlorinated dioxins and furans
	11 surface	VOCs, SVOCs, PCBs, TOC, heavy metals, and CN
	1 subsurface	TCL/TAL, TOC
	2 subsurface	VOCs, SVOCs, PCBs, TOC, heavy metals, CN, chlorinated dioxins and furans
Surface water samples	**14 Total ******	
Upstream surface water samples (4 locations)	8	VOCs, SVOCs, PCBs, heavy metals, and CN
Downstream surface water samples (3 locations)	2	TCL/TAL
	4	VOCs, SVOCs, PCBs, heavy metals, and CN

Note:
Site-related metals: Arsenic, chromium, copper, lead, nickel, and zinc.
Heavy metals identified in Exhibit E of Order: Antimony, arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc.

* To be determined based on positive response during DNAPL screening using ultraviolet light.
** Each surface sediment sample will be analyzed, and up to 6 subsurface sediment samples will be analyzed. Subsurface sample numbers are contingent on presence of over six inches of sediment in depositional areas.
*** To be collected between confluence of North and South branches of Ley Creek and Townline Road.
**** Each surface water location will be sampled on two occasions.

Table 5. *Oil/water sump sampling summary table.*

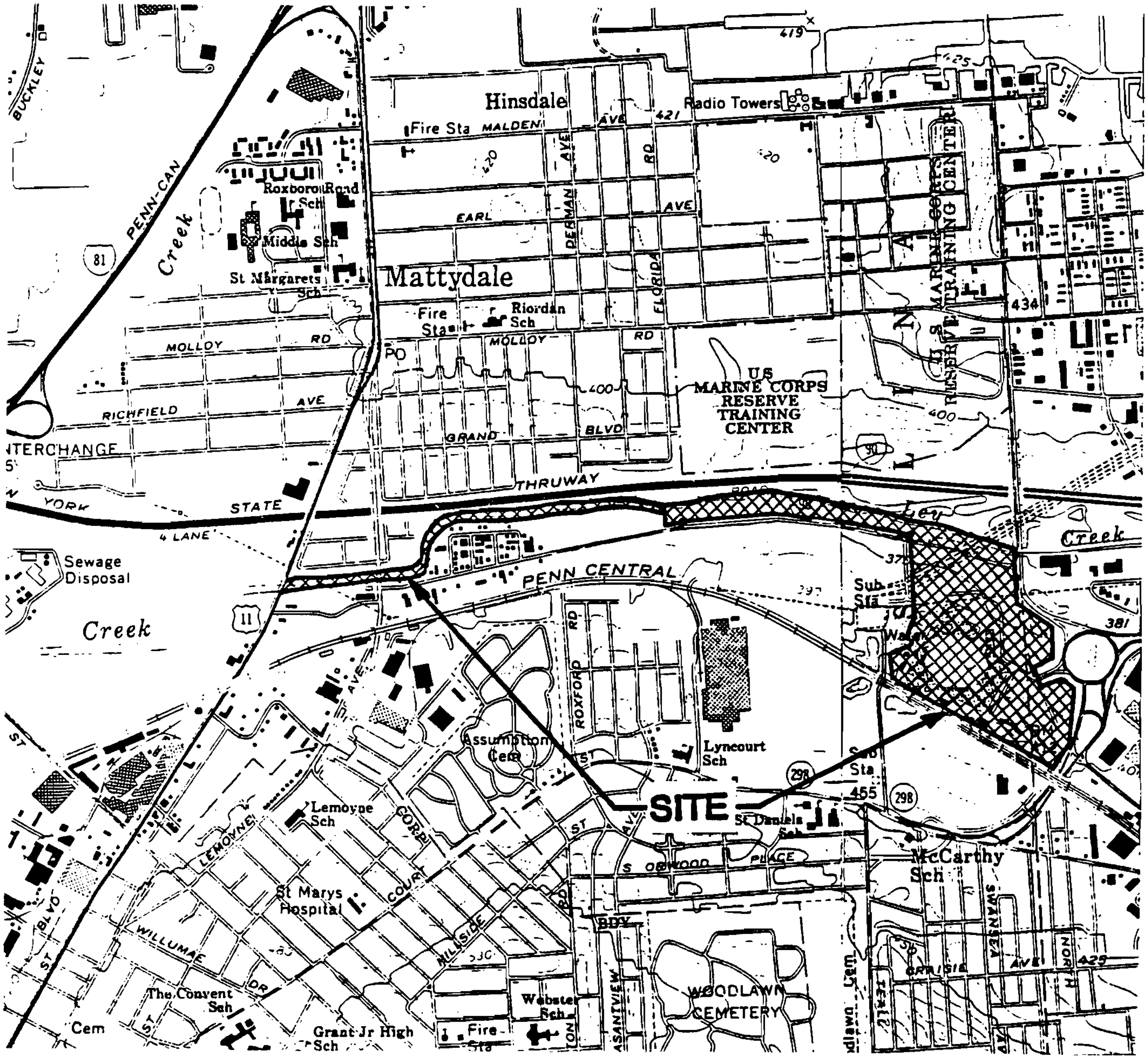
Parameter	Units	Water Samples								Oil Samples		
		OWS1 (11/26/97)	OWS2 (11/26/97)	OWS3 (11/26/97)	OWS4 (11/26/97)	OWS5 (11/26/97)	OWS6 (11/26/97)	OWS7 (11/26/97)	OWS8 (11/26/97)	Sump #1 (1/9/98)	Sump #4 (1/9/98)	Sump #5 (2/2/98)
PCB-1016	(ug/l)	< 10.0	< 0.56	< 0.51	< 11.0	< 2600.0	< 0.52	< 2.6	< 0.51	<9800	<5000	<100000
PCB-1221	(ug/l)	< 10.0	< 0.56	< 0.51	< 11.0	< 2600.0	< 0.52	< 2.6	< 0.51	<9800	<5000	<100000
PCB-1232	(ug/l)	< 10.0	< 0.56	< 0.51	< 11.0	< 2600.0	< 0.52	< 2.6	< 0.51	<9800	<5000	<100000
PCB-1242	(ug/l)	< 10.0	< 0.56	< 0.51	< 11.0	< 2600.0	< 0.52	< 2.6	< 0.51	<9800	<5000	<100000
PCB-1248	(ug/l)	91.0	< 0.56	1.1	48.0	16000.0	1.8	11.0	1.3	48000	17000	>2000000 (1)
PCB-1254	(ug/l)	< 10.0	< 0.56	< 0.51	< 11.0	< 2600.0	< 0.52	< 2.6	< 0.51	<9800	<5000	<100000
PCB-1260	(ug/l)	< 10.0	< 0.56	< 0.51	< 11.0	< 2600.0	< 0.52	< 2.6	< 0.51	<9800	<5000	<100000

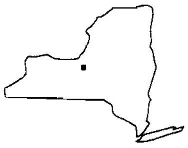
Notes:

(1) Oil sample, Sump #5, was sampled 2/2/98. Preliminary analytical results indicate that the oil is contaminated with Aroclor 1248 greater than 2,000,0000 ug/L.

MWH I:\DIV71\PROJECTS\4699\21535\DWG\71\016.DWG SF:1 6/29/98

FIGURE 1





QUADRANGLE LOCATION

GENERAL MOTORS CORPORATION
SYRACUSE, NEW YORK

SITE LOCATION MAP

0 2000 4000

SCALE IN FEET

SOURCE: SYRACUSE, EAST & WEST U.S.G.S. QUADRANGLE MAPS, DATE 1989.

O'BRIEN & GERE ENGINEERS INC.

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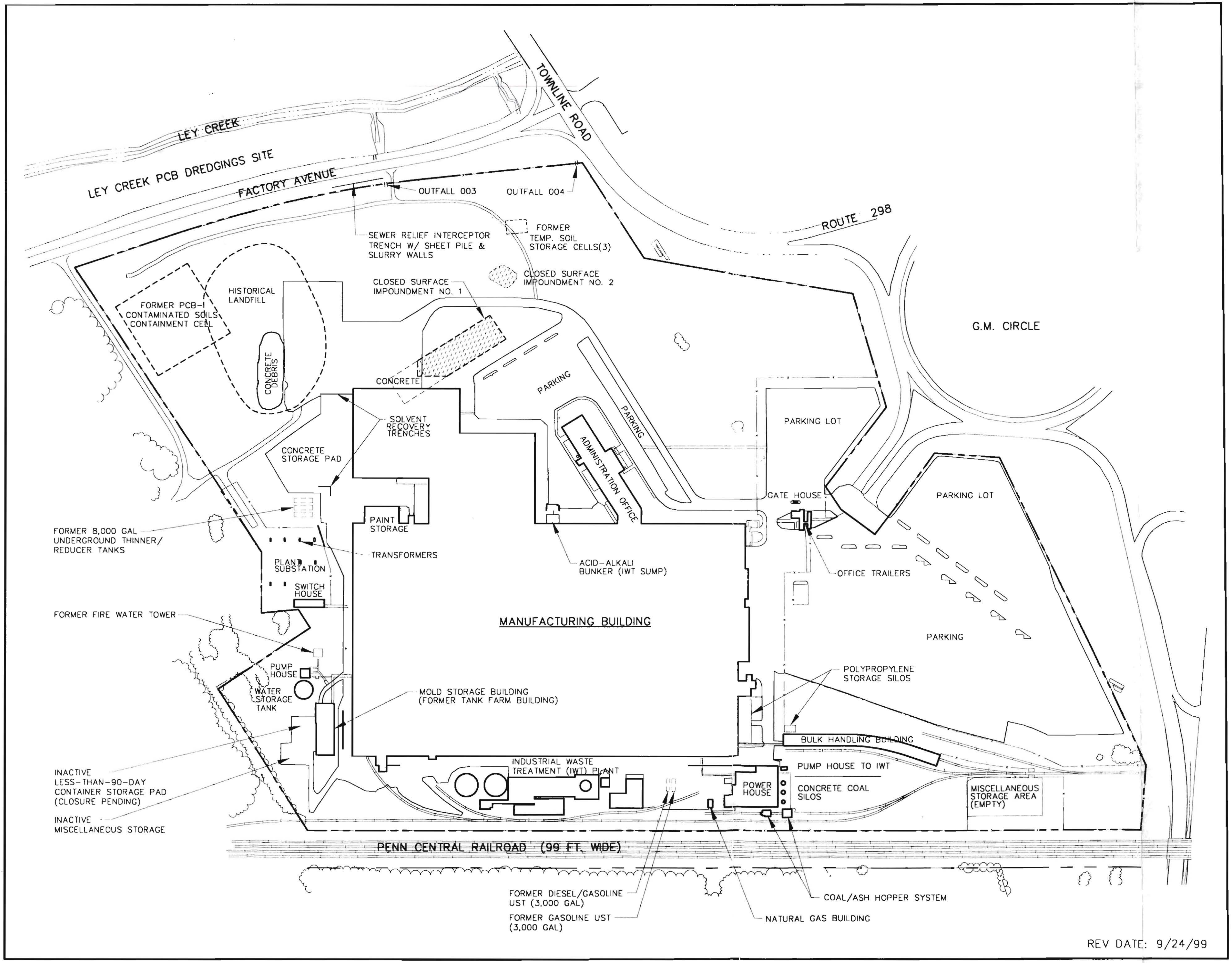


FIGURE 2

LEGEND

— — —	PROPERTY LINE
	TREE LINE
········	APPROX. LOCATION
—·—·—	FENCE

GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

FACILITY PLAN

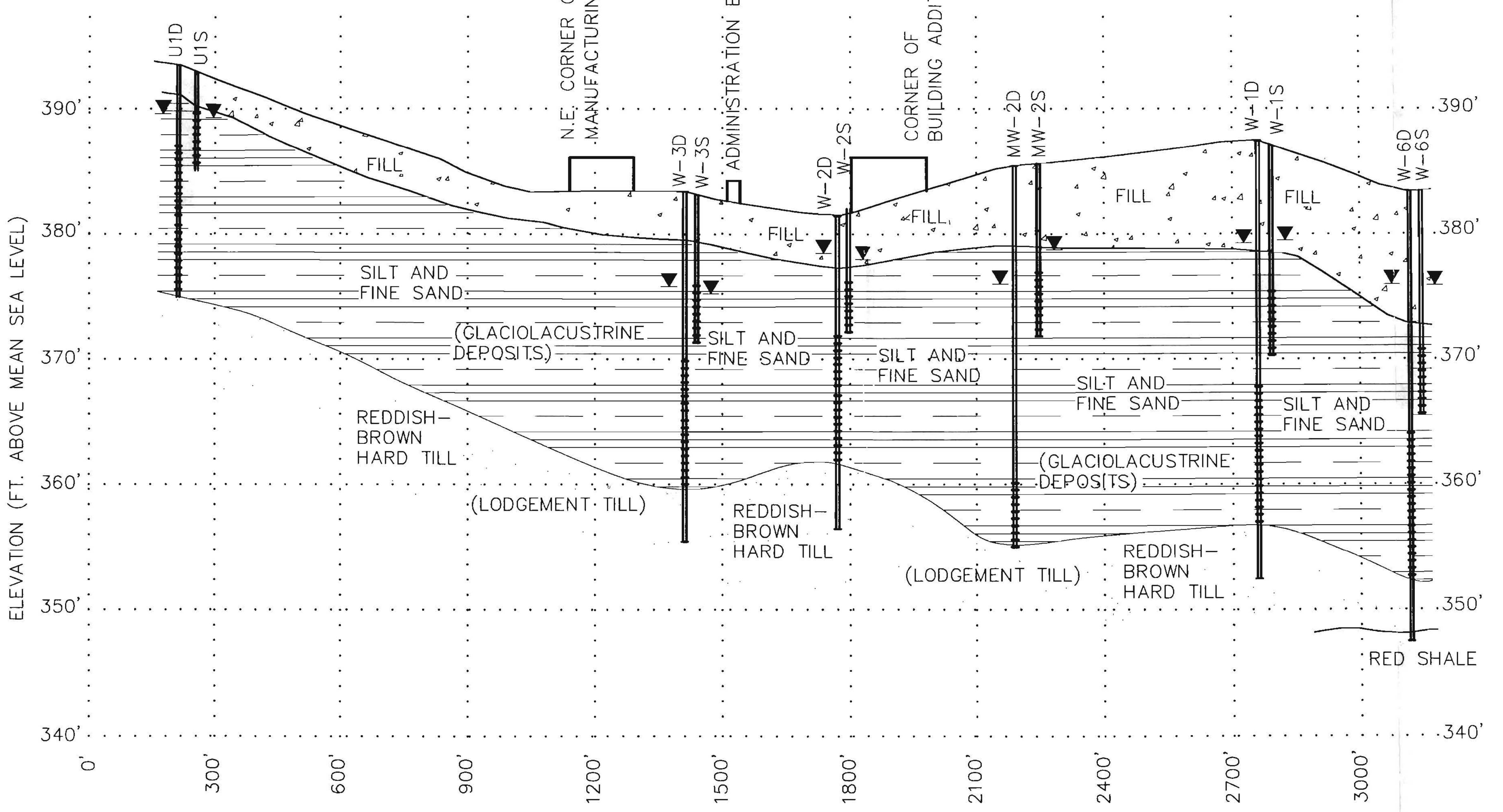
0 250 500
SCALE IN FEET

DATE: SEPTEMBER 1999
FILE NO. 4966.21535.010

O'BRIEN & GERE ENGINEERS INC.

MWH I:\DIV71\PROJECTS\4966\21535\DWG\71\012.DWG SF:1 6/29/98

FIGURE 3



NOTE:
PREPARED FROM DATA INCLUDED IN HYDROGEOLOGICAL INVESTIGATION REPORT (EDI 1985a) AND SURFACE IMPOUNDMENT CLOSURE GROUND WATER MONITORING REPORT (O'BRIEN & GERE ENGINEERS, 1989a)

REV DATE: 6/29/98

LEGEND

▼ GROUND WATER ELEVATION

GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

GENERALIZED GEOLOGIC CROSS SECTION VERTICAL EXAGGERATION 30X

NOT TO SCALE

DATE: JUNE 1998
FILE NO. 4966.21535-012

O'BRIEN & GERE
ENGINEERS INC.

PLOT_DATE

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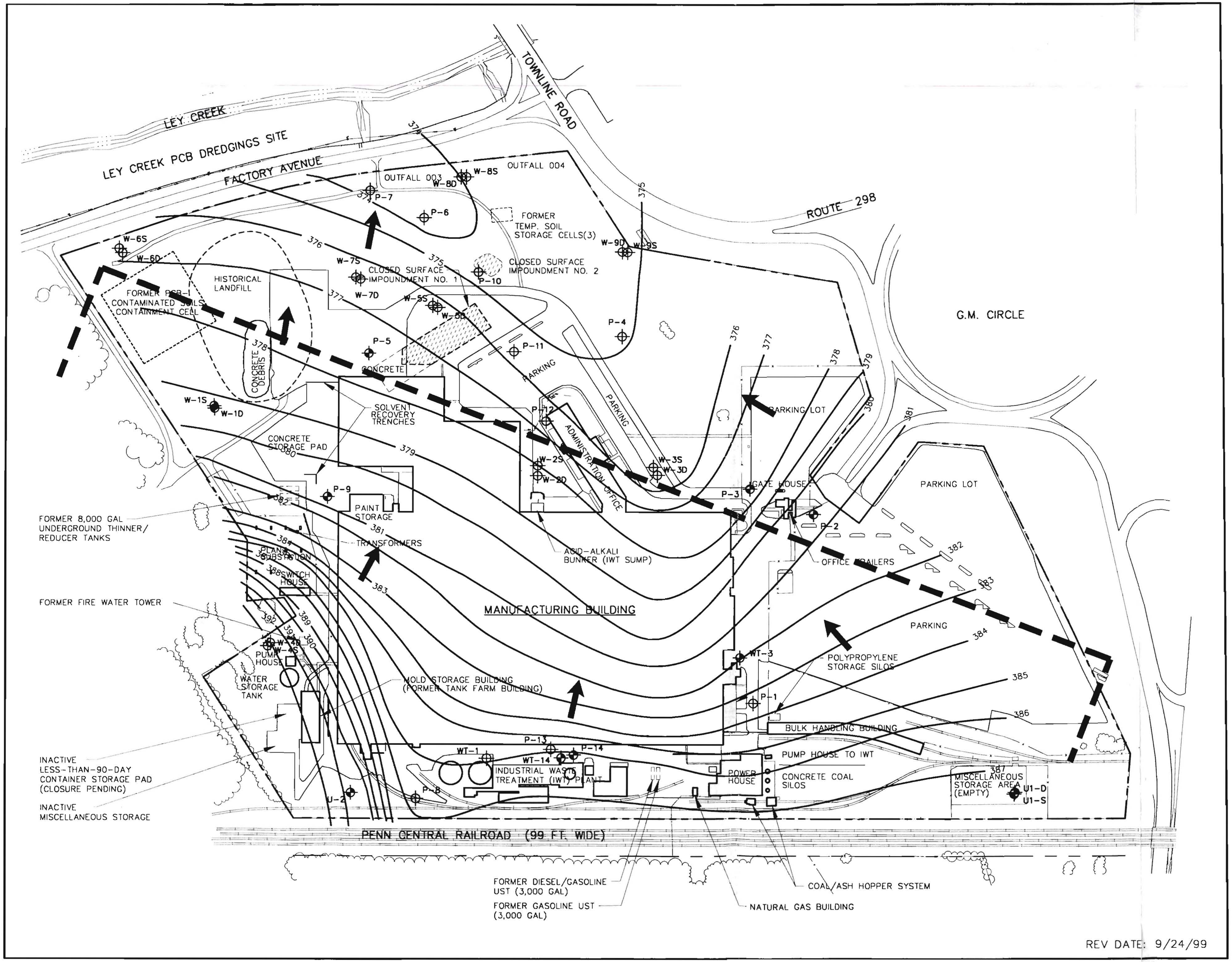
FIGURE 4



GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

SHALLOW GROUND WATER ELEVATION MAP JUNE 1985

DATE: SEPTEMBER 1999

FILE NO. 4966.21535.013

O'BRIEN & GERE ENGINEERS INC.

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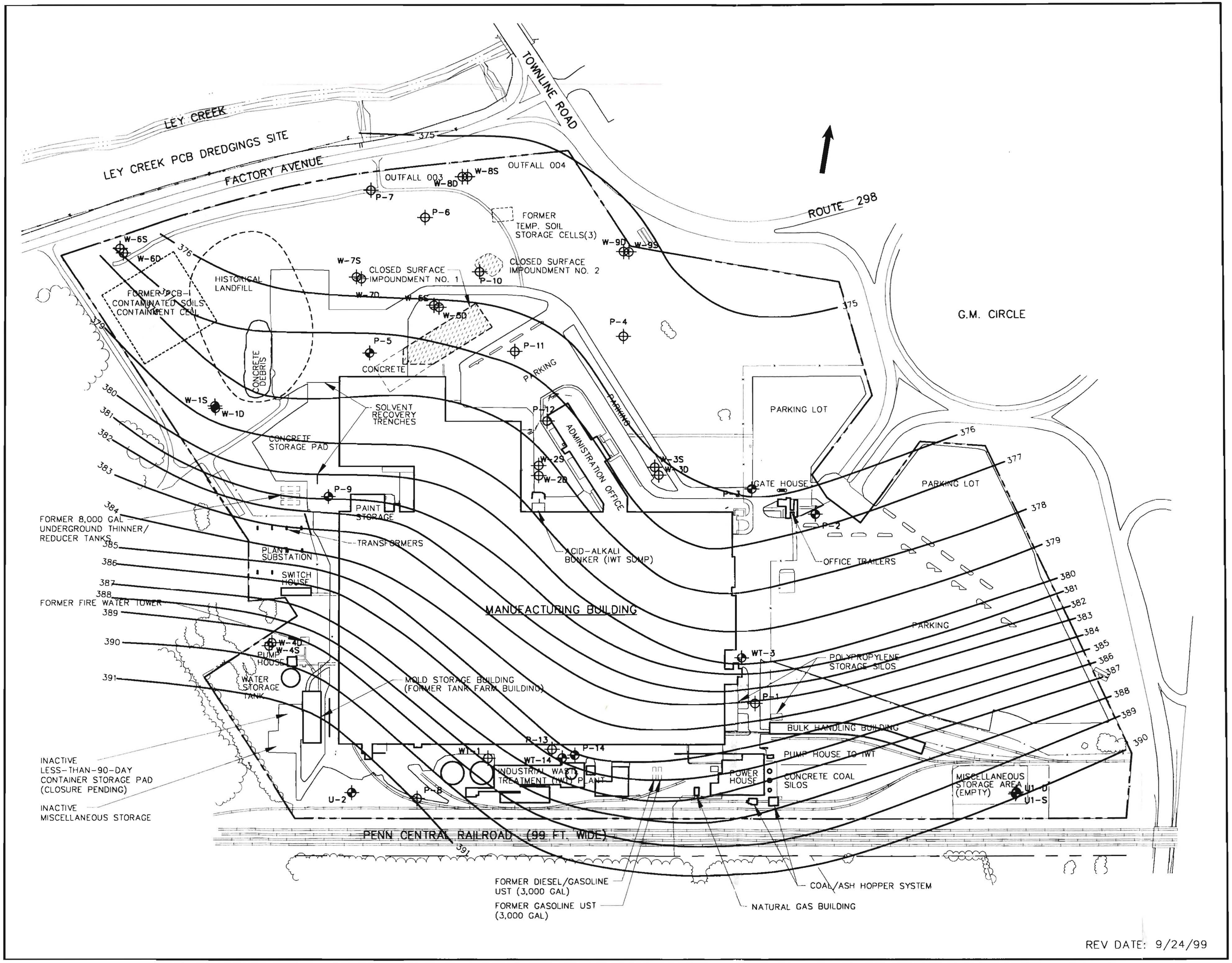


FIGURE 5

LEGEND

379	SHALLOW GROUND WATER ELEVATION
⬉	SHALLOW GROUND WATER FLOW DIRECTION
⌖ W-1D	MONITORING WELL (LOCATED 7/98)
⌖ P-4	MONITORING WELL (NOT LOCATED 7/98)
— — —	PROPERTY LINE
	TREE LINE
-------	APPROX. LOCATION
—·—·—	FENCE

GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

DEEP GROUND WATER ELEVATION MAP JUNE 1985

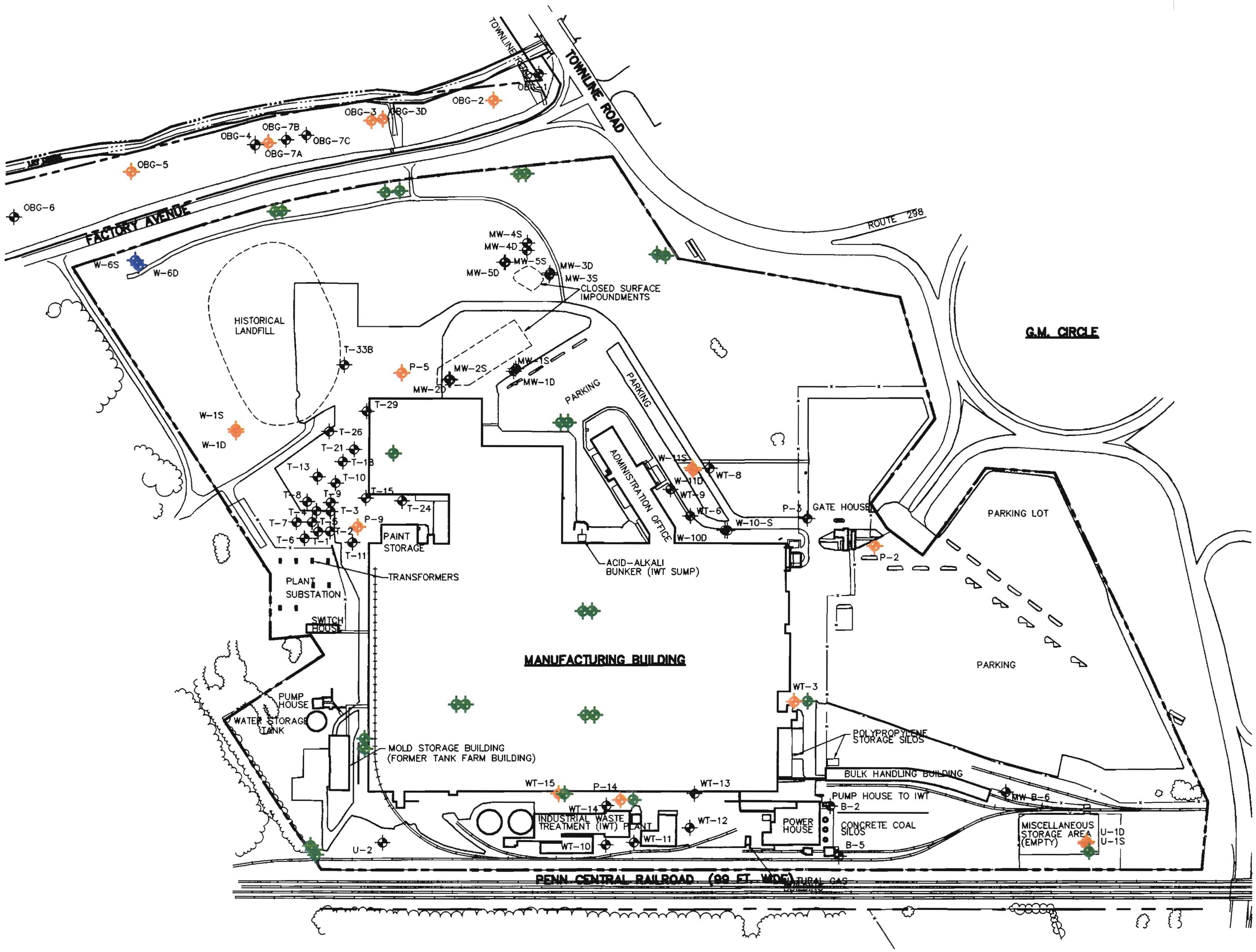
0 250 500
SCALE IN FEET

DATE: SEPTEMBER 1999
FILE NO. 4966.21535.014

O'BRIEN & GERE ENGINEERS INC.

MWH I:\DIV71\PROJECTS\4966\21535\DWG\71\001-1.DWG SF:1 (250)

FIGURE 6



REV DATE: 9/24/99

LEGEND

- PROPOSED NEW WELL
- EXISTING WELL TO BE SAMPLED (LOCATED 7/98)
- EXISTING WELL TO BE SAMPLED / LOCATED (LOCATED 6/96; NOT LOCATED 7/98)
- EXISTING WELL NOT TO BE SAMPLED (LOCATED 7/98)
- PROPERTY LINE
- TREE LINE
- APPROX. LOCATION
- FENCE

GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

MONITORING WELL LOCATIONS

0 250 500
SCALE IN FEET

DATE: SEPTEMBER 1999
FILE NO. 4966.21535.001

O'BRIEN & GERE
ENGINEERS INC.

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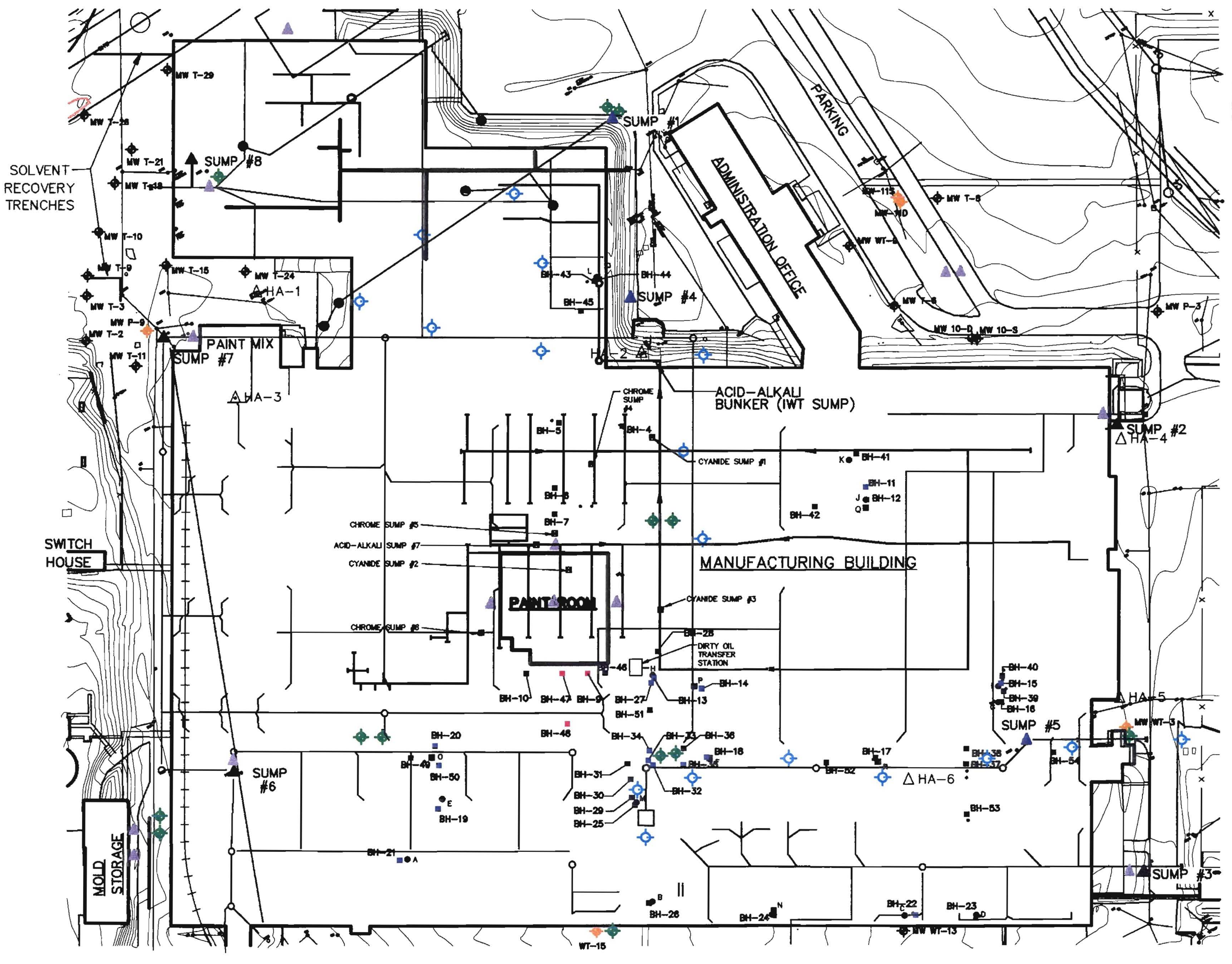


REV DATE: 9/24/99

FIGURE 7

LEGEND

A ●	BURIED MANHOLE
B ●	HYDRAULIC OIL SUMP (OUT OF SERVICE)
R ■	HYDRAULIC OIL UNDERGROUN STORAGE TANK (REMOVED)
BH-16 ■	CRA BORE HOLE
HA-5 △	CRA HAND AUGER SAMPLE LOCATION
▲	OIL/WATER COLLECTION SUMP
────	INACTIVE STORM SEWER
────	INACTIVE PROCESS SEWER
○	MANHOLE
E────	CAPPED PIPE
⌖	PROPOSED NEW WELL
⌖	EXISTING WELL TO BE SAMPLED
⌖	EXISTING WELL NOT TO BE SAMPLED
▲	PROPOSED SOIL BORING
🟦	OIL > 10,000 mg/kg IN SOIL OR FREE OIL IN SUMP
🟥	TCE/DCE > 10 mg/kg IN SOI
⌖	PROPOSED TEMPORARY PIEZOMETER
×──×	FENCE

GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

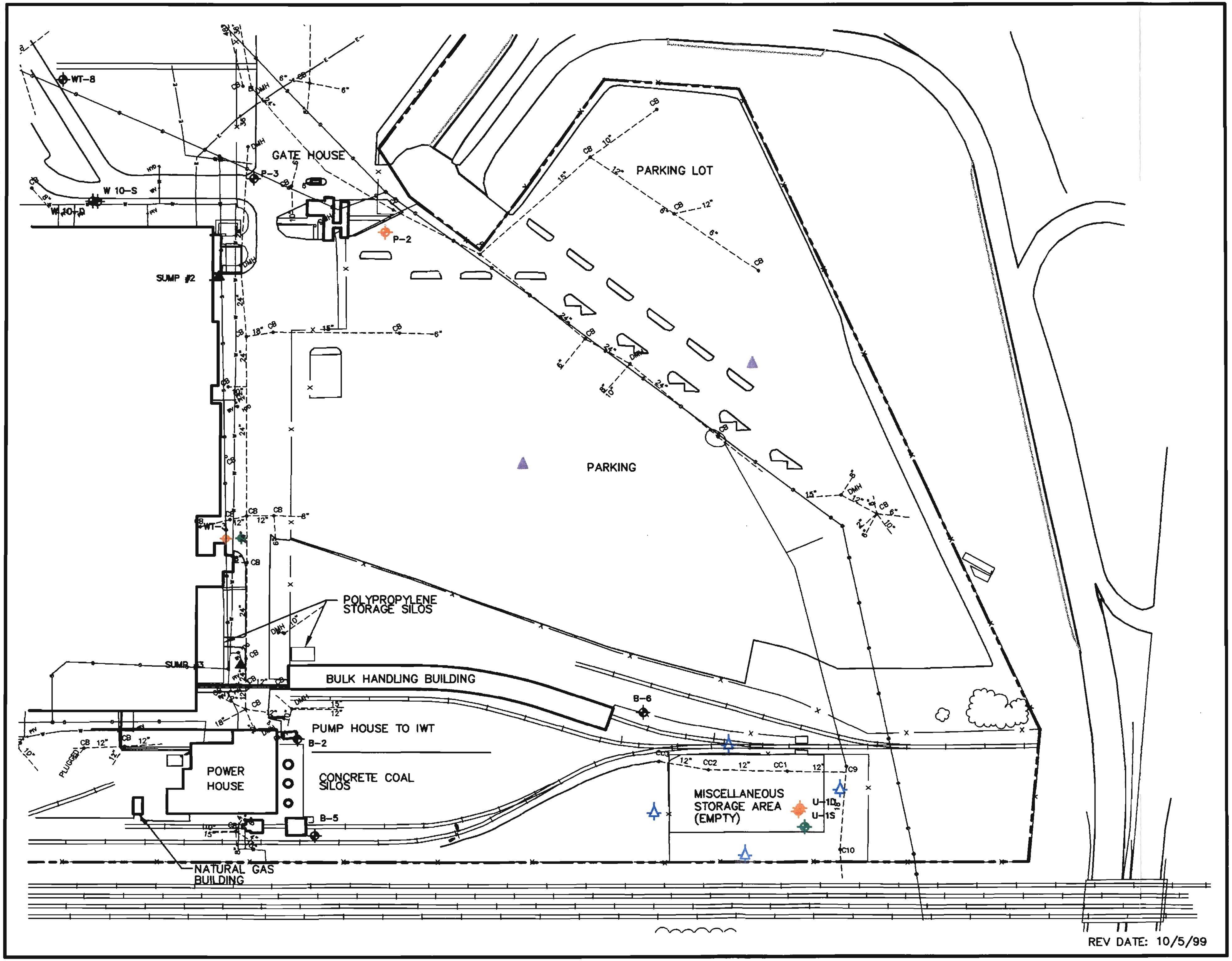
SAMPLING LOCATIONS MANUFACTURING BUILDING SUBSURFACE

0 120 240
SCALE IN FEET

DATE: SEPTEMBER 1999
FILE NO. 4966.21535.002

O'BRIEN & GERE ENGINEERS INC.

FIGURE 8



LEGEND

- PROPOSED NEW WELL
- EXISTING WELL TO BE SAMPLED (LOCATED 7/98)
- PROPOSED SURFACE SOIL SAMPLE
- PROPOSED SOIL BORING
- EXISTING WELL NOT TO BE SAMPLED (LOCATED 7/98)
- PROPERTY LINE
- TREE LINE
- APPROX. LOCATION
- FENCE
- SANITARY SEWER
- STORM SEWER
- WATER

GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

SAMPLING LOCATIONS SOUTHEAST PROPERTY AREA

0 120 240
SCALE IN FEET

DATE: OCTOBER 1999
FILE NO. 4966.21535.003

O'BRIEN & GERE ENGINEERS INC.

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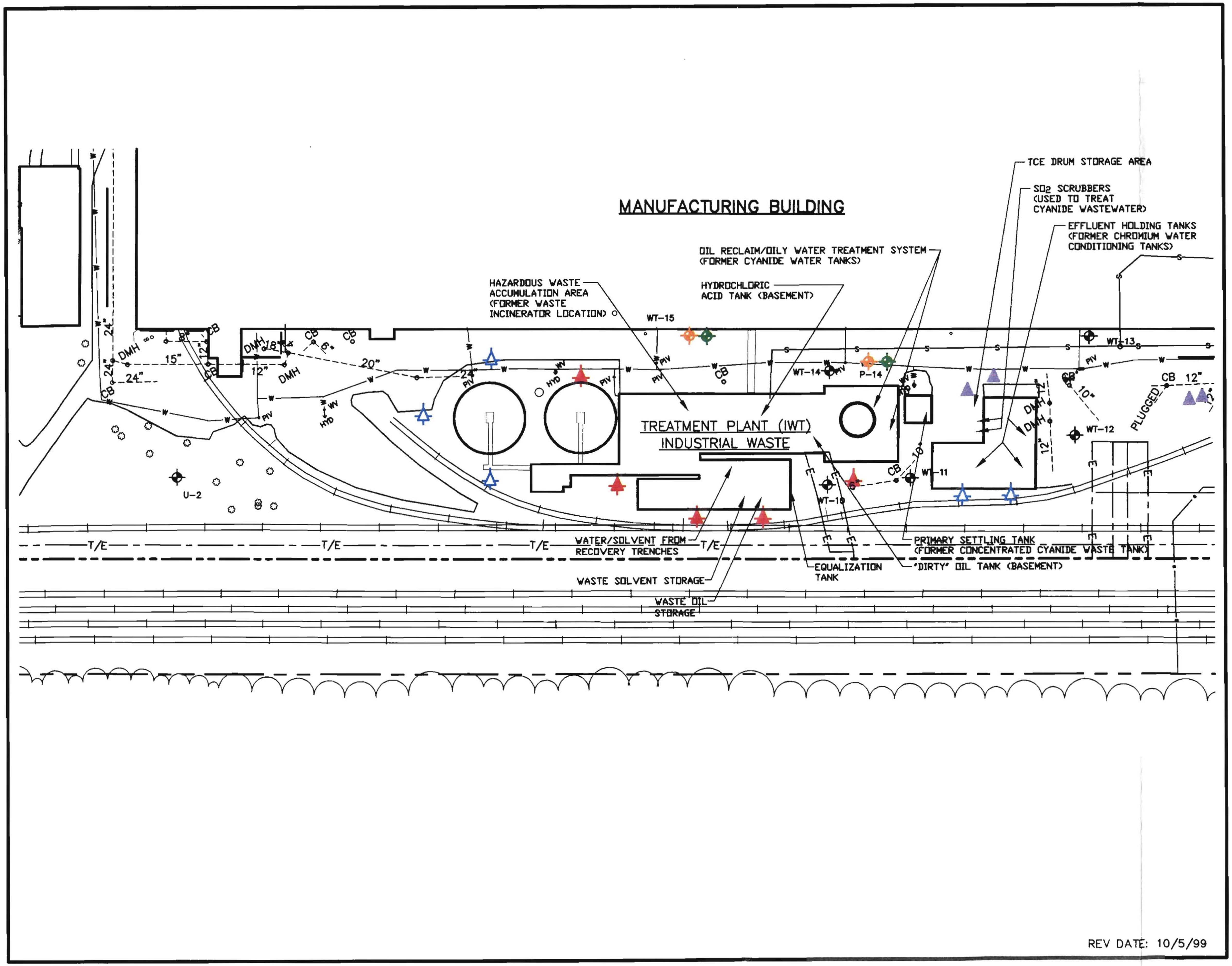


FIGURE 9

LEGEND

⊕ PROPOSED NEW WELL

⊕ EXISTING WELL TO BE SAMPLED (LOCATED 7/98)

△ PROPOSED SURFACE SOIL SAMPLE

▲ PROPOSED SOIL BORING

▲ PROPOSED SURFACE SOIL SAMPLE TO INCLUDE CHLORINATED DIOXIN/DIBENZOFURAN ANALYSIS

⊕ EXISTING WELL NOT TO BE SAMPLED (LOCATED 7/98)

PROPERTY LINE

TREE LINE

SANITARY SEWER

STORM SEWER

WATER

OVERHEAD TELEPHONE & ELECTRIC

GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

SAMPLE LOCATIONS
IWT PLANT AREA

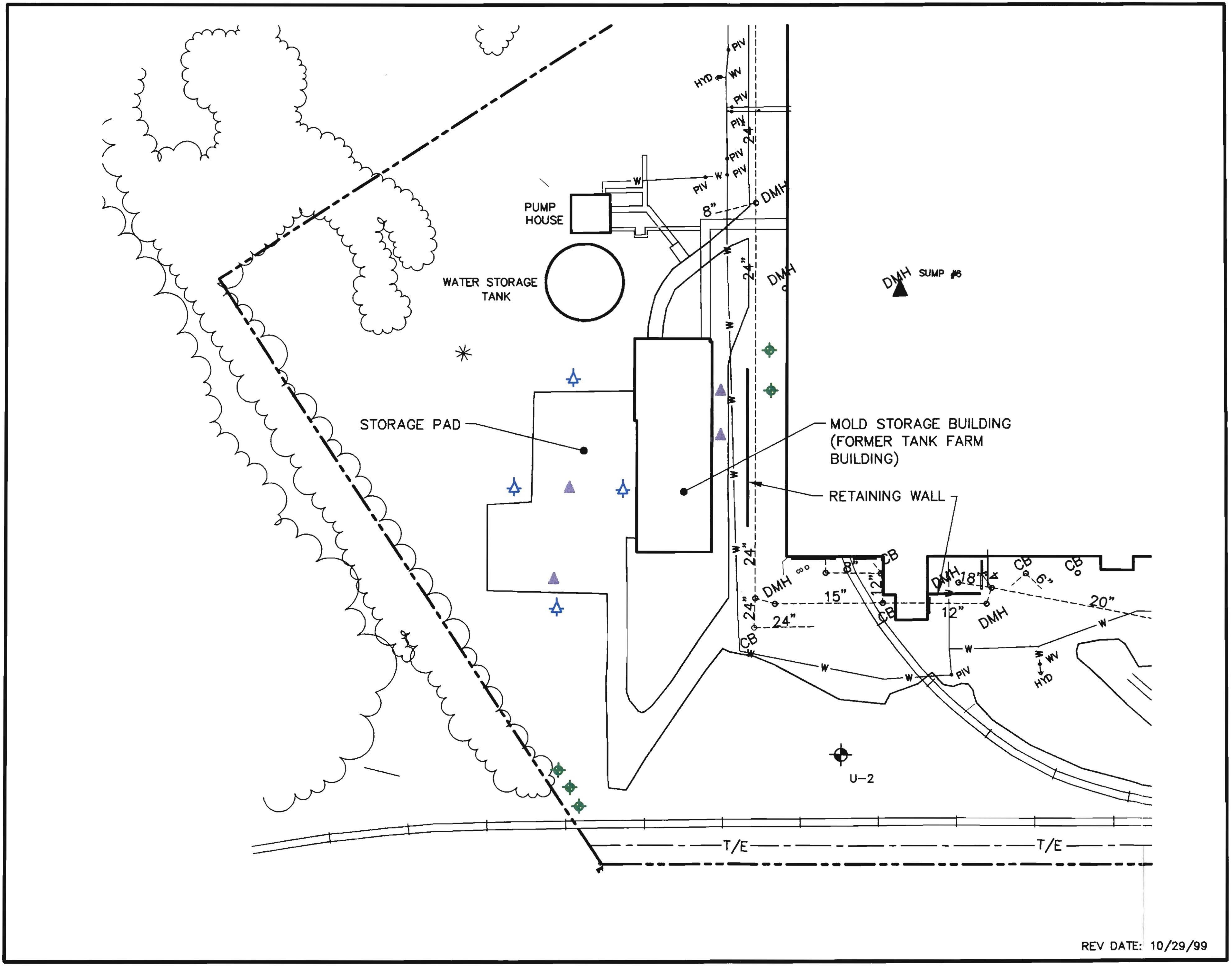
0 80 160
SCALE IN FEET

DATE: OCTOBER 1999
FILE NO. 4966.21535.008

O'BRIEN & GERE ENGINEERS INC.

MWH I:\DIV71\PROJECTS\4966\21535\DWG\71\004-1.DWG SF:1 (80) (X-REF:BASE.DWG) (DVIEW 59')

FIGURE 10



LEGEND

- ⊕ PROPOSED NEW WELL
- ⊕ EXISTING WELL NOT TO BE SAMPLED (LOCATED 7/98)
- △ PROPOSED SURFACE SOIL SAMPLE
- ▲ PROPOSED SOIL BORING
- — - — PROPERTY LINE
- TREE LINE
- FENCE
- - - - - STORM SEWER
- WATER
- — - T/E - — OVERHEAD TELEPHONE & ELECTRIC

GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

SAMPLING LOCATIONS SOUTHWEST PROPERTY AREA

0 60 120
SCALE IN FEET

DATE: OCTOBER 1999
FILE NO. 4966.21535.004

O'BRIEN & GERE
ENGINEERS INC.

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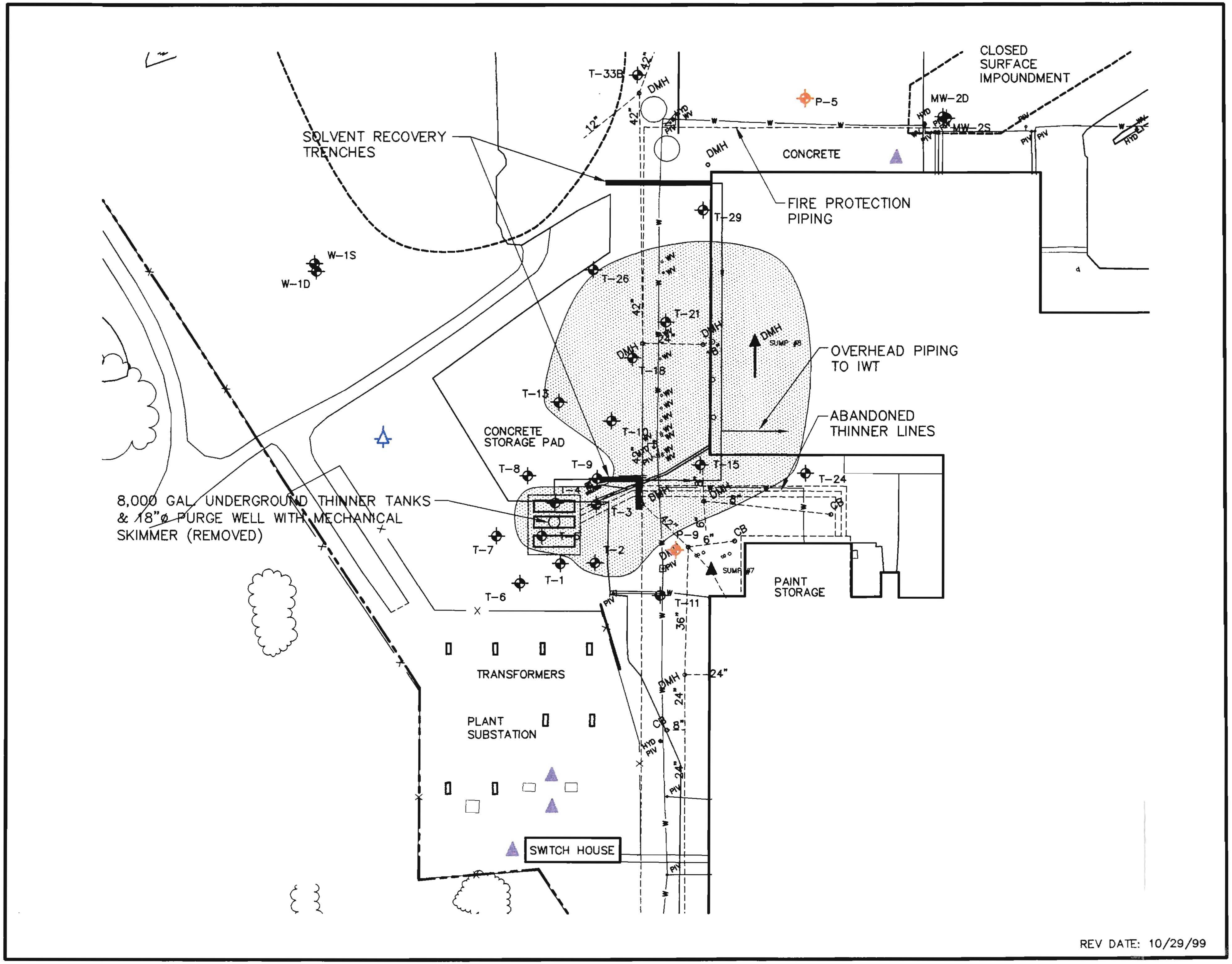

FIGURE 11

LEGEND

- ⌖ EXISTING WELL TO BE SAMPLED (LOCATED 7/98)
- △ PROPOSED SURFACE SOIL SAMPLE
- ▲ PROPOSED SOIL BORING
- ⌖ EXISTING WELL NOT TO BE SAMPLED (LOCATED 7/98)
- ▬ ▬ PROPERTY LINE
- TREE LINE
- ------- APPROX. LOCATION
- —x—x— FENCE
- – – – STORM SEWER
- —w— WATER

GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

SAMPLING LOCATIONS FORMER THINNER TANKS AREA

0 80 160
SCALE IN FEET

DATE: OCTOBER 1999
FILE NO. 4966.21535.005

O'BRIEN & GERE
ENGINEERS INC.

