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FINAL REPORT

REMEDIAL INVESTIGATION/FEASIBILITY STUDY AT THE FOURTH STREET SITE

SUBMITTED TO:

NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION

SUBMITTED BY:

BUFFALO URBAN RENEWAL AGENCY
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JANUARY 2001

PARSONS

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Report For:

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Submitted To:

New York State Department of Environmental Conservation Division of Hazardous Waste Remediation

Submitted By:

Buffalo Urban Renewal Agency

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January 2001

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EXECUTIVE SUMMARY

INTRODUCTION

Parsons Engineering Science, Inc. conducted a remedial investigation/feasibility study (RI/FS) on behalf of the Buffalo Urban Renewal Agency (BURA) at the Fourth Street Site former manufactured gas plant (MGP), in accordance with an Order-on-Consent between BURA and the New York State Department of Environmental Conservation (NYSDEC). This RI/FS report summarizes the investigation work conducted at the Site from April 1998 through August 1999. Also, it presents the technology screening, remedial alternatives, and recommended remedy developed during the feasibility study, using the investigation results. The RI/FS project objectives are to:

(1) Evaluate the nature and extent of impacts, including delineation and characterization of source areas, residuals, and potential migration pathways.

(2) Assess potential human health and environmental risks, and develop preliminary remediation goals.

(3) Develop data necessary to evaluate appropriate remedial alternatives.

(4) Determine remedial action objectives and remedial alternatives.

(5) Select an appropriate remedial alternative, and present a conceptual plan for implementing the selected alternative.

STUDY AREA INVESTIGATION AND METHODS

The NYSDEC approved the February 1998 RI/FS Work Plan and subsequent addenda dated October 1998 and July 1999. During the 1998 investigation, 23 subsurface soil borings were drilled to characterize the nature and extent of MGP residues to the south, east, and west of the previous investigations. Five groundwater monitoring wells were installed to evaluate groundwater quality, and to determine groundwater flow directions and other hydraulic properties in the various hydrogeologic units. Shallow (surface) soil samples were collected to characterize the presence, nature, and extent of constituents in the top one foot of the soil column.

Seven additional soil borings were drilled in August 1999 to investigate whether buried utilities were functioning as preferential pathways for the migration of non-aqueous phase liquid (NAPL).

STUDY AREA CHARACTERISTICS

The Site is defined as the area in which the RI/FS field sampling was conducted, with the exception of the background surface soil samples. The Site consists primarily of open, grass-covered areas, and includes an asphalt-covered parking area for the Waterfront School. City of Buffalo-owned property and the Waterfront School are adjacent to the Site to the southwest. A National Fuel Gas service facility is located southeast of the school. The remainder of the surrounding area is urbanized and includes residential, commercial, and recreational land. An elevated section of the NYS Thruway (I-190) is situated across Fourth Street to the southwest.

The Site is underlain by approximately 10 to 28 feet of unconsolidated sediments, overlying limestone bedrock. The unconsolidated sediments are comprised predominantly of fine-grained sands, with layers and lenses of sand and gravel, silty sand, and clayey silt.

The shallow aquifer beneath the Site is characterized as unconfined, and occurs mainly within the glacial lake sediments. Groundwater level measurements collected on four dates in 1998 indicated that groundwater flow is from the topographically high area northeast of the Site, towards Fourth Street, in a west-southwesterly direction.

NATURE AND EXTENT OF IMPACTS

The primary chemical constituents detected in soil or groundwater above area background concentrations or NYSDEC standards and guidance values included polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene, and xylenes (BTEX). Also, a dark-colored, viscous, dense, non-aqueous phase liquid (DNAPL) was observed in several soil borings.

Soil - Subsurface sample locations having levels of BTEX and PAHs above background or NYSDEC soil guidance values coincided with the presence of DNAPL in subsurface soils. This area correlates with the location of the former MGP facilities, including the former gas holder tanks, sulfur plant, retort house, purifying house, engine room, the underground storage tank, and portions of the coal houses. Two of five onsite surface soil samples exceeded background or NYSDEC guidance values. One of the five samples was located in the area of the former retort house, and the other sample appeared to be related to a former railway siding.

Groundwater - BTEX and PAHs were detected in several onsite monitoring wells at relatively low concentrations in groundwater samples from within the former facility area, and just west and west-northwest of the former facilities. Concentrations of BTEX within the Site exceeded NYSDEC groundwater quality standards/guidance values in water from MW-03, MW-04, and MW-05. No PAHs exceeded the NYSDEC standards/guidance values for groundwater.

FATE AND TRANSPORT

Vertical migration of DNAPL has likely occurred, but is hindered by less permeable layers in the lake sediments under the fill, as described in the boring logs. The lateral migration of DNAPL appears to be minimal, as its presence is limited to the immediate area of former MGP facility structures. Furthermore, there was no evidence of DNAPL transport along preferential buried utility pathways during the August 1999 utility investigation.

The low concentrations of BTEX and PAHs in groundwater suggest that partitioning of PAHs and BTEX from source materials to groundwater is limited, and consequently, potential migration of PAHs from the Site via the groundwater pathway is also limited. Furthermore, source materials from former MGP operations have been in place for more than 80 years, since the former MGP operations were terminated. Thus, the low concentrations of PAHs and BTEX in groundwater are not expected to increase, as steady-state conditions have probably been attained.

RISK ASSESSMENT

A human health risk assessment was performed to evaluate the potential human health risks and to assist in developing preliminary remediation goals, where appropriate. Results of the risk assessment demonstrated that, in the absence of any remedial action, risks to current and future receptors are very low. Both the calculated carcinogenic and non-carcinogenic risks fell below the USEPA risk threshold values.

Potential exposure of hypothetical future users of groundwater was not quantitatively evaluated because the groundwater pathway was not complete. Groundwater in the vicinity was not used as a potable drinking water supply, and no primary aquifers are located within two miles of the Site.

DEVELOPMENT OF REMEDIAL ALTERNATIVES

Preliminary remedial action objectives were established based on site-specific information, including the nature and extent of chemical constituents, human health risk assessment results, preliminary remediation goals (PRGs), impacted areas and volumes, existing Site conditions, and future land use plans. Remedial action objectives (RAOs) focus on controlling exposure of human receptors to chemicals of concern via routes such as dermal contact, ingestion, and inhalation, and on controlling the release of substances into the soil or and groundwater media. Preliminary RAOs for the Site are to: (1) maintain the current land use and allow the intended future use and development; (2) eliminate and/or minimize the exposure route hazards posed by the chemical constituents present in different media at the site; (3) remove or control identified sources of significant impacts, if any; and (4) monitor groundwater.

The need for interim remedial actions was evaluated based on data collected during the RI, and on the results of the risk assessment. No interim remedial actions were proposed because there were no imminent threats to human health or the environment posed by the distribution of chemical constituents at the Site. A previous study by the New York State Department of Health (NYSDOH, August 1996) did not identify any health risks to surrounding residential receptors or occupants in the school that were attributable to the Site.

Remedial action technologies that address the remedial action objectives were evaluated and screened. Conventional and innovative remediation technologies were evaluated. The technologies that were retained following evaluation and screening were combined to formulate remedial alternatives that meet the project RAOs and address the impacted soil and groundwater media. Three remedial alternatives were developed, including (1) limited action/deed restrictions with groundwater monitoring, (2) installation of an impermeable cap and an appropriate cover, deed restrictions, fence installation, and groundwater monitoring; and (3) removal of impacted soils either to one foot below the water table or to the depth at which preliminary remediation goals are exceeded, followed by groundwater monitoring. Each of these alternatives was evaluated using seven criteria: overall protection of human health and the environment, compliance with ARARS, long-term effectiveness and permanence, reduction in toxicity, mobility, or volume, short-term effectiveness, implementability, and cost.

Although human health risks for the Site as a whole were determined to be low, containment and soil removal alternatives were evaluated, to address the remedial action objective of eliminating and/or minimizing the exposure route hazards posed by chemical constituents in different site media. The human health risk assessment indicated that the reasonable mean exposure factor for sitewide carcinogenic risks was within the USEPA target risk range of 10-4 to 10-6, or the range in which risk management decisions are applied. Non-carcinogenic risks were low, as the hazard indices for all receptors was less than the USEPA threshold value of 1. A comparison of soil PRGs, which were calculated based on NYSDEC guidance values for residential land use, to onsite concentrations, indicated certain areas of the Site in which the PRGs were exceeded.

The evaluation of each remedial alternative based on the seven criteria listed above led to the recommendation of a preferred alternative. Based on the evaluations made for the Fourth Street Site, Alternative 2 is recommended: an impermeable cap with a vegetative or asphalt cover, deed restrictions, and a groundwater monitoring program. The basis for recommending Alternative 2 is the value of preventing future contact with surface and subsurface soils. The removal alternative (Alternative 3) was eliminated because there would be little additional environmental benefit gained, soil removal is not necessary to mitigate the human health risk, and remediation costs would increase more than fourfold.

CONCLUSIONS

- DNAPL and elevated levels of BTEX and PAHs were observed in soils in an area that correlates with the location of the former MGP facilities, including the former gas holder tanks, sulfur plant, retort house, purifying house, engine room, the underground storage tank, and portions of the coal houses of the former MGP facility.
- Vertical migration of DNAPL is possible to some extent, but is hindered by less permeable layers in the lake sediments under the fill. The lateral migration of DNAPL appeared to be minimal, as its presence was limited to the immediate

vicinity of former MGP facility structures. There was no evidence of transport along preferential pathways during the August 1999 utility investigation.

- BTEX and PAHs were detected in groundwater at relatively low concentrations compared to NYSDEC groundwater quality standards/guidance values from within the former facility area, and just west and west-northwest of the former facilities. Concentrations of BTEX within the Site only slightly exceeded NYSDEC standards in three wells, and no PAHs were detected above NYSDEC standards/guidance values.
- These low concentrations suggest that partitioning of PAHs and BTEX to groundwater from the soil is limited, and consequently, potential migration of these compounds from the Site via the groundwater pathway is also limited. Furthermore, source materials have been in place for more than 80 years since the former MGP operations were terminated. Thus, the low concentrations of PAHs and BTEX in groundwater are not expected to increase, as steady-state conditions have probably been attained.
- The groundwater pathway is not complete, as groundwater in the vicinity is not used as a potable drinking water supply, and no primary aquifers are located within two miles of the Site.
- Results of the risk assessment demonstrated that, in the absence of any remedial action, risks to potential receptors are very low. Both the calculated carcinogenic and non-carcinogenic risks fell below the USEPA threshold values.
- Remedial action objectives are: (1) maintain the current land use and allow the intended future use and development; (2) eliminate contact with surface and subsurface soils exceeding preliminary remediation goals; (3) remove or control identified sources of significant impacts, if any; and (4) monitor groundwater.
- Three alternatives were developed to meet the remedial action objectives, and were evaluated against seven criteria. Alternative 2 is recommended: an impermeable cap with a vegetative or asphalt cover, deed restrictions, and a groundwater monitoring program.

SECTION 1

SECTION 1
INTRODUCTION

1.1 PROJECT OBJECTIVES

This preliminary remedial investigation/feasibility study (RIFS) report summarizes the investigation work conducted at the Fourth Street Site (the Site) during April, May, and November 1998, and August 1999. This report also presents the technology screening and initial remedial alternatives development of the feasibility study.

In accordance with an Order on Consent with the New York State Department of Environmental Conservation (NYSDEC), Buffalo Urban Renewal Agency (BURA) has performed the RI/FS at the Site to:

(1) Evaluate the nature and extent of impacts, including delineation and characterization of source areas, residuals, and potential migration pathways;

(2) Assess potential human health and environmental risks, and develop preliminary remediation goals;

(3) Develop data necessary to evaluate appropriate remedial alternatives; and

(4) Determine remedial action objectives and remedial alternatives.

(5) Select an appropriate remedial alternative and present a conceptual plan for implementing the selected alternative.

The following guidance documents were utilized during the RI/FS to achieve these objectives: CERCLA, 42 U.S.C. Sections 9601 et seq., as amended; the current National Contingency Plan (NCP); the USEPA Interim Final Guidance document entitled "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA", (October 1988), and any subsequent revisions thereto; appropriate technical and administrative guidelines; the NYSDEC-approved Site RI/FS Work Plan, (February, 1998); and NYSDEC comments on the Site RI/FS Work Plan (March 20, 1998).

1.2 PROJECT BACKGROUND

1.2.1 Site Description

The Site is located in the City of Buffalo, Erie County, New York (see Figure 1.1). The Site is defined as the area in which the RI/FS field sampling was conducted, with the exception of the background surface soil samples. Prior to this RI/FS, the areal extent of impacts had not been defined. However, previous environmental investigations indicated that impacts occurred in an area encompassing approximately 0.25 acres of undeveloped property, currently owned by BURA. The area where dense, non-aqueous phase liquid (DNAPL) in the shallow subsurface was identified by these previous studies is shown on Figure 1.2 (inside the triangular fenced area).

The area surrounding the fenced BURA property where DNAPL was discovered is urbanized and includes institutional, residential, commercial, and recreational land use. The fenced property is situated adjacent to the City's Waterfront School. The adjacent property is owned by the City of Buffalo. An elevated section of the New York State Thruway (Route 190) is situated approximately 600 feet to the west of the Site.

1.2.2 Site History

Citizens Gas Works operated a manufactured gas plant (MGP) on what is now the Fourth Street Site and adjacent property that is owned by the City of Buffalo (see Figure 1.3). The MGP facility at this location operated from the 1870s to the early 1900s prior to 1915.

Review of the 1870 City Atlas indicates that Citizens Gas Works may have provided surrounding businesses and dwellings with coal gas for industrial fuel and lighting. Surrounding Citizens Gas Works were the Lee Holland and Company Lumber business, Farina Flour Mills, American Glucose Company, residential lots, and vacant lots. A shipping slip accessing the Erie Canal was located adjacent to the present day Waterfront School property. A photocopy of the 1870 City Atlas is included in Appendix A.

The 1915 City Atlas indicated that Citizens Gas Works was no longer in existence. Private residences and empty lots occupied the current BURA property. The Montgomery Lumber facility was located on what is now City of Buffalo owned land. Also, there were numerous empty lots and railways on the former location of Fourth Street. The Buffalo Gas Works, an adjacent MGP, is visible and located on Genesee Street near Fourth Street. The Erie Canal was located where the NYS Thruway now exists.

From 1934 to 1958, a portion of the property was used by Greyhound Bus Company to service its vehicles. A photograph taken in 1958 also showed that numerous industrial, commercial, and residential buildings existed on and adjacent to the Site. These include: Montgomery Brothers Lumber Co., or successors; a railroad spur to serve the facility; a former Greyhound Bus maintenance garage; and numerous private residences. Also noted in this photo were stockpiles of raw materials or finished products from a nearby business. The stockpiles were located on the area adjacent to the railroad spur. The BURA property was primarily occupied by private residences, a few empty lots, and a portion of the bus facility. The NYS Thruway (I-190) was constructed where the Erie Canal was formerly located (see Appendix A).

In a 1977 photo and a 1989 photo, the Site appears much as it does today. In both of the photos, the Waterfront School is in-place, and the railroad spur and lumber facilities are no longer visible. Figure 1.3 shows the location of the former MGP structures in relation to the present day structures.

The historical information and maps indicated that several of the businesses in the investigation area contained coal bins, "sand piles", furnaces, engine rooms, garages, etc. These facilities are all potential sources for MGP residuals.

1.2.3 Previous Investigations

A limited subsurface exploration and analytical testing program was undertaken at the Waterfront School in 1990. The purpose of the environmental investigation was to investigate the potential presence of a ferric/ferrocyanide complex and other chemical constituents previously detected on the adjacent National Fuel Gas property, near the southern boundary of the Buffalo Waterfront School. In part, this study concluded that: (1) there were high organic vapor readings obtained from several soil borings; (2) there was a significant quantity of fill on the school property containing a range of man-made materials; and (3) upon analysis, the soil samples exhibited elevated levels of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs), exceeding United States Environmental Protection Agency (USEPA) cleanup criteria.

Additional investigation activities were conducted on the school property in 1991 and 1992 to ascertain the potential onsite contamination. These activities included the performance of a soil gas survey, the excavation of 29 exploratory test pits, the installation of four monitoring wells, analysis of soil, groundwater and NAPL samples, and the generation of a final report summarizing the activities. The report concluded the following: (1) a black tar-like substance (NAPL) was detected in the shallow subsurface soil in test pits and soil borings; (2) the property did not appear to be suitable for residential development due to the potential health concerns caused by the tar-like substance; and (3) relatively high concentrations of VOCs and SVOCs were detected in soil and groundwater. Chemical analyses of a NAPL sample indicated total BTEX concentration of 9,160 ppm, a concentration of 46,690 ppm total PAHs, and a concentration of 3,050 ppm total phenols.

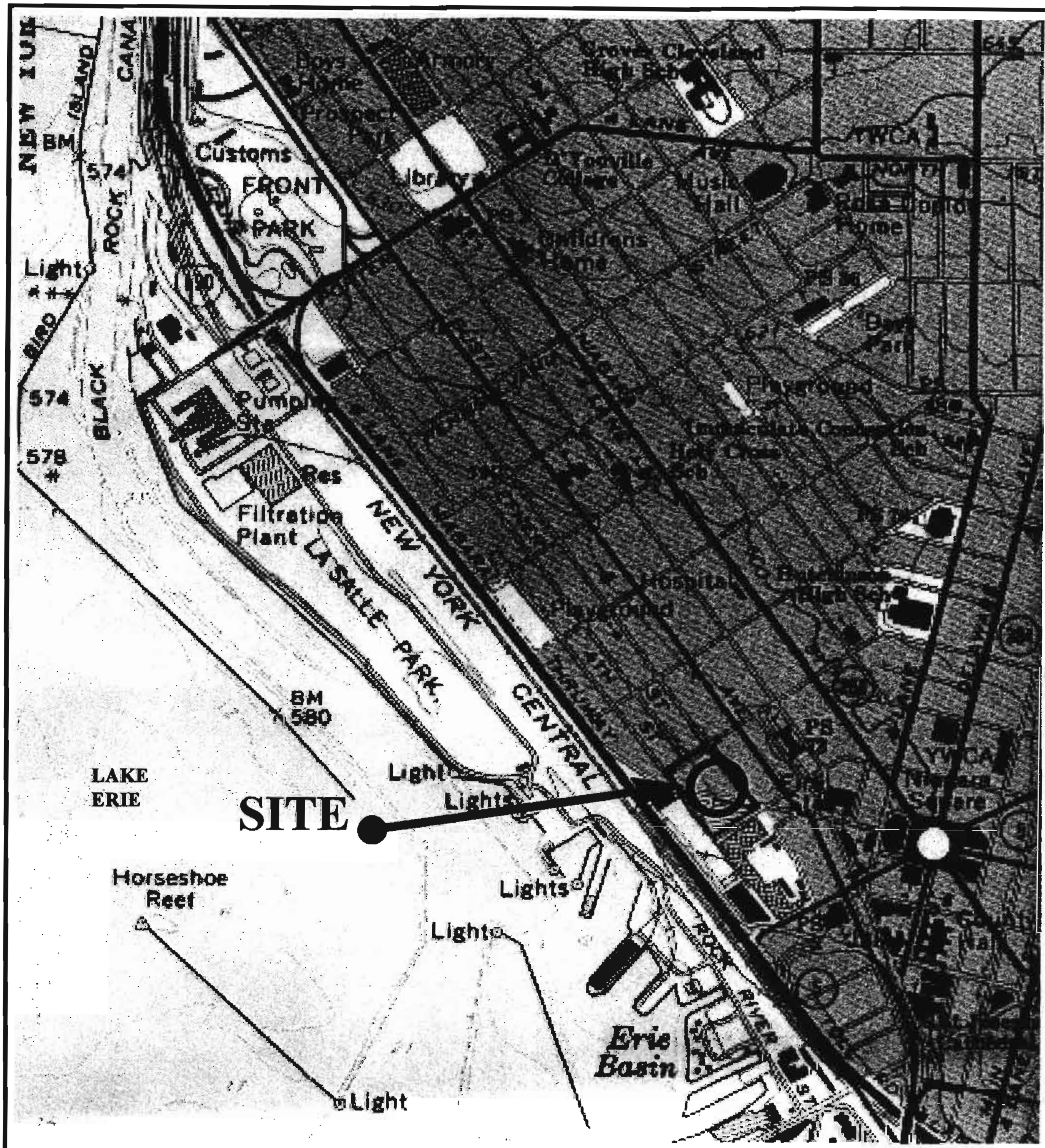
During August 1996, the NYSDEC and the New York State Department of Health (NYSDOH) obtained soil samples from the BURA and Waterfront School properties and resampled one groundwater well installed in the previous 1991-1992 investigation (NYSDEC, 1996). The results of the sample analyses indicated the following: (1) a single soil sample, collected from BURA property and analyzed for Toxicity Characteristics Leaching Procedure, exceeded the regulatory threshold concentration for benzene and is hazardous waste according to 6NYCRR Part 371; (2) groundwater standards/guidance values were exceeded for several parameters; and (3) the levels of benzene, toluene, ethylbenzene, xylene (BTEX), and polycyclic aromatic hydrocarbons (PAHs) detected in the soil samples were elevated when compared to NYSDEC standards. Based on these previous investigations, the RI/FS was conducted, beginning in February 1998.

1.3 REPORT ORGANIZATION

This report documents all work performed during the RI/FS, provides detailed results of the chemical analyses, and describes the nature and extent of detected chemicals in each environmental medium sampled. The report is organized as follows:

- Section 1 - Describes the Site background, description, objectives, history, and previous investigations;
- Section 2 - Describes the field investigation methods;
- Section 3 - Discusses the physical characteristics of the Site including surface features, land use, geology, and hydrogeology;
- Section 4 - Details the nature and extent of impacts in each medium sampled;
- Section 5 - Summarizes the human health risk assessment;
- Section 6 - Discusses preliminary remedial action objectives;
- Section 7 - Presents remedial technologies;
- Section 8 - Presents remedial alternatives;
- Section 9 - Presents a list of references used in preparation of this report; and
- Appendices A through G provide supporting documentation.

(Update needed.)



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QUADRANGLE LOCATION
LONGITUDE: 78° 52' 30"
LATITUDE: 42° 52' 30"

SOURCE: U.S.G.S. 7.5 SERIES BUFFALO NW, New York-Ont (TOPOGRAPHIC), 1965

Figure 1.1

Buffalo Urban Renewal Agency
Fourth Street Site
SITE LOCATION MAP

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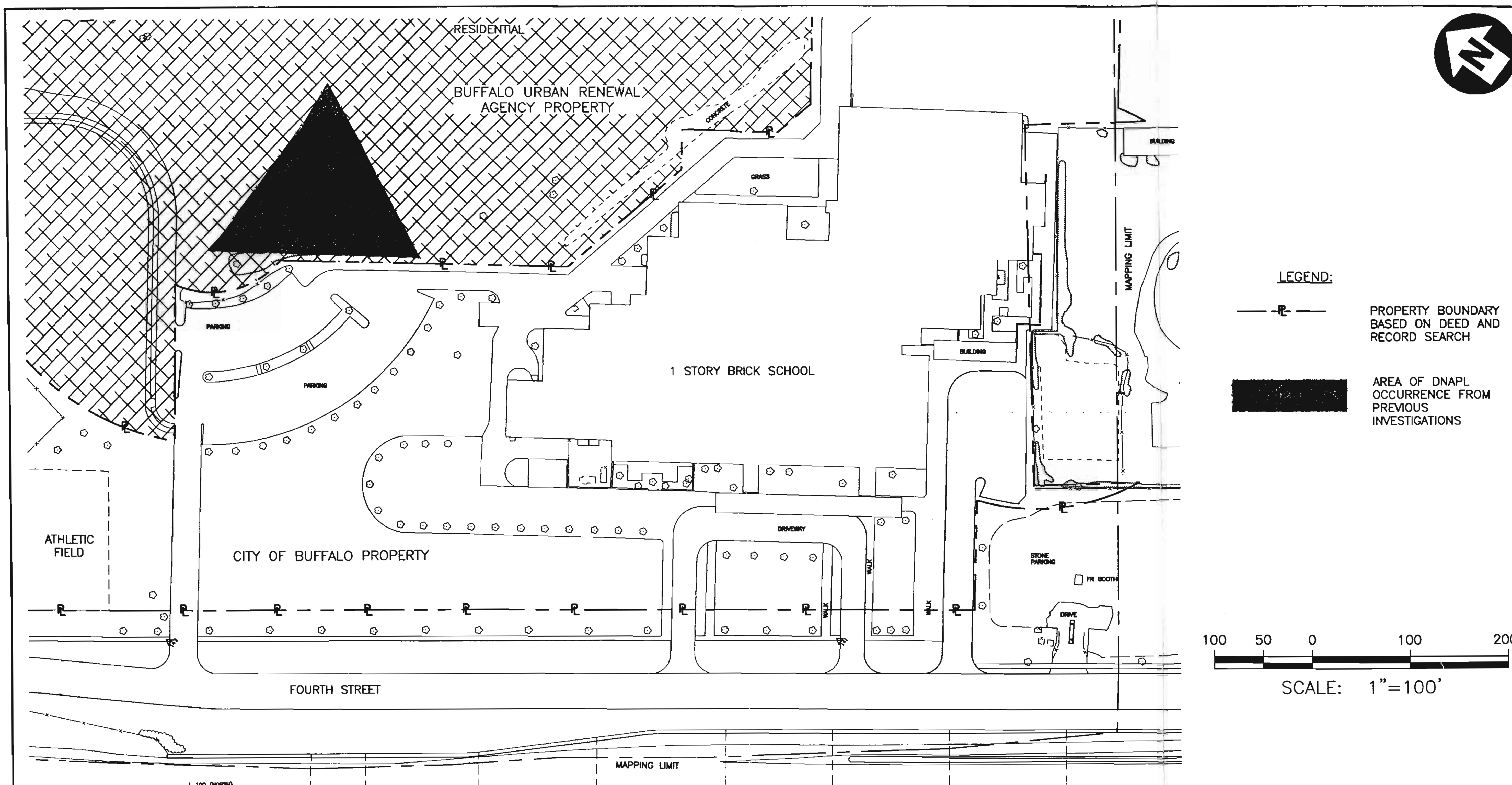
OFFICES IN PRINCIPAL CITIES



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SCALE: PAPER SCALE, 1=1
XREF'S: NONE

FIGURE 1.2

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

SITE PLAN

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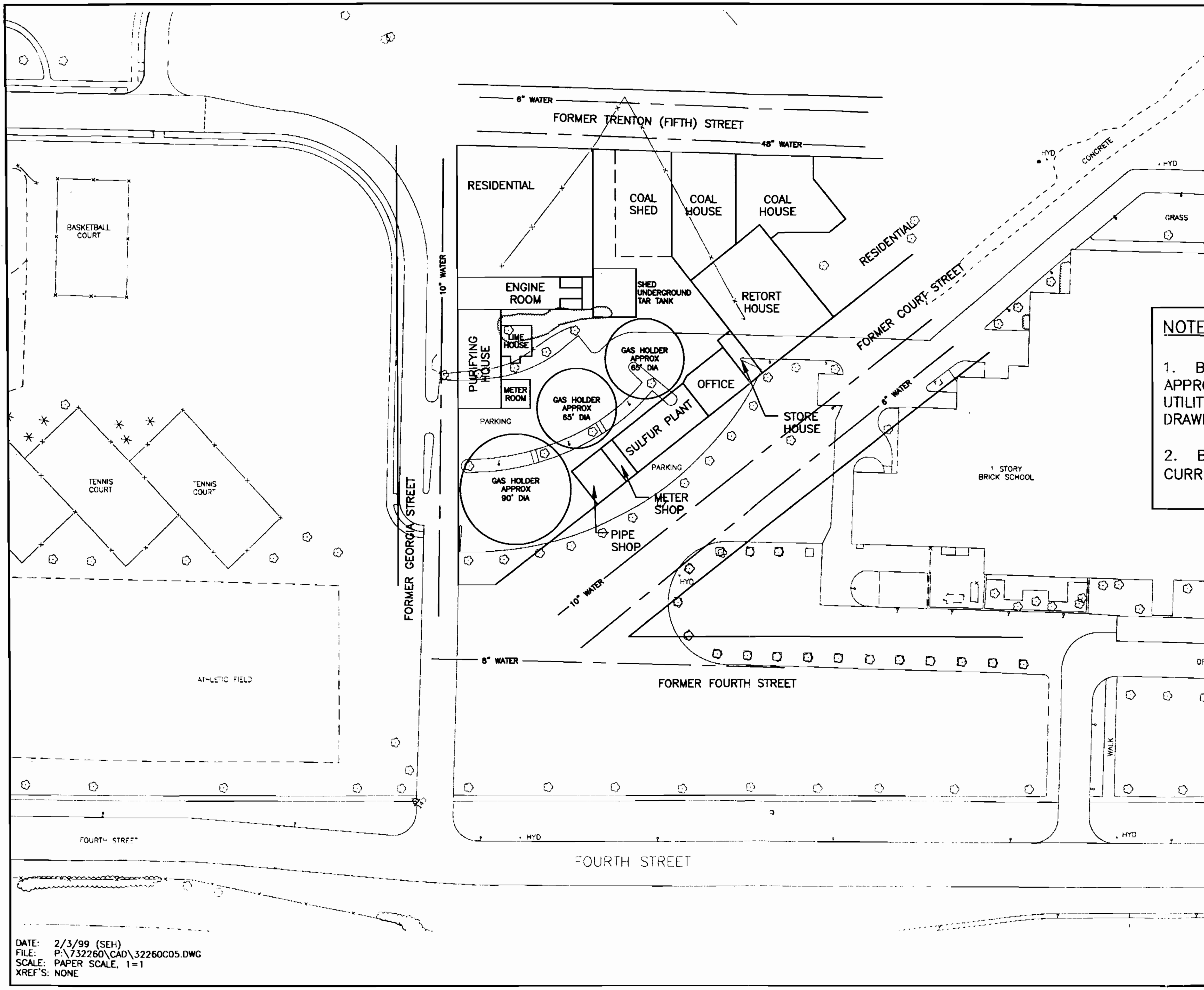

NOTES:

1. BOLD LINES AND TEXT REFLECT APPROXIMATE LOCATION OF STRUCTURES AND UTILITIES TAKEN FROM 1889 CITY ATLAS DRAWINGS. ALL ARE APPROXIMATE.

2. BACKGROUND (LIGHTER LINES) ARE CURRENT SITE CONDITIONS AS SURVEYED 4/98.

80 40 0 80 160

SCALE: 1"=80'

FIGURE 1.3

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

LOCATION OF HISTORICAL STRUCTURES AND UTILITIES

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SECTION 2

SECTION 2
STUDY AREA INVESTIGATION AND METHODS

2.1 INTRODUCTION

The 1998 field investigation reported herein was primarily an assessment of the magnitude and extent of impacts to soil and groundwater. Emphasis was placed on whether there were any: (1) onsite source areas; or (2) immediate risks posed to local residents. The soil and groundwater samples were analyzed for chemical parameters that reflect the area's manufacturing and disposal history, and the results of previous sampling. The August 1999 field investigation was an assessment of the potential for underground utilities to act as preferential pathways for the migration of DNAPL.

Results from the 1998 and 1999 investigations were used to characterize the potential migration pathways of chemical constituents, to determine the potential impacts to public health and the environment, and to identify preliminary response objectives and remedial action alternatives.

During the 1998 investigation, subsurface soil borings were drilled to characterize the nature and extent of MGP residues to the south, east, and west of the original investigations. Also, soil borings were specified to characterize the presence and extent of MGP residues in areas where data were lacking, and to provide additional geologic and stratigraphic information. During April and May 1998, a total of 19 soil borings were completed. In November 1998, four additional soil borings were drilled to further characterize any MGP residues. Seven soil borings were advanced in August 1999, adjacent to known underground utilities, to provide specific information on the potential movement of DNAPL along utility bedding.

Five groundwater monitoring wells (MW-05 through MW-09) were installed in April and May 1998. An additional groundwater monitoring well was installed in November 1998 (MW-10), adjacent to the Waterfront School. Wells were installed to evaluate onsite and offsite groundwater quality, and to determine groundwater flow directions and other hydraulic properties in the various hydrogeologic units.

Onsite and offsite shallow soils (i.e. top one foot) were analyzed to characterize the presence, nature, and extent of constituents in the shallow soil. Laboratory analytical data were then used to define the presence and characterize the nature of residues, and to address risk assessment data requirements.

NYSDEC approved the February 1998 RI/FS Work Plan and subsequent addenda dated October 1998 and July 1999. The specific field data collection activities are discussed in more detail in the following subsections.

2.2 PRE-DRILLING ACTIVITIES

2.2.1 Citizen Participation Program

Prior to undertaking field activities, a citizen participation program (CPP) was initiated. This program consisted of citizen participation activities conducted at major stages of the remedial process. The CPP for the project was included with the Work Plan, and included the following:

- Developing and maintaining a tracking database for all CPP activities at the Site;
- Maintaining and communicating a CPP activity schedule to key project personnel in advance of scheduled activities;
- Informing the public and regulatory agencies of upcoming CPP activities;
- Coordinating meeting facilities, and schedules for CPP activities;
- Preparing fact sheets, public information letters, presentation boards, handouts and meeting minutes, including attendance at meetings;
- Preparing mailing lists and envelopes, and issuing mailings;
- Ensuring copies of reports are filed in the appropriate document depositories;
- Coordinating with other public relations consultants and staff; and
- Holding a public meeting in April 1998, prior to the beginning of the field work.

2.2.2 Data Compilation

Regional and site-specific data regarding environmental conditions were collected, compiled, and evaluated concurrently with the field investigation. Available information was used to focus the field tasks of the remedial investigation. Also, the information obtained was also used to clarify the goals and procedures of subsequent tasks.

Several sources of information were utilized to determine demographics, land use, water supply sources, surface water bodies, hydrogeology, and potentially-sensitive receptors. Additionally, the document review included historical research to document MGP operations, and ownership. A general description of MGP operations is given in Appendix A. Also, historic Site information is included in Appendix A.

Sources of information included City of Buffalo files and reports, NYSDEC Region 9 files, previous Site investigations and reports, and New York State Urban Development Corporation (NYSUDC) files. Previous Site investigation reports and reports generated for neighboring properties thoroughly assessed potentially-sensitive receptors. Results of those investigations and reports are presented in Section 3.1.

2.2.3 Utilities Tracing

Before field work began, various agencies were contacted through the Underground Facilities Protective Organization (UFPO) utility locating service to determine buried utility locations. Other agencies that were contacted included the Buffalo Water and Sewer Departments. Based on discussions and Site walkovers with representatives of these agencies, wells and borings were located to avoid any underground or aboveground utilities. No aboveground or subsurface utilities were encountered during the 1998 RI field work.

2.2.4 Base Map Preparation

A base map was prepared showing the Site location, within the BURA parcel, and the adjacent City of Buffalo property. The map included the current location of buildings, property boundaries, adjacent property, topography, underground utilities, and other features.

The base map was prepared by a New York State-licensed land surveyor, TVGA, with a horizontal scale of one inch equals 40 feet, and topographic contours in one-foot intervals. The areal extent of the original map was approximately 26 acres. Horizontal and vertical ground control was established by the surveyor, and referenced to a US Geological Survey (USGS) benchmark.

2.3 SUBSURFACE SOIL SAMPLING

A subsurface soil sampling program was performed during 1998 to enable quantitative mapping of areas of concern, and to assess the extent of any impacts. The subsurface soil sampling locations were selected based on visual observation of stained surface soil and stressed vegetation, and historical chemical analysis. Generally, borings were completed adjacent to locations of previous MGP structures. Also, the soil borings were located to avoid damage and disruption to the school parking lot, to assist in determining the depth of impacts, and to assess the areal extent of impacted soil. A total of 23 borings were drilled. In April and May 1998, nineteen borings were drilled to depths as great as 26.8 feet below grade. Four additional borings were drilled in November 1998 to further define the extent of impacts. Six of the 23 borings were completed as groundwater monitoring wells. During drilling, the area was monitored with a photoionization detector (PID) to assess the presence of VOCs. Some boring locations were adjusted in the field due to underground utility lines or other obstructions. The soil boring locations are shown on Figure 2.1.

In August 1999, a supplemental investigation was conducted to determine the potential for offsite DNAPL migration along the bedding of buried utilities. Information on present and historical utility lines was collected from the City of Buffalo Engineering Department, Water Department, and the Buffalo Sewer Authority. UFPO was also contacted to mark out utilities in the area of interest, and to clear selected boring locations. The results of the data search were compiled and plotted on a site drawing (see

Figure 2.2). The drawing shows approximate locations of utility lines that have the greatest potential of functioning as preferential migration pathways for DNAPL. These lines were selected based on their depth, diameter, and location within defined areas of DNAPL occurrence. Those lines considered most likely to function as DNAPL migration pathways are those with larger diameters and depths of greater than six feet.

Eight boring locations were initially selected to be adjacent to utility lines having the potential to function as preferential pathways for offsite DNAPL migration. The coordinates of each location were then provided to a licensed New York State surveyor. The surveyor then located the proposed borings in the field to ensure that the desired locations were accurate (see Section 2.8 for details on surveying). The borings were then drilled to depths two feet greater than the approximate invert of the adjacent utility line. A total of seven borings were completed because auger refusal was encountered in one location at a depth of 18 inches. The refusal was attributed to a weir associated with an 8-foot diameter trunk sewer line. Due to the presence of other nearby utilities, this boring could not be relocated.

2.3.1 Drilling Methodology

All borings were drilled by SJB Services, Inc. using hollow-stem augers. Boring logs showing detailed descriptions of the subsurface materials encountered are contained in Appendix B.

All soil samples were collected on a continuous basis, with a standard split-spoon sampler, advanced by a 140-pound free-falling hammer, according to ASTM Standard D1586-84. Soil samples collected for laboratory analysis were labeled with the soil boring identifier or the monitoring well identifier, and the depth from which the sample was collected. All soil borings were advanced and monitoring wells were installed under the supervision of a qualified geologist. In borings not scheduled to be completed with a monitoring well, the borehole was abandoned by tremie-grouting with cement-bentonite grout. The utility borings were backfilled with bentonite holeplug.

All drilling equipment was decontaminated between holes by steam cleaning. A biodegradable detergent was used to remove heavy residuals, when necessary. All drill cuttings and other potentially-impacted solid wastes were contained in 55-gallon drums. Decontamination water, development water, and purge water were also contained in 55-gallon drums. One composite waste soil sample, and one composite waste water sample were collected from the drums on November 18, 1998 and submitted to the laboratory for VOC and cyanide analysis. A second composite waste sample was collected and analyzed during the August 1999 investigation. The drums from all investigative work have been staged onsite for subsequent disposal by BURA.

2.3.2 Subsurface Environmental Sampling

Upon sample retrieval, each split-spoon was opened, and the soil sample scanned with a PID. The PID reading (total volatile organics) was recorded in the field notebook in parts per million (ppm). The soil samples were then logged relative to appearance, color, grain size, structure, moisture content, contact stratigraphy, and other pertinent features. This information was recorded on the field boring logs (Appendix B).

Field screening and visual data were used to select samples for laboratory analysis. To define the lower extent of impacts, samples were collected beneath the zones showing visible DNAPL, staining, and sheens. After completion of the borehole, headspace readings were acquired with the PID. The sample below the visible DNAPL with the highest headspace reading was typically selected for chemical analysis. The second sample selected for analysis from a borehole was typically the sample with the lowest headspace reading. The second sample was usually selected from a depth below the first sample, to determine approximate depths at which impacts were reduced or were not present. The selected subsurface soil samples were submitted to the laboratory for analysis.

During the utility investigation, samples were collected from all seven boreholes. Samples were collected from the deepest portion of the borehole which was at, or slightly below, the approximate invert of the adjacent utility line.

Laboratory analyses for potential MGP-related compounds were conducted on the soil samples collected from the soil borings. Forty-six soil samples were analyzed for BTEX, PAHs, phenolic compounds, and total cyanide, as indicated on Table 2.1. The seven samples collected during the utility boring investigation were analyzed for BTEX and PAHs. Also, associated Quality Assurance/Quality Control (QA/QC) samples were collected during all sampling events. A discussion of soil sample results is presented in Section 4.

2.3.3 Geotechnical Sampling and Testing

Two soil samples for geotechnical analyses were collected from the soil borings. The geotechnical analyses provide data for Site characterization and the feasibility study. These soil samples were collected using split-spoons in accordance with ASTM Method D-1586-84, and analyzed for grain size distribution using ASTM Method D-422-63, for Atterberg limits using ASTM Method D-4318-84, and for percent moisture by ASTM Method D-2216. The geotechnical laboratory reports are presented in Appendix C.

2.4 MONITORING WELL INSTALLATION AND SAMPLING

During the field investigation, six monitoring wells were installed and sampled for further characterization of groundwater. Three wells (MW-05, MW-06, and MW-07) were installed to more accurately define the groundwater flow direction and to assist in delineating potential impacts to groundwater. Two wells (MW-08 and MW-09) were installed to assess potential impacts associated with the former Wilkeson Boat Slip and a former MGP located on the adjacent National Fuel Gas property. A sixth monitoring well (MW-10) was installed in November 1998 to determine potential impacts adjacent to the school, and to define groundwater flow direction. The monitoring wells are installed above the bedrock and screened so that potential contamination at any depth can be detected in the well. The locations of the monitoring wells are shown on Figure 2.1.

2.4.1 Well Installation Procedure and Construction

The monitoring wells were constructed with two-inch diameter, schedule 40 PVC with flush-threaded joints. Well screens varied in length, ranging from 10 to 15 feet. The screen slot size for each well was 0.01-inch. All wells were constructed with a six-inch sump beneath the screen to allow for DNAPL collection. A filter pack of silica sand was backfilled in the annular space, between the well and native soil, from the bottom of the sump to a maximum of two feet above the well screen. A minimum two-foot thick seal, composed of bentonite chips, was placed over the filter pack. A cement-bentonite grout was installed from the top of the bentonite seal to the ground surface. All wells were protected with hinged, locking, metal casings or curb boxes installed flush with ground surface. Drilling records and well construction diagrams are contained on the boring logs in Appendix B.

2.4.2 Well Development

To complete each monitoring well installation, the wells were developed by continuous bailing. Well development continued until the well water became reasonably clear and sediment free, approaching 50 nephelometric turbidity units (NTUs). At least three well volumes were removed from each well during development. Temperature, conductivity, pH, and turbidity were monitored during development. All downhole equipment was decontaminated between wells. All development water was contained and staged onsite. Appendix D contains the well development logs.

2.4.3 Groundwater Sampling

Samples of groundwater were collected on May 15, 1998 from the five new monitoring wells and existing monitoring wells MW-03 and MW-04. A sample from MW-10 was collected on November 18, 1998 after it was installed and developed. Prior to sampling each well, the water level was measured and the well was purged by removing a minimum of three well volumes of water using a high density polyethylene (HDPE) disposable bailer. The purge volume was recorded along with visual (estimate of turbidity and color, sheen, or rust), olfactory (any chemical odors), and water quality data (turbidity, pH, conductivity, and temperature). Representative samples could not be obtained in MW-2 due to the presence of DNAPL, and MW-1 because the well has been abandoned.

After each well was purged, it was allowed to recover to 90 percent or greater of its static level. Sample collection was conducted using a disposable HDPE bailer. All of the equipment introduced into the monitoring well was thoroughly cleaned according to sampling protocols. Chain-of-Custody was documented from sample collection to sample analysis at the laboratory. Samples were packed on ice in coolers, and sent via overnight courier to the laboratory for analysis. Groundwater sampling records are presented in Appendix D.

A total of nine groundwater samples plus the associated QA/QC samples, were analyzed for BTEX, PAHs, phenolic compounds, and total cyanide, as indicated on Table 2.1. A discussion of groundwater sample results is presented in Section 4.

2.5 SURFACE SOIL SAMPLING

Five surface soil samples were collected from onsite locations during the 1998 investigation. Samples were collected from the zero to one foot depth interval, and analyzed for the presence of BTEX, PAHs, phenolic compounds, and cyanide. Surface soil samples (Figure 2.1) were collected from areas that are accessible to the students, teachers, and workers at the Waterfront School, and local residents.

A total of seven surface soil samples were collected from offsite locations to provide background data for the risk assessment and comparison to onsite data. Offsite soil samples were collected from locations outside of the area, potentially impacted by the former MGP. Samples were analyzed for the presence of BTEX, PAHs, phenolic compounds, cyanide, and total organic carbon (TOC). The TOC data were used to complete equilibrium partitioning calculations of soil cleanup criteria for organic compounds. Figure 2.1 shows offsite surface soil sample locations. A discussion of onsite and offsite sample results is presented in Section 4.

Onsite and offsite surface soil samples were collected using a hand-held bucket auger. The top layer of sod was removed from the sample location, retained, and replaced after samples were collected. The bucket auger was cleaned between sample locations in accordance with the Work Plan.

2.6 HYDRAULIC CONDUCTIVITY TESTING

The objective of the hydraulic conductivity testing (slug tests) was to characterize the hydraulic properties of the hydrogeologic units found at the Site. Monitoring wells MW-03 through MW-09 were tested. Slug tests were not performed on MW-02 and MW-10. Slug tests were not performed on MW-02 due to the presence of DNAPL in the well. NYSDEC did not require slug testing in MW-10.

Rising head and falling head slug tests were performed using a 4-foot long slug made of 1-inch diameter stainless steel. Water level data were collected using pressure transducers and recorded with an electronic data logger. Also, water level measurements were collected with a water level indicator to correct for drift in the transducer readings, and as a data backup.

The data from the slug tests were analyzed using the Bouwer and Rice (1976, 1989) method. The slug test data and the computational reports are presented in Appendix E. A discussion of the hydrogeologic units and their hydraulic properties is presented in Section 3.

2.7 WATER LEVEL MONITORING

Depth to groundwater was measured in all of the wells and converted into groundwater elevations so that the direction and gradient of groundwater flow could be determined. Water levels were collected on several dates between May 1998 and November 1998.

2.8 SURVEYING

All sample locations, including surface soil samples, soil boring locations, and monitoring well locations, were surveyed by a New York State-licensed surveyor. Monitoring well elevations were surveyed relative to an established USGS Geodetic datum. The survey was conducted to achieve a ground control accuracy of 1/5,000 ft. horizontal, and 0.1 ft. vertical. Also, property boundary line survey was performed using deed and record information. Accuracy of the final maps is in accordance with requirements set forth in the Work Plan. For the utility investigation, the surveyor was utilized to locate the boreholes prior to drilling.

2.9 LABORATORY ANALYSES

The analytical testing parameters for surface soil, subsurface soil, and groundwater are summarized on Table 2.1. Sample results and associated QA/QC samples results are discussed in Section 4. Laboratory analytical data are included in Appendix F.

All analyses were conducted using the NYSDEC Analytical Services Protocol (ASP), dated September 1989 and including the 1991, 1993, and 1995 revisions. All analytical work was performed by a laboratory approved by the New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) for all categories of solid and hazardous waste. Chemical and physical analyses not covered by ASP procedures were conducted using procedures specified in the Quality Assurance Project Plan (QAPP). Sample custody, laboratory procedures, and other QA/QC requirements were performed in accordance with the specifications in the QAPP.

2.10 DATA VALIDATION

Data validation was performed on soil and groundwater samples. In accordance with the NYSDEC approved Work Plan, full validation (USEPA Level IV) was performed on ten percent of the collected samples, and the remaining samples were evaluated at USEPA Level III. The Level III validation included a review of holding times, QC blanks, surrogate recoveries, matrix spike/matrix spike duplicate (MS/MSD) precision and accuracy, internal standard responses, calibration responses, field duplicate precision, and all other instrument performance QC checks. The full validation included Level III review in addition to calculations of detected results from the raw data, verifying the presence or absence of compounds or analytes from a sample, and calculating laboratory and sample QC results with instrument raw data. The data validation report is included in Appendix F. Analytical summary tables are included in the validation report. All laboratory analytical data presented in this report have been validated in accordance with the validation described above.