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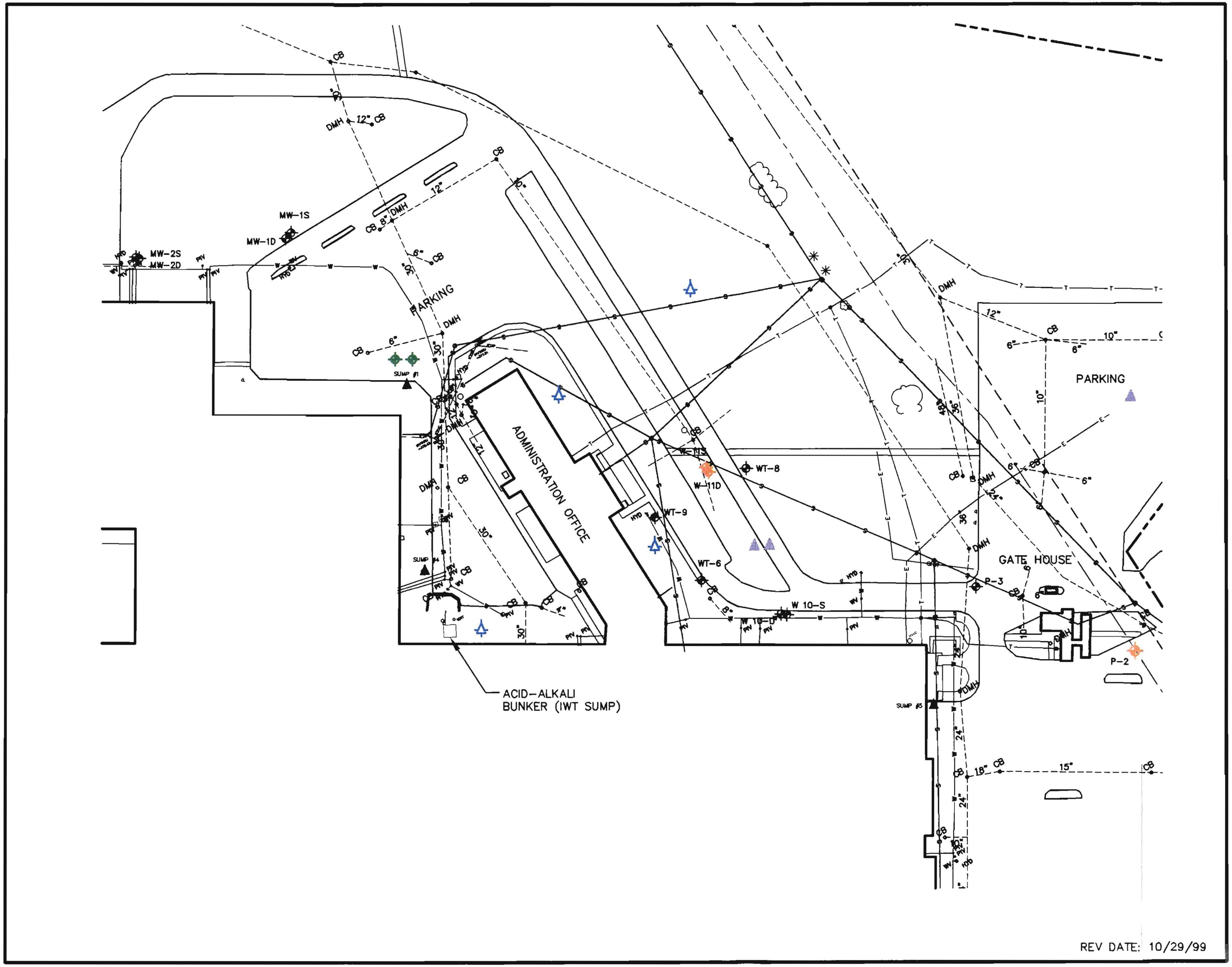


FIGURE 12

LEGEND

- ⊕ PROPOSED NEW WELL
- ⊕ EXISTING WELL TO BE SAMPLED (LOCATED 7/98)
- △ PROPOSED SURFACE SOIL SAMPLE
- ▲ PROPOSED SOIL BORING
- ⊕ EXISTING WELL NOT TO BE SAMPLED (LOCATED 7/98)
- — - — PROPERTY LINE
- TREE LINE
- ------- APPROX. LOCATION
- —x— FENCE
- —o— SANITARY SEWER
- - - - STORM SEWER
- —W— WATER
- —E— ELECTRIC
- —T— TELEPHONE

GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

SAMPLING LOCATIONS NORTHEAST PROPERTY AREA

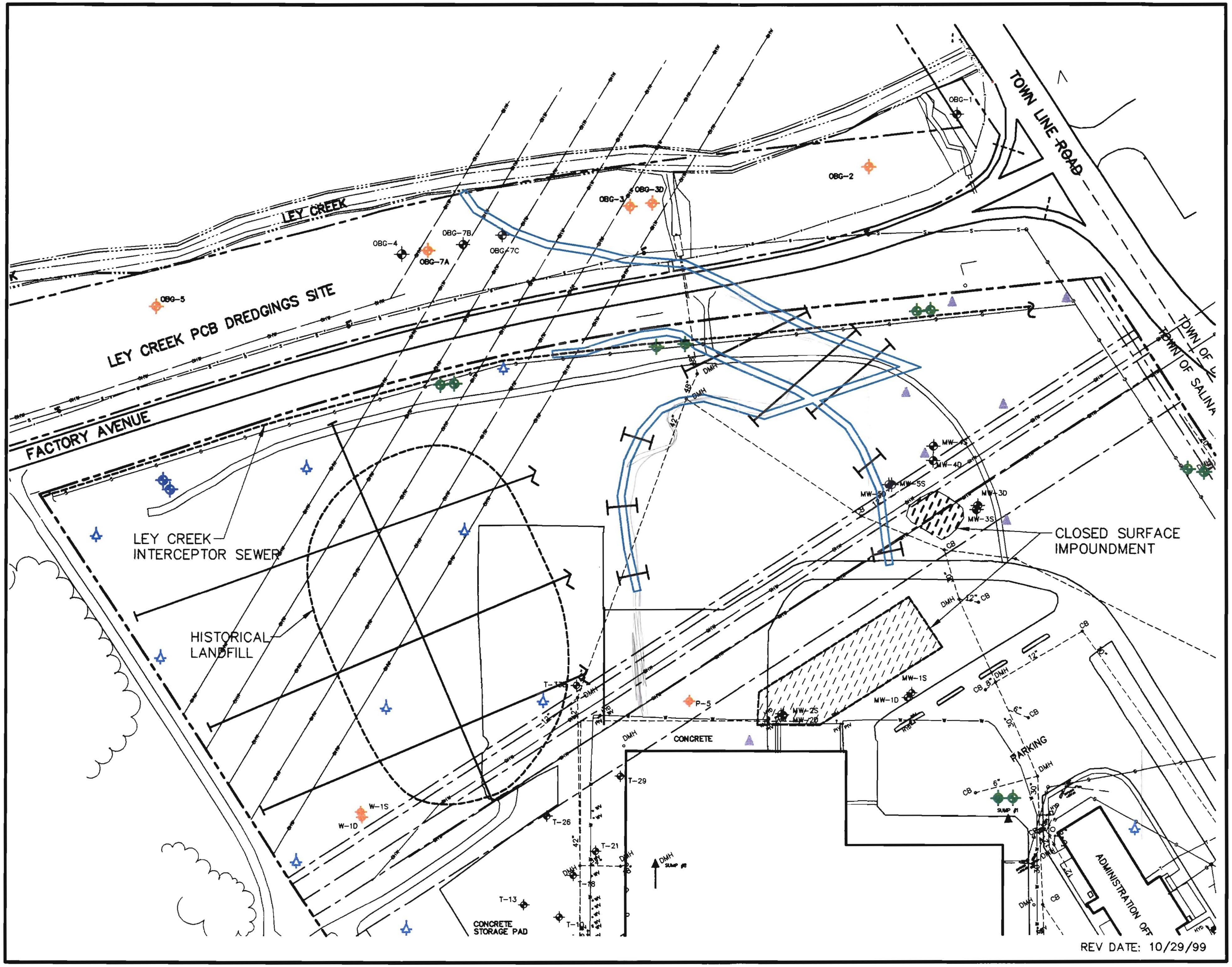
0 80 160
SCALE IN FEET

DATE: OCTOBER 1999
FILE NO. 4966.21535.006

O'BRIEN & GERE ENGINEERS INC.

MWH I:\DIV71\PROJECTS\4966\21535\DWG\71\WORKPLAN\039-F13.DWG SF:1 (120) (X-REF:BASE.DWG) (DVIEW 59°)

FIGURE 13



REV DATE: 10/29/99

LEGEND

⊕	PROPOSED NEW WELL
⊕	EXISTING WELL TO BE SAMPLED (LOCATED 7/98)
⊕	EXISTING WELL TO BE SAMPLED (LOCATED 6/96) (NOT LOCATED 7/98)
△	PROPOSED SURFACE SOIL SAMPLE
▲	PROPOSED SOIL BORING
⊕	EXISTING WELL NOT TO BE SAMPLED (LOCATED 7/98)
├─┤	PROPOSED TEST TRENCH
═	ESTIMATED HISTORICAL LOCATION OF DRAINAGE SWALES
━ ━	PROPERTY LINE
﹏	TREE LINE
- - -	APPROX. LOCATION
—x—	FENCE
—∘—	SANITARY SEWER
- - -	STORM SEWER
—▾—	WATER

GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

SAMPLING LOCATIONS NORTHEAST PROPERTY AREA AND LEY CREEK DEFERRED GROUND WATER

0 120 240
SCALE IN FEET

DATE: OCTOBER 1999
FILE NO. 4966.21535.039

O'BRIEN & GERE ENGINEERS INC.

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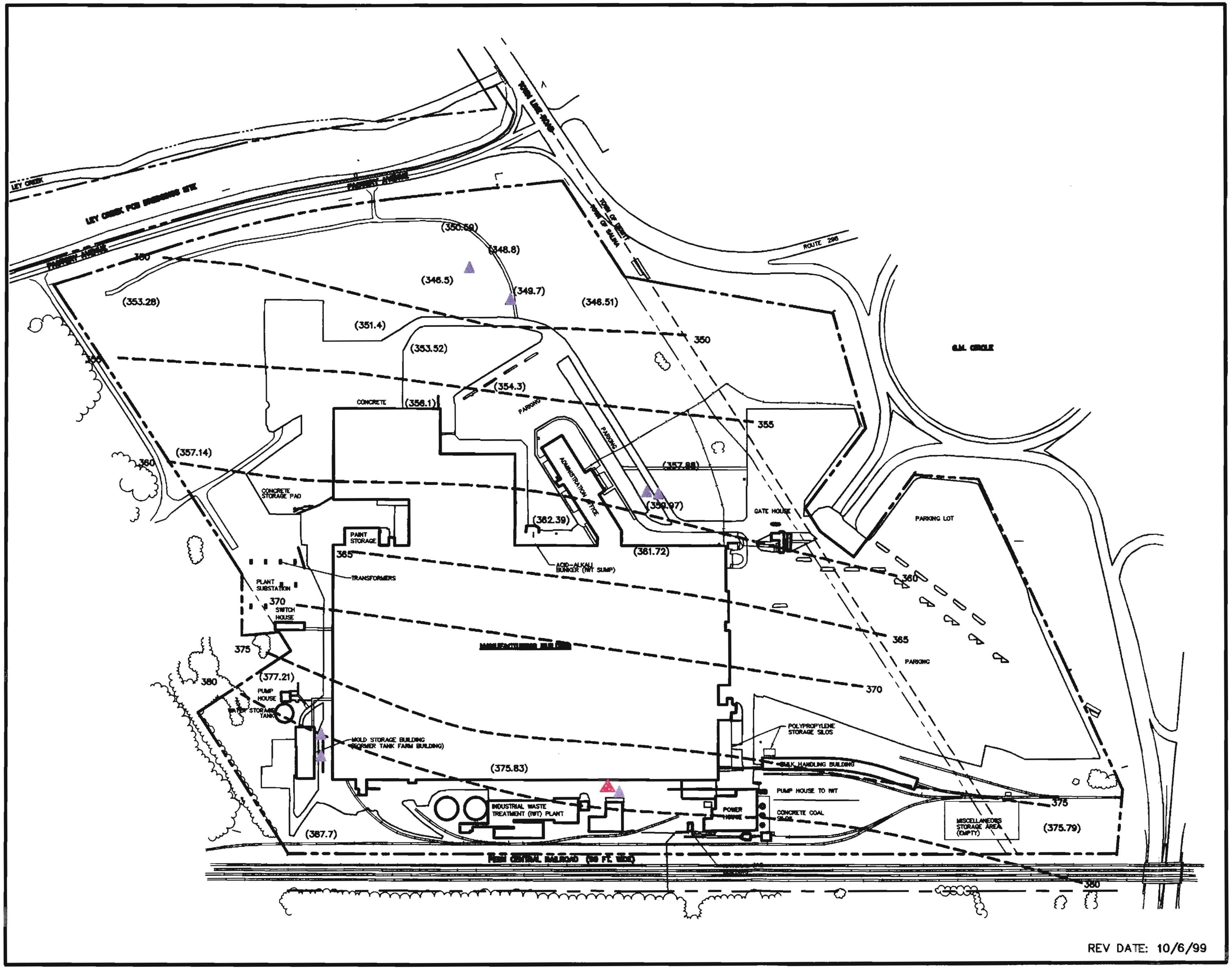

REV DATE: 10/6/99

FIGURE 14

LEGEND

— — —	TOP OF LODGEMENT TILL ELEVATION CONTOUR
(375)	TOP OF LODGEMENT TILL ELEVATION
▲	PROPOSED SOIL BORING
▲	PROPOSED DNAPL INVESTIG SOIL BORING/NEW WELL
— - —	PROPERTY LINE
☁	TREE LINE
------	APPROX. LOCATION
—x—	FENCE

GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

TOP OF LODGEMENT TILL MAP AND DNAPL BORING LOCATIONS

0 250 500
SCALE IN FEET

DATE: OCTOBER 1999
FILE NO. 4966.21535.040

O'BRIEN & GERE ENGINEERS INC.

F:\DIV71\PROJECTS\4966\21535\DWG\71\015.DWG SF:1000

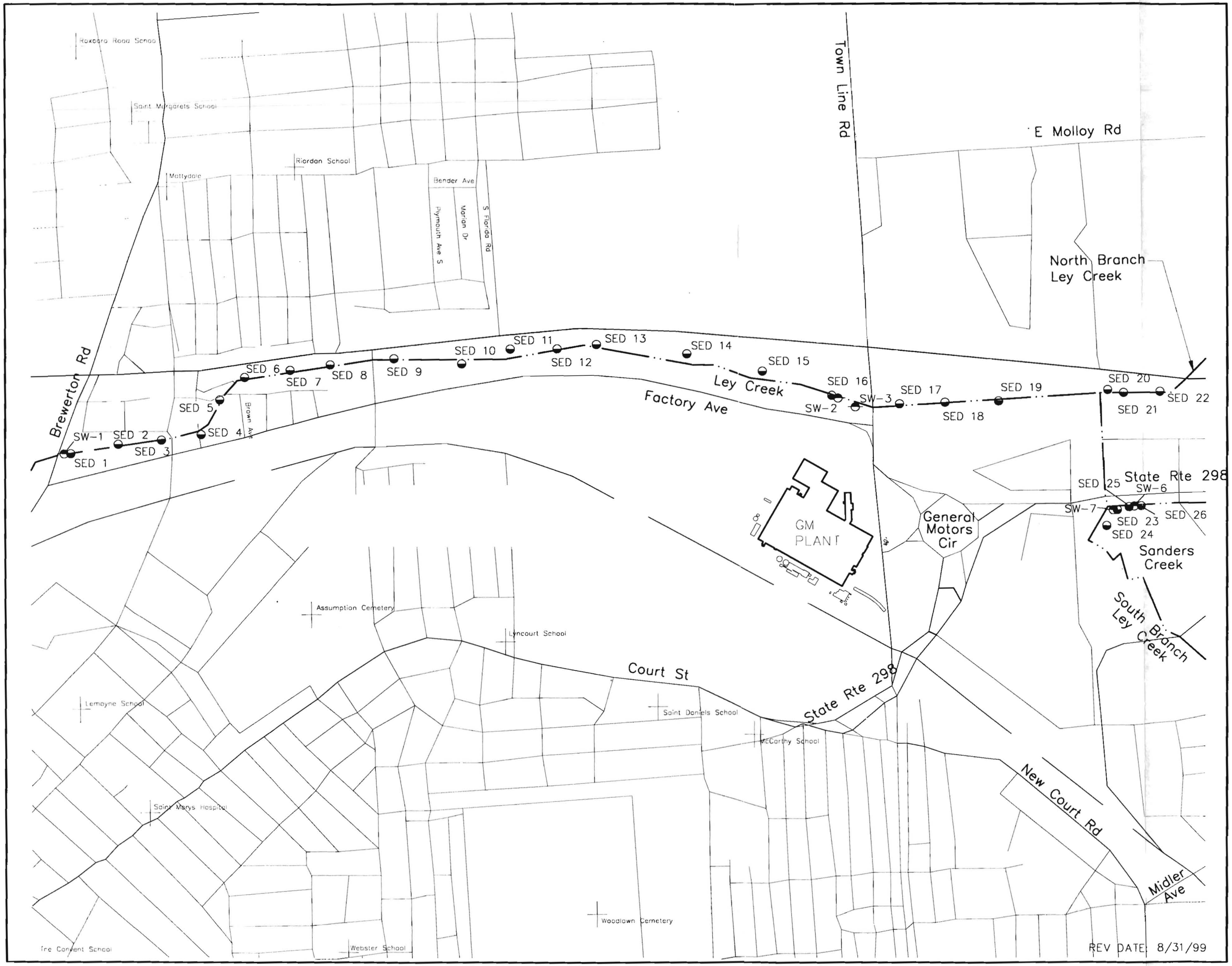

FIGURE 15

LEGEND

◓ SEDIMENT CORE SAMPLE LOCATION

⊖ SURFACE WATER SAMPLE LOCATION

LEY CREEK
DEFERRED MEDIA SITE
SYRACUSE, NEW YORK

LEY CREEK SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS

0 1000 2000
SCALE IN FEET

DATE: AUGUST 1999
FILE NO. 4966.21535.015

O'BRIEN & GERE ENGINEERS INC.

Figure 16
Anticipated Schedule

ID	Task Name	Duration	Start	Finish
1	SRI/FS WP submittal	0d	6/30/98	6/30/98
2	Agency SRI/FS WP review	55.8w	7/1/98	7/26/99
3	Agency comments - LCDM	0d	10/15/98	10/15/98
4	Agency approval - LCDM	0d	11/9/98	11/9/98
5	LCDM field activities	5d	11/16/98	11/20/98
6	LCDM sample analysis	6w	11/23/98	1/1/99
7	LCDM data validation	16d	1/4/99	1/25/99
8	LCDM analyt.summary report development	1d	2/16/99	2/16/99
9	LCDM analytical summary report submittal	0d	2/17/99	2/17/99
10	Agency comments - man. bldg.	0d	5/20/99	5/20/99
11	Agency approval - man. bldg.	0d	6/17/99	6/17/99
12	Man. bldg. field activities	32d	7/6/99	8/18/99
13	Man. bldg. sample analysis	50d	7/7/99	9/14/99
14	Man. bldg. data validation	20d	9/27/99	10/22/99
15	Agency comments - remainder	0d	7/26/99	7/26/99
16	SRI/FS WP revisions	10.4w	7/27/99	10/6/99
17	Agency well install. approval	0d	8/26/99	8/26/99
18	Revised SRI/FS WP submittal	0d	10/6/99	10/6/99
19	Agency SRI/FS WP approval	0d	10/15/99	10/15/99
20	Field activities - well installation	2.8w	9/28/99	10/15/99
21	Field activities - remaining work	6w	10/18/99	11/26/99
22	Sample analyses	12w	10/19/99	1/10/00
23	Data validaton	4w	1/11/00	2/7/00
24	Analytical summary report development	14d	2/8/00	2/25/00
25	Analytical summary report submittal	0d	2/24/00	2/24/00

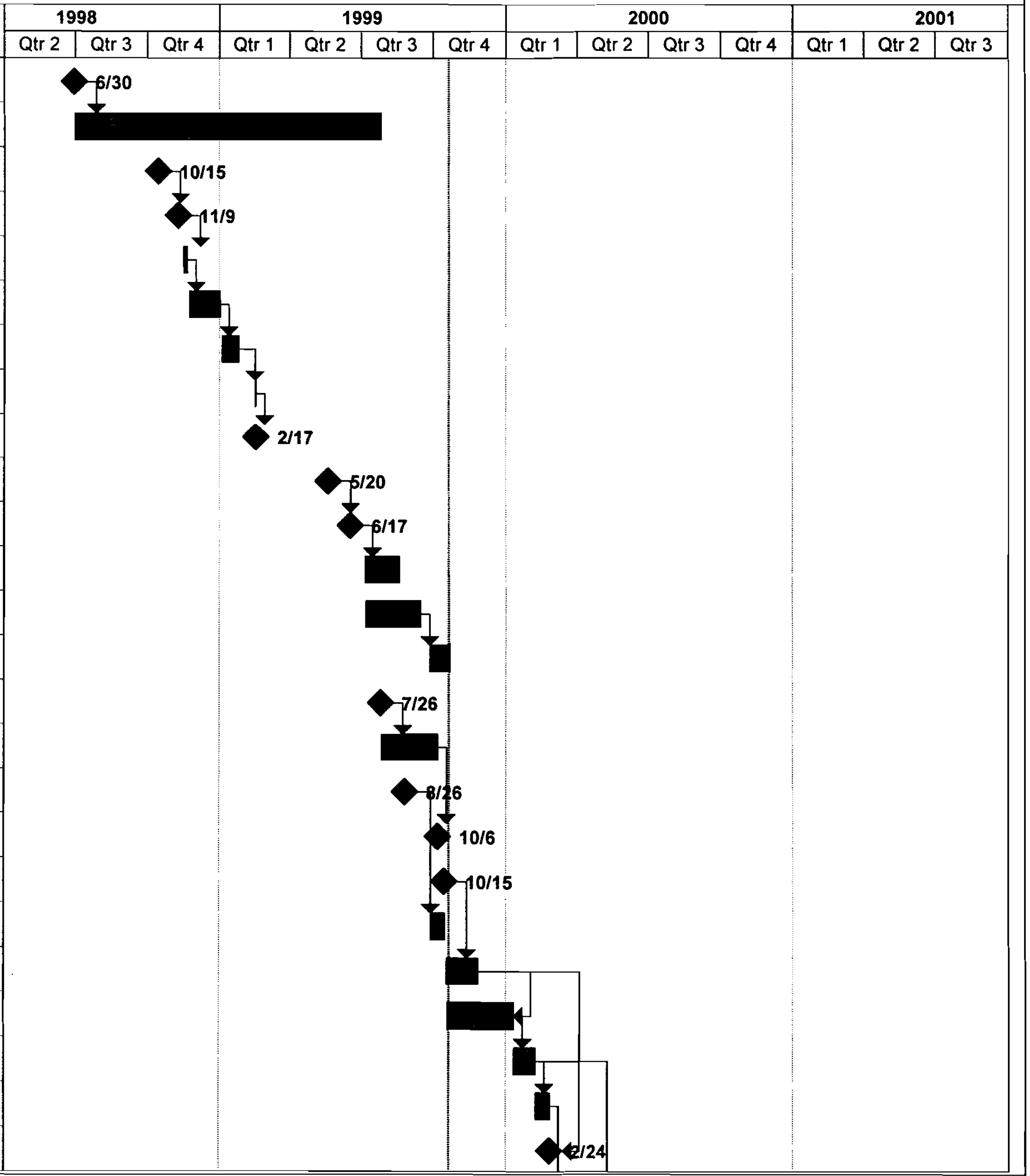

Figure 16
Anticipated Schedule

ID	Task Name	Duration	Start	Finish
26	SRI Report development	20w	11/30/99	4/17/00
27	SRI Report submittal	0d	4/17/00	4/17/00
28	Agency SRI Report review	6w	4/18/00	5/29/00
29	SRI Report revisions	6w	5/30/00	7/10/00
30	Revised SRI Report submittal	0d	7/10/00	7/10/00
31	Agency SRI Report approval	0d	8/21/00	8/21/00
32	ERA Scoping Memo submittal	0d	7/24/98	7/24/98
33	Agency ERA scoping comments	0d	8/28/98	8/28/98
34	Revised ERA scoping submittal	0d	1/11/99	1/11/99
35	Agency revised ERA scoping comments	0d	11/1/99	11/1/99
36	ERA LCDM SMDP	0d	11/26/99	11/26/99
37	ERA Work Plan development	6w	11/29/99	1/7/00
38	ERA Work Plan submittal	0d	1/7/00	1/7/00
39	Agency ERA Work Plan review	6w	1/10/00	2/18/00
40	ERA Work Plan revisions	3w	2/21/00	3/10/00
41	Revised ERA Work Plan submittal	0d	3/10/00	3/10/00
42	Agency ERA Work Plan approval	0d	4/21/00	4/21/00
43	ERA Work Plan implementation	20w	4/24/00	9/8/00
44	ERA submittal	0d	9/8/00	9/8/00
45	Agency ERA review	6w	9/11/00	10/20/00
46	ERA revisions	3w	10/23/00	11/10/00
47	Revised ERA submittal	0d	11/10/00	11/10/00
48	Agency ERA approval	0d	12/22/00	12/22/00
49	Agency HHRA scoping comments	0d	1/6/99	1/6/99
50	Revised HHRA scoping submittal	0d	10/12/99	10/12/99

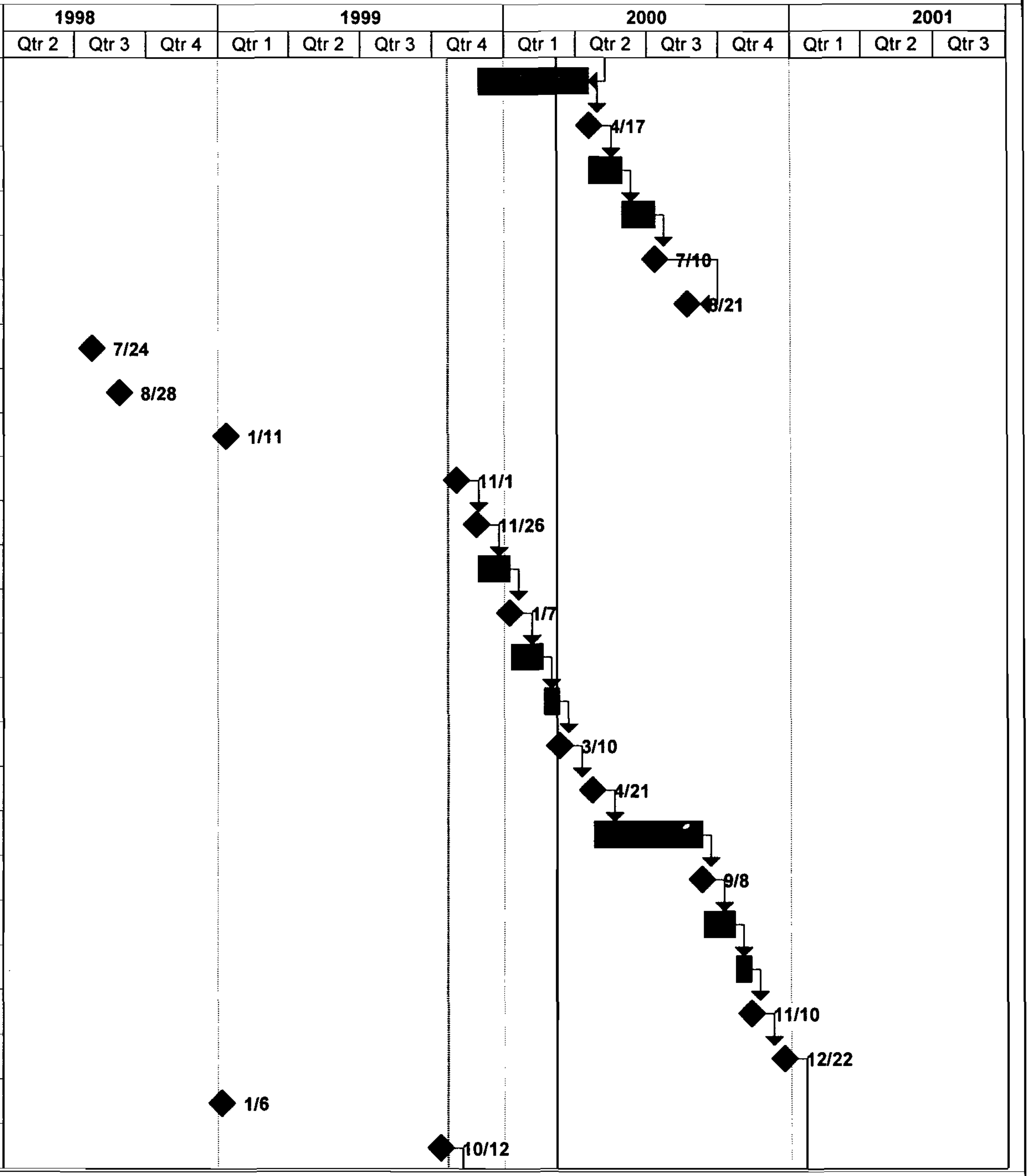

Figure 16
Anticipated Schedule

ID	Task Name	Duration	Start	Finish
51	Agency HHRA scoping approval	0d	11/22/99	11/22/99
52	HHRA EPAR development	30d	2/28/00	4/7/00
53	HHRA EPAR submittal	0d	4/7/00	4/7/00
54	Agency HHRA EPAR review	6w	4/10/00	5/19/00
55	HHRA EPAR revisions	3w	5/22/00	6/9/00
56	Revised HHRA EPAR submittal	0d	6/9/00	6/9/00
57	Agency HHRA EPAR approval	0d	7/21/00	7/21/00
58	HHRA development	21d	7/28/00	8/25/00
59	HHRA submittal	0d	8/25/00	8/25/00
60	Agency HHRA review	6w	8/28/00	10/6/00
61	HHRA revisions	3w	10/9/00	10/27/00
62	Revised HHRA submittal	0d	10/27/00	10/27/00
63	Agency HHRA approval	0d	12/8/00	12/8/00
64	SFS Screening Memo Development	31d	12/25/00	2/5/01
65	SFS Screening Memo submittal	0d	2/5/01	2/5/01
66	Agency SFS Screening Memo review	6w	2/6/01	3/19/01
67	Agency SFS Screening Memo approval	0d	3/19/01	3/19/01
68	SFS Report Development	33d	3/20/01	5/3/01
69	SFS Report submittal	0d	5/2/01	5/2/01
70	Agency SFS Report review	6w	5/3/01	6/13/01
71	SFS Report revisions	4w	6/14/01	7/11/01
72	Revised SFS Report submittal	0d	7/11/01	7/11/01
73	Agency SFS Report approval	0d	8/22/01	8/22/01

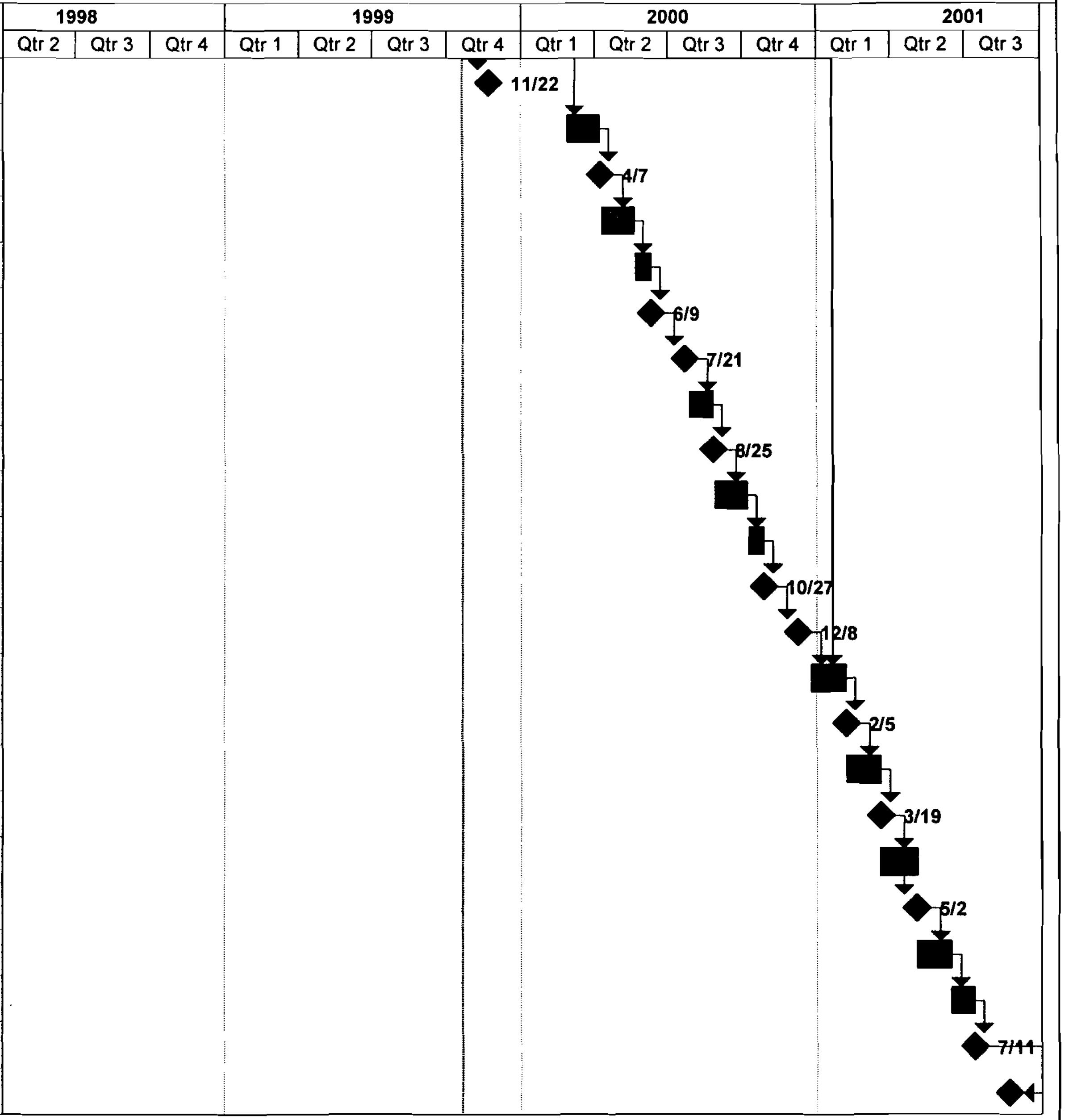

Figure 17

O'Brien & Gere Project Organization Chart

Supplemental Remedial Investigation /Feasibility Study

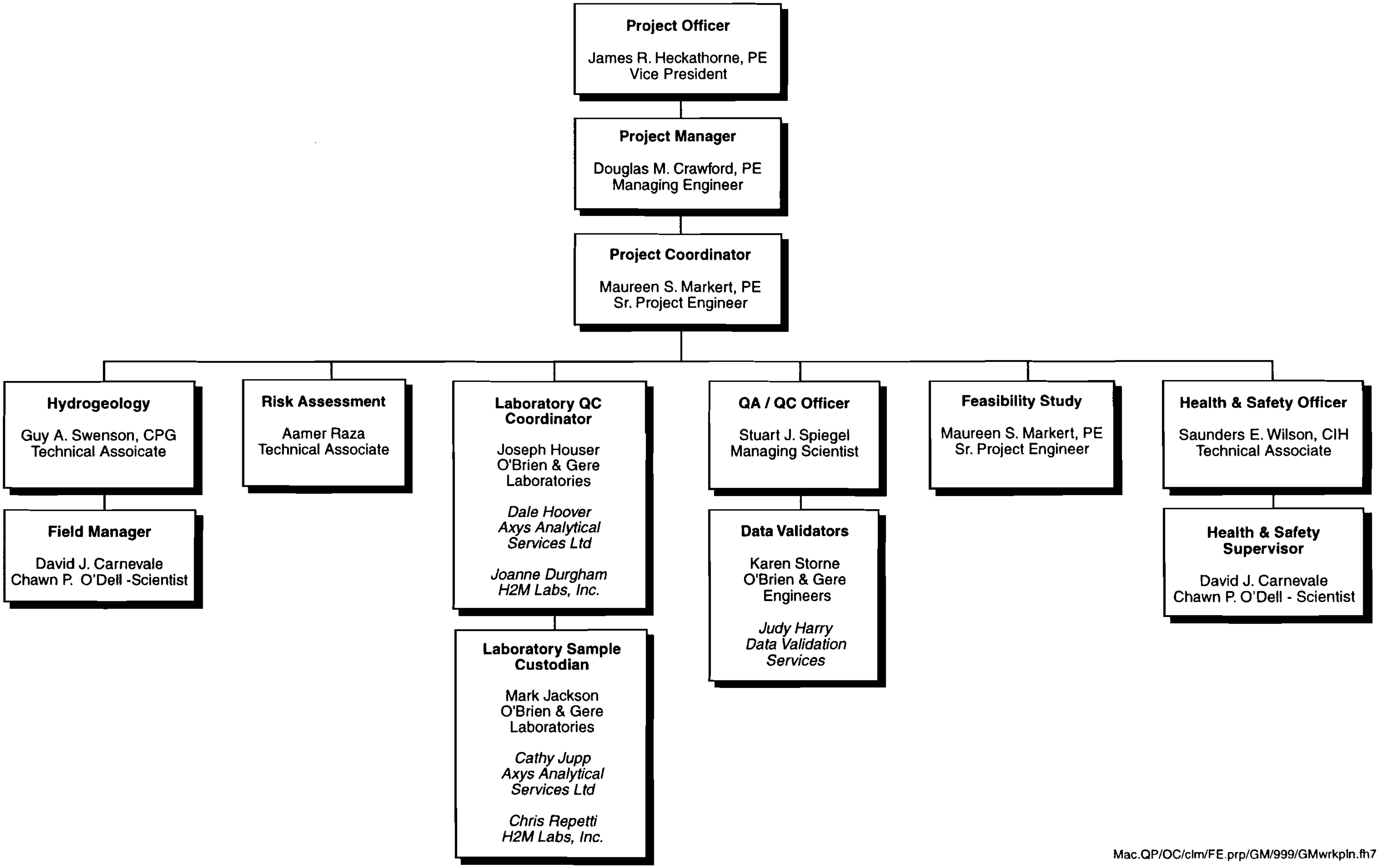

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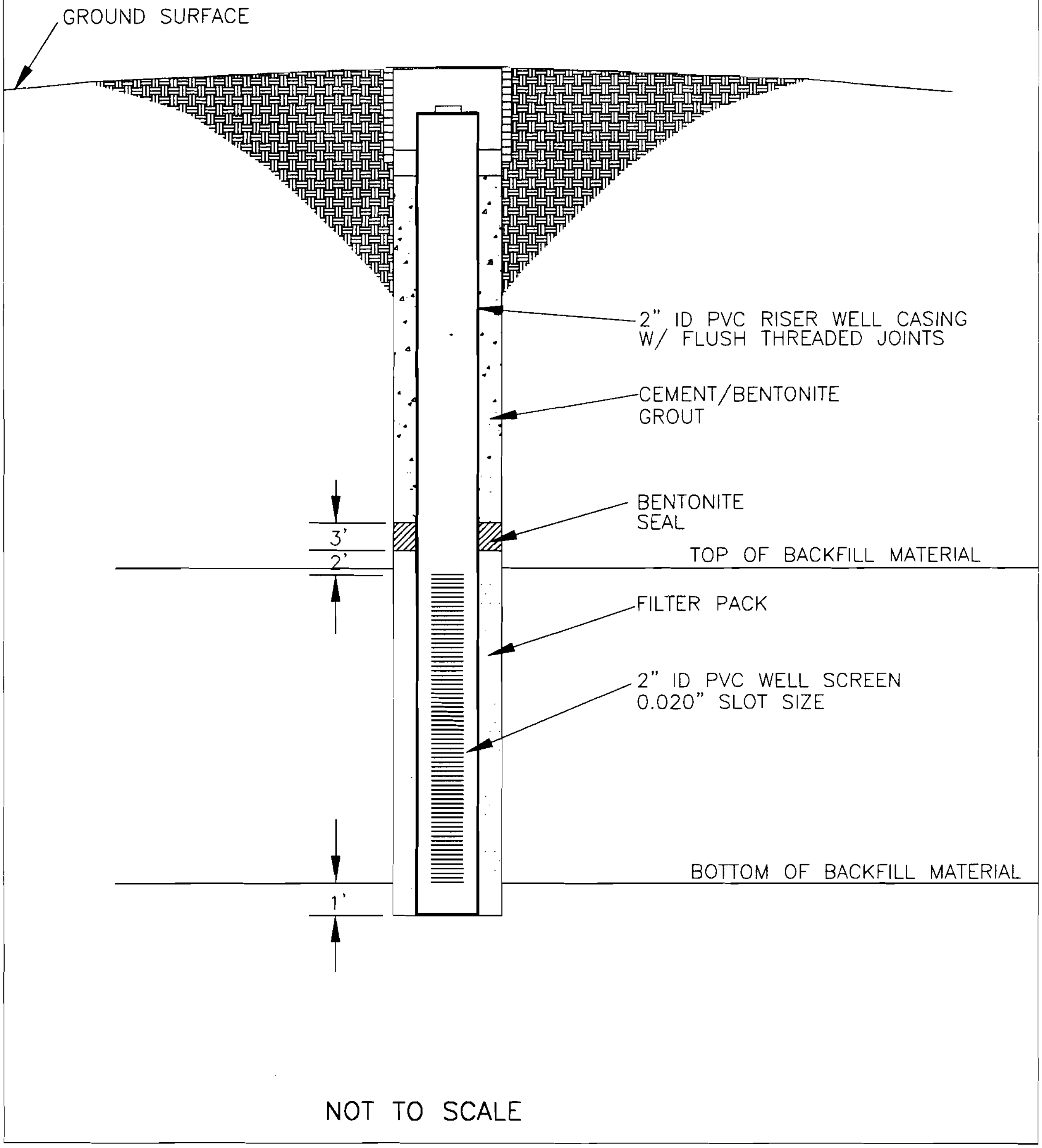
FIGURE 18



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GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

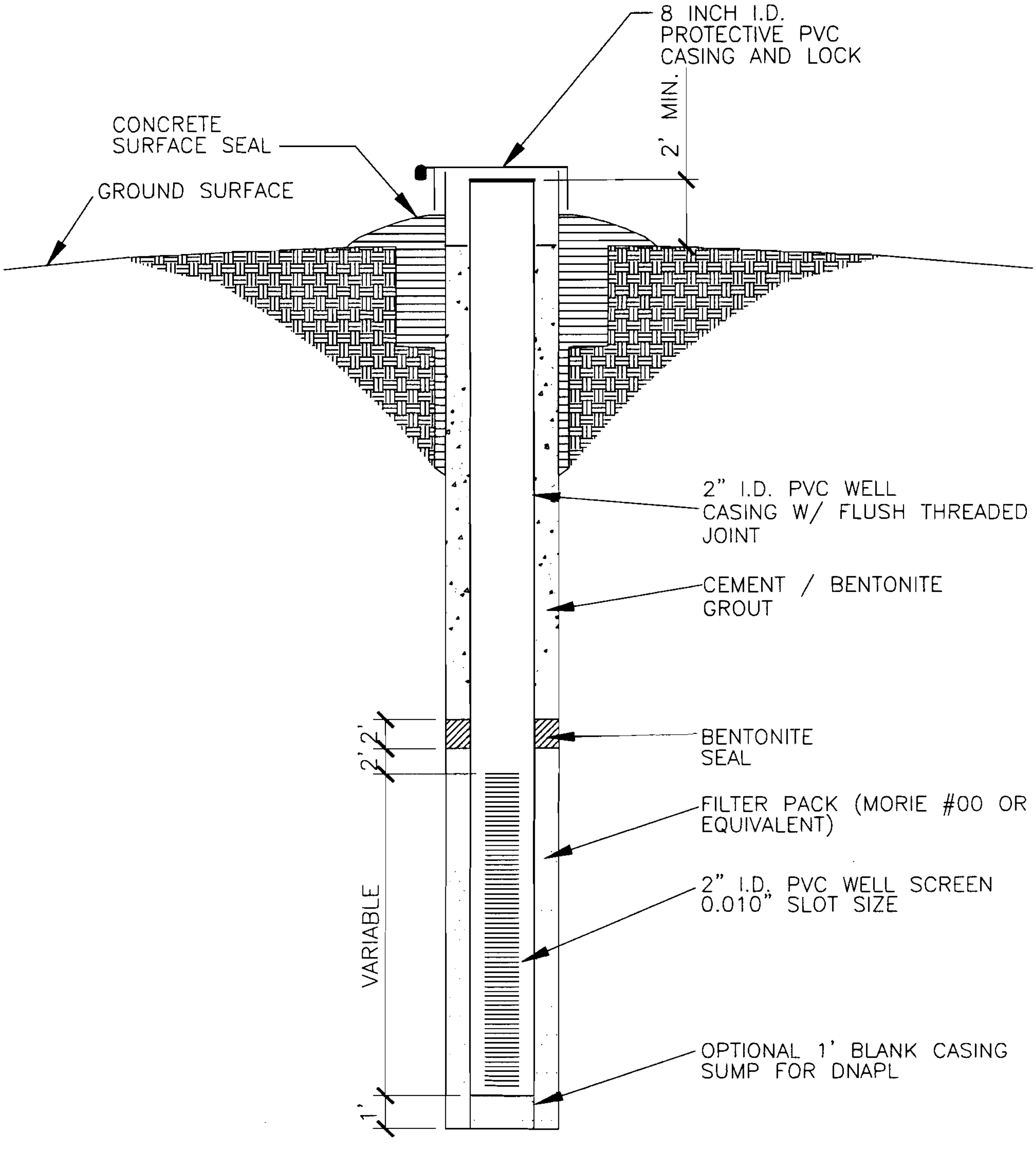
TYPICAL FLUSHMOUNT PIEZOMETER CONSTRUCTION DETAIL

FILE NO. 4966.21535-027
OCT. 1999

O'BRIEN & GERE ENGINEERS INC.

PLOT DATE: 10/25/99 SYR PWW

FIGURE 19



GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

TYPICAL MONITORING WELL CONSTRUCTION DETAIL

FILE NO. 4966.21535-031
OCT. 1999

NOT TO SCALE

O'BRIEN & GERE ENGINEERS INC.

DWG PATH: I:\DIV71\PROJECTS\4966\21535\DWG\71\031.DWG SF 1=1

PLOT DATE: 10/25/99 SYR PWW

APPENDIX A

Field sampling plan

FIELD SAMPLING PLAN

Supplemental Remedial Investigation/Feasibility Study Former Inland Fisher Guide Facility and Ley Creek Deferred Media

General Motors Corporation
Syracuse, New York

October 1999

Contents

List of Attachments

1. Introduction

This Field Sampling Plan (FSP) has been prepared by O'Brien & Gere Engineers, Inc. (O'Brien & Gere) on behalf of the General Motors Corporation (GM) for the Supplemental Remedial Investigation (SRI) at the Former Inland Fisher Guide (IFG) Facility and Ley Creek Deferred Media in Syracuse, New York. This FSP provides specific field sampling procedures to be used during the implementation of the SRI. This FSP is one component of the Work Plan, which also includes a Quality Assurance Project Plan (QAPP), and a Health and Safety Plan (HASP).

2. General field investigation guidelines

2.1. Underground utilities

Underground utilities, including electric, telephone, cable TV, sewers, and water, will be identified prior to any drilling, trenching, and sampling. Public and private owned utilities will be located by contacting responsible agencies by phone at least 48 hours prior to field activities, so their underground utilities can be marked at the site. Other potential on-site hazards such as sharp objects, overhead power lines, and building hazards will be identified and addressed prior to commencement of field activities.

2.2. Sample identification

Each sample will be given a unique identification. Sample identification will be classified by media, location, depth (if applicable), and time. Labels with sample identification information will be attached to each sample container.

2.3. Sampling equipment

The following is a general list of equipment necessary for sample collection:

- Stainless steel spoons and bowls for collecting soil and sediment samples
- Appropriate sample containers provided by the laboratory
- Sample bottles (kept closed and in the laboratory-shipped coolers until the samples are collected)
- Reagent-grade preservatives and pH paper or meter (or pre-preserved sample containers) for aqueous samples

- Chain-of-Custody labels, tags, seals, and record forms
- Log book, field sampling records, and indelible ink markers
- Laboratory grade decontamination soaps (such as Alconox), reagent-grade solvents and distilled water to be used for decontaminating equipment between sampling stations
- Buckets, wash basins, and scrub brushes to be used for decontaminating equipment
- Camera and film to document sampling procedures and sample locations
- Stakes and flagging tape to identify sampling locations
- Shipping labels and forms
- Knife
- Packing/shipping material for sample bottles
- Strapping tape
- Clear plastic tape
- Duct tape
- Aluminum foil
- Reclosable plastic bags
- Portable field instruments, including a photoionization detector (PID), ultraviolet (UV) screening light, pH meter, thermometer, conductivity meter, water velocity meter and water level indicator
- Combustible gas indicator
- Poly-sheeting
- Driller's jars (for archiving samples).

2.4. Field records

Field log books will be maintained by the field manager and other team members to provide a daily record of significant events, observations, and measurements during the field investigation. Entries will be signed and dated.

Information pertinent to the field investigation and/or sampling activities will be recorded in the log books. The books will be bound with consecutively numbered pages. Entries in the log book and/or on field sampling logs will include, at a minimum, the following information:

- Name and title of author, date and time of entry, and physical/environmental conditions during the field activity
- Purpose of sampling activity
- Location of sampling activity
- Name and address of field contact
- Name and title of field crew members
- Name and title of any site visitors
- Sample media (soil, sediment, ground water, etc.)
- Sample collection method, including equipment utilized
- Number and volume of sample(s) taken
- Description of sampling point(s)
- Volume of ground water removed before sampling
- Preservatives used
- Date and time of collection
- Sample identification number(s)
- Sample distribution (*e.g.*, laboratory)
- Field observations

- Field measurements made, such as pH, temperature, conductivity, water level, turbidity, flow, UV response

- References for maps and photographs of the sampling site(s)

- Information pertaining to sample documentation such as:

  - Bottle lot numbers
  - Dates and method of sample shipments
  - Chain-of-Custody record numbers
  - Air bill number.

Original data recorded in Field Log Books, Sample Tags, and Chain-of-Custody Records will be written with waterproof ink. These accountable, serialized documents will be maintained as a component of the project file.

If an error is made on an accountable document assigned to one individual, that individual will make corrections simply by crossing a single line through the error and entering the correct information. The erroneous information will not be erased. Any subsequent error discovered on an accountable document will be corrected by the person who made the entry. All subsequent corrections will be initialed and dated.

3. Field instruments

Field analytical equipment that require field calibration will be calibrated immediately prior to each day's use and more frequently if required. The calibration procedures will conform to manufacturer's standard instructions. This calibration will be conducted such that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. Equipment requiring field calibration include the PID, pH meter, specific conductivity meter, thermometer and turbidity meter. Records of instrument calibration will be maintained by the Field Manager and will be subject to audit by the Quality Assurance Officer. Copies of the instrument manuals will be maintained by the Field Manager.

3.1. Portable photoionization detector

The PID will be a HNU Model #101 (or equivalent), equipped with a minimum 10.6 eV lamp. The PID should be capable of ionizing and detecting compounds with an ionization potential of less than 10.6 eV. This accounts for approximately 70% of the volatile organic compounds on the NYSDEC ASP Target Compound List. Calibration will be performed at the beginning of each day of use with a standard calibration gas specified by the manufacturer. Calibration data will be recorded in field notebooks or on calibration log sheets to be maintained on-site. A battery check will be completed at the beginning of each working day. This information will also be recorded in field notebooks or on the calibration log sheets. If calibration and battery checks do not conform to manufacturers' recommended requirements, replacement instruments will be obtained.

3.2. pH meter

Calibration of the pH meter will be performed at the start of each day of use, and after very high (>12) or low (<5) readings as required by this plan. National Institute of Standards and Technology (NIST) - traceable standard buffer solutions which bracket the expected pH range will be used. The standards will most likely be pH of 7.0 and 10.0 standard units. The pH calibration and slope knobs will be used to set the meter to display the value of the standard being checked. The calibration data will be recorded in the field log book.

3.3. Specific conductivity meter/thermometer

Calibration checks using the conductivity standard will be performed at the start of each day of use or after very high or low readings. The portable conductivity meter will be calibrated using a reference solution specified by the manufacturer. Readings must be within 5 percent to be acceptable.

Temperature readings will be taken using thermometers which have been compared to a NIST traceable thermometer. Prior to use, the thermometers will be inspected to ensure that there is no mercury separation and will be periodically checked in the field. The thermometers used will be calibrated against NIST traceable reference thermometer by immersing both thermometers in a bath of freezing (0° C) or boiling (100° C) and comparing the reading. If the error is more than 1° C, then the thermometer should be discarded and replaced.

3.4. Water flow rate/velocity

The surface water velocity meter proposed to be utilized for the measurement of water velocity is the Marsh-McBirney Inc. Flo-Mate. Calibration of the portable velocity meter will be performed in accordance with the manufacturer's guidelines, at the start of each day of use. The calibration data will be recorded in the field log book or on calibration sheets maintained on-site.

3.5. Field turbidity meter

To obtain consistently accurate results, the field turbidity meter will be calibrated before each set of tests in the following manner:

- Turn the instrument off and check the mechanical zero setting. Adjust the screwdriver adjustment control on the meter face if necessary to obtain a zero-Nephelometric Turbidity Unit (NTU) reading.

- Press the power switch to ON and perform a battery check by pressing the BATT CHECK switch and verifying that the meter indicates in the BATTERY CHECK area. If not, charge the battery pack.

- Calibrate in accordance to the manufacturers specifications.

4. Equipment decontamination

4.1. Drill rig and heavy equipment

Equipment and materials associated with sampling must be cleaned before and after use at a site and between discrete investigation locations including individual soil borings and test trenches. Items such as drill rigs, auger flights, and miscellaneous heavy equipment present potential sources of interference to environmental samples. These items may contact the materials to be sampled and may retain contaminants from other sources such as roadways or storage areas. They may also hold soil material from previous sites that has not been removed. A central location at the site will be established for decontamination of the drill rig.

Two options are available to clean heavy equipment:

Steam cleaning. A steam generator uses high pressure to remove visible debris and residuals. Steam generators are typically easy to handle, and they generate relatively low volumes of decontamination water. This method also has disadvantages. It requires a fixed or portable power source, and may not be economical for use on small pieces of equipment or for sampling events that are of short duration.

Manual scrubbing. This procedure can be as effective as steam cleaning, or it can be preferred in situations where steam cleaning fails to remove visible material. The field technician scrubs the equipment with a laboratory grade detergent solution to remove material. After the scrubbing, the technician rinses the equipment with water. Manual scrubbing is labor-intensive, and it generates relatively large volumes of wash and rinse solutions.

4.2. Decontamination of sampling equipment

Decontamination procedures are designed to remove particles and compounds which could affect the integrity of samples and, thus, the interpretation of environmental sampling data. To establish decontamination methods for a particular site, the field manager must have an understanding of the conditions of the site and the expected type and concentrations of the contaminants. An awareness of site contaminants aids in the selection of reagents for decontamination. For example, if acetone is a contaminant of concern, it cannot be used in the solvent rinse step of decontamination.

Decontamination methods and materials are selected based upon the type of contamination and the decontamination method's ability to remove the contaminants. The following are the basic elements of the decontamination procedure:

- Equipment which has the potential to contact the environmental medium to be sampled should be washed with a detergent solution and rinsed with control water before it is used. Control water is clean water from a supply with a known chemical composition.

- A solvent, acetone for example, is used to remove contamination due to organic compounds. The solvent causes the contaminant to solubilize in the decontamination solution.

- Acid is used when decontaminate sampling equipment to be used for inorganic contaminants. It provides a low pH solution and causes the inorganic contaminant to withdraw from the equipment and enter solution.

- The materials used to contain decontamination solutions and scrub the equipment must be resistant to attack from solutions.

Specific limitations to field decontamination include the following items:

Space requirements. Decontamination requires space both for the decontamination process itself and for the storage of equipment and materials after decontamination. This space must be available at the site and must be away from the area of contamination.

Disposal issues. Materials generated by the decontamination process, such as rinse waters, must be properly disposed.

A field decontamination station should be located away from the source of contamination (to prevent potential cross contamination) but close enough to the sampling team to facilitate equipment handling. The decontamination station should be set up in such a way as to not affect clean areas of the site. Whenever possible, field sampling should be initiated in that area of the site with the lowest known contamination and proceed to the area of highest known or suspected contamination.

The following is a step-by-step procedure for field equipment decontamination:

1. Using a laboratory grade detergent and control water, remove visible particles and residuals. Note the following:

    - This step may be preceded by a steam or high pressure wash in order to facilitate residual removal

    - For equipment that cannot be adequately cleaned with a brush due to internal mechanisms or tubing, the decontamination solution should be circulated through the equipment

2. Rinse the equipment thoroughly with control water to remove the detergents.

3. If the samples are to be analyzed for inorganic compounds, apply an acid rinse to remove trace metals. The acid solution can be made with 10% reagent grade nitric or hydrochloric acid and deionized/distilled water: that is, 1 part acid to 10 parts water.

4. Thoroughly rinse the equipment with control water.

5. Rinse the equipment with a high purity solvent (pesticide grade) to remove traces of organic compounds. Acetone, methanol, and other water soluble solvents are acceptable for the solvent rinse step. Acetone is recommended as it is an excellent solvent and miscible in water. Base the choice of the particular solvent on site conditions.

6. Allow the solvent rinse to evaporate and the equipment to air dry.

7. Give the equipment a thorough rinse with control water to remove residual traces of solvent.

8. Wrap the sampling equipment with a clean inert material such as oil free aluminum foil for transport to the sample collection area.

A preferred procedure for decontamination of ground water sampling pumps is included in Section 10.

The decontamination process should be well documented. Each step, materials used, and the disposition of waste should be recorded in a field notebook. Miscellaneous items such as weather conditions, nearby activities, and other issues which could affect results should also be recorded. Decontamination fluids that contain solvents or acid will be contained in 5 gallon polyethylene buckets sealed and labeled. The buckets will be turned over to GM personnel for final disposal.

4.3. Disposition of investigation-derived wastes

Wastes generated during the implementation of the SRI will be managed in accordance with GM and NYSDEC requirements.

Aqueous waste - Ground water generated during well drilling, development, and evacuation will be discharged to the ground surface in the vicinity of the well in unpaved areas. Ground water from wells in paved areas, as well as decontamination water, will be collected in containers and transferred to the on-site Industrial Waste Treatment (IWT) plant for disposal. Provisions will be taken so that waste materials are not spilled due to freezing condition, storage, etc.

Non-aqueous wastes includes soil, sediment and solid waste generated during the implementation of the SRI, as well as disposable materials used by O'Brien & Gere and its subcontractors, including PPE, disposable sampling equipment, and other potentially contaminated materials used during the implementation of the SRI. Non-aqueous investigation-derived wastes (IDW) that are not returned to the source will be containerized in 55 gallon drums or rolloff containers and placed in an area of the site designated by GM for ultimate disposal by GM.

Wastes to be returned to the source will include the soils generated during the installation of the test trenches. For test trenches, the excavated material will be backfilled. For soil borings, cuttings will be containerized and either characterized for off-site disposal or stored for management as part of the final site remediation.

5. Soil boring and subsurface soil sampling

5.1. Shallow/deep overburden

Soil borings will be completed at the site in the shallow and deep overburden materials to provide lithologic and chemical data as well as to install monitoring wells and temporary piezometers. For soil borings to be completed as monitoring wells, borings shall be completed using minimum 4¼-inch inside diameter (I.D.) hollow stem augers to a depth specified by the field manager or hydrogeologist that meets the objectives of the work plan. For temporary piezometers and soil borings not to be completed as monitoring wells, a smaller diameter auger or direct push methodology may be utilized.

Samples of subsurface materials will be collected continuously to provide physical descriptions of the material at each soil boring location. The sampling method employed will be consistent with ASTM Method D-1586-84 using a standard 2 foot long, 2-inch outside diameter split-spoon sampler with a 140 lb. hammer. A 3-inch outside diameter sampler may be used in lieu of the 2-inch sampler to collect sufficient soil sample for laboratory analysis.

The drilling subcontractor will be responsible for obtaining accurate and representative samples, informing the hydrogeologist of changes in drilling pressure, and keeping a separate general log of soils encountered. Included in this log must be a record of blow counts (*i.e.* the number of blows from a 140 or 300 pound soil sampling drive weight required to drive the split-barrel sampler 6 inches).

A hydrogeologist will be on-site during the drilling and sampling operations to fully describe each soil sample including, but not limited to:

- soil type
- color

- percent recovery
- moisture content
- stratification and/or layering
- odor and other observations, such as organic content and cohesiveness.

The modified Wentworth Soil Classification System will be used to describe the soil samples.

The hydrogeologist will be responsible for retaining representative portions of each sample in the appropriate sample containers labeled at a minimum with:

- site name
- boring number
- sample interval
- date
- time of sample collection.

Sampling procedures

1. Identify the soil boring designation and record the location on the soil boring log, Attachment A.
2. Put on a new pair of disposable gloves.
3. Create a clean surface with a plastic sheet onto which the sampling equipment can be positioned.
4. Clean all meters, tools, and equipment before placing on the plastic sheet.
5. Retrieve the split spoon sampler from the borehole. Remove the split-spoon sampler open shoe and head attachments. Place the split-spoon on the plastic sheet.
6. Remove one half of the sample tube to expose the soil sample.

7. Measure the length of soil sample retrieved and record result on the soil boring log.

8. Split the soil sample in half along its longitudinal axis to expose the center of the soil core.

9. Pass the soil sample beneath the UV light to assess for the presence of NAPL and DNAPL. Record results on the soil boring log.

10. Place one portion of the sample into precleaned 4 oz. sample containers for VOC analysis (as applicable), and a second portion into a glass container and cover with aluminum foil, or place into a ziplock® bag and seal, for PID headspace screening. The headspace sample will be allowed to attain ambient temperatures prior to screening with the PID. Results of the PID screening and UV screening will be recorded on the soil boring log.

11. Place the remaining portion of soil sample into the appropriate sample jars for the required analyses, as specified in the work plan.

12. After the last sample has been collected, record the date and time. Place sample bottles in a cooler with ice.

13. Begin the chain of custody documentation. Ship the cooler to the laboratory for analysis within 48 hours of sample collection or as specified in the QAPP.

Soil sampling equipment, including split spoon samplers, will be decontaminated between samples in accordance with the procedures described in Section 4.2. Soil borings that will not be completed as monitoring wells will be backfilled with bentonite, and staked for subsequent surveying of location. Drill cuttings will be containerized and either characterized for off-site disposal or stored for management as part of the final site remediation.

5.2. Top of bedrock

Soil borings will be completed at the site through the lodgment till, to the top of bedrock for purposes of monitoring well installation. Steel casing will be used to isolate the upper overburden aquifer when drilling into the lodgement till layer to minimize the potential for migration of site-related constituents. Soil borings that penetrate the till layer will be installed as follows:

1. Subsurface soil sampling will be conducted until bedrock is reached in accordance with the method described in Section 5.1. If the boring is installed adjacent to an existing soil boring, then subsurface soil sampling will be completed, as required, beyond final depth of the existing soil boring until bedrock is reached in accordance with the method described in Section 5.1.

2. The borehole shall be advanced to a minimum depth of 2 ft into the lodgement till unit with $6^1/_4$ inch I.D. hollow-stem augers.

3. An appropriate length of nominal 5-inch new carbon steel casing will be installed through the hollow stem augers into the lodgment till and grouted in place with a Portland Cement/bentonite grout mixture. The augers shall be completely filled with grout prior to removal from the borehole.

4. The Portland cement/bentonite grout mixture shall be allowed to cure for a minimum of 24 hours prior to completing the borehole.

5. The borehole shall be completed to the top of bedrock using $4^3/_4$ inch fluid rotary drilling method.

6. Monitoring well installation and development

The steps to install screened monitoring wells include the following:

1. Identify task objectives.
2. Identify well location (clear of all subsurface utilities).
3. Identify drilling method and drill borehole. See Section 5.
4. If the well is to be used to monitor ground water quality, the well screen, plug, and riser should be certified clean from the manufacturer. If they are not, clean them with a high pressure steam cleaner.
5. Inspect the well construction materials for proper specifications and integrity. The well screen should be new, machine slotted PVC with a slot size of 0.010 inches. The screen should be plugged at the bottom. The filter material will be Morie #00 or equivalent.
6. Measure and record depth of borehole and the lengths and quantities of all materials placed in the hole. This includes, but is not limited to, screen interval, blank casing or riser length, and filter pack, bentonite seal, grout, and protective casing.
7. Prior to installation of the well screen and riser assembly, attempts will be made to evacuate the standing water column within the auger string. This will minimize the amount of suspended sediments which may be entrained in the sandpack during installation. The evacuated water will be contained in 55-gallon drums, or a portable poly-tank.
8. Install the screen and riser assembly to the required depth. The PVC screen and casing materials will be connected with threaded joints. See that the well is straight. Use centralizers if necessary.
9. The top of bedrock monitoring well will be constructed with 2-inch diameter PVC riser pipe and screen. The screen length will be selected based on the thickness of the lodgment till unit available to screen. For example, if the lodgment till thickness is 5 ft and the 5-

inch steel casing is installed 2 ft into the till unit, then a 3 ft screen length shall be used.

10. Compute and measure the volume of filter pack required to fill the annular space; record these data in the field notebook during installation. Emplace the filter pack in increments; this procedure enables progress to be monitored carefully and to prevent bridging. If bridging occurs, break the bridge before proceeding with installation. The filter pack should extend a minimum of 2 ft above the top of the screen.

11. Withdraw the augers or temporary casing in the stipulated increments. To limit borehole collapse, the level of filter pack material should be maintained within the augers or casing.

12. Place a bentonite pellet or slurry seal above the filter pack. If bridging in the tremie pipe occurs, the pellets may be allowed to free fall. Tap the pellets into place with a weighted tape. If the seal is installed above the water table, take care to see that the sealant is hydrated. The minimum thickness of the bentonite seal should be 2 ft.

13. Cement should be one of the five Portland types specified in ASTM C 150. Quick setting cement containing additives should not be used because the additives may leach from the cement and affect the chemistry of the ground water. Once the grout is prepared, tremie it to the top of the bentonite seal. It should be installed from the bottom of the hole upward. This reduces the opportunity for void spaces to develop in the grout.

14. Install a protective casing, which extends below the frost line, to slightly above the top of the well casing. Drill a weep hole into the protective casing so that accumulated water can drain. See that the well identification is clearly visible on the inside and outside of the protective casing lid.

A typical monitoring well construction detail is included as Figure 19 of the Work Plan. If DNAPL is observed during drilling, the well construction will be modified in the field to include a one-foot section of solid casing below the bottom slot.

Each newly installed monitoring well, piezometer, or existing well will be developed to clear fine grain sediments that have settled in or around the well screen to assure that the well screen is transmitting representative portions of ground water. The development will be by one of two methods, pumping or bailing ground water. Water removed from the wells will be allowed to drain onto the ground surface in unpaved areas. For wells in paved areas, water will be collected in 55-gallon drums and treated at the IWT plant.

Ground water will be evacuated from the bottom of the well using a submersible pump, bailer, or centrifugal pump. If a submersible pump or centrifugal pump is used, a clean dedicated hose will be used for each well.

Development should continue until the turbidity of the discharged water is equal to or less than 50 NTU. If 50 NTU cannot be attained, then development will continue until there is no further improvement in turbidity, with the approval of the NYSDEC.

Given the anticipated fine-grained nature of the native soils, the preferred method for well development is through the use of a bailer. Surging is not recommended in fine-grained formations, as surging can create excessive sediment entrainment in the sandpack which in turn releases sediment to the well. If a pump is used and the 50 NTU target cannot be reached by pumping, bailer will be used to continue well development until the 50 NTU limit is achieved and/or no improvement is observed.

7. Temporary piezometer installation

Temporary piezometers will be installed to evaluate the presence of non-aqueous phase liquids (NAPLs). The steps to install temporary piezometers are as follows:

1. Identify project objectives.
2. Identify piezometer location (clear of all subsurface utilities).
3. Identify drilling method and drill borehole. See Section 5.
4. Inspect the piezometer construction materials for proper specifications and integrity. The well screen should be new, 2-inch I.D., machine slotted PVC with a slot size of 0.020 inches. The screen should be plugged at the bottom. In addition, the screen slot size should retain at least 90% of the filter material, if required. The piezometer screen, plug, and riser should be certified clean from the manufacturer. If they are not, clean them with a high pressure steam cleaner.
5. Measure and record depth of borehole and the lengths and quantities of all materials placed in the hole. This includes, but is not limited to, screen interval, blank casing or riser length, filter pack, and bentonite seal.
6. Install the screen and riser assembly to the required depth. The PVC screen and casing materials will be connected with threaded joints. See that the well is straight. Use centralizers if necessary.
7. A filter pack is to be utilized for each piezometer installation. Emplace the filter pack around the screen interval so that the filter pack extends a minimum of 0.5 ft above the top of the screen.

8. Place a bentonite pellet or slurry seal above the filter pack. If bridging in the tremie pipe occurs, the pellets may be allowed to free fall. Tamp the pellets into place with a weighted tape. If the seal is installed above the water table, take care to see that the sealant is hydrated. The minimum thickness of the bentonite seal should be 0.5 ft.

A typical piezometer construction detail is included as Figure 18 of the Work Plan

Subsequent to installation, each temporary piezometer will be developed or cleared of fine grain sediments that have settled in or around the screen during installation so that the well screen is transmitting representative portions of ground water. The development will be by one of two methods, pumping or bailing ground water.

Ground water will be evacuated from the bottom of the piezometer using a submersible pump, bailer, or centrifugal pump. If a submersible pump or centrifugal pump is used, a clean dedicated hose will be used for each well.

8. *In situ* hydraulic conductivity testing

An *in situ* hydraulic conductivity test is used to evaluate the hydraulic conductivity of an unconfined aquifer within close proximity to the screened interval of the monitoring well. The objective of the test is to create a sufficient hydraulic potential (head) difference between the aquifer and the well such that inflow or outflow to the well over a specific time interval can be graphically correlated to aquifer hydraulic conductivity.

The test will be performed by removing an appropriate volume of water from the well by use of clean pump or bailer (rising head test). If sufficient difference in head is obtained by this method (at least 10-25% of the length of water column in the well), then recovery data can be collected. In this case, the subsequent rise of the water level in the well over time will be measured by an accurate measuring device until the head difference approaches a minimum of 75% of full recovery. Measurements shall be collected at frequent time intervals (every 30 secs to 1 min.) at the start of the test and adjusted appropriately according to the rate of recovery in the well.

If no significant drawdown is anticipated or can be obtained by this method, an AquiStar DL4A-16A pressure transducer system or equivalent will be utilized. A Teflon® rod (slug) will be released into the well in order to create a positive flow potential (falling head test) from the well into the aquifer. Following completion of the falling head test, the Teflon® rod will be removed in order to cause a negative flow potential (rising head test). The water level recovery rates during both the falling and rising head tests will be monitored at pre-programmed intervals by the pressure transducer data logging system.

Data from these tests will be evaluated using Hvorslev's graphic analysis of piezometer recovery data (Freeze and Cherry 1979) or the Bouwer and Rice Method (Bouwer and Rice 1976), as appropriate.

9. Test trench excavations

Test trenches will be excavated using a backhoe. Test trenching will extend to the top of native materials or to the maximum reach of the trenching equipment. The width of the trench will be based on the width of the trenching equipment and the side wall stability of the trench. Locations of test trenches will be finalized in the field based on the location of areas of concern and existing underground utilities. During excavation activities, personnel will stand upwind of the excavation area to the extent possible. Air monitoring will be conducted in accordance with the HASP. Test trench materials will be visually described in the field notebook or on test trench logs, as well as photographed for future reference.

Material removed from the test trench will be placed on polyethylene sheeting. Following sampling, the materials from the test trench will be placed back in the excavation. Test trenches will be backfilled as trenching activities occur or as soon as possible after completion. For gravel roadways and parking areas, the backfill will be tamped down in lifts as they are replaced. For test trenches located in asphalt-covered areas, the surface will be replaced with cold or hot asphalt mix, compacted by rolling, and trimmed flush with the adjoining surface. Following backfilling of the excavation, the test trench will be staked to facilitate subsequent location by surveying.

If during test trenching activities, a pipe or other buried utility is encountered, excavation will cease; the orientation and dimensions will be recorded; the test trench will be backfilled and a new test trench attempted in the general vicinity of the initial location. If a pipe or underground utility is accidentally severed, the owner of the utility will immediately be notified. Liquid flows or electricity will be shut off immediately and appropriate repairs initiated as soon as possible. The NYSDEC will be notified as to the release of any fluid material that occurs and the appropriate response actions will be implemented.

If during test trenching activities, highly contaminated materials are encountered, disturbance of these materials will be minimized, and the trench will be backfilled. Any highly contaminated material which is removed from the trench will not be backfilled, but will be appropriately containerized for characterization and off-site disposal or management as part of the final remediation.

Trench material samples will be discrete samples collected from excavated, staged trench material. Disposable scoops, hand trowels, or shovels are used to collect these samples.

Use the following procedure to collect a sample:

1. Screen the area to be sampled using a PID or another appropriate screening device, and record readings in the field log. A PID is used to screen samples for two reasons:

    - To furnish a field safety measure (ambient air screening)

    - To select potentially affected samples for analysis (headspace screening)

    The operator of the PID must be experienced in its use and aware of how factors such as temperature, humidity, or methane affect the instrument's readings.

2. Record the characteristics of the trench material including grain size, content, staining, and color.

3. To collect a discrete sample for VOC analysis, use a stainless steel laboratory spoon or its equivalent. Immediately place the VOC sample into the appropriate sample container. Samples for VOC analysis are not to be mixed or homogenized. Continue sampling for other parameters. Subsequent samples will be homogenized for the remaining, non-VOC analyses.

4. Place the homogenized sample into appropriate sample containers.

5. Check that the cap of each sample container has a Teflon liner, if required for the analytical method. Secure the cap tightly.

6. Label the sample bottle with the appropriate sample tag or use pre-labeled bottles. The tags could be permanent labels or clean tape. Label the tag carefully and clearly using indelible ink. Complete appropriate sampling forms and record in the field log book.

7. Initiate chain of custody form.

8. Place the sample containers on ice in a cooler. Ship the cooler to the laboratory for analysis within 48 hr of sample collection or as specified in the QAPP.

9. Decontaminate equipment between sample locations and after use following the procedures outlined in Section 4.2.

10. Ground water sampling - low flow purging

The objectives of ground water sampling are the following:

- To enable personnel to collect representative samples of ground water for laboratory analysis.
- To assess the horizontal and vertical distribution of contaminants in a water-bearing unit.

Ground water elevation measurements

Ground water elevations should be measured in each site well prior to commencing ground water sampling activities. Care shall be taken to disturb only the upper portion of the well water column to avoid re-suspension of settled solids in the wells. Ground water elevation measurements will be taken as follows:

1. Identify the well and record the location on the Ground Water Field Sampling Log, Attachment B.
2. Put on a new pair of disposable gloves.
3. Using an electric well probe, measure the depth to water table.
4. Clean the well probe and rinse it with control water after each use.

Sampling procedures

1. Identify the well and record the location on the Ground Water Field Sampling Log, Attachment B. Review well depth, depth to water, and screened interval data.
2. Put on a new pair of disposable gloves.
3. Cut a slit in the center of a plastic sheet, and slip it over the well creating a clean surface onto which the sampling equipment can be positioned.

4. Clean all meters, tools, and equipment before placing on the plastic sheet.

5. Prepare the submersible pump for operation. The pump discharge tubing should be new or dedicated Teflon® or Teflon® coated polyethylene. Connect the tubing to the in-line water quality indicator parameter meter.

6. Slowly and carefully lower the sampling pump and associated equipment into the well. The objective is to minimize mixing of the stagnant water above the screened interval with the water within the interval and avoid re-suspension of fines within the well. Position the pump intake in the center of the screened interval.

7. Commence well purging by low flow pumping from the well. The flow rate shall not exceed 0.5 liters/min. Record purge rate on the Ground Water Field Sampling Log.

8. During purging, monitor and record pH, specific conductivity, temperature, oxidation-reduction potential (redox), and turbidity approximately every three minutes from the in-line monitor and turbidity meter.

9. Well sampling can commence after equilibration of water quality parameters. Equilibration is defined as three consecutive readings within 10 % of each other and drawdown has stabilized. Record total volume of water purged and purging time on the Ground Water Field Sampling Log for future reference.

10. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to avoid pumping the well dry and/or allow stabilization of indicator parameters.

    If the recharge rate of the well is very low and the well is purged dry, then sampling should commence as soon as the well has recharged to a sufficient level to collect the appropriate volume of samples. The time period between purging to dryness and collection of ground water samples shall not exceed 24 hours. To maintain turbidity levels as low as possible, samples will be collected using dedicated tubing and a peristaltic pump.

11. Remove the sampling bottles from their transport containers, and prepare the bottles for receiving samples. Inspect all labels to insure

proper sample identification. Sample bottles should be kept cool with their caps on until they are ready to receive samples. Arrange the sampling containers to allow for convenient filling. Always fill the containers labeled purgeable priority pollutant first.

12. After the last sample has been collected, record the date and time. Place sample bottles in a cooler with ice.

13. Begin the Chain of Custody documentation. Ship the cooler to the laboratory for analysis within 48 hr of sample collection or as specified in the QAPP.

14. Remove the submersible pump from the well and decontaminate the pump both internally and externally. Associated pump wiring shall be rinsed with decontaminating fluids as well. Decontamination will be performed by the following procedure:

    - Pump solution (approximately five gallons) of potable water and non-phosphate detergent through pump.

    - Pump clean potable water through pump.

    - Pump methanol or isopropyl alcohol solution through pump.

    - Pump distilled/deionized water through pump.

    Return the pump to its covered storage box.

15. Replace the well cap, and lock the well protection assembly before leaving the well location.

11. Surface soil sampling

Surface soil samples will be discrete samples. A discrete sample represents a single location in the soil column. Discrete soil samples will be collected from near surface soils at a depth of 0 to 1 ft at locations identified in the work plan. Hand augers, disposable scoops, hand trowels, or shovels are used to collect these samples.

Use the following procedure to collect a sample:

1. If necessary, penetrate the soil to the appropriate sampling depth.

2. Screen the area to be sampled using a PID or another appropriate screening device, and record readings in the field log. A PID is used to screen samples for two reasons:

    - To furnish a field safety measure (ambient air screening)

    - To select potentially affected soil samples (headspace screening)

    The operator of the PID must be experienced in its use and aware of how factors such as temperature, humidity, or methane affect the instrument's readings.

3. Using a clean tool, remove and discard a thin layer of soil from the area. Record the characteristics of the soils including grain size, content, staining, and color.

4. To collect a discrete soil sample for VOC analysis, use a stainless steel laboratory spoon or its equivalent. Immediately place the VOC sample into the appropriate sample container. Soil samples for VOC analysis are not to be mixed or homogenized. Continue sampling for other parameters. Subsequent samples will be homogenized for the remaining, non-VOC analyses.

5. Place the homogenized sample into appropriate sample containers.

6. Check that the cap of each sample container has a Teflon liner, if required for the analytical method. Secure the cap tightly.

7. Label the sample bottle with the appropriate sample tag or use pre-labeled bottles. The tags could be permanent labels or clean tape. Label the tag carefully and clearly using indelible ink. Complete appropriate sampling forms and record in the field log book.

8. Initiate chain of custody form.

9. Place the sample containers on ice in a cooler. Ship the cooler to the laboratory for analysis within 48 hr of sample collection or as specified in the QAPP.

10. Decontaminate equipment between sample locations and after use following the procedures outlined in Section 4.2.

11. Clearly mark each sample location with a stake or flag displaying the sample number.

12. Surface water and sediment sampling

For each surface water and sediment sample collected, field notes will be taken by the field crew to provide a detailed description of the sampling event. Additionally, a photo log of the sampling locations will be maintained. Field notes for each sampling event will be recorded in a bound field logbook and will contain the following information:

- location
- date and time
- weather conditions
- physical characteristics of sample area
- water depth
- sampler's names
- sampling equipment utilized
- additional comments as appropriate.

12.1. Surface water sampling

The objective of the site surface water investigation is to adequately characterize the surface water quality of Ley Creek upstream, downstream, and adjacent to the Former IFG Facility. The surface water investigation for the site will consist of 1) in-field measurements of surface water quality, and 2) the collection of surface water samples for laboratory analysis. Surface water sampling will be conducted during high and low flow conditions. Details concerning the tasks to be conducted for the surface water investigation are presented below.

Water velocity measurements

The surface water velocity meter proposed to be utilized for the measurement of water velocity is the Marsh-McBirney Inc. Flo-Mate Portable Water Flowmeter (Flo-Mate). The Flo-Mate measures the velocity of the water in ft per second (fps). Measurements are collected by submerging the sensing probe, installed at the end of the wading rod, into the water column and recording the output on the meter's display. If the water depth is greater than 2 ft, then a measurement will be recorded at 20 percent and 80 percent of the creek's depth. The two measurements will then be averaged to obtain the velocity for that sampling location. Discharge (cubic ft per second) of the creek will be estimated by multiplying the water velocity (fps) by the area of flow (square ft). The area of flow is calculated by multiplying the creek width by the average water depth. The wading rod will be used to measure water depth and a tape measure will be used to measure creek width. Calibration of the velocity meter will be conducted in accordance with the manufacturer's specifications and as presented in Section 3.

Surface water sampling events will be conducted during high and low flows of Ley Creek. United States Geological Survey (USGS) Water Resources Information for Ley Creek will be obtained and evaluated for the site area. The USGS information includes Historical Streamflow Daily Values for Ley Creek at Park Street, Syracuse N.Y., and is accessible via the Internet. The Streamflow Values will be used to evaluate the high and low flows of Ley Creek and determine the schedule for each sampling effort. In addition to the USGS information, local weather conditions may influence sampling times, whereas, high flow samples would be collected after a significant rain event and low flow samples would be collected subsequent to a dry period.

Prior to a sampling event, stream flow data will be obtained, if accessible, from the USGS gauging station at Park Street and used in conjunction with field measurements collected at the site with the Flow-Mate. The determination of high and low flow will be based on the variation of flow from the mean flow typical for Ley Creek, as presented by the USGS. Flow periods representative of the annual high and low extremes will be selected for sampling. It is likely that the high and low flows of the creek will be represented within a time period of a few months.

In-field water quality measurements

Water quality measurements will be collected during the surface water sampling field effort. Temperature, specific conductivity, pH and flow rate (velocity) will be evaluated using direct-reading instrumentation at the same time and location of the surface water sampling.

Direct-reading instrumentation to be used for the in-field tests will provide real-time measurements of the aforementioned parameters. The Horiba U-10, or an equivalent direct-reading meter, will be utilized for measuring temperature, specific conductivity and pH. Measurements are collected by submerging the sensing probe into the water column at the sampling location and recording the output on the meter's display. Calibration of the water quality meter will be conducted in accordance with the manufacturer's specifications and as presented in Section 3.

Surface water sampling

Surface water samples will be collected prior to sediment samples starting with the furthest downstream location in order to avoid collection of sediment materials potentially dispersed in the water column. Surface water sample locations are described in the Work Plan and shown on Figure 15 of the Work Plan. Surface water sample locations will be staked and flagged on the bank of Ley Creek for subsequent surveying of locations

The following procedures will be utilized for the collection of surface water from the sampling locations identified at the site.

1. Cover hands with protective disposable gloves and don chemical-resistant waterproof boots or waders if wading into the creek is required.

2. Place labeled sample containers near the sampling location. Stand in the water, if necessary, downstream of where the sample containers will be filled.

3. Partially submerge the sampling container below the water's surface, remove the lid and allow creek water to fill the container. Replace the lid.

4. Sample containers used for volatile analysis are filled completely, whereas, no air bubbles are observed after filling. If preservation material is included in the sample container, care should be taken to avoid overfilling the container and potentially losing or diluting the preservative.

5. Begin the chain-of-custody record.

6. Preserve samples in a cooler with ice prior to shipment to the laboratory. Ship samples within 48 hours or as specified in the QAPP.

7. Decontaminate the sampling equipment in accordance with Section 4 and prior to collection of the next discrete surface water sample.

12.2. Sediment sampling

The objective of the site sediment investigation is to characterize the vertical and lateral sediment quality in depositional areas of Ley Creek upstream and downstream of the Former IFG Facility in locations as noted in the work plan. The sediment investigation for the site will consist of 1) a substrate probing program, and 2) the collection of sediment core samples for laboratory analysis. Details concerning the tasks to be conducted for the sediment investigation are presented in the following sections.

Substrate probing

Substrate probing will be conducted in portions of Ley Creek to locate depositional areas, determine sample locations and numbers, and provide information concerning the volume and composition of Ley Creek sediment. Probing will be conducted by traversing the center of Ley Creek, if possible, or the shore by foot and visually observing locations within the creek channel likely to accumulate sediments. Likely areas of sediment deposition include, but are not limited to:

- the inner bank of a bend or turn in the creek
- areas of relatively slower moving and deeper water
- discharges of outfalls or tributaries to the creek
- areas upstream of a structure or piece of debris such as an overhanging tree trunk or limb.

A rod of approximately 6 ft in length will be forced into the substrate of the creek in anticipated depositional areas to evaluate substrate composition and depth. The rod will be demarcated to allow the approximate depth measurement of the substrate. Depositional areas will be defined as those areas where the substrate exceeds a baseline substrate depth by 6 inches or more. The baseline substrate depth will be determined in the field after a qualitative evaluation of the type and depth of substrate existing throughout the portion of Ley Creek adjacent to the site. Depositional areas will be identified by field personnel via staking or flagging tape attached to vegetation on the adjacent bank. Staked or flagged areas should also be identified on a site figure to be referenced during the subsequent sediment sampling efforts. Additional information concerning the characteristics of the creek at the identified depositional areas will be collected, including:

- substrate composition
- creek width
- water depth
- approximate flow rate/discharge.

A minimum of one depositional sediment sampling area will be identified every 500 ft. If no specific depositional area is identified within a 500 ft length of creek, then an appropriate sampling location for that 500 ft segment will be selected in the field. The selected location may include a composite of sub-samples collected within a relatively close proximity. Composite sub-sample locations will be documented in accordance with the FSP.

Sediment core sampling

Sampling and analysis of sediment core samples will be conducted to characterize the nature and extent of contamination in the sediments of the site. Based on information obtained from the substrate probing task, sediment core samples will be collected from depositional areas located in Ley Creek, North Branch Ley Creek, South Branch Ley Creek, and Sanders Creek. Potential sampling locations are presented on Figure 15 of the Work Plan, based on a minimum sample interval of 500 ft. Sediment sampling will be conducted subsequent to the surface water sampling efforts and will begin at the downstream locations and continue upstream as not to disturb the sediments of each subsequent sampling location. Sediment core locations will be staked and flagged on the bank of Ley Creek for subsequent surveying of location.

The following procedures will be utilized while collecting sediment cores from the sampling locations identified at the site. If the depth of the substrate does not allow the use of the coring methodology (less than 2 inch), and creek flow will allow collection of an undisturbed sample, then a stainless steel spoon or a clean shovel and mixing bowl will be used in lieu of the Lexan® tubing for sediment sample collection. Compositing of multiple core samples of corresponding depth will be conducted for relatively large depositional areas. Depending on the size of the depositional area, up to five sub-samples will be collected to form the composite sample.

A clean, stainless steel bowl will be used for homogenization of the sub-samples. Samples for VOC analyses will be submitted as discrete samples and not mixed or composite.

1. Cover hands with protective disposable gloves.

2. Lower a clean, 2 inch (outside diameter) section of Lexan tubing into the creek and gently push the tube through the substrate until refusal.

3. Cover the top of the Lexan tube with an appropriate cap and slowly extract the tube from the substrate.

4. Before the bottom of the core tube breaks the water surface and while maintaining the core in a vertical position, install a clean cap on the bottom of the core tube to prevent loss of the sample from the tube.

5. Transport the core to an appropriate processing station for core sectioning, maintaining the core tube in a vertical position. The shore, if appropriate, or the laboratory will be used as the processing station.

6. At the processing station, remove the top cap of the core tube and siphon off the water overlying the sediment core, taking care not to remove any sediment.

7. Separate the core sample into 6 inch sections by inserting a piston into the bottom of the core tube and pushing the sample out of the top end of the core tube. Cut the 6 inch sections from the extruded sample with a clean metal putty knife and place into the appropriate sample containers, as defined in the QAPP.

8. Extrude the remaining sample from the core tube, in 6 inch sections, and process as in Step 7.

9. In addition to the required information discussed herein, record the depth to tube refusal, core sample composition and length of section, if less than 6 inch.

10. Rinse the Lexan core tube with creek water and place on shore for subsequent disposal.

11. Begin the chain-of-custody record.

12. Preserve samples in a cooler with ice prior to shipment to the laboratory within 24 hours or as specified in the QAPP.

13. Prepare clean sampling apparatus for the next discrete core sample.

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Attachment A

Soil boring log

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING

Client: General Motors Corporation

Proj. Loc: Former IFG Facility
Syracuse, NY

File No.:

Drill Method:
Sampler: 2-inch Split Spoon
Hammer: 140 lbs
Fall: 30 inches

Page 1 of 1
Location:
Start Date:
End Date:

Boring Company:
Foreman:
Drill Rig:
OBG Geologist:

Screen	=	\	Grout
Riser	☐	▨	Sand Pack
Steel	//	■	Bentonite

Depth Below Grade	No.	Depth (feet)	Blows /6"	Penetr/ Recovery	"N" Value	Sample Description	Stratum Change General Descript	Equip. Installed	Field Testing PID (ppm)	

Notes:

Attachment B

Ground water sampling log

O'Brien & Gere Engineers, Inc.

Low Flow Ground Water Sampling Log

Date ______________________________ Personnel ________________ Weather ________________

Site Name **Former IFG Facility** Evacuation Method ________________ Well # ________________

Site Location **Syracuse, NY** Sampling Method ________________ Project # ________________

Well information:

Depth of Well * ______________ ft.

Depth to Water * ______________ ft.

Length of Water Column ______________ ft.

* Measurements taken from

☐ Top of Well Casing

☐ Top of Protective Casing

☐ (Other, Specify)

Water parameters:

Lower submersible pump slowly through stagnant water column
Position pump in center of screened interval & maximum pumping rate of 0.5 liters/minute
Collect readings at every three minute intervals

Elapsed Time	Depth To Water	Temperature	pH	Conductivity	Oxidation Reduction Potential	Dissolved Oxygen (mg/l)	Turbidity (NTU)	Flow Rate (ml/min).

Water sample:

Time collected: ________________ Total volume of purged water removed: ________________

Physical appearance at start

Color ________________

Odor ________________

Sheen/Free Product ________________

Physical appearance at sampling

Color ________________

Odor ________________

Sheen/Free Product ________________

Samples collected:

Container Size	Container Type	# Collected	Field Filtered	Preservative	Container pH

Notes:

APPENDIX B

Quality assurance project plan

4966/21535

QUALITY ASSURANCE PROJECT PLAN

Supplemental Remedial Investigation/Feasibility Study Former Inland Fisher Guide Facility and Ley Creek Deferred Media

General Motors Corporation
Syracuse, New York

10/29/99
James R. Heckathorne, P.E., O'Brien & Gere Engineers, Inc., Project Officer **Date**

Douglas M. Crawford 10/29/99
Douglas M. Crawford, P.E., O'Brien & Gere Engineers, Inc., Project Manager **Date**

Stuart Spiegel 10/29/99
Stuart Spiegel, O'Brien & Gere Engineers, Inc., Quality Assurance Officer **Date**

October 1999

O'BRIEN & GERE ENGINEERS, INC.

O'Brien & Gere Engineers
5000 Brittonfield Parkway
Syracuse, New York 13221

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Douglas M. Crawford, P.E., O'Brien & Gere Engineers, Inc., Project Manager

Maureen S. Markert, P.E., O'Brien & Gere Engineers, Inc., Project Coordinator

Stuart Spiegel, O'Brien & Gere Engineers, Inc., Quality Assurance Officer

Karen A. Storne, O'Brien & Gere Engineers Inc., Data Validator

Judy Harry, Data Validation Services, Data Validator

1. Introduction

This Quality Assurance Project Plan (QAPP) has been developed by O'Brien & Gere Engineers, Inc. (O'Brien & Gere) for the Supplemental Remedial Investigation at the Former Inland Fisher Guide (IFG) Facility and Ley Creek Deferred Media (site) in Syracuse, New York. It provides quality assurance/quality control (QA/QC) criteria for work efforts associated with sampling and analysis of environmental media. This QAPP is one component of the Work Plan, which also includes a Field Sampling Plan (FSP), and a Health and Safety Plan (HSP).

This document has been prepared utilizing the guidance provided in the New York State Department of Environmental Conservation's (NYSDEC) *RCRA Quality Assurance Project Plan Guidance* (NYSDEC 1991), United States Environmental Protection Agency's (USEPA's) *EPA Requirements For Quality Assurance Project Plans For Environmental Data Operations*, EPA QA/R-5 (USEPA 1994a), and USEPA's *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (USEPA 1980).

This QAPP will assist in generating data of a known and acceptable level of precision and accuracy. The QAPP provides information regarding the project description and personnel responsibilities, and sets forth specific procedures to be used during sampling of relevant environmental matrices, other field activities, and the analyses of data.

The following quality assurance topics are addressed in this plan:

- Project organization and responsibilities
- Project background and definitions
- Project description and schedule
- Data quality objectives
- Project narrative
- Special training requirements

- Documentation
- Sampling design
- Sampling method requirements
- Sample handling and custody
- Analytical method requirements
- Quality control requirements
- Instrumentation/equipment testing and maintenance
- Calibration and frequency
- Inspection requirements for supplies
- Data acquisition requirements
- Data management
- Performance, system audits, and corrective actions
- QA reports to management
- Data review, validation and verification
- Data validation
- Reconciliation with user requirements.

2. Project organization and responsibilities

While each person involved in the investigation and in the generation of data are implicitly part of the QA program for the project, certain individuals have specifically designated responsibilities. Within O'Brien & Gere Engineers, these are the Project Officer, the Project Manager, Project Coordinator, QA Officer, the Data Validators, and the Environmental Technicians. O'Brien & Gere Laboratories, Inc. of Syracuse, New York, Axys Analytical Services Ltd. of Sidney, British Columbia, Canada, and H2M Labs, Inc. of Melville, New York will provide analytical services for the investigation. Laboratory personnel with QA/QC responsibilities include the Laboratory QC Coordinators and Laboratory Sample Custodians.

2.1. New York State Department of Environmental Conservation project manager

Susan Benjamin, P.E., will serve as the New York State Department of Environmental Conservation Project Manager. As such, she will have overall responsibility for all phases of the remedial action.

2.2. Project officer

James R. Heckathorne, P.E., will serve as the Project Officer. As such, he will be responsible for the overall corporate management of the investigation and for the completion of work specified in the Work Plan. It will be his responsibility to provide for the allocation of staff and other resources required to complete the project within the specified schedule and budget.

2.3. Project manager

Douglas M. Crawford, P.E., will serve as the Project Manager. As such, he will have responsibility for the implementation and completion of each of the tasks identified in the Work Plan. He will manage the administrative aspects of the project, and will report to the Project Officer.

2.4. Project coordinator

Maureen S. Markert, P.E., will serve as the Project Coordinator. As such, she will have responsibility for coordinating the technical aspects of the project and function as the firm's principal client and regulatory contact for the project. The Project Coordinator will report to the Project Manager.

2.5. QA officer

Stuart J. Spiegel will serve as the QA Officer (QAO). As such, he will be responsible for overall project QA. He will review project plans and revisions to such plans to maintain proper QA throughout the investigation. In addition, the QAO will be responsible for performance and system audits, data processing activities, data processing QC, data quality review, corrective actions, and coordinating the QA/QC efforts between O'Brien & Gere Engineers and the laboratories. The QAO will report to the Project Manager. Stuart Spiegel's resume is included in Appendix A.

2.6. Data validators

Karen A. Storne of O'Brien & Gere and Judy Harry of Data Validation Services will serve as the data validators. As such, they will be responsible for reviewing chemical data and validating laboratory analytical data. Validation reports will be submitted to the QAO for review. The QAO will have overall responsibility for data validation, and the data validators will report to the QAO. Karen Storne's and Judy Harry's resumes are included in Appendix A.