2.11 DATABASE MANAGEMENT

All laboratory data generated during the RI was stored and managed using Paradox^{tm} database software. Laboratory results were provided on diskettes and read directly into the database. Following data validation, the master database was updated to reflect any changes as a result of data validation. These changes included concentration changes, where appropriate, and removal, addition, and/or changes to data qualifiers. All data used in the RI report were taken from the updated master database to ensure that only current, validated analytical results were used. A separate electronic database was used to store and sort data generated from water level measurements and hydraulic conductivity testing.

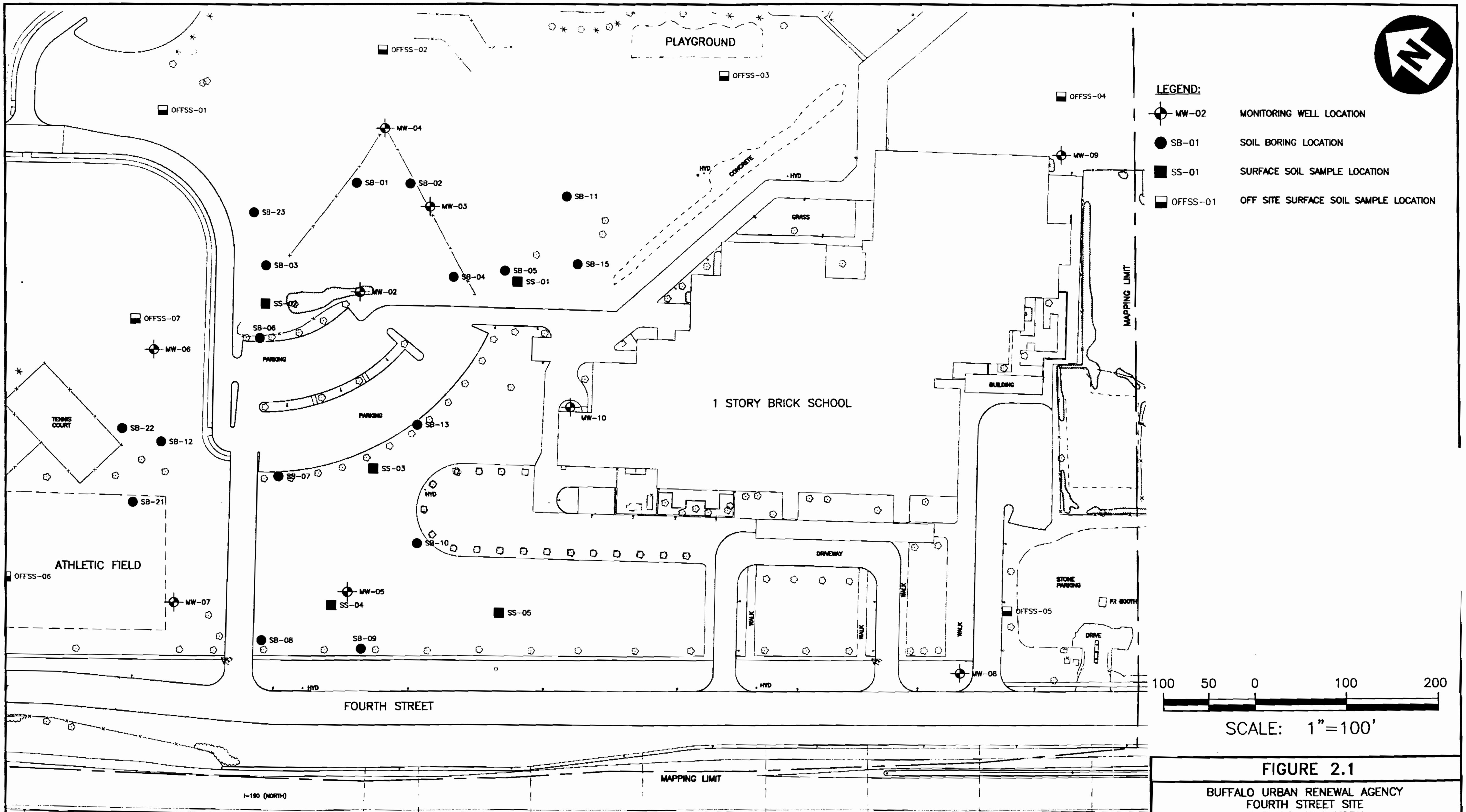

FIGURE 2.1

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

1998 SAMPLE LOCATION MAP

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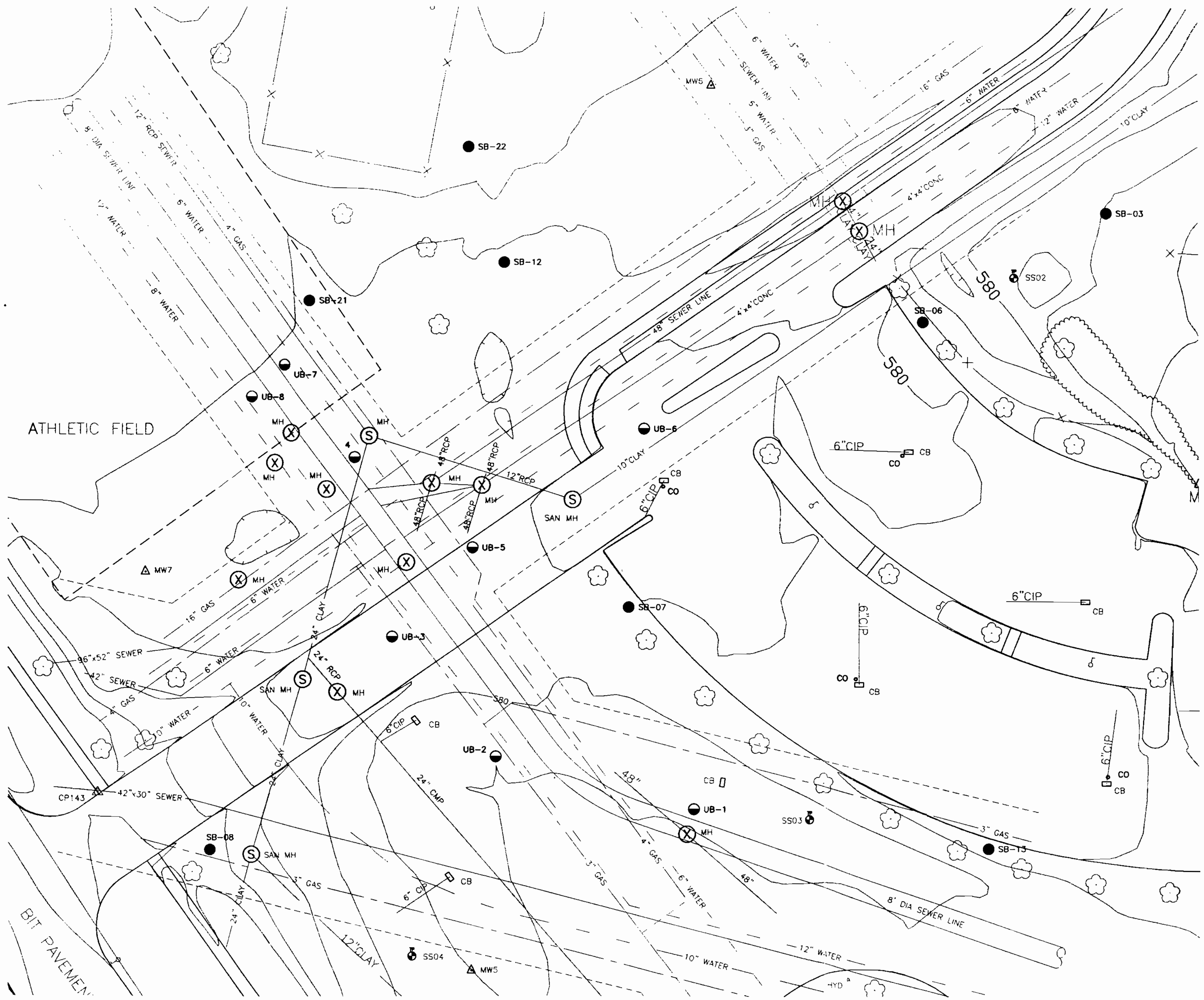
DATE: 2/3/99 (SEH)
FILE: P:\732260\CAD\32260C03.DWG
SCALE: PAPER SCALE, 1=1
XREF'S: NONE



LEGEND:

UB-3	UTILITY BORING LOCATIONS
— - —	GAS LINE (ABANDONED)
———	SEWER LINE
— — —	WATER LINE
- - - - -	APPROXIMATE FORMER ROAD LOCATION
SB-03	EXISTING BORING LOCATIONS
MW7	EXISTING MONITORING WELL LOCATIONS
MH	MANHOLE
SAN MH	SANITARY MANHOLE
CB	CATCH BASIN

NOTE:

UTILITY LINE LOCATIONS SHOWN ARE APPOXIMATE

40 20 0 40 80

SCALE: 1"=40'

FIGURE 2.2

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

UTILITIES SITE MAP

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XREF'S: NONE

Table 2.1
Analytical Summary
Groundwater, Surface and Subsurface Soils

Matrix	Parameter	Analytical Method(a)	Field Samples: Number of Samples	Field Samples: Field Duplicate	Field Samples: Field Blank	Field Samples: Sub-Total	QC Samples: MS/MSD(b) (Pairs)	QC Samples: Trip Blank	Total Samples
Soil Borings and Well Borings	BTEX	8020	53	4	3	60	5	1	66
	PAHs/Phenolics	8270	53	4	3	60	3		63
	CYANIDE	335.2	46	3	3	52	3		55
Onsite Surface Soils	BTEX	8020	5	1	1	7	1		7
	PAHs/Phenolics	8270	5	1	1	7	1		7
	CYANIDE	335.2	5	1	1	7	1		7
Offsite Surface Soils	BTEX	8020	7			7			7
	PAHs/Phenolics	8270	7			7			7
	CYANIDE	335.2	7			7			7
	Total Organic Carbo	Lloyd Kahn	7			7	1		7
Groundwater	BTEX	8020	9	2	2	13	2	2	17
	PAHs/Phenolics	8270	9	2	2	13	2		15
	CYANIDE	335.2	9	2	2	13	2		15
Residual Waste Samples	TCL VOCs (soil)	8260	1			1			1
	TCL VOCs (water)	8270	1			1			1
	CYANIDE (soil)	335.2	1			1			1
	CYANIDE (water)	335.2	1			1			1

(a) USEPA SW846 Methods
(b) Matrix Spike/Matrix Spike Duplicate for organic analyses; matrix spike and laboratory duplicate for inorganic analyses

SECTION 3

SECTION 3
STUDY AREA PHYSICAL CHARACTERISTICS

3.1 PHYSICAL SETTING AND TOPOGRAPHY

3.1.1 Physiography

The Fourth Street Site study area is situated in the Erie-Ontario Lake Plain Province. The Erie-Ontario Plain has little significant relief except in the vicinity of major drainageways. The lack of significant relief typifies the topography of an abandoned lake bed. On the Erie-Ontario Plain, elevations range from 700 to 1,000 feet above mean sea level. The mean elevation at the Lake Erie shoreline is 569 feet above mean sea level (Buehler and Tesmer, 1963).

3.1.2 Site Topography

The Site is relatively flat. The ground slopes gently from an elevation of 584 feet at the eastern boundary to an elevation of approximately 579 in the central part of the Site, west of the parking area. Ground elevation increases to approximately 584 feet where Georgia Street meets Fourth Street. The small changes in elevation direct surface drainage toward the center of the Site. Topography is shown on Figure 3.1.

3.1.3 Site Features

The Site consists primarily of open, grass-covered areas, and includes an asphalt-covered parking area for the Waterfront School. City of Buffalo-owned property and the Waterfront School are adjacent to the Site to the southwest. A National Fuel Gas service facility is located southeast of the school. The remainder of the surrounding area is urbanized and includes residential, commercial, and recreational land. An elevated section of the NYS Thruway (I-190) is situated across Fourth Street to the southwest.

3.1.4 Potentially Sensitive Receptors

A report prepared for a nearby industrial location identified the presence and type of sensitive receptors within the vicinity of the Fourth Street location (Groundwater Technology, 1996). The report indicates that the local water supply comes from Lake Erie, at a point approximately one mile off-shore in the Emerald Channel. This channel is located at the mouth of the Niagara River. One groundwater supply well is reportedly located within one-half mile of the Site, and three additional supply wells are reportedly located within one to two miles of the Site. All of these wells are reported to be hydraulically upgradient of the Site. The database search revealed that these wells were either unused or are used for industrial purposes.

This report also states that there are no state-listed wetlands existing within one-half mile of the Site. The surrounding area consists of urban land use, and no natural habitats for potentially endangered species are reported to exist.

3.2 SURFACE WATER HYDROLOGY

3.2.1 Regional Hydrology

The Site is located approximately 1,500 feet east of the Lake Erie shoreline, adjacent to Buffalo Harbor. In the Erie-Ontario Lake Plain Province, streams and creeks meander across the flat lake plains. Within the region, streams and creek gradients are generally small, and there are numerous swampy areas. Most of the streams in the region drain in a northwesterly to westerly direction to Lake Erie and the Niagara River. North of Buffalo, the main drainageway is Ellicott Creek, which flows westerly and empties into the Niagara River. South of the Site, Cazenovia and Cayuga Creeks drain to the Buffalo River. Buffalo River enters the Buffalo Harbor approximately 2,000 feet southwest of the Site (Buehler and Tesmer, 1963).

3.2.2 Site Hydrology

The Site is generally isolated from any surface water bodies. Although Lake Erie and Buffalo River are proximal to the Site, they do not receive direct storm runoff from the Site. At one time, the Erie Barge Canal existed where the NYS Thruway is currently located. Several boat slips were connected to the canal, including the Wilkeson Slip, formerly located southeast of the current Waterfront School.

Direct storm runoff from the Site is controlled by sewer systems that existed prior to the existence of the Waterfront School, and by sewer systems installed to control drainage around the school and the parking lot. Utility drawings for the Waterfront School, and the sewers in the vicinity of the Fourth Street Site, indicate that storm water from the Site is discharged to the 8-foot diameter Swan Trunk Sewer. The Swan Trunk sewer conveys the combined sanitary and storm discharge to the Buffalo Sewer Authority Wastewater Treatment Plant on Bird Island. The water is treated prior to discharge from the wastewater treatment plant. Thus, the Site is not expected to impact local surface water bodies. Figure 2.2 shows the active and abandoned utilities southwest of the school parking lot.

3.3 GEOLOGY/HYDROGEOLOGY

3.3.1 Regional Geology

The Site is underlain by bedrock of Upper Silurian, and Middle and Upper Devonian age. The bedrock consists mainly of shale, limestone, and dolomite. The units are bedded due to their depositional environment. The dip of the bedrock is to the south, between 20 and 60 feet per mile (Buehler and Tesmer, 1963).

The unconsolidated deposits are mainly the result of glaciation that occurred 10,000 to 15,000 years ago. The glacial deposits are of three main types:

1. Till - a non-sorted mixture of clay, silt, sand, and gravel deposited directly from the glacial ice sheet.
2. Lake deposits - bedded clay, silt, and sand that settled out in lakes fed by the meltwater from the glacier.
3. Sand and gravel deposits - sand and gravel deposited in glacial streams.

Glacial deposits in the region range from less than 50 feet in the northern part of the Erie-Niagara basin, to more than 600 feet in the southern part of the basin (Buehler and Tesmer, 1963).

Other non-glacial deposits, called alluvium, are found in the region. The alluvium is a recent deposit formed by streams. Numerous swamp deposits (decayed plant matter) can be found in poorly drained areas of the region.

3.3.2 Regional Hydrogeology

Buffalo and the other communities adjacent to Lake Erie obtain their water from the lake. Also, municipal water supplies are obtained from the Niagara River. The flow of groundwater in unconsolidated deposits is controlled by topography. In bedrock, groundwater flow is controlled by the vertical and horizontal joint patterns in bedrock. Locally, groundwater movement is controlled by flow systems that feed the many streams and creeks in the region, ultimately discharging to the Niagara River or Lake Erie.

3.3.3 Site Geology

Characterization of the Site geology is based upon 23 soil borings drilled during the recent field investigation, and boring logs from boreholes drilled during previous investigations. The Site is underlain by approximately 10 to 28 feet of unconsolidated sediments, overlying limestone bedrock. Maps indicate that the bedrock is the Middle Devonian Onondaga Limestone, but this was not confirmed during drilling. The unconsolidated sediments are comprised predominantly of fine-grained sands, with layers and lenses of sand and gravel, silty sand and clayey silt. Unconsolidated units at the Site can be generalized into three main units:

- Fill - an unsorted mixture of brick, cement, slag, coal, wood, silt, sand, and gravel.
- Lake deposits - clay, silt, and sand with some gravel.
- Till - a nonsorted mixture of clay, silt, sand, and gravel deposited directly from glacial ice sheets.

Fill was found over the entire Site at thicknesses of up to 18 feet (soil boring SB-07), but typically fill thicknesses range from 4.5 to 14 feet. The greatest thickness occurred beneath the former location of the MGP, as shown in Figures 3.2 through 3.4. The water table generally exists between four and six feet below ground surface; thus, the lower portions of the fill were usually saturated. In borings at the northern boundary of the Site, a discontinuous peat layer was found at the bottom of the fill. The thickness of the peat layer ranged from six inches to more than five feet.

The fill is underlain by glacial lake deposits consisting of clay, silt, gravel, and sand. Grain size analyses (Appendix C) indicate that clay content ranges from 3.5 percent to 11.5 percent, silt content ranges from 13.2 percent to 45.3 percent, sand content ranges from 37.8 percent to 68.3 percent, and gravel content ranges from 5.4 percent to 15 percent. The lake deposits range in thickness from 3.9 to 18.6 feet, but are thinnest beneath the former MGP. This unit is generally saturated.

A thin, discontinuous veneer of till can be found beneath the lake deposits. The till is typically a gray, gravely sand with some silt and clay. Although variable and often absent in a borehole, the till layer, when encountered, is generally less than two feet thick. The till layer is usually saturated and hard, and is present in bedrock depressions, as seen in Figures 3.3 and 3.4.

Although not confirmed by rock coring, it is likely that competent bedrock exists beneath the Site at depths that range from 10.6 feet to 26.8 feet. Based on the 1998 soil borings, the bedrock appears to consist of a light gray fossiliferous limestone that contains considerable amounts of chert. The type of bedrock is reportedly the Middle Devonian, Onondaga Limestone.

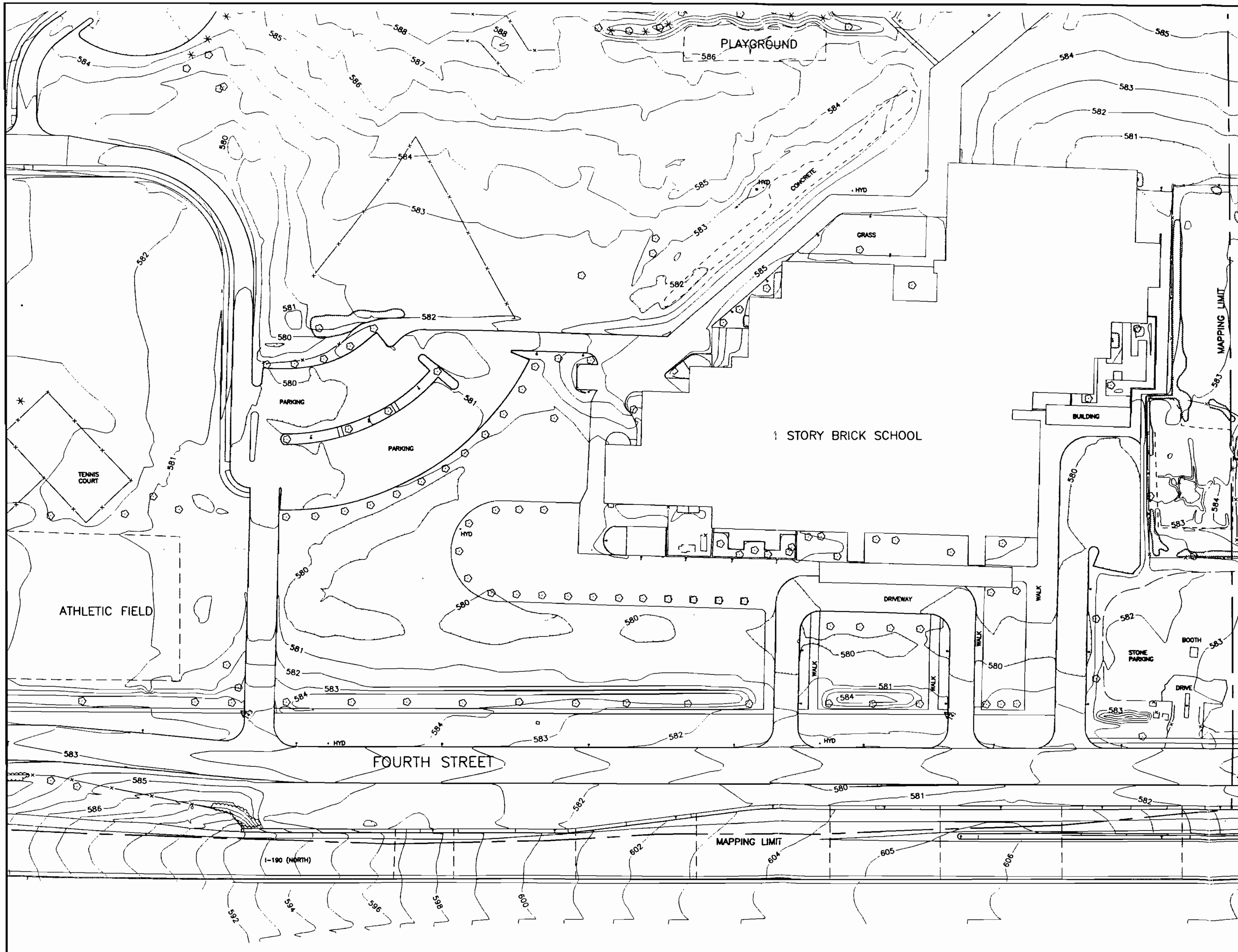
3.3.4 Site Hydrogeology

The characterization of the Site hydrogeology is based upon water level readings and *in situ* hydraulic conductivity tests performed in seven monitoring wells. The shallowest aquifer beneath the Site can be characterized as unconfined, occurring mainly within the glacial lake sediments. In general, the monitoring wells are screened from the top of rock to above the water table. Groundwater level measurements were collected on four dates: May 15, June 19, July 13, and November 20, 1998. Figures 3.5 and 3.6 are water table contour maps derived from the water levels measured on May 15, and November 20, 1998. The water level data for all wells are presented on Table 3.1.

Water levels and elevations determined for MW-08 and MW-09 suggest that the direction of groundwater flow adjacent to these wells is influenced by the former Wilkeson slip that once existed near the southern side of the school. MW-08 and MW-09 were not used in the construction of the water table contour maps due to their distant locations from the Site, and their proximity to the former Wilkeson slip.

As expected, regional groundwater flow in the water table aquifer above bedrock is from the topographically high area northeast of the Site, toward Lake Erie. In the study area north of the school, groundwater flow direction during the four 1998 monitoring events was to the west-southwest. As the water table elevations decreased, from May to November 1998, the direction of groundwater flow was essentially unchanged. The groundwater gradient was approximately 0.0178 feet per foot on May 15, 0.016 feet per foot on June 19, 0.0195 feet per foot on July 13, and 0.0143 feet per foot on November 20, 1998.

Based upon slug tests on new and existing monitoring wells (except MW-02), hydraulic conductivities in the saturated section of each borehole range from 5.77×10^{-5} cm/sec (0.16 ft/day, MW-06) to 1.11×10^{-3} cm/sec (3.15 ft/day, MW-09). The average (geometric mean) hydraulic conductivity of all wells tested was 3.27×10^{-4} cm/sec (0.924 ft/day). Hydraulic conductivity data are summarized in Table 3.2.



LEGEND:

581 ——— TOPOGRAPHIC CONTOUR LINE (INTERVAL: 1 FOOT)

581 GROUND SURFACE ELEVATION IN FEET RELATIVE TO MEAN SEA LEVEL

NOTE:

1. TOPOGRAPHY DETERMINED USING TVGA SITE FLYOVER AND WALKOVER 4/98.

2. HORIZONTAL DATUM STATE PLANE COORDINATES CONFORMING TO NAD 1927

3. VERTICAL DATUM IS NGVD 1929

100 50 0 100 200

SCALE: 1"=100'

FIGURE 3.1

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

SITE TOPOGRAPHY MAP

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180 LAWRENCE BELL DRIVE – SUITE 100 * WILLIAMSVILLE, N.Y. 14221 * 716/633-7074
OFFICES IN PRINCIPAL CITIES

DATE: 11/04/99 (SEH)
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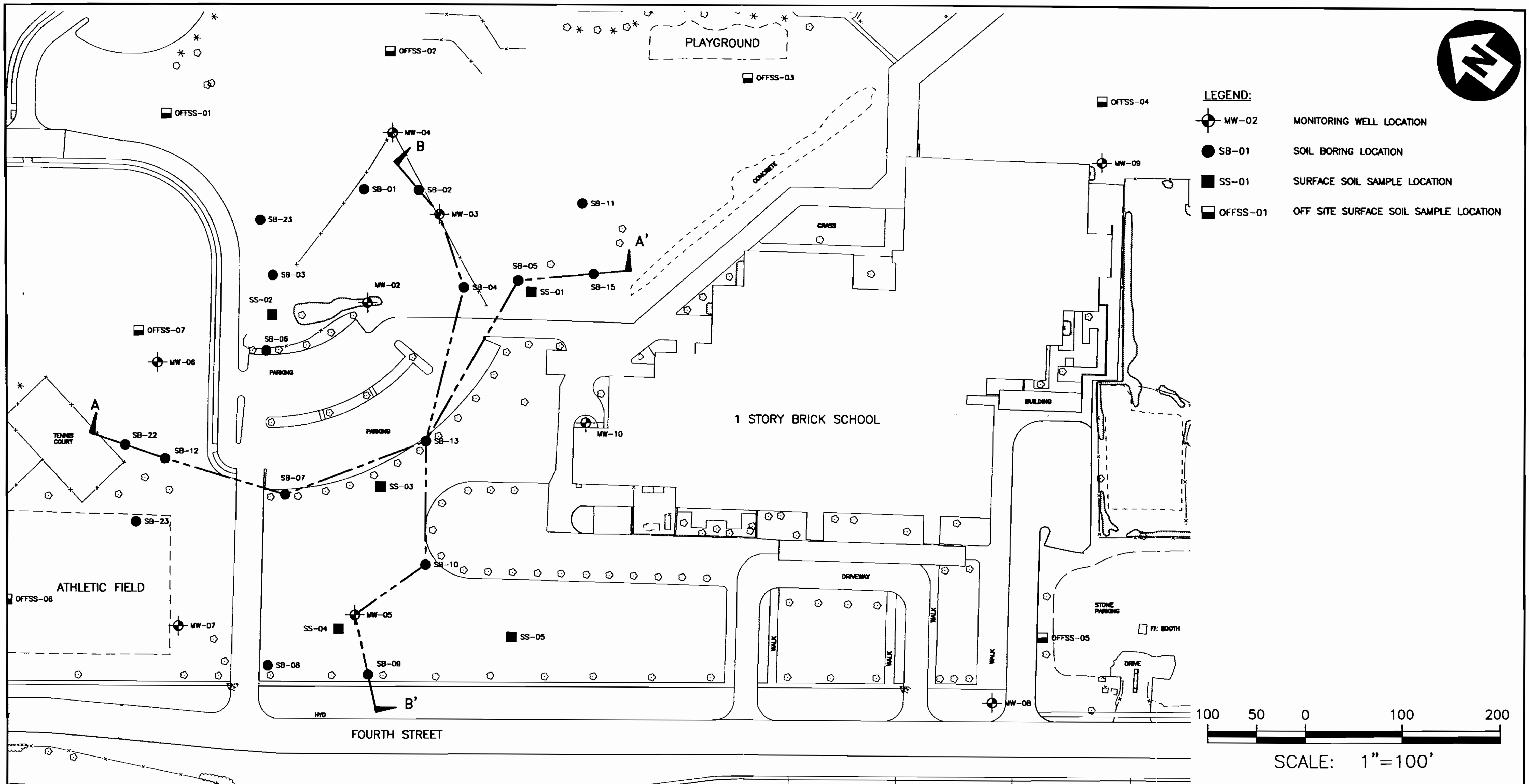

FIGURE 3.2

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

CROSS SECTION LOCATION MAP

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DATE: 1/5/99 (SEH)
FILE: P:\732260\CAD\32260C16.DWG
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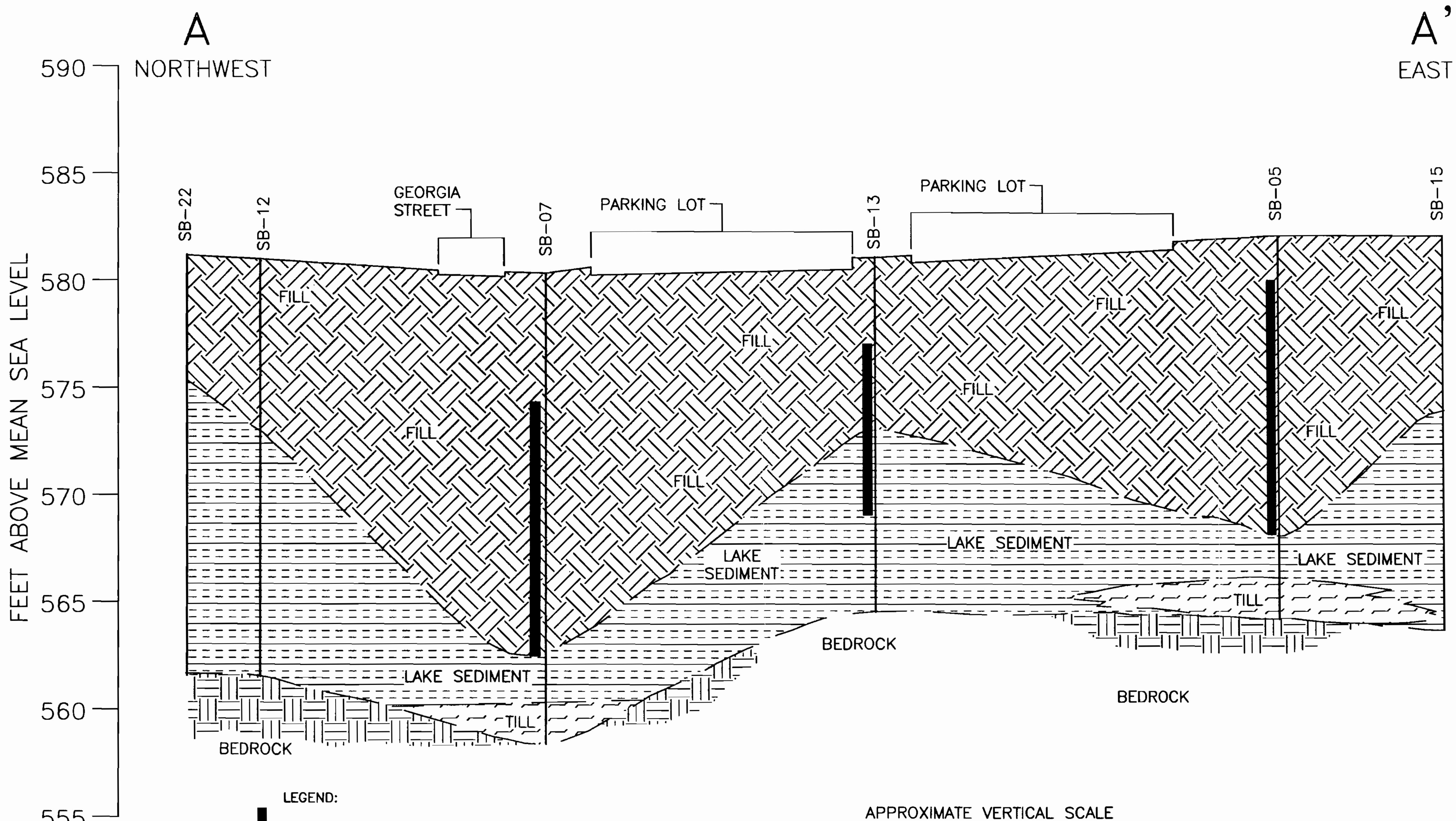

LEGEND:

APPROXIMATE ZONE OF DENSE NON-AQUEOUS PHASE LIQUID OCCURRENCE DETERMINED FROM VISUAL OBSERVATION OF FREE-PHASE PRODUCT

BEDROCK – ONONDAGA LIMESTONE

FILL – UNSORTED MIXTURE OF BRICK, CEMENT, SLAG, COAL, WOOD, SILT, SAND AND GRAVEL

LAKE SEDIMENT – CLAYS, SILTS AND SANDS WITH SOME GRAVEL

TILL – UNSORTED MIXTURE OF CLAY, SILT, SAND AND GRAVEL DEPOSITED FROM ICE

APPROXIMATE VERTICAL SCALE

5 2.5 0 5 10

SCALE: 1"=5'

APPROXIMATE HORIZONTAL SCALE

50 25 0 50 100

SCALE: 1"=50'

FIGURE 3.3

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

CROSS SECTION
A–A'

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DATE: 02/02/99 (JAR)
FILE: P:\732260\CAD\32260C17.DWG
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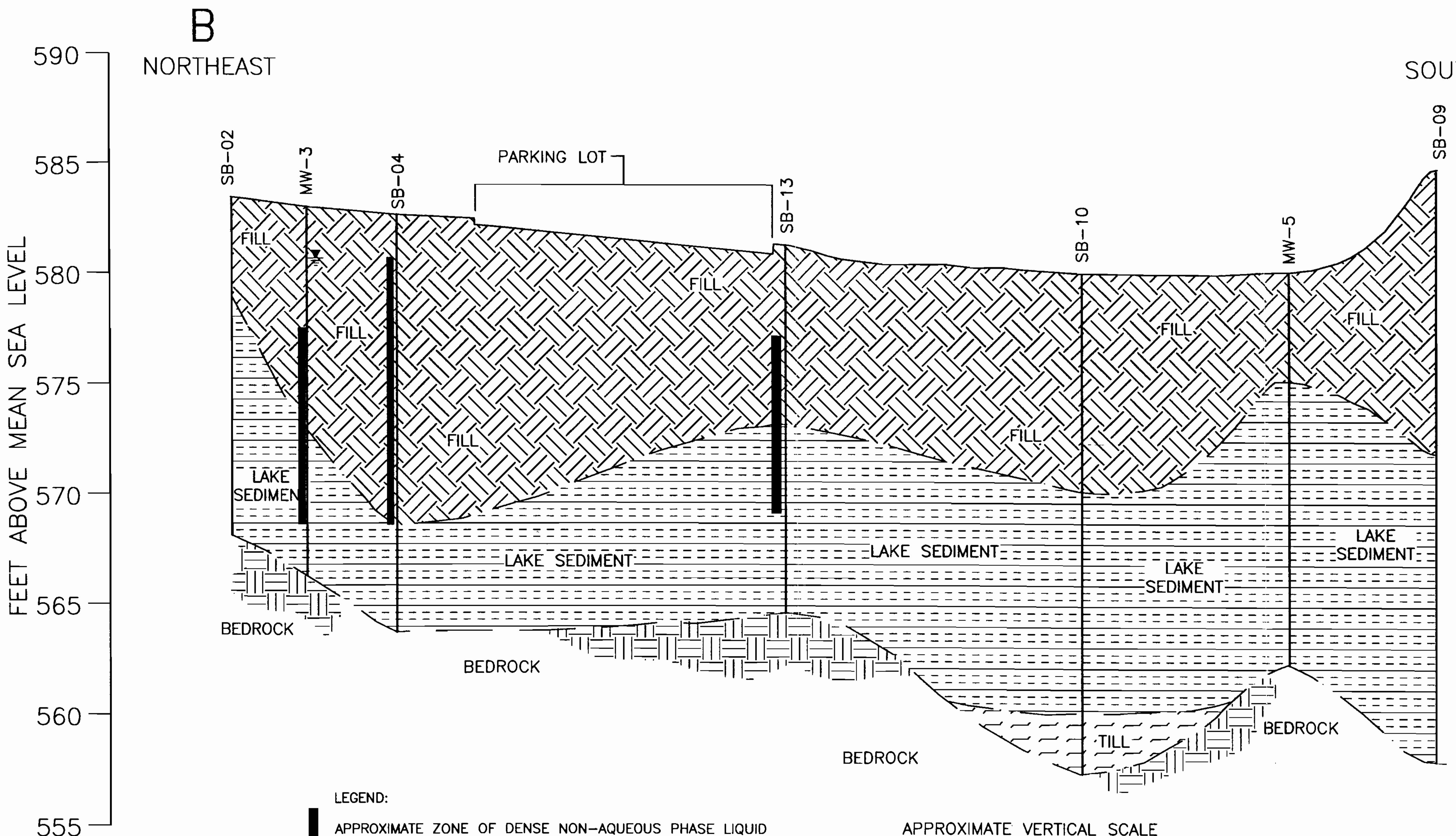

LEGEND:

APPROXIMATE ZONE OF DENSE NON-AQUEOUS PHASE LIQUID OCCURRENCE DETERMINED FROM VISUAL OBSERVATION OF FREE-PHASE PRODUCT

BEDROCK – ONONDAGA LIMESTONE

FILL – UNSORTED MIXTURE OF BRICK, CEMENT, SLAG, COAL, WOOD, SILT, SAND AND GRAVEL

LAKE SEDIMENT – CLAYS, SILTS AND SANDS WITH SOME GRAVEL

TILL – UNSORTED MIXTURE OF CLAY, SILT, SAND AND GRAVEL DEPOSITED FROM ICE

APPROXIMATE VERTICAL SCALE

5 2.5 0 5 10

SCALE: 1"=5'

APPROXIMATE HORIZONTAL SCALE

50 25 0 50 100

SCALE: 1"=50'

FIGURE 3.4

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

CROSS SECTION
B–B'

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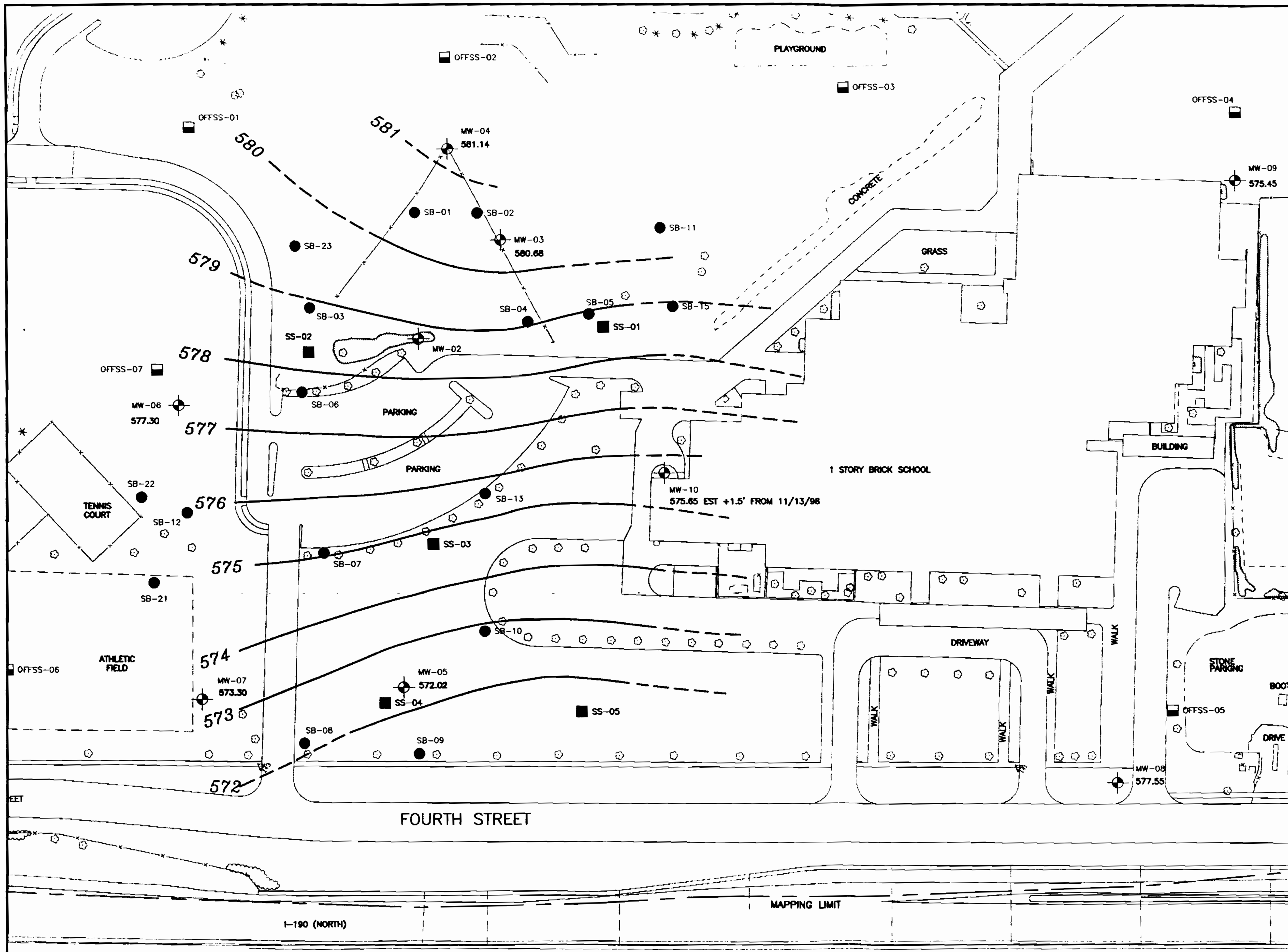


NOTES:

1. PROXIMITY OF MW-08 AND MW-09 TO MW-03, MW-04 AND MW-05 DOES NOT ALLOW REPRESENTATIVE CONTOURS TO BE SHOWN BENEATH THE SCHOOL.
2. NO WATER DETECTED IN MW-02. WELL WAS NOT USED TO DEVELOP CONTOURS.
3. HORIZONTAL DATUM STATE PLANE COORDINATES NAD 1927.
4. VERTICAL DATUM NGVD 1927.

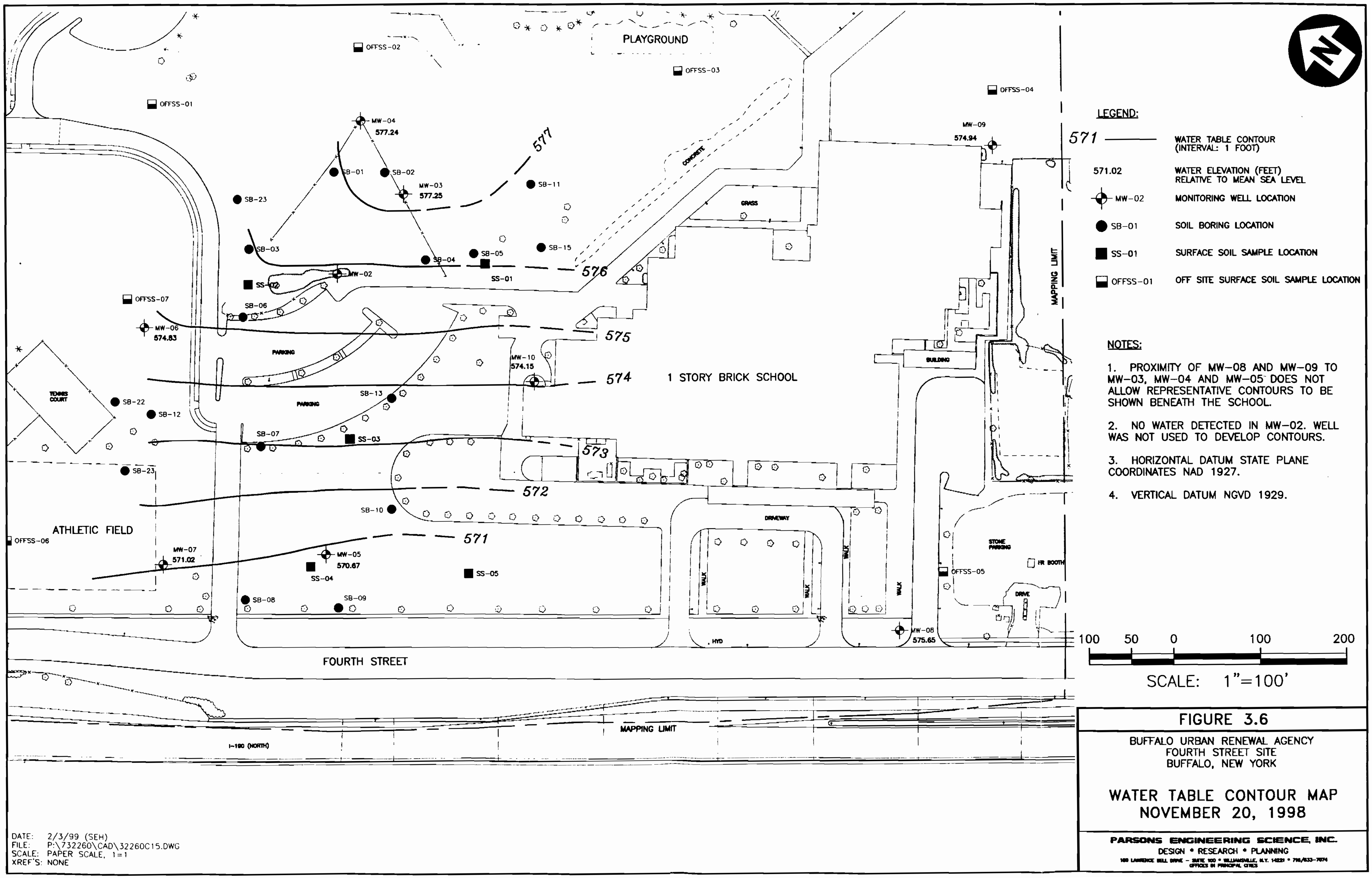
FIGURE 3.5

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

WATER TABLE CONTOUR MAP
MAY 15, 1998

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING

DATE: 2/3/99 (SEH)
FILE: P:\732260\CAD\32260C07.DWG
SCALE: PAPER SCALE, 1=1
XREF'S: NONE



NOTES:

1. PROXIMITY OF MW-08 AND MW-09 TO MW-03, MW-04 AND MW-05 DOES NOT ALLOW REPRESENTATIVE CONTOURS TO BE SHOWN BENEATH THE SCHOOL.

2. NO WATER DETECTED IN MW-02. WELL WAS NOT USED TO DEVELOP CONTOURS.

3. HORIZONTAL DATUM STATE PLANE COORDINATES NAD 1927.

4. VERTICAL DATUM NGVD 1929.

FIGURE 3.6

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

WATER TABLE CONTOUR MAP
NOVEMBER 20, 1998

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING

DATE: 2/3/99 (SEH)
FILE: P:\732260\CAD\32260C15.DWG
SCALE: PAPER SCALE, 1=1
XREF'S: NONE

Table 3.1
BURA Fourth Street Site
Water Levels and Elevations

Monitoring Well	Date	5/15/98		6/19/98		7/13/98		11/20/98		8/25/99	
	Top of Casing Elevation	Depth to Water (ft)	Water Level Elevation	Depth to Water (ft)	Water Level Elevation	Depth to Water (ft)	Water Level Elevation	Depth to Water (ft)	Water Level Elevation	Depth to Water (ft)	Water Level Elevation
MW-02	584.8										
MW-03	585.6	4.92	580.68	6.16	579.44	6.45	579.15	8.35	577.25	8.08	577.52
MW-04	586.8	5.66	581.14	6.79	580.01	7.22	579.58	9.56	577.24	7.78	579.02
MW-05	579.6	7.58	572.02	7.94	571.66	8.06	571.54	8.93	570.67	8.22	571.38
MW-06	581.3	4.00	577.30	5.11	576.19	5.18	576.12	6.47	574.83	5.98	575.32
MW-07	580.3	6.80	573.50	7.12	573.18	7.56	572.74	9.28	571.02	8.61	571.69
MW-08	583.9	6.35	577.55	7.05	576.85	6.90	577.00	8.25	575.65	8.30	575.60
MW-09	583.1	7.65	575.45	7.86	575.24	7.77	575.33	8.16	574.94	8.30	574.80
MW-10	583.5							9.35	574.15	9.32	574.18

Note: Water levels could not be obtained from MW-02 due to the presence of free product.
Depth to water is from top of casing.
Water elevations are in feet above mean sea level.
MW-10 installed November 13, 1998.

TABLE 3.2
SLUG TEST ANALYSIS RESULTS

Well No.	Depth to Screen Top (ft)	Depth to Screen Bot. (ft)	Screen Length (ft)	Depth to Water (ft) (bgs)	Test Type	Hydraulic Conductvity (ft/day)	Hydraulic Conductivity (cm/sec)
MW-3	3.90	13.90	10.0	2.91	Falling	2.47	8.73E-04
				2.91	Rising	1.64	5.79E-04
MW-4	3.90	13.90	10.0	3.71	Falling	1.67	5.88E-04
				3.71	Rising	2.67	9.42E-04
MW-5	5.00	19.00	14.0	7.63	Rising	1.54	5.42E-04
MW-6	10.00	20.00	10.0	4.15	Falling	0.16	5.77E-05
				4.15	Rising	0.10	3.54E-05
MW-7	6.35	19.35	13.0	7.02	Rising	0.72	2.53E-04
MW-8	7.00	22.00	15.0	4.89	Rising	0.16	5.73E-05
MW-9	7.00	19.00	12.0	5.31	Falling	2.61	9.22E-04
					Rising	3.15	1.11E-03
				Geometric Mean		9.24E-01	3.27E-04

$\sqrt[n]{K_1 * K_2 * \ldots K_n}$

Note: Slug test analyses were performed on 5/19/98.

Bouwer,Herman. 1989. "The Bouwer and Rice Slug Test - An Update". Ground Water vol. 27, no. 3, May-June, 1989. Bouwer, H., and R.C. Rice, 1976. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells". Water Resources Research. vol. 12, no. 3, June 1976.

SECTION 4

SECTION 4
NATURE AND EXTENT OF IMPACTS

4.1 INTRODUCTION

The nature and extent of impacts from the Site are discussed by media and by chemical constituent groups. Analytical data for surface soils, subsurface soils, and groundwater are presented in data tables and plotted on drawings to facilitate interpretation of the results. PAH concentrations in surface and subsurface soils were compared to statistical background levels based on background upper tolerance limits (BUTLs) (USEPA, 1989) using offsite soil sample results. BUTLs were not calculated for BTEX and cyanide because they were not detected in offsite soil samples. A more detailed discussion of calculations and applications of BUTLs is presented in Section 6.

Comparison of individual samples to regulatory standards, criteria, and guidelines was not performed in this section of the report. This is consistent with "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (USEPA, 1988).

Maximum concentrations in soils and groundwater were compared to applicable standards in the Human Health Risk Assessment provided in Section 5. These comparisons were not used to identify areas requiring remediation, but as a screening process to identify potential chemicals of concern. Development of preliminary remediation goals (PRGs) and delineation of areas requiring potential remedial action are presented in Sections 6 and 7, respectively.

Surface soils, subsurface soils, and groundwater samples were analyzed for BTEX, PAHs, metals, and cyanide, as described in Section 2. Analytical results for soil samples are discussed in milligrams per kilogram (mg/kg). Concentrations of constituents in groundwater are presented in micrograms per liter (µg/L). Where appropriate, the presence of constituents was correlated with former MGP facility structures and waste generation locations as indicated in Figure 4.1.

A summary of previous investigations was presented in Section 1.2.3. The results of the previous investigation were utilized only qualitatively in interpreting the nature and extent of impacts. Previous studies did not contain validated analytical data, and many sample locations were not surveyed. The previous investigations were considered, however, in determining the extent of DNAPL (see Section 4.3.5).

4.2 SURFACE SOILS

Five surface soil samples (SS-01 through SS-05) were collected from the area of the former MGP facility, and immediately southwest of this area. These locations were chosen because they are accessible to the students, teachers, and workers at the Waterfront School. Seven offsite surface soil samples (OFFSS01 through OFFSS07) were collected from northwest, north, and east of the Site (Figure 4.1). Analytical results are presented in Table 4.1, and concentrations are plotted on Figure 4.2.

4.2.1 BTEX

BTEX was not detected in onsite or offsite surface soil samples.

4.2.2 PAHs

PAHs were detected in all surface soil samples, onsite and offsite, as indicated on Figure 4.2. Offsite surface soil sample concentrations ranged from 0.745 mg/kg in OFFSS-04 to 18.93 mg/kg in OFFSS-06. The sum of the BUTL values for PAHs is 19.79 mg/kg. This value was used as a background concentration for comparison purposes. Total concentrations of PAHs in onsite surface soil samples ranged from 1.1 mg/kg in SS-04 to 136.3 mg/kg in SS-01. Onsite samples SS-02, SS-03, and SS-04 were below the BUTL value. SS-01 and SS-05 had concentrations in excess of the offsite sample concentration range. Sample SS-01 (136 mg/kg) is located in the area of the retort house of the former MGP facility. SS-05 (63 mg/kg) is located within the former Fourth Street right-of-way, and does not appear to be within the influence of the former MGP facility. The analytical results and physical observations in adjacent subsurface borings SB-09, SB-10, and MW-05 indicate that this area is beyond the influence of the MGP facility. Review of historical information dating to 1915 (see Appendix A) revealed that the area near SS-05 was previously occupied by a railroad siding used by the business formerly adjacent to Fourth Street.

4.2.3 TOC

Total organic carbon analysis was performed only on the offsite samples. Concentrations ranged from 29,200 to 60,100 mg/kg, or 2.9 to 6.0 percent. These results were utilized in equilibrium partitioning calculations for soil cleanup criteria for organic compounds, in the risk assessment, and in the feasibility study (Sections 5 and 6).

4.2.4 Phenols

Phenols were not detected in any onsite surface soil samples, and were detected in only one offsite surface soil sample. Phenol was detected in OFFSS-02, at a concentration slightly above the detection limit.

4.2.5 Cyanide

Cyanide was not detected in any offsite surface soil samples, but was detected in three onsite surface soil samples. Cyanide was detected in SS-01, SS-02, and SS-03 at concentrations of 1.6, 1.6 and 7.2 mg/kg, respectively. SS-01 is located in the area of the former retort house, and sample SS-02 is located in the area of the former purifier house. SS-03 is located in the area of the former Court Street right-of-way, approximately 20 feet south of the former pipe shop housing.

4.3 SUBSURFACE SOILS

Twenty-three soil borings were drilled at the Site in May and November 1998. Two samples were collected in each soil boring, as specified in Section 2, with a few exceptions. Only one sample was collected from SB-04 and SB-05 due to the presence of DNAPL. No samples were obtained from SB-07 due to the presence of DNAPL throughout the depth of borehole. Samples SB-04 and SB-05 were located in the area of the former retort house, and SB-07 was within 10 feet of the former location of the largest gas holder associated with the former MGP facility. Due to the presence of DNAPL, representative samples of the lake deposits below the fill could not be obtained from these three borings. Therefore, the concentration of chemical constituents within these deposits could not be identified. Depth of fill in each of these borings is indicated on boring logs contained in Appendix B.

In addition to samples collected in each soil boring, two samples were collected from each monitoring well location. During the utility investigation, seven subsurface soil samples were collected from the borings (one sample per boring). The depth of each of these borings is indicated on the boring logs contained in Appendix B. Analytical results are presented in Table 4.2, and concentrations are plotted on Figures 4.3 (soil borings) and 4.4 (utility borings).

4.3.1 BTEX

Total BTEX concentrations ranged from not detected to greater than 33 mg/kg. Concentrations greater than 1 mg/kg were detected in both samples of SB-03, both samples of SB-06, and the shallow samples of SB-12 and SB-13. No BUTL values were calculated for total BTEX due to the absence of these compounds in background samples.

Shallow samples from SB-03 and SB-06 (collected at 6 feet to 8 feet, and 4 feet to 6 feet below ground surface (bgs) respectively) had higher concentrations (18 mg/kg and 30 mg/kg respectively) than the deeper samples collected at 10 feet to 12 feet bgs in SB-03 (1.6 mg/kg), and 8 feet to 10 feet bgs in SB-06 (13 mg/kg). SB-03 is located directly adjacent to the engine room of the former MGP facility, and SB-06 is located in the area of the former purifying house. BTEX was detected in both the fill and the lake sediments below the fill in these borings.

SB-13 is located approximately 30 feet south of the sulfur plant, hydrologically downgradient of the former MGP. BTEX in this sample was detected at 31.8 mg/kg within the uppermost lake sediments underlying fill, but less than 1 mg/kg within the lower lake sediments above bedrock.

SB-12 is located approximately 120 feet west-northwest of the westernmost gas holder. BTEX was detected at 33.3 mg/kg in the sample collected immediately below a peat bed underlying the fill, from 16 feet to 18 feet bgs. The next sample interval, 18 feet to 20 feet bgs, contained BTEX concentrations less than 1 mg/kg. Although the MGP site cannot be ruled out as a source for the occurrence of BTEX in this sample, the occurrence of BTEX without a significant detection of PAHs suggests that the source for the BTEX is not related to the former MGP operations (Shreve, 1967, and Barry et. Al., 1996). The depth and location as well as the distance from the sample location to the former facilities also suggest that the source of BTEX in this sample is from another source. Review of historical data indicates the presence of a former machine shop approximately 50 feet upgradient of the sample location (Appendix A). A former garage was also located in the immediate vicinity of the boring.

Concentrations of BTEX (less than 1 mg/kg) were detected in the shallow samples from SB-04, SB-05, MW-05, SB-15, and MW-08, and both the shallow and deep samples from SB-10, SB-21, SB-22, SB-23, MW-09, and MW-10.

4.3.2 PAHs

Total PAH concentrations ranged from not detected to greater than 211 mg/kg. Sample locations exhibiting concentrations greater than 19.79 mg/kg (above the BUTL value) included the shallow samples of SB-13 and SB-22, as well as both the shallow and deep samples from SB-03 and SB-06.

SB-13 is located approximately 30 feet south of the sulfur house used during the former MGP operations. Concentrations of PAHs were 21.5 mg/kg in the uppermost lake deposits directly below the fill, and less than 10 mg/kg in the lower lake deposits above bedrock.

The concentration of total PAHs in the fill material of SB-22 was 20.6 mg/kg, only slightly above the BUTL value of 19.79. No PAHs were detected in underlying lake sediments. The source of PAHs in this boring does not appear to be the former MGP facility, because of the distance (greater than 100 feet) and location in relation to the former facility, as well as the relatively low concentrations. The shallow depth at which the PAHs were found indicate that this is representative of typical fill material in the area. The concentration is in the same range as offsite samples OFFSS-01 (16.4 mg/kg) and OFFSS-06 (18.9 mg/kg).

The shallow samples collected from 6 feet to 8 feet bgs in SB-03, and 4 feet to 6 feet in SB-06, exhibited higher concentrations (185 mg/kg and 212 mg/kg respectively) than the deeper samples collected at 10 feet to 12 feet bgs in SB-03 (156 mg/kg), and 8 feet to 10 feet bgs in SB-06 (26.6 mg/kg). SB-03 is located directly adjacent to the engine room of the former MGP facility, and SB-06 is located in the area of the former purifying house. PAHs were detected in both the fill and the lake sediments below the fill in each boring.

Lesser concentrations (below 10 mg/kg) were detected in the shallow samples of SB-01, SB-04, SB-05, SB-11, MW-05, MW-06, MW-08 and MW-09, and in the shallow and deep samples of SB-12, and SB-21, and the deep sample of SB-23.

4.3.3 Phenols

Total phenols were detected in three samples at low concentrations ranging from below quantitation limits to just slightly above quantitation limits: the deep sample from SB-03 (1.35 mg/kg), the shallow sample of SB-22 (0.125 mg/kg), and the shallow sample from MW-09 (0.059 mg/kg).

4.3.4 Cyanide

Cyanide was detected in only three samples: the shallow samples from SB-03, SB-06, and MW-09. Concentrations of cyanide were 2.9 mg/kg in MW-09, estimated at 4.2 mg/kg in SB-03, and estimated at 46.3 mg/kg in SB-06. Borings SB-03 and SB-06 are located near the engine room and purifying house of the former MGP.

4.3.5 DNAPL

The visible presence of DNAPL was noted in several borings. In this investigation, the presence of DNAPL is defined as a dark brown, viscous liquid, typically having odors, elevated PID readings, and sheens. Boring logs from this investigation (Appendix B) and from a previous investigation indicate that MW-02, MW-03, SB-03, SB-04, SB-05, SB-06, SB-07, and SB-13 all contained DNAPL at various depths. The presence of DNAPL in most locations was confined to the fill layer, with the exception of SB-06, SB-07, and SB-13. At these locations, the upper portion of the lake sediment also contained DNAPL, but observable product was not apparent in the lower lake sediments or immediately above bedrock. In general, all borings where the DNAPL was observed or inferred were located within or immediately adjacent to the area of the former MGP. Figure 4.5 indicates the inferred horizontal and vertical extent of DNAPL in the borings.

Monitoring wells MW-02 and MW-03 were installed in 1992. Boring logs from that previous investigation indicate DNAPL was present in MW-02 (Huntingdon-Empire Soils, 1992); in fill material from 2 feet to 11 feet bgs; and in underlying lake deposits from 11 feet to approximately 14 feet bgs. These boring logs also indicate that DNAPL was present in MW-03; in fill material from 6 feet to 10 feet bgs; and in underlying lake deposits from 10 feet to approximately 14 feet bgs. The total depth of DNAPL in these wells is uncertain due to smearing of the product as the borehole was drilled. However, the bottom two feet of lake deposits in each boring did not appear to contain any DNAPL. MW-02 is located in the area of the former underground tar tank, and MW-03 is located in the area of the former coal house.

The boring log for SB-03 (drilled during the RI), located in the vicinity of the former engine room, indicated that a sheen was present from 6 feet to10 feet bgs. The sheen was observed within the bottom 4 feet of fill, and does not appear to be present in the lake deposits beneath the fill.

Both SB-04 and SB-05 are located in the area of the former retort house. Boring logs for both locations indicate that DNAPL was present from 4 feet to 14 feet bgs in SB-04, and from 3 feet to 14 feet bgs in SB-05. The DNAPL was found within the fill at both locations.

Data from SB-06, located in the area of the former purifying house, indicate that DNAPL was present from 4 feet to 10 feet bgs, within the bottom three feet of fill, and the top three feet of underlying lake deposits.

The boring log indicated the presence of DNAPL from 6 feet to 18 feet bgs in SB-07, which is located in the vicinity of the largest of the former gas holders. DNAPL was found within the fill, and noted in the soils underlying the fill, though smeared product was observed on the sampling device.

SB-13, located approximately 30 feet south of the sulfur plant, contained DNAPL from 4 feet to 14 feet bgs, as indicated on the boring log. DNAPL was found within the top four feet of fill and within the uppermost six feet of lake deposits.

4.3.6 Source Area Summary

Sample locations indicating the presence of BTEX and PAHs coincide with the presence of DNAPL in subsurface soils (Figure 4.5). This area extends from the center of the Site, westward beyond SB-07 and SB-13. The area correlates with the location of the former MGP facilities, including the gas holder tanks, sulfur plant, retort house, purifying house, engine room, the underground storage tank, and portions of the coal houses.

PAHs and BTEX detected in SB-12 and SB-22, located west-northwest of the Site, appear to be unrelated to the MGP facility. SB-12 contains primarily BTEX, with low concentrations of PAHs. SB-22 contained low levels of BTEX, and total PAHs just slightly exceeding the total of the BUTLs. Both of these locations are more than 100 feet from the former MGP facility, and are not downgradient of the facility. Also, there was no DNAPL evident in these soil borings.

As mentioned in Section 1.2.2, historical information and maps indicated that several of the businesses in the investigation area contained coal bins, "sand piles", furnaces, engine rooms, garages, etc. These facilities are all potential sources for MGP and other petroleum-related residuals. These sources may have contributed to the presence of PAHs in background and onsite surface soil samples, such as in SS-05, and BTEX in samples such as SB-12.

4.3.7 Utility Boring Analytical Summary

No evidence of DNAPL was observed in any of the seven soil borings drilled during the August 1999 utility investigation. In boring UB-5, a sheen was observed in the bottom of the 2 to 4-foot sample interval and in the sample between 5 and 6 feet. Also, as indicated on Figure 4.4 and Table 4.2, concentrations of BTEX and PAHs in the borings were very low. BTEX concentrations ranged from 0.005 mg/kg in B-8 to a maximum of 0.117 mg/kg in B-7. Only two of the seven borings had detectable levels of PAHs, with a maximum of 0.9 mg/kg in B-5. As mentioned previously, care was taken to make accurate estimates of historical and current utility line locations, and to place borings as near as possible to the utility lines, within allowable safety limitations.

The utility boring where NAPL was encountered (UB-5) is located east of the Swan Trunk sewer, near SB-7. Borings located both east and west of the Swan Trunk Sewer, further downstream than UB-5, did not show the presence of NAPL, indicating that offsite migration of NAPL is not occurring adjacent to the sewer s. The NAPL observed in UB-5 appeared to lighter than water, as it was occurring in the form of a sheen (not coal tar which is denser than water), and was observed in only the upper portion of the boring (2 to 6 feet below ground surface). Furthermore, NAPL was not observed deeper in UB-5, nor was it observed in any other boring at the approximate invert of the Swan Trunk (12 feet below ground surface).

In addition, the Swan Trunk Sewer and many of the other underground sewers and utilities in the site vicinity were constructed in the early 1900s (see RI/FS Appendix A). Within that time period, competent bedding was not typically used during the installation of underground utilities. The analytical results, the absence of bedding, and no apparent downstream migration of contaminants suggest that offsite migration of DNAPL adjacent to or in the bedding of utility lines is not occurring.

4.4 GROUNDWATER

Groundwater samples were collected from MW-03 through MW-10, and analyzed as described in Section 2. Analytical data are presented in Table 4.3, and concentrations are plotted on Figure 4.6. Samples could not be obtained from MW-02 due to the presence of DNAPL (approximately 2 feet thick) in the well. MW-2 is located in the area of the underground tar tank used at the former MGP facility.

4.4.1 BTEX

BTEX was detected in six groundwater samples. Total BTEX concentrations in MW-03, MW-04, MW-05, MW-06, and MW-10 ranged from 1.1 μg/L to 21.7 μg/L. Wells MW-03 and MW-04 are located within or immediately adjacent to, the area of the former MGP facility. MW-05 is located southwest, and hydraulically downgradient of the area, MW-06 is located northeast of the area, and MW-10 is located approximately 130 feet directly south of the former facility. The BTEX concentration in MW-09 was 1,987 μg/L. This monitoring well is located approximately 600 feet south-southeast of the former MGP facility. Based on groundwater flow directions and the distance from the former facilities, MW-09 is not influenced by the Site.

4.4.2 PAHs

PAHs were detected at very low concentrations in only three groundwater samples: MW-03 at 4 µg/L, MW-05 at 4 µg/L, and MW-09 at 9 µg/L. These are estimated concentrations and are below quantitation limits. MW-09 is not influenced by the Site, based on groundwater flow directions. MW-03 is within the area of the former MGP facility, and MW-05 is hydraulically downgradient of the former facility. Soil borings SB-07 and SB-13 are upgradient and in close proximity to MW-05. Concentrations of BTEX were detected in SB-13, and SB-07 contained appreciable amounts of DNAPL.

4.4.3 Phenols

Phenols were detected in only one groundwater sample, MW-09, at 42 µg/L. As mentioned, MW-09 is located south-southeast of the area, beyond the influence of the area of the former MGP facility.

4.4.4 Cyanide

Cyanide was detected in four samples, including MW-03, MW-05, MW-09, and MW-10. Concentrations of total cyanide ranged from 11 µg/L to 140 µg/L. MW-03 is located near the coal house of the former MGP facility, MW-05 is located southwest, hydraulically downgradient of the area, MW-09 is located south-southeast of the area (outside of any hydraulic influence), and MW-10 is located approximately 130 feet directly south of the former MGP facility, adjacent to the Waterfront School.

4.5 FATE AND TRANSPORT

The fate and transport characteristics of MGP-related chemicals were evaluated to: (1) identify pathways through which chemicals detected in the various environmental media may be transported; and (2) estimate the potential for migration of these chemicals away from the source area(s). Potential risks to human health and the environment, potential routes of exposure, and potential receptors are discussed in Section 5, the human health risk assessment.

The environmental pathways evaluated as potential routes of migration include air, groundwater, surface water, and surface and subsurface soils. Chemicals of concern for various routes were selected based on historical investigations, results of analytical sampling conducted during the RI, and results of the human health risk assessment. The fate and transport discussion is limited primarily to the subsurface soil and groundwater routes because these pose the greatest potential for migration. The primary chemical groups of concern for these routes are PAHs and BTEX, because chemicals within these groups exceeded soil or groundwater standards (see Section 6 for details on standards and preliminary remediation goals).

4.5.1 Potential Routes of Migration

The potential migration pathways identified in the conceptual model presented in the Work Plan were modified based on new data obtained during the RI. These potential pathways are evaluated below. Their importance as migration pathways is discussed relative to Site conditions and features observed during the RI field operations.

4.5.1.1 Air Route

The potential exists for migration of VOCs by volatilization at or near the soil surface. This process could be enhanced by low barometric pressure, high winds, and high temperatures. Air monitoring during all aspects of the field work with a PID did not indicate the presence of VOCs in the breathing zone, above action levels specified in the Project Health & Safety Plan. Also, no BTEX compounds were detected in surface soil samples collected at the Site.

There is little potential for transport of particulate matter (i.e. wind-born dust) because most of the Site is either grass-covered or paved. Therefore, the air route does not appear to be a significant route of chemical migration.

4.5.1.2 Groundwater Route

Unconfined groundwater flow is generally to the west-southwest. The nearest discharge area for groundwater is Lake Erie, approximately 1,800 feet southwest of the Site. The utility investigation results indicate that the utility trenches and conduits do not appear to serve as potential preferential pathways for groundwater flow away from the Site. Many of these utility trenches may be at least partially below the groundwater surface on a seasonal basis. In the vicinity of the Site, there are no primary aquifers located within a two-mile radius of the Site, groundwater is not used, and a potable water supply is provided by the City. Also, groundwater downgradient of the Site is not used for domestic or industrial use. No other groundwater receptors are present at or near the Site.

Approximately five sumps are located in the basement of the Waterfront School. However, groundwater flow from the Site is not directly towards the school. Also, previous testing of the sumps from one sampling event in 1996 indicated that the source of chemical compounds in the sump sample was unknown, and there would not be any exposure to these chemicals, or impacts to public health (NYSDOH, 1996).

Due to the lack of receptors, groundwater was only qualitatively evaluated in the risk assessment. However, groundwater was evaluated as a medium of concern in the feasibility study (Sections 6 through 9). In the feasibility study, sump water analytical results from the NYSDOH, site specific soil data, and groundwater data collected during the RI were used to develop remedial action objectives.

4.5.1.3 Surface Water Route

Precipitation accumulating on the ground surface drains to the center of the Site, where a topographic low is present. The topographic gradient is very gentle, however, most precipitation will infiltrate in the grass-covered areas. Storm drains are present within the paved parking lot area. Any surface water collecting in these storm drains flows into a 12-inch sewer beneath the parking lot. This sewer runs west, off the Site to Fourth Street. Because surface water discharging to the storm sewers has little contact with soils, due to the paved surface, surface water does not appear to be a significant route for migration.

4.5.1.4 Surface Soil Route

Migration of surface soils from the Site via runoff is very limited due to the vegetative cover and paved areas. Also, dermal contact is limited by the vegetative cover and pavement. Concentrations of MGP constituents in onsite soil samples were low, in most cases below the mean offsite soil sample concentrations. Therefore, the surface soil route does not appear to be a significant migration pathway.

4.5.1.5 Subsurface Soil Route

In subsurface soils, the unsaturated zone does provide a path for downward movement via percolation. For certain compounds that are relatively mobile in soils, water derived from recharge events could transport the dissolved or suspended constituents downward to the water table.

The horizontal and vertical extent of DNAPL was inferred from observations made during the RI drilling program. DNAPL appeared to be present in certain areas at depths ranging from 4 to 18 feet below ground surface. Due to the absence of a confining layer within the unconsolidated fill and soils, the gradual downward migration of DNAPL is possible if not affected by other forces (i.e. adsorption, surface tension), until it reaches a layer of reduced permeability. If DNAPL encounters a relatively impermeable layer, it may begin to migrate horizontally along the impermeable boundary toward topographically lower areas, and/or in the direction of groundwater movement (Cohen and Mercer, 1993). Therefore, the subsurface soil route appears to be a potential route of migration.

The August 1999 utility boring investigation was performed to investigate the potential for offsite migration of DNAPL, adjacent to buried utility lines. The borings were advanced, adjacent to the underground utilities, to determine the presence or absence of DNAPL in the bedding material or fill surrounding the targeted utility. During the investigation, no DNAPL was observed in the bedding or fill material of the utilities investigated. Also, concentrations of BTEX and PAHs were very low (see Figure 4.4 and Table 4.2). Thus, based on field observations and chemical analytical data, DNAPL is not migrating offsite via bedding material or fill adjacent to underground utilities.

4.5.2 Contaminant Persistence

4.5.2.1 BTEX

Benzene, toluene, ethylbenzene, and xylenes (BTEX) are relatively mobile and non-persistent in many shallow soil environments, but tend to be more persistent in deeper soils and groundwater. BTEX constituents tend to volatilize relatively rapidly from shallow soil and surface water. Half-lives in soil range on the order of several days to several weeks. Persistence in groundwater tends to be much longer, with half-lives ranging from several days to two years (Howard, 1990).

Organic carbon partition coefficients (K_{oc}) are relatively low, indicating limited ability to adsorb to soils, and a preference to partition to groundwater. Once in the groundwater system, biodegradation of BTEX (and other hydrocarbons and related organic compounds) can be significant and rapid in the presence of oxygen (Borden and Bedient, 1986).

BTEX is present in Site subsurface soils in concentrations ranging from not detected to 33 mg/kg. These results indicate that in spite of the relatively low partitioning coefficients, significant concentrations still remain in some Site soils, particularly in the area of the former purifying house, and south of the former sulfur plant. There is apparently only limited leaching (partitioning) to groundwater. At MW-03 and MW-05, total BTEX concentrations in shallow groundwater were 1.5 µg/L and 21.7 µg/L, respectively.

4.5.2.2 PAHs

PAHs were detected in soil and groundwater at the Site. Because the physical and chemical properties of these compounds vary substantially depending on the specific compound and the specific soils and hydrology, the fate and transport characteristics also vary. Some fate characteristics, though, are roughly correlated with molecular weight. Low molecular weight aromatic organic compounds, such as naphthalene and phenols, degrade more rapidly and may migrate more easily than higher molecular weight compounds in the same compound class. The compounds detected during the RI can be grouped by molecular weight as follows (ATSDR, 1990):

- Low molecular weight: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene;
- Medium molecular weight: fluoranthene and pyrene; and
- High molecular weight: benzo(a)anthracene, benzo(b)fluoranthene, benzo-(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, chrysene, dibenz-(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

Potential mobility of PAHs in soil is primarily related to the K_{oc} values. The low molecular weight PAHs have K_{oc} values in the range of 10^3 to 10^4 mL/g, which indicates a moderate potential to be adsorbed to organic material. Medium and higher molecular weight compounds with larger K_{oc} values (10^4 to 10^6 mL/g) have a much greater tendency to adsorb and resist movement through soil. Volatilization of the lower molecular weight compounds from shallow soils may be similar to VOCs. However, some PAHs in soil may be transported to groundwater, and then move laterally in the aquifer, depending on soil/water conditions.

4.5.3 Migration of Chemical Constituents

Of the five migration routes mentioned in Section 4.5.1 (air, groundwater, surface water, surface soil and subsurface soil), the groundwater and subsurface soil routes are the primary means by which detected compounds can be potentially transported beyond their present boundaries. The generally low constituent concentrations in surface soils minimize the potential for transport through the air, surface soil, and surface water routes.

4.5.3.1 Subsurface Soil

Chemical constituents in soils at depths greater than two feet bgs have limited ability to migrate by soil movement. Subsurface soils deeper than two feet bgs do act as an indirect route for migration by serving as a potential route for DNAPL migration.

Vertical migration of DNAPL is possible to some extent, but is hindered by less permeable layers in the lake sediments under the fill, as described in the boring logs (Appendix B). The lateral migration of DNAPL also appears to be minimal, as its presence is limited primarily to the immediate area of former MGP facility structures.

4.5.3.2 Groundwater

As determined from the groundwater study presented in Section 3.3.4, groundwater flows west-southwesterly across the Site towards Fourth Street and Lake Erie. The linear groundwater velocity was calculated to estimate the rate of potential migration of soluble constituents in the direction of groundwater flow.

The average linear groundwater velocity was calculated as follows: $V=(Kxi)/n_e$

where: K = hydraulic conductivity (ft/d);
i = hydraulic gradient (ft/ft); and
n_e = effective porosity (%).

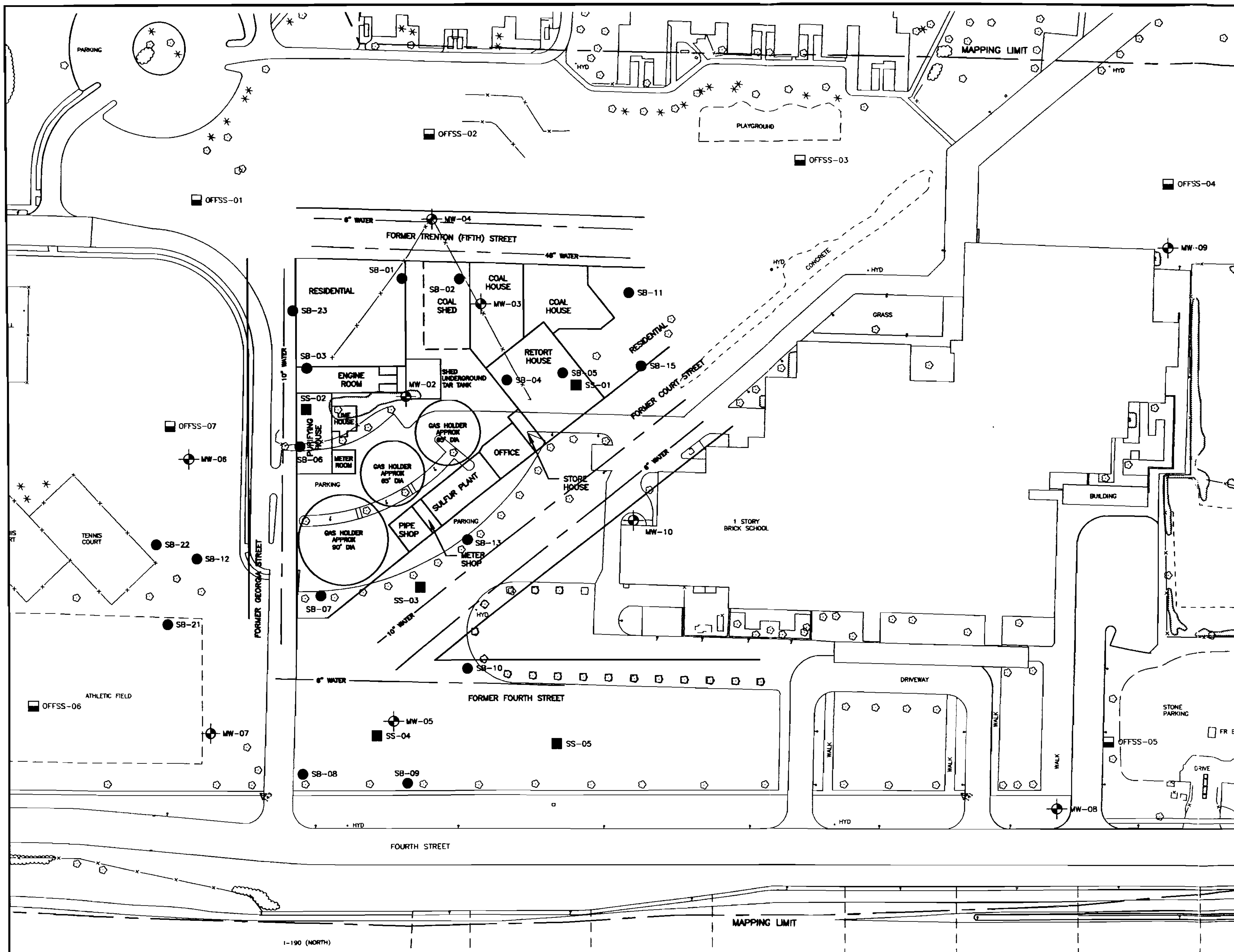
Assuming an effective porosity of 15 percent, a geometric mean hydraulic conductivity of 0.924 ft/day (see Table 3.2), and a hydraulic gradient of 0.01775 feet per foot, the average linear velocity is 0.109 ft/day, or 39.9 ft/year.

The primary compounds detected in groundwater were PAHs and BTEX. Most organic compounds, including PAHs and BTEX, will move more slowly than the linear groundwater velocity calculated above. The mobility of organic compounds is related to the degree to which they adsorb to the soil, and in particular to any organic carbon in the soils. Soil with a high TOC content more readily adsorbs organic compounds than soils with a low TOC content. Organic compounds with a large K_{oc} will more readily adsorb to soils. Thus, the movement of the organic compounds relative to the movement of groundwater will be less.

As indicated in Table 4.3, PAHs detected in Site groundwater are the relatively low molecular weight PAHs, and therefore have a low K_{oc}. However, very low concentrations of PAHs were found at estimated levels below the quantitation limits in MW-03, which is located within the area of the former MGP facility. Very low concentrations of PAHs (i.e. 4 µg/L of naphthalene) were also detected in MW-05, located near Fourth Street, and downgradient of the former MGP facilities. These concentrations suggest that partitioning of PAHs to groundwater from soil is limited, and consequently, potential migration of PAHs from the Site is also limited.

Low concentrations of BTEX were found slightly above quantitation limits in MW-03, MW-04, MW-05, and MW-06. As with PAHs, the low concentrations indicate that partitioning from source materials to groundwater is limited, and consequently, potential migration from the Site also appears very limited.

Furthermore, the Site history indicates that source materials have been in place for more than 80 years since the former MGP operations were terminated (Section 1.2.2). Thus, the low concentrations of PAHs and BTEX are not expected to increase, as steady-state conditions have probably been attained.



LEGEND:

- MW-02 — MONITORING WELL LOCATION
- SB-01 — SOIL BORING LOCATION
- SS-01 — SURFACE SOIL SAMPLE LOCATION
- OFFSS-01 — OFF SITE SURFACE SOIL SAMPLE LOCATION

NOTES:

1. BOLD LINES AND TEXT REFLECT APPROXIMATE LOCATION OF STRUCTURES AND UTILITIES TAKEN FROM 1889 CITY ATLAS DRAWINGS. ALL ARE APPROXIMATE.

2. BACKGROUND (LIGHTER LINES) ARE CURRENT SITE CONDITIONS AS SURVEYED 4/98.

100 50 0 100 200

SCALE: 1"=100'

FIGURE 4.1

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

HISTORICAL STRUCTURE/ SAMPLE LOCATION CORRELATION

PARSONS ENGINEERING SCIENCE, INC.
DESIGN * RESEARCH * PLANNING
180 LAWRENCE BELL DRIVE – SUITE 100 * WILLIAMSVILLE, N.Y. 14221 * 716/633-7074
OFFICES IN PRINCIPAL CITIES

DATE: 1/26/99 (FCW)
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SCALE: PAPER SCALE, 1=1
XREF'S: NONE

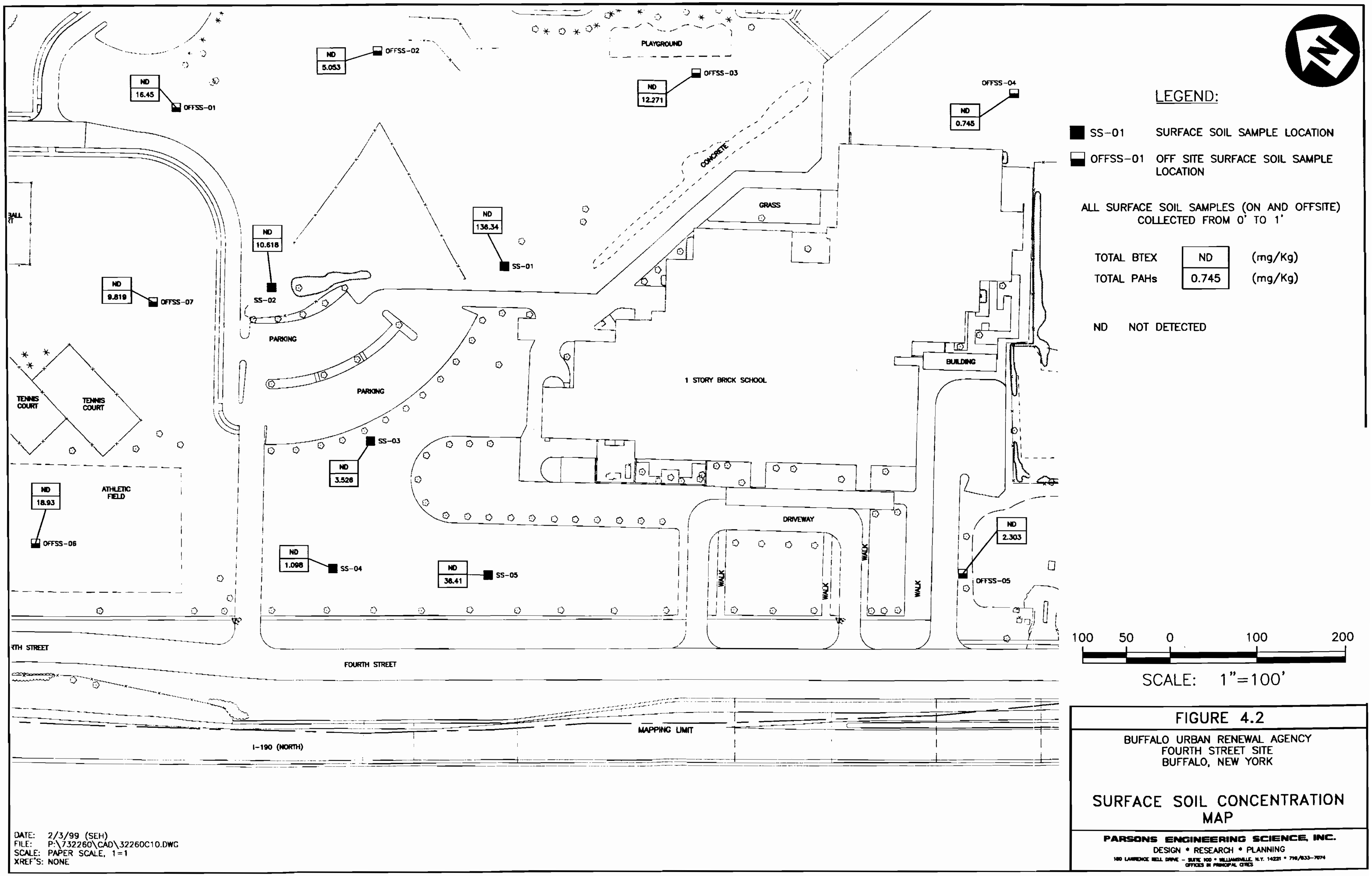

FIGURE 4.2

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

SURFACE SOIL CONCENTRATION MAP

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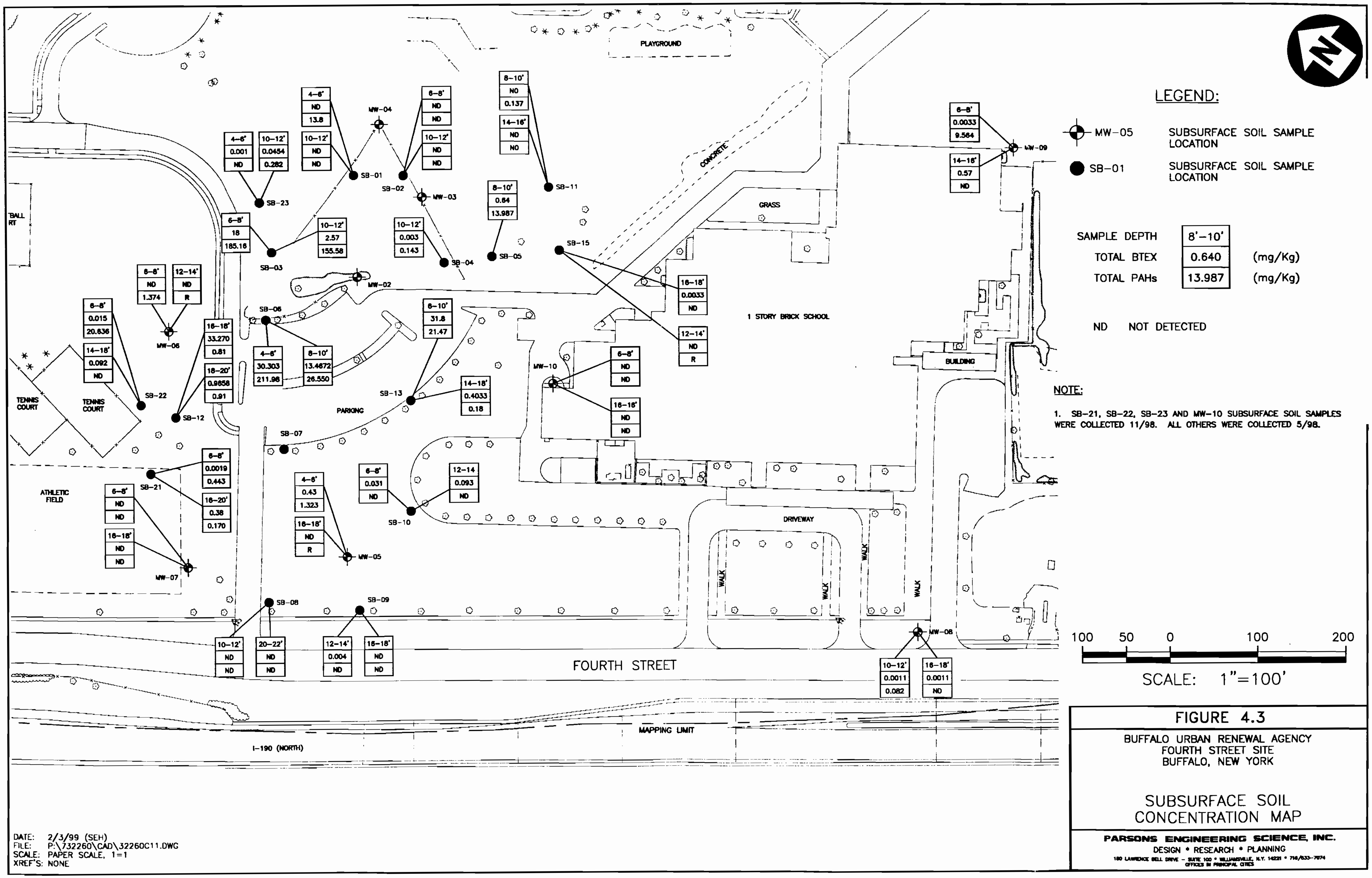
OFFICES IN PRINCIPAL CITIES



LEGEND:
MW-05 SUBSURFACE SOIL SAMPLE LOCATION
SB-01 SUBSURFACE SOIL SAMPLE LOCATION
SAMPLE DEPTH 8'-10'
TOTAL BTEX 0.640 (mg/Kg)
TOTAL PAHs 13.987 (mg/Kg)
ND NOT DETECTED
NOTE:
1. SB-21, SB-22, SB-23 AND MW-10 SUBSURFACE SOIL SAMPLES WERE COLLECTED 11/98. ALL OTHERS WERE COLLECTED 5/98.
100 50 0 100 200
SCALE: 1"=100'
FIGURE 4.3
BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK
SUBSURFACE SOIL CONCENTRATION MAP
PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
PLAYGROUND
CONCRETE
GRASS
1 STORY BRICK SCHOOL
BUILDING
PARKING
DRIVEWAY
WALK
TENNIS COURT
TENNIS COURT
ATHLETIC FIELD
FOURTH STREET
MAPPING LIMIT
I-190 (NORTH)
MW-04
SB-01
SB-02
MW-03
SB-23
SB-03
SB-04
SB-05
SB-11
SB-15
MW-02
SB-06
MW-06
SB-22
SB-12
SB-13
SB-07
MW-10
SB-21
MW-07
SB-10
MW-05
SB-08
SB-09
MW-08
MW-09
4-6' ND 13.8
6-8' ND ND
10-12' ND ND
10-12' ND ND
8-10' ND 0.137
14-16' ND ND
4-6' 0.001 ND
10-12' 0.0454 0.282
6-8' 18 185.16
10-12' 2.57 155.58
10-12' 0.003 0.143
8-10' 0.64 13.987
6-8' 0.0033 9.564
14-16' 0.57 ND
6-8' ND 1.374
12-14' ND R
6-8' 0.015 20.636
14-16' 0.092 ND
16-18' 33.270 0.81
18-20' 0.9658 0.91
4-6' 30.303 211.98
8-10' 13.4672 26.550
6-10' 31.8 21.47
14-18' 0.4033 0.18
16-18' 0.0033 ND
12-14' ND R
6-8' ND ND
16-18' ND ND
6-8' 0.0019 0.443
16-20' 0.38 0.170
6-8' ND ND
16-18' ND ND
4-6' 0.43 1.323
16-18' ND R
6-8' 0.031 ND
12-14 0.093 ND
10-12' ND ND
20-22' ND ND
12-14' 0.004 ND
16-18' ND ND
10-12' 0.0011 0.082
16-18' 0.0011 ND
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XREF'S: NONE