2.7. Sampling personnel

Sampling tasks required by this investigation will be conducted by experienced chemists, engineers, geologists, hydrogeologists, and/or environmental technicians. Their responsibilities will include the documentation of proper sample collection protocols, sample collection, equipment decontamination, and chain-of-custody documentation. The sampling personnel will report to the Project Coordinator.

2.8. Laboratory QC coordinator

Joseph Houser of O'Brien & Gere Laboratories, Inc., Dale Hoover of Axys Analytical Services Ltd., and Joanne Durghan of H2M Labs, Inc. will serve as the Laboratory QC Coordinators. As such, they will be responsible for the individual laboratory's QA/QC activities associated with the project. The specific duties of the Laboratory QC Coordinator include determining whether analyses are conducted within the appropriate holding times and that laboratory custody procedures are followed. Moreover, the Laboratory QC Coordinator monitors daily precision and accuracy records, maintains detailed copies of all procedures, reschedules analyses based upon unacceptable data accuracy or precision, and identifies and implements corrective actions necessary to maintain QA standards.

The Laboratory QC Coordinators or their designees will conduct initial validations and assessments of analytical data results and report the findings directly to the QAO.

2.9. Laboratory sample custodian

Mark Jackson of O'Brien & Gere Laboratories, Inc., Cathy Jupp of Axys Analytical Services Ltd., and Chris Repetti of H2M Labs, Inc. will serve as the Laboratory Sample Custodians. As such, their responsibilities include verifying proper sample entry and sample handling procedures by laboratory personnel. The laboratory sample custodians will report to the laboratory QC Coordinators.

3. Project background and definition

3.1. Project background

The project history and background are presented in Section 3 of the Work Plan.

3.2. Project definition

The project definition is presented in Sections 1 and 4 of the Work Plan.

4. Project description and schedule

4.1. Project description

The overall project description is presented in Sections 4 and 5 of the Work Plan.

4.2. Project schedule

The project schedule is presented in Section 6 of the Work Plan.

5. Data quality objectives

5.1. Objectives

Data quality objectives (DQOs) are quantitative and qualitative statements specifying the quality of the environmental data required to support the decision making process. DQOs define the total acceptable uncertainty in the data for each specific activity conducted during the investigation. The uncertainty includes both sampling error and analytical error. Ideally, zero uncertainty is the intent. However, the variables associated with the process (field and laboratory) inherently contribute to the uncertainty of the data. It is the overall objective to keep the total uncertainty within an acceptable range that will not hinder the intended use of the data. The QA/QC requirements have been established such that there will be a high degree of confidence in the measurements.

The principle DQOs of this investigation are to generate data of sufficient quality to support both qualitative and quantitative conclusions concerning the evaluation of the presence of chemical constituents which have impacted the Former IFG Facility and Ley Creek Deferred Media and the nature of the respective constituents. In order to achieve these DQOs, the process of data generation was designed to develop a body of analytical data of sufficient quality to be used to support conclusions made as a result of this investigation. Specific data quality requirements such as criteria for precision, accuracy, representativeness, completeness, comparability, and sensitivity are specified in this document.

Laboratory analyses and analytical levels will adhere to the guidelines described in USEPA's *Data Quality Objectives for Remedial Response Activities* (USEPA 1987). Analytical levels are defined in the guidance document as follows:

- Level I implies field screening or analysis using portable instruments. Results are often not compound specific and not quantitative but results are available on a real-time basis.

- Level II implies field analyses using more sophisticated portable analytical instruments. In some cases, the instruments may be set up in a mobile laboratory on-site. There is a wide range of the quality of data that can be generated for Level II analyses. In general, data quality depends on the use of suitable calibration standards, reference materials, sample preparation equipment, and training of the instrument operator. Results are available on a real-time basis or within several hours.

- Level III implies that analyses be performed in an off-site laboratory. Level III analyses may or may not use USEPA Contract Laboratory Program (CLP) procedures, but may not utilize documentation procedures required of Level IV analyses. The laboratory may or may not be a CLP laboratory. Level III analyses can provide data of the same quality as Level IV, but USEPA methods such as *Test Methods for Evaluating Solid Waste* (SW-846) (USEPA, July 1992) are utilized instead of CLP methods.

- Level IV implies CLP routine analytical services (RAS). Analyses are performed in an off-site CLP analytical laboratory following CLP protocols. Level IV is characterized by rigorous QA/QC protocols and documentation.

- Level V implies analyses by non-standard methods. Analyses are performed in an off-site analytical laboratory which may or may not be a CLP laboratory. Method development or method modification may be required for specific constituents or detection limits. CLP special analytical services (SAS) are Level V.

Table 5-1 contains sampling efforts, objectives, analyses, data uses, and analytical levels. The remainder of this QAPP describes the specific approaches that will be taken to achieve the required DQOs.

In order to assess adherence to DQOs, O'Brien & Gere has developed the QA/QC program described in this QAPP. The NYSDEC, in its guidance document for QAPPs, states that "quality assurance is a management system for ensuring that all information, data, and decisions resulting from a monitoring program are technically sound, and properly documented." QC is defined as the "functional mechanism through which QA achieves its goals" (NYSDEC 1991). This QAPP is consistent with the requirements set forth by the NYSDEC's *RCRA Quality Assurance Project Plan Guidance* (NYSDEC 1991).

Table 5-1. *Sampling efforts, objectives, analyses, data uses, and analytical level.*

Sampling effort	Objective	Types of analysis	Data uses	Analytical level
Ground water sampling	Characterize the vertical and horizontal extent of contamination in the ground water and provide risk assessment data.	VOCs SVOCs PCBs Site Related Metals Cyanide	1. Support remedial approach. 2. Assess risk.	III
Subsurface soil sampling	Characterize the nature and extent of contamination in the subsurface soil and provide risk assessment data.	VOCs SVOCs PCBs Site Related Metals Cyanide	1. Support remedial approach. 2. Assess risk.	III
Surface soil sampling	Characterize the nature and extent of contamination in the surface soil and provide risk assessment data.	VOCs SVOCs PCBs Site Related Metals Mercury Cyanide Dioxins and Dibenzofurans	1. Support remedial approach. 2. Assess risk.	III
Surface soil sampling	Characterize the nature and extent of contamination in the surface soil and provide risk assessment data.	TCL VOCs, SVOCs, PCBs, Pesticides, TAL metals	1. Support remedial approach. 2. Assess risk.	III
Sediment sampling	Characterize the nature and extent of contamination in the sediment and provide risk assessment data.	VOCs SVOCs PCBs CN Heavy Metals TOC Dioxins and Dibenzofurans	1. Support remedial approach. 2. Assess risk.	III
Sediment sampling	Characterize the nature and extent of contamination in the sediment and provide risk assessment data.	TCL VOCs, SVOCs, PCBs, Pesticides TAL Metals	1. Support remedial approach. 2. Assess risk.	III
Surface water sampling	Characterize the nature and extent of contamination in the surface water and provide risk assessment data.	temperature pH specific conductance	1. Support remedial approach. 2. Assess risk.	I

Table 5-1. *Sampling efforts, objectives, analyses, data uses, and analytical level.*

Sampling effort	Objective	Types of analysis	Data uses	Analytical level
Surface water sampling	Characterize the nature and extent of contamination in the surface water and provide risk assessment data.	VOCs SVOCs PCBs Heavy Metals Cyanide	1. Support remedial approach. 2. Assess risk.	III
Surface water sampling	Characterize the nature and extent of contamination in the surface water and provide risk assessment data.	TCL VOCs, SVOCs, PCBs, pesticides TAL Metals	1. Support remedial approach. 2. Assess risk.	III
Waste sampling	Screen waste samples.	VOCs SVOCs PCBs Site Related Metals Mercury Cyanide	1. Support remedial approach. 2. Assess risk.	III*
Waste sampling	Screen waste samples.	TCL VOCs, SVOCs, PCBs, Pesticides, TAL Metals	1. Support remedial approach. 2. Assess risk.	III*

Note:
VOCs indicate volatile organic compounds.
SVOCs indicate semivolatile organic compounds.
PCBs indicate polychlorinated biphenyls.
TOC indicates total organic carbon.
Site Related Metals include arsenic, chromium, copper, lead, nickel, and zinc.
Heavy Metals include antimony, arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc.
Dioxins and Dibenzofurans include the compounds listed in Table 12-6.
TCL VOCs indicate the target compound list volatile organic compounds listed in Table 12-3.
TCL SVOCs indicate the target compound list semivolatile organic compounds listed in Table 12-4.
TAL Metals indicate the target analyte list metals listed in Table 12-7.
* indicates that analysis for these screening samples will not include QC sampling and analysis.

The following is a brief description of the data quality parameters addressed in the QAPP.

Precision describes the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements, that have been made in an identical manner, compared to their average value. Precision can be expressed in a variety of manners, including absolute methods such as deviation from the mean or median values, standard deviation and variance, or relative methods, such as relative deviation from the mean or median. The overall precision will be determined through the analysis of field duplicate and laboratory duplicate samples.

Accuracy is defined as the degree of difference between measured or calculated values and the true value. The closer the numerical value of the measurement comes to the true value, or actual concentration, the more accurate the measurement is. Accuracy is expressed in terms of absolute or relative error. Accuracy will be determined through analysis of spiked samples and the analysis of standards with known concentrations.

Representativeness refers to the degree to which a sample taken from a site accurately reflects the matrix at the site. It is a qualitative parameter which is most concerned with the design of the sampling program. Factors that should be considered in the determination of representativeness include appropriateness of sampling and analytical methodologies, representativeness of the selected media, and representativeness of the selected analytical procedures. Representativeness will be achieved by the use of procedures for the collection and preservation of samples as described in the methods, the NYSDEC's *RCRA Quality Assurance Project Plan Guidance* (NYSDEC, March 1991), the FSP, and this QAPP.

Comparability refers to the use of consistent procedures, second source reference standards, reporting units, and standardized data format with document control. Adherence to standard procedures and the analysis of external source standard materials maximizes the probability that data generated from a particular method at a given laboratory can be validly compared to the data of another. This QAPP has been written to provide data which will be comparable to other data collected, as standard methods will be utilized for this investigation.

Completeness refers to the process of obtaining the required data as outlined in the Work Plan. Completeness is also defined as the percentage of measurements judged to be useable. Samples for which the critical data points fail completeness objectives will require reanalysis of samples (within the specified holding times) until the DQOs are met. The completeness goal has been specified at 90% for this investigation.

Sensitivity refers to a measurable concentration of an analyte which has an acceptable level of confidence. Method detection limits (MDLs) are the lowest concentration of an analyte that can be measured with 99% confidence that the analyte concentration is greater than zero. Practical quantitation limits (PQLs) and/or contract required quantitation limits

(CRQLs) are levels above the MDLs at which the laboratory has demonstrated the quantitation of analytes. The analytical methods associated with this project have MDLs and CRQLs at sufficiently low levels to adequately assess the project DQOs.

5.2. Field sampling

The objective of field sampling procedures is to obtain samples that represent the environmental matrix being investigated. This will be accomplished through the use of proper sampling techniques and equipment as presented in the NYSDEC's *RCRA Quality Assurance Project Plan Guidance* (NYSDEC 1991), where applicable. Appropriate sampling techniques are presented in the FSP.

5.3. Laboratory analyses

To obtain data of a quality sufficient to meet the project DQOs, the following methods will be performed:

- VOC analysis by gas chromatography (GC) and gas chromatography/mass spectrometry (GC/MS)
- SVOC analysis by GC/MS
- Pesticide and PCB analysis by gas chromatography (GC)
- Dioxin and dibenzofuran analysis by GC/MS
- Metal analysis by inductively coupled plasma (ICAP)
- Cyanide analysis by spectrophotometer
- TOC analysis by TOC analyzer.

The specific methods, analytical QA/QC, and data reporting will adhere to the analytical methods listed in Table 12-1.

6. Project narrative

The field tasks for this Supplemental Remedial Investigation will include sampling of surface and subsurface soil, ground water, sediment and surface water. In addition, the presence of light non-aqueous phase liquid (LNAPL) and dense non-aqueous phase liquid (DNAPL) will also be investigated. The data will be used to conduct a human health risk assessment, an ecological risk assessment and to provide information for development, evaluation, and selection of remedial actions to be documented in the Supplemental Feasibility Study. The Supplemental Remedial Investigation Report will document the field activities, and the Supplemental Feasibility Study Report will document the identification and evaluation of remedial alternatives.

Data usability with respect to the data quality objectives and data uses will be compared to the project requirements. In the event that the completeness objective of 90% is not achieved, samples will be recollected at the discretion of the NYSDEC Project Manager.

The sample locations are presented in Sections 4 and 5 of the Work Plan. The sample custody requirements are presented in Section 11 of this QAPP. The analytical methods to be used in this investigation are listed in Table 12-1. O'Brien & Gere Laboratories, Inc., Axys Analytical Services Ltd. , and H2M Labs, Inc. will perform the analytical services. The data results will be reported to O'Brien & Gere in NYSDEC ASP Category B format. Full data validation will be performed on the analytical data with the exception of the waste samples and the samples analyzed for pH, temperature, and specific conductance, which will be used for screening purposes.

At the discretion of the Project Manager, field and laboratory performance audits will be performed during the field program and during the laboratory analysis program. Corrective action procedures will be implemented based on unacceptable audit or validation results.

7. Special training requirements

As described in the HASP, all field investigation personnel must comply with the training requirements for hazardous waste operations, codified in 29 CFR 1910.120(e). Each individual must have successfully completed a 40-hour (or 24-hour) course appropriate to the level of work which they perform. In addition, each individual must have completed an 8-hour refresher course within the last 12 months if the initial training was more than 12 months ago. Personnel acting in the capacity of an onsite supervisor, directly responsible for supervising employees engaged in hazardous waste operations, shall also have successfully completed an 8-hour Supervisor training course. Field investigation personnel must have documentation (copies of certificates, or I.D. cards) available onsite as proof of compliance with these training requirements.

8. Documentation

The analytical data generated for this project will be reported to O'Brien & Gere in NYSDEC ASP Category B format and contain the information required by this format. The laboratories will provide data packages within 5 weeks of receipt of the last sample at the laboratory. The field logs, data packages, and records will be included in the O'Brien & Gere project file. The project files will be archived at O'Brien & Gere for a period of 10 years.

9. Sampling design

9.1. Objectives

The objective of the sampling is to obtain environmental media of sufficient quality to support both qualitative and quantitative information as to the identity, location, and amount of contamination in the ground water, subsurface soil, surface soil, sediment, and surface water samples as defined in the Work Plan. Sampling procedures and practices that will be used in the investigation are presented in the FSP.

9.2. Sampling network

The types of parameters, critical methods, matrices, and numbers of samples to be collected for this project are presented in Table 9-1. The specific parameters for each method, contract required quantitation limits and the method detection limit are presented in Tables 12-2 through 12-7. In addition to the critical methods, non-critical methods for ph, temperature, and specific conductance will be performed.

9.3. Sampling locations

Sampling locations for the investigation are described in Sections 4 and 5 the Work Plan.

Table 9-1. *Field sampling summary*

Parameter (critical method)	Matrix	Sample containers and volumes	Preservation	Holding times	Number of Environmental Samples	QC sample frequency			
						Field duplicate	Trip blank	MS/MSD	Equip. blank
VOCs (NYSDEC ASP Method 8021B)[1]	Ground water, surface water	2-40 milliliter glass vials with Teflon® lined septum caps	4°C	7 days from VTSR	57-58	one per 20 samples or one per matrix (for less than 20 samples)	1 ea. per cooler	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
VOCs (NYSDEC ASP Method 8260A)[1]	Surface water	2-40 milliliter glass vials with Teflon® lined septum caps	4°C	7 days from VTSR	2	one per 20 samples or one per matrix (for less than 20 samples)	1 ea. per cooler	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
VOCs (NYSDEC ASP Method 8021B)[1]	Subsurface soil, surface soil, sediment, waste**	125 milliliter wide mouth glass container sealed with a septum	4°C	10 days from VTSR	156 + TBD*	one per 20 samples or one per matrix (for less than 20 samples)	1 ea. per cooler	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
VOCs (NYSDEC ASP Method 8260A)[1]	Subsurface soil, surface soil, sediment	125 milliliter wide mouth glass container sealed with a septum cap	4°C	10 days from VTSR	10	one per 20 samples or one per matrix (for less than 20 samples)	1 ea. per cooler	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.

Table 9-1. *Field sampling summary*

Parameter (critical method)	Matrix	Sample containers and volumes	Preservation	Holding times	Number of Environmental Samples	QC sample frequency			
						Field duplicate	Trip blank	MS/MSD	Equip. blank
SVOCs (NYSDEC ASP Method 8270C)[1]	Ground water, surface water	1-one liter amber glass container with Teflon® lined screw caps	4°C FC	5 days from VTSR to extraction; 40 days from extraction to analysis	58	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
SVOCs (NYSDEC ASP Method 8270C)[1]	Subsurface soil, surface soil, sediment, waste**	250 milliliter wide mouth glass container with Teflon® lined lid	4°C	5 days from VTSR to extraction; 40 days from extraction to analysis	126	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
PCBs (NYSDEC ASP Method 8082)[1]	Ground water, surface water	1-one liter amber glass container with Teflon® lined screw caps	4°C	5 days from VTSR to extraction; 40 days from extraction to analysis	58	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
Pesticides (NYSDEC ASP Method 8081A)[1]	Surface water	1-one liter amber glass container with Teflon® lined screw caps	4°C	5 days from VTSR to extraction; 40 days from extraction to analysis	2	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.

Table 9-1. *Field sampling summary*

Parameter (critical method)	Matrix	Sample containers and volumes	Preservation	Holding times	Number of Environmental Samples	QC sample frequency			
						Field duplicate	Trip blank	MS/MSD	Equip. blank
PCBs (NYSDEC ASP Methods 8082)[1]	Subsurface soil, surface soil, sediment, waste**	250 milliliter wide mouth glass container with Teflon® lined lid	4°C	5 days from VTSR to extraction; 40 days from extraction to analysis	175 + TBD*	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
Pesticides (NYSDEC ASP Methods 8081A)[1]	Subsurface soil, surface soil, sediment, waste**	250 milliliter wide mouth glass container with Teflon® lined lid	4°C	5 days from VTSR to extraction; 40 days from extraction to analysis	10	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
PCDD and PCDFs (NYSDEC ASP Method 8290)[1]	Surface soil, sediment	50 grams in 4 oz. amber glass jar with Teflon® lined screw cap.	4°C	30 days from VTSR to extraction; 40 days to analysis	17	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
Site-Related Metals (NYSDEC ASP Method 6010B	Ground water	1-250 or 500 milliliter plastic bottle	HNO_3 to pH<2, 4°C	6 months from VTSR 26 days from VTSR for mercury	44	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.

Table 9-1. *Field sampling summary*

Parameter (critical method)	Matrix	Sample containers and volumes	Preservation	Holding times	Number of Environmental Samples	QC sample frequency			
						Field duplicate	Trip blank	MS/MSD	Equip. blank
Heavy Metals (NYSDEC ASP Method 6010B, NYSDEC ASP Method 7470A)	Surface water	1-250 or 500 milliliter plastic bottle	HNO_3 to pH<2, 4°C	6 months from VTSR 26 days from VTSR for mercury	12	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
TAL Metals (NYSDEC ASP Method 6010B, NYSDEC ASP Method 7470A, NYSDEC ASP Method 7841)	Surface Water	1-250 or 500 milliliter plastic bottle	HNO_3 to pH<2, 4°C	6 months from VTSR 26 days from VTSR for mercury	2	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
Site-Related Metals (NYSDEC ASP Method 6010B)[1]	Subsurface soil, surface soil, waste**	4 ounce wide mouth glass container with Teflon® lined lid	4°C	6 months from VTSR 26 days from VTSR for mercury	98	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
Heavy Metals (NYSDEC ASP Method 6010B, NYSDEC ASP Method 7471A, TAL Metals)	Sediment	4 ounce wide mouth glass container with Teflon® lined lid	4°C	6 months from VTSR 26 days from VTSR for mercury	30	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.

Table 9-1. *Field sampling summary*

Parameter (critical method)	Matrix	Sample containers and volumes	Preservation	Holding times	Number of Environmental Samples	QC sample frequency			
						Field duplicate	Trip blank	MS/MSD	Equip. blank
Mercury (NYSDEC ASP Method 7471A)	Subsurface soil, surface soil, waste**	4 ounce wide mouth glass container with Teflon® lined lid	4°C	26 days from VTSR for mercury	17	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
TAL Metals (NYSDEC ASP Method 6010B, NYSDEC ASP METHOD 7471A, NYSDEC ASP Method 7841)	Subsurface soil, surface soil, sediment, waste**	4 ounce wide mouth glass container with Teflon® lined lid	4°C	6 months from VTSR 26 days from VTSR for mercury	10	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
Cyanide (NYSDEC ASP Method 9010B/9014)[1]	Ground water, surface water	1-250 or 500 milliliter plastic bottle	NaOH to pH>12, 4°C, OA	12 days from VTSR	58	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
Cyanide NYSDEC ASP Method (9010B/9014)[1]	Subsurface soil, surface soil sediment, waste**	4 ounce wide mouth glass container with Teflon® lined lid	4°C	12 days from VTSR	141	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.

Table 9-1. *Field sampling summary*

Parameter (critical method)	Matrix	Sample containers and volumes	Preservation	Holding times	Number of Environmental Samples	QC sample frequency			
						Field duplicate	Trip blank	MS/MSD	Equip. blank
Total organic carbon (Lloyd Kahn Method)^2	Sediment	4 ounce wide mouth glass container with Teflon® lined lid	4°C	14 days from collection	30	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.

NOTES:

1 - NYSDEC ASP references New York State Department of Environmental Conservation *Analytical Services Protocol*, October 1995 Revisions, Albany, New York.

2 - USEPA, Region II, Environmental Services Division, Monitoring Management Branch, *Determination of Total Organic Carbon in Sediment*, Edison, New Jersey, 1988.

Equip. indicates equipment.

VTSR indicates verified time of sample receipt.

FC indicates that if free chlorine is present in samples, it must be removed by the appropriate addition of $Na_2S_2O_3$.

OA indicates that if oxidizing agents are present, add 5 ml 0.1N $NaAsO_2$ per liter and 0.6g of ascorbic acid per liter.

MS/MSD indicates matrix spike/matrix spike duplicate sample.

VOCs indicates volatile organic compounds and are listed in Tables 12-2 and 12-3.

SVOCs indicate semivolatile organic compounds and are listed in Table 12-4.

PCBs indicates polychlorinated biphenyls and are listed with pesticides in Table 12-5.

PCDD and PCDFs indicate polychlorinated dibenzodioxins and polychlorinated dibenzofurans respectively , listed in Table 12-6.

Site-related metals include arsenic, chromium, copper, lead, nickel, and zinc.

Heavy metals include antimony, arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc.

TAL metals are listed in Table 12-7.

NA indicates not applicable.

* Subsurface soil sample numbers (VOC analysis) related to DNAPL investigation will be determined in the field following UV screening.

** QC samples will not be collected along with samples collected for waste characterization purposes; the number of waste samples will be determined in the field.

10. Sampling method requirements

10.1. Sampling procedures

Protocols for the various sampling activities are described in detail in the FSP.

10.2. Decontamination of sampling equipment

Protocols for the decontamination of sampling equipment are described in detail in the FSP.

11. Sample handling and custody

11.1. Sample preparation and preservation

Immediately after collection, samples will be transferred to properly labeled sample containers and properly preserved. Table 9-1 lists the proper sample containers, volume requirements, and preservations. Samples requiring refrigeration for preservation will be promptly transferred to coolers packed with wet ice and/or ice packs. Samples will be shipped or transported within 48 hours of being collected and will arrive at the laboratory no later than 72 hours after sample collection. Proper chain-of-custody documentation will be maintained as discussed in Section 11 of this QAPP. Samples will be extracted, digested and analyzed within the holding times specified in Table 9-1.

11.2. Sample custody procedures

Chain-of-custody procedures will be instituted and followed throughout the investigation. These procedures include field custody, laboratory custody, and evidence files. Samples are physical evidence and will be handled according to strict chain-of-custody protocols. The QAO must be prepared to produce documentation that traces the samples from the field to the laboratory and through analyses. The USEPA has defined custody of evidence as follows:

- In actual possession
- In view after being in physical possession
- In a locked laboratory
- In a secure, restricted area.

QA measures for this project will begin with the sample containers. Pre-cleaned sample containers will be purchased from a USEPA-certified manufacturer (I-Chem 200 or equivalent).

Chain-of-custody records will be kept starting in the field when sample collection is completed. In the field log book, samplers will note climatic data and equipment employed during collection. Physical characteristics of the sample, date, time of day, sample location, and any abnormalities noted during sampling will be recorded in the field log book.

The field sampler will indicate the sample identification number, date, time, sample matrix, sample type (*i.e.*, grab or composite), number of containers and the analysis requested on the appropriate chain-of-custody form. The chain-of-custody form will be signed and placed in a sealed ziploc bag in the cooler. An example chain-of-custody form is included as Figure 11-1. The shipping container will be closed, and two paper or plastic seals will be affixed to the latch and lid (only if the samples are shipped via overnight courier) and the field sampler will initial the seal. The seals must be broken to open the cooler and will indicate tampering if the seal is broken before receipt at the laboratory.

The cooler will be shipped via an overnight delivery service or hand delivered to the laboratory. When the samples arrive at the laboratory, the sample custodian will sign the courier's air bill or bill of lading (unless hand-delivered) and will note the cooler temperature on the chain of custody. If shipped, the couriers airbill will be attached to the chain of custody and the airbill number will be written on the chain-of-custody form. If the cooler arrives at the laboratory after hours, an external chain-of-custody will be properly filled out and will accompany the cooler until the laboratory receives the cooler. An example external chain-of-custody is included in Figure 11-2.

Figure 11-1. *Example chain-of-custody*

Project Name:____________________
Project No. ____________________
Sheet ____ of ____

Office: ____________________
Address:____________________
Phone: ____________________

CHAIN OF CUSTODY

Cooler Temperature ____________________

CLIENT: LOCATION:	COLLECTED BY: (Signature)

SAMPLE DESCRIPTION/LOCATION	Date	Time	Sample Matrix[1]	Sample Type[2]	No. of Containers	ANALYSIS REQUESTED/COMMENTS[3]

[1] Matrix = Ground water, surface water, sediment, etc [2]Type = grab, composite [3] VOC - NYSDEC ASP 8021B, 8260A

Relinquished by:__________ of:__________	Date	Time	Received by:__________ of:__________	Date	Time
Relinquished by:__________ of:__________	Date	Time	Received by:__________ of:__________	Date	Time
Use this space if shipped via courier (e.g., Fed Ex) Relinquished by:__________ of:__________	Date	Time	Courier Name and Airbill Number:__________ ***Attach delivery/courier receipt to Chain of Custody**	Date	Time
Relinquished by:__________ of:__________	Date	Time	Received by:__________ of:__________	Date	Time

Figure 11-2. *Example external chain-of-custody*

O'BRIEN AND GERE LABORATORIES, INC.
CASE FILE FORM

PROGRAM INFORMATION

Client: _________ Div. _____ Ref. No. _______

Program: ____________________________

Custody Seal: _____ Intact _____ Not Intact _____ NA

AFTER HOURS CUSTODY

RELINQUISHED BY:	DATE	TIME	RECEIVED BY SECURITY GUARD:	DATE	TIME
RELINQUISHED BY SECURITY GUARD TO COOLER:	DATE	TIME	RECEIVED BY SAMPLE CUSTODIAN:	DATE	TIME

COMMENTS/DISCREPANCY:

RESOLUTION/CLIENT COMMENT:

Signed: ___________

Date: ____________ QA/QC Approval: ______________________________

Signed: _____________

Date: _____________

O'BRIEN AND GERE LABORATORIES, INC.
CASE FILE FORM
(continued)

CLIENT COMMENTS: (continued)

Signed: ____________ Project Manager Approval: ________

Date: ______________ QA/QC Approval: ____________

The sample custodian's duties and responsibilities upon sample receipt will be to:

- Document receipt of samples
- Inspect sample shipping containers for the presence or absence of custody seals (only if shipped via overnight courier) and for container integrity
- Sign the appropriate forms or documents, verify and record the agreement or disagreement of information on sample documents and, if there are discrepancies, record the problem and notify the QAO
- Label sample with laboratory sample number
- Place samples in secure, limited-access storage.

At the laboratory, the analysts will be required to log samples and extracts in and out of storage as the analysis proceeds. Samples and extracts will be returned to secure storage at the close of business. Written records will be kept of each time the sample or extract changes hands. Care must be exercised to properly complete, date, and sign items needed to generate data. Copies of the following will be stored for incorporation into the sample file:

- Documentation of the preparation and analysis of samples, including copies of the analyst's notebooks
- Bench sheets, graphs, computer printouts, chromatograms, and mass spectra, as applicable
- Copies of QA/QC data
- Instrument logs showing the date, time, and identity of the analyst
- Analytical tracking forms that record the date, time, and identity of the analyst for each step of the sample preparation, extraction, and analysis.

Upon completion of the analyses, the QAO or his designee will begin assimilating the field and laboratory notes. In this way, the file for the samples will be generated. The final file for the sample will consist of the following:

- Laboratory data packages, including summary and raw data from the analysis of environmental and QC samples, chromatograms, mass spectra, calibration data, work sheets, sample preparation logs

- Chain-of-custody records.

12. Analytical method requirements

12.1. Analytical methods

The analytical methods utilized in this project are presented in Table 12-1. The laboratories will utilize the analytical methods, and the quality control requirements provided in Tables 13-1 through 13-7 to analyze samples for this project. In the event of an analytical system failure, the laboratory QC Coordinator will identify the situation and provide corrective action guidance. The O'Brien & Gere QAO will be notified and the situation will be documented in the data package case narrative.

Interferences will be identified and documented. Samples may be diluted only if analytes of concern generate responses in excess of the linear range of the instrument. When matrix interferences are present, samples will be cleaned up during the extraction/sample preparation process using appropriate methods. The clean-up, extraction and sample preparation methods must be listed in the case narrative. If the laboratory has taken appropriate actions and matrix interferences prevent the laboratory from achieving the specified detection limits, the QAO will be contacted and the Laboratory QC Coordinator will document in the case narrative that the laboratory demonstrates good analytical practices in order to achieve the specified detection limits.

The samples collected and analyzed for waste characterization purposes for this project will be prepared, including performing clean-up, using appropriate and approved methods.

Table 12-1. *Analytical methods for parameters*

Sample Type	Parameter	Analytical method	Reference
Ground water, subsurface soil, surface soil, sediment, surface water, waste*	VOCs	NYSDEC ASP Method 5030A/8021B	1
Subsurface soil, surface soil, sediment, surface water, waste*	TCL VOCs	NYSDEC ASP Method 5030A/8260A	1
Ground water, surface water	SVOCs	NYSDEC ASP Method 3520C/8270C	1
Subsurface soil, surface soil sediment, waste*	SVOCs	NYSDEC ASP Method 3550B/8270C	1
Surface water	TCL SVOCs	NYSDEC ASP Method 3520C/8270C	1
Subsurface soil, surface soil, sediment, waste*	TCL SVOCs	NYSDEC ASP Method 3550B/8270C	1
Ground water, surface water	PCBs	NYSDEC ASP Method 3520C/8082	1
Surface water	TCL Pesticides	NYSDEC ASP Method 3520C/8081A	1
Surface water	TCL PCBs	NYSDEC ASP Method 3520C/8082	1
Subsurface soil, surface soil, sediment, waste*	PCBs	NYSDEC ASP Method 3550B/8082	1
Subsurface soil, surface soil, sediment, waste*	TCL Pesticides	NYSDEC ASP Method 3550B/8081A	1
Subsurface soil, surface soil, sediment, waste*	TCL PCBs	NYSDEC ASP Method 3550B/8082	1
Ground water	Site Related Metals	NYSDEC ASP Method 3005A/6010B	1
Surface water	Heavy Metals	NYSDEC ASP Method 3005A/6010B NYSDEC ASP Method 7470A (Mercury)	1
Subsurface soil, surface soil, sediment, waste*	Heavy Metals	NYSDEC ASP Method 3050B/6010B NYSDEC ASP Method 7471A (Mercury)	1
Subsurface soil, surface soil, waste*	Site Related Metals	NYSDEC ASP Method 3050B/6010B	1

Table 12-1. *Analytical methods for parameters*

Sample Type	Parameter	Analytical method	Reference
Surface water, sediment, subsurface soil, surface soil, waste*	TAL Metals	NYSDEC ASP Method 3005A/6010B NYSDEC ASP Method 7470A (Mercury) NYSDEC ASP Method 9010B/9014 (Cyanide) NYSDEC ASP Method 7841 (Thallium)	1
Ground water, subsurface soil, surface soil, surface water, sediment, waste*	Cyanide	NYSDEC ASP Method 9010B/9014 (Cyanide)	1
Surface soil, sediment	Dioxin and Dibenzofuran	NYSDEC ASP Method 8290	1
Sediment	TOC	Lloyd Kahn Method	2
Sediment, subsurface soil, surface soil	Percent Solids	SM 2540G	3

NOTES:
VOCs indicate volatile organic compounds
SVOCs indicate semivolatile organic compounds
PCBs indicate polychlorinated biphenyls
Site Related Metals include arsenic, chromium, copper, lead, nickel, and zinc.
Heavy metals including antimony, arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc.
Dioxins and Dibenzofurans include the compounds listed in Table 12-6.
TCL VOCs indicate the target compound list volatile organic compounds listed in Table 12-3.
TCL SVOCs indicate the target compound list semivolatile organic compounds listed in Table 12-4.
TCL pesticides and PCBs indicate the target compounds list pesticides and PCBs listed in Table 12-5.
TAL Metals indicate the target analyte list metals listed in Table 12-7.
TOC indicates total organic carbon.
ASP indicates Analytical Services Protocol.
* QC samples will not be required for waste sampling; the results from the waste samples will be used for screening purposes only.

1 New York State Department of Environmental Conservation *Analytical Services Protocol*, 10/95 Revisions, Albany, New York.
2 USEPA, Region II, Environmental Services Division, Monitoring Management Branch, *Determination of Total Organic Carbon in Sediment*, Edison, New Jersey, 1988.
3 *Standard Methods for the Examination of Water and Wastewater*, 18th Edition, Washington, D.C., APHA, AWWA, WPCF, 1992.

12.2. Method detection limits

The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. The PQL is the lowest concentration that can be reliably quantified within specified limits of precision and accuracy during routine laboratory operations. Tables 12-2, 12-3, 12-4, 12-5, 12-6 and 12-7 list typical laboratory MDLs and NYSDEC ASP target compound list CRQLs or PQLs (if CRQLs are not provided in the method) to be used as reference during this investigation. Background site information will be taken into consideration when utilizing these reference values.

Table 12-2. *Laboratory CRQLs and MDLs for volatile organic compounds (NYSDEC ASP Method 8021B).*

Parameter	Water CRQL (ug/L)	Water MDL (ug/L)	Soil CRQL (ug/kg), wet wt	Soil MDL (ug/kg), wet wt
Chloromethane	10	0.4	10	0.4
Vinyl chloride	1	0.5	1	0.5
Bromomethane	10	0.3	10	0.3
Chloroethane	1	0.3	1	0.3
1,1-Dichloroethene	1	0.4	1	0.4
Methylene chloride	1	0.4	1	0.4
Trichlorofluoromethane	1	0.2	1	0.2
cis- 1,2-Dichloroethene	1	0.3	1	0.3
trans-1,2-Dichloroethene	1	0.3	1	0.3
1,1-Dichloroethane	1	0.2	1	0.2
Chloroform	1	0.2	1	0.2
1,1,1-Trichloroethane	1	0.3	1	0.3
Carbon tetrachloride	1	0.3	1	0.3
1,2-Dichloroethane	1	0.3	1	0.3
Benzene	1	0.2	1	0.2
Trichloroethene	1	0.3	1	0.3
1,2-Dichloropropane	1	0.4	1	0.4
Bromodichloromethane	1	0.4	1	0.4
cis-1,3-Dichloropropene	1	0.3	1	0.3
Toluene	1	0.2	1	0.2
trans-1,3-Dichloropropene	1	0.3	1	0.3
1,1,2-Trichloroethane	1	0.2	1	0.2
Dibromochloromethane	1	0.3	1	0.3
2-Chloroethyl vinyl ether	10	3	10	3
Tetrachloroethene	1	0.3	1	0.3
Chlorobenzene	1	0.1	1	0.1

Table 12-2. *Laboratory CRQLs and MDLs for volatile organic compounds (NYSDEC ASP Method 8021B).*

Parameter	Water CRQL (ug/L)	Water MDL (ug/L)	Soil CRQL (ug/kg), wet wt	Soil MDL (ug/kg), wet wt
Ethylbenzene	1	0.1	1	0.1
Xylene (total)	3	0.5	3	0.5
1,2-Dichlorobenzene	5	0.3	5	0.3
1,3-Dichlorobenzene	5	0.1	5	0.1
1,4-Dichlorobenzene	5	0.2	5	0.2
Dichlorodifluoromethane	10	0.3	10	0.3
Bromoform	10	0.4	10	0.4
1,1,2,2-Tetrachloroethane	1	0.3	1	0.3

Notes:
CRQL indicates contract required quantitation limit.
MDL indicates method detection limit.
µg/L indicates microgram per liter or parts per billion.
µg/Kg indicates microgram per kilogram or parts per billion.

Table 12-3. *Laboratory CRQLs and MDLs for volatile organic compounds (NYSDEC ASP Method 8260A).*

Parameter	Water CRQL (ug/L)	Water MDL (ug/L)	Soil CRQL (ug/kg), wet wt	Soil MDL (ug/Kg), wet wt
Chloromethane	10	0.3	10	0.3
Vinyl chloride	10	0.2	10	0.2
Bromomethane	10	0.2	10	0.2
Chloroethane	10	0.2	10	0.3
Acetone	10	0.6	10	0.5
1,1-Dichloroethene	10	0.2	10	0.2
Methylene chloride	10	0.2	10	0.3
Carbon disulfide	10	0.1	10	0.2
trans-1,2-Dichloroethene	10	0.2	10	0.2
1,1-Dichloroethane	10	0.2	10	0.1
2-Butanone	10	0.2	10	0.6
cis-1,2-Dichloroethene	10	0.2	10	0.2
Chloroform	10	0.2	10	0.1
1,1,1-Trichloroethane	10	0.1	10	0.2
Carbon tetrachloride	10	0.2	10	0.2
1,2-Dichloroethane	10	0.1	10	0.1
Benzene	10	0.2	10	0.1
Trichloroethene	10	0.1	10	0.1
1,2-Dichloropropane	10	0.1.	10	0.2
Bromodichloromethane	10	0.1	10	0.1
4-Methyl-2-Pentanone	10	0.4	10	0.3
cis-1,3-Dichloropropene	10	0.1	10	0.1
Toluene	10	0.2	10	0.3
trans-1,3-Dichloropropene	10	0.1	10	0.1
1,1,2-Trichloroethane	10	0.2	10	0.1
Dibromochloromethane	10	0.2	10	0.1
2-Hexanone	10	0.3	10	0.9
Tetrachloroethene	10	0.2	10	0.1
Chlorobenzene	10	0.2	10	0.1

Table 12-3. *Laboratory CRQLs and MDLs for volatile organic compounds (NYSDEC ASP Method 8260A).*

Parameter	Water CRQL (ug/L)	Water MDL (ug/L)	Soil CRQL (ug/kg), wet wt	Soil MDL (ug/Kg), wet wt
Ethylbenzene	10	0.2	10	0.2
Xylene (total)	10	0.5	10	0.6
Styrene	10	0.1	10	0.2
Bromoform	10	0.2	10	0.1
1,1,2,2-Tetrachloroethane	10	0.2	10	0.2

Notes:
CRQL indicates contract required quantitation limit.
MDL indicates method detection limit.
μg/L indicates microgram per liter or parts per billion.
μg/Kg indicates microgram per kilogram or parts per billion.

Table 12-4. *Laboratory CRQLs and MDLs for semivolatile organic compounds (NYSDEC ASP Method 8270C).*

Parameter	Water CRQL (ug/L)	Water MDL (ug/L)	Soil CRQL (ug/kg), wet wt	Soil MDL (ug/kg), wet wt
Phenol	10	0.4	330	5.8
Bis(2-chloroethyl)ether	10	0.4	330	5.9
2-Chlorophenol	10	0.4	330	6.0
1,3-Dichlorobenzene	10	0.4	330	4.2
1,4-Dichlorobenzene	10	0.4	330	6.2
1,2-Dichlorobenzene	10	0.4	330	4.7
2-Methylphenol	10	0.4	330	4.2
Bis(2-chloroisopropyl)ether	10	0.6	330	5.5
4-Methylphenol	10	0.4	330	5.6
N-Nitroso-di-n-propylamine	10	0.5	330	4.9
Hexachloroethane	10	0.5	330	6.2
Nitrobenzene	10	0.4	330	4.2
Isophorone	10	0.5	330	4.0
2-Nitrophenol	10	0.5	330	3.7
2,4-Dimethylphenol	10	0.5	330	7.8
Bis(2-chloroethoxy)methane	10	0.5	330	5.2
2,4-Dichlorophenol	10	0.4	330	4.7
1,2,4-Trichlorobenzene	10	0.4	330	6.0
Naphthalene	10	0.4	330	3.8
4-Chloroaniline	10	0.5	330	6.1
Hexachlorobutadiene	10	0.5	330	4.7
4-Chloro-3-methylphenol	10	0.7	330	4.5
2-Methylnaphthalene	10	0.4	330	5.8
Hexachlorocyclopentadiene	10	0.5	330	12.5
2,4,6-Trichlorophenol	10	0.4	330	8.0
2,4,5-Trichlorophenol	50	0.7	1600	11.3
2-Chloronaphthalene	10	0.4	330	3.3
2-Nitroaniline	25	1.4	800	10.5
Dimethylphthalate	10	0.4	330	6.6

Table 12-4. *Laboratory CRQLs and MDLs for semivolatile organic compounds (NYSDEC ASP Method 8270C).*

Parameter	Water CRQL (ug/L)	Water MDL (ug/L)	Soil CRQL (ug/kg), wet wt	Soil MDL (ug/kg), wet wt
Acenaphthylene	10	0.4	330	7.0
2,6-Dinitrotoluene	10	0.5	330	4.7
3-Nitroaniline	25	1.6	800	11.5
Acenaphthene	10	0.5	330	3.6
2,4-Dinitrophenol	25	3.2	800	55.3
4-Nitrophenol	25	1.3	800	18.9
Dibenzofuran	10	0.4	330	3.8
2,4-Dinitrotoluene	10	0.4	330	5.6
Diethylphthalate	10	0.5	330	4.1
4-Chlorophenyl-phenylether	10	0.4	330	3.8
Fluorene	10	0.5	330	3.2
4-Nitroaniline	25	1.6	800	16.1
4,6-Dinitro-2-methylphenol	25	14.7	800	50.1
N-Nitrosodiphenylamine	10	0.6	330	4.1
4-Bromophenyl-phenylether	10	0.4	330	5.5
Hexachlorobenzene	10	0.4	330	4.2
Pentachlorophenol	25	0.6	800	16.5
Phenanthrene	10	0.4	330	2.7
Anthracene	10	0.4	330	4.6
Di-n-butylphthalate	10	0.6	330	5.7
Fluoranthene	10	0.5	330	3.2
Pyrene	10	0.5	330	6.5
Butylbenzylphthalate	10	0.6	330	11.8
3,3-Dichlorobenzidine	20	0.3	660	5.4
Carbazole	10	0.5	330	3.4
Benzo(a)anthracene	10	0.5	330	3.0

Table 12-4. *Laboratory CRQLs and MDLs for semivolatile organic compounds (NYSDEC ASP Method 8270C).*

Parameter	**Water CRQL (ug/L)**	**Water MDL (ug/L)**	**Soil CRQL (ug/kg), wet wt**	**Soil MDL (ug/kg), wet wt**
Chrysene	10	0.5	330	4.7
Bis(2-ethylhexyl)phthalate	10	0.4	330	8.6
Di-n-octylphthalate	10	0.6	330	7.2
Benzo(b)fluoranthene	10	0.4	330	4.9
Benzo(k)fluoranthene	10	0.4	330	3.0
Benzo(a)pyrene	10	0.4	330	4.7
Indeno(1,2,3-cd)pyrene	10	0.4	330	6.3
Dibenzo(a,h)anthracene	10	0.4	330	6.4
Benzo(g,h,i)perylene	10	0.4	330	6.4

Notes:
CRQL indicates contract required quantitation limit.
MDL indicates method detection limit.
μg/L indicates microgram per liter or parts per billion.
μg/Kg indicates microgram per kilogram or parts per billion.

Table 12-5. *Laboratory CRQLs and MDLs for Pesticides and PCBs (NYSDEC ASP Methods 8081A and 8082).*

Parameter	Water CRQL (μg/L)	Water MDL (μg/L)	Soil CRQL (μg/kg), wet wt.	Soil MDL (μg/Kg), wet wt.
alpha-BHC	0.05	0.004	1.7	0.3
gamma-BHC	0.05	0.006	1.7	0.3
beta-BHC	0.05	0.007	1.7	0.3
heptachlor	0.05	0.007	1.7	0.3
delta-BHC	0.05	0.004	1.7	0.2
aldrin	0.05	0.01	1.7	0.3
heptachlor epoxide	0.05	0.008	1.7	0.2
endosulfan I	0.05	0.006	1.7	0.2
4,4'-DDE	0.1	0.01	3.3	0.4
dieldrin	0.1	0.009	3.3	0.4
endrin	0.1	0.008	3.3	0.4
4,4'-DDD	0.1	0.009	3.3	0.3
endosulfan II	0.1	0.01	3.3	0.3
4,4'-DDT	0.1	0.01	3.3	0.3
endosulfan sulfate	0.1	0.02	3.3	0.5
endrin aldehyde	0.1	0.008	3.3	0.3
endrin ketone	0.1	0.008	3.3	0.4
methoxychlor	0.5	0.05	17	2.6
alpha-chlordane	0.05	0.008	1.7	0.2
gamma-chlordane	0.05	0.01	1.7	0.2
toxaphene	5.0	0.08	170	2.5
Aroclor 1016	1.0	0.04	33	1.8
Aroclor 1221	2.0	0.06	67	2.0
Aroclor 1232	1.0	0.04	33	0.8

Table 12-5. *Laboratory CRQLs and MDLs for Pesticides and PCBs (NYSDEC ASP Methods 8081A and 8082).*

Parameter	Water CRQL (μg/L)	Water MDL (μg/L)	Soil CRQL (μg/kg), wet wt.	Soil MDL (μg/Kg), wet wt.
Aroclor 1242	1.0	0.04	33	1.9
Aroclor 1248	1.0	0.05	33	0.7
Aroclor 1254	1.0	0.07	33	1.7
Aroclor 1260	1.0	0.06	33	1.5

Notes:
CRQL indicates contract required quantitation limit.
MDL indicates method detection limit.
μg/L indicates microgram per liter or parts per billion.
μg/Kg indicates microgram per kilogram or parts per billion.

Table 12-6. *Laboratory CRQLS and MDLs for polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) (NYSDEC ASP Method 8290).*

Parameter	Soil CRQL (ng/kg), wet wt	Soil MDL (ng/kg), wet wt
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1	*
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	5	*
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	5	*
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	5	*
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	5	*
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	5	*
1,2,3,4,6,7,8,9- Octachlorodibenzo-p-dioxin (OCDD)	10	*
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	1	*
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	5	*
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	5	*
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	5	*
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	5	*
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	5	*
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	5	*
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	5	*

Table 12-6. *Laboratory CRQLS and MDLs for polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) (NYSDEC ASP Method 8290).*

Parameter	Soil CRQL (ng/kg), wet wt	Soil MDL (ng/kg), wet wt
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	5	*
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	10	*

Notes:
CRQL indicates contract required quantitation limit.
MDL indicates method detection limit.
ng/Kg indicates nanogram per kilogram.
* The traditional definition of MDL, as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero, is difficult to apply to PCDD/PCDF by HRGC-HRMS. Although the laboratory performs the MDL study according to 40 CFR, Part 136, Appendix B, the MDL value is not used in reporting the concentration of PCDDs or PCDFs. The MDL studies are scheduled using blank matrix material (such as sand) and are usually analyzed on one instrument. The results reported are specific of the conditions of that specific instrument on that given day and cannot be representative of all analyses performed by the method.

A peak in a high resolution channel with the right retention time to be analyte A, having a signal-to-noise ratio of ≥ 2.5, and having the ratio of the two monitored ions within the method specified limits to be analyte A, is judged to be analyte A. If the apparent concentration is within the range of the calibration curve, the level is reported as such. If the apparent concentration is above the calibration range, the sample is diluted and reinjected. Data are not reported below the range of the calibration curve, only concentrations above the CRQLs are reported.