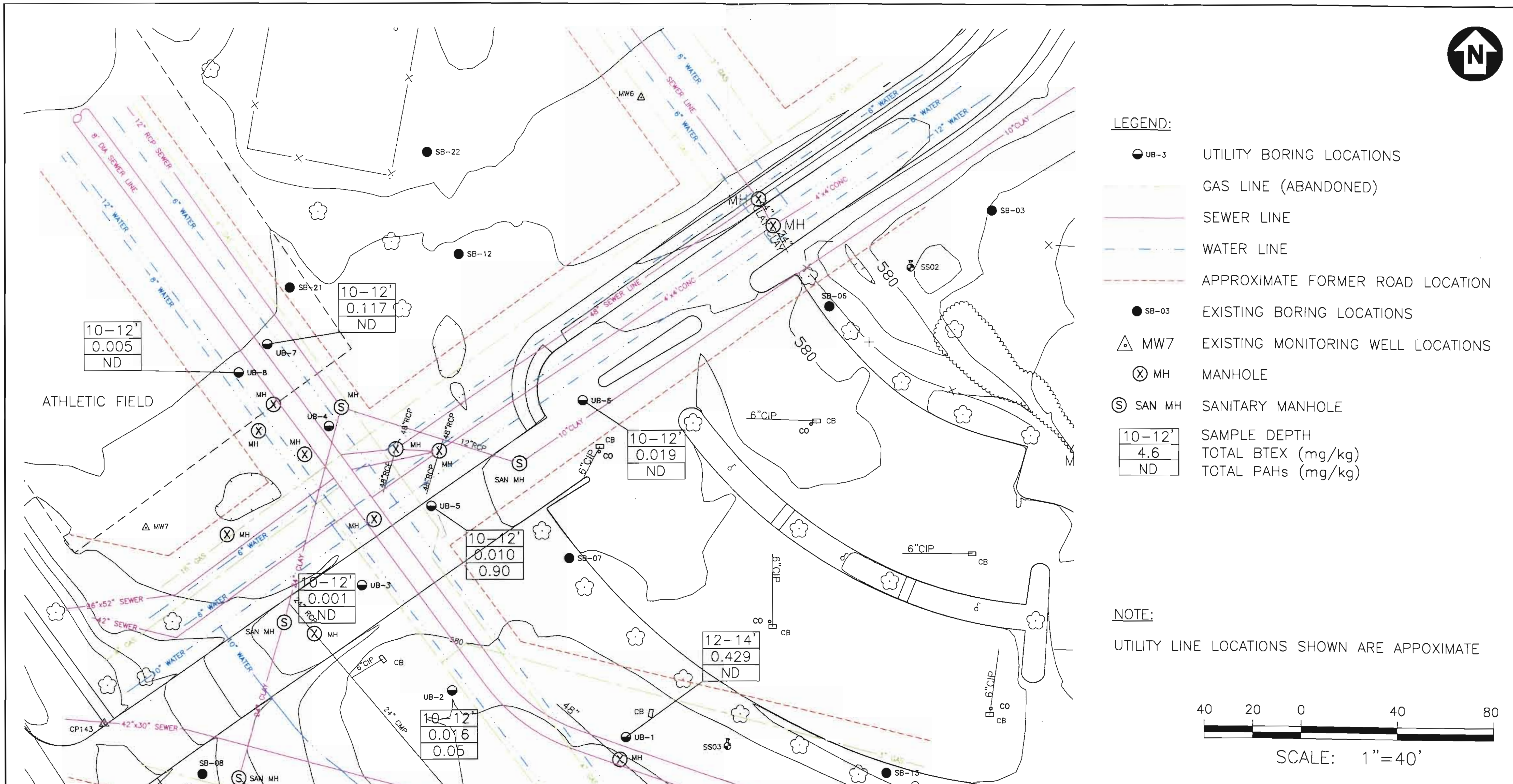


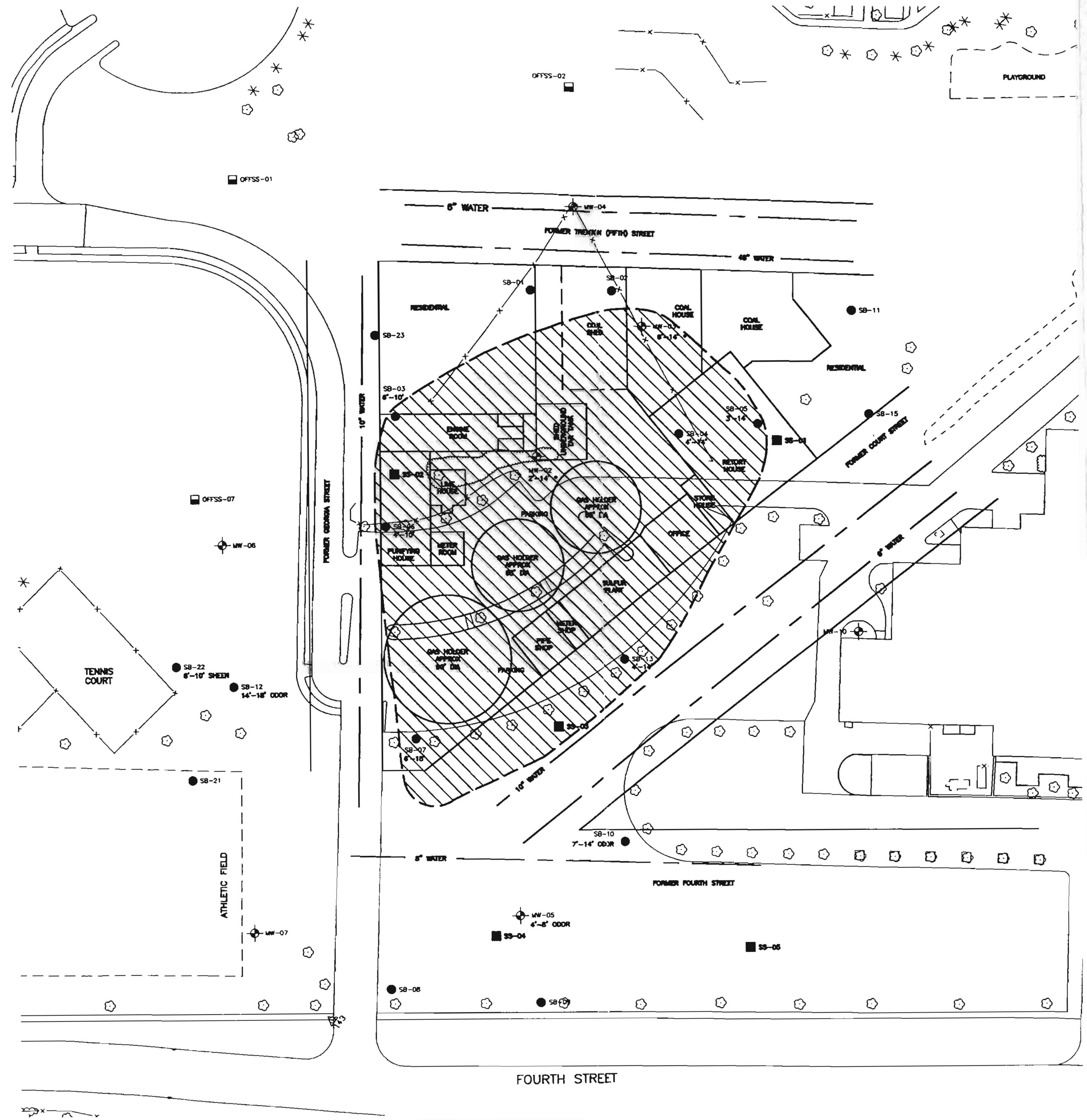
FIGURE 4.4

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

UTILITY BORING
SUBSURFACE SOIL CONCENTRATION MAP

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, N.Y. 13088 • 315/451-9560
OFFICES IN PRINCIPAL CITIES

DATE: 10/25/99 (JAR)
FILE: P:\732260\CAD\32260C22.DWG
SCALE: PAPER SCALE, 1=1
XREF'S: NONE



LEGEND:

MW-02	MONITORING WELL LOCATION
SB-01	SOIL BORING LOCATION
SS-01	SURFACE SOIL SAMPLE LOCATION
OFFSS-01	OFF SITE SURFACE SOIL SAMPLE LOCATION
6'-10'	DEPTH AT WHICH DNAPL WAS OBSERVED
6'-10' *	DEPTH WHERE DNAPL IS INFERRED
	AREA OF DNAPL OCCURRENCE

NOTE:

EXTENT OF DNAPL INFERRED FROM VISUAL OBSERVATION OF FREE/PHASE LIQUID

80 40 0 80 160

SCALE: 1"=80'

FIGURE 4.5

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

OCCURRENCE OF DNAPL

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
180 LAWRENCE BELL DRIVE – SUITE 100 • WILLIAMSVILLE, N.Y. 14221 • 716/633-7074
OFFICES IN PRINCIPAL CITIES

DATE: 2/3/99 (SEH)
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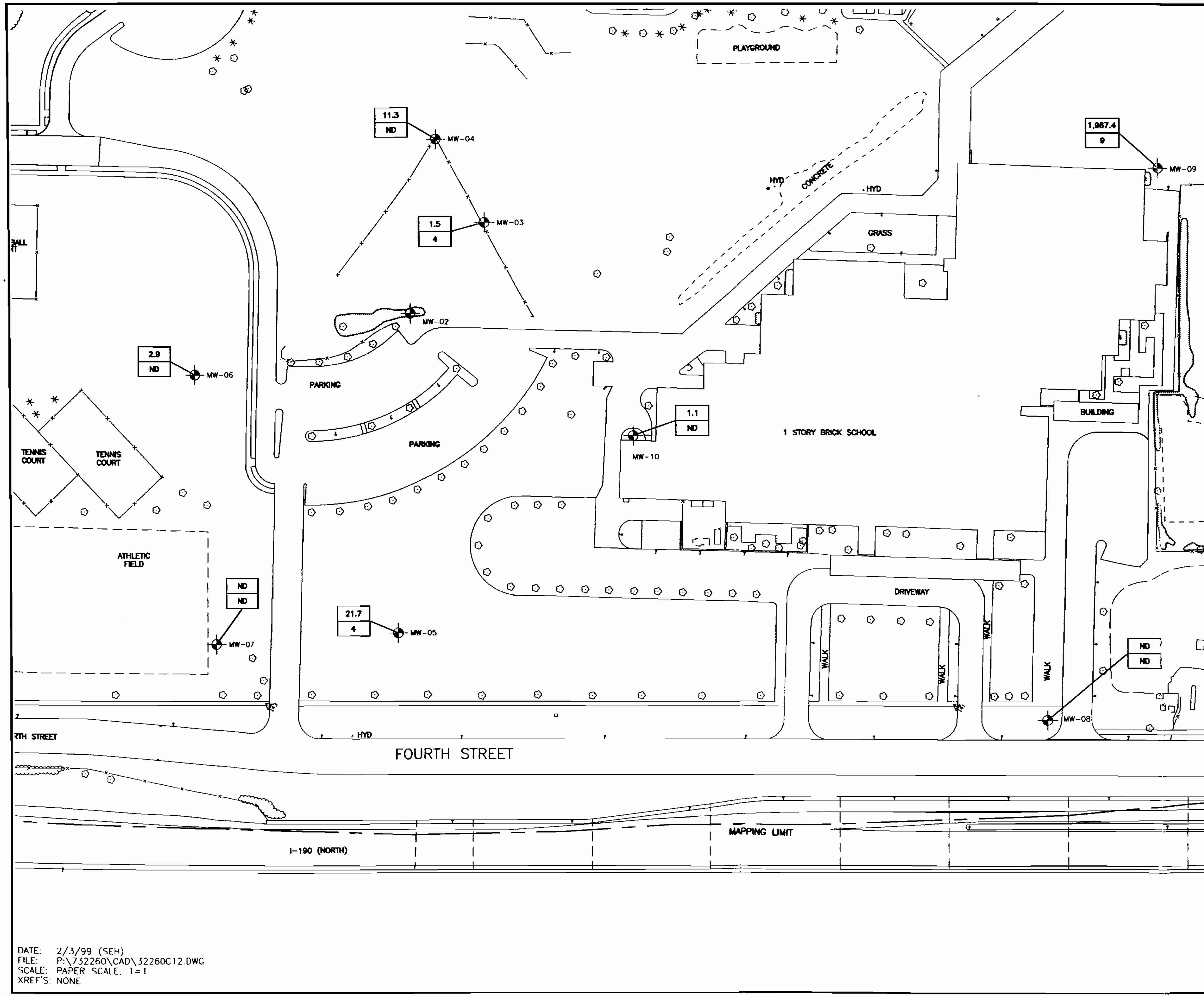

LEGEND:

MW-03 MONITORING WELL LOCATION

SAMPLE ID: MW-01

TOTAL BTEX	1.5	(µg/L)
TOTAL PAHs	4	(µg/L)

ND NOT DETECTED

NOTE:

1. MW-10 GROUNDWATER SAMPLE COLLECTED 11/98. ALL OTHERS COLLECTED 5/98.
2. GROUNDWATER SAMPLE NOT COLLECTED FROM MW-02 DURING 5/98 SAMPLING EVENT. THE WELL CONTAINS ONLY DNAPL.

100 50 0 100 200

SCALE: 1"=100'

FIGURE 4.6

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

GROUNDWATER CONCENTRATION MAP

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OFFICES IN PRINCIPAL CITIES

Table 4.1
BURA Fourth Street Site
Surface Soil Analytical Results

CAS NO.	COMPOUND	SAMPLE ID:	OFFSS01	OFFSS02	OFFSS03	OFFSS04	OFFSS05	OFFSS06
		DEPTH:	0-0.5'	0-0.5'	0-0.5'	0-0.5'	0-0.5'	0-0.5'
		LAB ID:	186597-01	186597-02	186597-03	186597-04	186597-05	186597-06
		SOURCE:	STL	STL	STL	STL	STL	STL
		SDG:	PE597	PE597	PE597	PE597	PE597	PE597
		MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		SAMPLED:	5/13/98	5/13/98	5/13/98	5/13/98	5/13/98	5/13/98
		VALIDATED:	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98
		UNITS:						
	BTEX							
	None							
	PAHs							
83-32-9	Acenaphthene	mg/Kg	0.33 J	0.085 J	0.2 J	ND	ND	0.23 J
208-96-8	Acenaphthylene	mg/Kg	ND	ND	ND	ND	ND	0.12 J
120-12-7	Anthracene	mg/Kg	0.65 J	0.21 J	0.45 J	ND	0.071 J	0.65 J
56-55-3	Benzo(a)anthracene	mg/Kg	1.5 J	0.44 J	1.2 J	0.074 J	0.21 J	1.8 J
50-32-8	Benzo(a)pyrene	mg/Kg	1.2 J	0.35 J	0.99 J	0.069 J	0.19 J	1.6 J
205-99-2	Benzo(b)fluoranthene	mg/Kg	2 J	0.47 J	1.6 J	0.096 J	0.25 J	2.5 J
191-24-2	Benzo(g,h,i)perylene	mg/Kg	0.3 J	0.17 J	0.31 J	ND	0.11 J	0.43 J
207-08-9	Benzo(k)fluoranthene	mg/Kg	0.56 J	0.16 J	0.52 J	ND	0.092 J	0.65 J
218-01-9	Chrysene	mg/Kg	1.3 J	0.41 J	1 J	0.076 J	0.21 J	1.6 J
53-70-3	Dibenz(a,h)anthracene	mg/Kg	0.12 J	0.053 J	0.11 J	ND	ND	0.19 J
132-64-9	Dibenzofuran	mg/Kg	0.25 J	0.058 J	0.11 J	ND	ND	0.17 J
206-44-0	Fluoranthene	mg/Kg	2.5 J	0.78 J	1.9 J	0.15 J	0.38 J	2.8 J
86-73-7	Fluorene	mg/Kg	0.32 J	0.097 J	0.19 J	ND	ND	0.27 J
193-39-5	Indeno(1,2,3-cd)pyrene	mg/Kg	0.42 J	0.19 J	0.4 J	0.044 J	0.12 J	0.56 J
91-20-3	Naphthalene	mg/Kg	0.3 J	ND	0.091 J	ND	ND	0.16 J
85-01-8	Phenanthrene	mg/Kg	2.4 J	0.81 J	1.5 J	0.096 J	0.3 J	2.5 J
129-00-0	Pyrene	mg/Kg	2.3 J	0.77 J	1.7 J	0.14 J	0.37 J	2.7 J
PAHs	Total PAHs	mg/Kg	16.45	5.053	12.271	0.745	2.303	18.93
	PHENOLS							
108-95-2	Phenol	mg/Kg	ND	0.069 J	ND	ND	ND	ND
PHENOLS	Total Phenols	mg/Kg	ND	0.069	ND	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	mg/Kg	ND	ND	ND	ND	ND	ND
SOLIDS	Percent Solids	%	87.3	86.5	85.5	75.9	76.5	81
7440-44-0	Total Organic Carbon	mg/Kg	34800	29200	35800	53900	49600	57500

ND - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.

Table 4.1
BURA Fourth Street Site
Surface Soil Analytical Results

CAS NO.	COMPOUND	SAMPLE ID: / DEPTH: / LAB ID: / SOURCE: / SDG: / MATRIX: / SAMPLED: / VALIDATED: / UNITS:	OFFSS07 / 0-0.5' / 186597-07 / STL / PE597 / SOIL / 5/13/98 / 7/3/98	SS-01 / 0-0.5 / 186525-02 / STL / PE525 / SOIL / 5/12/98 / 7/3/98	SS-02 / 0-0.5 / 186525-04 / STL / PE525 / SOIL / 5/12/98 / 7/3/98	SS-03 / 0-0.5 / 186525-05 / STL / PE525 / SOIL / 5/12/98 / 7/3/98	SS-04 / 0-0.5 / 186525-06 / STL / PE525 / SOIL / 5/12/98 / 7/3/98	SS-05 / 0-0.5 / 186525-07 / STL / PE525 / SOIL / 5/12/98 / 7/3/98
	BTEX							
	None							
	PAHs							
83-32-9	Acenaphthene	mg/Kg	0.13 J	2.1 J	0.15 J	ND	R	0.36 J
208-96-8	Acenaphthylene	mg/Kg	ND	0.44 J	ND	ND	R	0.15 J
120-12-7	Anthracene	mg/Kg	0.37 J	7.8 J	0.39 J	ND	0.048 J	1 J
56-55-3	Benzo(a)anthracene	mg/Kg	0.96 J	11 J	0.99 J	0.24 J	0.2 J	3.1 J
50-32-8	Benzo(a)pyrene	mg/Kg	0.73 J	10 J	0.73 J	0.49 J	R	2.7 J
205-99-2	Benzo(b)fluoranthene	mg/Kg	1 J	15 J	1.3 J	0.62 J	0.12 J	5.1 J
191-24-2	Benzo(g,h,i)perylene	mg/Kg	0.31 J	3.2 J	0.38 J	0.41 J	R	0.86 J
207-08-9	Benzo(k)fluoranthene	mg/Kg	0.29 J	4.9 J	0.33 J	0.23 J	0.066 J	0.92 J
218-01-9	Chrysene	mg/Kg	0.85 J	8.8 J	0.84 J	0.25 J	0.12 J	2.7 J
53-70-3	Dibenz(a,h)anthracene	mg/Kg	0.1 J	1 J	0.098 J	0.11 J	R	0.38 J
132-64-9	Dibenzofuran	mg/Kg	0.079 J	1.8 J	0.11 J	ND	R	0.32 J
206-44-0	Fluoranthene	mg/Kg	1.5 J	21 J	1.4 J	0.24 J	0.25 J	6.3 J
86-73-7	Fluorene	mg/Kg	0.16 J	2.4 J	0.18 J	ND	0.058 J	0.44 J
193-39-5	Indeno(1,2,3-cd)pyrene	mg/Kg	0.39 J	3.5 J	0.39 J	0.43 J	R	1.2 J
91-20-3	Naphthalene	mg/Kg	0.05 J	1.4 J	0.13 J	0.056 J	R	0.28 J
85-01-8	Phenanthrene	mg/Kg	1.3 J	24 J	1.5 J	0.15 J	0.18 J	4.7 J
129-00-0	Pyrene	mg/Kg	1.6 J	18 J	1.7 J	0.3 J	0.056 J	5.9 J
PAHs	Total PAHs	mg/Kg	9.819	136.34	10.618	3.526	1.098	36.41
	PHENOLS							
108-95-2	Phenol	mg/Kg	ND	ND	ND	ND	ND	ND
PHENOLS	Total Phenols	mg/Kg	ND	ND	ND	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	mg/Kg	ND	1.6	1.6	7.2	ND	ND
SOLIDS	Percent Solids	%	85.6	84.1	87.4	82.2	78	77.2
7440-44-0	Total Organic Carbon	mg/Kg	60100	NA	NA	NA	NA	NA

ND - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.

Table 4.2
BURA Fourth Street Site
Subsurface Soil Analytical Results

		SAMPLE ID:	SB-01C	SB-01F	SB-02D	SB-02F	SB-03D	SB-03F
		DEPTH:	4-6'	10-12'	6-8'	10-12'	6-8'	10-12'
		LAB ID:	185948-01	185948-02	185948-03	185948-04	185948-05	185948-06
		SOURCE:	STL	STL	STL	STL	STL	STL
		SDG:	PE948	PE948	PE948	PE948	PE948	PE948
		MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		SAMPLED:	4/29/98	4/29/98	4/29/98	4/29/98	4/30/98	4/30/98
		VALIDATED:	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98
CAS NO.	COMPOUND	UNITS:						
	BTEX							
71-43-2	Benzene	mg/Kg	0.0012 U	0.0012 U	0.0013 U	0.0012 U	3.6	0.85
100-41-4	Ethylbenzene	mg/Kg	0.0012 U	0.0012 U	0.0013 U	0.0012 U	7.9	0.44
108-88-3	Toluene	mg/Kg	0.0012 U	0.0012 U	0.0013 U	0.0012 U	1.1 U	0.34
1330-20-7	Xylenes, total	mg/Kg	0.0012 U	0.0012 U	0.0013 U	0.0012 U	6.5	0.94
BTEX	Total BTEX	mg/Kg	ND	ND	ND	ND	18	2.57
	PAHs							
83-32-9	Acenaphthene	mg/Kg	0.33 J	0.4 U	0.43 U	0.4 U	12	1.6 J
208-96-8	Acenaphthylene	mg/Kg	0.12 J	0.4 U	0.43 U	0.4 U	0.86 J	7
120-12-7	Anthracene	mg/Kg	0.81	0.4 U	0.43 U	0.4 U	7.5	9.4
56-55-3	Benzo(a)anthracene	mg/Kg	1.1	0.4 U	0.43 U	0.4 U	9.2	6.2
50-32-8	Benzo(a)pyrene	mg/Kg	0.78	0.4 U	0.43 U	0.4 U	8.1	5.3
205-99-2	Benzo(b)fluoranthene	mg/Kg	0.93	0.4 U	0.43 U	0.4 U	8.6	6
191-24-2	Benzo(g,h,i)perylene	mg/Kg	0.29 J	0.4 U	0.43 U	0.4 U	3.1	2.7
207-08-9	Benzo(k)fluoranthene	mg/Kg	0.34 J	0.4 U	0.43 U	0.4 U	3.6	2
218-01-9	Chrysene	mg/Kg	1	0.4 U	0.43 U	0.4 U	7.6	5.6
53-70-3	Dibenz(a,h)anthracene	mg/Kg	0.11 J	0.4 U	0.43 U	0.4 U	1.1 J	0.68 J
132-64-9	Dibenzofuran	mg/Kg	0.35 J	0.4 U	0.43 U	0.4 U	8.6	6.1
206-44-0	Fluoranthene	mg/Kg	2.2	0.4 U	0.43 U	0.4 U	17	15
86-73-7	Fluorene	mg/Kg	0.48	0.4 U	0.43 U	0.4 U	9.8	6.8
193-39-5	Indeno(1,2,3-cd)pyrene	mg/Kg	0.35 J	0.4 U	0.43 U	0.4 U	4.1	3.2
91-20-3	Naphthalene	mg/Kg	0.31 J	0.4 U	0.43 U	0.4 U	41	41
85-01-8	Phenanthrene	mg/Kg	2.6	0.4 U	0.43 U	0.4 U	30	26
129-00-0	Pyrene	mg/Kg	1.7	0.4 U	0.43 U	0.4 U	13	11
91-57-6	2-Methylnaphthalene							
PAHs	Total PAHs	mg/Kg	13.8	ND	ND	ND	185.16	155.58
	PHENOLs							
105-67-9	2,4-Dimethylphenol	mg/Kg	0.41 U	0.4 U	0.43 U	0.4 U	2.9 U	0.73 J
95-48-7	2-Methylphenol	mg/Kg	0.41 U	0.4 U	0.43 U	0.4 U	2.9 U	0.27 JN
106-44-5	4-Methylphenol	mg/Kg	0.41 U	0.4 U	0.43 U	0.4 U	2.9 U	0.35 J
PHENOLS	Total Phenols	mg/Kg	ND	ND	ND	ND	ND	1.35
	INORGANICS							
57-12-9	Cyanide	mg/Kg	1.1 UJ	1.1 UJ	1.2 UJ	1.1 UJ	4.2 J	1.1 UJ
SOLIDS	Percent Solids	%	81.4	83.1	77.6	83	57.3	82

ND - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.

Table 4.2
BURA Fourth Street Site
Subsurface Soil Analytical Results

CAS NO.	COMPOUND	SAMPLE ID:	SB-04F	SB-05E	SB-06C	SB-06E	SB-08F	SB-08J
		DEPTH:	10-12'	8-10'	4-6'	8-10'	10-12'	20-22'
		LAB ID:	185948-07	185948-08	185988-01	185988-02	185988-04	185988-05
		SOURCE:	STL	STL	STL	STL	STL	STL
		SDG:	PE948	PE948	PE948	PE948	PE948	PE948
		MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		SAMPLED:	4/30/98	4/30/98	5/1/98	5/1/98	5/1/98	5/1/98
		VALIDATED:	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98
		UNITS:						
	BTEX							
71-43-2	Benzene	mg/Kg	0.0013 U	0.31 U	1.8	0.96	0.0012 U	0.0012 U
100-41-4	Ethylbenzene	mg/Kg	0.0013 U	0.26 J	19	5.8	0.0012 U	0.0012 U
108-88-3	Toluene	mg/Kg	0.0013 U	0.31 U	0.4 U	0.0072	0.0012 U	0.0012 U
1330-20-7	Xylenes, total	mg/Kg	0.003	0.38	9.5	6.7	0.0012 U	0.0012 U
BTEX	Total BTEX	mg/Kg	0.003	0.64	30.3	13.4672	ND	ND
	PAHs							
83-32-9	Acenaphthene	mg/Kg	0.43 U	0.59	11	1.4	0.42 U	0.4 U
208-96-8	Acenaphthylene	mg/Kg	0.43 U	0.23 J	1.2	0.15 J	0.42 U	0.4 U
120-12-7	Anthracene	mg/Kg	0.43 U	0.64	9.1 J	1.1	0.42 U	0.4 U
56-55-3	Benzo(a)anthracene	mg/Kg	0.43 U	0.69	11	0.91	0.42 U	0.4 U
50-32-8	Benzo(a)pyrene	mg/Kg	0.43 U	0.6	9.3 J	1.3 J	0.42 U	0.4 U
205-99-2	Benzo(b)fluoranthene	mg/Kg	0.43 U	0.57	9.2 J	0.89 J	0.42 U	0.4 U
191-24-2	Benzo(g,h,i)perylene	mg/Kg	0.43 U	0.28 J	0.78	0.85 J	0.42 U	0.4 U
207-08-9	Benzo(k)fluoranthene	mg/Kg	0.43 U	0.23 J	2.7	0.28 J	0.42 U	0.4 U
218-01-9	Chrysene	mg/Kg	0.43 U	0.62	9.4 J	0.88	0.42 U	0.4 U
53-70-3	Dibenz(a,h)anthracene	mg/Kg	0.43 U	0.087 J	0.9	0.1 J	0.42 U	0.4 U
132-64-9	Dibenzofuran	mg/Kg	0.43 U	0.57	1.1	0.18 J	0.42 U	0.4 U
206-44-0	Fluoranthene	mg/Kg	0.06 J	1.5	19	1.4	0.42 U	0.4 U
86-73-7	Fluorene	mg/Kg	0.43 U	1.1	7.3 J	1.1	0.42 U	0.4 U
193-39-5	Indeno(1,2,3-cd)pyrene	mg/Kg	0.43 U	0.28 J	3	0.61 J	0.42 U	0.4 U
91-20-3	Naphthalene	mg/Kg	0.43 U	1.8	58	10	0.42 U	0.4 U
85-01-8	Phenanthrene	mg/Kg	0.43 U	2.8	30	3.3	0.42 U	0.4 U
129-00-0	Pyrene	mg/Kg	0.083 J	1.4	29	2.1	0.42 U	0.4 U
91-57-6	2-Methylnaphthalene							
PAHs	Total PAHs	mg/Kg	0.143	13.987	211.98	26.55	ND	ND
	PHENOLs							
105-67-9	2,4-Dimethylphenol	mg/Kg	0.43 U	0.42 U	0.54 U	0.44 U	0.42 U	0.4 U
95-48-7	2-Methylphenol	mg/Kg	0.43 U	0.42 U	0.54 U	0.44 U	0.42 U	0.4 U
106-44-5	4-Methylphenol	mg/Kg	0.43 U	0.42 U	0.54 U	0.44 U	0.42 U	0.4 U
PHENOLS	Total Phenols	mg/Kg	ND	ND	ND	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	mg/Kg	1.2 UJ	1.2 UJ	46.3 J	1.2 UJ	1.2 UJ	1.1 UJ
SOLIDS	Percent Solids	%	77.5	79.4	62.5	76.4	80.3	84.3

ND - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.

Table 4.2
BURA Fourth Street Site
Subsurface Soil Analytical Results

CAS NO.	COMPOUND	SAMPLE ID:	SB-09G	SB-09I	SB-10D	SB-10G	SB-11E	SB-11H
		DEPTH:	12-14'	16-18'	6-8'	12-14'	8-10'	14-16'
		LAB ID:	186141-01	186141-02	186141-04	186141-03	186141-05	186141-06
		SOURCE:	STL	STL	STL	STL	STL	STL
		SDG:	PE141	PE141	PE141	PE141	PE141	PE141
		MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		SAMPLED:	5/4/98	5/4/98	5/4/98	5/4/98	5/5/98	5/5/98
		VALIDATED:	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98
		UNITS:						
	BTEX							
71-43-2	Benzene	mg/Kg	0.0008 J	0.0014 U	0.0062 U	0.085 J	0.0012 U	0.0012 UJ
100-41-4	Ethylbenzene	mg/Kg	0.0013 U	0.0014 U	0.0062 U	0.0014 U	0.0012 U	0.0012 UJ
108-88-3	Toluene	mg/Kg	0.0014	0.0014 U	0.0062 U	0.0008 J	0.0012 U	0.0012 UJ
1330-20-7	Xylenes, total	mg/Kg	0.0018	0.0014 U	0.031	0.0072	0.0012 U	0.0012 UJ
BTEX	Total BTEX	mg/Kg	0.004	ND	0.031	0.093	ND	ND
	PAHs							
83-32-9	Acenaphthene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
208-96-8	Acenaphthylene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
120-12-7	Anthracene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
56-55-3	Benzo(a)anthracene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
50-32-8	Benzo(a)pyrene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
205-99-2	Benzo(b)fluoranthene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
191-24-2	Benzo(g,h,i)perylene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
207-08-9	Benzo(k)fluoranthene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
218-01-9	Chrysene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
53-70-3	Dibenz(a,h)anthracene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
132-64-9	Dibenzofuran	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
206-44-0	Fluoranthene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.052 J	0.4 UJ
86-73-7	Fluorene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
91-20-3	Naphthalene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
85-01-8	Phenanthrene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.044 J	0.4 UJ
129-00-0	Pyrene	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.041 J	0.4 UJ
91-57-6	2-Methylnaphthalene							
PAHs	Total PAHs	mg/Kg	ND	ND	ND	ND	0.137	ND
	PHENOLs							
105-67-9	2,4-Dimethylphenol	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
95-48-7	2-Methylphenol	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
106-44-5	4-Methylphenol	mg/Kg	0.42 UJ	0.48 UJ	0.41 UJ	0.46 UJ	0.4 UJ	0.4 UJ
PHENOLS	Total Phenols	mg/Kg	ND	ND	ND	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	mg/Kg	1.2 U	1.4 U	1.2 U	1.4 U	1.2 U	1.2 U
SOLIDS	Percent Solids	%	79.1	69.9	81.3	73.2	84.2	84

ND - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.

Table 4.2
BURA Fourth Street Site
Subsurface Soil Analytical Results

CAS NO.	COMPOUND	SAMPLE ID:	SB-12I	SB-12J	SB-13E	SB-13HI	SB-15G	SB-15I
		DEPTH:	16-18'	18-20'	8-10'	14-18'	12-14'	16-18'
		LAB ID:	186141-07	186141-08	186319-03	186319-01	186319-06	186319-07
		SOURCE:	STL	STL	STL	STL	STL	STL
		SDG:	PE141	PE141	PE141	PE141	PE141	PE141
		MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		SAMPLED:	5/5/98	5/5/98	5/6/98	5/6/98	5/7/98	5/7/98
		VALIDATED:	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98
		UNITS:						
	BTEX							
71-43-2	Benzene	mg/Kg	13	0.18	1.9	0.16 J	0.0011 U	0.0011 U
100-41-4	Ethylbenzene	mg/Kg	5.9	0.24	11	0.1 J	0.0011 U	0.0011 U
108-88-3	Toluene	mg/Kg	0.37	0.0058	1.9	0.0033 J	0.0011 U	0.0012
1330-20-7	Xylenes, total	mg/Kg	14	0.54	17	0.14 J	0.0011 U	0.0021
BTEX	Total BTEX	mg/Kg	33.27	0.9658	31.8	0.4033	ND	0.0033
	PAHs							
83-32-9	Acenaphthene	mg/Kg	0.44 UJ	0.36 UJ	0.65	0.37 U	R	0.37 UJ
208-96-8	Acenaphthylene	mg/Kg	0.44 UJ	0.36 UJ	0.83	0.37 U	R	0.37 UJ
120-12-7	Anthracene	mg/Kg	0.44 UJ	0.36 UJ	1.2	0.37 U	R	0.37 UJ
56-55-3	Benzo(a)anthracene	mg/Kg	0.44 UJ	0.36 UJ	0.92	0.37 U	R	0.37 UJ
50-32-8	Benzo(a)pyrene	mg/Kg	0.44 UJ	0.36 UJ	0.87	0.37 U	R	0.37 UJ
205-99-2	Benzo(b)fluoranthene	mg/Kg	0.44 UJ	0.36 UJ	0.63	0.37 U	R	0.37 UJ
191-24-2	Benzo(g,h,i)perylene	mg/Kg	0.44 UJ	0.36 UJ	0.29 J	0.37 U	R	0.37 UJ
207-08-9	Benzo(k)fluoranthene	mg/Kg	0.44 UJ	0.36 UJ	0.21 J	0.37 U	R	0.37 UJ
218-01-9	Chrysene	mg/Kg	0.44 UJ	0.36 UJ	0.78	0.37 U	R	0.37 UJ
53-70-3	Dibenz(a,h)anthracene	mg/Kg	0.44 UJ	0.36 UJ	0.41 U	0.37 U	R	0.37 UJ
132-64-9	Dibenzofuran	mg/Kg	0.44 UJ	0.36 UJ	0.43	0.37 U	R	0.37 UJ
206-44-0	Fluoranthene	mg/Kg	0.44 UJ	0.36 UJ	1.6	0.37 U	R	0.37 UJ
86-73-7	Fluorene	mg/Kg	0.44 UJ	0.36 UJ	1.2	0.37 U	R	0.37 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	mg/Kg	0.44 UJ	0.36 UJ	0.26 J	0.37 U	R	0.37 UJ
91-20-3	Naphthalene	mg/Kg	0.81 J	0.91 J	4.8	0.18 J	R	0.37 UJ
85-01-8	Phenanthrene	mg/Kg	0.44 UJ	0.36 UJ	4.3	0.37 U	R	0.37 UJ
129-00-0	Pyrene	mg/Kg	0.44 UJ	0.36 UJ	2.5	0.37 U	R	0.37 UJ
91-57-6	2-Methylnaphthalene							
PAHs	Total PAHs	mg/Kg	0.81	0.91	21.47	0.18	R	ND
	PHENOLs							
105-67-9	2,4-Dimethylphenol	mg/Kg	0.44 UJ	0.36 UJ	0.41 U	0.37 U	0.37 U	0.37 U
95-48-7	2-Methylphenol	mg/Kg	0.44 UJ	0.36 UJ	0.41 U	0.37 U	0.37 U	0.37 U
106-44-5	4-Methylphenol	mg/Kg	0.44 UJ	0.36 UJ	0.41 U	0.37 U	0.37 U	0.37 U
PHENOLS	Total Phenols	mg/Kg	ND	ND	ND	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	mg/Kg	1.3 U	1.1 U	1.2 U	1.1 U	1.1 U	1.1 U
SOLIDS	Percent Solids	%	74.6	92.1	81.6	89.3	90.3	91.1

ND - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.

Table 4.2
BURA Fourth Street Site
Subsurface Soil Analytical Results

CAS NO.	COMPOUND	SAMPLE ID:	SB21D	SB21J	SB22D	SB22HI	SB23C	SB23F
		DEPTH:	6-8'	18-20'	6-8'	14-18'	4-6'	10-12'
		LAB ID:	195271-03	195271-04	195326-03	195326-01	195326-04	195326-05
		SOURCE:	STL	STL	STL	STL	STL	STL
		SDG:	195271/195	195271/195	195271/195	195271/195	195271/195	195271/195
		MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		SAMPLED:	11/13/98	11/13/98	11/16/98	11/16/98	11/16/98	11/16/98
		VALIDATED:	12/26/98	12/26/98	12/26/98	12/26/98	12/26/98	12/26/98
		UNITS:						
	BTEX							
71-43-2	Benzene	mg/Kg	0.0019 J	0.04	0.0013 U	0.065 J	0.001 J	0.022
100-41-4	Ethylbenzene	mg/Kg	0.0027 UJ	0.16	0.0041	0.011	0.0012 UJ	0.0012 U
108-88-3	Toluene	mg/Kg	0.0027 UJ	0.006 U	0.0011 J	0.0071 U	0.0012 UJ	0.015
1330-20-7	Xylenes, total	mg/Kg	0.0027 UJ	0.18	0.0098	0.016	0.0012 UJ	0.0084
BTEX	Total BTEX	mg/Kg	0.0019	0.38	0.015	0.092	0.001	0.0454
	PAHs							
83-32-9	Acenaphthene	mg/Kg	0.93 UJ	0.4 U	0.74	0.55 U	0.39 U	0.4 U
208-96-8	Acenaphthylene	mg/Kg	0.93 UJ	0.4 U	0.056 J	0.55 U	0.39 U	0.4 U
120-12-7	Anthracene	mg/Kg	0.93 UJ	0.4 U	1.4	0.55 U	0.39 U	0.4 U
56-55-3	Benzo(a)anthracene	mg/Kg	0.14 J	0.4 U	1.4	0.55 U	0.39 U	0.4 U
50-32-8	Benzo(a)pyrene	mg/Kg	0.93 UJ	0.4 U	1.1	0.55 U	0.39 U	0.4 U
205-99-2	Benzo(b)fluoranthene	mg/Kg	0.1 J	0.4 U	1.2	0.55 U	0.39 U	0.4 U
191-24-2	Benzo(g,h,i)perylene	mg/Kg	0.93 UJ	0.4 U	0.33 J	0.55 U	0.39 U	0.4 U
207-08-9	Benzo(k)fluoranthene	mg/Kg	0.93 UJ	0.4 U	0.39 J	0.55 U	0.39 U	0.4 U
218-01-9	Chrysene	mg/Kg	0.093 J	0.4 U	1.2	0.55 U	0.39 U	0.4 U
53-70-3	Dibenz(a,h)anthracene	mg/Kg	0.93 UJ	0.4 U	0.11 J	0.55 U	0.39 U	0.4 U
132-64-9	Dibenzofuran	mg/Kg	0.93 UJ	0.4 U	0.72	0.55 U	0.39 U	0.4 U
206-44-0	Fluoranthene	mg/Kg	0.93 UJ	0.4 U	2.6	0.55 U	0.39 U	0.044 J
86-73-7	Fluorene	mg/Kg	0.93 UJ	0.4 U	1.2	0.55 U	0.39 U	0.4 U
193-39-5	Indeno(1,2,3-cd)pyrene	mg/Kg	0.93 UJ	0.4 U	0.39 J	0.55 U	0.39 U	0.4 U
91-20-3	Naphthalene	mg/Kg	0.93 UJ	0.17 J	0.5	0.55 U	0.39 U	0.14 J
85-01-8	Phenanthrene	mg/Kg	0.93 UJ	0.4 U	4.6	0.55 U	0.39 U	0.056 J
129-00-0	Pyrene	mg/Kg	0.11 J	0.4 U	2.7	0.55 U	0.39 U	0.042 J
91-57-6	2-Methylnaphthalene							
PAHs	Total PAHs	mg/Kg	0.443	0.17	20.636	ND	ND	0.282
	PHENOLs							
105-67-9	2,4-Dimethylphenol	mg/Kg	0.93 UJ	0.4 U	0.063 J	0.55 U	0.39 U	0.4 U
95-48-7	2-Methylphenol	mg/Kg	0.93 UJ	0.4 U	0.44 U	0.55 U	0.39 U	0.4 U
106-44-5	4-Methylphenol	mg/Kg	0.93 UJ	0.4 U	0.062 J	0.55 U	0.39 U	0.4 U
PHENOLS	Total Phenols	mg/Kg	ND	ND	0.125	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	mg/Kg	2.7 UJ	1.2 U	1.3 U	1.4 U	1.2 U	1.2 U
SOLIDS	Percent Solids	%	36.4	83	76.1	70.5	84.8	82.9

ND - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.

Table 4.2

BURA Fourth Street Site
Subsurface Soil Analytical Results

CAS NO.	COMPOUND	SAMPLE ID:	MW-5C	MW-5I	MW-06D	MW-06G	MW-07D	MW-07I
		DEPTH:	4-6'	16-18'	6-8'	12-14'	6-8'	16-18'
		LAB ID:	186319-04	186319-05	186319-09	186319-10	186375-01	186375-02
		SOURCE:	STL	STL	STL	STL	STL	STL
		SDG:	PE141	PE141	PE141	PE141	PE141	PE141
		MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		SAMPLED:	5/6/98	5/6/98	5/6/98	5/6/98	5/8/98	5/8/98
		VALIDATED:	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98
		UNITS:						
	BTEX							
71-43-2	Benzene	mg/Kg	0.34 U	0.0011 U	0.0013 U	0.0013 UJ	0.0014 U	0.0013 UJ
100-41-4	Ethylbenzene	mg/Kg	0.34 U	0.0011 U	0.0013 U	0.0013 UJ	0.0014 U	0.0013 UJ
108-88-3	Toluene	mg/Kg	0.34 U	0.0011 U	0.0013 U	0.0013 UJ	0.0014 U	0.0013 UJ
1330-20-7	Xylenes, total	mg/Kg	0.43	0.0011 U	0.0013 U	0.0013 UJ	0.0014 U	0.0013 UJ
BTEX	Total BTEX	mg/Kg	0.43	ND	ND	ND	ND	ND
	PAHs							
83-32-9	Acenaphthene	mg/Kg	0.45 U	R	0.43 U	R	0.45 U	0.43 U
208-96-8	Acenaphthylene	mg/Kg	0.45 U	R	0.43 U	R	0.45 U	0.43 U
120-12-7	Anthracene	mg/Kg	0.45 U	R	0.43 U	R	0.45 U	0.43 U
56-55-3	Benzo(a)anthracene	mg/Kg	0.076 J	R	0.15 J	R	0.45 U	0.43 U
50-32-8	Benzo(a)pyrene	mg/Kg	0.055 J	R	0.12 J	R	0.45 U	0.43 U
205-99-2	Benzo(b)fluoranthene	mg/Kg	0.073 J	R	0.15 J	R	0.45 U	0.43 U
191-24-2	Benzo(g,h,i)perylene	mg/Kg	0.45 U	R	0.043 J	R	0.45 U	0.43 U
207-08-9	Benzo(k)fluoranthene	mg/Kg	0.45 U	R	0.047 J	R	0.45 U	0.43 U
218-01-9	Chrysene	mg/Kg	0.069 J	R	0.14 J	R	0.45 U	0.43 U
53-70-3	Dibenz(a,h)anthracene	mg/Kg	0.45 U	R	0.43 U	R	0.45 U	0.43 U
132-64-9	Dibenzofuran	mg/Kg	0.45 U	R	0.43 U	R	0.45 U	0.43 U
206-44-0	Fluoranthene	mg/Kg	0.14 J	R	0.27 J	R	0.45 U	0.43 U
86-73-7	Fluorene	mg/Kg	0.45 U	R	0.43 U	R	0.45 U	0.43 U
193-39-5	Indeno(1,2,3-cd)pyrene	mg/Kg	0.45 U	R	0.054 J	R	0.45 U	0.43 U
91-20-3	Naphthalene	mg/Kg	0.66	R	0.43 U	R	0.45 U	0.43 U
85-01-8	Phenanthrene	mg/Kg	0.12 J	R	0.17 J	R	0.45 U	0.43 U
129-00-0	Pyrene	mg/Kg	0.13 J	R	0.23 J	R	0.45 U	0.43 U
91-57-6	2-Methylnaphthalene							
PAHs	Total PAHs	mg/Kg	1.323	R	1.374	R	ND	ND
	PHENOLS							
105-67-9	2,4-Dimethylphenol	mg/Kg	0.45 U	0.38 U	0.43 U	0.42 U	0.45 U	0.43 U
95-48-7	2-Methylphenol	mg/Kg	0.45 U	0.38 U	0.43 U	0.42 U	0.45 U	0.43 U
106-44-5	4-Methylphenol	mg/Kg	0.45 U	0.38 U	0.43 U	0.42 U	0.45 U	0.43 U
PHENOLS	Total Phenols	mg/Kg	ND	ND	ND	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	mg/Kg	1.3 U	1.1 U	1.3 U	1.3 U	1.3 U	1.3 U
SOLIDS	Percent Solids	%	74.5	87.2	77.6	78.8	73.6	77.2

ND - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.

Table 4.2
BURA Fourth Street Site
Subsurface Soil Analytical Results

CAS NO.	COMPOUND	SAMPLE ID:	MW-08F	MW-08I	MW-09D	MW-09H	MW10D	MW10I
		DEPTH:	10-12'	16-18'	6-8'	14-16'	6-8'	16-18'
		LAB ID:	186525-10	186525-12	186525-08	186525-09	195271-01	195271-02
		SOURCE:	STL	STL	STL	STL	STL	STL
		SDG:	PE525	PE525	PE525	PE525	195271/195	195271/195
		MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		SAMPLED:	5/11/98	5/11/98	5/11/98	5/11/98	11/13/98	11/13/98
		VALIDATED:	7/3/98	7/3/98	7/3/98	7/3/98	12/26/98	12/26/98
		UNITS:						
	BTEX							
71-43-2	Benzene	mg/Kg	0.0013 U	0.0012 UJ	0.0033 J	0.23	0.0014 UJ	0.0011 U
100-41-4	Ethylbenzene	mg/Kg	0.0013 U	0.0012 UJ	0.0013 UJ	0.19	0.0014 UJ	0.0011 U
108-88-3	Toluene	mg/Kg	0.0011 J	0.0011 J	0.0013 UJ	0.0059 U	0.0014 UJ	0.0011 U
1330-20-7	Xylenes, total	mg/Kg	0.0013 U	0.0012 UJ	0.0013 UJ	0.15	0.0014 UJ	0.0011 U
BTEX	Total BTEX	mg/Kg	0.0011	0.0011	0.0033	0.57	ND	ND
	PAHs							
83-32-9	Acenaphthene	mg/Kg	0.43 UJ	0.39 UJ	0.4 J	0.4 UJ	0.41 U	0.37 U
208-96-8	Acenaphthylene	mg/Kg	0.43 UJ	0.39 UJ	0.42 UJ	0.4 UJ	0.41 U	0.37 U
120-12-7	Anthracene	mg/Kg	0.43 UJ	0.39 UJ	0.72 J	0.4 UJ	0.41 U	0.37 U
56-55-3	Benzo(a)anthracene	mg/Kg	0.43 UJ	0.39 UJ	0.85 J	0.4 UJ	0.41 U	0.37 U
50-32-8	Benzo(a)pyrene	mg/Kg	0.082 J	0.39 UJ	0.51 J	0.4 UJ	0.41 U	0.37 U
205-99-2	Benzo(b)fluoranthene	mg/Kg	0.43 UJ	0.39 UJ	0.61 J	0.4 UJ	0.41 U	0.37 U
191-24-2	Benzo(g,h,i)perylene	mg/Kg	0.43 UJ	0.39 UJ	0.15 J	0.4 UJ	0.41 U	0.37 U
207-08-9	Benzo(k)fluoranthene	mg/Kg	0.43 UJ	0.39 UJ	0.25 J	0.4 UJ	0.41 U	0.37 U
218-01-9	Chrysene	mg/Kg	0.43 UJ	0.39 UJ	0.7 J	0.4 UJ	0.41 U	0.37 U
53-70-3	Dibenz(a,h)anthracene	mg/Kg	0.43 UJ	0.39 UJ	0.064 J	0.4 UJ	0.41 U	0.37 U
132-64-9	Dibenzofuran	mg/Kg	0.43 UJ	0.39 UJ	0.26 J	0.4 UJ	0.41 U	0.37 U
206-44-0	Fluoranthene	mg/Kg	0.43 UJ	0.39 UJ	1.1 J	0.4 UJ	0.41 U	0.37 U
86-73-7	Fluorene	mg/Kg	0.43 UJ	0.39 UJ	0.52 J	0.4 UJ	0.41 U	0.37 U
193-39-5	Indeno(1,2,3-cd)pyrene	mg/Kg	0.43 UJ	0.39 UJ	0.2 J	0.4 UJ	0.41 U	0.37 U
91-20-3	Naphthalene	mg/Kg	0.43 UJ	0.39 UJ	0.33 J	0.4 UJ	0.41 U	0.37 U
85-01-8	Phenanthrene	mg/Kg	0.43 UJ	0.39 UJ	1.6 J	0.4 UJ	0.41 U	0.37 U
129-00-0	Pyrene	mg/Kg	0.43 UJ	0.39 UJ	1.3 J	0.4 UJ	0.41 U	0.37 U
91-57-6	2-Methylnaphthalene							
PAHs	Total PAHs	mg/Kg	0.082	ND	9.564	ND	ND	ND
	PHENOLs							
105-67-9	2,4-Dimethylphenol	mg/Kg	0.43 UJ	0.39 UJ	0.42 UJ	0.4 UJ	0.41 U	0.37 U
95-48-7	2-Methylphenol	mg/Kg	0.43 UJ	0.39 UJ	0.42 UJ	0.4 UJ	0.41 U	0.37 U
106-44-5	4-Methylphenol	mg/Kg	0.43 UJ	0.39 UJ	0.059 J	0.4 UJ	0.41 U	0.37 U
PHENOLS	Total Phenols	mg/Kg	ND	ND	0.059	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	mg/Kg	1.2 U	1.1 U	2.9	1.2 U	1.4 U	1.1 U
SOLIDS	Percent Solids	%	76.8	85.4	79	84.2	72.6	90.4

ND - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.

Table 4.2
BURA Fourth Street Site
Subsurface Soil Analytical Results

		SAMPLE ID:	UB001	UB002	UB002-DUP	UB003	UB005	UB006
		DEPTH:	12-14'	10-12'	10-12'	10-12'	10-12'	10-12'
		LAB ID:	206975-04	206975-03	206975-06	206975-08	206975-05	206975-05
		SOURCE:	STL	STL	STL	STL	STL	STL
		SDG:	206975	206975	206975	206975	206975	206975
		MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		SAMPLED:	08/25/99	08/25/99	08/25/99	08/25/99	08/25/99	08/25/99
		VALIDATED:	10/15/99	10/15/99	10/15/99	10/15/99	10/15/99	10/15/99
CAS NO.	COMPOUND	UNITS:						
	BTEX							
71-43-2	Benzene	mg/Kg	0.4	0.0028 J	0.13 J	0.0013 UJ	0.0013 U	0.0047 J
100-41-4	Ethylbenzene	mg/Kg	0.0051 J	0.012 J	0.0064 UJ	0.001 J	0.0021	0.007 U
108-88-3	Toluene	mg/Kg	0.0043 J	0.0013 UJ	0.0064 U	0.0013 UJ	0.0023	0.007 U
1330-20-7	Xylenes, total	mg/Kg	0.02	0.0009 J	0.014 J	0.0013 UJ	0.0055	0.014
BTEX	Total BTEX	mg/Kg	0.4294	0.0157	0.144	0.001	0.0099	0.0187
	PAHs							
83-32-9	Acenaphthene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.44 UJ	0.47 UJ
208-96-8	Acenaphthylene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.44 UJ	0.47 UJ
120-12-7	Anthracene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.048 J	0.47 UJ
56-55-3	Benzo(a)anthracene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.44 UJ	0.47 UJ
50-32-8	Benzo(a)pyrene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.44 UJ	0.47 UJ
205-99-2	Benzo(b)fluoranthene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.44 UJ	0.47 UJ
191-24-2	Benzo(g,h,i)perylene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.44 UJ	0.47 UJ
207-08-9	Benzo(k)fluoranthene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.44 UJ	0.47 UJ
218-01-9	Chrysene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.44 UJ	0.47 UJ
53-70-3	Dibenz(a,h)anthracene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.44 UJ	0.47 UJ
132-64-9	Dibenzofuran	mg/Kg						
206-44-0	Fluoranthene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.44 UJ	0.47 UJ
86-73-7	Fluorene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.046 J	0.47 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.44 UJ	0.47 UJ
91-20-3	Naphthalene	mg/Kg	0.49 UJ	0.05 J	0.17 J	0.44 UJ	0.1 J	0.47 UJ
85-01-8	Phenanthrene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.48 J	0.47 UJ
129-00-0	Pyrene	mg/Kg	0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.086 J	0.47 UJ
91-57-6	2-Methylnaphthalene		0.49 UJ	0.42 UJ	0.43 UJ	0.44 UJ	0.14 J	0.47 UJ
PAHs	Total PAHs	mg/Kg	ND	0.05	0.17	ND	0.9	ND
	PHENOLS							
105-67-9	2,4-Dimethylphenol	mg/Kg	NA	NA	NA	NA	NA	NA
95-48-7	2-Methylphenol	mg/Kg	NA	NA	NA	NA	NA	NA
106-44-5	4-Methylphenol	mg/Kg	NA	NA	NA	NA	NA	NA
PHENOLS	Total Phenols	mg/Kg	NA	NA	NA	NA	NA	NA
	INORGANICS							
57-12-9	Cyanide	mg/Kg	NA	NA	NA	NA	NA	NA
SOLIDS	Percent Solids	%	NA	NA	NA	NA	NA	NA

ND - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.

Table 4.2
BURA Fourth Street Site
Subsurface Soil Analytical Results

CAS NO.	COMPOUND	SAMPLE ID: / DEPTH: / LAB ID: / SOURCE: / SDG: / MATRIX: / SAMPLED: / VALIDATED: / UNITS:	UB007 / 10-12' / 206975-02 / STL / 206975 / SOIL / 08/25/99 / 10/15/99	UB008 / 10-12' / 206975-01 / STL / 206975 / SOIL / 08/25/99 / 10/15/99
	BTEX			
71-43-2	Benzene	mg/Kg	0.1	0.0012 UJ
100-41-4	Ethylbenzene	mg/Kg	0.0064 U	0.0046 J
108-88-3	Toluene	mg/Kg	0.0036 J	0.0012 UJ
1330-20-7	Xylenes, total	mg/Kg	0.013	0.0012 UJ
BTEX	Total BTEX	mg/Kg	0.1166	0.0046
	PAHs			
83-32-9	Acenaphthene	mg/Kg	0.42 UJ	0.41 UJ
208-96-8	Acenaphthylene	mg/Kg	0.42 UJ	0.41 UJ
120-12-7	Anthracene	mg/Kg	0.42 UJ	0.41 UJ
56-55-3	Benzo(a)anthracene	mg/Kg	0.42 UJ	0.41 UJ
50-32-8	Benzo(a)pyrene	mg/Kg	0.42 UJ	0.41 UJ
205-99-2	Benzo(b)fluoranthene	mg/Kg	0.42 UJ	0.41 UJ
191-24-2	Benzo(g,h,i)perylene	mg/Kg	0.42 UJ	0.41 UJ
207-08-9	Benzo(k)fluoranthene	mg/Kg	0.42 UJ	0.41 UJ
218-01-9	Chrysene	mg/Kg	0.42 UJ	0.41 UJ
53-70-3	Dibenz(a,h)anthracene	mg/Kg	0.42 UJ	0.41 UJ
132-64-9	Dibenzofuran	mg/Kg		
206-44-0	Fluoranthene	mg/Kg	0.42 UJ	0.41 UJ
86-73-7	Fluorene	mg/Kg	0.42 UJ	0.41 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	mg/Kg	0.42 UJ	0.41 UJ
91-20-3	Naphthalene	mg/Kg	0.42 UJ	0.41 UJ
85-01-8	Phenanthrene	mg/Kg	0.42 UJ	0.41 UJ
129-00-0	Pyrene	mg/Kg	0.42 UJ	0.41 UJ
91-57-6	2-Methylnaphthalene		0.42 UJ	0.41 UJ
PAHs	Total PAHs	mg/Kg	ND	ND
	PHENOLs			
105-67-9	2,4-Dimethylphenol	mg/Kg	NA	NA
95-48-7	2-Methylphenol	mg/Kg	NA	NA
106-44-5	4-Methylphenol	mg/Kg	NA	NA
PHENOLS	Total Phenols	mg/Kg	NA	NA
	INORGANICS			
57-12-9	Cyanide	mg/Kg	NA	NA
SOLIDS	Percent Solids	%	NA	NA

ND - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.

Table 4.3
BURA Fourth Street Site
Groundwater Analytical Results

		SAMPLE ID:	MW-03	MW-04	MW-05	MW-06
		LAB ID:	186721-03	186721-02	186721-06	186721-08
		SOURCE:	STL	STL	STL	STL
		SDG:	PE721	PE721	PE721	PE721
		MATRIX:	WATER	WATER	WATER	WATER
		SAMPLED:	5/15/98	5/15/98	5/15/98	5/15/98
		VALIDATED:	7/3/98	7/3/98	7/3/98	7/3/98
CAS NO.	COMPOUND	UNITS:				
	BTEX					
71-43-2	Benzene	ug/l	1.5	0.7 J	4	0.5 J
100-41-4	Ethylbenzene	ug/l	1 U	2.7	13	1 U
108-88-3	Toluene	ug/l	1 U	1 U	1.9	1.1
1330-20-7	Xylenes, total	ug/l	1 U	7.9	2.8	1.3
BTEX	Total BTEX	ug/l	1.5	11.3	21.7	2.9
	PAHs					
83-32-9	Acenaphthene	ug/l	2 J	10 U	10 U	11 U
86-73-7	Fluorene	ug/l	1 J	10 U	10 U	11 U
91-20-3	Naphthalene	ug/l	10 U	10 U	4 J	11 U
129-00-0	Pyrene	ug/l	1 J	10 U	10 U	11 U
PAHs	Total PAHs	ug/l	4	ND	4	ND
	PHENOLs					
108-95-2	Phenol	ug/l	10 U	10 U	10 U	11 U
PHENOLS	Total Phenols	ug/l	ND	ND	ND	ND
	INORGANICS					
57-12-9	Cyanide	ug/l	85	10 U	11	10 U

ND - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.

Table 4.3
BURA Fourth Street Site
Groundwater Analytical Results

		SAMPLE ID:	MW-07	MW-08	MW-09	MW10
		LAB ID:	186721-07	186721-05	186721-04	195482-01
		SOURCE:	STL	STL	STL	STL
		SDG:	PE721	PE721	PE721	195482
		MATRIX:	WATER	WATER	WATER	WATER
		SAMPLED:	5/15/98	5/15/98	5/15/98	11/18/98
		VALIDATED:	7/3/98	7/3/98	7/3/98	12/27/98
CAS NO.	COMPOUND	UNITS:				
	BTEX					
71-43-2	Benzene	ug/l	1 U	1 U	1900	0.6 J
100-41-4	Ethylbenzene	ug/l	1 U	1 U	41	1 U
108-88-3	Toluene	ug/l	1 U	1 U	2.4	0.5 J
1330-20-7	Xylenes, total	ug/l	1 U	1 U	44	1 U
BTEX	Total BTEX	ug/l	ND	ND	1987.4	1.1
	PAHs					
83-32-9	Acenaphthene	ug/l	10 U	11 U	7 J	10 U
86-73-7	Fluorene	ug/l	10 U	11 U	2 J	10 U
91-20-3	Naphthalene	ug/l	10 U	11 U	10 U	10 U
129-00-0	Pyrene	ug/l	10 U	11 U	10 U	10 U
PAHs	Total PAHs	ug/l	ND	ND	9	ND
	PHENOLs					
108-95-2	Phenol	ug/l	10 U	11 U	42	10 U
PHENOLS	Total Phenols	ug/l	ND	ND	42	ND
	INORGANICS					
57-12-9	Cyanide	ug/l	10 U	10 U	13	140 J

ND - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.

SECTION 5

SECTION 5
HUMAN HEALTH RISK ASSESSMENT

5.1 INTRODUCTION

The risk assessment was performed to provide an estimate of current and future human health risks associated in the absence of remedial action. The results of the risk assessment were used to assist in establishing preliminary remediation goals (PRGs) for remedial action, if required (see Section 6). Constituents of potential concern (COPCs) identified in this human health screening were evaluated in accordance with federal USEPA, USEPA Region II, and NYSDOH risk assessment guidance for the evaluation of potential human health effects from site-related media (USEPA 1989; NYSDOH 1998). The risk assessment process included the following major steps:

- Data Evaluation and Identification of COPCs (Subsection 5.3);
- Exposure Assessment (Subsection 5.4);
- Toxicity Assessment (Subsection 5.5); and
- Risk Characterization and Uncertainty Analysis (Subsections 5.6 and 5.7).

These steps are briefly discussed in this section and are presented in detail in Appendix G. Potential sources of chemical constituents, exposure pathways, and receptors are described in this section and illustrated in the conceptual site model (CSM) presented in Figure 5.1.

5.2 DATA EVALUATION AND IDENTIFICATION OF COPCs

5.2.1 Data Evaluation

The following media were quantitatively addressed in the risk assessment: (1) surface soil; and (2) mixed surface and subsurface soil. Groundwater data were compiled and evaluated in the screening process (identification of COPCs). Given the lack of human receptors, however, groundwater was not quantitatively evaluated.

A sample location map is provided in Section 2, Figure 2.1. Statistical summaries of the onsite soil and groundwater data are provided in Appendix G (Attachment G.1).

5.2.2 Constituent screening

For those chemical constituents detected, site-specific screening was performed using NYSDEC TAGM (1994), NYSDEC Ambient Groundwater Quality Standards and Guidance Values (1998), and NYSDOH (1992) values. Chemicals present in the samples were compiled for each medium of concern and were screened to identify COPCs. A discussion of the screening process and the results are presented in Appendix G

(Attachment G.2), and a summary of the COPCs identified for each soil interval and for groundwater is provided in Table 5.1.

In surface soil, five SVOCs and cyanide were identified as COPCs. In subsurface soil, two VOCs, seven SVOCs, and cyanide were identified as COPCs. These COPCs were further evaluated quantitatively. In groundwater, two VOCs exceeded screening values, but this medium was not quantitatively evaluated because exposure pathways are not complete (see Section 5.4).

5.3 EXPOSURE ASSESSMENT

The objective of the exposure assessment is to estimate the type and magnitude of potential exposure to the COPCs identified following the methodology discussed in Appendix G. An exposure pathway is considered complete only when all of the following four elements is present:

- A contaminant source;
- A mechanism for release, retention, or transport of a chemical in a given medium;
- A point of human contact with the medium (i.e. exposure point); and
- A plausible receptor and route of exposure at the exposure point.

A CSM was developed to identify the source of chemical constituents and the potential receptors and pathways of exposure (Figure 5.1). The CSM provides an overall assessment of the primary and secondary sources, and the corresponding release mechanisms and impacted media. The CSM also identifies potential receptors and associated pathways of exposure to impacted media.

The primary source of detected chemical constituents, including BTEX, PAHs, and cyanide, is waste resulting from past activities involving the manufacture, storage, and distribution of manufactured gas. The probable release mechanism(s) for the chemical constituents to soil include deposition onto surface soil; infiltration and percolation through the soil into the subsurface soil; and subsurface release through gas holders, buried tanks, or other former MGP structures. Therefore, the primary onsite media impacted by the MGP are surface and subsurface soil. Under various end-use scenarios, chemical constituents may migrate from surface soil to subsurface soil via infiltration and percolation, and/or chemical constituents in subsurface soil may be excavated and redistributed onto the surface to become mixed with surface soil.

The potential secondary release mechanisms from soil include the generation of fugitive dust and the volatilization of chemical constituents from soil, resulting in air (dust and vapors) being considered a secondarily impacted medium. Routes identified for exposure to chemical constituents include inhalation of chemical constituents in air (dust and vapors), as well as direct contact with soil via ingestion and dermal contact.

Both current and future receptors were evaluated for potential exposure to soils. Current and reasonably foreseeable future land-use scenarios were based on the Site description provided in Section 1 of this report.

Current land use at the Site and the immediate vicinity is institutional (elementary school), commercial, and recreational. A portion of the Site is currently a paved a parking area with planted islands, although the majority of the Site is covered by soil with vegetative cover. Current surface soils (0 to 0.5 foot) were used to assess potential exposure of current receptors. In addition, the 0 to 0.5 foot interval was used to evaluate a potential onsite worker if future excavation does not occur.

Potential (future) land-use scenarios include industrial/commercial or residential. Given the history of the area, these land-use scenarios are appropriate. Mixed surface and subsurface soils are evaluated for future receptors to account for potential excavation and redistribution of soils during the "hypothetical" future redevelopment. Given the lack of a completed exposure pathway for groundwater, it was not quantitatively evaluated.

Current receptors include current school employees, school students, and adolescent trespassers; potential future receptors include industrial/commercial workers, construction workers, and onsite residents. A detailed discussion of the current and future receptors is provided in Section 5.4.1.

5.3.1 Potential Receptors

The following potential receptors are identified for the Site.

5.3.1.1 Current Adolescent Receptors

Given the absence of substantial fencing, it is likely that adolescents and students at the Waterfront School may access portions of the Site during the school day. Therefore, these receptors may be exposed to surface soils. Incidental ingestion of soil, dermal contact with soil, inhalation of fugitive dust from soil, and inhalation of volatiles from soil were identified as potential pathways for exposure to be considered.

5.3.1.2 Current School Employees

Current workers are defined as individuals that are employed at or near the Site (at the Waterfront School), and have unlimited access to Site media. Currently, onsite workers include school employees that utilize the parking area. The current workers (school employees) are assumed to be potentially exposed daily (5-day work week) to Site media. Current school employees are assumed to be exposed to surface soil (0 to 0.5 foot in depth). Incidental ingestion of soil, dermal contact with soil, inhalation of fugitive dust from soil, and inhalation of volatiles from soil were identified as potential pathways for exposure to be considered.

5.3.1.3 Future Industrial/Commercial Workers

Future workers are defined as individuals that will potentially be employed at an industrial or commercial facility, and will have unlimited access to Site media. Future workers are assumed to be potentially exposed daily (5-day work week) to Site media.

Given that potential workers are the most likely future receptors, potential risks resulting from exposure to soils were evaluated for both a non-excavation (0 to 0.5 foot) and an excavation (0 to 12 feet) scenario. Incidental ingestion of soil, dermal contact with soil, inhalation of fugitive dust from soil, and inhalation of volatiles from soil were identified as potential pathways for exposure to soil to be considered.

5.3.1.4 Hypothetical Future Construction Workers

In addition to the workers described above, construction workers may also be exposed to Site soils in the future. The difference between industrial/commercial workers and construction workers is that construction workers have the potential to be more highly exposed than other workers, but over a shorter period of time (i.e. the duration of the construction activity).

Exposure to soils at a depth of 0 to 12 feet is expected when standard commercial/industrial or residential development occurs. A depth of 12 feet is considered to be reasonable for standard development. Incidental ingestion of soil, dermal contact with soil, inhalation of fugitive dust from soil, and inhalation of volatiles from soil were identified as potential pathways for exposure to soil to be considered.

5.3.1.5 Hypothetical Future Residents (Adult and Child)

Hypothetical future residents are defined as individuals that reside onsite and have unlimited access to Site media. The residents are assumed to be exposed to Site media on a daily basis. Both an adult and child resident are considered in the risk assessment.

Hypothetical future residents are assumed to be exposed to mixed surface soil (0 to 12 feet) which would result following residential development. Incidental ingestion of soil, dermal contact with soil, inhalation of fugitive dust from soil, and inhalation of volatiles from soil were identified as potential pathways for exposure to soil to be considered.

5.3.1.6 Hypothetical Future School Employees and Students

The potential pathway for exposure of school employees and students to contaminated groundwater and/or DNAPL was considered. This pathway of exposure was eliminated from further consideration, because no impacts to the school from DNAPL or contaminated groundwater have been documented. This pathway was eliminated using information obtained from MW-10, a monitoring well directly adjacent to the school. The absence of detectable levels of BTEX and PAHs in the soil, the absence of detectable concentrations of PAHs in groundwater, a low BTEX concentration of 1.1 µg/L in groundwater, and the absence of DNAPL, demonstrates that migration of contaminated groundwater and/or DNAPL has not impacted the school. Based on the data collected during this investigation, migration of groundwater and DNAPL are not expected to impact the school in the future.

5.3.2 Estimation of Intake

Two types of exposure estimates are currently used for CERCLA-type risk assessments: reasonable maximum exposure (RME), and central tendency (CT). The RME is defined as the highest exposure that could reasonably be expected to occur for a given exposure pathway, and is intended to account for both uncertainty in the chemical concentration and variability in the exposure parameters (such as exposure frequency or averaging time). The CT, which is meant to characterize a more average exposure, is evaluated for comparison purposes and is based on mean exposure parameters. A discussion of the methodology used to evaluate exposure is provided in Appendix G.

5.3.3 Exposure Point Concentrations

In assessing the possible exposures of hypothetical or actual receptors to Site chemical constituents, an exposure-point concentration (EPC) must be calculated for each chemical in each medium. EPCs are the chemical concentrations at the point at which a receptor will be exposed. The EPCs are used to quantify current and future exposure scenarios.

For soil, under both current and hypothetical future exposure scenarios, the exposure point concentrations were estimated from the RI analytical data for the most probable future receptors. The statistical analysis of the analytical data is presented in Appendix G (Attachment G.1).

5.4 TOXICITY ASSESSMENT

The objective of the toxicity assessment is to weigh available evidence regarding the potential for particular chemical constituents to cause adverse effects in exposed individuals and to provide, where possible, an estimate of the relationship between the extent of exposure to a chemical and the increased likelihood and/or severity of adverse effects.

The most recent available toxicity data was used to calculate carcinogenic and non-carcinogenic risks. This includes the Integrated Risk Information System (IRIS; USEPA 1998b) updates and Health Effects Assessment Summary Tables (HEAST; USEPA 1995b). In addition, provisional and surrogate toxicity factors were included in the assessment, where available and appropriate. Toxicity values used in the risk assessment are provided in Appendix G (Attachment G.3, Table G.3-2).

Appendix G (Attachment G.4) provides toxicity profiles for the COPCs. The toxicity profiles discuss the physical and chemical properties, fate and transport, and toxicity associated with each COPC.

5.5 RISK CHARACTERIZATION

To characterize potential non-carcinogenic effects, comparisons were made between projected intakes of substances and toxicity values. To characterize potential carcinogenic effects, probabilities that an individual will develop cancer over a lifetime of exposure were estimated from projected intakes and chemical-specific dose-response information. Major assumptions, scientific judgments, and to the extent possible, estimates of the uncertainties embodied in the risk assessment are also presented.

For each COPC having available toxicity values, a cancer risk and hazard quotient (HQ) estimate were presented (see Appendix G for methodology used to derive cancer risks and hazard quotients). Appendix G (Attachment G.3) presents the cumulative cancer risk and Hazard Index (HI = sum of all HQs for a given pathway and receptor) estimates derived for each receptor, pathway, and chemical at each site. A summary of the derived risks and hazards are presented in Table 5.2.

5.5.1 Carcinogenic Effects

USEPA's target range for carcinogenic risk associated with Superfund sites is one-in-ten thousand (1E-04) to one-in-one million (1E-06). That is, the receptor risk due to the Site should not exceed this target range. If any COPCs were identified during the risk characterization as contributing significantly to a receptor with a cumulative cancer risk of 1×10^{-4} or greater, they were identified as chemicals of concern (COCs). The cumulative cancer risk is defined as the summation of the risks associated with all media and all pathways of exposure. The COCs were then discussed in an uncertainty analysis to determine whether they should be considered final COCs.

5.5.1.1 Derived Carcinogenic Risk for the Current Receptors

Table 5.2 presents a summary of the carcinogenic risks derived for current receptors exposed to chemical constituents in surface soil in the 0 to 0.5 foot depth interval. The carcinogenic risk calculation tables are presented in Appendix G (Attachment G.3). The total receptor risks derived were 6×10^{-5} (RME) for the current school employee and 4×10^{-5} (RME) for the current adolescent trespasser. Both of these total receptor risks fall below the target of 1×10^{-4}, indicating that remedial action is not warranted for the protection of current receptors from potential carcinogenic risks. Carcinogenic chemicals of concern (COC), therefore, were not identified for current receptors.

5.5.1.2 Derived Carcinogenic Risk for Future Receptors

Table 5.2 presents a summary of the carcinogenic risks derived for future receptors exposed to chemical constituents in soil in the 0 to 0.5 foot and the 0 to 12 foot interval. The carcinogenic risk calculation tables are presented in Appendix G (Attachment G.3).

The total receptor risks for the RME exposure scenario were 7 x 10^{-5} for the future industrial/commercial worker (surface soil exposure), 3 x 10^{-5} for the future industrial worker (mixed surface and subsurface soil exposure), 3 x 10^{-6} for the future construction worker and 9 x 10^{-5} for the future resident (combined child and adult). All of these total receptor risks fall below the target of 1 x 10^{-4}, indicating that remedial action is not warranted for the protection of future receptors from potential carcinogenic risks. Carcinogenic chemicals of concern (COC), therefore, were not identified for future receptors.

5.5.2 Non-carcinogenic Effects

Calculation of an HI in excess of one indicates the potential for adverse health effects. Indices greater than one will be generated any time intake for any of the COPCs exceeds its reference dose (RfD) or reference concentration (RfC). However, if there are two or more chemicals involved, it is possible to generate an HI greater than one, even if none of the individual chemical intakes or concentrations exceed their respective RfDs or RfCs. If a particular COPC was determined to contribute significantly (HQ of 0.1 or greater) to a receptor HI of one or greater, it was identified as a COC. The cumulative HI is defined as the summation of the hazards associated with all media and all exposure pathways.

5.5.2.1 Derived Non-carcinogenic Risk for Current Receptors

Table 5.2 presents a summary of the non-carcinogenic hazard index derived for current receptors exposed to chemical constituents in soil in the 0 to 0.5 foot depth interval. The non-cancer calculation tables are presented in Appendix G (Attachment G.3). The total receptor HIs were 0.0003 (RME) for the current school employee and 0.0006 (RME) for the current adolescent trespasser. Both of these total receptor risks fall below the target of one, indicating that remedial action is not warranted for the protection of current receptors from potential non-carcinogenic risks. Non-carcinogenic chemicals of concern (COC), therefore, were not identified for current receptors.

5.5.2.2 Derived Non-carcinogenic Risk for Future Receptors

Table 5.2 presents a summary of the non-carcinogenic hazard indices derived for future receptors exposed to chemical constituents in soil in the 0 to 0.5 foot and the 0 to 12 feet intervals. The non-cancer risk calculation tables are presented in Appendix G (Attachment G.3). The total receptor HIs for the RME exposure scenario were 0.0004 for the future industrial/commercial worker (surface soil exposure), 0.1 for the future industrial/commercial worker (mixed surface and subsurface soil exposure), and 0.8 for the future resident (combined child and adult). The derived hazard indices did not exceed the target of one for any future receptors, indicating that remedial action is not warranted for the protection of future receptors from potential non-carcinogenic risks. Non-carcinogenic chemicals of concern (COC), therefore, were not identified for future receptors.

5.6 UNCERTAINTY ASSESSMENT

The discussion of uncertainties was developed for the following risk assessment steps: data evaluation, exposure assessment, toxicity assessment, and risk characterization. A detailed discussion of the uncertainties associated with these steps is included in Appendix G.

5.7 CONCLUSIONS

Constituents identified in soils and groundwater were evaluated in a screening process to identify COPCs at the Fourth Street Site. The risk assessment evaluated potential exposure of current and future receptors to soils (Figure 5.1). A quantitative analysis of the carcinogenic and non-carcinogenic risks from COPCs identified in soils to these receptors was consequently conducted. Results of the risk assessment demonstrated that, in the absence of any remedial action, risks to potential receptors are very low. Both the calculated carcinogenic and non-carcinogenic risks fell below the USEPA threshold values.

Groundwater was evaluated in the screening process, but potential exposure of hypothetical future receptors was not quantitatively evaluated. Groundwater in the vicinity is not used as a potable drinking water supply, and no primary aquifers are located within two miles of the Site. Although the groundwater medium was not evaluated quantitatively, it was evaluated as a medium of concern in the feasibility study. A comparison to NYSDEC Class GA standards was conducted to determine potentially impacted areas (see Section 6).

Figure 5.1
Human Health Conceptual Site Model
Fourth Street Site

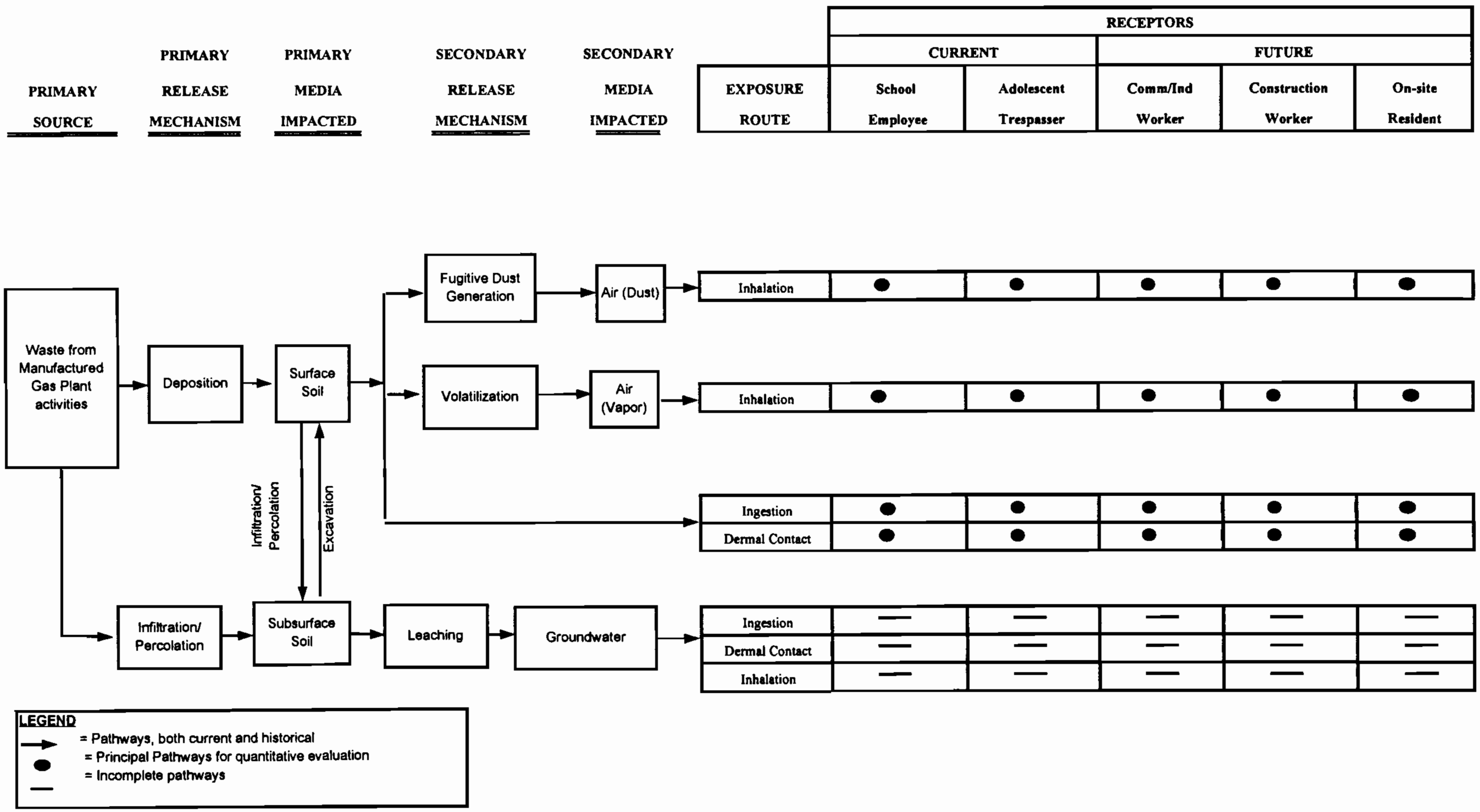


Table 5.1
Constituent of Potential Concern (COPC) Summary
Fourth Street Site

Constituent	Surface Soil COPC (0-0.5 ft) MDC[1] (mg/kg)	Surface Soil COPC (0-0.5 ft) EPC[2] (mg/kg)	Subsurface Soil COPC (0-12 ft) MDC[1] (mg/kg)	Subsurface Soil COPC (0-12 ft) EPC[2] (mg/kg)
Volatiles				
Benzene	--	--	3.60E+00	3.60E+00
Xylenes	--	--	1.70E+01	1.70E+01
Semi-Volatiles				
Benzo(a)anthracene	1.10E+01	1.10E+01	1.10E+01	6.47E+00
Benzo(a)pyrene	1.00E+01	1.00E+01	1.00E+01	6.48E+00
Benzo(b)fluoranthene	1.50E+01	1.50E+01	1.50E+01	7.48E+00
Chrysene	8.80E+00	8.80E+00	9.40E+00	5.28E+00
Dibenz(a,h)anthracene	1.00E+00	1.00E+00	1.10E+00	4.67E-01
2,4-Dimethylphenol	--	--	7.30E-01	3.38E-01
Naphthalene	--	--	5.80E+01	5.34E+01
Inorgancs				
Cyanide	7.20E+00	7.20E+00	4.63E+01	3.43E+00

-- Not a COPC for media of concern
(1) MDC = maximum detected concentration (this is the value used in the screening process, Section 5, Appendix J.2)
(2) EPC = exposure point concentration (this is the value used in the HHRA, Section 5, Appendix J.3)

Table 5.2
SUMMARY OF CANCER RISKS AND HAZARD INDICES
Fourth Street Site

Receptor	Media	Pathway	Cancer Risk RME	Cancer Risk CT	Hazard Index RME	Hazard Index CT
		Current Receptors				
Current School Employee	Surface Soil	Ingestion	3.E-05	1.E-06	3.E-04	7.E-05
		Dermal Contact	3.E-05	6.E-07	3.E-05	3.E-06
		Inhalation of Dust	6.E-10	3.E-11	NC	NC
	Receptor Totals		6.E-05	2.E-06	3.E-04	7.E-05
Current Trespasser	Surface Soil	Ingestion	2.E-05	4.E-06	5.E-04	1.E-04
		Dermal Contact	2.E-05	1.E-06	5.E-05	3.E-06
		Inhalation of Dust	3.E-10	6.E-11	NC	NC
	Receptor Totals		4.E-05	5.E-06	6.E-04	1.E-04
		Future Receptors				
Future Industrial/ Commercial Worker (Non-excavation scenario)	Surface Soil	Ingestion	3.E-05	3.E-06	4.E-04	2.E-04
		Dermal Contact	4.E-05	1.E-06	4.E-05	7.E-06
		Inhalation of Dust	3.E-09	5.E-10	NC	NC
	Receptor Totals		7.E-05	5.E-06	4.E-04	2.E-04
Future Industrial/ Commercial Worker (Excavation Scenario)	Subsurface Soil	Ingestion	1.E-05	1.E-06	2.E-03	8.E-04
		Dermal Contact	1.E-05	5.E-07	1.E-03	2.E-04
		Inhalation of Dust	1.E-09	2.E-10	4.E-06	4.E-06
		Inhalation of Volatiles	2.E-06	4.E-07	1.E-01	1.E-01
	Receptor Totals		3.E-05	2.E-06	1.E-01	1.E-01
Future Construction Worker	Subsurface Soil	Ingestion	2.E-06	5.E-07	9.E-03	2.E-03
		Dermal Contact	6.E-07	9.E-08	1.E-03	2.E-04
		Inhalation of Dust	4.E-11	4.E-11	4.E-06	4.E-06
		Inhalation of Volatiles	8.E-08	8.E-08	1.E-01	1.E-01
	Receptor Totals		3.E-06	6.E-07	1.E-01	1.E-01
Hypothetical Residents: Adult	Subsurface Soil	Ingestion	2.E-05	1.E-06	2.E-03	6.E-04
		Dermal Contact	2.E-05	5.E-07	2.E-03	2.E-04
		Inhalation of Dust	1.E-09	2.E-10	6.E-06	3.E-06
		Inhalation of Volatiles	3.E-06	4.E-07	2.E-01	8.E-02
	Receptor Totals		4.E-05	2.E-06	2.E-01	8.E-02
Hypothetical Residents: Child	Subsurface Soil	Ingestion	4.E-05	3.E-06	2.E-02	6.E-03
		Dermal Contact	9.E-06	3.E-07	3.E-03	3.E-04
		Inhalation of Dust	1.E-09	2.E-10	2.E-05	1.E-05
		Inhalation of Volatiles	2.E-06	4.E-07	6.E-01	3.E-01
	Receptor Totals		5.E-05	4.E-06	6.E-01	3.E-01
Hypothetical Residents: Adult + Child	**Receptor Totals**		9.E-05	6.E-06	8.E-01	4.E-01

SECTION 6

SECTION 6
PRELIMINARY REMEDIAL ACTION OJBECTIVES

6.1 INTRODUCTION

The purpose of this section is to (1) specify federal and state statutes, regulations, and guidelines that are potentially applicable to the development of remediation goals and remedy selection for the Site; (2) develop and present PRGs to be used in the development of remedial action objectives for the Site; and (3) identify remedial action objectives for the purpose of evaluating the effectiveness of remedial alternatives for the Site.

Federal and state goals and requirements, including chemical-, action-, and location-specific standards, criteria, and guidelines that may be applicable or relevant to the Site are discussed in Sections 6.1.1, 6.1.2, and 6.2. PRGs, consisting of chemical-specific long-term cleanup goals for specific media, are presented in Section 6.3. Remedial action objectives (RAOs), consisting of media-specific goals for protecting human health and the environment and for meeting PRGs to the extent practicable, are discussed in Section 6.4.

6.1.1 Federal Goals and Requirements

In accordance with Section 300.430(e)(2)(i) of the National Contingency Plan (NCP), remediation goals should be established based on exposure levels that are protective of human health and the environment, and should be developed by considering Applicable or Relevant and Appropriate Requirements (ARARs) under federal environmental or state environmental laws. USEPA guidance for Superfund Sites specifies that remedial actions should be evaluated, in large part, based on compliance with ARARs, such as maximum contaminant levels for groundwater and surface water, and protection of human health and the environment using appropriate risk analysis.

Section 121 of CERCLA (42 U.S.C. Section 9621) establishes requirements for the selection of remedial actions at Superfund sites. Section 121 establishes the fundamental requirement that actions be selected and carried out consistent with the NCP, to the extent practicable, and in a manner that provides for a "cost-effective response." Section 121(d) generally requires that remedial actions attain a degree of cleanup and control of future releases that ensures protection of human health and the environment. Section 121(d)(2) further provides that selected remedial actions, or the completion of such actions, must attain a level or standard of control that attains "legally applicable or relevant and appropriate standards." At a minimum, such actions are to attain a level of protection or standard of control that is equivalent to ARARs promulgated under federal and state laws.

Specific federal goals and requirements are discussed in Section 6.2.

6.1.2 New York State Goals and Requirements

New York State Standards, Criteria ,and Guidelines (SCGs) are standards or requirements that implement the New York State Environmental Conservation Law. Since New York State does not have ARARs in its statute, SCGs are used to avoid misinterpretation of New York State requirements. Remedial actions conducted in New York State are required to attain SCGs to the extent practicable, as presented in the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) #HWR-90-4030 (NYSDEC, 1990). SCGs are based on USEPA's ARARs and include federal standards that are more stringent than the New York State standards. NYSDEC requires that SCGs be taken into account when determining the remediation goals for a site.

In addition to SCGs, there are "to be considered" items, or TBCs. TBCs include guidance documents, advisory criteria, and guidelines issued by federal or state agencies that are not promulgated or binding under federal or state law and do not have the status of SCGs. However, such guidance may be considered appropriate for protection of human health and the environment and are evaluated along with SCGs in determining the appropriate remedy for a site.

6.2 STANDARDS, CRITERIA, AND GUIDELINES (SCGs)

The three types of SCGs are:

- Chemical-specific SCGs (i.e. action levels applicable to a given substance);
- Action-specific SCGs (i.e. design and performance standards for particular facilities or units); and
- Location-specific SCGs (i.e. siting restrictions due to wetlands, historical structures, and other location-related resources).

The three types of SCGs listed above, along with any appropriate TBCs, are discussed in Sections 6.2.1, 6.2.2, and 6.2.3, respectively, as they pertain to the Site.

6.2.1 Chemical-Specific SCGs

Chemical-specific SCGs are health-based or risk-based concentration limits, goals, or ranges in various environmental media for specific hazardous substances. Chemical-specific SCGs include remediation goals for chemicals of concern in designated media (such as soil or sediment), which can be used in the development of remedial action objectives for site media.

The primary residuals detected at the Site are MGP-related constituents (BTEX, PAHs, and cyanide). These chemicals have the greatest potential impact at the Site. Chemical-specific SCGs were also developed for certain chemicals that are not considered MGP-related.

Statutes, regulations, and guidelines to be used in the identification of chemical-specific SCGs are listed in Table 6.1. Chemical-specific SCGs that may be applicable to a former MGP Site, such as the Fourth Street Site, are listed in Tables 6.2 through 6.4. These SCGs are numerical criteria or standards for protecting human health and the environment from potentially adverse impacts posed by former MGP sites.

Chemical-specific TBCs, such as soil action levels established for two MGP Sites in Iowa and one MGP site in New York State, are also listed in Table 6.1.

6.2.1.1 Soil

NYSDEC has developed soil cleanup objectives and levels to protect human health and the environment from potentially significant impacts. NYSDEC considered a variety of factors, such as soil contact and ingestion, residential land use, a one-in-one-million cancer risk, the impacts of soil leaching on groundwater and drinking water quality, background soil concentrations, and detection limits. These soil cleanup objectives and levels are listed in TAGM #HWR-94-4046 for over 125 different organic and inorganic chemicals based on a soil organic carbon content of one percent (NYSDEC, 1994). The values in Table 6.2 are based on the TAGM #HWR-94-4046 methodology and adjusted, as appropriate, based on an average site total organic carbon content of 4.58 percent from the 1998 offsite background soil sampling results.

The NYSDEC-recommended soil cleanup objectives listed in the 1994 TAGM #HWR-94-4046 guidance for organic parameters corresponds to whichever is lower: the human health-based level (based on residential land use) or the groundwater-protective level. To develop soil cleanup objectives for organics for protecting groundwater quality, the NYSDEC used a procedure based on organic constituent partitioning between the soil and water as a function of organic carbon content (i.e. equilibrium partitioning theory). For metals and other inorganics, the NYSDEC soil cleanup objectives are based on eastern United States or site-specific background levels. Correction factors are also applied to account for dilution and other forms of attenuation as constituents migrate into the subsurface (NYSDEC, 1994b).

Seven background surface soil samples were collected around the perimeter of the Site and were used in the development of soil PRGs for protecting groundwater, as shown in Table 6.2. Two samples were collected on the northeast side of the Site, two samples were collected northeast of the school building, one sample was collected south of the school building, and two samples were collected near the athletic field and tennis courts. The background samples were analyzed for PAHs, phenol, and cyanide. Total PAHs ranged from 0.7 to 19 mg/kg in these background samples.

The NYSDEC soil cleanup objectives for organic parameters listed in Table 6.2 were based on residential exposure or groundwater protection, and were adjusted using an average background total organic carbon (TOC) content of 4.58 percent, as measured in the background soil samples. The following equation was used to adjust the cleanup objective levels:

$$Cs = (f) \times (K_{oc}) \times (Cw)$$

where Cs = allowable soil or sediment concentration

f_{oc} = fraction of organic carbon in the soil or sediment

Koc = partition coefficient between water and soil media (from technical literature)

C_W = appropriate water quality SCG

Background upper tolerance limits (BUTLs) were also calculated for each detected constituent in soil based on the background sampling results. The BUTLs define, in a statistical manner, soil background levels at the Site. The formula for calculating a BUTL is as follows (the tolerance factors are provided in a USEPA guidance document [1989]):

$$BUTL = \overline{X} + k(a)$$

where $\overline{X}$ = statistical mean value for a background chemical
k = tolerance factor
a = standard deviation

Table 6.2 present, BUTLs and the calculations uses to derive them.

6.2.1.2 Groundwater

NYSDEC has also developed standards and guidance values to protect groundwater and surface water (NYSDEC, 1993a). The State developed these values based on levels of protection for drinking water sources, fish propagation and survival, and human and wildlife consumption of fish. NYSDEC Division of Water's ambient water quality standards and guidance values for chemicals detected at the Site in Class GA groundwater (i.e. for any groundwater) are listed in Table 6.3. BUTLs for groundwater are not listed, because background samples are not available.

The maximum contaminant levels (MCLs) for drinking water established under the Federal Safe Drinking Water Act and Part 5 of the New York State Public Health Law (10 NYCRR) are not applicable at the Site. There appears to be no potential for future use of groundwater at the Site as a public water supply source based on the current water supply infrastructure. Local water is derived from a municipal source, which draws its water from Lake Erie. The nearest groundwater wells are used for industrial purposes or are not used at all.

6.2.1.3 Air

NYSDEC's Division of Air Resources air quality guidelines for MGP-related residuals are listed in Table 6.4. These guidelines are TBCs that are based on protecting public health from impacts due to inhalation. Short-term Guideline Concentrations (SGCs) pertain to exposures of a few hours or less, whereas Annual Guideline Concentrations (AGCs) apply to long-term exposure. SGCs may need to be considered in assessing impacts due to excavation or material transport during site remediation. Also, AGCs for dust and VOCs, such as benzene, may need to be considered, depending upon the type of remediation being evaluated.

6.2.2 Action-Specific SCGs

Action-specific SCGs are technology- or activity-based requirements or limitations pertaining to waste remediation. These SCGs are prompted by and apply to the implementation of particular remedial activities. Statutes, regulations, and guidelines used in the identification of action-specific SCGs for the Site are listed in Table 6.5. Action-specific TBCs are also listed in Table 6.5.

6.2.2.1 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) and corresponding New York State waste management laws and regulations under 6 NYCRR Parts 370 through 375 provide several potentially applicable action-specific SCGs because these regulations govern the management of hazardous and solid waste in New York State. In general, soil in place is not a waste unless it is excavated and processed by being moved to another site, treated, or disposed. RCRA guidance is available for determining what constitutes generation of a hazardous or solid waste.

Toxicity Characteristic Leaching Procedure (TCLP) limits are specified in 40 CFR Part 261 and 6 NYCRR Part 371. These regulations also define the corrosivity, reactivity, and ignitability characteristics under RCRA. Federal regulations limit the corrosivity RCRA characteristic to liquids (40 CFR Part 261.22). The reactivity characteristic is defined in qualitative terms (see 40 CFR Part 261.23). However, disposal facilities currently use *de facto* limits of 250 parts per million (ppm) of releasable cyanide (i.e. hydrogen cyanide) and 500 ppm of releasable sulfide (hydrogen sulfide) based on USEPA SW-846 test methods (USEPA, 1994). The ignitability characteristic is defined for a solid material in 40 CFR Part 261.21 as an oxidizer or a material causing fire and, when ignited under standard temperature and pressure, burning vigorously and persistently so as to create a hazard.

<u>MGP Process Residuals</u>

The manufactured gas industry operated during the period from the early 1800s until the mid-1950s, so any process residuals at historic MGP sites would have been generated before the enactment of RCRA and, thus, before the November 19, 1980, effective date of USEPA's hazardous waste treatment, storage, and disposal facility regulations. Therefore, *in situ* site materials that are hazardous by characteristic are not subject to RCRA regulation. However, if materials exceeding hazardous waste characteristic parameters are excavated and processed, they are deemed to have been generated and can become subject to the generator requirements of 40 CFR Part 262 and the transport, storage, and disposal requirements under 40 CFR Parts 263 through 265 of RCRA.

Until 1990, MGP site remediation wastes could be disposed of under RCRA as non-hazardous solid wastes that were not subject to regulation under Subtitle C (hazardous waste program) of RCRA. This is due to the fact that in the mid 1980s, USEPA ruled that MGP wastes qualified for the Bevill Amendment exclusion for mineral processing wastes. In addition, MGP residuals typically exhibited none of the hazardous toxicity characteristics that were then in effect.