Table 12-7. *Laboratory CRQLs and MDLS for metals (NYSDEC ASP Methods 6010B, 7841, 7470A/7471A), cyanide (NYSDEC ASP Method 9010B/9014), total organic carbon (Lloyd Kahn Method).*

Parameter	Water CRQL (ug/L)	Water MDL (ug/L)	Soil CRQL (mg/kg), wet wt.	Soil MDL (mg/kg), wet wt
Aluminum	100	19.9	10	3.3
Antimony	60	3.9	6	0.3
Arsenic	5	4.3	0.5	0.2
Barium	100	0.2	10	0.02
Beryllium	10	0.05	1	0.007
Cadmium	10	0.2	1	0.02
Calcium	1000	20.3	100	1.4
Chromium	10	0.9	1	0.1
Cobalt	50	1.1	5	0.09
Copper	10	1.5	1	0.06
Iron	50	11.8	5	1.4
Lead	5	1.9	0.5	0.1
Magnesium	1000	9.4	100	1.1
Manganese	50	0.3	5	0.05
Mercury	0.2	0.1	0.1	0.06
Nickel	50	1.6	5	0.1
Potassium	5000	37.8	500	6.0
Selenium	5	3.6	0.5	0.2
Silver	10	1.0	1	0.07
Sodium	1000	29.2	100	1.3
Thallium	5	6.2	0.5	0.7

Table 12-7. *Laboratory CRQLs and MDLS for metals (NYSDEC ASP Methods 6010B, 7841, 7470A/7471A), cyanide (NYSDEC ASP Method 9010B/9014), total organic carbon (Lloyd Kahn Method).*

Parameter	Water CRQL (ug/L)	Water MDL (ug/L)	Soil CRQL (mg/kg), wet wt.	Soil MDL (mg/kg), wet wt
Vanadium	50	1.1	5	0.06
Zinc	10	2.9	1	0.9
Cyanide	10	10	0.5	0.5
Total Organic Carbon	NA	NA	100	37

Notes:
CRQL indicates contract required quantitation limit.
MDL indicates method detection limit.
NA indicates not applicable.
μg/L indicates microgram per liter or parts per billion.
mg/Kg indicates milligram per kilogram or parts per million.

13. Quality control requirements

The overall effectiveness of a quality control program depends upon operating in the field and laboratory according to a program that systematically ensures the precision and accuracy of analyses by detecting errors and preventing their recurrence or measuring the degree of error inherent in the methods applied. The following sections describe the QA/QC checks that will be utilized in the laboratory and the field during this project.

13.1. Laboratory QA/QC checks

Tables 13-1 through 13-7 summarize the laboratory quality control checks, frequency of analysis, control limits, and laboratory corrective actions by analytical method. A brief description of laboratory QA/QC analyses are contained in the following subsections.

13.1.1. GC/MS tuning

Tuning and performance criteria are established to verify mass resolution, identification, and to some degree, instrument sensitivity. These criteria are not sample specific; conformance is determined using standard materials. Therefore, these criteria should be met in all circumstances.

13.1.2. Calibration

Compliance requirements for satisfactory instrument calibration are established to verify that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of analysis, and continuing calibration and performance checks document satisfactory maintenance and adjustment of the instrument on a day-to-day basis. Section 15.2 of this QAPP describes the laboratory equipment calibration process.

13.1.3. Blanks

Several types of blanks will be analyzed by the laboratory. Corrective action procedures will be implemented for blank analyses if target compounds are detected at concentrations greater than the CRQL. The criteria for evaluation of blanks apply to any blank associated with a group of samples. If problems with a blank exist, data associated with the project must be carefully evaluated to determine whether or not there is an inherent variability in the data for the project, or if the problem is an isolated occurrence not affecting other data.

A reagent blank consists of laboratory distilled water and any reagents added to a sample during analysis only, or straight solvent. This type of sample is analyzed to evaluate whether contamination is occurring during the analysis of the sample. A reagent blank is usually analyzed following highly contaminated samples to assess the potential for cross-contamination during analysis.

A method blank is a water or soil blank which undergoes the preparation procedures applied to a sample *(i.e.*, extraction, digestion, clean-up). These samples are analyzed to examine whether sample preparation, clean-up, and analysis techniques result in sample contamination. The laboratory will prepare and analyze a method blank with each group of twenty samples of similar matrix that are extracted, digested, or analyzed at the same time.

Equipment blanks will also be collected as required and submitted for laboratory analysis. Equipment blanks will be handled in the same manner as environmental samples. Equipment blanks are analyzed to assess contamination introduced during field sampling procedures and sample shipment, respectively.

Trip blanks will consist of samples of distilled and/or deionized water that have undergone shipment from the sampling site to the laboratory in coolers with the environmental samples to be analyzed for VOCs. Trip blanks will be analyzed for VOCs to determine if contamination has taken place during sample handling and/or shipment. Trip blanks will be utilized for samples at a frequency of one each per shipment sent to the laboratory for volatile organic analysis.

13.1.4. Internal standards performance

Internal standards, which are compounds not found in environmental samples, will be spiked into blanks, samples, MS/MSDs, and laboratory control samples (LCSs) at the time of sample preparation. Internal standards for PCDD and PCDF analyses are used to quantitate target compounds and to correct for variability of sample preparation, cleanup, and analysis with respect to individual sample matrices. Internal standards must meet retention time and performance criteria specified in the analytical method or the sample will be reanalyzed.

13.1.5. Recovery standard

Recovery standards consist of two labeled PCDDs and PCDFs which are spiked into environmental samples, blanks, and QC samples prior to sample injection for PCDF and PCDD analyses. Recovery standards are used to monitor instrument performance by evaluating retention time shifts and are used to quantitate results of internal standards.

13.1.6. Surrogate recovery

Accuracy and matrix biases for individual samples are monitored for organic analyses using surrogate additions. Surrogates are compounds similar in nature to the target analytes which are spiked into environmental samples, blanks, and quality control samples prior to sample preparation for organic analyses. The evaluation of the results of these surrogate spikes is not necessarily straightforward. The sample itself may produce effects due to such factors as interferences and high concentrations of analytes. Since the effects of the sample matrix are frequently outside the control of the laboratory and may present relatively unique problems, the review and validation of data based on specific sample results is frequently subjective.

13.1.7. LCS

LCSs are standard solutions that consist of known concentrations of the target analytes spiked into laboratory distilled water or a clean sand. They are prepared or purchased from a certified manufacturer from a source independent from the calibration standards to provide an independent verification of the calibration procedure. They are spiked with target analytes. These QC samples are then prepared and analyzed following the same procedures employed for environmental sample analysis to assess method accuracy independently of sample matrix effects. The laboratory will prepare and analyze a LCS with each group of twenty samples of similar matrix that are extracted, digested, or analyzed at the same time. Percent recoveries will be evaluated to assess the efficiency of preparation and analysis method independent of environmental sample matrix effects.

13.1.8. MS/MSD or laboratory duplicate samples

MS/MSD or laboratory duplicate analyses will be performed on environmental samples at a frequency of one per sample matrix and every twenty samples of similar matrix. Whenever possible MS/MSD/laboratory duplicate samples will be prepared and analyzed within the same batch as the environmental samples. MS/MSD samples will be spiked at the laboratory with target analytes. MS/MSD/laboratory duplicate data are generated to determine long-term precision and accuracy of the analytical method with respect to sample matrices. Generally, these data alone are not used to evaluate the precision and accuracy for individual samples since data may reflect specific matrix effects only present within one sample.

13.1.9. Compound identification and quantitation

The objective of the qualitative criteria is to minimize the number of erroneous identifications of compounds. An erroneous identification can either be a false positive (reporting a compound present when it is not) or a false negative (not reporting a compound that is present). The identification criteria can be applied much more easily in detecting false positives than false negatives. Negatives, or non-detected compounds, on the other hand represent an absence of data and are, therefore, much more difficult to assess. The objective for quantitative requirements is to maximize the accuracy of data and sensitivity of the instrument. Samples should be analyzed undiluted to maximize sensitivity. Samples must be re-analyzed at the appropriate dilution when concentrations exceed the linear calibration range to maximize accuracy.

13.2. Field QA/QC checks

In order to evaluate data quality, QA/QC samples will be collected during the field investigation. Table 9-1 lists the environmental and corresponding QC samples to be collected by analyses and matrix type.

13.2.1. Field duplicate samples

Collection of field duplicate samples provides for the evaluation of the laboratory's precision performance by comparing analytical results of two samples from the same location. Field duplicate samples are also collected to evaluate field sample collection precision procedures. Field duplicate samples are duplicate samples collected from one location and sent to the laboratory blind (with two different sample identifications). One field duplicate sample will be collected for every 20 environmental samples (*i.e.*, minimum frequency of 5%) or one per matrix for less than 20 samples.

13.2.2. Matrix spikes and matrix spike duplicates

MS/MSD samples are duplicate samples that have spiking solutions added. MS/MSD samples are considered identical to the original sample and require that the sampled material be homogenized in the field and laboratory prior to analyses. Due to the potential loss of volatile compounds during homogenization, samples collected for VOC analyses will not be homogenized in the field. Since they will not be homogenized, field samplers must make every effort to collect representative samples of the location sampled for VOCs. The percent recovery of the spiked amount indicates the accuracy of the extraction as well as interferences caused by the matrix. Relative percent differences (RPDs) between spike sample recoveries will indicate the precision of the data. One MS/MSD sample set will be collected for every 20 environmental samples submitted to the laboratory or one per group of similar concentration and matrix (*i.e.*, minimum frequency of 5%).

13.2.3. Field/equipment blanks

Field/equipment blanks will consist of samples of analyte-free water that are passed through and or over decontaminated sampling equipment. One field/equipment blank will be collected per set of sampling equipment per sampling event. Field/equipment blanks will not be required if dedicated sampling equipment are utilized. The field/equipment samples will be subject to the same analyses as the environmental samples.

13.2.4. Trip blanks

Trip blanks will consist of samples of distilled and/or deionized water that have undergone shipment from the sampling site to the laboratory in coolers with the environmental samples to be analyzed for VOCs. Trip blanks will be analyzed for VOCs to determine if contamination has taken place during sample handling and/or shipment. Trip blanks will be utilized for samples at a frequency of one each per shipment sent to the laboratory for volatile organic analysis.

13.3. Corrective action

Generally, the following corrective actions may be taken by the laboratory. When calibration, instrument performance, and blank criteria are not met, the cause of the problem will be located and corrected. The analytical system will then be recalibrated. Sample analysis will not begin until calibration, instrument performance, and blank criteria are met. When matrix spike, reference standard, or duplicate analyses are out of control, samples analysis will cease. The problem will be investigated. Depending on the results of overall QC program for the sample set, the data may be accepted, accepted with qualification, or determined unusable. If the laboratory determines data to be unusable, those samples will be re-prepared and reanalyzed. If matrix interferences are suspected, samples will be subjected to one or more of the clean-up techniques specified in the analytical methods. If QC criteria are met upon reanalysis, only the new results are reported. If QC criteria are still not met upon reanalysis, both sets of sample results will be reported. (See Section 12.1 of this QAPP).

The laboratory will make every reasonable effort to correct QC excursions and to document the presence of matrix interferences. In this way, unnecessary resampling of difficult matrices may be avoided. However, if matrix interferences are not documented resampling may be required.

The corrective actions listed in Tables 13-1 through 13-7 will be followed by the laboratory.

13.4. Control limits

Control limits are either listed in the appropriate methods or are established separately for matrix type for surrogate, LCS, MS/MSD, and laboratory duplicate analyses. Control limits can be considered action limits. The laboratory established limits are defined as ±three standard deviations of the mean and correspond to 99.7% confidence limits of a normal distribution curve. The laboratory will establish control limits for each analyte of concern using a minimum of twenty data points. During the validation, laboratory control limits will be reviewed against method limits, where applicable, to verify that laboratory control limits used will produce data that meets data quality objectives.

The control limits used to assess data for this program will be summarized by the laboratory in the analytical report.

13.5. Field sampling QA/QC

Field sampling crews will always be under direct supervision of a field sampling leader. Bound log books and appropriate data sheets will be used to document the collection of samples and data so that an individual sample or data set can be traced back to its point of origin, sampler, and type of sampling equipment. Sampling will be performed according to the methods provided in the FSP and in this QAPP. Field QA/QC samples include blind field duplicate, MS/MSD, and trip blank samples and will be collected by the sampling team. These samples will be sent to the laboratory for analysis in conjunction with the environmental samples. Field sampling precision will be evaluated through the RPD of the matrix spike and blind field duplicate sample analyses results. Control limits for the blind field duplicate precision have been established at ±50% for water samples and ±100% for soil samples. Decontamination of sampling equipment, if required, will be verified through the analysis of equipment blanks. The presence of matrix interferences will be evaluated by the analysis of spiked MS/MSD samples. The integrity of aqueous environmental submitted for VOC analysis will be evaluated by the analysis of trip blank samples which accompany each shipment of environmental samples to the laboratory. The trip blank results will be used to determine of contamination of the samples occurred during shipment and/or storage. Proper chain-of-custody protocols, as presented in Section 11 of this QAPP, will be followed.

Table 13-1. *Volatile Organic Compounds NYSDEC ASP Method 8021B Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Corrective Action
Holding Times	Samples must be extracted and analyzed within holding time.	VOCs: Analyze within 10 days from verified time of sample receipt (VTSR).	If holding times are exceeded for initial or any reanalyses required due to QC excursions, notify the QAO immediately since resampling may be required.
Initial Calibration	Prior to start up and when criteria are exceeded for continuing calibration.	1. Minimally five concentrations, one calibration standard should be at concentration near the CRQL. 2. If RSD <20% the average RRF or average calibration factor may be used for quantitation. If RSD >20% a linear regression calibration that does not pass through the origin with a correlation coefficient (r^2) >0.990 must be used for quantitation; or a nonlinear first or second order calibration curve with a coefficient of determination (COD) $\geq$0.990 following USEPA Method 8021 Section 7.5.2.4 must be used for quantitation.	1. Identify and correct problem. 2. Recalibrate instrument; samples must not be analyzed until initial calibration criteria are met.
Calibration Verification	Calibration standards must contain target compounds at mid-range concentration. Continuing calibration standards should be analyzed every ten samples for every 12 hour period.	Response (% difference) or concentration (% drift) < 15.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard. Samples must be bracketed by compliant calibration standards.

Table 13-1. *Volatile Organic Compounds NYSDEC ASP Method 8021B Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Corrective Action
Retention Time Windows	Retention time windows (absolute retention time) must be established in accordance with USEPA method 8000B (Section 7.6) or relative retention times must be used if internal standards are employed .	Compounds must be within established retention time windows or within laboratory established relative retention time criteria for the succeeding calibration standards.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard.
Method Blank Analysis	1 per 20 samples of similar matrix extracted at the same time, or one per analytical batch, for every 12 hour period. Analyzed after the calibration verification.	Compound concentrations must be <CRQL .	1. Reanalyze. 2. If limits are still exceeded, reanalyze method blank and associated samples if holding times have not elapsed. 3. If holding times have elapsed, contact the QAO immediately since resampling may be required.
LCS Analysis	1 per analytical batch of similar matrix extracted at the same times, every 12 hour period. LCSs must be spiked with all target compounds at the same concentration as the matrix spike.	Percent recoveries must be within laboratory control limits.	1. Reanalyze and examine results of other QC analyses. 2. If the percent recovery is above laboratory control limits (biased high) and the affected compound is not detected in the associated samples, corrective action is not required; document in case narrative. 3. If percent recovery is below laboratory control limits or <10%, reanalyze the LCS one additional time. If recoveries remain below limits and other QC criteria (surrogate, internal standards, calibration) have been met, notify QAO immediately and document in case narrative report. 4. If recoveries are below laboratory control limits and additional QC excursions are observed, locate and correct problem, recalibrate instrument and re-extract and/or re-analyze samples since last satisfactory LCS. If samples requiring re-extraction or reanalysis over holding time requirements, notify the QAO immediately prior to proceeding since resampling may be required.

Table 13-1. *Volatile Organic Compounds NYSDEC ASP Method 8021B Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Corrective Action
MS/MSD Analysis	1 per matrix type and every batch or 20 samples of similar matrix. MS/MSDs must be spiked with all target compounds at concentrations specified in the method.	Recovery and RPD within laboratory control limits.	1. If LCS criteria are met, document in case narrative; no additional corrective action required. 2. If LCS criteria are exceeded also, examine other QC data for source of problem; ie surrogate recoveries for extraction efficiency and calibration data for instrument performance issues. 3. Take corrective action as required, re-extract or reanalyze samples and associated MS/MSD and LCSs as required.
Internal Standards	If used, samples, blanks, MS/MSDs, and LCSs must be spiked with 1-chloro-3-fluorobenzene.	1. Response -50% to +100% of internal standards from calibration verification. 2. RT must be ± 30 seconds from associated standard. 3. Do not reanalyze for MS/MSD analyses.	1. Inspect for malfunction and correct if necessary. 2. Reanalyze. 3. If still outside of the limits, contact QAO and qualify data. 4. Document corrective action.
Surrogate Spike	Samples, blanks, MS/MSDs, and LCSs must be spiked with method specified surrogate compounds.	1. Recovery within laboratory control limits.	1. Reanalyze. 2. If recovery is still outside control limits but >10%, document in case narrative report. 3. If recovery is <10% with reanalysis, re-extract and reanalyze the sample if the holding time has not elapsed. If holding time has elapsed, notify the QAO immediately prior to proceeding since resampling may be required.
Identification	Samples, blanks, and QC data.	1. Retention times must be within established retention time windows or must meet relative retention time criteria. 2. Confirmation analysis according to Method 8000B Section 7.9 is required	1. Investigate problem; reanalyze calibration standards to check for retention time shift.
Quantitation	Samples, blanks, and QC data.	1. Internal and external standard method. Verify concentration is within linear calibration range. 2. Every effort must be made to meet specified CRQL requirements. Soil samples concentrations must be corrected to dry weight.	1. If concentration is above linear calibration range, dilute sample and reanalyze. Dilution should result in concentration in the upper calibration range of the instrument.

Table 13-1. *Volatile Organic Compounds NYSDEC ASP Method 8021B Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Corrective Action
Trip Blank Analysis	1 per cooler.	Compounds concentrations must be <CRQL.	1. Investigate problem; reanalyze to verify laboratory cross contamination is not a factor. 2. Notify the QAO immediately since resampling may be necessary.
Equipment Blank Analysis	As required.	Compounds concentrations must be <CRQL.	1. Investigate problem; reanalyze to verify laboratory cross contamination is not a factor. 2. Notify the QAO immediately since resampling may be necessary.
Field Duplicate Analysis	Every 20 samples.	50% RPD for waters and 100% RPD for soil.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis during the validation process.
Dilutions	1. When target analyte concentration exceeds upper limit of calibration curve. 2. Do not dilute for high concentrations in MS/MSD samples.	Not applicable	Not applicable
Confirmation Analysis	Quantitation confirmation will be performed at a 10% per matrix frequency. Qualitative confirmation will be performed for positive sample results, if matrix interference is present.	Not Applicable	Not Applicable

NOTE: Method is part of the New York State Department of Environmental Conservation *Analytical Services Protocol*, October 1995 Revisions

Table 13-2. *Volatile Organic Compounds NYSDEC ASP Method 8260A Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Corrective Action
Holding times	Samples must be extracted and analyzed within holding time.	VOCs: Analyze within 10 days from VTSR.	If holding times are exceeded for initial or any reanalyses required due to QC excursions, notify QAO immediately since resampling may be required.
MS Tuning	Once every 12 hours.	Bromoflurobenzene (BFB) key ions and abundance criteria listed in the NYSDEC ASP criteria must be met for all 9 ions.	1. Tune the mass spectrometer. 2. Document corrective action - samples cannot be analyzed until control limit criteria have been met.
Initial Calibration	Prior to sample analysis and when continuing calibration criteria are not met.	1. Five concentrations bracketing expected concentration range for all compounds of interest; one standard should be at or below the CRQL, as listed in the NYSDEC ASP criteria. 2. Compounds listed must meet NYSDEC ASP criteria; remaining compounds must meet a maximum %RSD of 100 and a minimum RF of 0.01.	1. Identify and correct problem. 2. If criteria are still not met, recalibrate. 3. Document corrective action - samples cannot be analyzed until calibration control limit criteria are met.
Calibration Verification	Every 12 hours, following BFB, at a concentration near the midpoint of the calibration.	Compounds listed must meet NYSDEC ASP criteria; remaining compounds must meet a maximum %D of 100 and a minimum RF of 0.01.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document corrective action - samples cannot be analyzed until calibration control limit criteria are met.
Method Blank Analysis	Every 12 hours, following continuing calibration. After analysis of sample that contains target compounds at levels greater than the initial calibration; to check for carryover.	Common laboratory contaminants (methylene chloride, acetone, 2-butanone), less than 5 X CRQL; anything else, less than CRQL. For carryover check, less than CRQL.	1. Source of contamination must be investigated and corrected. 2. Clean instrument, recalibrate analytical system, and reanalyze all samples. 3. Document corrective action - samples cannot be analyzed until blank criteria have been met.
Trip Blank	1 per cooler containing VOC samples.	Common laboratory contaminants (methylene chloride, acetone, 2-butanone), less than 5 X CRQL; anything else, less than CRQL.	1. Investigate problem, contact QAO. 2. Write an explanation.

Table 13-2. *Volatile Organic Compounds NYSDEC ASP Method 8260A Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Corrective Action
Equipment Blank	As required.	Compounds concentrations must be <CRQL.	1. Investigate problem; reanalyze to verify laboratory cross contamination is not a factor. 2. Notify the QAO immediately since resampling may be necessary.
LCS Analysis	Each analytical batch (every 12 hours). Prepare independently from calibration standards.	Recovery within laboratory control limits. Spike must contain all target analytes.	1. Only if recovery failures are above control limits and these compounds are not detected in the associated samples, is corrective action not required; document in case narrative. 2. Reanalyze LCS and examine results of other QC analyses. 3. If recovery is still outside limits, and other QC criteria are met, contact QAO. 4. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS. 5. Document corrective action.
Internal Standards	All samples, blanks, and MS/MSD/MSB	1. Response -50% to +100% of internal standards from continuing calibration of the day. 2. RT must be ± 30 seconds from associated standard. 3. Do not reanalyze for MS/MSD analyses.	1. Inspect for malfunction and correct if necessary. 2. Reanalyze. 3. If still outside of the limits, contact QAO and qualify data. 4. Document corrective action.

Table 13-2. *Volatile Organic Compounds NYSDEC ASP Method 8260A Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Corrective Action
Surrogate Spike	All samples, blanks, and MS/MSD/MSB	1. Recovery within NYSDEC ASP criteria. 2. Do not reanalyze for diluted sample or MS/MSD. 3. If surrogate in method blank is outside of limits, blank and all associated samples must be reanalyzed.	1. Reanalyze any environmental or QC sample with surrogates that exceed control limits, unless MS/MSD demonstrates same pattern as associated sample. 2. If surrogate recovery is met, report only second analysis; otherwise submit both sets of data and qualify the data. 3. Document corrective action.
MS/MSD Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, or per each 7 calendar day period in which samples are received, whichever is more frequent.	Recovery and RPD within NYSDEC ASP criteria.	1. Reanalyze if < 10%. 2. If LCS criteria are exceeded also, examine other QC data for source of problem; *i.e.*, surrogate recoveries for extraction efficiency and calibration data for instrument performance issues. 3. Take corrective action if other QC data criteria are exceeded; re-extract or reanalyze samples and associated MS/MSD and LCSs as required.
Matrix Spike Blank (MSB)	1 per MS/MSD.	Recovery within NYSDEC ASP criteria.	1. Reprepare and reanalyze MSB, MS and MSD. 2. If recovery is still outside limits, and other QC criteria are met, contact QAO. 3. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory MSB. 4. Document corrective action.

Table 13-2. *Volatile Organic Compounds NYSDEC ASP Method 8260A Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Corrective Action
Field Duplicate Analysis	Every 20 samples	50% RPD for waters and 100% RPD for soil.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis.
Tentatively Identified Compounds	Not applicable.	Not applicable	Not applicable
Dilutions	1. When target analyte concentration exceeds upper limit of calibration curve. 2. Do not dilute for high concentrations in MS/MSD samples.	Not applicable	Not applicable

NOTE: Method is part of the New York State Department of Environmental Conservation *Analytical Services Protocol*, October 1995 Revisions.

Table 13-3. *Semivolatile Organic Compounds NYSDEC ASP Method 8270C Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Corrective Action
Holding Times	Samples must be extracted and analyzed within holding time.	SVOCs: Extract within 5 days from VTSR. Analyze extracts within 40 days from extraction.	If holding times are exceeded for initial or any reanalyses required due to QC excursions, notify the QAO immediately since resampling may be required.
MS Tuning	Once every 12 hours.	DFTPP key ions and abundance criteria listed in the NYSDEC ASP criteria must be met for all 13 ions.	1. Tune the mass spectrometer. 2. Document corrective action - samples cannot be analyzed until control limit criteria have been met.
Initial Calibration	Prior to sample analysis and when continuing calibration criteria are not met.	1. Five concentrations bracketing expected concentration range for all compounds of interest; one standard should be at or below the CRQL, as listed in the NYSDEC ASP criteria. 2. Compounds listed must meet NYSDEC ASP criteria; remaining compounds must meet a maximum %RSD of 100 and a minimum RF of 0.01.	1. Identify and correct problem. 2. If criteria are still not met, recalibrate. 3. Document corrective action - samples cannot be analyzed until calibration control limit criteria are met.
Calibration Verification	Every 12 hours, following DFTPP at a concentration of 50 ng.	Compounds listed must meet NYSDEC ASP criteria; remaining compounds must meet a maximum %D of 100 and a minimum RF of 0.01.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document corrective action - samples cannot be analyzed until calibration control limit criteria are met.
Method Blank Analysis	With each extraction batch, of no more than 20 analytical samples, or each 7 calendar day period in which samples are received, whichever is more frequent.	Common laboratory contaminants (phthalate esters), less than 5 X CRQL, anything else, less than CRQL.	1. Source of contamination must be investigated and corrected. 2. Clean instrument, recalibrate analytical system and reextract and reanalyze all associated samples. 3. Document corrective action - samples cannot be analyzed until blank criteria have been met.

Table 13-3. *Semivolatile Organic Compounds NYSDEC ASP Method 8270C Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Corrective Action
Equipment Blank	As required.	Compounds concentrations must be <CRQL.	1. Investigate problem; reanalyze to verify laboratory cross contamination is not a factor. 2. Notify the QAO immediately since resampling may be necessary.
LCS Analysis	With each extraction batch, of no more than 20 analytical samples. Prepared independently from calibration standards.	Recovery within laboratory control limits, Spike must contain all target compounds.	1. Only if recovery failures are above control limits and these compounds are not detected in the associated samples, is corrective action not required; document in case narrative. 2. Reanalyze LCS and examine results of other QC analyses. 3. If recovery is still outside limits, and other QC criteria are met, contact QAO . 4. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS. 5. Document corrective action.
Internal Standards	All samples and blanks (including MS/MSD/MSB).	1. Response -50% to +100% of the internal standards from the continuing cal of the day. 2. RT must be ± 30 sec. from associated standard. 3. Do not reanalyze for MS/MSD analysis.	1. Inspect for malfunction and correct. 2. Reanalyze. 3. If recovery is still outside criteria, submit both analyses; qualify data. 4. Document corrective action.

Table 13-3. *Semivolatile Organic Compounds NYSDEC ASP Method 8270C Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Corrective Action
Surrogate Spike	All samples and blanks (including MS/MSD/MSB).	Recovery within NYSDEC ASP criteria (except for advisory surrogates). Do not reanalyze for dilutions or MS/MSD analyses.	1. If more than 1 acid extractable or 1 base neutral fails, or if any one surrogate %R is < 10%, reanalyze, unless MS/MSD shows same pattern as the associated samples. 2. If recovery is still outside control limits, reextract and reanalyze. 3. If blank fails surrogate criteria, all associated samples must be reextracted and reanalyzed. 4. If surrogate recovery is met, report only the second analysis; otherwise, submit both sets of analyses. 5. Document corrective action.
MS/MSD Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, or per each 7 calendar day in which samples were received, whichever is more frequent.	Recovery and RPD within NYSDEC ASP criteria.	1. Reanalyze if <10%. 2. If LCS criteria are exceeded also, examine other QC data for source of problem; *i.e.*, surrogate recoveries for extraction efficiency and calibration data for instrument performance issues. 3. Take corrective action if other QC data criteria are exceeded; re-extract or reanalyze samples and associated MS/MSD and LCSs as required.

Table 13-3. *Semivolatile Organic Compounds NYSDEC ASP Method 8270C Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Corrective Action
MSB	1 per MS/MSD.	Recovery within NYSDEC ASP criteria.	1. Reprepare, reextract, and reanalyze MSB, MS and MSD. 2. If recovery is still outside limits, and other QC criteria are met, contact QAO. 3. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory MSB. 4. Document corrective action.
Field Duplicate Analysis	Every 20 samples.	50% RPD for waters and 100% RPD for soil.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis.
Tentatively Identified Compounds	Not applicable	Not applicable	Not applicable
Dilutions	1. When target analyte concentration exceed upper limit of calibration curve. 2. Prior to diluting, samples will be cleaned up during sample preparation/extraction procedure using appropriate methods when matrix interference is present. 3. Do not dilute for high concentrations in MS/MSD samples.	Not applicable	Not applicable

NOTE: Method is part of the New York State Department of Environmental Conservation *Analytical Services Protocol*, October 1995 Revisions.

Table 13-4. *Pesticides NYSDEC ASP Method 8081A and PCBs NYSDEC ASP Method 8082 Quality Control Requirements and Corrective Actions (where applicable)*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Holding Times	Samples must be extracted and analyzed within holding time.	Extract within 5 days from VTSR. Analyze extracts within 40 days from extraction.	If holding times are exceeded for initial or any reanalyses required due to QC excursions, notify the QAO immediately since resampling may be required.
Initial Calibration	Prior to start up and when criteria are exceeded for continuing calibration.	1. Minimally 3 concentrations, one calibration standard for multi component compounds. 2. For Pest/PCBs, as listed in NYSDEC ASP criteria. 3. For other methods, %RSD must be <10%.	1. Identify and correct problem. 2. Recalibrate instrument; samples must not be analyzed until initial calibration criteria are met.
Calibration Verification	Calibration standards must contain target compounds at mid-range concentration. Minimally, analyze calibration standards every 12 hours. Calibration verification standards should be analyzed every 20 samples.	1. For Pest/PCBs, as listed in NYSDEC ASP criteria. 2. For other methods, %D <15%.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard. Samples must be bracketed by compliant calibration standards.
Retention Time Windows	Retention time windows must be established in accordance with NYSDEC ASP criteria.	1. Compounds must be within NYSDEC ASP criteria. 2. Retention time shift for surrogate in samples and standards must not exceed 0.3%.	1. Reanalyze non-compliant standards and samples. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard.
Method Blank Analysis	With each extraction batch, of no more than 20 analytical samples, or each 7 calendar day period in which samples are received, whichever is more frequent.	1. Compound concentrations must be <CRQL 2. Surrogate retention times must be within retention time windows.	1. Source of contamination must be investigated and corrected. 2. Clean instrument, recalibrate analytical system and reextract and reanalyze all associated samples. 3. Document corrective action - samples cannot be analyzed until blank criteria have been met.

Table 13-4. *Pesticides NYSDEC ASP Method 8081A and PCBs NYSDEC ASP Method 8082 Quality Control Requirements and Corrective Actions (where applicable)*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Equipment Blank	As required.	1. Compound concentrations must be <CRQL 2. Surrogate retention times must be within retention time windows.	1. Source of contamination must be investigated and contact QAO. 2. Document in case narrative.
Resolution check	For Pest/PCBs, analysis at the beginning of every initial calibration, on each GC column and instrument.	Depth of valley between 2 adjacent peaks ≥60.0% of the height of the shorter peak.	1. Investigate problem and correct. 2. Reanalyze. 3. Document corrective action.
Analytical Sequence	For Pest/PCB, in accordance with NYSDEC ASP criteria.	Must meet NYSDEC ASP criteria.	1. Reanalyze with correct sequence. 2. Document corrective action.
LCS Analysis	1 per 20 samples of similar matrix extracted at the same time. LCSs must be spiked with target compounds (or Aroclors suspected to be present at the site) at concentration specified in the method.	Percent recoveries must be within laboratory control limits.	1. Only if recovery failures are above control limits and these compounds are not detected in the associated samples, is corrective action not required; document in case narrative. 2. Reanalyze LCS and examine results of other QC analyses. 3. If recovery is still outside limits, and other QC criteria are met, contact QAO. 4. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS. 5. Document corrective action.

Table 13-4. *Pesticides NYSDEC ASP Method 8081A and PCBs NYSDEC ASP Method 8082 Quality Control Requirements and Corrective Actions (where applicable)*

Audit	Frequency	Control Limits	Laboratory Corrective Action
MS/MSD Analysis	1 per matrix type and every 20 samples of similar matrix. MS/MSDs must be spiked with target compounds (or Aroclors suspected to be present at the site) at concentrations specified in the method.	Recovery and RPD within NYSDEC ASP criteria.	1. Reanalyze if <10%. 2. If LCS criteria are exceeded also, examine other QC data for source of problem; *i.e.*, surrogate recoveries for extraction efficiency and calibration data for instrument performance issues. 3. Take corrective action if other QC data criteria are exceeded; re-extract or reanalyze samples and associated MS/MSD and LCSs as required.
MSB	1 per MS/MSD.	Recovery within NYSDEC ASP criteria.	1. Reprepare, reextract, and reanalyze MSB, MS and MSD. 2. If recovery is still outside limits, and other QC criteria are met, contact QAO. 3. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory MSB. 4. Document corrective action.
Sulfur Blank	For Pest/PCBs, if only part of a set of samples required sulfur removal.	Compound concentrations must be ≤CRQL.	Reextract and reanalyze blank and associated samples.
Instrument Blank	For Pest/PCBs; the first analysis in the 12 hour analytical sequence.	Compound concentration must be ≤0.5 times the CRQL. Surrogates must be within retention time windows.	1. Stop analysis and correct. 2. Reanalyze. 3. All samples must be associated with acceptable instrument blank.
Surrogate Spike	Samples, blanks, MS/MSD/MSB, and LCSs must be spiked with method specified surrogate compounds.	1. Recovery within NYSDEC ASP criteria. 2. Corrective action is not required if one of the two required surrogates has recovery outside of control limits if the recovery is >10%.	1. Reanalyze. 2. If recovery is still outside control limits but >10%, document in case narrative report. 3. If recovery is <10% with reanalysis, re-extract and reanalyze the sample if the holding time has not elapsed. If holding time has elapsed, notify the QAO immediately prior to proceeding since resampling may be required.

Table 13-4. *Pesticides NYSDEC ASP Method 8081A and PCBs NYSDEC ASP Method 8082 Quality Control Requirements and Corrective Actions (where applicable)*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Identification	Samples, blanks, and QC data.	1. Retention times must be within established retention time windows or must meet relative retention time criteria.	1. Investigate problem; reanalyze calibration standards to check for retention time shift.
Quantitation	Samples, blanks, and QC data.	1. Internal or external standard method. 2. Verify concentration is within linear calibration range. 3. Peak areas from three to five PCB peaks unique to the target Aroclor will be used to quantitate the Aroclor concentration. 4. Every effort must be made to meet specified CRQL requirements. 5. Soil samples concentrations must be corrected to dry weight.	1. If concentration is above linear calibration range, dilute sample and reanalyze. Dilution should result in concentration in the upper calibration range of the instrument. 2. Perform appropriate cleanup procedures as necessary to minimize sample matrix effects.
Field Duplicate Analysis	Every 20 samples.	50% RPD for waters and 100% RPD for soil.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis during the validation process.
Dilutions	1. When target analyte concentration exceed upper limit of calibration curve. 2. Prior to diluting, samples will be cleaned up during sample preparation/extraction procedure using appropriate methods when matrix interference is present. 3. Do not dilute for MS/MSD samples.	Not applicable	Not applicable

Table 13-4. *Pesticides NYSDEC ASP Method 8081A and PCBs NYSDEC ASP Method 8082 Quality Control Requirements and Corrective Actions (where applicable)*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Confirmation Analysis	Quantitation confirmation will be performed at a 10% per matrix frequency; qualitative confirmation will be performed for positive sample results. If any matrix interference is present, if an altered Aroclor is suspected, or if overlapping Aroclors are present qualitative confirmation will be performed.	Not Applicable	Not Applicable

NOTE: Method is part of the New York State Department of Environmental Conservation *Analytical Services Protocol*, October 1995 Revisions

Table 13-5. *PCDDs/PCDFs NYSDEC ASP Method 8290 Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Holding Times	Samples must be extracted and analyzed within holding time.	Extract within 30 days of VTSR for extraction, 40 days to analysis for solid samples. Cleanup using alumina, silica gel, and activated carbon.	If holding times are exceeded for initial or any reanalyses required due to QC excursions, notify QAO since resampling may be required.
MS Tuning	At the beginning and end of the 12 hour sequence. Prior to calibration, blank, sample and QC sample analysis.	Tune instrument using PFK in accordance with method 8290, Section 7.6.2.2, and Table 6. Minimally, the mass spectrometer must have a static resolving power at least 10,000 (10% valley). The laboratory will verify resolution criteria using masses 304.9824 or any other signal close to m/z 303.9016 (TCDF). Verify PFK the exact mass of m/z 380.9760 is within 5 ppm of the required value. Total cycle time must be ≤1.0 second.	1. Identify and correct problem. 2. Re-tune the mass spectrometer; samples must not be analyzed until tuning criteria are met.

Table 13-5. *PCDDs/PCDFs NYSDEC ASP Method 8290 Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Laboratory Corrective Action
GC Column Performance Check Standard (Window defining mixture)	At the beginning of 12 hour sequence, prior to initial calibration or continuing calibration standard.	Must contain the first and last for each homologous series tetra- through heptachlorinated congeners. It also contains other TCDD isomers and $^{13}C_{12}$-2,3,7,8-TCDD to document resolution (refer to Table 7 of method 8290). Method 8290 Section 8.2.1 must be met. Chromatographic resolution (for DB5 and DB225 columns as appropriate) between 2378-TCDD and the peaks representing any other unlabeled TCDD isomers must be resolved with a valley $\leq$25%. GC column performance standard is also used to determine the retention times for quantitative determination of the non -2378-substituted congeners. All peaks must be labeled and identified on the chromatograms, additionally, first eluters should be labeled with the letter F, and the last eluters with the letter L. The retention time of recovery standards must not vary by >10 seconds from the retention time in the most recent continueing calibration standard.	1. Identify and correct problems 2. Reanalyze; samples must not be analyzed until GC column performance check criteria are established.
Selective Ion Monitoring (SIM) Descriptors	Acquire SIM data for all ions listed in the five descriptors.	The ions listed in Method 8290, Table 6 must be monitored. The tetra and penta chlorinated dioxins and furans can be combined.	1. Identify and correct problems. 2. Document in the case narrative.

Table 13-5. *PCDDs/PCDFs NYSDEC ASP Method 8290 Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Initial Calibration	Before any samples are analyzed, when criteria are exceeded for continuing calibration, and if calibration , sample fortification (internal standard) or recovery standard solutions are replaced with a different lot. Calibration standard consist of 17 unlabeled target compounds spiked with the 5 labeled internals, and 2 labeled recovery standards. Additionally, 7 labeled PCDDs/PCDFs are used by the laboratory as surrogate and alternative standards. Use 8290 Table 5.	Minimally five concentrations, using the calibration range specified in Table 5 of EPA method 8290 except for tetra congeners in which the laboratory will use calibration range of 0.5 picogram (pg)/microliter (uL) to 100 pg/uL. Relative ion abundance criteria specified in EPA method 8290 Table 8 must be met. Instrument sensitivity: the S/N ration must ≥10. On each selected ion current profile (SICP) and for each GC signal corresponding to the elution of a target analyte and its labeled standard, the S/N must be ≥2.5. The S/N measurement is required for each peak with a S/N <5. The result of the calculation must appear on the SICP above the GC peak in question. RSD ≤20% for the 17 unlabeled PCDDs/PCDFs relative to the internal standard and ≤30% for the nine labeled internal standards relative to the recovery standards. Resolution for 123478-HXCDD and 123678-HXCDD must be ≤ 50%. The resolution for 2378-TCDD and 1234-TCDD must be ≤ 25%. The retention time of the isomers must fall within the appropriate retention time window established by the window defining mixture.	1. Identify and correct problem. 2. Recalibrate instrument; samples must not be analyzed until initial calibration criteria are met.

Table 13-5. *PCDDs/PCDFs NYSDEC ASP Method 8290 Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Continuing Calibration	Analyze at beginning of the 12 hour sequence following the GC performance check standard and at the end of the 12 hour sequence.	Relative ion abundance criteria specified in EPA method 8290 Table 8 must be met. If %D ≤20% for the 17 unlabeled standards and ≤30% for the nine labeled standards use average RRF for quantitation. If %D ≤25% (or ≤35% for labeled standards) for the ending continuing calibration standards only, quantitate results using average of RRF from the beginning and ending continuing calibration standards. The resolution for 123478-HXCDD and 123678-HXCDD must be ≤50%. The resolution for 2378-TCDD and 123XTCDD must be ≤ 25%. The retention time of the recovery standard must not vary by >10 seconds from the retention time from the first continuing calibration. The S/N must be > 2.5 for unlabeled and >10 for labeled PCDDs/PCDFs.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; samples cannot be analyzed until continuing calibration criteria are met.
Internal Standards	Samples, blanks, MS/MSDs, LCSs are spiked with labeled internal standards prior to extraction. The laboratory will use 1,2,3,6,7,8-HxCDF in place of method required 1,2,3,4,7,8-HxCDF because 1,2,3,4,7,8-HxCDF is used as a surrogate.	Percent recoveries must be within 40% to 130%. HPCDD, HPCDF, and OGDD percent recoveries must be within 25 to 130%. Ion abundance criteria specified in EPA method 8290 must be met.	1. Re-extract and/or re-analyze. 2. If re-extraction and re-analysis does not solve problem and other QC criteria were met, submit both runs and discuss in narrative report.
Surrogate or Alternate Standards	Samples, blanks, and MS/MSDs are spiked with seven labeled standards after extraction and prior to cleanup.		
Recovery Standard	Consists of 13C12 1,2.3.4-TCDD and 13C12 1,2,3,7,8,9-HxCDD which are added to field samples, blanks, QC samples prior to sample injection.	Recovery standard are used to calculate internal standard recovery.	If the absolute retention time of the recovery standard shifts >10 seconds from the continuing calibration standard, reanalyze.

Table 13-5. *PCDDs/PCDFs NYSDEC ASP Method 8290 Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Method Blank Analysis	1 per 20 samples of similar matrix extracted at the same time, analyzed between the calibration standard and samples.	Compound concentrations must be <CRQL.	1. Reanalyze. 2. If limits are still exceeded, re-extract and reanalyze method blank and associated samples if holding times have not elapsed. 3. If holding times have elapsed, contact QAO Manager since resampling may be required.
MS/MSD Analysis	1 per matrix type and every 20 samples of similar matrix. MS/MSDs must be spiked with compounds specified in the Method 8290, Table 5.	Recovery within laboratory limits. RPD within 20%.	1. Reanalyze. 2. If recovery or RPD is still outside limits, document in case narrative report.
Duplicate Analysis	1 per sample batch.	RPD within 20%.	1. Reanalyze. 2. If RPD is still outside limits, document in case narrative report.

Table 13-5. *PCDDs/PCDFs NYSDEC ASP Method 8290 Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Identification	Samples, blanks, and QC data.	For 2,3,7,8-substituted congeners, which has labeled internal or recovery standard present, the retention time of sample component for the two quantitation ions must be within -1 to +3 seconds of the labeled standard. (Method 8290 Tables 2 and 3, for 10 congeners) For 2,3,7,8-substituted congeners, which do not have labeled internal standard present, the retention time must fall within 0.005 retention time units of the relative retention times measured in the continuing calibration. (Method 8290 Table 3, for 6 congeners) For the non-2,3,7,8 substituted compounds (tetra through octa, 119 congeners), the retention time must be within the corresponding homologous retention time established by the GC column performance check standard. The ion current response for both ions must reach a maximum with ±2 seconds. Ion abundance rations specified in Method 8290 Table 8 must be met. Signal-to-noise ratio (S/N): all ion current intensities must be ≥2.5 times for positive identification of a PCDD/PCDF compound or a group of coeluting isomers. The identification of PCDFs are made only if no S/N ≥2.5 is detected at the same retention time (±2 seconds) in the corresponding polychlorinated diphenyl ether channel. The S/N of the internal standard must be ≥10 times the background noise.	1. If identification criteria are not all met, but in the judgement of the operator the target compound is present, proceed with quantitation and document reasoning in the data package.
Identification	Samples, blanks, and QC data.	Verify the presence of 1,2,8,9-TCDD and 1,3,4,6,8-PeCDF in the daily performance check.	1. Identify problem and correct.

Table 13-5. *PCDDs/PCDFs NYSDEC ASP Method 8290 Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Quantitation	Samples, blanks, and QC data.	Internal and external standard method. For OCDD, OCDF and homologous series with only one 2,3,7,8-substituted isomer (TCDD, PeCDD, HpCDD, TCDF) the mean RF is used (see Method 8290 Table 4). For homologous series with more than one 2378-substituted isomers the mean RF for individual 2,3,7,8-substituted congeners is used (PeCDF, HxCDF, HxCDD, HpCDF - see Method 8290 Table 4, 7.7.1.4.6.2). Based on the five-point calibration curve for each homologue. Verify saturation has not occurred. Every effort must be made to meet specified CRQL requirements. Soil and sediment samples concentrations must be corrected to dry weight. If interferences are present, additional cleanup may be required to achieve CRQLs. If 2,3,7,8-TCDF is detected on DB-5 column, the sample extract must be reanalyzed on DB-225 column or the equivalent to resolve 2,3,7,8-TCDF.	1. If peak is saturated, dilute sample and reanalyze. 2. If 2378-substituted PCDD/PCDF concentration is greater than the calibration limit, a second analysis using 1/10 aliquot is performed (see Method 8290, Section 7.9.3.1) 3. Perform appropriate cleanup procedures as necessary to minimize sample matrix effects.
Sample Specific Estimated Detection Limit (EDL)	Sample specific EDL is the concentration of a five analyte required to produce a signal with a peak height of at least 2.5 times the background signal.	Calculate an EDL for each 2,3,7,8-substituted congener that is not identified.	Not applicable

Table 13-5. *PCDDs/PCDFs NYSDEC ASP Method 8290 Quality Control Requirements and Corrective Actions*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Estimated Maximum Possible Concentration (EMPC)	All samples, blanks, QC data.	Samples characterized by a response above background level with a S/N of at least 2.5 for both quantitation ions.	When the response of a signal having the same retention time as a 2378-substituted congener has a S/N in excess of 2.5 and does not meet any of the other identification criteria, calculate the EMPC according to method 8290, Section 7.9.5.2.
Equipment Blank Analysis	1 per sampling equipment and after collection of 20 samples.	Compounds concentrations must be <CRQL.	1. Investigate problem; reanalyze to verify laboratory cross contamination is not a factor. 2. Notify QAO Officer since resampling may be necessary.
Field Duplicate Analysis	Every 20 samples.	Aqueous: RPD ≤50% for results > 5xCRQL. Soils: RPD ≤100% for results >5xCRQL. For Results <5xCRQL must agree within ±2xCRQL for aqueous and soils.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis during the validation process.

Table 13-6. *Metals NYSDEC ASP Method 6010B, Mercury NYSDEC ASP Method 7470A, 7471A, Cyanide NYSDEC ASP Method 9010B/9014, Thallium NYSDEC ASP Method 7841 Quality Control Requirements and Corrective Actions (where applicable)*

Audit	Frequency	Control Limits	Corrective Action
Holding Times	Samples must be digested and analyzed within holding time.	Metals: Analyze 6 months from VTSR. Mercury: Analyze 26 days from VTSR. Cyanide: Analyze 12 days from VTSR.	If holding times are exceeded for initial or any reanalyses required due to QC excursions, notify the QAO immediately since resampling may be required.
Calibration Verification (ICV, CCV)	Two point calibration for ICP. A blank and 3 standards for mercury and cyanide. Calibrate daily or once every 24 hours and each time instrument is set up; verify at more frequent of 10% or every 2 hours. Also verify at the beginning and end of each run. One cyanide standard should be at CRQL.	90% to 110% of expected value for ICP 80% to 120% of expected true value for Mercury. 85% to 115% for cyanide. Highest standard mix ± 5% of true value for ICP. Correlation coefficient for first or second order curve must be ≥ 0.995. Cyanide ICV must be distilled. The difference in time between the CCV and blank and the difference between the CCV and the sample immediately preceding may not exceed the lowest difference in time between any 2 consecutive samples associated with the CCV.	1. Correct problem and recalibrate 2. Reanalyze. 3. Document corrective action - samples cannot be analyzed until calibration control limit criteria have been met.
Calibration Blank	At beginning and end of run after the ICV and CCV, and at a rate of 10% during run or every 2 hours.	Less than CRQL.	1. Identify and correct problem. 2. Recalibrate, reanalyze sine the last good calibration blank. 3. Document corrective action - samples cannot be analyzed until blank control limit criteria have been met.

Table 13-6. *Metals NYSDEC ASP Method 6010B, Mercury NYSDEC ASP Method 7470A, 7471A, Cyanide NYSDEC ASP Method 9010B/9014, Thallium NYSDEC ASP Method 7841 Quality Control Requirements and Corrective Actions (where applicable)*

Audit	Frequency	Control Limits	Corrective Action
Preparation Blank Analysis	1 per batch of samples digested, or 1 in 20, whichever is greater.	Less than CRQL. If concentration is greater than CRQL, the lowest analyte concentration in the samples must be greater than 10 times the blank concentration. The blank concentration must not be below the negative CRQL.	1. Reprep and reanalyze affected samples. 2. Document corrective action - samples cannot be analyzed until blank criteria are met.
Equipment Blank	As required.	Compounds concentrations must be <CRQL.	1. Investigate problem; reanalyze to verify laboratory cross contamination is not a factor. 2. Notify the QAO immediately since resampling may be necessary.
LCS Analysis	Every 20 samples or each digestion batch. Prepared independently from calibration standards.	Recovery within 80% to 120%.	1. Stop analysis, locate and correct problem, recalibrate instrument and redigest, reanalyze samples since last satisfactory LCS. 2. Document corrective action.
Post Verification Spike Analysis	Every 20 samples or every digestion batch.	Recovery within 85% to 115%.	1. Dilute sample and reanalyze. 2. If recovery is still outside limits, contact QAO.
CRDL standard	For ICP (CRI), concentration at 2 times the CRQL at the beginning and end of the analytical sequence or 2 times per every 8 hours. For other methods, (CRA), concentration at the CRQL at the beginning and end of the analytical sequence or 2 times per every 8 hours.	Recovery within 80 % to 120%.	1. Document corrective action.
ICP Serial Dilution Analysis	Required when analyte concentration is >50 times the IDL after dilution for ICP.	An analysis of a 1:5 dilution of the sample should provide a result with 90% to 110% of the original determination (for concentrations 50x the IDL).	1. Qualify data. 2. Document corrective action.