Due to more recent regulatory changes, however, MGP site remediation wastes now may be classified as hazardous waste subject to Subtitle C regulation. In 1990, USEPA ruled that remediation waste from "historic" sites no longer qualifies for the Bevill Amendment exclusion; therefore, MGP site remediation wastes are now subject to hazardous waste regulation if they exhibit a hazardous characteristic. Moreover, in 1990, USEPA established the Toxicity Characteristic (TC) Rule, which expanded the regulated compound list for toxicity characteristics to add 24 organic constituents including benzene, a common component in coal- and petroleum-based residuals.

The loss of the Bevill status also affects land disposal of MGP site remediation wastes that exhibit a hazardous characteristic. Land disposal requirements for hazardous waste as they apply to coal- and petroleum-based residuals under the Federal Land Ban Program are discussed further in Section 6.2.2.2.

RCRA Exceedances

A Toxicity Characteristics Leaching Procedure (TCLP) analysis, performed during the August 1996 NYSDEC and NYDOH investigation, indicated that one DNAPL sample exceeded the toxicity characteristic level of 0.5 mg/L for benzene.

In November 1998, New York State adopted a number of federal changes made to RCRA between June 1993 and July 1997, including land disposal restriction rule changes (see Section 6.2.2.5), organic air emissions standards for tanks, the universal waste rule, and the expanded public participation rule.

On August 12, 1997, the USEPA proposed approval of a number of previous New York State RCRA rule changes, allowing for state delegation of additional USEPA RCRA programs, including its 1990 toxicity characteristics revisions, boiler/industrial furnace requirements, and corrective action management unit (CAMUs) provisions, and eliminating the need for dual permitting related to these programs. These program delegations took effect on October 14, 1997.

6.2.2.2 Land Disposal Restrictions (LDRs)

Federal Land Ban Program

The Hazardous and Solid Waste Amendments (HSWA) to RCRA were signed into law on November 8, 1984. These amendments include specific provisions, known as land disposal restrictions (LDRs), restricting the land disposal of RCRA-classified hazardous waste. The specific purpose of the LDRs is to minimize the potential for future human health and environmental risks by requiring treatment of hazardous wastes prior to their disposal on land. The site waste streams anticipated to exceed hazardous waste regulatory standards are coal-based process residuals and petroleum-contaminated residuals.

The LDRs are a complex set of regulations, presented in 40 CFR Part 268, and they are applicable only to remedial actions constituting placement (land disposal) of hazardous waste. If a waste becomes subject to a land disposal restriction, its regulatory status is determined by its regulatory classification at the point of generation. Thus, waste excavated and found to be hazardous is subject to the LDR program even if it is later rendered non-hazardous. To become eligible for land disposal, the waste must be treated to specified concentration levels for each hazardous constituent present in the waste (not merely the constituent(s) that caused the waste to be classified as hazardous) using the best demonstrated available technology

(BDAT), or in some cases, a treatment methodology specified in the rule for a particular class of constituents. Variances have been allowed for this pre-treatment requirement.

MGP Process Residuals

USEPA has classified MGP residuals as "newly regulated" (55 Fed. Reg. 22560, 22667-68, June 1, 1990) because they were excluded from hazardous waste regulations in 1984 when the LDR program was enacted. Under the HSWA statute, USEPA must take separate action to apply the LDR program to wastes that have only recently become subject to Subtitle C regulation.

On May 12, 1997, the USEPA finalized several of the associated issues covered in the 1996 Proposed Supplemental Phase IV LDR rule, including streamlining measures for reducing the paperwork associated with the LDR Program (62 FR 25997). Also, on May 12, 1997, the USEPA presented the Second Phase IV Supplemental Proposal, which revised new hazardous waste provisions originally proposed in the January 1996 Supplemental Phase IV Proposal. This second proposed rule: (1) revises UTSs for twelve metal constituents in affected wastes, including characteristic mineral processing wastes; (2) addresses LDR sampling procedures; (3) solicits comments on a conditional exclusion for secondary mineral processing materials, on co-processing of materials in Bevill-exempt mining units, and on whether certain mineral processing wastes currently excluded from federal hazardous waste regulations warrant regulatory control; and (4) restricts the use of most hazardous waste as fill material. The finalized version of this rule was published on May 26, 1998. MGP wastes are a subset of the newly identified mineral processing wastes covered by this rule, and effective August 24, 1998, land disposal restrictions apply to MGP wastes that are characterized as hazardous.

The USEPA continues to support using the TCLP (SW-846 Test Method 1311) to determine whether MGP wastes are hazardous and believes MGP wastes can be thermally treated to achieve UTSs for organic constituents.

Petroleum-Based Residuals

Federal LDRs and UTSs would apply to petroleum-based residuals if they are generated as part of a site remediation, and they exhibit a hazardous characteristic.

New York State Land Disposal Restrictions

New York State recently adopted federal UTSs as part of the State RCRA modification proposal that was published in November 1998.

6.2.2.3 MGP Combustion Strategy

In 1993, USEPA and Edison Electric Institute (EEI) developed a strategy for burning soils containing MGP residuals in coal-fired utility boilers. A USEPA-approved document describing that strategy, which is consistent with the RCRA hazardous waste program, was published by EEI in April 1993 (EEI, 1993). The document applies only to the management of excavated MGP solid materials that are hazardous by characteristic and covers relevant onsite activities, including excavation, accumulation, and treatment in 90-day units and offsite disposal.

The MGP combustion strategy is based on the capability of soils containing MGP residuals to be burned with coal and other fuel in high efficiency utility boilers or in equivalent high-efficiency combustion units. The strategy requires that remediation waste that exhibits a hazardous characteristic be rendered non-hazardous before it leaves the generation site. This may be accomplished through the use of 90-day tanks, containers, or containment buildings covered by 40 CFR Section 262.34(a). Under federal regulations, waste may be treated in such units during the 90-day accumulation period without a permit, and if the waste thereafter no longer exhibits a hazardous characteristic, any further management of the waste, including the burning of such materials in utility boilers, no longer would be subject to Subtitle C of RCRA.

Treatment in 90-day units can consist of blending characteristically hazardous MGP soils with relatively dry, combustible materials, such as coal, coal fines, clean wood chips, corn cobs, and clean soil. A blending ratio can be established by using a field testing process that will ensure that the most concentrated sample of MGP soils is rendered non-hazardous within the 90-day accumulation period.

6.2.2.4 Water Treatment Discharge

If the chosen remediation alternative at the Fourth Street Site includes a release to surface water, then discharge limits would need to be established for individual MGP-related residuals, based on site conditions and water quality SCGs. However, although Lake Erie and the Buffalo River are in the vicinity of the Site, they do not receive direct storm runoff from the Site, and the Site is generally isolated from surface water bodies. The NYSDEC guidance for estimating surface water discharge limits is described in the Division of Water's SPDES guidance for permit development contained in the following Technical and Operational Guidance Series (TOGs) documents (NYSDEC, various dates):

1.3.1	Waste Assimilative Capacity Analysis & Allocation for Water Quality-Based Effluent Limits	May 1990
1.3.1C	Development of Water Quality-Based Effluent Limits for Metals/Amendment	August 1991
1.3.2	Toxicity Testing in the SPDES Program	May 1990

The NYSDEC guidance for estimating surface water discharge limits is based on two items: (1) the best available treatment technology that is economically achievable and (2) mixing of the discharge water with upstream surface water to allow water quality standards to be met downstream of the discharge. If pretreated water from remediation activities were discharged to the publicly owned treatment works (POTW), then pretreatment limits established through either the municipality or the NYSDEC would have to be met.

Local water comes from a municipal source, which draws its supply from Lake Erie. Three groundwater wells are located within a three-mile radius of the Site, but all of them are hydraulically upgradient and are either used for industrial purposes or not used at all. Therefore, SCGs for public water supplies developed by the NYS Department of Health were not considered in estimating surface water discharge limits.

6.2.2.5 Air Emissions from a Point Source

Methodologies for calculating air discharge limits are available from NYSDEC (1991). Calculating air discharge limits from a point source involves two steps: (1) estimating emissions of volatile organics and fugitive dust (sometimes termed a box model); and (2) estimating air concentrations as they disperse from the emission source (sometimes termed a dispersion model). Models for estimating air emission rates and dispersion are available from USEPA. Maximum 1-hour, 24-hour, and annual average air concentrations are typically estimated.

6.2.2.6 Additional Regulatory Initiatives

On April 29, 1996, the USEPA proposed *Requirements for Management of Hazardous Contaminated Media*, for RCRA hazardous wastes treated, stored, or disposed of during cleanup actions. This proposal, also known as the Hazardous Waste Identification Rule for Contaminated Media (HWIR-media), presented two comprehensive alternative approaches to managing contaminated media:

1. The Bright Line Approach, which would modify LDR treatment requirements and permitting procedures for higher-risk, contaminated media and would give EPA and authorized states the authority to remove certain lower-risk, contaminated media from regulation as "hazardous wastes" under most of Subtitle C of RCRA.

2. The Unitary Approach, which would exempt some types of contaminated media from Subtitle C, thereby reducing regulatory requirements.

The HWIR-media regulations were finalized on November 30, 1998 (USEPA RCRA Hotline, October 1999). The USEPA decided to promulgate only selected elements rather than one of the comprehensive approaches of the HWIR-media proposal. The USEPA also plans to complement the finalized rule by leaving the CAMU regulations in place, rather than withdrawing these regulations, as had been proposed (see Section 2.2.2.1). The elements finalized in the rule are:

- streamlined permitting for treating, storing, and disposing of remediation wastes generated at cleanup sites, which, among other things, eliminates the requirements for facility-wide corrective action at remediation-only facilities;

- a variation on the proposed remediation piles, called staging piles, modified in response to public comments;

- a RCRA exclusion for dredged materials managed under the Clean Water Act or Marine Protection Research and Sanctuaries Act permits; and

- streamlined procedures for State authorization.

Groundwater Restoration Technical Impracticability (TI)

The USEPA has issued guidance on addressing sites where restoration of groundwater to background conditions is not feasible or practicable. The guidance is contained in a USEPA memorandum entitled, "Guidance for Evaluating the Technical Impracticability of Groundwater Restoration" (USEPA, 1993a). One of the significant points of this guidance is that sources of groundwater impacts need to be removed but only where practicable and, in general, where significant reduction of current or future risk can be realized. This USEPA guidance also addresses DNAPL and the impracticability of its removal. While this guidance was prepared primarily for federal Superfund site cleanups, it is USEPA guidance that can be considered for the Fourth Street project as needed. There have been at least 23 Technical Impracticability (TI) waivers issued by the USEPA at Superfund sites across the United States.

6.2.3 Location-Specific SCGs

Location-specific SCGs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Potential location-specific SCGs for the Site include restrictions on certain land development activities in floodplains, wetlands, and navigable waters of the United States; restrictions to protect critical habitats for endangered or threatened species; restrictions on activities in areas designated as wilderness, wildlife refuges, or sole-source aquifers for drinking water; and restrictions to preserve historic structures and properties. Statutes, regulations, and guidelines to be used in the identification of location-specific SCGs for the Site are listed in Table 6.6. Some of these statutes, regulations, and guidelines and their relevance to the Site are discussed below.

Endangered Species/Critical Habitat

There are no known occurrences of endangered plant or animal species within or near the Site.

Historic Structures

The former Buffalo Gas Works MGP is located on Genesee Street near Fourth Street, or east/southeast of the school. The property contains a building that is listed as a local landmark and is also on the National Register (personal communication, City of Buffalo Preservation Board).

6.3 PRG DEVELOPMENT

PRGs are chemical-specific, long-range target cleanup goals developed to assist in the selection of a preferred site remedy. USEPA risk assessment guidance describes the procedure for determining PRGs (USEPA, 1991). PRGs have the following four attributes:

1. They are concentration goals for specific media and land use combinations based on SCGs, quantitative estimates of risk, or reliable background concentrations;
2. They can be identified at the beginning of the investigation;

3. They are dynamic values that are modified throughout the course of the investigation and engineering evaluation as site-specific information is accumulated; and
4. In their final form in the Proposed Remedial Action Plan (PRAP) and in the Record of Decision (ROD), they will serve as a starting point for determining the extent of remediation.

Details concerning development of site-specific PRGs are provided in the following sections. PRGs for soil include recommended soil cleanup objectives from NYSDEC TAGM HWR-94-4046 (NYSDEC, 1994b) based on residential exposure or protection of groundwater, as well as background upper tolerance limits. For groundwater, NYSDEC Ambient Water Quality Standards and Guidelines (October 1998) were utilized as PRGs.

6.3.1 PRGs for Soil Based on Residential Exposure and Protection of Groundwater (NYSDEC TAGM)

Cleanup objectives were derived for all detected chemicals using NYSDEC TAGM 4046 (1994). An organic carbon content of 4.58 percent (based on seven background surface soil samples analyzed for total organic carbon) was used to derive site-specific TAGM values (Appendix G). The adjusted TAGM 4046 soil cleanup objectives for detected chemicals are shown on Table 6.7.

6.3.2 Groundwater PRGs

Groundwater constituents were compared to NYSDEC Class GA groundwater standards (1998). Groundwater PRGs are shown on Table 6.7.

6.3.3 Risk-Based PRGs for Soil

The risk assessment results (Section 5) indicated that there were no chemicals of concern (COCs) for current or future receptors for either soil interval (surface soil, or mixed surface and subsurface soil). Consequently, risk-based PRGs were not derived for any constituent detected at the Site.

COCs based on carcinogenic effects are defined as those constituents contributing significantly (individual cancer risk of 1×10^{-6} or greater) to a cumulative cancer risk of 1×10^{-4} or greater for a given land use. For non-carcinogenics, COCs are defined as those constituents contributing significantly (individual hazard quotient of 0.1 or greater) to a hazard index (HI) of 1.0 or greater for a given land use.

Results of the risk assessment demonstrated that, in the absence of any remedial action, risks to potential current or future receptors are very low. Both the calculated carcinogenic and non-carcinogenic risks fell below the USEPA threshold values.

The greatest potential for risk is associated with current or future exposure to utility workers during excavation work in areas where impacted soil or DNAPL have been observed and documented. There has been no evidence of NAPL or impacted material within manholes, utility lines, or other underground structures. As stated in Section 4.3.7, no evidence of DNAPL was observed in the seven borings drilled adjacent (outside) to utility lines. Only two of the borings had detectable levels of PAHs, with a maximum concentration of only 0.9 mg/kg in boring B-5.

However, appropriate precautions should be taken when excavating or entering utility manways in areas where impacts have been identified. The potential for exposure will be controlled through deed restrictions (see Section 9.2.2). Deed restrictions will include language requiring protective measures and compliance with OSHA regulations for intrusive work around utility lines.

6.3.4 Background Upper Tolerance Limits

As mentioned in Section 4, BUTLs (USEPA, 1989) were calculated for PAHs using offsite soil sample results. BTEX and cyanide were not detected in offsite soil samples. Thus, BUTLs were not calculated for these compounds. BUTLs are presented in Table 6.2; some were retained as interim PRGs, which are shown in Table 6.7.

6.3.5 Application of PRGs

PRGs for soil were selected as either the site-specific adjusted NYSDEC TAGM value, or the BUTL for that particular chemical constituent, whichever was higher. PRGs for soil were compared to validated analytical results of all environmental samples collected as part of the RI field effort. The results of this comparison are presented in Table 6.8. The impacted volume of soil was determined by utilizing the PRGs, as well as other information developed during the RI, such as geology, hydrogeology, locations of former MGP structures, potential source areas, and Site history. Figure 6.1 identifies these impacted areas. A range of potential remedial action alternatives was then developed and evaluated. These potential alternatives, which encompass the broad areas of treatment, containment, and/or removal, are presented in Section 7.

Groundwater PRGs consisting of NYSDEC Class GA Ambient Water Quality Standards, were compared to validated analytical results of groundwater samples collected during the RI. The results of this analysis are shown on Table 6.9.

6.4 REMEDIAL ACTION OBJECTIVES

Preliminary remedial action objectives (RAOs) were developed for the purpose of evaluating the applicability of remedial technologies and the effectiveness of remedial alternatives. These objectives consist of media-specific goals for protecting human health and the environment and for meeting standards, criteria, and guidelines (SCGs) to the extent practicable in a cost-effective manner.

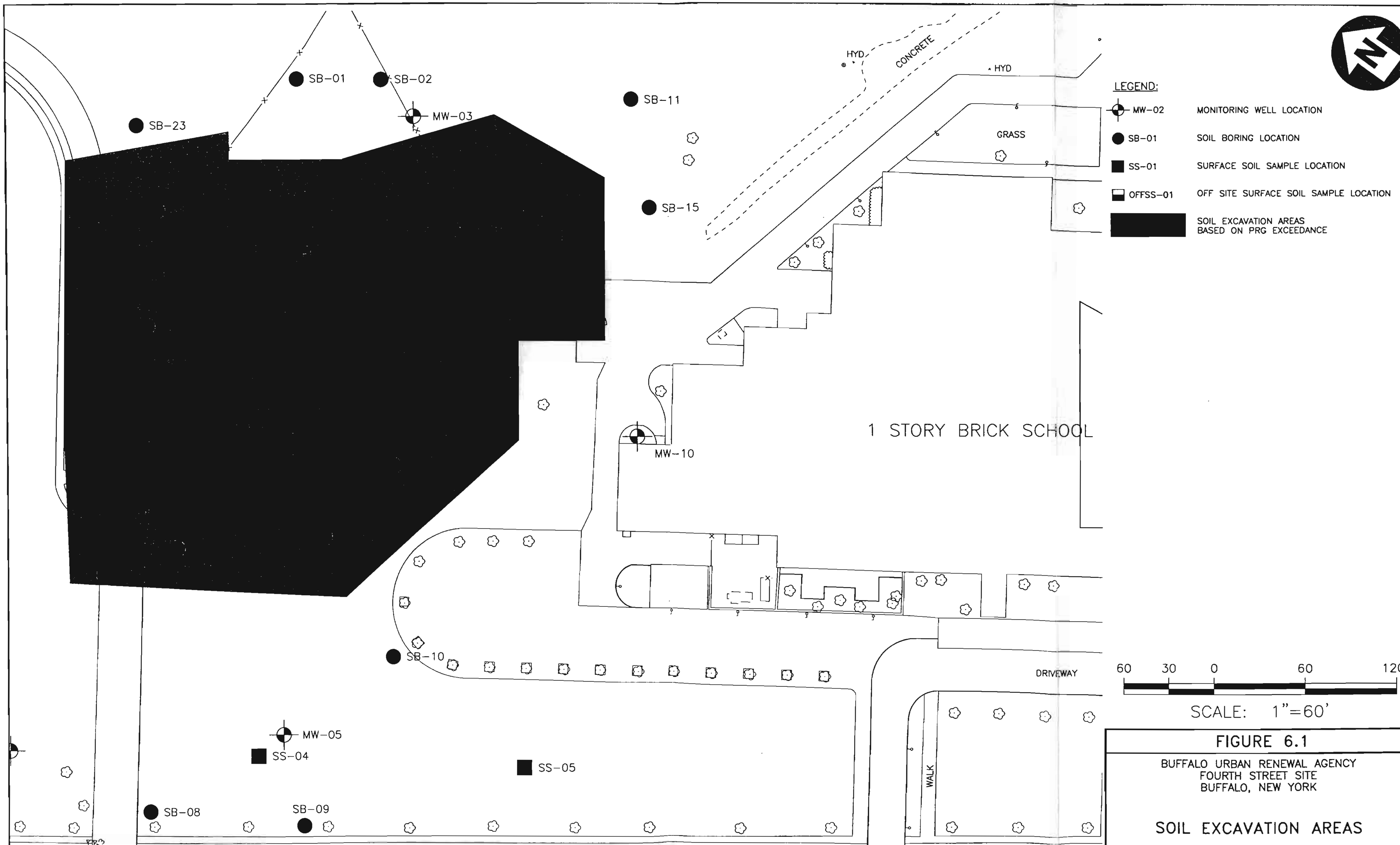
The preliminary RAOs were established based on Site-specific information, including the nature and extent of chemical constituents, human health risk assessment results, preliminary remediation goals (PRGs, discussed in detail herein), existing Site conditions, and future land use plans. RAOs typically focus on controlling exposure of receptors (humans, wildlife, aquatic life) to chemicals of concern via exposure routes such as dermal contact, ingestion, and inhalation. The RAOs also focus on controlling the release of hazardous substances into the environment (soils and groundwater). Technical feasibility and practicality of achieving the PRGs were also considered in developing the preliminary RAOs. Final RAOs are usually presented, along with the preferred remedy, by the lead agency (NYSDEC) in the Proposed Remedial Action Plan and the subsequent Record of Decision.

Preliminary RAOs for the Site are as follows:

- Maintain the current land use of the property (open space, recreation, institutional) for the foreseeable future and allow the Site to be available for intended future use and development;
- Eliminate and/or minimize the exposure route hazards posed by the chemical constituents present in different media at the site;
- Remove or control identified sources of significant impacts, if any; and
- Monitor groundwater, as needed, to evaluate groundwater quality following Site remediation, if any.

The need for interim remedial actions (IRMs) was also evaluated based on data collected during the RI and on the results of the risk assessment. No interim remedial actions were proposed because there are no imminent threats to human health or the environment posed by the distribution of chemical constituents at the Site. No chemical constituents were detected in soil in the boring nearest the school (MW-10), and no detected groundwater constituents in MW-10 exceeded the NYSDEC Water Quality Standards.

Direct contact with surface soils is not a significant threat. The highest concentrations in soil were found at depths ranging from 6 to 15 feet below ground surface. As discussed in Section 1, the Site history indicates that the constituents, including DNAPL, have been present for at least 80 years since the former MGP operations were terminated. A previous study by the New York State Department of Health (NYSDOH, 1996) indicated there would not be any exposure to contaminants, or impacts to public health. Although no new IRMs are proposed, the existing fence restricting access to the area of concern will be maintained and repaired, as needed.



LEGEND:

MW-02	MONITORING WELL LOCATION
SB-01	SOIL BORING LOCATION
SS-01	SURFACE SOIL SAMPLE LOCATION
OFFSS-01	OFF SITE SURFACE SOIL SAMPLE LOCATION
	SOIL EXCAVATION AREAS BASED ON PRG EXCEEDANCE

60 30 0 60 120

SCALE: 1"=60'

FIGURE 6.1

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK

SOIL EXCAVATION AREAS

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
180 LAWRENCE BELL DRIVE - SUITE 100 • WILLIAMSVILLE, N.Y. 14221 • 716/633-7074
OFFICES IN PRINCIPAL CITIES

DATE: 10/25/99 (JAR)
FILE: P:\732260\CAD\32260C19.DWG
SCALE: PAPER SCALE, 1=1
XREF'S: NONE

TABLE 6.1
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF CHEMICAL-SPECIFIC SCGs
FOURTH STREET SITE

REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
FEDERAL				
Resource Conservation and Recovery Act (RCRA)	42 U.S.C. Section 6901 et seq.			
Identification and Listing of Hazardous Wastes	40 CFR Part 261	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 40 CFR Parts 260-266.	SCG	Neither coal nor petroleum-based residuals are listed hazardous wastes. For BURA residuals determined to be characterisitcally hazardous based on the TCLP, the requriements are applicable. The TCLP limit for benzene is 0.5 mg/l. These regulations do no set cleanup standards, but would need to be considered when establishing remedial action objectives.
Clean Water Act (CWA)	33 U.S.C. Section 1251-1376			
Ambient Water Quality Criteria Guidelines	40 CFR Part 131	Establishes toxicity-based surface wat	Not Applicable	These standards are not applicable as no action under consideration would affect surface water.
Safe Drinking Water Act (SDWA)	40 U.S.C. Section 300			
National Primary Drinking Water Standards	40 CFR Part 141	Establishes maximum contaminant levels or MCLs, which are health-based standards for public water supply systems with at least 15 service connections or which serve a minimum of 25 persons.	Not Applicable	These standards are not applicable as no action under consideration would affect a public water supply system nor do plans exist for future use of groundwater as a public water supply source.
Maximum Contaminant Level Goals (MCLGs)	40 CFR 141.50-141.51	Non-enforceable health goals for public water systems.	Not Applicable	
Clean Air Act (CAA)	40 U.S.C. Section 7401-7642			
National Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Establishes ambient air quality standards for pollutants fir the protection of public health.	SCG	These standards are to be considered in establishing remedial action objectives for air if air emissions are expected.

TABLE 6.1
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF CHEMICAL-SPECIFIC SCGs
FOURTH STREET SITE

REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Comprehensive Environmental Response, Compensation, and Liability Act Record of Decision, Fairfield Coal Gasification Site, Fairfield, IA	U.S. EPA Region VII, Sept. 1990	Establishes action levels for contaminated soils at 500 mg/kg total PAHs and 100 mg/kg carcinogenic PAHs.	TBC	RODs for MGP sites with similar histories, Constituents of concern, and receptiors/pathways are considered in establishing action levels for media of concern at the BURA site.
Record of Decision, Peoples Natural Gas Coal Gasification Site, Dubuque, IA	U.S. EPA Region VII, Sept. 1991	Establishes action levels for contaminated soil at 500 mg/kg total PAHs and 100 mg/kg carcinogenic PAHs for soils to 6 foot depth; 2,900 mg/kg total PAHs and 200 mg/kg carcinogenic PAHs for soils below 6 foot depth.	TBC	RODs for MGP sites with similar histories, constituents of concern, and receptors/pathways are considered in establishing action levels for media of concern at the BURA site.
STATE				
New York State Environmental Conservation Law Inactive Hazardous Waste Disposal Sites	Article 27, Title 13	Establishes general cleanup goals for environmental media to levles that will eliminate a significant threat to the environment. This allows NYSDEC to designate inactive hazardous waste disposal sites.	SCG	Sites are listed based on evidence of a significant threat posed by hazardous waste disposed of at the site. A significantly increased risk to human health would constitute a significant threat. The BURA site is not listed on the registry on Inactive Hazardous Waste Disposal Sites.
NYSDEC Division of Hazardous Substances Regualtion Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 372-376.	SCG	Neither coal nor petroleum-based residuals are listed hazardous wastes. For BURA residuals determined to be characteristically hazardous based on the TCLP, the requirements are applicable. The TCLP limit for benzene is 0.5 mg/L. These regulations do not set cleanup standards, but would need to be considered when establishing remedial action
NYSDEC Soil Cleanup Objectives	Division of Hazardous Waste Remediation, TAGM HW94-4046, 1994.	Establishes soil cleanup objectives based on residential land use and protecting groundwater quality.	SCG	See Table 6.2.
NYSDEC Technical Guidance for Screening Contaminated Sediments	Division of Fish and Wildlife Division of Marine Resources November 1993.	Describes the methodology for establishing sediment criteria for the purpose of identifying contaminated sediment potentially causing harmful impacts to marine and aquatic ecosystems.	Not Applicable	These standards are not applicable as no action under consideration would affect sediments.

TABLE 6.1
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF CHEMICAL-SPECIFIC SCGs
FOURTH STREET SITE

REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Public Health Law, Drinking Water Supplies	10 NYCRR Part 5	Establishes maximum contaminant levels or MCLs which are health-based standards for public water systems.	Not Applicable	These standards are not applicable as no action under consideration involves construction of a public water supplu system or future use of groundwater as a public water supply source.
New York State Water Classifications and Quality Standards Surface Water Classifications and Standards for Class C Waters	6 NYCRR Parts 701, 702, 704	Defines surface water classifications and ambient water quality standards that are the basis for establishing effluent limitations under the SPDES	Not Applicable	These standards are not applicable as no action under consideration would affect sediments.
Groundwater Quality Standards	6 NYCRR Part 703.5	Establishes quality standards for groundwater and incorporates federal and state.	SCG	These criteria are potentially applicable in establishing remedial action objectives for groundwater.
NYSDEC Ambient Water Quality Standards and Guidance Values	Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1	Provides a compilation of ambient water quality standards and guidance values for toxic and non-conventional pollutants for use in NYSDEC programs, including the SPDES permit program.	SCG	These standards and guidance values are applicable in establishing remedial action objectives for groundwater. NYSDEC standards and guidance values Class GA groundwater are listed in Table 6.3.
New York State Ambient Air Quality Guidelines	6 NYCRR Part 257 Air Guide - 1	Establishes state ambient air quality standards and guidelines for evaluating air quality impacts.	SCG	See Table 6.4.
NYSDEC Division of Environmental Remediation Record of Decision, Owego Coal Gasification Plant Site, Owego, New York.	NYS ID# 754008	Establishes remedial action cleanup goal of 12 ppm or less of total carcinogenic PAHs and 500 ppm total PAHs for site surficial soils. Deeper soils remediation to project	TBC	RODs for MGP sites with similar histories, constituents of concern, and receptors/pathways are considered in establishing action levels for media of concern at the BURA site.
NYSDEC Division of Environmental Remediation Risk-Based Corrective Action	Procedures for Inactivation of Petroleum-Impacted Sites	Specifies methods to develop site cleanup criteria for many of the chemicals associated with the primary site constituents, such as PAHs and BTEX.	TBC	A draft document by the NYSDEC is currently in the works, and no date for finalization of the document has been set.

TABLE 6.2
BASIS FOR ESTABLISHING SOIL PRGs(1)

MGP-Related Residual(2)	SCG (3)	Background Upper Tolerance Limit(4)
Volatiles		
Benzene	0.266	--
Ethylbenzene	25.2	--
Toluene	6.87	--
Xylenes	5.5	--
Semivolatiles		
Acenaphthene	50	0.44
Acenaphthylene	50	0.3
Anthracene	50	0.65
Benzo(a)anthracene	0.224	1.8
Benzo(a)pyrene	0.061	1.6
Benzo(b)fluoranthene	5.04	2.5
Benzo(g,h,i)perylene	50	0.44
Benzo(k)fluoranthene	5.04	0.65
Chrysene	1.83	1.6
Dibenzo(a,h)anthracene	0.014	0.37
Fluoranthene	50	2.8
Fluorene	50	0.44
Indeno(1,2,3-c,d)pyrene	14.7	0.56
Naphthalene	50	0.44
Phenanthrene	50	2.5
Pyrene	50	2.7
Phenols		
Phenol*		0.36
2,4-Dimethylphenol*	--	--
2-Methylphenol*	0.344	--
4-Methylphenol*	3.89	--
Inorganics		
Cyanide	--	--

(1) PRG = preliminary remediation goal. A dash (" - ") indicates that the item is not applicable or that no value is available.
(2) An asterisk ("*") indicates that the chemical is not MGP-related.
(3) SCG = standard, criterion, or guideline. The values listed are recommended soil cleanup objectives from TAGM HWR-94-4046 based on the lower of the values associated with residential exposure or protection of groundwater. The values for protection of groundwater have been adjusted using the measured organic carbon concentration of 4.58% (NYSDEC, 1994). The SCG . for total semivolatile organic compounds is <500 ppm and <50 ppm for individual semivolatile organic comopunds.
(4) Background upper tolerance limits (BUTLs) for soil

Table 6.2 (cont'd)

Fourth Street Site

BASIS for Establishing Soil PRGs

CAS NO.	COMPOUND	SAMPLE ID:	OFFSS01	OFFSS02	OFFSS03	OFFSS04	OFFSS05	OFFSS06	OFFSS07	Statistical Mean Value	Standard Deviation	Tolerance Factor (K) for Seven Samples	BUTL	Is BUTL higher than maximum detected value?	BUTL or Maximum Detected Value
		DEPTH:	0-0.5'	0-0.5'	0-0.5'	0-0.5'	0-0.5'	0-0.5'	0-0.5'						
		LAB ID:	186597-01	186597-02	186597-03	186597-04	186597-05	186597-06	188597-07						
		SOURCE:	STL	STL	STL	STL	STL	STL	STL						
		SDG:	PE597	PE597	PE597	PE597	PE597	PE597	PE597						
		MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL						
		SAMPLED:	5/13/98	5/13/98	5/13/98	5/13/98	5/13/98	5/13/98	5/13/98						
		VALIDATED:	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98						
		UNITS:													
	BTEX														
	None														
	PAHs														
83-32-9	Acenaphthene	mg/Kg	0.33 J	0.085 J	0.2 J	0.22 UJ	0.22 UJ	0.23 J	0.13 J	0.20	0.08	3.399	0.47	Y	0.44
208-96-8	Acenaphthylene	mg/Kg	0.19 UJ	0.195 UJ	0.195 UJ	0.22 UJ	0.22 UJ	0.12 J	0.195 UJ	0.19	0.03	3.399	0.30	N	0.30
120-12-7	Anthracene	mg/Kg	0.65 J	0.21 J	0.45 J	0.22 UJ	0.071 J	0.65 J	0.37 J	0.37	0.22	3.399	1.14	Y	0.65
56-55-3	Benzo(a)anthracene	mg/Kg	1.5 J	0.44 J	1.2 J	0.074 J	0.21 J	1.8 J	0.96 J	0.88	0.66	3.399	3.13	Y	1.80
50-32-8	Benzo(a)pyrene	mg/Kg	1.2 J	0.35 J	0.99 J	0.069 J	0.19 J	1.6 J	0.73 J	0.73	0.57	3.399	2.65	Y	1.60
205-99-2	Benzo(b)fluoranthene	mg/Kg	2 J	0.47 J	1.6 J	0.096 J	0.25 J	2.5 J	1 J	1.13	0.93	3.399	4.28	Y	2.50
191-24-2	Benzo(g,h,i)perylene	mg/Kg	0.3 J	0.17 J	0.31 J	0.22 UJ	0.11 J	0.43 J	0.31 J	0.26	0.11	3.399	0.62	Y	0.44
207-08-9	Benzo(k)fluoranthene	mg/Kg	0.56 J	0.16 J	0.52 J	0.22 UJ	0.092 J	0.65 J	0.29 J	0.36	0.22	3.399	1.10	Y	0.65
218-01-9	Chrysene	mg/Kg	1.3 J	0.41 J	1 J	0.076 J	0.21 J	1.6 J	0.85 J	0.78	0.57	3.399	2.72	Y	1.60
53-70-3	Dibenzo(a,h)anthracene	mg/Kg	0.12 J	0.053 J	0.11 J	0.22 UJ	0.22 UJ	0.19 J	0.1 J	0.14	0.07	3.399	0.37	N	0.37
206-44-0	Fluoranthene	mg/Kg	2.5 J	0.78 J	1.9 J	0.15 J	0.38 J	2.8 J	1.5 J	1.43	1.03	3.399	4.94	Y	2.80
86-73-7	Fluorene	mg/Kg	0.32 J	0.097 J	0.19 J	0.22 UJ	0.22 UJ	0.27 J	0.16 J	0.21	0.07	3.399	0.46	Y	0.44
193-39-5	Indeno(1,2,3-cd)pyrene	mg/Kg	0.42 J	0.19 J	0.4 J	0.044 J	0.12 J	0.56 J	0.39 J	0.30	0.19	3.399	0.94	Y	0.56
91-20-3	Naphthalene	mg/Kg	0.3 J	0.195 UJ	0.091 J	0.22 UJ	0.22 UJ	0.16 J	0.05 J	0.18	0.08	3.399	0.46	Y	0.44
85-01-8	Phenanthrene	mg/Kg	2.4 J	0.81 J	1.5 J	0.096 J	0.3 J	2.5 J	1.3 J	1.27	0.95	3.399	4.49	Y	2.50
129-00-0	Pyrene	mg/Kg	2.3 J	0.77 J	1.7 J	0.14 J	0.37 J	2.7 J	1.6 J	1.37	0.97	3.399	4.67	Y	2.70
PAHs	Total PAHs	mg/Kg	16.45	5.053	12.271	0.745	2.303	18.93	9.819						19.79
	PHENOLS														
108-95-2	Phenol	mg/Kg	0.19 UJ	0.069 J	0.195 UJ	0.22 UJ	0.22 UJ	0.205 UJ	0.195 UJ	0.18	0.05	3.399	0.36	N	0.36
	Total Phenols		ND	0.069	ND	ND	ND	ND	ND						
	INORGANICS														
57-12-9	Cyanide	mg/Kg	1.1 U	1.1 U	1.2 U	1.3 U	1.3 U	1.1 U	1.2 U						
SOLIDS	Percent Solids	%	87.3	86.5	85.5	75.9	76.5	81	85.6						
7440-44-0	Total Organic Carbon	mg/Kg	34800	29200	35800	53900	49600	57500	60100						

ND - Not Detected (totals)

U - Not Detected.

J - Estimated Value.

JN - Estimated with a tentative identification.

R - Rejected Value.

TABLE 6.3
BASIS FOR ESTABLISHING GROUNDWATER PRGs[1]

MGP-Related Residual[2]	SCG[3] ug/L NYS Class GA Standard [4]
Volatiles	
Benzene	1.0
Ethylbenzene	5.0
Toluene	5.0
Xylenes	5.0
Semivolatiles	
Acenaphthene	20.0
Fluorene	50.0
Naphthalene	10.0
Pyrene	50.0
Phenols	
Total Phenols	1.0
Inorganics	
Cyanide	200.0

(1) PRG = preliminary remediation goal.
(2) SCG = standard, criterion, or guideline.
(3) From NYSDEC, 1998.

TABLE 6.4

BASIS FOR ESTABLISHING AIR PRGS (μg/m^3)

MGP-Related Residual	NYS Air Guidelines[1]	
	AGC[2]	SGC[3]
Volatiles		
Benzene	0.12	30
Ethylbenzene	1,000	100,000
Toluene	2,000	89,000
Xylenes	300	100,000
Semivolatiles		
Acenaphthene	-	-
Acenaphthylene	-	-
Anthracene	-	-
Benzo(a)anthracene	-	-
Benzo(a)pyrene	0.002	-
Benzo(b)fluoranthene	-	-
Benzo(g,h,i)perylene	-	-
Benzo(k)fluoranthene	-	-
Chrysene	-	-
Dibenzo(a,h)anthracene	-	-
Fluoranthene	-	-
Fluorene	-	-
Indeno(1,2,3-c,d)pyrene	-	-
Naphthalene	120	12,000
Pyrene	-	-
Phenols		
Phenol*	-	-
2,4-Dimethylphenol*	-	-
2-Methylphenol*	-	-
4-Methylphenol*	-	-
Inorganics		
Cyanide	12	150

(1) Acceptable ambient level guidelines from New York State Air Guide 1. A dash ("-") indicates that no value is available (NYSDEC Division of Air Resources, 1991).

(2) Annual Guidance Concentration

(3) Short-term (≤ 1hour) Guideline Concentration

(4) An asterisk ("*") indicates that the chemical is not MGP-related.

TABLE 6.5
STATUTES, REGULATIONS, AND GUIDELINES USED
IN THE IDENTIFICATION OF ACTION-SPECIFIC SCGs
FOURTH STREET SITE

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
FEDERAL					
Any Site Remediation Activity	Occupational Health and Safety Act	29 U.S.C. Section 651-678			
	Worker Health and Safety	29 CFR 1910.120	Training, personnel protection, medi[illegible] and other health and safety requirement[illegible] and employees engaged in hazardous wa[illegible]ons.	SCG	These regulations apply to remedial activities associated with site wastes identified as hazardous and to remedial activities involving construction.
		29 CFR 1926	Standards for general construction.		
Management of Hazardous Waste Generated Onsite	Resource Conservation and Recovery Act (RCRA)	42 U.S.C. Section 6901 et seq.			
	Standards for Hazardous Waste Generators; Manifesting, Pre-transportation, Reporting Requirements	40 CFR Part 262 Subparts B, C, D	Regulations governing packaging, la[illegible]ing, and manifesting of hazardous waste	SCG	These generator requirements are potentially applicable to remedial activities involving the offsite transport of hazardous waste generated onsite.
Institutional Controls	Resource Conservation and Recovery Act (RCRA)	40 U.S.C. Section 6901 et seq.			
	Land Disposal Facility Notice in Deed	40 CFR 264/265 116-119(b)(1)	Establishes provisions for a deed notatio[illegible] hazardous waste disposal units, to preve[illegible] disturbance by future owners.	SCG	These regulations are potentially applicable because closed areas may be similar to closed RCRA units.
Generation, Management, and Treatment of Hazardous Waste	Resource Conservation and Recovery Act (RCRA) Subtitle C - Hazardous Waste Management	40 U.S.C. Section 6901 et seq.			
	Identification and Listing of Hazardous Wastes	40 CFR Part 261	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 40 CFR Parts 260-266.	SCG	MGP residuals are not a listed hazardous waste. Neither coal nor petroleum-based residuals are listed hazardous wastes. For BURA residuals determined to be characteristically hazardous based on the TCLP, the requirements are applicable. The TCLP limit for benzene is 0.5 mg/L. These regulations do not set clean-up standards, but would apply during various remedial actions.
	Standards for Hazardous Waste Generators	40 CFR Part 262			
	Hazardous Waste Determinations	40 CFR Part 262.11	Generators must characterize their wastes to determine if the waste is hazardous by listing (40 CFR 261, Subpart D), by characteristic (40 CFR 261, Subpart C), or excluded from regulation (40 CFR 261.4).	SCG	These regulations would be applicable to wastes generated during remedial activities at the site. Neither coal nor petroleum-based residuals are listed hazardous wastes, but may be hazardous by characteristic (particularly for benzene toxicity).

TABLE 6.5
STATUTES, REGULATIONS, AND GUIDELINES USED
IN THE IDENTIFICATION OF ACTION-SPECIFIC SCGs
FOURTH STREET SITE

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Generation, Management, and Treatment of Hazardous Waste (cont.)	90-Day Accumulation Rule	40 CFR Part 262.34	Allows generators of hazardous waste to store and treat hazardous waste at the generation site for up to 90 days in tanks, containers, and containment buildings without having to obtain a RCRA hazardous waste permit.	SCG	Land disposal restrictions apply to MGP residuals considered hazardous, effectively prohibiting dilution of these wastes. This does not apply to petroleum-based residuals as they are subject to LDRs, including UTSs.
	Standards for Owners/Operators of Hazardous Waste Treatment, Storage, Disposal (TSD) Facilities	40 CFR Part 264/265			
	General Facility Standards	Subpart B	General requirements for owners/operators of TSD facilities including general waste analysis and compatibility; notices and inspection requirements; location and construction standards; and security.	SCG	These subpart standards would be applicable for the construction, operation or closure of a new or currently permitted TSD facility used for management of remediation waste classified as a hazardous waste or for the closure of existing interim-status and new land disposal facilities where hazardous waste will remain in place after completion of closure. These subparts should be considered if existing waste treatment facilities at a site are to be used for the management of hazardous remediation waste.
	Releases from Solid Waste Management Units	Subpart F	Requires the establishment of a detection, compliance, and corrective action monitoring program to ensure protection of the groundwater by assessing the performance of the TSD facility during operations. The groundwater monitoring program is required to be performed during the post- closure period for land disposal facilities where hazardous waste remains in place after closure.	SCG	
	Closure and Post-Closure	Subpart G	Establishes closure and post-closure requirements for TSD facilities, including post-closure property uses.	SCG	
	Tank Systems	Subpart J	Tank systems for the treatment or storage of hazardous wastes are to be designed and operated in a manner to prevent releases to the environment.	SCG	Applicable for the tank treatment and/or storage of all remediation waste that is classified as a hazardous waste.
	Corrective Action for Solid Waste Management Units	Subpart S	The USEPA or delegated state authority can designate a Corrective Action Management Unit (CAMU) or a Temporary Unit (TU) to allow more flexible management of remediation wastes within these units. Placement or consolidation of remediation waste within these units does not constitute land disposal or creation of a unit subject to minimum technology requirements.	SCG	NYSDEC is authorized to designate CAMUs.

TABLE 6.5
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF ACTION-SPECIFIC SCGs
FOURTH STREET SITE

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Generation, Management, and Treatment of Hazardous Waste (cont.)	Miscellaneous Units	Subpart X	New miscellaneous units must be designed, constructed, and operated to meet regulatory performance standards.	SCG	Standards applicable to the construction and operation of new miscellaneous units used to treat remediation waste that is classified, or is sufficiently similar to a hazardous waste. These regulations apply to thermal desorption units that are not classified as incinerators or industrial furnaces.
Capping of Hazardous Waste	RCRA Subtitle C	40 U.S.C. Section 6901 et. seq.			
	Standards for Capping: Surface Impoundments Waste Piles Landfills	40 CFR Part 264/265 Subpart K Subpart L Subpart N	Regulations governing placement of cap. Requirements for installation, permeability, maintenance of cover; elimination of free liquids or solidification; run-on/run-off damage control; and post-closure use of property.	SCG	RCRA hazardous waste placed at site after the effective date of the requirements, or placement of hazardous waste into another unit will make requirements applicable when the waste is being covered with a cap for the purpose of leaving it behind after the remedy is completed. These requirements are not applicable unless documented placement occurs or has occurred.
Capping of Non-Hazardous Waste	RCRA Subtitle D	42 U.S.C. Section 6901 et. seq.			
	Criteria for Classification of Solid Waste Disposal Facilities	40 CFR Part 257	Minimum criteria for siting, construction, operation, and closure of solid waste disposal facilities. Each state is to develop, permit, and enforce a solid waste management program based on USEPA requirements.	SCG	These regulations are applicable to remedial activities which would leave wastes and spill residues in place or to construction of remediation waste management facilities. MGP and petroleum related site residuals must be identified as solid and/or hazardous waste in order to determine applicability of waste management consideration. These requirements are not applicable unless documented placement occurs or has occurred.
Water Treatment Discharges	Clean Water Act	33 U.S.C. Section 1251-1376			
	Wastewater Discharge Permits; Effluent Guidelines, Best Available Technology (BAT) and BMPPT	40 CFR Parts 122, 125, 401	Permit requirements for point source discharges to waters of the United States; establishes effluent standards and requirements for preventing toxic releases.	SCG	Would be applicable for remedial actions involving a direct wastewater discharge to surface waters.
	Discharge to publicly-owned treatment works (POTW)	40 CFR Part 403.5	Discharge must comply with local POTW pretreatment program.	SCG	Requirements would be applicable to remedial actions involving a discharge to a POTW.
	Underground Injection Control Program	40 CFR Parts 144-147	Provisions for protection of groundwater drinking water resources.	SCG	Would be applicable for remedial actions involving reinjection of treated water.

TABLE 6.5
STATUTES, REGULATIONS, AND GUIDELINES USED
IN THE IDENTIFICATION OF ACTION-SPECIFIC SCGs
FOURTH STREET SITE

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Air Emissions from a Point Source	Clean Air Act (CAA)	40 U.S.C. Section 7401-7642			
	National Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Establishes ambient air quality standards for protection of public health.	SCG	NAAQS may be applicable in evaluating whether there are air impacts at the site during remedial activities.
	New Source Review (NSR) and Prevention of Significant Deterioration (PDS) Requirements	40 CFR Part 52	New sources or modifications which emit greater than the defined threshold for listed pollutants must perform ambient impact analysis and install controls which meet best available control technology (BACT).	SCG	These regulations are potentially applicable and would require a comparison of potential emissions from the remedial activity to the emission thresholds for NSR.
	National Emission Standards for Hazardous Air Pollutants (NESHAPs)	40 CFR Part 61 40 CFR Part 63	Source-specific regulations which establish emissions standards for hazardous air pollutants (HAPs).	SCG	NESHAPs could be relevant and appropriate if HAP emissions from remedial activities exceed the thresholds for compliance.
	New Source Performance Standards (NSPS)	40 CFR Part 6	Source-specific regulations with establish testing, control, monitoring and reporting requirements for new emission sources.	SCG	NSPS could be relevant and appropriate if stream-generating equipment, thermal desorption units, or other regulated new sources were to be used onsite.
	Air Emission Standards for Process Vents	40 CFR 264/265	This regulation applies to process vents associated with distillation, fractionation, thin-film evaporation, solvent extraction, or air/stream stripping operations that manage hazardous waste with an organic concentration of at least 10 parts per million by weight (ppmw). Performance standards for closed-vent systems and control devices are specified in this regulation to demonstrate compliance with the above standards.	SCG	This regulation would be applicable to the onsite treatment of remediation waste designated as hazardous waste having an organic concentration of at least 10 ppmw.
Land Disposal of Hazardous Waste	RCRA Subtitle C Land Disposal Restrictions (LDRs) Phase IV Supplemental Proposal on Land Disposal of Mineral Processing Wastes	40 U.S.C. Section 6901 et. seq. 40 CFR Part 268 62 FR 25997	Restricts land disposal of hazardous wastes that exceed specific criteria. Establishes Universal Treatment Standards (UTSs) to which hazardous wastes must be treated prior to land disposal. Supplemental Phase IV LDR rule (i) requires the waste or residual meet certain UTSs, (ii) prohibits storage except to facilitate treatment or disposal, (iii) prohibits the use of dilution to meet UTSs, and (iv) applies LDR paperwork requirements to the waste.	TBC	Petroleum-based residuals are subject to LDRs, including UTSs. MGP residuals are among the mineral processing wastes determined by USEPA in 1989 and 1990 to be subject to RCRA, as they were no longer excluded from RCRA by the Bevill Amendment. Thus, MGP wastes are a subset of the newly-identified mineral processing wastes covered by the May 26, 1998, Phase IV LDR rule. LDRs apply to waste characteristic for ignitability, reactivity, and corrosivity, requiring treatment to eliminate the waste characteristic and achieve UTSs for any underlying hazardous constituents (UHCs).