Table 13-6. *Metals NYSDEC ASP Method 6010B, Mercury NYSDEC ASP Method 7470A, 7471A, Cyanide NYSDEC ASP Method 9010B/9014, Thallium NYSDEC ASP Method 7841 Quality Control Requirements and Corrective Actions (where applicable)*

Audit	Frequency	Control Limits	Corrective Action
Interference Check Sample Analysis	Beginning and end of each analytical run or twice during every 8 hours, whichever is more frequent for ICP.	Percent recovery of all elements should be between 80% and 120%.	1. Correct problem 2. Recalibrate. 3. Reanalyze samples analyzed since last satisfactory ICS. 4. Document corrective action.
Matrix Spike Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater.	Recovery within 75% to 125% (does not apply if sample conc > 4 X spike conc). Spike must contain analytes at concentrations listed in NYSDEC ASP.	1. Analyze post digestion/post distillation spike (with the exception of mercury). 2. Document corrective action.
Laboratory Duplicate Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater.	RPD 20% for concentrations > 5X CRQL. Absolute difference less than 2X CRQL otherwise.	1. Investigate problem and reanalyze. 2. Document corrective action.
Field Duplicate Analysis	Every 20 samples.	50% RPD for waters and 100% RPD for soil.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis.
Furnace Analysis	Every sample must be injected in duplicate and spiked; method of standard additions is required when the sample absorbance or concentration is ≥ 50% of the spike concentration and the %recovery is not within control limits.	%Recovery 85% to 115%, Relative Standard Deviation <20% for duplicate injection. MSA correlation coefficient > 0.995.	1. Reanalyze. 2. Dilute and reanalyze if <40% recovery, reanalyze if recovery 40%-60% and no MSA is required; if method blank fails second time, correct problem and reanalyze all associated samples. 3. If limits are still exceeded, qualify data. 4. Document corrective action.
Instrument Detection Limits (IDL)	In accordance with NYSDEC ASP.	Not applicable	Not applicable

Table 13-6. *Metals NYSDEC ASP Method 6010B, Mercury NYSDEC ASP Method 7470A, 7471A, Cyanide NYSDEC ASP Method 9010B/9014, Thallium NYSDEC ASP Method 7841 Quality Control Requirements and Corrective Actions (where applicable)*

Audit	Frequency	Control Limits	Corrective Action
Interelement correction for ICP	In accordance with NYSDEC ASP.	Not applicable	Not applicable
Linear Range for ICP	In accordance with NYSDEC ASP.	Not applicable	Not applicable

NOTE: Method is part of the New York State Department of Environmental Conservation *Analytical Services Protocol*, October 1995 Revisions

Table 13-7. *Total Organic Carbon Lloyd Kahn Method Quality Control Requirements and Corrective Actions.*

Audit	Frequency	Control Limits	Corrective Action
Holding Times	Samples must be digested and analyzed within holding time.	Total Organic Carbon: Analyze 14 days from collection.	If holding times are exceeded for initial or any reanalyses required due to QC excursions, notify the QAO immediately since resampling may be required.
Calibration Verification (ICV, CCV)	Four point calibration curve every month. ICV each time instrument is set up; verify with CCV at frequency of 10%. Analyze reagent blank every calibration.	80% to 120% of expected value. If used, correlation coefficient for first or second order curve must be ≥0.995.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document corrective action - samples cannot be analyzed until calibration control limit criteria have been met.
Preparation Blank Analysis	1 per batch of samples digested, or 1 in 20, whichever is greater.	Less than CRQL.	1. Reanalyze blank. 2. If limits are still exceeded, clean instrument and recalibrate analytical system and reprep and reanalyze affected samples if detected. 3. Document corrective action - samples cannot be analyzed until blank criteria are met.
Equipment blank	As required.	Compounds concentrations must be <CRQL.	1. Investigate problem; reanalyze to verify laboratory cross contamination is not a factor. 2. Notify the QAO immediately since resampling may be necessary.
LCS Analysis	Every 20 samples or each digestion batch. Prepared independently from calibration standards.	Recovery within laboratory control limits.	1. Reanalyze LCS 2. If recovery is still outside limits, contact QAO, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS. 3. Document corrective action.
MS Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater.	Recovery 75% to 125% (does not apply if sample conc > 4 X spike conc).	1. Reanalyze. 2. Document corrective action.

Table 13-7. *Total Organic Carbon Lloyd Kahn Method Quality Control Requirements and Corrective Actions.*

Audit	Frequency	Control Limits	Corrective Action
Laboratory Duplicate Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater.	RPD less than in-house limits for concentrations > 5X CRQL. Absolute difference less than CRQL otherwise.	1. Investigate problem and reanalyze. 2. Document corrective action.
Field Duplicate Analysis	Every 20 samples.	100% RPD for soil.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis.

NOTE: Method is part of the New York State Department of Environmental Conservation *Analytical Services Protocol*, October 1995 Revisions

13.6. Data assessment procedures

The procedures employed by the laboratory to assess the quality of data generated in the laboratory include, but are not limited to, the following:

- Determination of analytical precision per method
- Determination of analytical accuracy per method
- Determination of analytical completeness
- Determination of MDLs and PQLs.

Data quality reviews by analysts, supervisors, managers, laboratory directors, and QA personnel contribute to the total process.

Precision and accuracy may be assessed utilizing control charts. Control charts will consist of line graphs which provide a continuous graphic representation of the state of each analytical procedure. The standard deviation of the mean of the QC measurement is calculated and the upper and lower warning limits are set at plus or minus two standard deviation units. The upper and lower control limits are set at plus or minus three standard deviation units. Acceptable data are realized when results fall between the lower and upper warning limits. If the QC value falls between the control limit and the warning limit, the analysis should be scrutinized as possibly out of control.

In general, the accuracy of the methods will be determined by spiking the sample matrix with the analyte and by analyzing reference materials with known concentrations. The spiking levels will be selected to reflect the concentration range of interest. Percent recoveries of the spikes and reference materials will be calculated and compared to the established limits. The precision of the methods will be determined by the analysis of matrix spike and laboratory and field duplicate samples. The precision will be evaluated by calculating the RPD between the duplicates. RPD calculations will be compared to the established limits.

The definitions and equations used for the assessment of data quality are discussed below.

Accuracy - Is a measure of the nearness of an analytical result, or a set of results, to the true value. It is usually expressed in terms of error, bias, or percent recovery (%R).

Normally, the term accuracy is used synonymously with percent recovery. It describes either the recovery of a synthetic standard of known value, or the recovery of known amount of analyte (spike) added to a sample of known value. The %R or accuracy can be calculated by using:

standards: %R = (observed value/true value) x 100

spikes: %R = ((conc. spike + sample conc.) - sample conc. x 100)/conc. spike

Precision - Refers to the agreement or reproducibility of a set of replicate results among themselves without assumption of any prior information as to the true result. It is usually expressed in terms of the percent difference (%D) or RPD. The %D is calculated by using:

%D = (larger SR - smaller SR x 100)/ smaller SR

where SR is the sample result. The RPD is calculated by using:

RPD = (|OSR - DSR| x 100)/ ((OSR + DSR)/2)

where OSR is the original sample result and DSR is the duplicate sample result.

Average - The average or arithmetic mean (X) of a set of n values (Xi) is calculated by summing the individual values and dividing by n:

$$X = (\sum Xi_{I=1 \text{ to } n})/n$$

Range - The range (R_i) is the difference between the highest and lowest value in a group. For n sets of duplicate values (X_2, X_1) the range (R_i) of the duplicates and the average range (R) of the n sets are calculated by the following:

$$R_i = X_2 - X_1$$

$$R = \sum Ri_{i=1 \text{ to } n}/n$$

Standard Deviation and Variation - The standard deviation (S) of a sample of n results is the most widely used measure to describe the variability of a data set. It is calculated by using the following equation:

$$S = \sqrt{\frac{\sum (Xi - X)^2_{i-1 \text{ to } n}}{n}}$$

where X is the average of the n results and Xi is the value of result. Normally, X ± S will include 68% and X ± 2S includes about 95% of normally distributed data.

The variance is equal to S^2. The percent relative standard deviation (%RSD) or coefficient of variation (CV) is the standard deviation divided by the mean and multiplied by 100 as follows:

$$CV = 100S/X$$

The Laboratory QC Coordinator, with individual laboratory group leaders, will identify any data that should be rated as "unacceptable", based on the assessment of the QA/QC criteria. Data assessment will be evaluated during data validation and discussed in the data validation report(s).

14. Instrument/equipment testing and maintenance

Each major piece of analytical laboratory instrumentation that will be used on this project has been documented and is on file with the laboratory. An equipment form will be prepared for each new purchase and old forms will be removed from the instrument area and filed when an instrument is replaced.

The laboratory will be required to maintain an equipment form detailing both preventative maintenance activities and the required QA testing and monitoring. In the event the instrument does not perform within the limits specified on the monitoring form, the Laboratory Manager will be notified and a decision will be made as to what corrective action is necessary. The corrective action procedure shall be documented in the instrument log. If repair is necessary, an "out-of-order" sign will be placed on the instrument until repairs are completed. Repairs made to the instrument will be documented in the instrument log book. Required QA/QC testing and monitoring will be completed prior to the resumption of sample analysis.

Preventative maintenance procedures will be carried out on field equipment by O'Brien & Gere personnel in accordance with the procedures outlined by the manufacturer's equipment manuals. Maintenance activities involving field equipment will be recorded in the field notebook.

Routine maintenance is performed to keep laboratory instruments running under optimum conditions and to reduce instrument malfunction. Specific preventative maintenance programs outlining required maintenance procedures and their application frequencies are incorporated in laboratory SOPs for each methodology.

Minimally, field and laboratory instruments will undergo maintenance on an annual basis and when calibration, blank, or QC analyses indicate that maintenance is necessary to correct or improve system performance. Maintenance, whether performed by laboratory personnel or manufacturer, is documented as an entry in the appropriate log. Log entries include the reason for maintenance, maintenance performed, date, and initials of person in charge during maintenance.

The operating temperatures for refrigerators, coolers, ovens, water baths will be monitored by the laboratory daily. The analyst will record the following information in a bound log book: equipment ID, temperature reading, data and time of reading, and analysis initials.

15. Calibration and frequency

15.1. Field equipment calibration

Field equipment used to collect specific conductance, pH, temperature, flow, and turbidity data will be calibrated in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Equipment to be used for the field sampling will be examined to certify that it is in good operating condition. This includes checking the manufacturing's operating manual and the instructions for each instrument to ensure that the maintenance requirements are being observed.

Calibration of field instruments is governed by the specific Standard Operating Procedure for the applicable field analysis method. The calibration will be performed at the intervals specified by the manufacturers. In the event that an internally calibrated field instrument fails to meet calibration procedures, it will be returned to the manufacturer for service. Calibration procedures are discussed in Section 3 of the FSP.

15.2. Laboratory equipment calibration

Proper calibration of laboratory analytical instrumentation is essential for the generation of reliable data which meets the project's DQOs. Analytical instrument calibration is monitored through the use of control limits which are established for individual analytical methods. Calibration procedures to be followed are specified, in detail, in the analytical methods. These procedures specify the type of calibration, calibration materials to be used, range of calibration, and frequency of calibration.

The laboratory will be responsible for proper calibration and maintenance of laboratory analytical equipment. Calibration procedures are presented in the analytical methods and the laboratory QA Manual. The following subsections detail some of the calibration procedures outlined in the analytical methods and the laboratory QA Manual.

15.2.1. Gas chromatography/mass spectrometry (GC/MS)

Before the GC/MS is calibrated for volatile and semivolatile analysis, the mass calibration and resolutions of the instruments are verified by a 50 nanogram (ng) injection of 4-bromofluorobenzene (BFB) for VOCs or by a 50 ng injection of decafluorotriphenylphosphine (DFTPP) for SVOCs. The tune must meet the ion abundance criteria specified in the analytical method. The system must be verified every 12 hours of analysis and when the instrument performance check solution fails to meet criteria. After re-tuning, the performance check solution is reanalyzed. Samples are not analyzed until tuning criteria are met. For dioxin and dibenzofuran analysis, the instrument is tuned using perfluorokerosene (PFK) according to NYSDEC ASP Method 8290.

For volatile and semivolatile analysis, an initial five-point calibration is performed for the target compounds prior to start-up and whenever system specifications change or if the continuing calibration acceptance criteria have not been met. One of the calibration standards must be at a concentration near the method detection limit. A calibration curve is generated for unheated purge for water sample analysis. The relative response factors (RRFs) and percent relative standard deviation (% RSD) of specific compounds must meet established criteria as specified in the method. If these parameters fail to meet criteria, corrective actions must be implemented and the initial calibration must be repeated. A midpoint continuing calibration standard containing the target compounds is analyzed at the beginning of every 12 hour period following the GC/MS tune. This standard must meet specific QC limits listed in the method to verify that the initial five-point calibration is still valid. For dioxin and dibenzofuran analysis, the instrument is calibrated according to NYSDEC ASP Method 8290.

15.2.2. Gas chromatography

After determination of acceptable chromatograph resolution, detector sensitivity and chromatographic performance, calibration curves are generated from the analysis of standards at known concentrations covering the dynamic range of each analysis group for the primary and confirmation columns. The lowest concentration calibration standard establishes the quantitation limit based on the final volume of the samples. Recalibration of initial standard curves are completed when method criteria are not compliant. Compounds of interest will have a RSD of the response factors of the initial standard curve of less than 20%, a correlation coefficient or coefficient of determination of greater than 0.990 before analysis may begin.

At the beginning of each new analysis sequence and every 10 sample analyses (or 12 hour period), a mid-point standard must be analyzed to verify continued calibration. For analysis to continue, the response for the analytes of interest must not vary by more than 15%. In the event that calibration criteria are not met, a new calibration curve must be prepared for the compound.

The laboratory will calculate retention time windows for the standards on the GC columns and whenever a new GC column is installed.

If any of the calibration verification standards fall outside the daily retention time window, the system is out of control. The cause of the problem must be identified and corrected before sample analysis may resume.

15.2.3. Metals and inorganics

Instrument calibration for metal analyses is performed daily. A two point calibration for ICP analyses is performed. Five point calibrations are performed for spectrophotometers. The calibration curves must have correlation coefficients greater than or equal to 0.995. Calibration verification is monitored by analyzing a calibration verification standard and a calibration blank following calibration, every ten samples, and at the end of the analytical sequence. The calibration verification standard recovery must be within appropriate method criteria or the instrument must be resloped and, if necessary, recalibrated. The calibration blank must not contain target compounds at concentrations greater than the CRQL or corrective actions are implemented.

To verify interelement and background corrective factors for ICAP analysis, interference check samples (ICSA and ICSAB) must be analyzed at the beginning and end of the analysis sequence or a minimum of twice per eight hours. The percent recoveries for ICS solutions must be within 80% to 120% or corrective actions must be implemented. In addition, for ICAP analyses, a serial dilution analysis must be performed per sample matrix. If the analyte concentration is greater than fifty times the method detection limit (MDL) in the original sample, a serial dilution (five fold dilution) must agree within ten percent of the original determination. Detection limits, interelement corrective factors, and linear ranges must be established at the frequency specified in the method.

15.3. Standards and solutions

The use of standard materials of a known purity and quality is necessary for the generation of reproducible data. The laboratory will monitor the use of laboratory materials including solutions, standards, and reagents. Standards and standard solutions are obtained from the USEPA or USEPA-certified commercial vendors. Standard reference materials and performance evaluation materials are obtained from the NIST or USEPA-certified commercial vendors.

Standards and standard solutions are verified prior to use. This verification may be in the form of a certification from the supplier. Standards may also be verified by comparison to a standard curve or another standard from a separate source. Standards are routinely checked for signs of deterioration, including unusual volume changes, discoloration, formation of precipitates, or changes in analyte response.

Solvent materials are also verified prior to use. Each new lot of solvent is analyzed to verify the absence of interfering constituents. Reagent and method blanks are routinely analyzed to evaluate possible laboratory-based contamination of samples.

15.4. Records

A records book will be kept for standards and will include the following information:

- Material name
- Control or lot number
- Purity and/or concentration
- Supplier/manufacturer
- Receipt/preparation date
- Recipient's/preparer's name
- Expiration date.

These records will be checked periodically as part of the laboratory internal laboratory controls review.

15.5. Calibration records

A bound notebook will be kept with each instrument that requires calibration. The notebook will contain a record of activities associated with QA monitoring and instrument repairs. These records will be checked during periodic equipment review and internal and external QA/QC audits.

16. Inspection requirements for supplies

The use of standard materials of a known purity and quality is necessary for the generation of reproducible data. The laboratory will monitor the use of laboratory consumable materials including solutions, standards, and reagents. Standards and standard solutions are obtained from the USEPA or USEPA-certified commercial vendors. Standard reference materials and performance evaluation materials are obtained from the NIST or USEPA-certified commercial vendors.

Standards and standard solutions are verified prior to use. This verification may be in the form of a certification from the supplier. Standards may also be verified by comparison to a standard curve or another standard from a separate source. Standards are routinely checked for signs of deterioration, including unusual volume changes, discoloration, formation of precipitates, or changes in analyte response.

Solvent materials are also verified prior to use. Each new lot of solvent is analyzed to verify the absence of interfering constituents. Reagent and method blanks are routinely analyzed to evaluate possible laboratory-based contamination of samples.

The sample containers used for this project will be supplied by the laboratory. The containers will be pre-cleaned sample containers that will be purchased from a USEPA-certified manufacturer (I-Chem 200 or equivalent container).

17. Data acquisition requirements

Non-direct measurement data are not currently anticipated to be utilized for this project.

18. Data management

Data will be generated in the laboratory for critical methods and in the field for non-critical methods. The generated data will be entered into the laboratory database management system. Records described in Sections 8, 11.2, and 15.4 will be incorporated into the final project files for the samples. The data review process, described in Section 12.1 will be performed by the laboratory.

Field and analytical data collected during the investigation will be managed in a Foxpro relational database management system (DBMS). The DBMS will incorporate and relate data collected in the field, laboratory analytical data, and any applicable comparison data. Field data will be collected and documented in standardized field notebooks and chain of custody forms and hand entered into the database. Analytical data will be obtained from the laboratory in electronic disk deliverable (EDD) format for direct importation into the DBMS. Comparison data will be hand entered or electronically imported into the DBMS, depending on its existing format.

The DBMS will be available to the project team for custom queries and displays. The database will also be utilized to aid in Data Validation. Data qualifiers, resulting from the Data Validation, will be entered into the database to provide a validated data set. The DBMS will also be QA/QC checked against the hard copy data during this process.

19. Performance and system audits

19.1. Performance and system audits

At the discretion of the Project Manager, field and laboratory performance audits consisting of on-site performance evaluations will be performed once during the field program and during the laboratory analysis program. The audits will be performed by O'Brien & Gere's QAO or his designee. These audits will evaluate the adherence of the field and laboratory programs to the QA program outlined in this QAPP. The protocols used to conduct the audits may be found in the following sections. Acceptance criteria used in determining the need for corrective action will be those criteria defined in this QAPP. Where acceptance criteria are not defined for laboratory procedures and analytical methods, the laboratory's standard operating procedure and QA Manual will be consulted. The results of the field and laboratory audits will be documented and submitted to the Project Manager. These reports and any corrective actions which were implemented as a result of the audits will be included in the SRI report.

19.1.1. Laboratory audit protocol

The laboratory audit will note factors which may affect the quality of the analytical results. Minimum QA/QC criteria specified in this QAPP and the analytical methods must be adhered to. The areas of concern of the laboratory audit will include:

- Implementation of a scientifically sound QA/QC program addressing precision, accuracy, reproducibility, comparability, completeness, and blank contamination
- Sufficient documentation and record keeping for technical personnel external to the laboratory to recreate each analytical event
- Compliance with the project requirements for laboratory analysis.

The specific parameters to be evaluated include:

- Data comparability
- Calibration and quantitation
- QC execution

- Out-of-control events
- Standard operating procedures
- Sample management
- Record keeping
- Instrument calibration records
- Other analytical records
- QC records
- Corrective action reports
- Maintenance logs
- Data review
- Limits of detection
- QC limits
- Analytical methods.

19.1.2. Field audit protocol

The purpose of a field audit is to identify whether the systems and procedures described in the Work Plan and QAPP are operational in the field and contributing to the production of accurate and defensible analytical results. An on-site evaluation will be preformed by the QAO or his designee. The areas of concern in a field audit include:

- Sampling procedures
- Decontamination of sampling equipment, if applicable
- Chain-of-custody procedures
- Standard operating procedures
- Proper documentation in field notebooks.

19.2. System audits

Routine laboratory and field performance will be monitored through the analysis of equipment and laboratory blanks, spiked samples, laboratory control samples, laboratory and field duplicates, and performance evaluation samples. The Laboratory QC Coordinator, in conjunction with the QAO and the Project Manager, will formulate corrective actions in the event that QC limits specified in this document are exceeded. The results of the system audits will be documented in the Supplemental Remedial Investigation Report.

19.3. Corrective actions

Corrective action procedures will be implemented based on unacceptable audit results or upon detection of data unacceptableness during validation. Two types of audits will be performed during this investigation. The data generation process will be audited by assessing adherence to control limits and by performing an on-site laboratory audit, if requested by the Project Manager. The field program will be audited by assessing adherence to the procedures outlined in the FSP, the Work Plan and in this document by the analysis of field QC samples and by performing an on-site field audit, if requested by the Project Manager. If required, corrective action procedures will be developed on a case-by-case basis. The enacted corrective actions will be documented in the appropriate notebook, log, or case file. File and laboratory personnel are encouraged to discuss specific issues and proposed corrective actions with the QAO.

Generally, the following corrective actions may be taken by the laboratory. When calibration, instrument performance, and blank criteria are not met, the cause of the problem will be located and corrected. The analytical system will then be recalibrated. Sample analysis will not begin until calibration, instrument performance, and blank criteria are met. When matrix spike, reference standard, or duplicate analyses are out of control, samples analysis will cease. The problem will be investigated. Depending on the results of overall QC program for the sample set, the data may be accepted, accepted with qualification, or determined unusable. If the laboratory determines data to be unusable, those samples will be re-prepared and reanalyzed. If matrix interferences are suspected, samples will be subjected to one or more of the clean-up techniques specified in the analytical methods. If QC criteria are met upon reanalysis, only the new results are reported. If QC criteria are still not met upon reanalysis, both sets of sample results will be reported.

The laboratory will make every reasonable effort to correct QC excursions and to document the presence of matrix interferences. In this way, unnecessary resampling of difficult matrices may be avoided. However, if matrix interferences are not documented resampling may be required.

Corrective actions for the field investigation program, if required, will generally involve altering the incorrect field procedure to match the guidelines set forth in the FSP, the Work Plan and in this QAPP.

If problems arise with procedures or guidelines set forth herein, the client, the QAO, and the Project Manager, in conjunction with the appropriate agencies, will formulate an appropriate corrective action.

20. QA reports to management

The deliverables associated with the SRI investigation will contain separate QA sections in which data quality information collected during the investigation is summarized. These reports will be prepared under the direction of the Project Manager and will include the QAO's report on the accuracy, precision, and completeness of the data and the results of the performance and system audits, if required.

21. Data review, validation and verification

For data to be scientifically valid, legally defensible, and comparable, valid procedures must be used to prepare this data. Laboratory Analytical Level III (USEPA, 1987) documentation (NYSDEC ASP Category B) will be provided by the laboratory for each sample analysis.

21.1. Data production, handling and reporting

Specific laboratory procedures and instrumentation can be found in the QA Manual and/or standard operating procedures (SOPs) from the laboratory. The data production and reporting procedures described below will be employed at the laboratory.

21.1.1. Data reduction

Data reduction consists of manual and computer data reduction procedures and calculations. Computer data reduction procedures and calculations will be checked manually by the laboratory to verify that compound identification and quantitation adhere to method requirements. The laboratory will be responsible for maintaining a listing of computer-based data reduction programs and SOPs for data reduction. Sample preparation or extraction logs will be used to document sample preparation information (for example, preparation weights, volumes, reagents). Instrument injection logs or bench sheets will also be maintained for each instrument.

Qualitative identification and quantitation of organic analytes will be performed by experienced analysts in accordance with analytical method requirements.

21.1.2. Laboratory data review

Analytical results are generally entered into the laboratory computer system by the analyst, independently reviewed by another analyst or supervisor experienced in the method, and approved by the Laboratory Manager. The following are requirements that are generally examined as part of this review:

- Initial calibration criteria were met. Standards in the calibration curve covered the expected concentration ranges of the samples including the CRQL.

- Initial and continuing calibrations met the acceptance criteria defined in the method standard procedure.
- Sample results fell within the range of the standard curve.
- For GC/MS methods requiring internal standards, retention times and area responses were evaluated against limits established by the daily calibration.
- Method blanks were processed with each analytical batch and no detectable levels of contamination were identified.
- MS/MSDs were performed at the required frequency and recoveries were within acceptable control limits.
- Duplicate analyses were performed at the required frequency and results were within the control limits.
- LCS analyses were performed with each analytical batch and the results obtained were within control limits.
- For organic compound analyses, surrogate spike recoveries were within control limits.
- Compounds identified by GC/MS have been manually rechecked by comparison with the data system library for both target compounds and tentatively identified compounds if required. Retention times and ratios of fragmentation were verified.
- Calculations have been accurately performed.
- Reporting units are correct.
- Data for the analysis provide a complete audit trail.
- Reported detection limits comply with data quality indicator requirements.

The analyst's supervisor will check a minimum of 10% of the data back to raw data in the secondary review. When required analyses on the samples in a project are complete, entered, and reviewed, a report will be generated. The report will be forwarded to the assigned Laboratory Project Supervisor or designee for review. The report will then be reviewed for the following items (at a minimum):

- QC data will be reviewed to identify whether or not internal specification and contract requirements have been met.
- Non-conformance reports, if any, will be reviewed for completion of corrective actions and their impact of results. Tables 13-1 to 13-7 in this QAPP will be referenced in the laboratory review process. Non-

compliance and corrective action procedures will be documented in the case narrative in the final report.

The report requires the signature of the Laboratory Project Supervisor or designee. Electronic data are copied onto computer tape, inventoried, and stored off-site in a secure facility, or within locked cabinets on site. This data archive system is maintained for a minimum of ten years.

Following final review, two copies of the report will be transmitted to O'Brien & Gere.

Analytical data packages which are fully validatable, and document sample preparation, extraction, and analysis, will be provided for the analyses. Data report forms will be securely bound and the pages will be sequentially numbered. The analytical reports for sample matrices will conform to the deliverable requirements included in NYSDEC ASP Category B. In addition to the hardcopy version of the analytical data packages, the laboratory will provide electronic deliverables.

22. Data validation

Data validation will be performed by Karen Storne of O'Brien & Gere for data generated by Axys Analytical Services Ltd. and H2M Labs, Inc. and by Judy Harry of Data Validation Services for data generated by O'Brien & Gere Laboratories, Inc. Data validation will be performed utilizing the QA/QC criteria established in this QAPP, as listed in Tables 13-1 to 13-7, the analytical methods, and/or the laboratory established criteria. Excursions from QA/QC criteria will be qualified based on guidance provided in the following documents or the most recent USEPA Region II data validation guidelines:

- United States Environmental Protection Agency (USEPA) Region II Data Validation Standard Operating Procedure for SW-846 Method 8290 Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) By High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry (HRGC/HRMS), SOP No. HW-19, Revision 1, October, 1994b.

- United States Environmental Protection Agency (USEPA) Region II Data Validation Standard Operating Procedure for Contract Laboratory Program (CLP)/Statement of Work (SOW) OLMO3.1, SOP No. HW-6, Revision 10, October, 1995.

- United States Environmental Protection Agency (USEPA) Region II Evaluation of Metals Data for the Contract Laboratory Program (CLP) based on SOW 3/90, SOP No. HW-2, Revision 11, January 1992.

Data validators will be responsible for reviewing the QC parameters as listed below. Data validators will recalculate approximately 10% of the laboratory sample calculations using raw data when verifying sample results. In addition, data validators will review approximately 10% of the raw data to verify that compound identification was performed correctly and transcription errors are not present.

Data quality will be evaluated using method control limits, or, if unavailable, laboratory control limits, as specified in Tables 13-1 through 13-7. When possible, laboratory control limits will be evaluated against control limits established in the analytical methods. When method control limits are not available, professional judgement will be used by the data validators to verify that laboratory control limits will produce data of high quality. Any control limits outside of the acceptable range specified in the method shall be identified. Sample data will be qualified based on excursions from control limits. Data not within control limits require corrective action by the laboratory. Data validators will check corrective action reports and results of reanalysis if available. Corrective actions implemented by the laboratory will be referenced in the data validation report.

Minor deficiencies in the data generation process noted in the data validation will result in approximation of sample data. Approximation of a data point indicates uncertainty in the reported concentration of the chemical but not its assigned identity. Major deficiencies noted in the data validation will result in the rejection of sample results. Rejected data would be considered unusable for quantitative or qualitative purposes. Data qualifiers may include the following:

U	Indicates that the compound was analyzed for, but was not detected. The sample quantitation limit is presented and adjusted for dilution and percent moisture. This qualifier is also used to signify that the detection limit of an analyte was raised as a result of analytes detected in laboratory and/or field blank samples.
J	Indicates that the detected sample result should be considered approximate based on excursions from QA/QC criteria. Additionally, for organic analyses this qualifier is used either when estimating a concentration for tentatively identified compounds or when the mass spectra data indicate the presence of a compound that meets identification criteria but, the sample result is less than the compound quantitation limit.
UJ	Indicates that the detection limit for the analyte in this sample should be considered approximate based on excursions from QA/QC criteria.
R	Indicates that the previously reported detection limit or sample result has been rejected due to a major excursion from QA/QC criteria, for example percent recoveries of less than ten percent. The data should not be used for qualitative or quantitative purposes.

If compounds are detected in laboratory and/or field blanks at concentrations greater than CRQL, data will be qualified based on blank action levels calculated at five times (ten times for common laboratory contaminants) the highest concentration detected in the associated blanks. Samples collected, prepared, or analyzed in conjunction with contaminated blanks, which contain analytes less than calculated action levels will be qualified as blank contaminants and flagged with the "U" qualifier. For solid samples, the action level will be calculated taking into account preparation weights and volumes and percent solid determinations. Qualification of sample results will be based on date of analysis for calibration blanks, date of sample preparation for method blanks, and date of sample collection for trip and equipment blank samples.

The following method specific QA/QC parameters will be evaluated during the data validation, where applicable.

22.1. GC/MS analyses for VOCs and SVOCs

- Holding Times and Sample Preservation
- Percent Solids
- GC/MS Instrument Performance Check
- Initial and Continuing Calibration
- Blank Analysis
- Surrogate Recovery
- MS/MSD Analysis
- Field Duplicate Analysis
- LCS Analysis
- Internal Standards Performance
- Compound Identification and Quantitation
- Reported Detection Limits
- Tentatively Identified Compounds
- System Performance
- Documentation Completeness
- Overall Assessment.

22.2. GC analysis for VOCs, Pesticides and PCB analysis

- Holding Times and Sample Preservation
- Percent Solids
- Calibration and GC Performance
- Analytical Sequence Check
- Retention Times
- Blank Analysis
- Surrogate Recovery
- MS/MSD Analysis
- Field Duplicate Analysis
- LCS Analysis
- Compound Quantitation
- Compound Identification
- Confirmation Analysis
- Cleanup Efficiency Verification
- Reported Detection Limits
- System Performance
- Documentation Completeness
- Overall Assessment.

22.3. GC/MS analyses for PCDDs and PCDFs

- Holding Times and Sample Preservation
- Percent Solids
- Mass Calibration
- GC Column Performance Check Solution
- Initial and Continuing Calibration
- Blank Analysis
- Internal Standard Criteria
- Recovery Standard Criteria
- MS Analysis
- Laboratory Duplicate Analysis
- Field Duplicate Analysis
- Compound Identification and Quantitation (10% Frequency)
- Estimated Detection Limits (EDLs)
- Estimated Maximum Possible Concentration (EMPC)
- Confirmation Analysis
- System Performance
- Documentation Completeness
- Overall Assessment.

22.4. Metal and inorganic analysis (where applicable)

- Holding Times and Sample Preservation
- Percent Solids
- Initial and Continuing Calibration
- Contract Required Detection Limit (CRDL) Standard
- Blank Analysis
- MS/MSD Analysis
- Laboratory Duplicate Analysis
- Field Duplicate Analysis
- LCS Analysis
- Furnace Atomic Absorption QC Analysis (if required)
- ICAP Interference Check Sample Analysis
- ICAP Serial Dilution Analysis
- Analyte Quantitation
- Reported Detection Limits
- Verification of Instrument Parameters
- Instrument Detection Limits
- Linear Ranges
- Instrument Performance
- Documentation Completeness
- Overall Assessment.

23. Reconciliation with user requirements

Validated sample results from this SRI will be reviewed by the Project Coordinator and the Project Manager. Data usability with respect to the data quality objectives and data uses will be compared to the project requirements. The parameters that will be used to assess the precision, accuracy, representativeness, comparability, and completeness, are presented in Sections 5 and 13 of this QAPP. In the event that the completeness objective of 90% is not achieved due to major quality control deviations in the sample analysis process, samples will be recollected at the discretion of the NYSDEC Project Manager.

Limitations of the data usability will be reported to NYSDEC and USEPA through the data validation report and the Supplemental Remedial Investigation Report. The data validation report will describe the reasons for data qualification and the Supplemental Remedial Investigation Report will summarize the impact of the qualified data on the data usage.

References

APHA, AWWA, WPCF. *Standard Methods for the Examination of Water and Wastewater*, 18th Edition, Washington, D.C. 1992.

New York State Department of Environmental Conservation. *RCRA Quality Assurance Project Plan Guidance*. 1991.

New York State Department of Environmental Conservation. *NYSDEC Analytical Services Protocol (ASP) Methods, 1995 Revisions*. 1995.

United States Environmental Protection Agency. *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80*. 1980.

United States Environmental Protection Agency. *Data Quality Objectives for Remedial Response Activities, EPA/540/6-87/003*. 1987.

United States Environmental Protection Agency. *Determination of Total Organic Carbon in Sediment*, Region II, Environmental Services Division, Monitoring Management Branch, Edison, New Jersey. 1988.

United States Environmental Protection Agency. *Region II Evaluation of Metals Data for the Contract Laboratory Program (CLP) based on SOW 3/90*, SOP No. HW-2, Revision 11. 1992.

United States Environmental Protection Agency. *EPA Requirements For Quality Assurance Project Plans For Environmental Data Operations*, EPA QA/R-5. 1994a.

United States Environmental Protection Agency. *Region II Data Validation Standard Operating Procedure for SW-846 Method 8290 Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) By High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry (HRGC/HRMS)*, SOP No. HW-19, Revision 1. 1994b.

United States Environmental Protection Agency. *Region II Data Validation Standard Operating Procedure for Contract Laboratory Program (CLP)/Statement of Work (SOW) OLMO3.1*, SOP No. HW-6, Revision 10. 1995.

ATTACHMENT A

Quality Assurance Officer and Data Validator Resumes

Stuart J. Spiegel

O'Brien & Gere Engineers, Inc.

Managing Scientist

PROFESSIONAL PROFILE

Mr. Spiegel joined the firm in 1973 as a laboratory microbiologist. He has been involved with state and federal regulatory issues since the early 1970s, and is thoroughly familiar with their applications. Mr. Spiegel manages the activities of scientists engaged in environmental assessment, environmental audits, property and corporate acquisitions, permitting, water quality impact evaluation, air pollution control, ecological studies, and other environmental quality programs.

Education

Syracuse University, 1972, BS/Biology
Syracuse University, 1977, MS/Sanitary Science

Professional Registrations

Specialist in Food, Dairy and Sanitary Microbiology, National Register of Microbiologists since 1979.

Professional Affiliations

American Society for Limnology and Oceanography
American Society for Microbiology
American Society for Testing and Materials
American Water Resources Association
International Association for Great Lakes Research
Society for Environmental Toxicology and Chemistry
Water Environment Federation
TAPPI
Co-Chairman, Government Affairs Committee, New York Water Pollution Control Association, 1986-1988
Attendee, Gordon Research Conference, Environmental Science-Water (Chemical-Biota Interactions), June 1986.
Adjunct Assistant Professor, Department of Civil Engineering, L.C. Smith College of Engineering, Syracuse University, 1979-1988.
Technical Writing Advisory Committee, State University of New York College of Agriculture and Technology, Morrisville, NY

REPRESENTATIVE PROJECTS

DATA VALIDATION

Mr. Spiegel has directed QA/QC and data validation efforts for a variety of clients. He started his career and was the quality control officer for O'Brien & Gere Laboratory for two years. For three years, he has been responsible for data validation services provided by the firm. Project tasks have been performed as part of CERCLA, RCRA, VCAP and related state programs, as well as corporate and property acquisitions, and have included:

- preparation of QAPPs and SOPs
- QA/QC for field and laboratory activities
- data validation of analyses for organic and inorganic compounds
- data validation in support of litigation
- data validation of samples analyzed for dioxins and furans
- reduced scale data reviews for screening purposes
- advisory role for project QA/QC issues

Major clients have included:

- General Motors
- US Air Force
- Rail car manufacturer (confidential)
- Hudson River study
- TRW
- Lexmark International (formerly a division of IBM)
- Allison Gas Turbine (formerly a division of GM)
- AlliedSignal
- GE
- WR Grace

SITE ASSESSMENT:

Mr. Spiegel has performed site investigations involving the management of field investigations or evaluation of data to determine potential contamination at sites around the country. His clients have included:

Gunlocke Company, Wayland, NY - Managed a site investigation for a property listed on the New York State List of Inactive Hazardous Waste sites. Site issues involved disposal of solvent impregnated rags. Project responsibilities included preparation of a delisting petition.

City of Geneva, NY - Field investigation of a 55-acre site to assess potential waste disposal issues, including solvents, heavy metals, PCB and petroleum hydrocarbon. A petition was prepared and accepted by the State not to add the property to the state inactive hazardous waste site list.

Hinman, Howard & Kattell, Binghamton, NY - Site investigation of a property of the Weitsman Site, Owego, NY on the New York State List of Inactive Hazardous Waste sites. Site issues involved heavy metal and trace organic constituents of foundry wastes. O'Brien & Gere was able to prove that hazardous waste had not been deposited on-site, and had the site delisted.

Rhino Trust, New York City, NY - Remediation and delisting petition for one parcel contaminated by lead. Site investigation and remediation of an adjacent parcel on the New York State List of Inactive Hazardous Waste Sites, presumptively for lead and 4-chloroaniline contamination. Preparation of a delisting petition for the property which was accepted by the state after implementation of an IRM.

Pilliod Company, AL - Preparation of a successful petition to have a facility delisted from the CERCLIS list based on a site assessment and evaluation of historical practices.

City of Oswego, NY - Site investigation, and evaluation of remedial measures and costs for the Breneman Building, a former manufacturing facility on the CERCLIS list. Issues included solvents, PCBs, USTs, paint formulations and petroleum product.

Harvard Industries - Litigation assistance in a cost recovery action relative to remediation at an NPL site in Ohio. Assisted with settlement negotiations and development of position papers for pre-litigation and mediation meetings. The litigation settled out of court.

Motorola, Arcade, NY
Syracuse Chamber of Commerce
Bond, Schoeneck & King, Attys., Syracuse
Nixon, Hargrave, Devans & Doyle, Attys., Rochester
Jones, Day, Reavis & Pogue, Attys., NYC
Gunlocke Industries, Weyland, NY
Sithe Energies, NYC
Baker & Hostetler
Indeck Energy Services, Chicago, IL
Collier, Shannon, Rill & Scott, Attys., Washington, DC
Niagara Mohawk Power Corporation
Alcan Aluminum, Cleveland, OH
New York State Energy Research and Development Authority (NYSERDA)
GTE

ENVIRONMENTAL CHEMISTRY AND BIOLOGY:

Mr. Spiegel has developed procedures, tests, and testing guidelines for a broad range of practical and research applications. His experience includes specialized projects in the toxicity of industrial effluent to biological treatment processes, development of indicators of microbial pollution, and applications of microbial bioassays. A representative listing of such projects includes:

Hudson River Water Treatability Study - Prepared study evaluating drinking water treatment options for Hudson River water.

Development of wastewater treatment plant performance testing techniques for use as part of a drain operations guide for an office equipment manufacturer.

Technical consultation for the city of Pittsfield, MA, during outbreak of Giardia lamblia in the City water system.

Development of a rapid inexpensive microbial bioassay system for the evaluation of potentially hazardous and toxic wastes.

Investigations of priority pollutants metal toxicity to municipal activated sludge processes.

Soil column studies to investigate PCB solubilization, migration and adsorption at a waste disposal site.

Analytical microbiology, especially in the area of water pollution indicators, including routine and biochemical analysis of indicators and water borne pathogens.

Evaluation of luciferin-luciferase adenosine triphosphate (ATP) rapid measure of microbial contamination in water treatment and surface waters.

Preparation of project report for the New York State Department of Environmental Conservation regarding the study of PCB and trihalomethane treatability in a Hudson River drinking water source.

APPOINTMENTS

Member, subcommittee on Membrane Filter Technic, Standard Methods for the Examination of Water and Wastewater, 15th Edition (1980).

Member, subcommittee on Rapid Methods in Microbiology, and the Joint Task Group on Bacteriological Examination of Recreational Waters, Standard Methods, 16th Edition (1985).

Wastewater Biology Task Force, Technical Practice Committee, Water Pollution Control Federation (1987).

Simplified Laboratory Procedures, Technical Practice Committee, Water Pollution Control Federation (1985).

REVIEWER

Former Journals:

Journal of the Water Pollution Control Federation
Freshwater Biology
Water Resources Bulletin

Presently:

WEF Publication, in preparation: **Wastewater Biology: The Habitats**

SELECTED PUBLICATIONS

Wilson, D.J., and S.J. Spiegel, 1997. **Elements of Industrial Health and Safety Programs**. AFE Facilities Engineering J. 24(3):15-18 (May/June).

Tifft, Edwin, C., Jr., and Stuart J. Spiegel, 1976. **Use of adenosine triphosphate assay in disinfection control**. Environ. Sci. Technol. 10:1268-1272.

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Spiegel, Stuart J., 1977. **Comparison of adenosine triphosphate (ATP) with classical estimates of aquatic microbial biomass in a eutrophic lake: Onondaga Lake, New York**. M.S. Thesis, Syracuse University, Syracuse, NY.

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Tong-Ngork, T., S.D. Field, S.J. Spiegel, and S.W. Effler, 1978. **Bacterial trends in a lake receiving copper sulfate treatment**. Abstr. Ann. Mtg. Am. Soc. Lmnol. Oceanog.

Spiegel, Stuart, J., and David R. Hill, 1978. **Relationship of fecal coliforms and suspended solids in combined sewer overflows.** Abstr. Ann. Mtg. Am. Soc. Microbiol. p. 212:Q103.

Hill, David R., Stuart J. Spiegel, and Randy R. Ott, 1978. **Statistical correlations of BOD:TOC:COD in industrial wastes,** p. 67-70. In: J.B. Carberry (ed.), Proceedings of the 10th Mid-Atlantic Industrial Waste Conference, Newark, Delaware.

Spiegel, Stuart J. 1978. **Mechanism of chlorine disinfection - progress in the search**. Clearwaters 8:17.

Spiegel, Stuart J. 1979. **Evaluation of the relationship between indicator bacteria and suspended solids in combined sewer overflows.** Presented at 22nd Conf. on Great Lakes Res., April 30-May 3, Rochester, NY.

Hill, David R., and Stuart J. Spiegel, 1979. **Making the connection: BOD, TOC, and COD in industrial wastes.** Ind. Wastes 25:21-22.

Szelewski, M.J., D.R. Hill, S.J. Spiegel, and E.C. Tifft, Jr., 1979. **Loss of polychlorinated biphenyl homologues during chromium trioxide extraction of fish tissue.** Anal. Chem. 51:2405-2407.

Spiegel, Stuart J., and Dwight A. MacArthur. 1980. **Conflict in water resources management: Sections 201 and 208 implementation.** Presented at the American Water Resources Association Unified River Basin Management Symposium, Gatlinburg, TN, May 4-7.

Hill, D.R., and S.J. Spiegel, 1980. **Characterization of industrial wastes by evaluation of the relationships between BOD, COD and TOC.** J. Water Pollut. Control Fed. 52(11):2704-2708.

Spiegel, Stuart J., 1981. **Status of groundwater law in New York State.** Clearwaters 11:15-16.

Murphy, C.B., Jr., and S.J. Spiegel. 1982. **Bioaccumulation and toxicity of heavy metals and related trace elements** (review). J. Water Pollut. Control Fed. 54:849-854.

Hale, F.D., and S.J. Spiegel. 1983. **Biological treatability of toxic and hazardous materials.** Presented at the First International Symposium on Toxicity Testing Using Bacteria, Burlington, Ontario, Canada, May 1983.

Murphy, C.B., Jr. and S.J. Spiegel. 1983. **Bioaccumulation and toxicity of heavy metals and related trace elements.** (Review). J. Water Pollut. Control Fed. 55(6):816-822.

Spiegel, Stuart J. 1984. **Future of biological treatment in the age of toxic wastes.** Clearwaters. 13(4):22-23.

Farmer, J. Kevin, Stuart J. Spiegel, and Steven R. Garver. 1984. **Rational procedures for establishing discharge concentration limits in municipal sewer use ordinances.** Presented at the Mid-Atlantic Industrial Waste Conf., University Park, PA.

Spiegel, Stuart J. 1984. **Drop by drop - the potential health impacts of acid precipitation.** Presented at the Medical Geology Conference on Health Threatening Toxins in Water, Brooklyn College, Brooklyn, NY.

Spiegel, Stuart J., Edwin C. Tifft, Jr., Cornelius B. Murphy, Jr. and Randy R. Ott. 1984. **Evaluation of Urban Runoff and Combined Sewer Overflow Mutagenicity.** U.S. Environmental Protection Agency Report No. EPA-600/S2-84-116, Cincinnati, OH.

Spiegel, S.J. 1984. **In vitro bioassay for the determination of activated sludge inhibition by priority pollutant metals.** Presented at the 57th Ann. Mtg. Water Pollut. Control Fed., New Orleans, LA.

Spiegel, S.J., J.K. Farmer, and S.R. Garver. 1985. **Heavy metal concentrations in municipal wastewater treatment plant sludge.** Bull. Environ. Contam. Toxicol. 35:38-43.

Spiegel, Stuart J. 1985. **Application of a bioassay for the determination of heavy metal impacts on activated sludge.** Presented at the 2nd Int'l. Symp. on Toxicity Testing Using Bacteria, Banff, Alberta, Canada.

Eddington, G., and S.J. Spiegel. 1985. **Industrial impacts before and after pretreatment - Geneva STP.** Presented at the Spring Meeting, New York Water Pollut. Control Assoc., Lake Placid, NY.

Cundall, C.L., and S.J. Spiegel 1986. **Case studies in environmental audits; a practical focus for plant managers and auditors.** Presented at the American Institute Chemical Engineers. Summer National Meeting, Boston, MA, August 24-27.

Rinko, J., and S.J. Spiegel. 1988. **Control and safety review of semiconductor industrial processes utilizing diborane.** Presented at the 81st Ann. Mtg. Air Pollut. Control Assoc., Dallas.

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Karen A. Storne

O'Brien & Gere Engineers, Inc. Project Scientist

PROFESSIONAL PROFILE

Ms. Storne joined O'Brien & Gere Engineers, Inc. in 1993 as a Project Scientist after having worked for O'Brien & Gere Laboratories as a Senior Chemist for five years. Ms. Storne has eleven years of experience working in the environmental and industrial hygiene field. Her current responsibilities include data validation, laboratory audits, quality assurance/quality control oversight and preparation of quality plans. Her responsibilities have included the operation of the following instruments: gas chromatograph/mass spectrometers, volatile and semivolatile organic gas chromatographs, fourier transform infrared spectrophotometers, high pressure liquid chromatographs, atomic absorption spectrometers. Her analytical chemistry experience also includes various sample preparations, wet chemistry techniques, data generation and interpretation.

Education

Syracuse University, 1987, BS/Chemistry
S.U.N.Y. at Upstate Medical Center, 1979, A.A.S./Respiratory Therapy
Herkimer County Community College, 1976, AS/Science
Hewlett Packard Mass Spectrometry Techniques and Interpretation Course, 1988
Audited CHE 575 Organic Spectroscopy, Syracuse University, 1989

Professional Affiliations

American Chemical Society

Special Training

Hazardous Waste Operations Training, 40-Hour OSHA Certificate
ISO 9000 Internal Auditor Training Course

TECHNICAL EXPERTISE

- Data validation, interpretation and usability assessments to qualify analytical sample results according to various state agency and USEPA Contract Laboratory Program (CLP) guidelines.

- Working knowledge of USEPA analytical methods including SW-846, CLP, water and wastes, and New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP).

- Quality assurance and quality control oversight for field and laboratory procedures.