TABLE 6.5
STATUTES, REGULATIONS, AND GUIDELINES USED
IN THE IDENTIFICATION OF ACTION-SPECIFIC SCGs
FOURTH STREET SITE

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Generation, Management, and Treatment of Hazardous Waste	Requirements for Management of Hazardous Contaminated Media (Hazardous Waste Identification Rule (HWIR) - Media)	61 FR 18879 40 CFR Part 260, et al.	Proposed rule which addresses contaminated media that are currently subject to regulation as hazardous wastes under RCRA. Allows more flexible management standards for media and wastes generated during site cleanups. Modifies LDR treatment requirements and gives USEPA and authorized states authority to remove certain wastes from regulation as hazardous waste under Subtitle C.	TBC	The USEPA has published two alternative HWIR rules: the "Harmonized Approach," which establishes bright line constituent-specific concentrations to divide high-risk and low-risk waste, and the "Unitary Approach," which would exempt all remediation waste from Subtitle C regulation provided the waste is managed in accordance with a remedial action plan. Neither approach was adopted in the finalized rule, published in November 1998.
Characteristic Hazardous Waste Treatment in Utility Boilers	MGP Site Remediation Strategy	MGP Site Remediation Strategy, MGP Subcommittee, Edison Electric Institute (EEI, 1993)	Strategy document intended to facilitate responsible parties undertaking the source removal of heavily contaminated organic residues and contaminated soils at MGP sites in a manner that is consistent with the RCRA hazardous waste program. The remediation strategy is based on the fact that contaminated soils can be burned in coal-fired utility boilers and covers relevant onsite activities including excavation, accumulation and treatment in 90-day units, and offsite transportation.	TBC	The remediation strategy applies only to the management of excavated solid materials that are hazardous by characteristic. The strategy does not supersede existing regulations; it is not intended to be the presumptive remedy under CERCLA nor can it serve as a shield against enforcement under RCRA or any other statute. The strategy should be implemented taking into account site-specific circumstances. It would not necessarily be appropriate or practical at all sites.
Treatment of Groundwater	Technical Impracticability (TI) Waiver for Groundwater Restoration	Guidance for Evaluating the Technical Impracticability of Groundwater Restoration (USEPA, 1993a)	Provides guidance on addressing sites where restoration of groundwater to background conditions is not feasible or practicable. Sources of groundwater impacts should be removed where practicable and where significant reduction of current and future risk can be realized. Guidance also addresses DNAPL and impracticability of its removal.	TBC	This guidance was prepared primarily for Superfund site cleanups, but can be considered for the BURA site. There have been at least 23 TI waivers issued by the USEPA at Superfund sites across the U.S.
All	USEPA Presumptive Strategy for MGP sites	---	Presumptive strategy initiative for MGP sites currently being developed by USEPA in collaboration with EEI, AGA, and industry. The strategy is to include a "remedy selection process" for decision making of management options effective at MGP sites. Also included will be case studies and technology description summary sheets for a number of industry-advocated technologies.	TBC	The MGP site presumptive strategy guidance document is currently under development. NOTE: This guidance will become an SCG once issued in final form.
STATE					
Generation, Management, and Treatment of Hazardous Waste	NYSDEC Division of Regulatory Affairs Siting of Industrial Hazardous Waste Facilities	6 NYCRR Part 361	Establishes procedures for selecting appropriate sites for hazardous waste facilities.	SCG	These regulations are potentially applicable for remedial activities which would involve the construction of hazardous waste remediation facilities.

TABLE 6.5
STATUTES, REGULATIONS, AND GUIDELINES USED
IN THE IDENTIFICATION OF ACTION-SPECIFIC SCGs
FOURTH STREET SITE

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Generation, Management, and Treatment of Hazardous Waste (cont.)	NYSDEC Division of Hazardous Substances Regulation Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 372-376.	SCG	MGP residuals are not a listed hazardous waste. Neither coal nor petroleum-based residuals are listed hazardous wastes. For BURA residuals determined to be characteristically hazardous based on the TCLP, the requirements are applicable. The TCLP limit for benzene is 0.5 mg/L. These regulations do not set clean-up standards, but would apply during various remedial actions.
	New York State Hazardous Waste Management Facility Regulations	6 NYCRR Part 370,373,372	Establishes New York State's USEPA-equivalent hazardous waste management program. Includes regulations for hazardous waste facility construction, operation, and closure; and standards for hazardous waste generation, manifesting, and transport.	SCG	{ See RCRA Hazardous Waste Management Regulations, 40 CFR Parts 262 and 264/265 under Federal SCGs listed in this table.}
	Corrective Action for Solid Waste Management Units	6 NYCRR Part 373-2.19	The NYSDEC Commissioner can designate a Corrective Action Management Unit (CAMU) or a Temporary Unit (TU) to allow more flexible management of remediation wastes within these units. Placement or consolidation of remediation waste within these units does not constitute land disposal or creation of a unit subject to minimum technology requirements.	SCG	NYSDEC is authorized to designate CAMUs for the purpose of implementing remedial actions under 6 NYCRR Part 373-2.6(1) or RCRA.
Capping of Non-Hazardous Waste	New York State Solid Waste Management Facility Regulations	6 NYCRR Part 360, 364 6 NYCRR Part 360-2.15	Establishes New York State's USEPA-equivalent solid waste management program. Includes regulations governing construction, operation, and closure of solid waste disposal facilities. Establishes landfill closure and post-closure requirements.	SCG	These regulations are applicable to remedial activities which would leave wastes and spill residues in place or to construction of remediation waste management facilities. Coal and petroleum-based site residuals must be identified as solid and/or hazardous waste in order to determine applicability of waste management consideration. These requirements are not applicable unless documented placement occurs or has occurred.
Land Disposal of a Hazardous Waste	Land Disposal Restrictions (LDRs)	6 NYCRR Part 376	Restricts land disposal of hazardous wastes that exceed specific criteria.	SCG	New York State adopted Federal UTSs in November 1998.
Water Treatment Discharge	New York State Regulations on the State Pollution Discharge Elimination System (SPDES)	6 NYCRR Parts 750-758	Defines permitting requirements for water treatment discharges including discharges made to a POTW.	SCG	The regulations would be applicable for alternatives that include a discharge to surface water or a POTW.

TABLE 6.5
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF ACTION-SPECIFIC SCGs
FOURTH STREET SITE

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Water Treatment Discharge (cont.)	Groundwater Effluent Standards	6 NYCRR Part 703.6	Establishes effluent standards and/or limitations for discharges to Class GA groundwater.	SCG	These regulations would be applicable for alternatives that include discharges to groundwater.
	Groundwater Effluent Limitations	Technical and Operational Guidance Series (TOGS) 1.1.2	This provides a substance-by-substance list of effluent limitations for substances having an ambient water quality standard or guidance value. It restates the effluent standards in 6 NYCRR Part 703.6 and provides effluent limitations for the substances that have an ambient standard but do not have an effluent standard in Part 703.	SCG	These regulations would be applicable for alternatives that include discharges to groundwater.
	NYSDEC Division of Water: Guidance on Groundwater Contamination Strategy	Technical and Operational Guidance Series (TOGS) 2.1.1	Establishes strategies for source control and remediation of groundwater contamination.	SCG	These strategies are potential guidelines when evaluating groundwater remediation options.
	NYSDEC Division of Water: Guidance on Permits/Standards for Underground Injection Recirculation (UIR)	Technical and Operational Guidance Series (TOGS) 2.1.2	Provides guidance on applicability of SPDES permits and groundwater effluent standards when using UIR for groundwater remediation.	SCG	This guidance is to be used when injection or recirculation of groundwater is considered as a remedial action.
Air Emissions from a Point Source	New York State Air Pollution Control Regulations	6 NYCRR Parts 120, 200-203, 207, 211, 212, 219 Air Guide-1	Establishes emissions standards for new sources of air pollutants, incinerators, and specific contaminants.	SCG	Requirements would be applicable to alternatives that result in air emissions of regulated substances or equipment.
	New York State Ambient Air Quality Standards	6 NYCRR Part 257	Establishes state ambient air quality standards and guidelines for protection of public health.	SCG	May be applicable in evaluating air impacts during remedial activities. Establishes short-term action limits for occupational exposure.
All	Proposed Standard Remedy Framework for the Remediation of Former MGP Sites in New York State	Draft Document Issued by MGP Workgroup of the Power Pool (MGP Workgroup, 1996)	Establishes "Standard Remedies," or remedial actions, corresponding to specified site conditions for the remediation of MGP sites. Standard remedies are developed based on protection of human health and the environment, technical feasibility, and future land use considerations (residential, comm./ind., vacant land).	SCG	These standard remedies are potential guidelines for developing and evaluating remedial options for MGP sites.
LOCAL					
Water Treatment Discharge	Local County or Municipality (POTW) Pretreatment Requirements	Local regulation	Establishes pretreatment requirements for water prior to discharge to the local sanitary sewer system. MGP-related parameters with requirements are benzene, toluene, ethylbenzene, naphthalene, and total cyanide.	SCG	These requirements are established separately for each water discharge that is routed through a municipal wastewater treatment plant prior to discharge.

TABLE 6.6
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF LOCATION-SPECIFIC SCGs
FOURTH STREET SITE

LOCATION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
FEDERAL					
Floodplain	Hazardous Waste Facility Located on 100-yr Floodplain	40 CFR 264.18(b)	A Treatment, Storage, and Disposal (TSD) Facility must be designed and operated to avoid washout.	SCG	Not applicable because the site is not located within the 100-year floodplain (based on review of FEMA map).
	Floodplain Management	40 CFR 6, Subpart A; 40 CFR 6.302	Activities taking place within floodplains must be done to avoid adverse impacts and preserve beneficial values in floodplains.	SCG	Not applicable because the site is not located within the 100-year floodplain (based on review of FEMA map).
Fault	Hazardous Waste Facility Located Near a Bedrock Fault	40 CFR 264.18(a)	New hazardous waste TSD facilities cannot be constructed within 200 feet of a fault displaced within Holocene time.	Not Applicable	No bedrock faults displaced within the Holocene time have been identified in review of local and regional geology.
Wetlands	Clean Water Act (CWA) Section 404 Dredge and Fill in Wetlands	33 U.S.C. 1344 33 CFR Parts 320-330 40 CFR Part 230	Discharge of dredge or fill material into wetlands are regulated by a permit.	Not Applicable	Not applicable to remedial activities resulting in a discharge of dredge or fill material because no juristictional wetlands have been identified on the site.
	Executive Order 11990 Protection of Wetlands	40 CFR Part 6 Subpart A	Executive Order 11990 activities taking place within wetlands must be done to avoid adverse impacts.	Not Applicable	Not applicable to remedial activities conducted because no jurisdiction wetlands have been identified on the site.
Historic Areas	National Historic Preservation Act Preservation of Historic Properties Controlled by a Federal Agency	16 U.S.C. 470; 16 U.S.C. 469 36 CFR Part 800	Actions must be planned to preserve historic properties and minimize harm to National Historic Landmarks.	Not Applicable	No potentially historic MGP buildings remain on the site. A listed site (National Fuel MGP site) is located near the site.
	Preservation of Area Containing Artifacts	36 CFR Part 65	Actions must be done to preserve and recover any historical/archeological artifacts found.	Not Applicable	No significant historic or archeological artifacts have been identified to date on the site.

TABLE 6.6
STATUTES, REGULATIONS, AND GUIDELINES USED
IN THE IDENTIFICATION OF LOCATION-SPECIFIC SCGs
FOURTH STREET SITE

LOCATION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Critical Habitat	Endangered Species Act and Fish and Wildlife Coordination Act	16 U.S.C. 1531			
	Critical Habitat of Endangered Species	50 CFR Part 200, Part 402 40 CFR Parts 320-330	Actions must be taken to conserve critical habitat in areas where there are endangered or threatened species.	Not Applicable	No endangered or threatened species are known to occur in or near the site.
Wilderness Area	Wilderness Act	16 U.S.C. 1131			
	Activities in Federally-Owned Wilderness Areas	50 CFR 35.1	Area must be administered to preserve wilderness areas.	Not Applicable	Site is not on or near a federally-owned wilderness area.
Wildlife Refuge	Wildlife Refuge System	16 U.S.C. 668dd			
	Activities in Areas Designated in Wildlife Refuge System	50 CFR Part 27	Activities are restricted in areas designated as part of the National Wildlife Refuge System.	Not Applicable	Site is not on or near a federally designated National Wildlife Refuge.
Waters of the United States	Clean Water Act (CWA) Section 404	33 U.S.C. 1344			
	Discharge of Dredge or Fill Material into Waters of the United States	33 CFR Parts 320-330 40 CFR Part 230	Discharges must be authorized in accordance with Section 404. Activities may qualify for a Nationwide permit authorized by the District Engineer of the USACOE.	Not Applicable	These standards are not applicable as no action under consideration would affect surface water.
Stream or River Area	Fish and Wildlife Coordination Act	16 U.S.C. 661			
	Modification to Waterways that Affects Fish or Wildlife	40 CFR 6.302	Actions must be taken to protect fish or wildlife when diverting channeling, or otherwise modifying a stream or river.	Not Applicable	These standards are not applicable as no action under consideration would affect surface water.
	Wild and Scenic Rivers Act	16 U.S.C. 1271, Section 7			
	Actions in Designated Wild and Scenic River Areas	40 CFR 6.302 (e)	Actions in federally-designated wild, scenic, or recreation river areas must avoid adverse effects.	Not Applicable	Remedial work on site would not impact a federally-designated wild or scenic river area.

TABLE 6.6
STATUTES, REGULATIONS, AND GUIDELINES USED
IN THE IDENTIFICATION OF LOCATION-SPECIFIC SCGs
FOURTH STREET SITE

LOCATION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Stream or River Area (cont.)	Rivers and Harbors Act 1899 Section 10 Obstruction or Alteration of Naigable Waters of the U.S.	33 U.S.C. Section 403 33 CFR Parts 320-330	Permit required for structures or activities that will affect navigable waters of the United States.	Not Applicable	These standards are not applicable as no action under consideration would affect surface water.
STATE					
Floodplain	TSD Facility Permiting Requirements Hazardous Waste Facility Located on 100-yr Floodplain	6 NYCRR Subpart 373-1	Facility must be designed and operated to avoid washout.	Not Applicable	Not applicable because the site is not located within the 100-year floodplain (based on review of FEMA map).
Aquifer	Secure Landfill Design and Operation Requirements - Hazardous Waste Facility Located Over a Aquifer	6 NYCRR Part 373-2.14	A secure landfill facility shall not be located over groundwater recharge areas serving public water supplies. Waste shall be no closer than 10 feet to an aquifer. New landfill units must have double liner systems with leachate collection if the landfill is located within one-quarter mile from an underground source of drinking water.	Not Applicable	The site is not located over a groundwater recharge area serving a public water supply.
Fault	Siting of Industrial Hazardous Waste Facilities Hazardous Waste Facility Located Near Fault	6 NYCRR Part 361	New hazardous waste facilities cannot be constructed within 200 feet of a fault displaced within Holocene time.	Not Applicable	No bedrock faults displaced within the Holocene time have been identified in review of local and regional geology.
Wetlands	New York State Freshwater Wetlands Act New York Freshwater Wetlands Implementation Program	ECL Article 24 and 71 6 NYCRR Parts 662-665	Activities in wetlands areas must be conducted to preserve and protect wetlands.	Not Applicable	Not applicable to remedial activities conducted on the site.

TABLE 6.6
STATUTES, REGULATIONS, AND GUIDELINES USED
IN THE IDENTIFICATION OF LOCATION-SPECIFIC SCGs
FOURTH STREET SITE

LOCATION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Historic Area	New York State Parks, Recreation, and Historic Preservation Law Preservation of Historic Structures or Artifacts	Section 14.09	Actions must be planned to preserve and recover historic structures or artifacts at sites regulated by the State.	Not Applicable	No potentially historical MGP buildings remain on the Site. A listed site (an MGP site) is located next to the BURA Site.
Critical Habitat	Endangered and Threatened Species of Fish and Wildlife	6 NYCRR Part 182	State regulations for protection of threatened and endangered species	Not Applicable	No endangered or threatened species have been identified.
Waters of New York State	Protection of Waters Program	6 NYCRR Part 608	Protection of Waters permit program regulates: (1) any disturbance of the bed or banks of a protected stream or watercourse, (2) construction and maintenance of dams, and (3) excavation or fill in navigable waters of the State.	Not Applicable	These standards are not applicable as no action under consideration would affect surface water.
	CWA Section 401 State Water Quality Certification (WQC) Program	33 U.S.C. 1341	State 401 WQC permit must be provided to Federal permitting agency (USACOE) for any activity including, but not limited to, the construction or operation of facilities which may result in any discharge into navigable waters of the U.S.	Not Applicable	These standards are not applicable as no action under consideration would affect surface water.
Coastal Zone	Coastal Zone Erosion	6 NYCRR Part 505	Land use, development, and other activities in coastal areas subject to coastal flooding and erosion must obtain a coastal erosion management permit.	Not Applicable	Site is not located within a New York State coastal area.

TABLE 6.6
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF LOCATION-SPECIFIC SCGs
FOURTH STREET SITE

LOCATION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Freshwater Sediments	Sediment Dredging	NYSDEC Interim Guidance Freshwater Navigitional Dredging	Establishes three levels or "classes" of sediment quality based on contaminant concentration, and assigns dredge and disposal options to each class.	Not Applicable	These standards are not applicable as no action under consideration would affect sediment.
Floodplain	Floodplain Management Criteria for State Projects	6 NYCRR Part 502	Establishes floodplain management practices for projects involving State-owned and State-financed facilities. Key requirements include limitations on projects, including placement of fill, which may result in an increase in flood levels or water surface elevations during a base flood discharge.	TBC	Not applicable because the site is not located within the 100-year floodplain (based on review of FEMA map).
LOCAL					
Floodplain	Flood Damage Prevention	City of Utica Code of Ordinances Chapter 19, "Flood Damage Prevention Law"	Variances are needed for activities occurring within floodplains shown to not cause an increase in flood levels during a base flood discharge. If shown to cause an increase, a variance will not be given.	SCG	Not applicable because the site is not located within the 100-year floodplain (based on review of FEMA map).

TABLE 6.7

SUMMARY OF PROPOSED PRGS FOR SOIL AND GROUNDWATER (1)

MGP-Related Residual(2)	Groundwater (mg/L)	Soil (mg/kg)
Volatiles		
Benzene	0.001	0.266
Ethylbenzene	0.005	25.2
Toluene	0.005	6.87
Xylenes	0.005	5.5
Semivolatiles		
Acenaphthene	0.02	50
Acenaphthylene	-	50
Anthracene	-	50
Benzo(a)anthracene	-	1.8
Benzo(a)pyrene	-	1.6
Benzo(b)fluoranthene	-	5.04
Benzo(g,h,i)perylene	-	50
Benzo(k)fluoranthene	-	5.04
Chrysene	-	1.83
Dibenzo(a,h)anthracene	-	0.37
Fluoranthene	-	50
Fluorene	0.05	50
Indeno(1,2,3-c,d)pyrene	-	14.7
Naphthalene	0.01	50
Phenanthrene	-	50
Pyrene	0.05	50
Phenols		
Phenol*	-	0.36
2,4-Dimethylphenol*	-	-
2-Methylphenol*	-	0.344
4-Methylphenol*	-	3.89
Total Phenols*	0.001	-
Inorganics		
Cyanide	0.2	-

(1) PRG = preliminary remediation goal. A dash ("-") indicates that the chemical is not of concern in this medium or that no standard exists for the chemical.

(2) An asterisk ("*") indicates that the chemical is not MGP-related.

Table 6.8
BURA Fourth Street Site
Analytical Results with PRGs for Soil

CAS NO.	COMPOUND	Proposed PRG (Adjusted TAGM Soil Cleanup Objective or BUTL)	SAMPLE ID: DEPTH: LAB ID: SOURCE: SDG: MATRIX: SAMPLED: VALIDATED: UNITS:	OFFSS01 0-0.5' 186597-01 STL PE597 SOIL 5/13/98 7/3/98	OFFSS02 0-0.5' 186597-02 STL PE597 SOIL 5/13/98 7/3/98	OFFSS03 0-0.5' 186597-03 STL PE597 SOIL 5/13/98 7/3/98	OFFSS04 0-0.5' 186597-04 STL PE597 SOIL 5/13/98 7/3/98
	BTEX						
	None						
	PAHs						
83-32-9	Acenaphthene	50	mg/Kg	0.33 J	0.085 J	0.2 J	0.44 UJ
208-96-8	Acenaphthylene	50	mg/Kg	0.38 UJ	0.39 UJ	0.39 UJ	0.44 UJ
120-12-7	Anthracene	50	mg/Kg	0.65 J	0.21 J	0.45 J	0.44 UJ
56-55-3	Benzo(a)anthracene	1.8	mg/Kg	1.5 J	0.44 J	1.2 J	0.074 J
50-32-8	Benzo(a)pyrene	1.8	mg/Kg	1.2 J	0.35 J	0.99 J	0.069 J
205-99-2	Benzo(b)fluoranthene	5.04	mg/Kg	2 J	0.47 J	1.6 J	0.096 J
191-24-2	Benzo(g,h,i)perylene	50	mg/Kg	0.3 J	0.17 J	0.31 J	0.44 UJ
207-08-9	Benzo(k)fluoranthene	5.04	mg/Kg	0.56 J	0.16 J	0.52 J	0.44 UJ
218-01-9	Chrysene	1.83	mg/Kg	1.3 J	0.41 J	1 J	0.076 J
53-70-3	Dibenzo(a,h)anthracene	0.37	mg/Kg	0.12 J	0.053 J	0.11 J	0.44 UJ
206-44-0	Fluoranthene	50	mg/Kg	2.5 J	0.78 J	1.9 J	0.15 J
86-73-7	Fluorene	50	mg/Kg	0.32 J	0.097 J	0.19 J	0.44 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	14.7	mg/Kg	0.42 J	0.19 J	0.4 J	0.044 J
91-20-3	Naphthalene	50	mg/Kg	0.3 J	0.39 UJ	0.091 J	0.44 UJ
85-01-8	Phenanthrene	50	mg/Kg	2.4 J	0.81 J	1.5 J	0.096 J
129-00-0	Pyrene	50	mg/Kg	2.3 J	0.77 J	1.7 J	0.14 J
PAHs	Total PAHs		mg/Kg	16.45	5.053	12.271	0.745
	PHENOLS						
108-95-2	Phenol	0.36	mg/Kg	0.38 UJ	0.069 J	0.39 UJ	0.44 UJ
	Total Phenols			ND	0.069	ND	ND
	INORGANICS						
57-12-9	Cyanide	NS	mg/Kg	1.1 U	1.1 U	1.2 U	1.3 U
SOLIDS	Percent Solids		%	87.3	86.5	85.5	75.9
7440-44-0	Total Organic Carbon		mg/Kg	34800	29200	35800	53900

ND - Not Detected (totals)
U - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.

Table 6.8

BURA Fourth Street Site

Analytical Results with PRGs for Soil

CAS NO.	COMPOUND	Proposed PRG (Adjusted TAGM Soil Cleanup Objective or BUTL)	SAMPLE ID: DEPTH: LAB ID: SOURCE: SDG: MATRIX: SAMPLED: VALIDATED: UNITS:	OFFSS05 0-0.5' 186597-05 STL PE597 SOIL 5/13/98 7/3/98	OFFSS06 0-0.5' 186597-06 STL PE597 SOIL 5/13/98 7/3/98	OFFSS07 0-0.5' 186597-07 STL PE597 SOIL 5/13/98 7/3/98	SS-01 0-0.5 186525-02 STL PE525 SOIL 5/12/98 7/3/98
	BTEX						
	None						
	PAHs						
83-32-9	Acenaphthene	50	mg/Kg	0.44 UJ	0.23 J	0.13 J	2.1 J
208-96-8	Acenaphthylene	50	mg/Kg	0.44 UJ	0.12 J	0.39 UJ	0.44 J
120-12-7	Anthracene	50	mg/Kg	0.071 J	0.65 J	0.37 J	7.8 J
56-55-3	Benzo(a)anthracene	1.8	mg/Kg	0.21 J	1.8 J	0.96 J	11 J
50-32-8	Benzo(a)pyrene	1.6	mg/Kg	0.19 J	1.6 J	0.73 J	10 J
205-99-2	Benzo(b)fluoranthene	5.04	mg/Kg	0.25 J	2.5 J	1 J	15 J
191-24-2	Benzo(g,h,i)perylene	50	mg/Kg	0.11 J	0.43 J	0.31 J	3.2 J
207-08-9	Benzo(k)fluoranthene	5.04	mg/Kg	0.092 J	0.65 J	0.29 J	4.9 J
218-01-9	Chrysene	1.83	mg/Kg	0.21 J	1.6 J	0.85 J	8.8 J
53-70-3	Dibenzo(a,h)anthracene	0.37	mg/Kg	0.44 UJ	0.19 J	0.1 J	1 J
206-44-0	Fluoranthene	50	mg/Kg	0.38 J	2.8 J	1.5 J	21 J
86-73-7	Fluorene	50	mg/Kg	0.44 UJ	0.27 J	0.16 J	2.4 J
193-39-5	Indeno(1,2,3-cd)pyrene	14.7	mg/Kg	0.12 J	0.56 J	0.39 J	3.5 J
91-20-3	Naphthalene	50	mg/Kg	0.44 UJ	0.16 J	0.05 J	1.4 J
85-01-8	Phenanthrene	50	mg/Kg	0.3 J	2.5 J	1.3 J	24 J
129-00-0	Pyrene	50	mg/Kg	0.37 J	2.7 J	1.6 J	18 J
PAHs	Total PAHs		mg/Kg	2.303	18.93	9.819	136.34
	PHENOLS						
108-95-2	Phenol	0.36	mg/Kg	0.44 UJ	0.41 UJ	0.39 UJ	0.4 UJ
	Total Phenols			ND	ND	ND	ND
	INORGANICS						
57-12-9	Cyanide	NS	mg/Kg	1.3 U	1.1 U	1.2 U	1.6
SOLIDS	Percent Solids		%	76.5	81	85.6	84.1
7440-44-0	Total Organic Carbon		mg/Kg	49600	57500	60100	NA

ND - Not Detected (totals)

U - Not Detected.

J - Estimated Value.

JN - Estimated with a tentative identification.

R - Rejected Value.

Table 6.8
BURA Fourth Street Site
Analytical Results with PRGs for Soil

CAS NO.	COMPOUND	Proposed PRG (Adjusted TAGM Soil Cleanup Objective or BUTL)	SAMPLE ID: / DEPTH: / LAB ID: / SOURCE: / SDG: / MATRIX: / SAMPLED: / VALIDATED: / UNITS:	SS-02 / 0-0.5 / 186525-04 / STL / PE525 / SOIL / 5/12/98 / 7/3/98	SS-03 / 0-0.5 / 186525-05 / STL / PE525 / SOIL / 5/12/98 / 7/3/98	SS-04 / 0-0.5 / 186525-06 / STL / PE525 / SOIL / 5/12/98 / 7/3/98	SS-05 / 0-0.5 / 186525-07 / STL / PE525 / SOIL / 5/12/98 / 7/3/98
	BTEX						
	None						
	PAHs						
83-32-9	Acenaphthene	50	mg/Kg	0.15 J	0.41 UJ	R	0.36 J
208-96-8	Acenaphthylene	50	mg/Kg	0.38 UJ	0.41 UJ	R	0.15 J
120-12-7	Anthracene	50	mg/Kg	0.39 J	0.41 UJ	0.048 J	1 J
56-55-3	Benzo(a)anthracene	1.8	mg/Kg	0.99 J	0.24 J	0.2 J	3.1 J
50-32-8	Benzo(a)pyrene	1.6	mg/Kg	0.73 J	0.49 J	R	2.7 J
205-99-2	Benzo(b)fluoranthene	5.04	mg/Kg	1.3 J	0.62 J	0.12 J	5.1 J
191-24-2	Benzo(g,h,i)perylene	50	mg/Kg	0.38 J	0.41 J	R	0.86 J
207-08-9	Benzo(k)fluoranthene	5.04	mg/Kg	0.33 J	0.23 J	0.066 J	0.92 J
218-01-9	Chrysene	1.83	mg/Kg	0.84 J	0.25 J	0.12 J	2.7 J
53-70-3	Dibenzo(a,h)anthracene	0.37	mg/Kg	0.098 J	0.11 J	R	0.38 J
206-44-0	Fluoranthene	50	mg/Kg	1.4 J	0.24 J	0.25 J	6.3 J
86-73-7	Fluorene	50	mg/Kg	0.18 J	0.41 UJ	0.058 J	0.44 J
193-39-5	Indeno(1,2,3-cd)pyrene	14.7	mg/Kg	0.39 J	0.43 J	R	1.2 J
91-20-3	Naphthalene	50	mg/Kg	0.13 J	0.056 J	R	0.28 J
85-01-8	Phenanthrene	50	mg/Kg	1.5 J	0.15 J	0.18 J	4.7 J
129-00-0	Pyrene	50	mg/Kg	1.7 J	0.3 J	0.056 J	5.9 J
PAHs	Total PAHs		mg/Kg	10.618	3.526	1.098	36.41
	PHENOLS						
108-95-2	Phenol	0.36	mg/Kg	0.38 UJ	0.41 UJ	0.43 UJ	0.43 UJ
	Total Phenols			ND	ND	ND	ND
	INORGANICS						
57-12-9	Cyanide	NS	mg/Kg	1.6	7.2	1.3 U	1.3 U
SOLIDS	Percent Solids		%	87.4	82.2	78	77.2
7440-44-0	Total Organic Carbon		mg/Kg	NA	NA	NA	NA

ND - Not Detected (totals)
U - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.

Table 6.8
BURA Fourth Street Site
Analytical Results with PRGs for Soil

CAS NO.	COMPOUND	Proposed PRG (Adjusted TAGM Soil Cleanup Objective or BUTL)	SAMPLE ID: DEPTH: LAB ID: SOURCE: SDG: MATRIX: SAMPLED: VALIDATED: UNITS:	SB-01C 4-6' 185948-01 STL PE948 SOIL 4/29/98 7/3/98	SB-01F 10-12' 185948-02 STL PE948 SOIL 4/29/98 7/3/98	SB-02D 6-8' 185948-03 STL PE948 SOIL 4/29/98 7/3/98	SB-02F 10-12' 185948-04 STL PE948 SOIL 4/29/98 7/3/98	SB-03D 6-8' 185948-05 STL PE948 SOIL 4/30/98 7/3/98
	BTEX							
71-43-2	Benzene	0.266	mg/Kg	0.0012 U	0.0012 U	0.0013 U	0.0012 U	3.6
100-41-4	Ethylbenzene	25.2	mg/Kg	0.0012 U	0.0012 U	0.0013 U	0.0012 U	7.9
108-88-3	Toluene	6.87	mg/Kg	0.0012 U	0.0012 U	0.0013 U	0.0012 U	1.1 U
1330-20-7	Xylenes, total	5.5	mg/Kg	0.0012 U	0.0012 U	0.0013 U	0.0012 U	6.5
BTEX	Total BTEX		mg/Kg	ND	ND	ND	ND	18
	PAHs							
83-32-9	Acenaphthene	50	mg/Kg	0.33 J	0.4 U	0.43 U	0.4 U	12
208-96-8	Acenaphthylene	50	mg/Kg	0.12 J	0.4 U	0.43 U	0.4 U	0.86 J
120-12-7	Anthracene	50	mg/Kg	0.81	0.4 U	0.43 U	0.4 U	7.5
56-55-3	Benzo(a)anthracene	1.8	mg/Kg	1.1	0.4 U	0.43 U	0.4 U	9.2
50-32-8	Benzo(a)pyrene	1.6	mg/Kg	0.78	0.4 U	0.43 U	0.4 U	8.1
205-99-2	Benzo(b)fluoranthene	5.04	mg/Kg	0.93	0.4 U	0.43 U	0.4 U	8.6
191-24-2	Benzo(g,h,i)perylene	50	mg/Kg	0.29 J	0.4 U	0.43 U	0.4 U	3.1
207-08-9	Benzo(k)fluoranthene	5.04	mg/Kg	0.34 J	0.4 U	0.43 U	0.4 U	3.6
218-01-9	Chrysene	1.83	mg/Kg	1	0.4 U	0.43 U	0.4 U	7.6
53-70-3	Dibenzo(a,h)anthracene	0.37	mg/Kg	0.11 J	0.4 U	0.43 U	0.4 U	1.4 J
132-64-9	Dibenzofuran	28.2	mg/Kg	0.35 J	0.4 U	0.43 U	0.4 U	8.6
206-44-0	Fluoranthene	50	mg/Kg	2.2	0.4 U	0.43 U	0.4 U	17
86-73-7	Fluorene	50	mg/Kg	0.48	0.4 U	0.43 U	0.4 U	9.8
193-39-5	Indeno(1,2,3-cd)pyrene	14.7	mg/Kg	0.35 J	0.4 U	0.43 U	0.4 U	4.1
91-20-3	Naphthalene	50	mg/Kg	0.31 J	0.4 U	0.43 U	0.4 U	41
85-01-8	Phenanthrene	50	mg/Kg	2.6	0.4 U	0.43 U	0.4 U	30
129-00-0	Pyrene	50	mg/Kg	1.7	0.4 U	0.43 U	0.4 U	13
91-57-6	2-Methylnaphthalene		mg/Kg					
PAHs	Total PAHs		mg/Kg	13.8	ND	ND	ND	185.16
	PHENOLs							
105-67-9	2,4-Dimethylphenol	NS	mg/Kg	0.41 U	0.4 U	0.43 U	0.4 U	2.9 U
95-48-7	2-Methylphenol	0.344	mg/Kg	0.41 U	0.4 U	0.43 U	0.4 U	2.9 U
106-44-5	4-Methylphenol	3.89	mg/Kg	0.41 U	0.4 U	0.43 U	0.4 U	2.9 U
PHENOLS	Total Phenols		mg/Kg	ND	ND	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	NS	mg/Kg	1.1 UJ	1.1 UJ	1.2 UJ	1.1 UJ	4.2 J
SOLIDS	Percent Solids		%	81.4	83.1	77.6	83	57.3

ND - Not Detected (totals)
U - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.
SB -Site Background.
[shaded box] - Indicates a concentration above the standard.

Table 6.8
BURA Fourth Street Site
Analytical Results with PRGs for Soil

CAS NO.	COMPOUND	Proposed PRG (Adjusted TAGM Soil Cleanup Objective or BUTL)	SAMPLE ID:	SB-03F	SB-04F	SB-05E	SB-06C	SB-06E
			DEPTH:	10-12'	10-12'	8-10'	4-6'	8-10'
			LAB ID:	185948-06	185948-07	185948-08	185988-01	185988-02
			SOURCE:	STL	STL	STL	STL	STL
			SDG:	PE948	PE948	PE948	PE948	PE948
			MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL
			SAMPLED:	4/30/98	4/30/98	4/30/98	5/1/98	5/1/98
			VALIDATED:	7/3/98	7/3/98	7/3/98	7/3/98	7/3/98
			UNITS:					
	BTEX							
71-43-2	Benzene	0.266	mg/Kg	0.85	0.0013 U	0.31 U	1.8	0.96
100-41-4	Ethylbenzene	25.2	mg/Kg	0.44	0.0013 U	0.26 J	19	5.8
108-88-3	Toluene	6.87	mg/Kg	0.34	0.0013 U	0.31 U	0.4 U	0.0072
1330-20-7	Xylenes, total	5.5	mg/Kg	0.94	0.003	0.38	9.5	6.7
BTEX	Total BTEX		mg/Kg	2.57	0.003	0.64	30.3	13.4672
	PAHs							
83-32-9	Acenaphthene	50	mg/Kg	1.6 J	0.43 U	0.59	11	1.4
208-96-8	Acenaphthylene	50	mg/Kg	7	0.43 U	0.23 J	1.2	0.15 J
120-12-7	Anthracene	50	mg/Kg	9.4	0.43 U	0.64	9.1 J	1.1
56-55-3	Benzo(a)anthracene	1.8	mg/Kg	6.2	0.43 U	0.69	11	0.91
50-32-8	Benzo(a)pyrene	1.6	mg/Kg	5.3	0.43 U	0.6	9.3 J	1.3 J
205-99-2	Benzo(b)fluoranthene	5.04	mg/Kg	6	0.43 U	0.57	9.2 J	0.89 J
191-24-2	Benzo(g,h,i)perylene	50	mg/Kg	2.7	0.43 U	0.28 J	0.78	0.85 J
207-08-9	Benzo(k)fluoranthene	5.04	mg/Kg	2	0.43 U	0.23 J	2.7	0.28 J
218-01-9	Chrysene	1.83	mg/Kg	6.6	0.43 U	0.62	9.4 J	0.88
53-70-3	Dibenzo(a,h)anthracene	0.37	mg/Kg	0.68 J	0.43 U	0.087 J	0.9	0.1 J
132-64-9	Dibenzofuran	28.2	mg/Kg	6.1	0.43 U	0.57	1.1	0.18 J
206-44-0	Fluoranthene	50	mg/Kg	15	0.06 J	1.5	19	1.4
86-73-7	Fluorene	50	mg/Kg	6.8	0.43 U	1.1	7.3 J	1.1
193-39-5	Indeno(1,2,3-cd)pyrene	14.7	mg/Kg	3.2	0.43 U	0.28 J	3	0.61 J
91-20-3	Naphthalene	50	mg/Kg	41	0.43 U	1.8	58	10
85-01-8	Phenanthrene	50	mg/Kg	26	0.43 U	2.8	30	3.3
129-00-0	Pyrene	50	mg/Kg	11	0.083 J	1.4	29	2.1
91-57-6	2-Methylnaphthalene		mg/Kg					
PAHs	Total PAHs		mg/Kg	155.58	0.143	13.987	211.98	26.55
	PHENOLs							
105-67-9	2,4-Dimethylphenol	NS	mg/Kg	0.73 J	0.43 U	0.42 U	0.54 U	0.44 U
95-48-7	2-Methylphenol	0.344	mg/Kg	0.27 JN	0.43 U	0.42 U	0.54 U	0.44 U
106-44-5	4-Methylphenol	3.89	mg/Kg	0.35 J	0.43 U	0.42 U	0.54 U	0.44 U
PHENOLS	Total Phenols		mg/Kg	1.35	ND	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	NS	mg/Kg	1.1 UJ	1.2 UJ	1.2 UJ	46.3 J	1.2 UJ
SOLIDS	Percent Solids		%	82	77.5	79.4	62.5	76.4

ND - Not Detected (totals)
U - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.
SB -Site Background.
[shaded box] - Indicates a concentration above the standard.

Table 6.8
BURA Fourth Street Site
Analytical Results with PRGs for Soil

CAS NO.	COMPOUND	Proposed PRG (Adjusted TAGM Soil Cleanup Objective or BUTL)	SAMPLE ID: DEPTH: LAB ID: SOURCE: SDG: MATRIX: SAMPLED: VALIDATED: UNITS:	SB-08F 10-12' 185988-04 STL PE948 SOIL 5/1/98 7/3/98	SB-08J 20-22' 185988-05 STL PE948 SOIL 5/1/98 7/3/98	SB-09G 12-14' 186141-01 STL PE141 SOIL 5/4/98 7/3/98	SB-09I 16-18' 186141-02 STL PE141 SOIL 5/4/98 7/3/98	SB-10D 6-8' 186141-04 STL PE141 SOIL 5/4/98 7/3/98
	BTEX							
71-43-2	Benzene	0.266	mg/Kg	0.0012 U	0.0012 U	0.0008 J	0.0014 U	0.0062 U
100-41-4	Ethylbenzene	25.2	mg/Kg	0.0012 U	0.0012 U	0.0013 U	0.0014 U	0.0062 U
108-88-3	Toluene	6.87	mg/Kg	0.0012 U	0.0012 U	0.0014	0.0014 U	0.0062 U
1330-20-7	Xylenes, total	5.5	mg/Kg	0.0012 U	0.0012 U	0.0018	0.0014 U	0.031
BTEX	Total BTEX		mg/Kg	ND	ND	0.004	ND	0.031
	PAHs							
83-32-9	Acenaphthene	50	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
208-96-8	Acenaphthylene	50	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
120-12-7	Anthracene	50	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
56-55-3	Benzo(a)anthracene	1.8	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
50-32-8	Benzo(a)pyrene	1.6	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
205-99-2	Benzo(b)fluoranthene	5.04	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
191-24-2	Benzo(g,h,i)perylene	50	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
207-08-9	Benzo(k)fluoranthene	5.04	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
218-01-9	Chrysene	1.83	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
53-70-3	Dibenzo(a,h)anthracene	0.37	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
132-64-9	Dibenzofuran	28.2	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
206-44-0	Fluoranthene	50	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
86-73-7	Fluorene	50	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	14.7	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
91-20-3	Naphthalene	50	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
85-01-8	Phenanthrene	50	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
129-00-0	Pyrene	50	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
91-57-6	2-Methylnaphthalene		mg/Kg					
PAHs	Total PAHs		mg/Kg	ND	ND	ND	ND	ND
	PHENOLs							
105-67-9	2,4-Dimethylphenol	NS	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
95-48-7	2-Methylphenol	0.344	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
106-44-5	4-Methylphenol	3.89	mg/Kg	0.42 U	0.4 U	0.42 UJ	0.48 UJ	0.41 UJ
PHENOLS	Total Phenols		mg/Kg	ND	ND	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	NS	mg/Kg	1.2 UJ	1.1 UJ	1.2 U	1.4 U	1.2 U
SOLIDS	Percent Solids		%	80.3	84.3	79.1	69.9	81.3

ND - Not Detected (totals)
U - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.
SB -Site Background.
[shaded box] - Indicates a concentration above the standard.

Table 6.8
BURA Fourth Street Site
Analytical Results with PRGs for Soil

CAS NO.	COMPOUND	Proposed PRG (Adjusted TAGM Soil Cleanup Objective or BUTL)	SAMPLE ID: DEPTH: LAB ID: SOURCE: SDG: MATRIX: SAMPLED: VALIDATED: UNITS:	SB-10G 12-14' 186141-03 STL PE141 SOIL 5/4/98 7/3/98	SB-11E 8-10' 186141-05 STL PE141 SOIL 5/5/98 7/3/98	SB-11H 14-16' 186141-06 STL PE141 SOIL 5/5/98 7/3/98	SB-12I 16-18' 186141-07 STL PE141 SOIL 5/5/98 7/3/98	SB-12J 18-20' 186141-08 STL PE141 SOIL 5/5/98 7/3/98
	BTEX							
71-43-2	Benzene	0.266	mg/Kg	0.085 J	0.0012 U	0.0012 UJ	13	0.18
100-41-4	Ethylbenzene	25.2	mg/Kg	0.0014 U	0.0012 U	0.0012 UJ	5.9	0.24
108-88-3	Toluene	6.87	mg/Kg	0.0008 J	0.0012 U	0.0012 UJ	0.37	0.0058
1330-20-7	Xylenes, total	5.5	mg/Kg	0.0072	0.0012 U	0.0012 UJ	14	0.54
BTEX	Total BTEX		mg/Kg	0.093	ND	ND	33.27	0.9658
	PAHs							
83-32-9	Acenaphthene	50	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
208-96-8	Acenaphthylene	50	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
120-12-7	Anthracene	50	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
56-55-3	Benzo(a)anthracene	1.8	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
50-32-8	Benzo(a)pyrene	1.6	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
205-99-2	Benzo(b)fluoranthene	5.04	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
191-24-2	Benzo(g,h,i)perylene	50	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
207-08-9	Benzo(k)fluoranthene	5.04	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
218-01-9	Chrysene	1.83	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
53-70-3	Dibenzo(a,h)anthracene	0.37	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
132-64-9	Dibenzofuran	28.2	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
206-44-0	Fluoranthene	50	mg/Kg	0.46 UJ	0.052 J	0.4 UJ	0.44 UJ	0.36 UJ
86-73-7	Fluorene	50	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	14.7	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
91-20-3	Naphthalene	50	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.81 J	0.91 J
85-01-8	Phenanthrene	50	mg/Kg	0.46 UJ	0.044 J	0.4 UJ	0.44 UJ	0.36 UJ
129-00-0	Pyrene	50	mg/Kg	0.46 UJ	0.041 J	0.4 UJ	0.44 UJ	0.36 UJ
91-57-6	2-Methylnaphthalene		mg/Kg					
PAHs	Total PAHs		mg/Kg	ND	0.137	ND	0.81	0.91
	PHENOLs							
105-67-9	2,4-Dimethylphenol	NS	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
95-48-7	2-Methylphenol	0.344	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
106-44-5	4-Methylphenol	3.89	mg/Kg	0.46 UJ	0.4 UJ	0.4 UJ	0.44 UJ	0.36 UJ
PHENOLS	Total Phenols		mg/Kg	ND	ND	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	NS	mg/Kg	1.4 U	1.2 U	1.2 U	1.3 U	1.1 U
SOLIDS	Percent Solids		%	73.2	84.2	84	74.6	92.1

ND - Not Detected (totals)
U - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.
SB -Site Background.
(shaded box) - Indicates a concentration above the standard.