- Preparation of Quality Assurance Project Plans (QAPPs) and Sampling and Analysis Plans (SAPs).

- Conduct laboratory audits.

- Technical coordinator for analytical data validation and chemical QA/QC.

REPRESENTATIVE PROJECTS

DATA VALIDATION:

AlliedSignal, Hudson County Site - Performed data validation reports for over 2,300 hexachromium analyses along with total chromium, TCL organics, and TPH analyses in accordance with NJDEPE requirements.

Electronics Manufacturer - Prepared a series of data validation/data usability reports for volatile organic and PCB data collected in connection with the private well sampling and public water connection, as well as remedial investigation programs. Validation was performed in accordance with USEPA Region II guidelines.

W.R. Grace - Performed data validation for 60 water samples analyzed by USEPA Method 601/602 and 8010/8020. The validation report was prepared in accordance with USEPA Region III guidelines.

TRW, Inc. - Performed the data validation and prepared several Data Validation/Data Usability Reports for data collected in connection with a Description of Current Conditions Report for a former TRW site .

Electronics Manufacturer - Performed data validation in accordance with NYSDEC protocol for surface water samples, and prepared a data validation/ data usability report.

Electronics Manufacturer - Performed data validation and prepared a data validation/data usability report for soil samples analyzed for polychlorinated dibenzofurans (PCDFs) and PCBs using USEPA SW-846 Methods 8290 and 8081 respectively, in accordance with National Functional Guidelines.

Railcar Manufacturer - Prepared data validation/data usability report for the analysis of over 350 samples for PCBs, in accordance of USEPA National Functional Guidelines.

U.S. Air Force - Patrick AFB and Cape Canaveral Air Force Station - Performed data validation for over 1000 analyses including soil, sediment, water, and biota samples analyzed for volatiles, semivolatiles, pesticides, PCBs, metals, TOCs, and explosive residues performed under AFCEE protocol. Data validation/usability reports were prepared and QA/QC laboratory oversight was performed.

U.S. Air Force - Eglin AFB - Prepared data validation/usability report for the analyses of 200 samples analyzed for volatiles, semivolatiles, pesticides, PCBs, metals, TOCs, and explosive residues in accordance with AFCEE protocol.

U.S. Air Force - Youngstown AFB - Performed data validation and prepared a validation report for 30 samples in connection with the U.S. Air Force Installation Restoration Program.

Electronics Manufacturer - Prepared a data validation/usability report for an Ohio site for water samples analyzed for volatiles, semivolatiles, PCBs, TPHs, metals, and cyanide using National Functional Guidelines.

General Motors - Performed data validation for 250 samples including soil, sediment, and water in accordance with USEPA National Functional Guidelines.

Dorney Road Landfill Site - Performed data validation for water samples analyzed for USEPA Method 524.2 in accordance with USEPA Region III guidelines.

Gibbs & Hill - Performed data validation of full CLP documentation from H_2M Labs, Inc. in support of a Phase 2 hazardous waste investigation. Included 35 potential hazardous waste sites, generating over 350 samples.

Wehran-New York, Inc., NYSDEC GFIM Landfill Site - Performed data validation of GC/MS volatile and semivolatile data packages from analyses performed by York Laboratories.

AlliedSignal, Willis Avenue Site - Performed data validation for samples analyzed by volatiles, semivolatiles, pesticides, PCBs, metals, and cyanide using NYSDEC ASP methods and USEPA methods.

QUALITY ASSURANCE/QUALITY CONTROL:

AlliedSignal, Hudson County Site: Conducted laboratory audit at the Envirotech Research, Inc. laboratory which performed over 2,300 hexachromium and total chromium analyses and over 220 TCL organic (volatiles, semivolatiles, PCBs), TAL metals, and TPH analyses using USEPA and NJDEPE methods.

Electronics Manufacturer - Prepared a Quality Assurance Project Plan for the analysis of soil samples by USEPA SW846 Methods 8290 (Dioxins) and 8081 (PCBs).

Niagara Mohawk - Prepared a Quality Assurance Project Plan in accordance with NYSDEC RCRA and USEPA guidance for the analysis of volatiles, semivolatiles, and PCBs in ground water, surface soil, subsurface soil and surface water samples.

U.S. Air Force - Prepared a data validation Standards Operating Procedure for the validation of over 2000 environmental samples analyzed for volatiles, semivolatiles, pesticides, PCBs, metals, TOCs, and explosive residues in connection with the U.S. Air Force Installation Restoration Program projects conducted by O'Brien & Gere.

Participated in a laboratory audit of Upstate Laboratories, Syracuse, NY, for compliance with regulations outlined in the NYSDEC Analytical Services Protocol.

U.S. Air Force Center for Environmental Excellence - Functioned as Quality Assurance Officer for several USAF projects involving laboratory quality oversight and data validation oversight.

Railcar Manufacturer - Performed audit at the OHM Mobile Laboratory utilized to analyze over 1500 samples for PCBs using USEPA Method SW-846 8081.

PRP Group - Prepared a Quality Assurance Project Plan in connection with the Tennessee Department of Environmental Conservation Voluntary Cleanup, Oversight, and Assistance Program guidance.

GTE - Prepared a Quality Assurance Project Plan in accordance with NYSDEC guidance. The QAPP addressed ground water, soil, surface soil samples to be analyzed for organics, inorganics, and radionuclides.

General Motors - Prepared a Quality Assurance Project Plan in accordance with USEPA CERCLA and Michigan Department of Natural Resources guidelines.

Smith Corona - Prepared Data Collection Quality Assurance Project Plan to address the ground water monitoring associated with operation, maintenance, and monitoring activities of a ground water treatment system.

ANALYTICAL CHEMISTRY:

Ms. Storne's responsibilities while at O'Brien & Gere Laboratories involved GC/MS analysis of drinking water, wastewater, sediment, soils, industrial effluents and hazardous waste. Included with these responsibilities was quantitation and interpretation of mass spectral data, quality assurance/quality control analysis of data and instrument maintenance. Ms. Storne is experienced in USEPA Contract Laboratory

Program (CLP) and USEPA Methods 624 and 8240, data interpretation, documentation, diskette deliverable generation, and quality control requirements. Projects which Ms. Storne has participated in include:

Niagara Mohawk Power Corporation - An RI/FS for NYSDEC which involved processing 70 samples in a two-week period. Tasks included the analysis, data review and generation of CLP deliverable packages for the entire program.

U.S. Army Corp of Engineers, Raritan Arsenal Site RI/FS - Analyzed approximately 140 samples in 3 months for volatile organics by CLP protocol with full documentation, chain-of-custody and generation of evidence files.

U.S. Army Corp of Engineers, Fort Leavenworth Military Reservation - Analysis of over 150 soil samples for GC/MS volatile organics for an RI/FS.

U.S. Air Force, Duluth International Airport Site - Interim Remedial Measure/Ground Water Monitoring of the Duluth IAP. Responsibilities included sample analysis and generation GC/MS VOA data, along with review of final laboratory package.

Electronics Manufacturer - REI involving GC/MS volatile analysis of soil samples by CLP protocol.

AlliedSignal, Semet Ponds Site - Analysis of water and soil samples for site assessments as part of an RI/FS program in connection with an industrial site in Solvay, NY.

PUBLICATIONS

Vacuum-Ultraviolet Emission Detection of Organometallic Multiphoton Ionization and Discharge Processes in Bulk Gases. The Journal of Physical Chemistry, 1992, Jeanne M. Hossenlopp, Karen A. Storne, and J. Chaiken.

Common Laboratory Errors That Lead to Rejected Environmental Data: Awareness and Solutions, Proceedings of the International Symposium of the American Public Works Association, April 1995.

A Criteria Review of New USEPA Quick Turnaround Methods, Water Environment Federation Symposium, Environmental Laboratories: Testing the Waters, August 1995.

EPA's Quick Turnaround Methods, the Limits to No-Wait Analysis, Waste Environmental Laboratory Solutions, April/May 1996.

Establishing Baseline Field QC Requirements: EPA's Quick Turnaround Methods, Specialist Workshop on Field-Portable Chromatography and Spectrometry, June 1996, Karen Storne, Howard Fribush (USEPA).

Automated Data Validation: What Are the Limitations, Proceedings of the Waste Testing and Quality Assurance Symposium, July 1996.

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North Creek, NY 12853

Occupation:	Data Validator/Environmental Technical Consultant
Years Experience:	22
Education:	B.S., Chemistry, Magna cum laude, 1976, Phi Beta Kappa
Certifications:	New York State Woman-Owned Business Enterprise (WBE)

Relevant Work History:

Data Validation Services: September 1989 - present

Sole proprietor of Data Validation Services, providing consultation/validation services to various regulatory and commercial clients.

These services include the review of analytical laboratory data for compliance with respect to various protocols, accuracy and defensibility of data, verification of reported values, and evaluation of quality parameters for analytical usability of results. Approved by NYSDEC NJDEP, and NYCDEP as a data validator for projects contracted through the Division of Hazardous Waste Remediation, Division of Solid Waste, and Division of Water Quality. Has also performed validation and usability determinations for data pertaining to USEPA Superfund and lead sites.

Performed validation for compliance with protocols including 1989/1991/1995 NYSDEC ASPs, 1987 NYSDEC CLP, USEPA OLM, USEPA OLC, USEPA ILM, USEPA DFLM, USEPA SOW3/90, USEPA SOW 7/87 CLP, USEPA SOW 2/88 CLP, USEPA SW846, RCRA, AFCEE, Part 360, 40 CFR, and Air analysis methods. Performed validation according to the NYSDEC Validation Scope of Work, USEPA National and Regional Functional Guidelines, USEPA Region II HW SOPs, AFCEE, and NJDEPE Division of Hazardous Site Mitigation/Publicly Funded Site Remediation SOPs.

Performed validation for USEPA Superfund Sites including Salem Acres, York Oil, Port Washington L-4 Landfill, and OTIS AFB; and for USEPA lead sites including SJ&J Piconne, Maska, Bowe System, and Syossett Landfill, involving CLP, RAS, and SAS protocols.

Contracted for NYSDEC Superfund Standby Contracts with LMS Engineers, Camp Dresser & McKee, Malcolm-Pirnie, and EC Jordan, involving samples collected at NYS Superfund Sites and analysed under the NYSDEC ASPs.

Validated data for NYSDEC Phase II remedial investigations, RI/FS projects, and PRP oversight projects for hazardous waste sites. Was the primary contractor for Lawler, Matusky & Skelly Engineers during fifth and sixth round Phase II investigation, reviewing results for TCL/TAL analyses performed according to EPA CLP and 1989 NYSDEC ASP. Provided data validation for Phase II investigations for Gibbs & Hill, Inc, reviewing results from TCL/TAL analyses performed according to 1989 NYSDEC ASP.

Performed validation services for clients conducting RI/FS activities involving samples of many matrices, including waste, air, sludges, leachates, solids/sediments, aqueous, and biota; clients have included Barton & Loguidice, Blasland Bouck & Lee, Camp Dresser & McKee, C&S Consulting Engineers, Clough Harbour & Associates, Columbia Analytical Services, C.T. Male, Dames & Moore, Ecology & Environment, EC Jordan, Fanning Phillips & Molnar, FluorDaniel GTI, Foster Wheeler, Frontier Technical, Galson Consultants, H2M Group, Lockwood, Kessler & Bartlett, LMS Engineers, Malcolm-Pirnie, Metcalf & Eddy, O'Brien & Gere, Parsons Engineering-Science, P. W. Grosser, Rizzo Associates, Roux Associates, Sear Brown Group, ThermoRemediation Inc., URS Consultants, Wehran Emcon, Weston, and YEC.

Validated sample data pertaining to numerous landfill site investigations for TCL/TAL and NYS Part 360 analytes.

Validated data for NYSDEC and NJDEPE sites for samples analysed according to EPA CLP SOPs, with validation performed according to NJDEPE validation procedures.

Provided consultation services to laboratories regarding analytical procedures and protocol interpretation, and to law firms for litigation support.

Provided services to firms involving audits of environmental analytical laboratories to determine analytical capability, particulary for compliance with NYSDEC ASP adn AFCEE requirements.

Guest speaker on a panel discussing Data Review/Compliance and Usability, for an analysts workshop for the New York Association of Approved Environmental Laboratories, 1993.

Adirondack Environmental Services: June 1987 - August 1989

Senior mass spectroscopist for AES. Responsible for GC/MS analyses of environmental samples; development of the GC/MS laboratory, initiating the instrumental and computer operations from the point of installation; and for implementing the procedures and methodologies for Contract Laboratory Protocol.

CompuChem Laboratories: May 1982 - January 1987

Managed a GC/MS laboratory; developed, implemented, and supervised QA/QC criteria at three different levels fo review; and was responsible for the development and production of environental and clinical samples. Directed a staff of 23 technical and clerical personnel, and managed the extraction, GC/MS, and data review labs.

Research Triangle Institute: December 1979 - May 1982

Worked as an analytial research chemist responsible for development of analytical methods for the EPA Federal Register at RTI. This involved analysis of biological and environmental samples for priority pollutants, primarily relating to wastewaters and to human sampling studies. Method development included modification and interfacing of volatile purge apparatus to GC/MS, analysis and resolution/identification of individual PCB congeners by capillary column by mass spectra.

Guardsman Chemical Company: February 1977 - November 1979

Performed all quality control functions for the manufacturing plant. Performed research and development on coatings and dyes.

Almay Cosmetics: May 1976 - December 1976

Product evaluation chemist. Responsible for analytical QC of manufactured products.

APPENDIX C

Health and safety plan

HEALTH AND SAFETY PLAN

Supplemental Remedial Investigation/Feasibility Study Former Inland Fisher Guide Facility and Ley Creek Deferred Media

General Motors Corporation
Syracuse, New York

October 1999

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1. Project and organizational information

1.1. Project description and general information

This Health and Safety Plan (HASP) has been developed for the use of O'Brien & Gere Engineers' employees performing work activities connected with the Supplemental Remedial Investigation (RI) at the Former Inland Fisher Guide (IFG) Facility and Ley Creek Deferred Media in Syracuse, New York. This HASP describes the responsibilities, training requirements, protective equipment, and standard operating procedures that have been identified to be appropriate for workers while on the site to address potential exposure to the chemical materials and safety hazards identified in this HASP. This HASP incorporates by reference the applicable Occupational Safety and Health Administration (OSHA) requirements in 29 CFR Part 1910 and 29 CFR Part 1926.

The requirements and guidelines in this HASP are based on a review of available information, an evaluation of potential on-site hazards, and current regulations. This HASP is specifically intended for the conduct of on-site activities within the scope of work defined in the Supplemental RI Work Plan (O'Brien & Gere 1999). O'Brien & Gere Engineers has no responsibility for the interpretations of this HASP or the activities at the Former IFG Facility and Ley Creek Deferred Media of any person or entities other than employees of O'Brien & Gere Engineers.

Consistent with 29 CFR 1910.120, field investigation personnel on site shall read this HASP before beginning on-site work, and the HASP shall be discussed with field investigation personnel by the site health and safety supervisor (HSS). The HASP shall be available for inspection and review by O'Brien & Gere Engineers' employees and GM representatives while work activities are underway. This HASP shall be reviewed by the HSS for applicability for the planned day's work. Changes in site conditions and future actions that may be conducted at this site or changes in regulations may necessitate the modification of the requirements of this HASP.

The Supplemental RI field activities will consist of the following tasks:

Inspection of existing well integrity
Redevelopment of existing wells
Monitoring well installation/development
Test trench installation
In situ hydraulic conductivity testing
Ground water sampling/analysis
Soil boring installation
Piezometer installation
Subsurface and surface soil sampling
Sediment probing
Sediment sampling
Surface water sampling

Supplemental RI activities are expected to be performed during the fall of 1998 as well as the summer and fall of 1999. Work conditions during this period are anticipated to range from warm to cool temperatures.

1.2. GM project personnel

This work is being performed for General Motors Corporation (GM). The primary GM contact for this project is James Hartnett (315-764-2239) in Massena, New York.

1.3. O'Brien & Gere project personnel

Officer:	James R. Heckathorne, P.E.
Project Manager:	Douglas M. Crawford, P.E.
Project Coordinator:	Maureen S. Markert , P.E.
Health and Safety Supervisor:	David J. Carnevale, Chawn P. O'Dell

1.4. On-site personnel

On site personnel will have received (and be up to date in) training in accordance with OSHA regulations as cited in 29 CFR 1910.120 pertaining to the training of workers at hazardous waste sites. Additionally, site personnel will be trained in the proper use and care of Personal Protective Equipment (PPE) and will be current in medical surveillance requirements.

1.5. Chain of command for on-site activities

The following represents the chain of command for site field activities:

GM → O'Brien & Gere → Subcontractors

O'Brien & Gere chain of command:
Douglas M. Crawford → Maureen Salanger
→ David Carnevale, Chawn O'Dell → field personnel

2. General site information

2.1. Site description

A site location map is presented as Figure 1. The Former IFG Facility comprises approximately 65 acres of property located at 1 General Motors Drive in the Town of Salina, Onondaga County, New York. Facility structures include the main manufacturing building, the attached administration building, the primary switch house, the powerhouse, the industrial waste treatment (IWT) plant, the mold storage (former tank farm) building and the bulk handling building. Various paved parking lots and undeveloped areas are present on the property. The facility is bounded to the south by Conrail railroad tracks and a wood pallet recycling facility, to the east and northeast by GM Circle and Townline Road, to the west by a Niagara Mohawk Power Corporation (NiMo) electrical transfer station and to the north by Factory Avenue and an undeveloped area adjacent to Ley Creek. The facility is located in an area zoned for industrial use in the Town of Salina. The area surrounding the facility is generally characterized as highly urbanized. A facility plan is presented as Figure 2.

The Ley Creek PCB Dredgings site is located directly north of the facility and Factory Avenue. The Ley Creek PCB Dredgings site consists of the area between Factory Avenue and Ley Creek, extending west from the Former IFG Facility Outfall 003 discharge for approximately 4,000 ft. Ley Creek Deferred Media includes ground water underlying the Ley Creek PCB Dredgings site and surface water and sediment between Townline Road and Route 11.

2.2. Site history

Historically, the Former IFG Facility was used for the manufacture of metal automotive trim components such as bumpers, grills, wheel disks and hubcaps. More recently, the facility was used for the manufacture of interior and exterior plastic trim components such as bumpers, grills and door panels. The facility began operations in 1952, operating initially as a plating facility and later for the manufacture of plastic automotive components. The facility ceased manufacturing operations in December 1993.

The Ley Creek Deferred Media include ground water underlying the Ley Creek PCB Dredgings site and Ley Creek surface water and sediment between Townline Road and Route 11. Ground water underlying the Ley Creek PCB Dredgings site, and surface water and sediment in the vicinity of the Ley Creek PCB Dredgings site, were originally investigated during the RI/FS for the Ley Creek PCB Dredgings site. Because of continuing State Pollutant Discharge Elimination System (SPDES)-permitted discharges to Ley Creek from the Former IFG Facility and the hydraulic connection of the shallow ground water at the Ley Creek PCB Dredgings site with upgradient ground water at the Former IFG Facility, NYSDEC deferred decisions related to these media to this RI/FS. A conceptual scope of work for surface water and sediment investigation was included in the Order, and addresses surface water and sediment between Townline Road and Route 11.

3. Work site hazards and protective measures

3.1. General

As a manufacturing plant, many operations involved oils, solvents, and other process chemicals. The primary anticipated contaminants at the facility are polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs) including benzene, toluene, ethylbenzene, xylene, trichloroethylene (TCE), 1,2-dichloroethelene (DCE), and vinyl chloride, and heavy metals such as arsenic, chromium, copper, lead, nickel, and zinc. In addition cyanide and semivolatile organic compounds (SVOCs) may be present in environmental media. Based on past site investigations, these contaminants could potentially be present in soil and ground water as well as waters that pass through or are stored in active and inactive storm sewers, process sewers, sumps, manholes or catch basins. Investigations of building surfaces such as floors, walls, and structural beams have shown the presence of PCBs and heavy metals in the form of dust and grime. In addition, asbestos was used in construction materials for site buildings. Analytical results from the site asbestos survey indicated that the asbestos is nonfriable and will not likely pose a hazard to field investigation personnel.

Based on historic data, the primary anticipated contaminants in Ley Creek surface water and sediment include PCBs, VOCs including acetone, 2-butanone, methylene chloride, and xylene, SVOCs primarily consisting of polynuclear aromatic hydrocarbons, and heavy metals. PCBs have been detected in ground water beneath the Ley Creek PCB Dredgings site, and contaminants potentially anticipated to be present in Former IFG Facility media could potentially be present in the Ley Creek Deferred Media ground water.

3.2. Properties of site contaminants

PCBs are a group of chlorine-substituted biphenyl compounds. They are moderately toxic, and have been found to cause cancer and birth defects in animals. Adverse health effects following exposure affect the skin (dermatitis; chloracne), eyes and mucous membranes (swelling and burning), and digestive (nausea, vomiting, pain) and neurological (headache, dizziness, fatigue) systems. The severity of the health effects depends on the concentration and chlorine content of the PCBs. PCBs may also contain trace contaminants of polychlorinated dibenzofurans, which are highly toxic.

Xylene and also benzene, toluene, DCE, TCE may be present in environmental media on the site. These volatile organic compounds (VOCs) have a narcotic effect; they depress the central nervous system, and can cause dizziness and drowsiness if inhaled at concentrations exceeding the OSHA PEL. TCE is a suspected carcinogen. Prolonged skin contact with xylene and TCE can lead to irritation and dryness.

Heavy metal residues may be present on the site. These metals are toxic if inhaled as particulate matter or ingested. The toxic effect and severity of toxicity of these metals varies with each element.

SVOCs may be present in media at the site. The toxic effect and severity of toxicity of SVOCs varies with each compound. The SVOCs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, and benzo(k)fluoranthene (polynuclear aromatic hydrocarbons) may be present in sediments. These SVOCs are probable human carcinogens.

3.3. Task-specific hazards

The Supplemental RI/FS is divided into the following tasks:

Task 1 - Inspection of existing well integrity
Task 2 - Redevelopment of existing wells
Task 3 - Monitoring well installation/development
Task 4 - *In situ* hydraulic conductivity testing
Task 5 - Ground water sampling/analysis

Task 6 - Soil/source area investigation
Task 7 - Sediment investigation
Task 8 - Surface water investigation
Task 9 - Surveying
Task 10 - Data validation
Task 11 - Analytical data summary report
Task 12 - Supplemental risk assessment
Task 13 - Supplemental remedial investigation report
Task 14 - Supplemental feasibility study
Task 15 - Supplemental feasibility study report.

Discussion of task-specific hazards is presented below for each planned field activity. This includes discussion of hazards related to contaminants, as well as safety or physical hazards related to the subject area, or operations or equipment inherent in the task, and the appropriate protective measures.

Well inspection and in situ hydraulic conductivity testing. The potential for release of VOCs into the atmosphere at levels that may present an inhalation hazard. During well inspection and *in situ* hydraulic conductivity testing, a PID will be used to evaluate the concentration of VOCs in the breathing zone. If the concentration of VOCs in the breathing zone is at 100 ppm above the background, the workers will don negative pressure respirators equipped with organic vapor cartridges, or leave the work area until the concentrations of the compounds fall below 75 ppm. If concentrations of VOCs in the breathing zone reach 500 ppm, personnel are to leave that work area until concentrations fall below 75 ppm.

Equipment that is potentially contaminated will be decontaminated using the equipment decontamination procedures outlined in Section 4.2 of this document and Section 4 of the FSP (Appendix A of the Supplemental RI Work Plan).

Soil borings, monitoring well and temporary piezometer installation. The potential exists for contact with contaminated soil and the inhalation of VOCs or respirable dust/particulates containing, cyanide, heavy metals or PCBs. These may be in the air as a result of intrusive activity.

Underground utilities will be cleared and marked prior to beginning this task. Overhead utilities will be located prior to installation of soil borings and monitoring wells. Soil boring and monitoring well locations will be moved so as not to be beneath overhead utilities, or appropriate protection will be requested of NiMo prior to initiation of these activities.

Other hazards generally associated with drilling operations include noise levels exceeding the OSHA criterion of 90 dBA, carbon monoxide released in the exhaust from the rig engines, moving parts on the drill rig that may catch clothing, and free or falling parts from the cat head that may cause injury.

Personnel must wear hearing protection and hard hats when working near the operating drill rig. Initially a modified level D protection will be worn (see Attachment B of this HASP for details; Level D is modified to include Nitrile gloves and disposable protective coveralls). Equipment that is potentially contaminated will be decontaminated using equipment decontamination procedures outlined in Section 4.2 of this document, and Section 4 of the Field Sampling Plan (FSP) (Appendix A of the Supplemental RI Work Plan).

Test trench installation. The potential exists for contact with contaminated soil and the inhalation of VOCs or respirable dust/particulates containing, cyanide, heavy metals or PCBs. These may be in the air as a result of intrusive activity.

Overhead utilities will be located prior to installation of test trenches. Appropriate protection will be requested of NiMo prior to initiation of these activities.

Other hazards generally associated with excavation operations include collapse of excavation walls, noise levels exceeding the OSHA criterion of 90 dBA, carbon monoxide released in the exhaust from the excavator engines, and moving parts on the excavator that may catch clothing.

Personnel may not enter excavations. Soil samples will be collected from the bucket of the excavator, and visual inspections will be performed from the ground level. Personnel must wear hearing protection and hard hats when working near the operating drill rig. Initially a modified Level D protection will be worn (see Section 4 for details; Level D is modified to include Nitrile gloves and disposable protective coveralls).

Equipment that is potentially contaminated will be decontaminated using equipment decontamination procedures outlined in Section 4.2 of this document, and Section 4 of the FSP (Appendix A of the Supplemental RI Work Plan).

Soil sampling. The potential exists for contact with contaminated soil and the inhalation of VOCs or respirable dust/particles containing, cyanide, metals or PCBs. During soil sampling activities, personnel will wear Nitrile gloves and protective coveralls to prevent direct contact with potentially contaminated soil. During soil sampling, a PID will be used to measure the concentration of VOCs in the breathing zone. If the concentration of VOCs in the breathing zone is at 100 ppm above the background (based on the PEL of trichloroethylene), the workers must don half-face negative pressure respirators equipped with organic vapor cartridges, or leave that work area until the concentrations of the compounds fall below 75 ppm. If concentrations of VOCs in the breathing zone reach 500 ppm, personnel are to leave that work area until concentrations fall below 75 ppm.

Equipment that is potentially contaminated will be decontaminated using the equipment decontamination procedures outlined in Section 4.2 of this document, and Section 4 of the FSP (Appendix A of the Supplemental RI Work Plan).

Ground water sampling. The potential exists for contact with contaminated ground water and for release of VOCs into the atmosphere at levels that may present an inhalation hazard. During well sampling, a PID will be used to evaluate the concentration of VOCs in the breathing zone. If the concentration of VOCs in the breathing zone is at 100 ppm above the background, the workers will don negative pressure respirators equipped with organic vapor cartridges, or leave the work area until the concentrations of the compounds fall below 75 ppm. If concentrations of VOCs in the breathing zone reach 500 ppm, personnel are to leave that work area until concentrations fall below 75 ppm.

Equipment that is potentially contaminated will be decontaminated using the equipment decontamination procedures outlined in Section 4.2 of this document and Section 4 of the FSP (Appendix A of the Supplemental RI Work Plan).

Sediment and surface water sampling. The potential exists for contact with contaminated sediment and surface water containing PCBs, VOCs, SVOCs, and metals during sediment sampling activities. The contaminants may be absorbed through direct contact with contaminated materials Level D protection will be worn (see Attachment B of this HASP for details), with the addition of waders if samplers wade in Ley Creek.

Surveying. The surveying task will be non invasive and presents minimal work site hazards. Survey personnel shall use caution not to slip on wet surfaces, trip over protruding objects, or fall on steep slopes or stairs. When locating objects within site buildings, survey personnel shall minimize contact with surfaces that could be potentially contaminated with PCBs or heavy metals in the form of dust or grime.

4. Personal protective equipment

4.1. Personal protective equipment selection

Personal protective equipment is selected to protect employees from identified and suspected/potential hazards which they are likely to encounter during site operations. Selection is based on the performance characteristics of the PPE, the site conditions, the task-specific conditions and durations, and the hazards involved. Selection and use of PPE will also meet the requirements of 29 CFR 1910, Subpart I (Personal Protective Equipment), in addition to the requirements of 29 CFR 1910.120. General levels of protection, known as Levels A, B, C and D are described in Attachment B.

For this specific project, field investigation personnel shall wear Level D protection or Modified Level D, as specified below. Level D protection shall include steel toe boots and a hard hat. Modified Level D protection shall include steel toe boots, a hard had Nitrile gloves and disposable coveralls. Personnel must also have hearing protection available, to be worn during operation of heavy equipment. The specific requirements for the various tasks of this project are described in the previous section, and summarized below:

Well inspection and in situ hydraulic conductivity testing. Level D protection will be used during these tasks. Depending on observations using the PID, as describe in Section 6.2 (Action Levels), a half-face negative pressure respirators equipped with organic vapor cartridges shall be added to Level D protection during performance of this task.

Ground water sampling and monitoring well development. Modified Level D protection will be used during these tasks. Depending on observations using the PID, as describe in Section 6.2 (Action Levels), a half-face negative pressure respirators equipped with organic vapor cartridges shall be added to Modified Level D protection during performance of this task.

Soil borings, monitoring well installation, piezometer installation, test trench excavation, and soil sampling. Modified Level D protection will be used during these tasks, with the addition of hearing protection. Depending on observations using the PID, as describe in Section 6.2 (Action Levels), a half-face negative pressure respirators equipped with organic vapor cartridges shall be added to Modified Level D protection during performance of this task.

Sediment and surface water sampling. Modified Level D protection will be used during these tasks, with the addition of waders. Personnel performing sampling in surface water over 2 ft in depth will be tied off from the shore and a flotation device will be present for use.

Surveying. Level D protection will be used during this task.

PPE is to be maintained in clean, sanitary, working order. Disposable protective clothing (*e.g.*, Nitrile gloves) are only to be worn/used once, and then disposed of in appropriate, designated containers. Reusable equipment is to be cleaned at the end of each day, stored such that it can dry, and remain free of contamination or damage from outside sources (*e.g.*, excessive sunlight, foot traffic, etc.).

Personnel using PPE are to use, don, doff, inspect, maintain, store and recognize the limitations of their equipment in accordance with the practices presented during their OSHA HAZWOPPER training. Any questions regarding this should be directed to the HSS.

The respiratory protective equipment to be used has been approved by the National Institute for Occupational Safety (NIOSH). Each user will have been trained and be medically approved prior to the issuance and use of respirators. Respirators will be issued for the exclusive use of one person and will be cleaned after each use by that person. Respirators will be inspected before use by the user. Cartridges for air-purifying respirators in use will be changed weekly, at a minimum. Fit testing will be performed prior to respirator use to verify that the respirator seals against the face so that the wearer receives air only through the air purifying cartridges and/or filters attached to the respirator. Facial hair which interferes with the effectiveness of a respirator is not permitted on personnel required to wear respirators.

4.2. Decontamination procedures

Procedures for equipment decontamination are presented in the FSP. Standard procedures for personal decontamination are presented in Attachment C of this HASP. A combination of the procedures for Levels C and D will be used for this project. Personnel leaving contaminated areas must follow these procedures, disposing of or cleaning contaminated articles, as appropriate. The HSS shall monitor the decontamination activities, and modify them as necessary. Avoiding contact with contaminated materials is encouraged, so as to minimized the extent of materials to be decontaminated.

Equipment, solvents, cleaners, etc. to be used in decontamination are specified in the FSP (Appendix A of the Supplemental RI Work Plan).

5. Site control measures

Site control measures are to be implemented for employee protection prior to initial site activities, to the extent practical.

5.1. Site entry, exit, and layout

Entry and exit from the work areas is to be controlled for both security and health/safety reasons. Access to the work areas will be limited to authorized personnel. Access by field investigation personnel will be monitored by the HSS, who will maintain a record of personnel at the Former IFG Facility and at the Ley Creek Deferred Media areas. The record will include personnel on the site, their arrival and departure times and their destination on the site.

Due to the nature of the work and the size of the areas to be involved in concurrent work activities, this site will not have permanent delineation of specific work zones, decontamination zones and support zones. Personnel are to minimize travel to within identifiable work areas, and decontaminate at the nearest available decontamination station. The locations of these will change over the progress of the project. The HSS will announce the locations at the daily safety briefings.

5.2. Site access and security

There is one entrance to the property. The entrance gate is located off the GM circle and is open while site personnel are on site, and locked during non-working hours. At the initiation of the field work, daily working hours will be established and coordinated with GM site personnel. The property is surrounded by a fence. All personnel shall park in the visitor parking lot just inside the entrance gate.

The site buildings are locked. To gain entrance, contact the site manager Field personnel, visitors, and subcontractors who enter the site shall sign the contractors log maintained in the security office within the manufacturing building. Access to the security office is coordinated through the site manager

Field personnel and subcontractors who work at the Ley Creek Deferred Media areas will sign in and sign out at the GM Syracuse facility .

5.3. Site communications

The HSS will establish a system appropriate to the site, the work and the work areas that will provide routine and emergency communications within and off the site. GM site personnel will provide the HSS with a portable radio for communication with GM site personnel. For emergency notification, call the site manager or, if not available, then Mr. James F. Hartnett is to be called at (315) 764-2239.

The HSS will coordinate with GM site personnel to communicate potential hazards posed by field activities and the locations of designated exclusion zones to other contractors on-site.

5.4. Standard operation procedures

Standard operating procedures (SOPs), or general safety practices, are listed in Attachment D of this Plan. Personnel will read these and adhere to the practices while working on this project.

5.5. Lighting and sanitary provisions

Existing plant lighting and sanitary facilities will be used. Supplemental lighting will be provided as necessary.

5.6. Disposal of site waste materials

Site waste materials, decontamination waters, waste materials, etc. will be disposed of by GM. Waste disposal shall be coordinated with James F. Hartnett .

5.7. Cleaning heavy equipment

Heavy equipment will be decontaminated before leaving the site. Equipment decontamination will be conducted in an area where decontamination water and runoff may be collected and handled properly. Equipment decontamination will include manual removal of gross contamination with shovels, or other devices, followed by steam or high pressure wash of lifting surfaces, tracks, wheels, and undercarriages.

6. Monitoring

6.1. Ongoing monitoring during site activities

Periodic monitoring for VOCs using a PID and for dust using a Mini-ram will be conducted during the course of the Supplemental RI field activities. Such monitoring will be done when:

- work begins at a different part of the site
- newly identified/discovered contaminants are handled
- a different operation begins
- handling or working near obvious liquid contamination, drums, etc.

Monitoring results will be recorded by the HSS.

6.2. Action levels

Monitoring is intended to verify that workers are not being overexposed while on the site. Levels have been established which indicate whether workers may potentially be overexposed. These levels are referred to as action levels. When an action level is exceeded, this indicates the need for increased protection of workers. This protection may be realized by increasing the level of PPE, evacuating the area, or temporarily ceasing site activities. The following action levels, based on the identified site hazards and anticipated work activities, are established for this project:

Table 6-1. *Action levels.*

Hazard	Action Level	Action
VOCs	100 ppm	don respirator with organic vapor cartridge
VOCs	500 ppm	withdraw from area
VOCs	75 ppm	re-enter when concentrations decrease to below 75 ppm and source has been controlled
dust	5 mg/m^3	withdraw from area
dust	2.5 mg/m^3	re-enter when concentrations decrease to below 2.5 ng/m^3

7. Emergency response plan

7.1. Emergency phone numbers

Telephones are located in the security office . Emergency phone numbers are as follows:

Ambulance:	911
Fire:	911
Police:	911

GM Project Manager: James F. Hartnett	(315) 764-2239 (office) (315) 764-5630 (home)
O'Brien & Gere Engineers: Douglas M. Crawford, P.E. Maureen S. Markert , P.E.	(315) 437-6100

7.2. Location of and directions to hospital

The directions to the nearest hospital (Saint Joseph's Hospital) are as follows, and as shown on Figure 4.

Exit the GM site at the main gate near GM Circle; take right to Court Street West (298W); follow 298W for approximately 3 miles; take left onto North State Street; follow North State Street for approximately 3/4 mile; Saint Joseph's Hospital is on the left.

7.3. Handling of emergency incident

In the event of an emergency, site personnel will signal distress by available means, and notify GM, the HSS and the Project Coordinator of the nature and extent of the emergency and of any injuries. Upon notification of an exposure incident involving field investigation personnel, the HSS will contact the appropriate emergency response personnel, who will, according to the seriousness of the accident, provide medical diagnosis and, if necessary, treatment. Contacts with outside response personnel (*e.g.*, ambulance, fire department) will be made at the direction of the HSS or the Project Coordinator, and the GM Project Manager. Should someone be transported to a hospital or doctor, a copy of this HASP must accompany them.

The HSS or designee, in coordination with GM's Project Manager are to maintain and direct site control and security both during and after the emergency incident.

In case of an emergency within a site building, personnel shall exit the building at the closest available outside door and move to the parking area located east of the manufacturing building in the vicinity of the plant engineering trailer.

7.4. Emergency medical treatment and first aid

The first rule of First Aid is "do not become another victim". If personnel cannot be assisted without threatening the health & safety of responding workers, then outside emergency response personnel are to be summoned. If an injury/exposure situation does not threaten the responder, then onsite personnel trained in First Aid and CPR may administer such care to injured and/or exposed personnel, as is practical.

7.5. Location of on-site emergency equipment

The onsite HSS must confirm that a fire extinguisher, first aid kit, eye wash kit, and telephones are available for site use, and have working knowledge of the use of such equipment.

1. Fire Extinguisher - located throughout the manufacturing building
2. First Aid Kit - located in the security office and IWT plant
3. Eye Wash Kit - located in the security office and IWT plant
4. Communications - IWT plant and security office .

7.6. Site evacuation

In case of an emergency within a site building, personnel shall exit the building at the closest available outside door and move to the parking area located directly to the east of the manufacturing building. In the case of an evacuation, the HSS will conduct a "head count" to account for all field investigation personnel. A log of field investigation personnel entering and leaving the Site will be kept so that each one can be accounted for in an emergency.

7.7. Fire fighting

A fire extinguisher, intended only for small fires, will be available at the entry and exit point during onsite activities. When the fire cannot be controlled with the extinguisher, the area should be evacuated immediately. The HSS, along with GM's Project Manager, will be responsible for contacting the fire department response personnel.

7.8. Resuming work

The HSS will evaluate whether and at what levels exposure actually occurred, the cause of such exposure, and the means to be taken to prevent similar incidents from occurring. Follow-up activities must be completed before onsite work is resumed following an emergency. Used emergency equipment must be recharged, refilled or replaced. Government agencies will be notified by GM as appropriate. An investigation of the incident must be conducted as soon as possible. The resulting report must be accurate, objective, complete, signed and dated.

References

American Conference of Governmental Industrial Hygienists (ACGIH). *Threshold Limit Values and Biological Indices for 1990 - 1991.* 1990.

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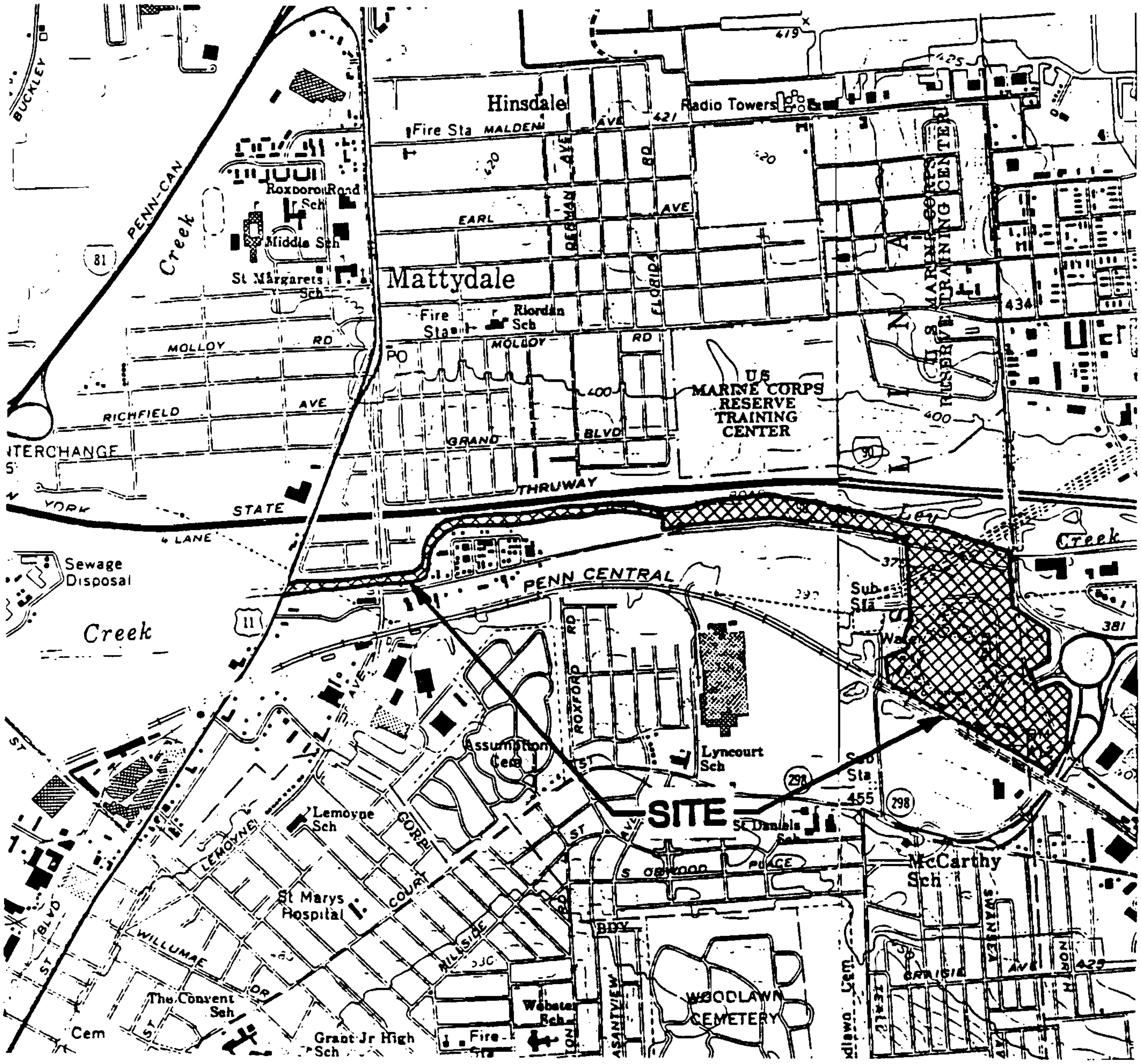
FIGURE 1



GENERAL MOTORS CORPORATION
SYRACUSE, NEW YORK

SITE LOCATION MAP

QUADRANGLE LOCATION

0 2000 4000

SCALE IN FEET

SOURCE: SYRACUSE, EAST & WEST U.S.G.S. QUADRANGLE MAPS, DATE 1989.

O'BRIEN & GERE ENGINEERS INC.

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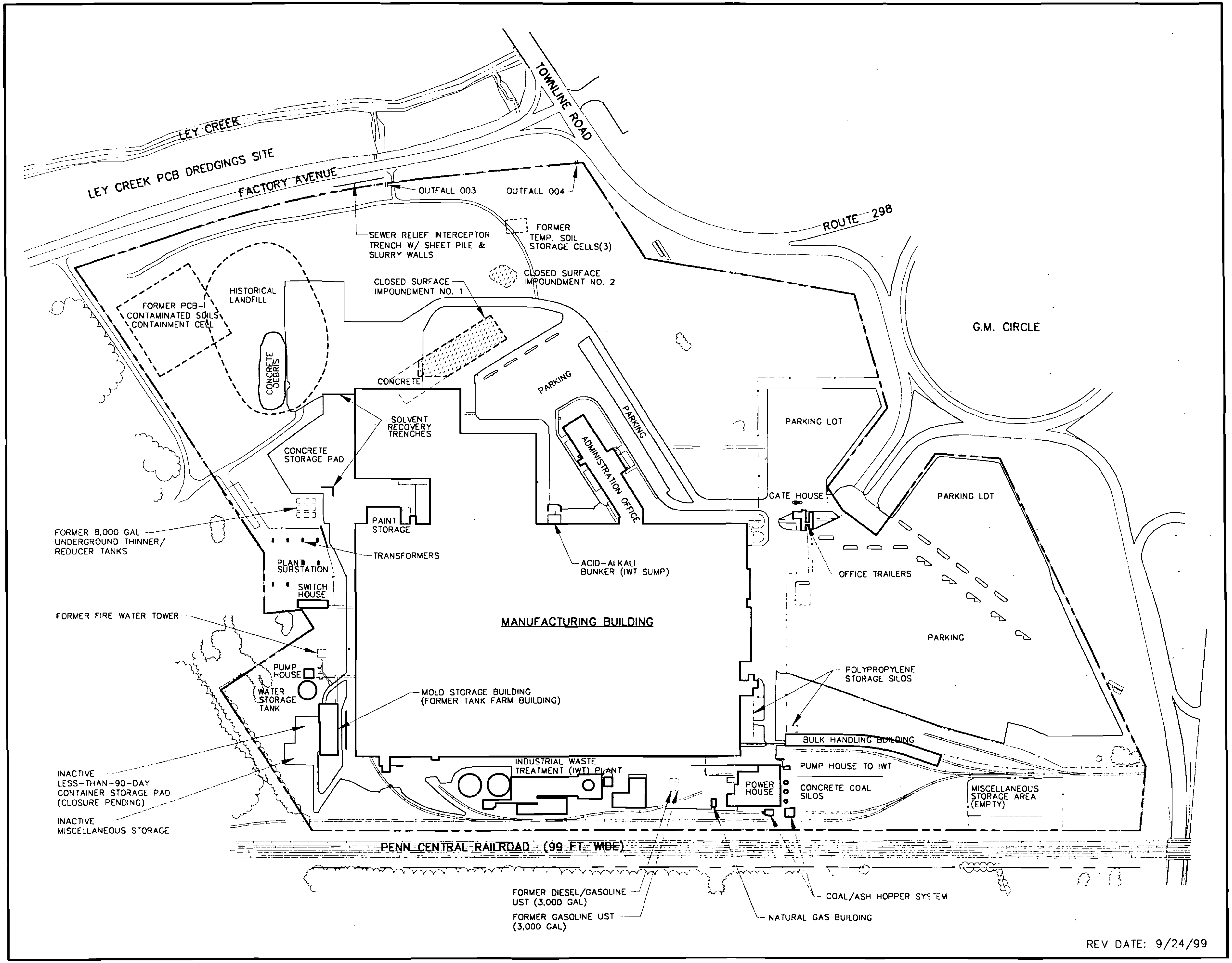
FIGURE 2



LEGEND

— — —	PROPERTY LINE
෴	TREE LINE
....	APPROX. LOCATION
—·—	FENCE

GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

FACILITY PLAN

0 250 500
SCALE IN FEET

DATE: SEPTEMBER 1999
FILE NO. 4966.21535.010

O'BRIEN & GERE

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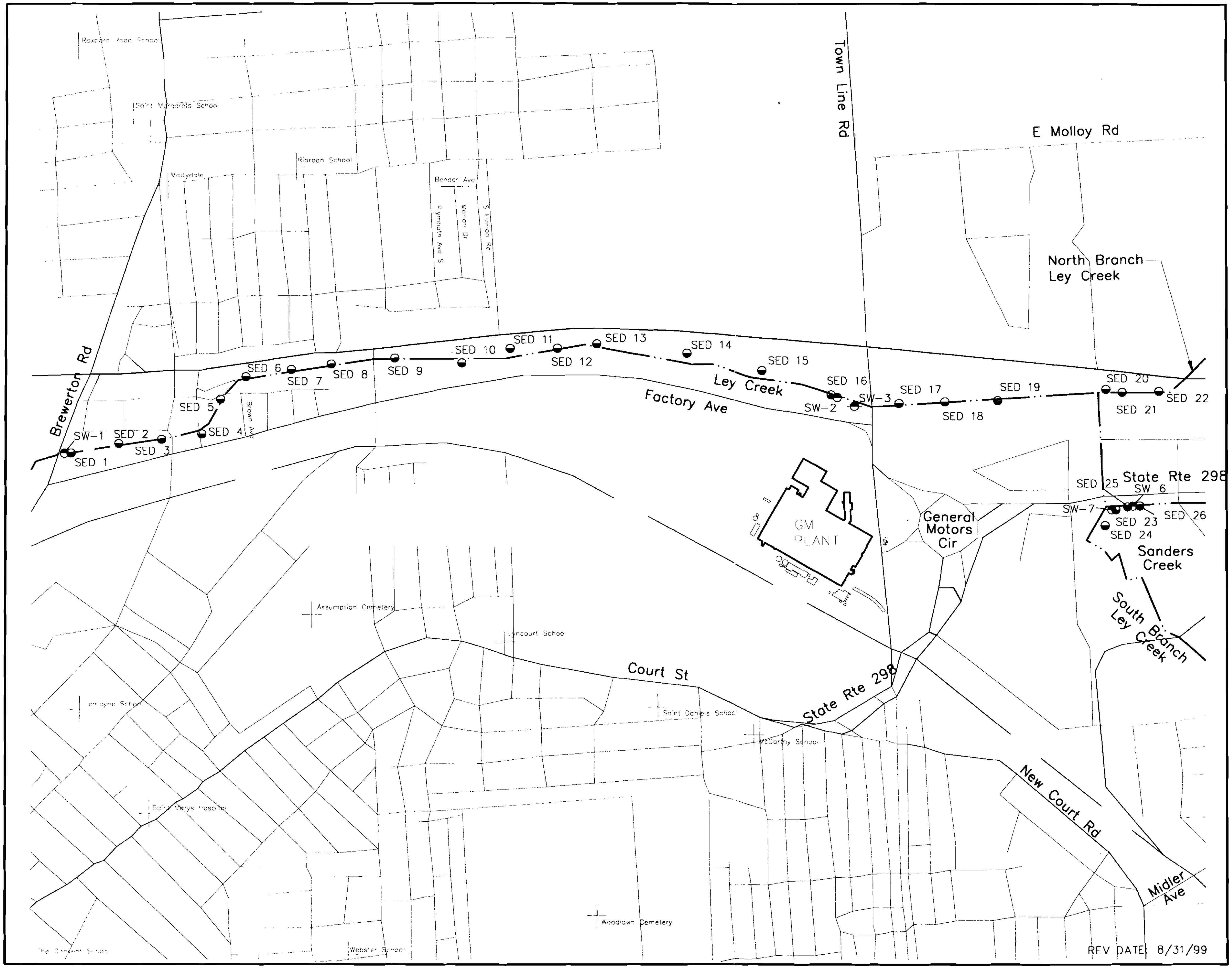

FIGURE 3

LEGEND

◒ SEDIMENT CORE SAMPLE LOCATION

⊖ SURFACE WATER SAMPLE LOCATION

LEY CREEK
DEFERRED MEDIA SITE
SYRACUSE, NEW YORK

LEY CREEK SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS

0 1000 2000
SCALE IN FEET

DATE: AUGUST 1999

FILE NO. 4966.21535.015

O'BRIEN & GERE

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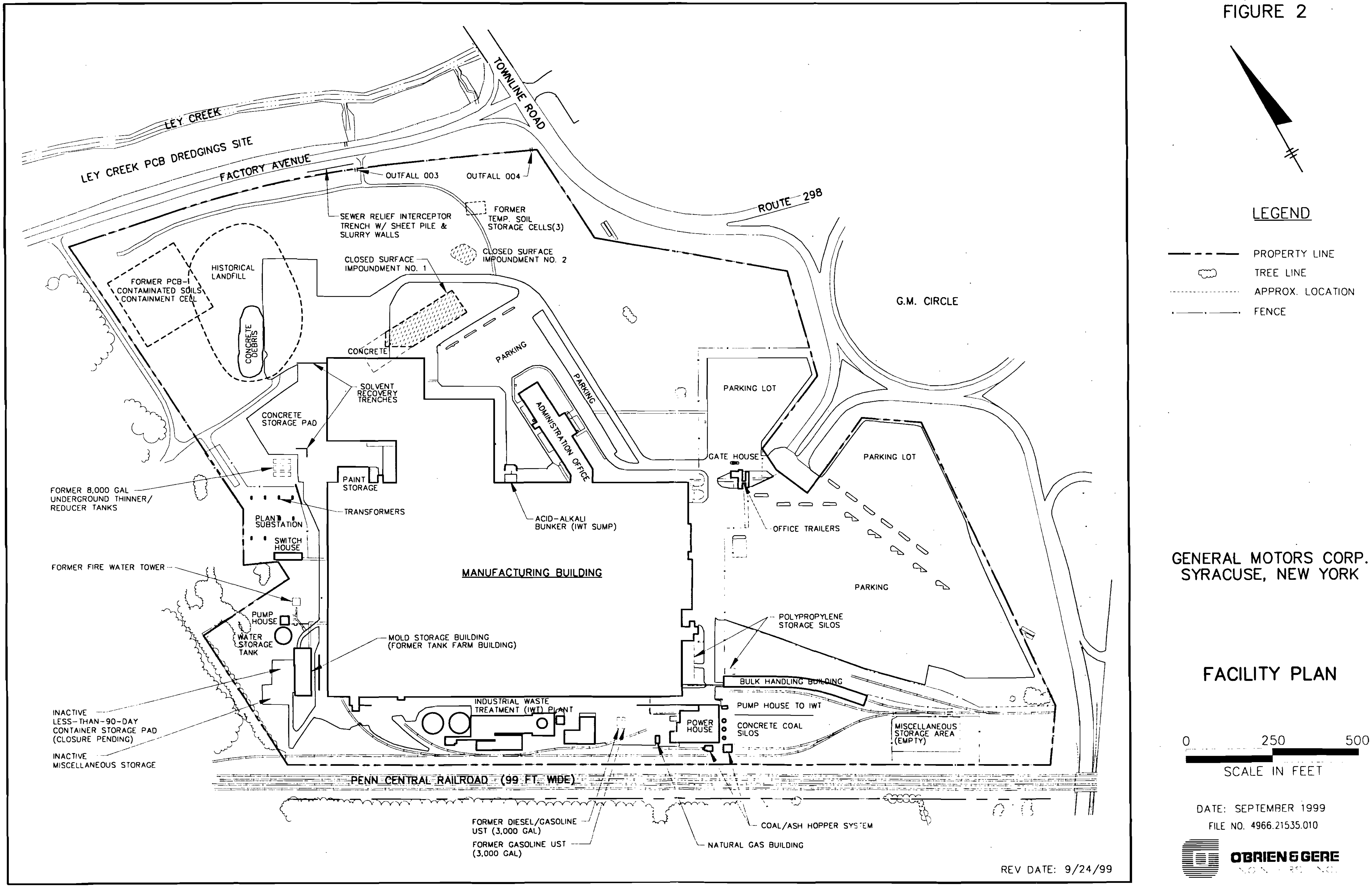
FIGURE 2



GENERAL MOTORS CORP.
SYRACUSE, NEW YORK

FACILITY PLAN

DATE: SEPTEMBER 1999
FILE NO. 4966.21535.010

O'BRIEN & GERE

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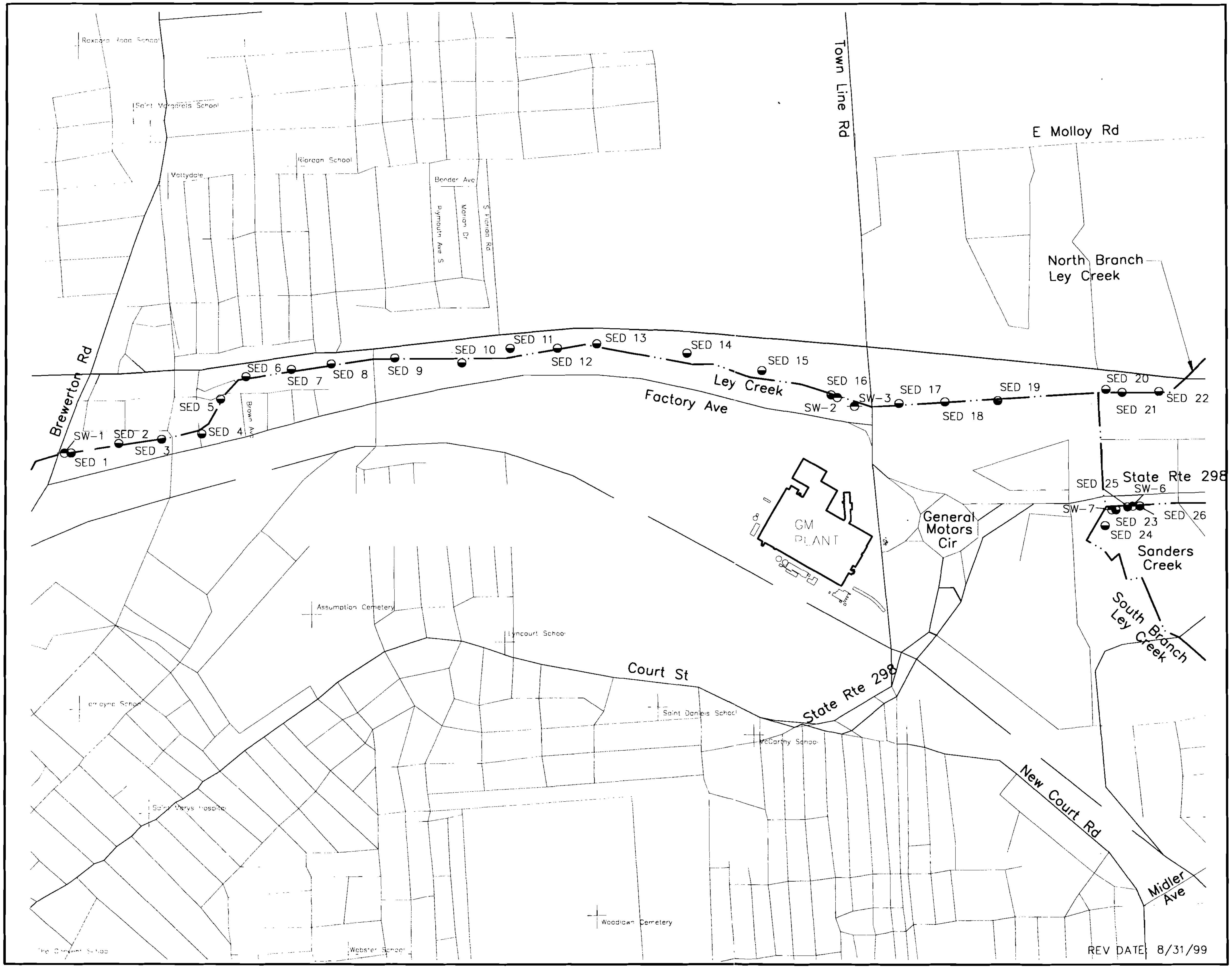


FIGURE 3

LEGEND

◒	SEDIMENT CORE SAMPLE LOCATION
⊖	SURFACE WATER SAMPLE LOCATION

LEY CREEK
DEFERRED MEDIA SITE
SYRACUSE, NEW YORK

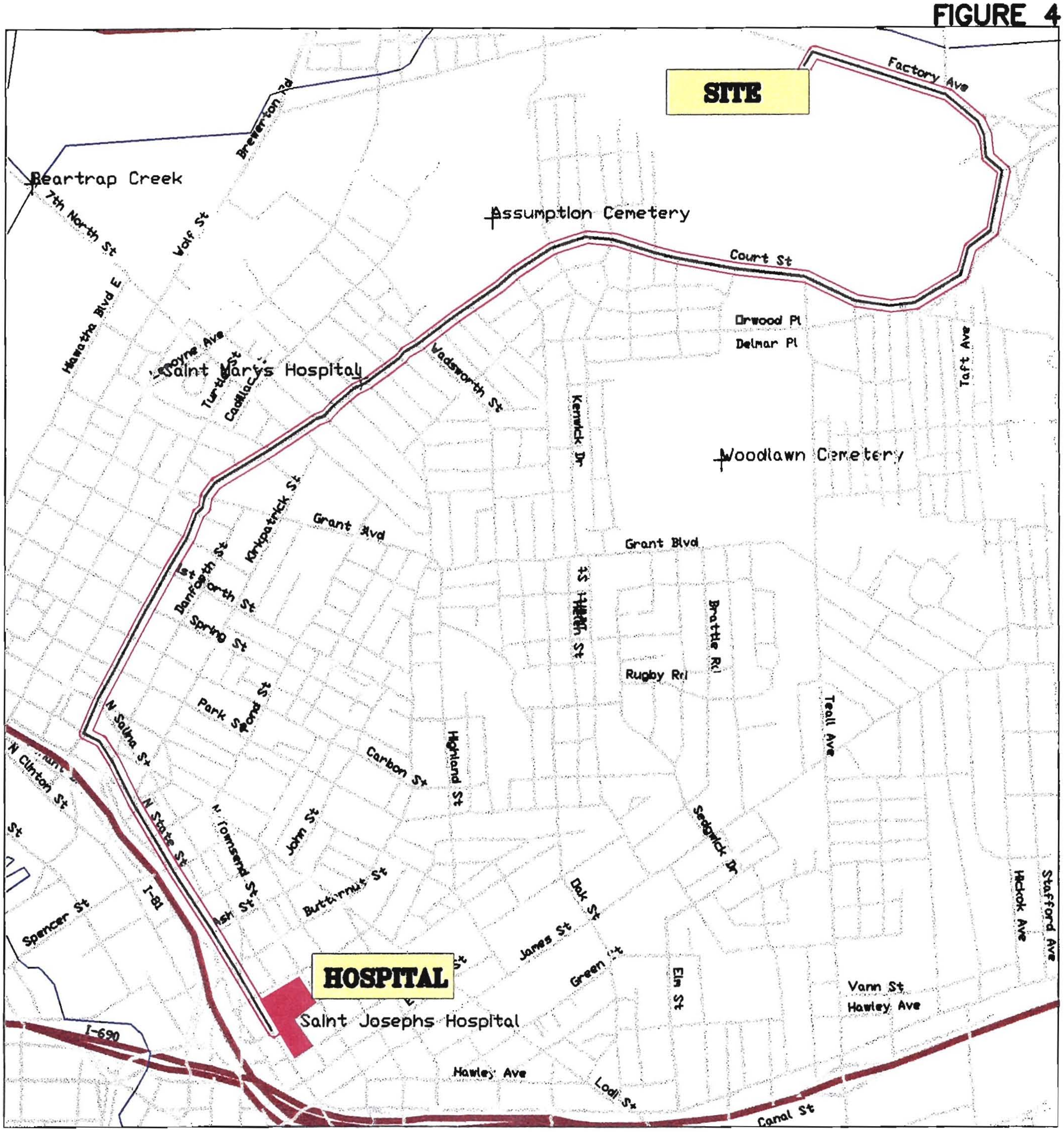
LEY CREEK SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS

0 1000 2000
SCALE IN FEET

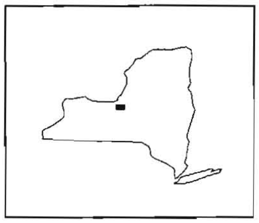
DATE: AUGUST 1999
FILE NO. 4966.21535.015

OBRIEN & GERE

FIGURE 4



SOURCE: SYRACUSE EAST & WEST, U.S.G.S. QUADRANGLE MAPS.



STATE LOCATION MAP

GENERAL MOTORS CORPORATION
SYRACUSE, NEW YORK

DIRECTIONS TO HOSPITAL

0 2000 4000
SCALE IN FEET

21535.111
June 1998

O'BRIEN & GERE ENGINEERS INC.

ATTACHMENT A

Health and safety program plan and policies

Attachment A. Health & Safety Program - Plan and Policies

A. Application of this Plan

This HASP is designed for compliance with OSHA (Occupational Safety & Health Administration) regulations codified in 29 CFR 1910.120, for hazardous waste site operations under the scope of 29 CFR 1910(a), effective April 13, 1990. O'Brien & Gere employees, clients and regulatory agency representatives, etc. are responsible for the health and safety of themselves and their employees and are responsible for implementing the procedures outlined in this HASP.

Project personnel must read this HASP prior to initiating the referenced onsite activities. Questions and concerns regarding the content of this Plan should be directed to the HSS and the Project Coordinator. A copy of this Plan must be at the site during site activities.

B. Health & Safety Meetings/Briefings

Pre-entry briefings are to be held prior to initiating site activity, and daily to appraise employees of the site HASP and procedures to be followed. Updates of this plan shall be based on site characterization and analysis and onsite observations.

C. Inspections

Inspections are to be conducted by the HSS or designee to determine the effectiveness of this HASP. Deficiencies in implementing the HASP are to be identified by the HSS, and corrected by the onsite Project Coordinator.

D. Information for O'Brien & Gere employees

O'Brien & Gere employees shall be informed of the site emergency response procedures and any potential fire, explosion, health safety or other hazards of the hazardous waste operation that have been identified in this HASP.

E. Availability of Health & Safety Plan

This HASP is available to any O'Brien & Gere employee or their representative who will be involved with the field investigation activities; to OSHA personnel and to personnel of other Federal, State, or local agencies with regulatory authority over the site.

F. Training

All field investigation personnel must comply with the training requirements for hazardous waste operations, codified in 29 CFR 1910.120(e). Each individual must have successfully completed a 40-hour (or 24-hour) course appropriate to the level of work which they perform. In addition, each individual must have completed an 8-hour refresher course within the last 12 months if the initial training was more than 12 months ago. Personnel acting in the capacity of an onsite supervisor, directly responsible for supervising employees engaged in hazardous waste operations, shall also have successfully completed an 8-hour Supervisor training course. Field investigation personnel must have documentation (copies of certificates, or I.D. cards) available onsite as proof of compliance with these training requirements.

G. Medical Surveillance

Employees engaged in potential hazardous waste site activities may be required to participate in a medical surveillance program depending on the level of work performed. Annual medical examinations are required for such personnel. More frequent medical examinations may be deemed necessary by the physician, or under circumstances of overexposure or development of symptoms of such. Personnel required to wear respiratory protection must have specific medical approval for the use of such, in accordance with 29 CFR 1910.134.

Written opinions from the physician, for each employee, to document fitness for hazardous waste operations, respirator use, or any limitations regarding such shall be maintained by the employer.

ATTACHMENT B

Description of personal protective clothing/equipment levels

Attachment B. Description of personal protective clothing/equipment levels

Level A Protection - to be designated for use by the HSS when the highest respiratory and contact protection is needed.

1. Self-contained, pressure demand breathing apparatus.
2. Fully-encapsulating, chemical resistant suit.
3. Inner chemical resistant gloves.
4. Chemical resistant safety boot.
5. Options as required:
    a. cooling unit
    b. coveralls
    c. long underwear
    d. hard hat
    e. disposable gloves and boot covers.

Level B Protection - This level is to be used when the highest level of respiratory protection is required, but less contact protection is needed than Level A.

1. Pressure demand cascade air system or suitable self-contained, pressure demand breathing apparatus.
2. Chemical-resistant coveralls, with hood.
3. Inner nitrile and outer nitrile chemical-resistant gloves.
4. Steel-toed boots with chemical-resistant outer boots.
5. Options as required:
    a. coveralls
    b. disposable outer boots
    c. face shield
    d. long underwear
    e. hard hat.

Level C Protection - to be designated for use only after the HSS has determined that increased skin and respiratory protection is required.

1. Full-face or half-face air purifying respirator equipped with organic vapor cartridges.
2. Chemical-resistant coveralls (*e.g.*, Tyvek®), with hood.
3. Inner nitrile and outer nitrile chemical resistant gloves
4. Steel-toed boots with chemical resistant overboots.
5. Options as required:
    a. coveralls
    b. disposable outer boots
    c. face shield (if wearing half-face respirator)
    d. long underwear
    e. hard hat.

Modified Level D -to be designated for use only after the HSS has determined that there is no respiratory danger and some skin protection is needed.

1. Chemical resistant disposable coveralls.
2. Nitrile gloves
3. Eye protection
4. Steel-toed boots with steel shank
5. Options as required:
    a. disposable outer boots
    b. face shield
    c. long underwear
    d. hard hat
    e. work gloves.

Level D Protection - to be designated for use only after the HSS has determined that there is no respiratory danger and minimal skin protection is needed.

1. Coveralls or long sleeve work shirt and long pants.
2. Steel-toed boots with steel shank
3. Options as required:
    a. work gloves
    b. disposable outer boots
    c. face shield or other eye protection
    d. long underwear

e. hard hat
f. latex gloves.

ATTACHMENT C

Decontamination procedures

Attachment C. Decontamination procedures

A. Personnel

The clothing of personnel leaving contaminated areas must be cleared of gross contamination prior to entering the buffer zone. In general, decontamination involves scrubbing with a low phosphate soap/water solution followed by clean water rinses. Disposable items will be disposed of in a dry container. Decontamination procedures for personnel exiting the buffer zone into the support zone are below. General decontamination procedures specific to the PPE worn will be established by the HSS at the time of the field investigation.

Station 1: Equipment drop
Deposit equipment used on-site (tools, sampling devices and containers, clipboards, etc.), on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations a cool down station may be set up within this area.

Station 2: Outer garments, boots, gloves - wash and rinse
Wash outer boots and outer gloves and splash suit with detergent water. Rinse off using copious amounts of water. Collect water in container.

Station 3: Outer boot and glove removal
Remove tape, outer boots and outer gloves. Deposit in lined disposal container.

Station 4: Outer garment removal
Remove and deposit outer garment in plastic lined disposal container.

Station 5: Respirator Removal
Remove and deposit respirator on plastic sheet. Avoid touching face with gloved fingers. Respirators are to be cleaned with soap and water by decontamination line personnel. Certain parts of contaminated respirators, such as harness assemblies and leather or cloth components, are difficult to decontaminate. If grossly contaminated, they may have to be discarded. Rubber components can be soaked in soap and water and scrubbed with a brush. In addition to being decontaminated, all respirators, non-disposable protective clothing, and other personal articles must be sanitized before they can be used again unless they are assigned to individuals. The manufacturer's instructions should be followed in sanitizing the respirator masks.

Station 6: Remove inner gloves and deposit in plastic lined disposal container.

Station 7: Field wash
Hands and face are to be washed before leaving the site.

Decontamination wash waters will be disposed of at the IWT Plant. O'Brien & Gere Engineers' field personnel will coordinate with the IWT Plant operator.

ATTACHMENT D

General safety practices

Attachment D. General safety practices

The following are important personal safety precautions which should be followed during any field operation:

1. Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-month transfer and/or ingestion of material is prohibited in any area designated as or suspected of being contaminated.

2. Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking, or any other activity.

3. Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.

4. No facial hair, which interferes with the satisfactory fit or the mask-to-face seal, is allowed on personnel required to wear respiratory protection equipment.

5. Contact with contaminated surfaces or with surfaces suspected of being contaminated should be avoided. Whenever possible, one should not walk through puddles, mud or other discolored surfaces; kneel on ground; lean sit or place equipment on drums, containers, vehicles or the ground.

6. Medicine and alcohol can enhance the effect from exposure to toxic chemicals. Prescribed drugs should not be consumed by personnel involved in the site investigation except with the informed permission of a physician. Alcoholic beverages are not to be consumed by personnel involved in site work.

7. Personnel and equipment in the contaminated areas should be minimized, consistent with effective site operations.

8. Work areas for various operational activities should be established.

9. Procedures for leaving the contaminated area must be planned and implemented prior to going to the site. Work areas and decontamination procedures must be established on the basis of prevailing site conditions.

10. Respirators should be issued for the exclusive use of one worker and will be cleaned and disinfected after each use.

11. Protective gloves and boots shall be taped to the disposable, chemical-protective suits.

12. Ear muffs or ear plugs may be required for personnel working around heavy equipment. Disposable, form-fitting plugs are preferred.

13. Cartridges for air-purifying respirators will be changed weekly, at a minimum.

ATTACHMENT E

Special precautions and procedures

Attachment E. Special Precautions & Procedures

This investigation poses potential exposure risks to both chemical and physical hazards. The chemical risks have been explained in the previous sections. The potential for chemical exposure to hazardous substances will be significantly reduced through the use of personal protective clothing, air monitoring, engineering controls, and implementation of safe work practices.

A. Additional Safety Procedures

The HSS or his/her designated representative, will be on site during all operations to observe for compliance with the safety procedures, as well as to observe for developing conditions which could result in harm to the health and/or safety of the workers. Should dusty conditions develop, the HSS or his/her designated representative will advise the workers to stop working until the exposed soil areas are sprayed with water to minimize the generation of airborne particles.

B. Heat and Cold Stress

The timing of this project may be such that heat and/or cold stress could pose a threat to the health and safety of site personnel. Work/rest regiments will be employed as necessary so that personnel do no suffer adverse effects form heat and/or cold stress. Special clothing and an appropriate diet and fluid intake will be recommended to site personnel to further reduce these temperature-related hazards. The work/rest regimes will be developed following the guidelines in the American Conference of Governmental Industrial Hygienists (ACGIH), *Threshold Limit Values and Biological Exposure Indices for 1990-1991 (ACGIH 1990).*

C. Heavy Machinery/Equipment

Site employees must remain aware of those activities that involve the use of heavy equipment and machinery. Respiratory protection and protective eye wear may be worn during site activities. This protective equipment significantly reduces the peripheral vision of the wearer. Therefore, it is essential that employees exercise extreme caution during operation of equipment and machinery to avoid physical injury to themselves or others.

D. Construction Materials and Site Refuse

Construction materials and site refuse will be contained in appropriate areas or facilities. Site personnel should make certain that cement, wood, etc., are not scattered throughout the area of activity and that trash and scrap materials are immediately and properly disposed of.

E. Daily Log Contents

The Project Coordinator and the HSS or his/her designated representative will establish a system appropriate to the site, the work and the work zones that will record, as a minimum, the following information:

- Personnel on the site, their arrival and departure times and their destination on the site.
- Incidents and unusual activities that occur on the site such as, but not limited to, accidents, spills, injuries, equipment failures and weather related problems.
- Conversations that may change the scope of the field activities.
- Daily information generated such as:
    - ▸ Changes to Work and Health and Safety Plans
    - ▸ Work accomplished and the current site status
    - ▸ Air monitoring results.

References

American Conference of Governmental Industrial Hygienists (ACGIH). *Threshold Limit Values and Biological Indices for 1990-1991.* 1990

APPENDIX D

SWMU status

Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Status

Unit Number	NYSDEC Unit Name (listed in draft Part 373 permit)	Status
	RCRA or NYSDEC regulated units	
1	Lagoon (NYSDEC)	Surface impoundment No. 1 was closed in 1989 in accordance with a RCRA closure plan. Impacted sediment was removed/disposed. Backfill included PCB-containing (< 40 mg/kg) soil from Meadowbrook/Hookway site. Cover consisted of clay, soil, and vegetation.
2	Holding Pond (NYSDEC)	Surface impoundment No. 2 was closed in 1989 in accordance with a RCRA closure plan. Impacted sediment was removed/disposed, and impoundment was backfilled with clean soil, regraded, and covered with soil and vegetation. The potential presence of solvent DNAPL in this area will be investigated as part of the Supplemental RI.
3	Drum Storage Area No. 1 (RCRA)	Closure plan proposed to NYSDEC and never finalized because of its planned inclusion in a multi-media site-wide program. Surface and subsurface soil sampling to be conducted in this area (southwest property area) as part of the Supplemental RI.
4	Drum Storage Area No. 2 (RCRA)	Out of service. Surface and subsurface soil sampling to be conducted in this area (IWTP area; TCE storage area) as part of the Supplemental RI.
5	Hazardous Waste Accumulation Area (RCRA)	Currently operated as temporary (less than 90 days) hazardous waste storage area.
6	Kolene Unit (RCRA)	Kolene unit dismantled in 1988 and removed from facility. The kolene unit was aboveground and not expected to have been a source of subsurface contamination.

Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Status

Unit Number	NYSDEC Unit Name (listed in draft Part 373 permit)	Status
Powerhouse Units		
7	Powerhouse Wastewater Sump	Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the sump will be inspected; residuals will be removed; and the sump will be decontaminated.
8	Ash Silo	Out of service. The ash silo is an aboveground structure and is not likely a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the silo will be inspected; residuals will be removed; the silo will be decontaminated; and the silo will be removed.
9	Ash Scrubber (tumbler)	Out of service. The ash scrubber is an aboveground structure and not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the scrubber will be inspected; residuals will be removed; the scrubber will be decontaminated; and the scrubber will be removed.
10	Ash Baghouse	Item is unknown to GM.
11	Ash Pit	Out of service. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the ash pit will be inspected; residuals will be removed; and the pit will be decontaminated.
12	Coal Elevator Sump	Out of service. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the sump will be inspected; residuals will be removed; and the sump will be decontaminated.

Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Status

Unit Number	NYSDEC Unit Name (listed in draft Part 373 permit)	Status
	Oil Reclamation System	
13	Underground Oil Reclamation Sumps	Out of service. As part of a 1981 NYSDEC Consent Order, the underground oil reclamation sumps were cleaned, coated with an epoxy material and filled with pourable concrete (closed in place) in approximately 1985. Subsurface soil samples were collected in the fill material surrounding each oil reclamation sumps in 1995-1996 as part of the Phase II ESA, as documented in the October 1997 Preliminary RI/FS Report. Extent of associated oil migration along abandoned storm sewer lines leading to oil/water collection sumps to be investigated during Supplemental RI.
14	Underground Oil Storage Tanks (five)	Tanks removed. Subsurface soil samples were collected in the fill material surrounding each oil tank in 1995-1996 as part of the Phase II ESA, as documented in the October 1997 Preliminary RI/FS Report.
15	Portable Pumping Units (five)	Mobile units no longer exist. The mobile units were aboveground and are not expected to have been a source of subsurface contamination.
16	Dirty Oil Transfer Station	Out of service. The Dirty Oil Transfer Station is an aboveground unit and is not likely a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the Dirty Oil Transfer Station will be inspected; residuals will be removed; the Dirty Oil Transfer Station will be decontaminated and removed.
17	Oil Reclaim Sump 518 Molder	Out of service. As part of a 1981 NYSDEC Consent Order, the oil reclaim sump was cleaned, coated with an epoxy material and filled with pourable concrete (closed in place) in approximately 1985. Subsurface soil samples were collected in the fill material surrounding the oil reclamation sump in 1995-1996 as part of the Phase II ESA, as documented in the October 1997 Preliminary RI/FS Report. The molder associated with Sump 518 was aboveground and was not connected to subsurface materials.

Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Status

Unit Number	**NYSDEC Unit Name (listed in draft Part 373 permit)**	**Status**
18	Oil Reclaim Sump 701 Molder	Out of service. As part of the 1981 NYSDEC Consent Order, the oil reclaim sump was cleaned, coated with an epoxy material and filled with pourable concrete (closed in place) in approximately 1985. Subsurface soil samples were collected in the fill material surrounding each oil reclamation sumps in 1995-1996 as part of the Phase II ESA, as documented in the October 1997 Preliminary RI/FS Report. The molder associated with Sump 701 was aboveground and was not connected to subsurface materials.
19	Oil Collection Trenches	Out of service. The majority of oil collection trenches that surrounded the injection molders were filled with concrete as part of the 1994 manufacturing operations shutdown. The oil collection trenches were shallow (approximately 6 in deep), cut or formed into the reinforced concrete slab, and are not expected to have been a source of subsurface contamination. The remaining trenches that were not filled in will be addressed during facilty decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the trenches will be inspected; residuals will be removed; and the trenches will be decontaminated.
20	Oil Collection Pans	Removed in 1992 and 1993 after ceasing of manufacturing operations. The oil collection pans were aboveground and are not expected to have been in contact with subsurface materials.
21	Dirty Oil Tanks (two)	The Dirty Oil Tanks (5,000 gal) were part of injection molder hydraulic oil reclamation and recycling processes. These tanks are aboveground and are not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the tanks will be inspected; residuals will be removed; the tanks will be decontaminated and removed.
22	Industrial Waste Treatment Plant Sump	Item unknown to GM. Potentially could be active sumps (Unit Nos. 61 and 62) which collect water from tank containment area. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the sumps will be inspected; residuals will be removed; and the sumps will be decontaminated.

Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Status

Unit Number	NYSDEC Unit Name (listed in draft Part 373 permit)	Status
23	Primary Dirty Oil Filter	The primary Dirty Oil Filter, Vacuum Distillation Units, and secondary Dirty Oil Filter were part of the injection molder hydraulic oil reclamation and recycling process. These units are aboveground and are not expected to have been a source of subsurface contamination. Items to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the units will be inspected; residuals will be removed; and the units will be decontaminated and removed.
24	Vacuum Distillation Units (two)	
25	Secondary Dirty Oil Filter	
26	Dirty Oil Holding Tanks (two)	Items unknown to GM.
27	Kidney Filters (two)	Unit part of injection molder hydraulic oil reclamation and recycling process. These filters are aboveground units and are not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the filters will be inspected; residuals will be removed; and the filters will be decontaminated and removed.
28	Interceptor Trenches (two)	Currently in service to collect ground water as part of 1986 thinner consent order program. The interceptor trenches will be left in place during facility demolition, as part of the site remediation.
29	Contaminated Ground Water Tank	Currently in service to collect ground water as part of 1986 thinner consent order program. Upon facility demolition, a new water treatment system will be installed at the site. Prior to the facility demolition, the following activities will be conducted: the tank will be inspected; residuals will be removed; and the tank will be decontaminated and removed.

Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Status

Unit Number	NYSDEC Unit Name (listed in draft Part 373 permit)	Status
30	Interceptor Sumps	Currently in service to collect oil/water from beneath manufacturing building and pump to the Industrial Waste Treatment (IWT) plant for treatment. Prior to facility demolition, five of the eight sumps will be inspected, cleaned and filled or plugged (closed in place). The three remaining sumps will continue to be pumped out, possibly periodically, for treatment at a new water treatment plant. O'Brien & Gere has collected water/oil samples from the interceptor sumps; data are presented in Table 5.
31	Paint Room Sump	Out of service. Paint room sump to be investigated during Supplemental RI. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the sump will be inspected; residuals will be removed; the sump will be decontaminated; and the sump will be filled with pourable concrete.
32	Clarifier	Active part of IWT plant. The clarifier tank is aboveground and is not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the clarifier will be inspected; residuals will be removed; the clarifier will be decontaminated and removed.
33	Inactive Clarifier	Reserve clarifier is an active part of IWT plant. The clarifier tank is aboveground and is not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the clarifier will be inspected; residuals will be removed; the clarifier will be decontaminated and removed.
34	Sludge Sump	Active part of IWT plant. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the sump will be inspected; residuals will be removed; the sump will be decontaminated.
35	Inactive Sludge Sump	Reserve sludge pump. Active part of IWT plant. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the sump will be inspected; residuals will be removed; the sump will be decontaminated.

Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Status

Unit Number	NYSDEC Unit Name (listed in draft Part 373 permit)	Status
36	Sludge Thickener Tank	Active part of IWT plant. The tank is aboveground and is not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the tank will be inspected; residuals will be removed; the tank will be decontaminated and removed.
37	Inactive Sludge Thickener Tank	Reserve sludge thickener tank. Active part of IWT plant. The tank is aboveground and is not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the tank will be inspected; residuals will be removed; the tank will be decontaminated and removed.
38	Sludge Holding Tank	Primary paint sludge tank out of service. The tank is aboveground and is not likely a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the tank will be inspected; residuals will be removed; the tank will be decontaminated and removed.
39	Filter Press	The filter press was cleaned, tested, and removed in June 1998. The filter press was aboveground and is not expected to have been a source of subsurface contamination.
40	Holding Tanks (three)	Active part of IWT plant (final effluent holding tanks). The tanks are aboveground and are not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the tanks will be inspected; residuals will be removed; the tanks will be decontaminated and removed.

Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Status

Unit Number	NYSDEC Unit Name (listed in draft Part 373 permit)	Status
41	Industrial Waste Sump	Also referred to as acid/alkali bunker. Active sump located in front (north) of manufacturing building which collects water from oil/water collection sumps 1, 2, 4, and 5 and pumps to main equalization tank. Due to the facility demolition, the Industrial Waste Sump will be closed, and the three remaining active oil/water collection sumps will be pumped directly to the new water treatment plant. Prior to the facility demolition, the following activities will be conducted: the sump will be inspected; residuals will be removed; the sump will be decontaminated; associated above ground piping will be removed and decontaminated; and the sump will be filled with pourable concrete.
42	Emergency Overflow Sump	Active part of IWT plant (related to gas engine). Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the sump will be inspected; residuals will be removed; the sump will be decontaminated and filled with flowable concrete.
43	Deionized Water Sump	Active part of IWT plant. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the sump will be inspected; residuals will be removed; the sump will be decontaminated and filled with flowable concrete.
44	Equalization Tank 1	Active part of IWT plant. The tank is aboveground and is not expected to have been a source of subsurface contamination. Prior to the facility demolition, the following activities will be conducted: the tank will be inspected; residuals will be removed; the tank will be decontaminated and removed.
45	Equalization Tank 2	Active part of IWT plant. The tank is aboveground and is not expected to have been a source of subsurface contamination Item to be addressed during facility decommissioning/demolition.. Prior to the facility demolition, the following activities will be conducted: the tank will be inspected; residuals will be removed; the tank will be decontaminated and removed.

Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Status

Unit Number	NYSDEC Unit Name (listed in draft Part 373 permit)	Status
46	Equalization Tank 3	Active part of IWT plant. The tank is aboveground and is not expected to have been a source of subsurface contamination Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the tank will be inspected; residuals will be removed; the tank will be decontaminated and removed.
47	Coalescing Plate Separators (two)	Active part of IWT plant (oil/water treatment process). The tanks are aboveground and are not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the tanks will be inspected; residuals will be removed; the tanks will be decontaminated and removed. The wet well will be inspected; residuals will be removed; and the well will be decontaminated and filled with flowable concrete.
48	Batch Tanks No. 1 and No. 2	
49	Flotation/Sedimentation Tank	
50	Wet Well	
51	Carbon Filtration Units (four)	Active part of IWT plant (oil/water treatment process). The units are aboveground and are not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the carbon units will be transported off-site to be regenerated.
52	2,000-Gallon Waste Oil Tank	Out of service. Item to be addressed during facility decommissioning/demolition. The tank is aboveground and is not expected to have been a source of subsurface contamination. Prior to the facility demolition, the following activities will be conducted: the tank will be inspected; residuals will be removed; the tank will be decontaminated and removed.
53	5,000-Gallon Waste Oil Tank	Out of service. The tank is aboveground and is not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the tank will be inspected; residuals will be removed; the tank will be decontaminated removed.

Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Status

Unit Number	NYSDEC Unit Name (listed in draft Part 373 permit)	Status
54	Waste Oil Bunkers (two)	Out of service. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the bunkers will be inspected and decontaminated.
55	Inactive Waste Oil Bunkers (four)	Out of service. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the bunkers will be inspected and decontaminated.
56	Former Cyanide Tank No. 1	The Former Cyanide Tank No. 1 is now referred to as the Flotation/Sedimentation/Wet Well Tank. The tank is aboveground and is not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the tank will be inspected; residuals will be removed; the tank will be decontaminated removed.
57	Former Sludge Holding Tanks (two)	Units dismantled and removed from facility. These units were aboveground and are not expected to have been a source of subsurface contamination.
58	Vacuum Filters (two)	
59	Sludge Conveyor	
60	Corrugated Plate Interceptor Unit	
61	SO2 Scrubbers	The SO2 Scrubbers were an aboveground unit that were removed from the site. Subsurface soil samples were collected in the vicinity of the SO2 Scrubbers during the 1995-1996 Phase II ESA.

Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Status

Unit Number	NYSDEC Unit Name (listed in draft Part 373 permit)	Status
62	Acid Alkali Tanks (three)	Out of service. The tanks are aboveground and are not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the tanks will be inspected; residuals will be removed; the tanks will be decontaminated removed.
63	Sludge Dumpster	Active part of IWT plant (oil/water treatment process). The dumpster is aboveground and is not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the dumpster will be inspected; residuals will be removed; the dumpster will be decontaminated and removed.
64	Filter Press Sump	Out of service. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the sump will be inspected; residuals will be removed; the sump will be decontaminated and removed.
Miscellaneous Units		
65	Hoffman Filter Unit	Out of service. The filter unit is aboveground and is not expected to have been a source of subsurface contamination. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the filter unit will be inspected; residuals will be removed; and the filter unit will be decontaminated and removed.
66	Old Storm Sewer System for Outfall 1	Outfall 001 out of service. During the Supplemental RI, soil and ground water in the northern property area to be investigated.
67	New Storm Sewer System for Outfall 3	In service to collect storm runoff from plant roof and grounds, and receive IWT plant treated effluent for discharge through Outfall 003. This sewer system will remain in place during the demolition activities and convey storm water from the site. Outfall 003 will continue to be monitored under the NYSDEC SPDES permit.

Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Status

Unit Number	NYSDEC Unit Name (listed in draft Part 373 permit)	Status
68	Old Contaminated Rubbish Containers	Item unknown to GM.
69	Past Landfill	Subsurface soil, fill, and ground water sampled as part of 1995-1996 Phase II ESA, as documented in the October 1997 Preliminary RI/FS report. Landfill materials and ground water in the vicinity will be investigated during the Supplemental RI.
70	Flammable Storage Room Waste Accumulation Area	Presently IWT plant garage. Item to be addressed during facility decommissioning/demolition. Prior to the facility demolition, the following activities will be conducted: the flammable storage room waste accumulation area will be inspected; residuals will be removed; the area will be decontaminated.
71	Emulsifier Bunkers (two)	Item unknown to GM. However, <u>emulsion tanks</u> in the IWT plant basement will be inspected, decontaminated and removed during the facility demolition.
72	Incinerator	Unit dismantled and removed from facility. The incinerator is an aboveground unit that is not expected to have been a source of subsurface soil contamination. Subsurface soil sampling activities were conducted in the vicinity of the incinerator during the 1995-1996 Phase II ESA. Surface soil in this area will be investigated during the Supplemental RI.
73	Process Sewers Handling Hazardous Constituents	Out of service. However, ground water is potentially infiltrating the process sewers leading to the acid/alkali sump. Based on visual observations of the acid/alkali sump, there was no free product. Thus, additional investigation of the process sewers is not proposed for the Supplemental RI.
74	Storm Sewers System for Outfall 4	In service to collect storm runoff from upstream off-site areas and plant parking lots (leading to Outfall 004). This storm sewer system will remain in place during the facility demolition activities and continue to convey storm water from the site as well as areas south of the site. Outfall 004 will continue to be monitored under the NYSDEC SPDES permit.

Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Status

AOC Number	AOC Name (listed in draft Part 373 permit)	Status
A	Thinner Tanks/Xylene Spill	Tanks removed in 1986 under SPDES consent order; soil and ground water in this area investigated during 1985 Phase II Hydrogeologic Investigation; thinner area ground water collection and treatment system in service. Routine quarterly ground water monitoring conducted in this area.
B	Oil Stains Near the Industrial Waste Sump	As part of the 1981 NYSDEC Consent Order, preventive measures were implemented to minimize overflow from industrial waste sump. These measures include a secondary containment bunker and sump. Subsurface soil samples collected in vicinity of oil stains near the industrial waste sump during the 1995-1996 Phase II ESA. Surface soil sampling and downgradient ground water sampling in this area included in Supplemental RI.
C	Oil Stains Near the Wet Well	Surface soil sampling in unpaved areas surrounding the IWT Plant to be conducted during the Supplemental RI.
D	PCB Contamination Near Northern Fence Line - Off-Site	Onondaga County surface soil analytical data is available for this area. Some impacted soils removed during 1991 Interim Remedial Measure (IRM) program. This area will be addressed during the Supplemental FS.
E	PCB Contamination Near Northern Fence Line - On-Site	Various northern property area soil sampling activities/data presented in October 1997 Preliminary RI/FS Report. Additional soil/ground water sampling to be conducted as part of Supplemental RI.
F	PCB and Xylene Spill Area Under Plant Building	Investigation of the xylene spill under the main plant building is not proposed as discussed in Section 4 of the Work Plan. PCB NAPL under the main plan building will be investigated during the Supplemental RI.
G	Ley Creek Sediments - Off-Site	Ley Creek dredged sediment evaluated as part of Ley Creek PCB Dredgings site RI/FS and NYSDEC March 1997 ROD. Ley Creek sediment evaluated as part of Ley Creek PCB Dredgings site RI/FS, and deferred by NYSDEC to this RI/FS. The Ley Creek sediment will be investigated during the Supplemental RI.

Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Status

AOC Number	AOC Name (listed in draft Part 373 permit)	Status
H	Former Extension of Impoundment 1 Under Building	Plant records do not indicate whether sediment from the portion of Impoundment No. 1 covered by the 1975 building addition was removed. This area will be investigated during the Supplemental RI.

APPENDIX E

Well integrity checklist

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Well Identification :

Personnel : Date :

WELL SPECIFICATIONS

Protective Casing	Above Ground	Flush Mounted
Well Construction	PVC	Stainless Steel
Well Diameter	2-inch	4-inch

Depth to Ground Water : ________

Well Depth: ________

WELL INTEGRITY

1. Well identification clearly marked ?	yes	no
2. Well covers and locks in good condition and secure ?	yes	no
3. Is the well stand pipe vertically aligned and secure ?	yes	no
4. Is the concrete pad and surface seal in good condition ?	yes	no
5. Are soils surrounding the well pad eroded ?	yes	no
6. Is the well casing in good condition ?	yes	no
7. Is the measuring point on casing well marked ?	yes	no
8. Is there standing water in the annular space ?	yes	no
9. Is the stand pipe vented at the base to allow drainage ?	yes	no
10. Does the total sounded depth correspond to the original well completion depth?	yes	no
11. Is the access down the well impeded or blocked? Explain.	yes	no

COMMENTS/RECOMMENDATIONS:

APPENDIX F

Data management requirements

Document A

A. Analytical Data

All analytical data should be provided in both a hard copy format as well as an electronic format. Two (2) copies of each data file should be submitted in either a PC-based spreadsheet format, *e.g.*, *.wk1 files, or a database format, *e.g.*, *.dbf or *.db files. The data files shall include all available sample description and location information in one table and laboratory results in another table and be linkable by a sample identification code.

Sample Information:

The sample information table should include the fields (columns) identified below, where applicable. For spreadsheet files, the field names are the column headings and each sample would occupy one row (record).

- **Sample ID** The sample identifier should be unique for a given environmental sample for a specific location (both horizontal and vertical), time, and matrix
- **Station ID** (if different from Sample ID)
- **Quality Control** D for field duplicate, M for MS/MSD, B for field blank, T for trip blank, S for split sample, C for spatial composite, P for temporal composite
- **Date Collected**
- **Time Collected**
- **Sample Matrix** The following two-character code should be used:

GW: Groundwater unfiltered
FG: Filtered groundwater (Filtrate)
SW: Surface water unfiltered (Total concentration)
PW: Surface water particulates (Suspended matter)
FW: Filtered surface water (Filtrate)
DG: Discharge outfall, pipe, CSO, manhole (assume unfiltered)
SP: Seepage (assume unfiltered)
SD: Sediment
PR: Pore water
SL: Soil
BT: Biota (biological tissue)
FA: Filtered air
PA: Particulate air

- **Location** Description of sample location, including water body name, well number if different from **Station ID** field, outfall pipe number, etc.

Northing	Defines sample location: coordinate system based on NAD 27 datum, New York Transverse Mercator coordinate (NYTM) or NY State Plane in feet
Easting	Defines sample location: coordinate system based on NAD 27 datum, New York Transverse Mercator coordinate (NYTM) or NY State Plane in feet
Survey	Descriptor of the manner in which the coordinates were determined and the accuracy thereof, *i.e.*, field survey, GPS, scaled off a base map, etc.
Base Elevation	Defines vertical position; elevation referenced to USGS/NGVD 1929 datum
Depth	Distance above (+) or below (-) base elevation to define the depth of the sample
Unit Increment	Unit of the depth increment (cm, inches, ft, etc.)
Reference Point	The type of reference point from which the increment is measured, *i.e.*, ground surface (or top of well casing for groundwater sample), water surface, or sediment/water interface.
Sample Desc.	Any additional text to further define the sample, *e.g.*, river mile locations on a tributary, species for a biota sample, etc.

Analytical Data:

The results of analyses for all parameters analyzed (including physical, conventional, and non-conventional parameters) should be included in this table in the following fields (columns), where applicable. Similar to the sample information table, the following fields should be the column headings. For a given sample, each parameter analyzed and its associated codes (**PID** and **CAS Number**, as defined below) should be in a separate row and not spread across the columns as separate field names. For example, if ten parameters are analyzed in a single sample, there should be ten rows (records) with the same **Sample ID** and each of the ten rows would have a unique parameter and value/concentration, as defined below.

Sample ID	Sample ID as stated above to provide linkage
Parameter	Physical or chemical parameter name, *e.g.*, flow/discharge, pH, conductivity, DO, TOC, fish weight, benzene, methyl-mercury, lead, total-PCB, etc.
PID	NYSDEC Parameter Identification Code (codes attached)

CAS Number	Chemical Abstract No. (if applicable)
Value	Concentration or other value
Unit	Units of measurement (mg/L, µg/gm, cfs, etc.)
Qualifier	Data qualifier assigned by laboratory
Technique	Analytical method used
Validation	Validation status (Y/N)
Laboratory	Name of laboratory performing analysis
Analysis Date	Date of analysis if not identical to date of collection

For file-size considerations, the analytical data tables can be separated by data type, *e.g.*, separate tables for conventional data, metals, organics, etc. However, each table should be structured as defined above.

B. Facility/Site Maps

The PRP shall provide to NYSDEC both blue-line copies and electronic files of drawings showing the facility/site. Five (5) sets of blue-line copies should be provided as well as two (2) copies of each file in an AutoCAD 12.0 format. Map data used to produce the site-feature maps should not be taken from maps of smaller scale than 1:24,000. USGS and NYSDOT, 7.5 minute quadrangle maps at 1:24,000 scale are acceptable, but 1:100,000 and 1:250,000 scale maps are not. Lines and points should be located to an accuracy of 25 feet. The site-feature maps should include, at a minimum, property lines, building locations (including manufacturing areas and waste handling/wastewater treatment areas), topographic and groundwater elevation contours (if available), locations of sewer lines (process, sanitary or combined), storm drains, manholes, outfalls to a receiving water body and sampling locations such as monitoring wells. Each of these features should be included on separate layers. Appropriate text descriptions of the features shall be included in each layer. A printout of the layer names and descriptions should be provided. Drawing title boxes should be included on both hard copies and the electronic files. The title boxes should include the name and address (including lot and block numbers) of the facility/site as well as the name and address of the drawing preparers.

All position data shall be referenced to either the New York Transverse Mercator or New York State Plane Coordinate Systems. All vertical data shall be referenced to the National Geodetic Vertical Datum (NGVD), 1929 Adjustment. A grid system should be used with coordinates clearly identified. In addition, the maps and files should include the locations and coordinates of survey control monuments and benchmarks with surveyor recovery notes. The drawings should be created using real, one-to-one distances (ft.), *i.e.*, not scaled. Units should use the AutoCAD decimal option.