Table 6.8
BURA Fourth Street Site
Analytical Results with PRGs for Soil

			SAMPLE ID:	SB-13E	SB-13HI	SB-15G	SB-15I	SB21D
			DEPTH:	8-10'	14-18'	12-14'	16-18'	6-8'
			LAB ID:	186319-03	186319-01	186319-06	186319-07	195271-03
			SOURCE:	STL	STL	STL	STL	STL
			SDG:	PE141	PE141	PE141	PE141	195271/195
		Proposed PRG	MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL
		(Adjusted TAGM	SAMPLED:	5/6/98	5/6/98	5/7/98	5/7/98	11/13/98
		Soil Cleanup	VALIDATED:	7/3/98	7/3/98	7/3/98	7/3/98	12/26/98
CAS NO.	COMPOUND	Objective or BUTL)	UNITS:					
	BTEX							
71-43-2	Benzene	0.266	mg/Kg	1.9	0.16 J	0.0011 U	0.0011 U	0.0019 J
100-41-4	Ethylbenzene	25.2	mg/Kg	11	0.1 J	0.0011 U	0.0011 U	0.0027 UJ
108-88-3	Toluene	6.87	mg/Kg	1.9	0.0033 J	0.0011 U	0.0012	0.0027 UJ
1330-20-7	Xylenes, total	5.5	mg/Kg	17	0.14 J	0.0011 U	0.0021	0.0027 UJ
BTEX	Total BTEX		mg/Kg	31.8	0.4033	ND	0.0033	0.0019
	PAHs							
83-32-9	Acenaphthene	50	mg/Kg	0.65	0.37 U	R	0.37 UJ	0.93 UJ
208-96-8	Acenaphthylene	50	mg/Kg	0.83	0.37 U	R	0.37 UJ	0.93 UJ
120-12-7	Anthracene	50	mg/Kg	1.2	0.37 U	R	0.37 UJ	0.93 UJ
56-55-3	Benzo(a)anthracene	1.8	mg/Kg	0.92	0.37 U	R	0.37 UJ	0.14 J
50-32-8	Benzo(a)pyrene	1.6	mg/Kg	0.87	0.37 U	R	0.37 UJ	0.93 UJ
205-99-2	Benzo(b)fluoranthene	5.04	mg/Kg	0.63	0.37 U	R	0.37 UJ	0.1 J
191-24-2	Benzo(g,h,i)perylene	50	mg/Kg	0.29 J	0.37 U	R	0.37 UJ	0.93 UJ
207-08-9	Benzo(k)fluoranthene	5.04	mg/Kg	0.21 J	0.37 U	R	0.37 UJ	0.93 UJ
218-01-9	Chrysene	1.83	mg/Kg	0.78	0.37 U	R	0.37 UJ	0.093 J
53-70-3	Dibenzo(a,h)anthracene	0.37	mg/Kg	0.41 U	0.37 U	R	0.37 UJ	0.93 UJ
132-64-9	Dibenzofuran	28.2	mg/Kg	0.43	0.37 U	R	0.37 UJ	0.93 UJ
206-44-0	Fluoranthene	50	mg/Kg	1.6	0.37 U	R	0.37 UJ	0.93 UJ
86-73-7	Fluorene	50	mg/Kg	1.2	0.37 U	R	0.37 UJ	0.93 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	14.7	mg/Kg	0.26 J	0.37 U	R	0.37 UJ	0.93 UJ
91-20-3	Naphthalene	50	mg/Kg	4.8	0.18 J	R	0.37 UJ	0.93 UJ
85-01-8	Phenanthrene	50	mg/Kg	4.3	0.37 U	R	0.37 UJ	0.93 UJ
129-00-0	Pyrene	50	mg/Kg	2.5	0.37 U	R	0.37 UJ	0.11 J
91-57-6	2-Methylnaphthalene		mg/Kg					
PAHs	Total PAHs		mg/Kg	21.47	0.18	R	ND	0.443
	PHENOLs							
105-67-9	2,4-Dimethylphenol	NS	mg/Kg	0.41 U	0.37 U	0.37 U	0.37 U	0.93 UJ
95-48-7	2-Methylphenol	0.344	mg/Kg	0.41 U	0.37 U	0.37 U	0.37 U	0.93 UJ
106-44-5	4-Methylphenol	3.89	mg/Kg	0.41 U	0.37 U	0.37 U	0.37 U	0.93 UJ
PHENOLS	Total Phenols		mg/Kg	ND	ND	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	NS	mg/Kg	1.2 U	1.1 U	1.1 U	1.1 U	2.7 UJ
SOLIDS	Percent Solids		%	81.6	89.3	90.3	91.1	36.4

ND - Not Detected (totals)
U - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.
SB -Site Background.
[shaded box] - Indicates a concentration above the standard.

Table 6.8
BURA Fourth Street Site
Analytical Results with PRGs for Soil

CAS NO.	COMPOUND	Proposed PRG (Adjusted TAGM Soil Cleanup Objective or BUTL)	SAMPLE ID: / DEPTH: / LAB ID: / SOURCE: / SDG: / MATRIX: / SAMPLED: / VALIDATED: / UNITS:	SB21J / 18-20' / 195271-04 / STL / 195271/195 / SOIL / 11/13/98 / 12/26/98	SB22D / 6-8' / 195326-03 / STL / 195271/195 / SOIL / 11/16/98 / 12/26/98	SB22HI / 14-18' / 195326-01 / STL / 195271/195 / SOIL / 11/16/98 / 12/26/98	SB23C / 4-6' / 195326-04 / STL / 195271/195 / SOIL / 11/16/98 / 12/26/98	SB23F / 10-12' / 195326-05 / STL / 195271/195 / SOIL / 11/16/98 / 12/26/98
	BTEX							
71-43-2	Benzene	0.266	mg/Kg	0.04	0.0013 U	0.065 J	0.001 J	0.022
100-41-4	Ethylbenzene	25.2	mg/Kg	0.16	0.0041	0.011	0.0012 UJ	0.0012 U
108-88-3	Toluene	6.87	mg/Kg	0.006 U	0.0011 J	0.0071 U	0.0012 UJ	0.015
1330-20-7	Xylenes, total	5.5	mg/Kg	0.18	0.0098	0.016	0.0012 UJ	0.0084
BTEX	Total BTEX		mg/Kg	0.38	0.015	0.092	0.001	0.0454
	PAHs							
83-32-9	Acenaphthene	50	mg/Kg	0.4 U	0.74	0.55 U	0.39 U	0.4 U
208-96-8	Acenaphthylene	50	mg/Kg	0.4 U	0.056 J	0.55 U	0.39 U	0.4 U
120-12-7	Anthracene	50	mg/Kg	0.4 U	1.4	0.55 U	0.39 U	0.4 U
56-55-3	Benzo(a)anthracene	1.8	mg/Kg	0.4 U	1.4	0.55 U	0.39 U	0.4 U
50-32-8	Benzo(a)pyrene	1.6	mg/Kg	0.4 U	1.1	0.55 U	0.39 U	0.4 U
205-99-2	Benzo(b)fluoranthene	5.04	mg/Kg	0.4 U	1.2	0.55 U	0.39 U	0.4 U
191-24-2	Benzo(g,h,i)perylene	50	mg/Kg	0.4 U	0.33 J	0.55 U	0.39 U	0.4 U
207-08-9	Benzo(k)fluoranthene	5.04	mg/Kg	0.4 U	0.39 J	0.55 U	0.39 U	0.4 U
218-01-9	Chrysene	1.83	mg/Kg	0.4 U	1.2	0.55 U	0.39 U	0.4 U
53-70-3	Dibenzo(a,h)anthracene	0.37	mg/Kg	0.4 U	0.11 J	0.55 U	0.39 U	0.4 U
132-64-9	Dibenzofuran	28.2	mg/Kg	0.4 U	0.72	0.55 U	0.39 U	0.4 U
206-44-0	Fluoranthene	50	mg/Kg	0.4 U	2.6	0.55 U	0.39 U	0.044 J
86-73-7	Fluorene	50	mg/Kg	0.4 U	1.2	0.55 U	0.39 U	0.4 U
193-39-5	Indeno(1,2,3-cd)pyrene	14.7	mg/Kg	0.4 U	0.39 J	0.55 U	0.39 U	0.4 U
91-20-3	Naphthalene	50	mg/Kg	0.17 J	0.5	0.55 U	0.39 U	0.14 J
85-01-8	Phenanthrene	50	mg/Kg	0.4 U	4.6	0.55 U	0.39 U	0.056 J
129-00-0	Pyrene	50	mg/Kg	0.4 U	2.7	0.55 U	0.39 U	0.042 J
91-57-6	2-Methylnaphthalene		mg/Kg					
PAHs	Total PAHs		mg/Kg	0.17	20.636	ND	ND	0.282
	PHENOLs							
105-67-9	2,4-Dimethylphenol	NS	mg/Kg	0.4 U	0.063 J	0.55 U	0.39 U	0.4 U
95-48-7	2-Methylphenol	0.344	mg/Kg	0.4 U	0.44 U	0.55 U	0.39 U	0.4 U
106-44-5	4-Methylphenol	3.89	mg/Kg	0.4 U	0.062 J	0.55 U	0.39 U	0.4 U
PHENOLS	Total Phenols		mg/Kg	ND	0.125	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	NS	mg/Kg	1.2 U	1.3 U	1.4 U	1.2 U	1.2 U
SOLIDS	Percent Solids		%	83	76.1	70.5	84.8	82.9

ND - Not Detected (totals)
U - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.
SB -Site Background.
[shaded box] - Indicates a concentration above the standard.

Table 6.8
BURA Fourth Street Site
Analytical Results with PRGs for Soil

CAS NO.	COMPOUND	Proposed PRG (Adjusted TAGM Soil Cleanup Objective or BUTL)	SAMPLE ID: / DEPTH: / LAB ID: / SOURCE: / SDG: / MATRIX: / SAMPLED: / VALIDATED: / UNITS:	MW-5C / 4-6' / 186319-04 / STL / PE141 / SOIL / 5/6/98 / 7/3/98	MW-5I / 16-18' / 186319-05 / STL / PE141 / SOIL / 5/6/98 / 7/3/98	MW-06D / 6-8' / 186319-09 / STL / PE141 / SOIL / 5/6/98 / 7/3/98	MW-06G / 12-14' / 186319-10 / STL / PE141 / SOIL / 5/6/98 / 7/3/98	MW-07D / 6-8' / 186375-01 / STL / PE141 / SOIL / 5/8/98 / 7/3/98
	BTEX							
71-43-2	Benzene	0.266	mg/Kg	0.34 U	0.0011 U	0.0013 U	0.0013 UJ	0.0014 U
100-41-4	Ethylbenzene	25.2	mg/Kg	0.34 U	0.0011 U	0.0013 U	0.0013 UJ	0.0014 U
108-88-3	Toluene	6.87	mg/Kg	0.34 U	0.0011 U	0.0013 U	0.0013 UJ	0.0014 U
1330-20-7	Xylenes, total	5.5	mg/Kg	0.43	0.0011 U	0.0013 U	0.0013 UJ	0.0014 U
BTEX	Total BTEX		mg/Kg	0.43	ND	ND	ND	ND
	PAHs							
83-32-9	Acenaphthene	50	mg/Kg	0.45 U	R	0.43 U	R	0.45 U
208-96-8	Acenaphthylene	50	mg/Kg	0.45 U	R	0.43 U	R	0.45 U
120-12-7	Anthracene	50	mg/Kg	0.45 U	R	0.43 U	R	0.45 U
56-55-3	Benzo(a)anthracene	1.8	mg/Kg	0.076 J	R	0.15 J	R	0.45 U
50-32-8	Benzo(a)pyrene	1.6	mg/Kg	0.055 J	R	0.12 J	R	0.45 U
205-99-2	Benzo(b)fluoranthene	5.04	mg/Kg	0.073 J	R	0.15 J	R	0.45 U
191-24-2	Benzo(g,h,i)perylene	50	mg/Kg	0.45 U	R	0.043 J	R	0.45 U
207-08-9	Benzo(k)fluoranthene	5.04	mg/Kg	0.45 U	R	0.047 J	R	0.45 U
218-01-9	Chrysene	1.83	mg/Kg	0.069 J	R	0.14 J	R	0.45 U
53-70-3	Dibenzo(a,h)anthracene	0.37	mg/Kg	0.45 U	R	0.43 U	R	0.45 U
132-64-9	Dibenzofuran	28.2	mg/Kg	0.45 U	R	0.43 U	R	0.45 U
206-44-0	Fluoranthene	50	mg/Kg	0.14 J	R	0.27 J	R	0.45 U
86-73-7	Fluorene	50	mg/Kg	0.45 U	R	0.43 U	R	0.45 U
193-39-5	Indeno(1,2,3-cd)pyrene	14.7	mg/Kg	0.45 U	R	0.054 J	R	0.45 U
91-20-3	Naphthalene	50	mg/Kg	0.66	R	0.43 U	R	0.45 U
85-01-8	Phenanthrene	50	mg/Kg	0.12 J	R	0.17 J	R	0.45 U
129-00-0	Pyrene	50	mg/Kg	0.13 J	R	0.23 J	R	0.45 U
91-57-6	2-Methylnaphthalene		mg/Kg					
PAHs	Total PAHs		mg/Kg	1.323	R	1.374	R	ND
	PHENOLs							
105-67-9	2,4-Dimethylphenol	NS	mg/Kg	0.45 U	0.38 U	0.43 U	0.42 U	0.45 U
95-48-7	2-Methylphenol	0.344	mg/Kg	0.45 U	0.38 U	0.43 U	0.42 U	0.45 U
106-44-5	4-Methylphenol	3.89	mg/Kg	0.45 U	0.38 U	0.43 U	0.42 U	0.45 U
PHENOLS	Total Phenols		mg/Kg	ND	ND	ND	ND	ND
	INORGANICS							
57-12-9	Cyanide	NS	mg/Kg	1.3 U	1.1 U	1.3 U	1.3 U	1.3 U
SOLIDS	Percent Solids		%	74.5	87.2	77.6	78.8	73.6

ND - Not Detected (totals)
U - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.
SB -Site Background.
[shaded box] - Indicates a concentration above the standard.

Table 6.8
BURA Fourth Street Site
Analytical Results with PRGs for Soil

CAS NO.	COMPOUND	Proposed PRG (Adjusted TAGM Soil Cleanup Objective or BUTL)	SAMPLE ID: / DEPTH: / LAB ID: / SOURCE: / SDG: / MATRIX: / SAMPLED: / VALIDATED: / UNITS:	MW-07I / 16-18' / 186375-02 / STL / PE141 / SOIL / 5/8/98 / 7/3/98	MW-08F / 10-12' / 186525-10 / STL / PE525 / SOIL / 5/11/98 / 7/3/98	MW-08I / 16-18' / 186525-12 / STL / PE525 / SOIL / 5/11/98 / 7/3/98	MW-09D / 6-8' / 186525-08 / STL / PE525 / SOIL / 5/11/98 / 7/3/98	MW-09H / 14-16' / 186525-09 / STL / PE525 / SOIL / 5/11/98 / 7/3/98
	BTEX							
71-43-2	Benzene	0.266	mg/Kg	0.0013 UJ	0.0013 U	0.0012 UJ	0.0033 J	0.23
100-41-4	Ethylbenzene	25.2	mg/Kg	0.0013 UJ	0.0013 U	0.0012 UJ	0.0013 UJ	0.19
108-88-3	Toluene	6.87	mg/Kg	0.0013 UJ	0.0011 J	0.0011 J	0.0013 UJ	0.0059 U
1330-20-7	Xylenes, total	5.5	mg/Kg	0.0013 UJ	0.0013 U	0.0012 UJ	0.0013 UJ	0.15
BTEX	Total BTEX		mg/Kg	ND	0.0011	0.0011	0.0033	0.57
	PAHs							
83-32-9	Acenaphthene	50	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.4 J	0.4 UJ
208-96-8	Acenaphthylene	50	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.42 UJ	0.4 UJ
120-12-7	Anthracene	50	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.72 J	0.4 UJ
56-55-3	Benzo(a)anthracene	1.8	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.85 J	0.4 UJ
50-32-8	Benzo(a)pyrene	1.6	mg/Kg	0.43 U	0.082 J	0.39 UJ	0.51 J	0.4 UJ
205-99-2	Benzo(b)fluoranthene	5.04	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.61 J	0.4 UJ
191-24-2	Benzo(g,h,i)perylene	50	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.15 J	0.4 UJ
207-08-9	Benzo(k)fluoranthene	5.04	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.25 J	0.4 UJ
218-01-9	Chrysene	1.83	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.7 J	0.4 UJ
53-70-3	Dibenzo(a,h)anthracene	0.37	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.064 J	0.4 UJ
132-64-9	Dibenzofuran	28.2	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.26 J	0.4 UJ
206-44-0	Fluoranthene	50	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	1.1 J	0.4 UJ
86-73-7	Fluorene	50	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.52 J	0.4 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	14.7	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.2 J	0.4 UJ
91-20-3	Naphthalene	50	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.33 J	0.4 UJ
85-01-8	Phenanthrene	50	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	1.6 J	0.4 UJ
129-00-0	Pyrene	50	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	1.3 J	0.4 UJ
91-57-6	2-Methylnaphthalene		mg/Kg					
PAHs	Total PAHs		mg/Kg	ND	0.082	ND	9.564	ND
	PHENOLs							
105-67-9	2,4-Dimethylphenol	NS	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.42 UJ	0.4 UJ
95-48-7	2-Methylphenol	0.344	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.42 UJ	0.4 UJ
106-44-5	4-Methylphenol	3.89	mg/Kg	0.43 U	0.43 UJ	0.39 UJ	0.059 J	0.4 UJ
PHENOLS	Total Phenols		mg/Kg	ND	ND	ND	0.059	ND
	INORGANICS							
57-12-9	Cyanide	NS	mg/Kg	1.3 U	1.2 U	1.1 U	2.9	1.2 U
SOLIDS	Percent Solids		%	77.2	76.8	85.4	79	84.2

ND - Not Detected (totals)
U - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.
SB -Site Background.
[shaded box] - Indicates a concentration above the standard.

Table 6.8
BURA Fourth Street Site
Analytical Results with PRGs for Soil

CAS NO.	COMPOUND	Proposed PRG (Adjusted TAGM Soil Cleanup Objective or BUTL)						
			SAMPLE ID:	MW10D	MW10I	UB001	UB002	UB002-DUP
			DEPTH:	6-8'	16-18'	12-14'	10-12'	10-12'
			LAB ID:	195271-01	195271-02	206975-04	206975-03	206975-06
			SOURCE:	STL	STL	STL	STL	STL
			SDG:	195271/195	195271/195	206975	206975	206975
			MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL
			SAMPLED:	11/13/98	11/13/98	08/25/99	08/25/99	08/25/99
			VALIDATED:	12/26/98	12/26/98	10/15/99	10/15/99	10/15/99
			UNITS:					
	BTEX							
71-43-2	Benzene	0.266	mg/Kg	0.0014 UJ	0.0011 U	0.4	0.0028 J	0.13 J
100-41-4	Ethylbenzene	25.2	mg/Kg	0.0014 UJ	0.0011 U	0.0051 J	0.012 J	0.0064 UJ
108-88-3	Toluene	6.87	mg/Kg	0.0014 UJ	0.0011 U	0.0043 J	0.0013 UJ	0.0064 U
1330-20-7	Xylenes, total	5.5	mg/Kg	0.0014 UJ	0.0011 U	0.02	0.0009 J	0.014 J
BTEX	Total BTEX		mg/Kg	ND	ND	0.4294	0.0157	0.144
	PAHs							
83-32-9	Acenaphthene	50	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
208-96-8	Acenaphthylene	50	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
120-12-7	Anthracene	50	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
56-55-3	Benzo(a)anthracene	1.8	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
50-32-8	Benzo(a)pyrene	1.6	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
205-99-2	Benzo(b)fluoranthene	5.04	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
191-24-2	Benzo(g,h,i)perylene	50	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
207-08-9	Benzo(k)fluoranthene	5.04	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
218-01-9	Chrysene	1.83	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
53-70-3	Dibenzo(a,h)anthracene	0.37	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
132-64-9	Dibenzofuran	28.2	mg/Kg	0.41 U	0.37 U			
206-44-0	Fluoranthene	50	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
86-73-7	Fluorene	50	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	14.7	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
91-20-3	Naphthalene	50	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.05 J	0.17 J
85-01-8	Phenanthrene	50	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
129-00-0	Pyrene	50	mg/Kg	0.41 U	0.37 U	0.49 UJ	0.42 UJ	0.43 UJ
91-57-6	2-Methylnaphthalene		mg/Kg			0.49 UJ	0.42 UJ	0.43 UJ
PAHs	Total PAHs		mg/Kg	ND	ND	ND	0.05	0.17
	PHENOLS							
105-67-9	2,4-Dimethylphenol	NS	mg/Kg	0.41 U	0.37 U	NA	NA	NA
95-48-7	2-Methylphenol	0.344	mg/Kg	0.41 U	0.37 U	NA	NA	NA
106-44-5	4-Methylphenol	3.89	mg/Kg	0.41 U	0.37 U	NA	NA	NA
PHENOLS	Total Phenols		mg/Kg	ND	ND	NA	NA	NA
	INORGANICS							
57-12-9	Cyanide	NS	mg/Kg	1.4 U	1.1 U	NA	NA	NA
SOLIDS	Percent Solids		%	72.6	90.4	NA	NA	NA

ND - Not Detected (totals)
U - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.
SB -Site Background.
[shaded box] - Indicates a concentration above the standard.

Table 6.8
BURA Fourth Street Site
Analytical Results with PRGs for Soil

CAS NO.	COMPOUND	Proposed PRG (Adjusted TAGM Soil Cleanup Objective or BUTL)	SAMPLE ID: / DEPTH: / LAB ID: / SOURCE: / SDG: / MATRIX: / SAMPLED: / VALIDATED: / UNITS:	UB003 / 10-12' / 206975-08 / STL / 206975 / SOIL / 08/25/99 / 10/15/99	UB005 / 10-12' / 206975-05 / STL / 206975 / SOIL / 08/25/99 / 10/15/99	UB006 / 10-12' / 206975-05 / STL / 206975 / SOIL / 08/25/99 / 10/15/99	UB007 / 10-12' / 206975-02 / STL / 206975 / SOIL / 08/25/99 / 10/15/99	UB008 / 10-12' / 206975-01 / STL / 206975 / SOIL / 08/25/99 / 10/15/99
	BTEX							
71-43-2	Benzene	0.266	mg/Kg	0.0013 UJ	0.0013 U	0.0047 J	0.1	0.0012 UJ
100-41-4	Ethylbenzene	25.2	mg/Kg	0.001 J	0.0021	0.007 U	0.0064 U	0.0046 J
108-88-3	Toluene	6.87	mg/Kg	0.0013 UJ	0.0023	0.007 U	0.0036 J	0.0012 UJ
1330-20-7	Xylenes, total	5.5	mg/Kg	0.0013 UJ	0.0055	0.014	0.013	0.0012 UJ
BTEX	Total BTEX		mg/Kg	0.001	0.0099	0.0187	0.1166	0.0046
	PAHs							
83-32-9	Acenaphthene	50	mg/Kg	0.44 UJ	0.44 UJ	0.47 UJ	0.42 UJ	0.41 UJ
208-96-8	Acenaphthylene	50	mg/Kg	0.44 UJ	0.44 UJ	0.47 UJ	0.42 UJ	0.41 UJ
120-12-7	Anthracene	50	mg/Kg	0.44 UJ	0.048 J	0.47 UJ	0.42 UJ	0.41 UJ
56-55-3	Benzo(a)anthracene	1.8	mg/Kg	0.44 UJ	0.44 UJ	0.47 UJ	0.42 UJ	0.41 UJ
50-32-8	Benzo(a)pyrene	1.6	mg/Kg	0.44 UJ	0.44 UJ	0.47 UJ	0.42 UJ	0.41 UJ
205-99-2	Benzo(b)fluoranthene	5.04	mg/Kg	0.44 UJ	0.44 UJ	0.47 UJ	0.42 UJ	0.41 UJ
191-24-2	Benzo(g,h,i)perylene	50	mg/Kg	0.44 UJ	0.44 UJ	0.47 UJ	0.42 UJ	0.41 UJ
207-08-9	Benzo(k)fluoranthene	5.04	mg/Kg	0.44 UJ	0.44 UJ	0.47 UJ	0.42 UJ	0.41 UJ
218-01-9	Chrysene	1.83	mg/Kg	0.44 UJ	0.44 UJ	0.47 UJ	0.42 UJ	0.41 UJ
53-70-3	Dibenzo(a,h)anthracene	0.37	mg/Kg	0.44 UJ	0.44 UJ	0.47 UJ	0.42 UJ	0.41 UJ
132-64-9	Dibenzofuran	28.2	mg/Kg					
206-44-0	Fluoranthene	50	mg/Kg	0.44 UJ	0.44 UJ	0.47 UJ	0.42 UJ	0.41 UJ
86-73-7	Fluorene	50	mg/Kg	0.44 UJ	0.046 J	0.47 UJ	0.42 UJ	0.41 UJ
193-39-5	Indeno(1,2,3-cd)pyrene	14.7	mg/Kg	0.44 UJ	0.44 UJ	0.47 UJ	0.42 UJ	0.41 UJ
91-20-3	Naphthalene	50	mg/Kg	0.44 UJ	0.1 J	0.47 UJ	0.42 UJ	0.41 UJ
85-01-8	Phenanthrene	50	mg/Kg	0.44 UJ	0.48 J	0.47 UJ	0.42 UJ	0.41 UJ
129-00-0	Pyrene	50	mg/Kg	0.44 UJ	0.086 J	0.47 UJ	0.42 UJ	0.41 UJ
91-57-6	2-Methylnaphthalene		mg/Kg	0.44 UJ	0.14 J	0.47 UJ	0.42 UJ	0.41 UJ
PAHs	Total PAHs		mg/Kg	ND	0.9	ND	ND	ND
	PHENOLs							
105-67-9	2,4-Dimethylphenol	NS	mg/Kg	NA	NA	NA	NA	NA
95-48-7	2-Methylphenol	0.344	mg/Kg	NA	NA	NA	NA	NA
106-44-5	4-Methylphenol	3.89	mg/Kg	NA	NA	NA	NA	NA
PHENOLS	Total Phenols		mg/Kg	NA	NA	NA	NA	NA
	INORGANICS							
57-12-9	Cyanide	NS	mg/Kg	NA	NA	NA	NA	NA
SOLIDS	Percent Solids		%	NA	NA	NA	NA	NA

ND - Not Detected (totals)
U - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.
R - Rejected Value.
SB -Site Background.
[shaded box] - Indicates a concentration above the standard.

Table 6.9

BURA Fourth Street Site
Analytical Results with PRGs for Groundwater

CAS NO.	COMPOUND	Proposed PRG (NYSDEC Class GA Groundwater Standards)	SAMPLE ID: LAB ID: SOURCE: SDG: MATRIX: SAMPLED: VALIDATED: UNITS:	MW-03 186721-03 STL PE721 WATER 5/15/98 7/3/98	MW-04 186721-02 STL PE721 WATER 5/15/98 7/3/98	MW-05 186721-06 STL PE721 WATER 5/15/98 7/3/98	MW-06 186721-08 STL PE721 WATER 5/15/98 7/3/98
	BTEX						
71-43-2	Benzene	1	ug/L	1.5	0.7 J	4	0.5 J
100-41-4	Ethylbenzene	5	ug/L	1 U	2.7	13	1 U
108-88-3	Toluene	5	ug/L	1 U	1 U	1.9	1.1
1330-20-7	Xylenes, total	5	ug/L	1 U	7.9	2.8	1.3
BTEX	Total BTEX		ug/L	1.5	11.3	21.7	2.9
	PAHs						
83-32-9	Acenaphthene	20	ug/L	2 J	10 U	10 U	11 U
86-73-7	Fluorene	50	ug/L	1 J	10 U	10 U	11 U
91-20-3	Naphthalene	10	ug/L	10 U	10 U	4 J	11 U
129-00-0	Pyrene	50	ug/L	1 J	10 U	10 U	11 U
PAHs	Total PAHs		ug/L	4	ND	4	ND
	PHENOLS						
108-95-2	Phenol	See Total	ug/L	10 U	10 U	10 U	11 U
PHENOLS	Total Phenols	1	ug/L	ND	ND	ND	ND
	INORGANICS						
57-12-9	Cyanide	200	ug/L	85	10 U	11	10 U

U - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.

[shaded box] - Indicates a concentration above the standard.

Table 6.9
BURA Fourth Street Site
Analytical Results with PRGs for Groundwater

CAS NO.	COMPOUND	Proposed PRG (NYSDEC Class GA Groundwater Standards)	SAMPLE ID: LAB ID: SOURCE: SDG: MATRIX: SAMPLED: VALIDATED: UNITS:	MW-07 186721-07 STL PE721 WATER 5/15/98 7/3/98	MW-08 186721-05 STL PE721 WATER 5/15/98 7/3/98	MW-09 186721-04 STL PE721 WATER 5/15/98 7/3/98	MW10 195482-01 STL 195482 WATER 11/18/98 12/27/98
	BTEX						
71-43-2	Benzene	1	ug/L	1 U	1 U	1900	0.6 J
100-41-4	Ethylbenzene	5	ug/L	1 U	1 U	41	1 U
108-88-3	Toluene	5	ug/L	1 U	1 U	2.4	0.5 J
1330-20-7	Xylenes, total	5	ug/L	1 U	1 U	44	1 U
BTEX	Total BTEX		ug/L	ND	ND	1987.4	1.1
	PAHs						
83-32-9	Acenaphthene	20	ug/L	10 U	11 U	7 J	10 U
86-73-7	Fluorene	50	ug/L	10 U	11 U	2 J	10 U
91-20-3	Naphthalene	10	ug/L	10 U	11 U	10 U	10 U
129-00-0	Pyrene	50	ug/L	10 U	11 U	10 U	10 U
PAHs	Total PAHs		ug/L	ND	ND	9	ND
	PHENOLs						
108-95-2	Phenol	See Total	ug/L	10 U	11 U	42	10 U
PHENOLS	Total Phenols	1	ug/L	ND	ND	42	ND
	INORGANICS						
57-12-9	Cyanide	200	ug/L	10 U	10 U	13	140 J

U - Not Detected.
J - Estimated Value.
JN - Estimated with a tentative identification.

[shaded box] - Indicates a concentration above the standard.

SECTION 7

SECTION 7
IDENTIFICATION AND SCREENING OF TECHNOLOGIES

7.1 INTRODUCTION

This section describes the following steps needed to develop remedial action alternatives:

- Preliminary screening of the technologies and process options with respect to implementability, effectiveness, and cost; and
- Identification of potentially suitable technologies (including innovative technologies) and/or process options.

The NYSDEC TAGM HWR-90-4030 specifies that individual remedial technologies should be preliminarily screened on their ability to meet media-specific remedial action objectives, their implementability, and their short-term and long-term effectiveness. In addition, the EPA National Oil and Hazardous Substances Pollution Contingency Plan (abbreviated as "NCP") under CERCLA states in 40 CFR Section 300.430 that cost can be used as a criterion to preliminarily screen remedial alternatives. The NCP states that grossly excessive costs, compared to the overall effectiveness of alternatives, may be used as one of several factors to eliminate alternatives. In addition, an alternative providing effectiveness and implementability equivalent to that of another alternative, but at a greater cost, may also be eliminated.

Screening for effectiveness considers three important aspects: (1) the ability of the process to handle estimated volumes or areas, and meet the remedial action objectives; (2) the potential for the process to impact human health and the environment during implementation; and (3) the reliability and record of performance for the process. Implementability encompasses technical feasibility, availability of the technologies, and the administrative feasibility of implementing a technology or process (USEPA, 1988 and NYSDEC, 1990). If an alternative requires equipment, specialists, or facilities that are not available within a reasonable period of time, it may be eliminated from further consideration (USEPA, 1993b). Screening based on cost focuses on both the costs of construction and long-term operation and maintenance costs (USEPA, 1993b).

Screening and technology summary information is presented herein, with additional information available for coal- and petroleum-based residuals in Section 3 of the Draft Feasibility Study submittal for the Harbor Point Site (Parsons ES, 1997). As coal- and petroleum-related constituents are similar, the soil technologies presented herein are potentially applicable to the Site. Many of the groundwater technologies presented are capable of remediating petroleum and chlorinated constituents, as well as coal-related constituents. Cost information for screening is provided in the text and tables for each technology considered and represents the technology cost only, not the overall remedial cost to achieve a cleanup objective. Cost rating levels are derived from the USEPA's Remediation Technologies Screening Matrix and Reference Guide (USEPA, 1993c).

Remedial action technologies were evaluated that would facilitate the RAOs listed in Section 6.4 and address the soil and groundwater. Both conventional and innovative remediation technologies are evaluated. Innovative treatment technologies, per the USEPA, are alternative treatment technologies (i.e. alternatives to land disposal) with limited full-scale experience and performance and cost data. Innovative technologies are identified where appropriate in the following tables. For the purpose of this FS, technologies are not considered innovative if they have at least one field trial at full-scale.

Tables 7.1 and 7.2 provide a summary of the technology screening process. Technologies are identified as potentially applicable for non-aqueous (soil) and aqueous (groundwater) media, respectively, for implementability and effectiveness as they pertain to Site conditions, and for cost as per NCP guidelines. Technologies are categorized into general response actions which include no action, institutional controls, capping, containment, removal, dewatering, preparation, treatment, and disposal. The "retained" and "not retained" status of each technology is stated in Tables 7.1 and 7.2 and summarized in Tables 7.3 and 7.4.

Note: A detailed discussion of applicable remedial technologies is provided in the FS Guidance Document for former MGP Sites (Parsons ES, 1996a). Therefore, only a very brief discussion is provided herein.

7.2 INSTITUTIONAL CONTROLS

One category of general response actions is institutional controls. Institutional controls generally provide readily implementable methods for preventing exposures to site-related residuals. Deed restrictions, runoff controls, and site security via fencing, locked entranceways, and "no trespassing" signs are typically highly effective, especially when used in conjunction with other remediation technologies. Monitoring of groundwater is an effective way to document changes in chemical characteristics over time. The cost to implement institutional controls can vary widely due to site-specific circumstances. For example, costs for groundwater monitoring depend on the size of the area requiring monitoring, the number of parameters being monitored, and the length of time monitoring is required.

7.3 CONTAINMENT TECHNOLOGIES

Soil and sediment covers can reduce potential exposure by preventing direct contact with residuals. An impermeable soil cap can both prevent direct contact and significantly reduce infiltration from precipitation or flooding. Barrier walls were evaluated based on their ability to restrict the potential migration of NAPLs and to contain groundwater from flowing offsite. Also, short-term groundwater pumping was evaluated to achieve steady-state groundwater flow conditions in conjunction with an impermeable cap and to create an inward hydraulic gradient. Barriers for surface water diversion were also considered. All of these technologies were evaluated as described herein.

7.3.1 Soil Containment Technologies

A soil cover or an impermeable cap can be covered with a vegetative surface layer, typically grass, or with crushed stone or asphalt (Figure 7.1). The surface layer of any cover or cap should be graded and maintained to control runoff, prevent flooding impacts, and minimize cap erosion. Various types of materials can be used to place a cover or cap, such as soils or alternate fill materials such as fly ash.

7.3.2 Groundwater Containment Technologies

Containment technologies evaluated included subsurface barriers and groundwater collection, such as wells or trenches.

7.3.2.1 Subsurface Barriers

Subsurface barrier wall technologies that are potentially applicable at the Site for containment of groundwater include: soil-bentonite, cement-bentonite, soil-attapulgite, cement-attapulgite, plastic concrete, and concrete slurry trenches; vibrating beam; geomembrane (for limited applications); and sheet pile barrier walls. However, barrier walls were not considered because of the limited nature and extent of groundwater impacts and because other technologies were considered more appropriate.

7.3.2.2 Groundwater Containment Via Collection

Extraction trenches and extraction wells are reliable and effective conventional methods for the containment of groundwater. Trenches are generally preferred if the groundwater to be collected extends within an elongated plume and is less than 20 to 25 feet deep. Wells are generally preferred if the groundwater to be collected is in multiple spots, if the area is broad laterally in both dimensions, or if the groundwater is deeper than 20 to 25 feet. Extraction wells are typically vertical wells; however, in recent years horizontal wells have been used particularly to collect shallow groundwater. The number and location of extraction trenches or wells needs to be determined based on the remedial action selected to maximize collection efficiency. Groundwater flow modeling might be used to provide a basis for optimizing numbers and locations of collection trenches or wells.

Groundwater extraction was not retained for further evaluation because of the limited nature and extent of groundwater impacts, and because other technologies were considered more appropriate.

7.4 SOURCE REMOVAL

Source removal options evaluated for soils include use of conventional equipment such as backhoes and excavators. Odors and volatile organic concentrations would be monitored and controlled, as needed.

7.5 PREPARATION OF SOILS FOR TREATMENT

Preparation of soils could include soil blending, screening, the dewatering of excavated soil and sediments, and the possible addition of solidification agent to the soils or sediments for improving material handling.

7.5.1 Soil Blending

Blending involves stabilizing compounds in soils and sediment with coal or other absorbent solid materials, as needed, prior to treatment or disposal. During the blending process, volatile constituents are freed and/or absorbed by the coal. A critical aspect of stabilizing is to use as little stabilizing material as possible (Shosky *et al.*, 1995).

7.5.2 Soil Screening

Screening of excavated material involves removing miscellaneous debris, such as wood and other objects from excavated soils prior to remediation. Screening is conducted to remove large particles and debris and thereby meet particle size requirements for transport, treatment, or disposal. A screening step was retained for further evaluation at the Site as a pretreatment/materials handling step in the soil remediation schemes.

7.5.3 Dewatering

Three dewatering techniques were considered for use following soil excavation. These techniques include dewatering by gravity, plate and frame press, and belt filter press. Each of these dewatering techniques can be tested at the bench-scale in a laboratory, as needed.

7.5.4 Solidification

Solidification is typically employed as a post-treatment step to make soils more manageable. The solidification process mixes an absorbent solid with wet soils to absorb excess water and improve material handling. Thus, solidification can provide dewatering, as well as material-handling benefits.

7.6 TREATMENT TECHNOLOGIES

Both conventional and less conventional treatment technologies were evaluated for use at the Site. Detailed technology information pertinent to evaluating these methods is contained in the Draft FS Document (Parsons ES, 1997). Many of the conventional treatment technologies are capable of remediating MGP residuals. Less conventional technologies are not retained for further evaluation if a site-specific pilot-scale test is needed. Larger former MGP sites, at locations with more space available, are more appropriate for testing less conventional technologies.

7.6.1 Soil Treatment Technologies

Potential soil treatment technologies consist of onsite treatment, offsite treatment, and recycle/reuse options. Onsite technologies that were evaluated were chemical oxidation, composting, CYAN-REM, extraction/soil washing, thermal desorption, IWT-Advanced Chemical Treatment, natural attenuation, passive bioventing, slurry phase bioremediation, in-place and *ex situ* stabilization, and the Sulchem Process. Incineration was considered as an offsite treatment, although any technology suitable for use onsite could potentially be used offsite. Recycle and reuse options are also viable and consist of cold-mix asphalt production without thermal pretreatment, both hot- and cold-mix asphalt production with thermal pretreatment, brick manufacture, cement manufacture, and co-burning in a utility boiler.

7.6.2 Groundwater/Filtrate Treatment Technologies

Nineteen different treatment technologies were identified for potential use to treat groundwater and filtrate from dewatering operations. These remediation techniques include the following: activated carbon, activated sludge, air stripping, alkaline hydrolysis, bag filtration, chemical oxidation, chemical precipitation, coagulation/flocculation, dissolved air/froth flotation, fluidized bed biological treatment, *in situ* air sparging, *in situ* bioremediation, ion exchange, natural attenuation, neutralization, oil/water separation, reactive barrier walls, sequencing batch reactors, UV/chemical oxidation/REDOX, and wetland applications.

7.6.3 Sparging and Intrinsic Bioremediation

Sparging, or biosparging, is the injection of air into the soil below the water table. It is used most commonly for treating sources of petroleum leaks and is very effective for volatile compounds in the groundwater. Monitoring wells can be configured in two ways: centered around the source of contamination, or in a line that is perpendicular to the groundwater flow so that the contamination can be intercepted. Soils with sands and gravel are preferred for sparging use because air that is introduced into heterogeneous soils tends to take preferential flow paths. Sparging can, however, work effectively in even these types of soils.

Intrinsic bioremediation, or natural attenuation, is the slowing of a dissolved contaminant plume in groundwater and the *in situ* reduction in contaminant concentration. The mechanisms of intrinsic bioremediation include biodegradation, abiotic oxidation, and hydrolysis. Numerous studies have documented that many petroleum hydrocarbons, particularly BTEX compounds, readily degrade naturally, and that complete mineralization of BTEX is possible. To demonstrate that intrinsic bioremediation is occurring, site characterization, modeling, and monitoring are all important, if not essential.

Based on the contamination found in the groundwater at the Site (exceedances of groundwater values for BTEX compounds only), and the location and size of the Site, sparging was retained for further evaluation as a remedial technology for treating groundwater and limiting its extent and migration.

7.6.4 DNAPL Extraction

It is not practical to completely remove DNAPL from the ground surface via extraction. DNAPL extraction tests at MGP sites in Utica, New York, and Stroudsburg, Pennsylvania, showed that DNAPL removal is not cost-effective. The 1995 DNAPL Extraction Demonstration Project completed at the New York site showed that subsurface residual DNAPL is extremely difficult to mobilize using hydraulic gradient manipulation and that the free-phase DNAPL accumulations were relatively low-conductivity, which inhibited the attempt to mobilize the DNAPL through enhanced hydraulic gradients (BB&L, 1996). In addition, extractability data from a field-scale remedial action of the CROW™ process at the MGP site in Pennsylvania was not effective at removing the DNAPL source in a cost-effective and timely manner (Parsons ES, 1997).

7.7 DISPOSAL OPTIONS

Disposal options have been identified for both soil and aqueous streams. Off-site disposal options were considered applicable for media from the Site.

7.7.1 Soil Disposal Options

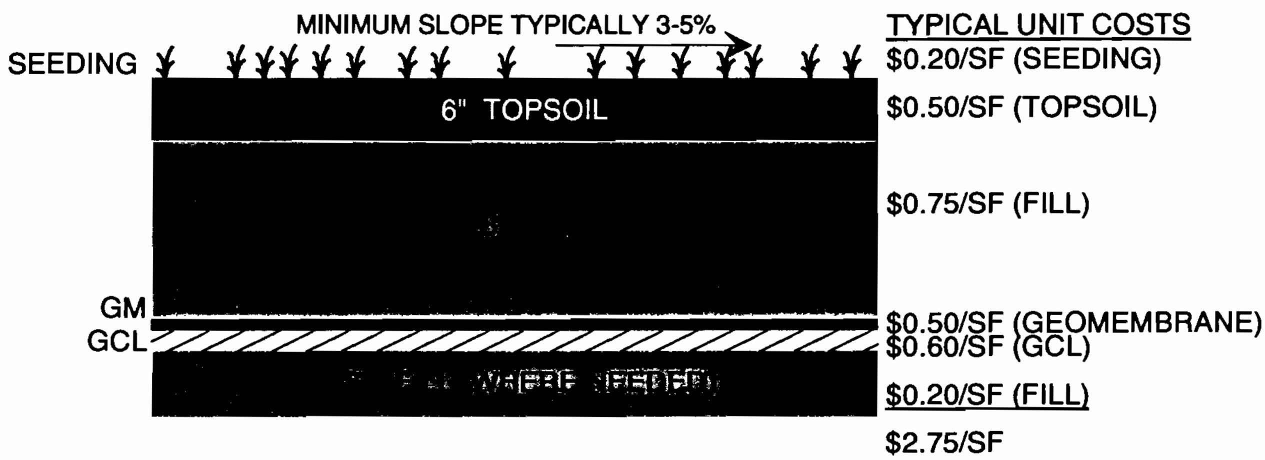
Offsite disposal options have been identified for the remediation of soils from the Site. Soils can be excavated, transported by truck, and disposed at an approved landfill permitted to receive these materials.

7.7.2 Aqueous Media Disposal Options

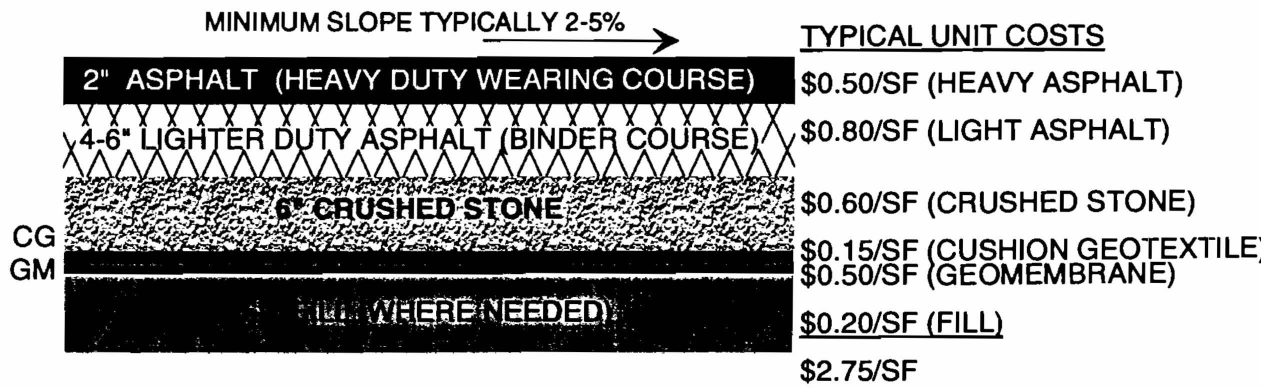
Site groundwater, leachate, surface water runoff, and filtrate from dewatering operations can be discharged or transported offsite to a publicly owned treatment works (POTW), to an adjacent surface water body, or to a permitted offsite treatment facility.

IMPERMEABLE CAP SCENARIOS

WITH GRASS COVER



WITH ASPHALT COVER



CG - CUSHION GEOTEXTILE
GM - GEOMEMBRANE
GCL - GEOSYNTHETIC CLAY
SF - SQUARE FOOT

TABLE 7.1
SCREENING OF REMEDIAL TECHNOLOGIES FOR SOILS ASSOCIATED WITH THE FOURTH STREET SITE

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST [1]	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION [2]
No Action	None	None	Achievement of remedial action objectives is dependent on compounds detected. Allows natural attenuation to occur.	Readily implementable. Not likely to be acceptable to public or regulatory agencies.	None	Retained for Comparative Purposes
Institutional Controls	Access Control	Deed Restrictions, Fencing/Posting	Achievement of remedial action objectives is dependent on compounds detected. Depends on future use and enforcement. Does not reduce contamination. Allows natural attenuation to occur. Prevents exposure to site contaminants from trespassing due to site proximity to public highway and waterway.	Readily implementable. Legal requirements and authority needed.	Variable	Retained
	Runoff Controls	Revegetation, Grading	Effective in minimizing surface water erosion due to runoff. Can be used along the perimeter to keep offsite runoff from migrating onsite and to control onsite runoff on caps.	Readily implementable if it does not interfere with the site's future redevelopment plans.	Variable	Retained
Containment	Soil Capping	Soil Cover	Effective for isolating shallow material from exposure. Limited effectiveness for minimizing infiltration.	Although requires time to implement, still readily implementable.	Low	Retained
		Impermeable Cap	Most effective and reliable as a physical and hydraulic impermeable barrier. Effective at minimizing direct contact and infiltration.	Requires more time to implement than soil cap.	Medium	Retained
Source Removal	Excavation of Soils	Mechanical Excavation	Large scale (heavy equipment) mechanical excavation is reliable and effective. Flow diversion and runon/runoff control often required.	Easily implemented due to use of conventional earth moving equipment.	Low	Retained

TABLE 7.1
SCREENING OF REMEDIAL TECHNOLOGIES FOR SOILS ASSOCIATED WITH THE FOURTH STREET SITE

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST [1]	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION [2]
Preparation	Soil Preparation (following excavation)	Solidification	Effective at improving the material handling of wet soils and for increasing mechanical strength of soils.	Easily implementable through the use of fly ash or lime. Sediment/soil volume would increase after solidification.	Low	Retained
		Consolidation (Uncontained)	Effective for consolidating contaminated material in one central location for treatment.	Readily implementable. Eliminates regulatory an cost implication associated with transporting the material.	Low	Not Retained
		EPRI/ARC Clean Soil Proces *(Innovative)*	Proven effective at bench and pilot scale. Limited data at full scale.	Potentially implementable. Innovative technology.	Low	Not Retained
		Soil Blending	Effective at stabilizing and rendering material nonhazardous by reducing the volatile compound concentration. Effective as a form of pretreatment for thermal desorption, co-burning, stabilization, etc.	Implementable.	Low	Retained
		Soil Screening	Effective at sizing soil particles and for removing debris from the material prior to treatment.	Readily implementable.	Low	Retained

TABLE 7.1
SCREENING OF REMEDIAL TECHNOLOGIES FOR SOILS ASSOCIATED WITH THE FOURTH STREET SITE

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST [1]	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION [2]
Treatment	Onsite treatment	Chemical Oxidation *(Innovative)*	An effective and proven technology for converting compounds of concern to less harmful species.	Implementable for solids when combined with a liquid to form a slurry. Not cost effective for high concentrations due to large amounts of oxidizing agents required.	Medium	Not Retained
		Composting/Land Farming/ Prepared Bed Treatment	Generally not effective at obtaining desired cleanup levels at sites as a "stand-alone" process	Piling of material is implementable. Typically nee the addition of a bulking agent.	Medium	Not Retained
		CYAN-REM *(Innovative)*	Effectiveness proven at a bench scale only.	Potentially implementable. Innovative technology. Large amounts of water requiring treatment would be generated.	High	Not Retained
		Extraction/Soil Washing	Proven effective for gross contamination. May need to be combined with other technologies to meet cleanup levels.	Implementability can be hindered by developing a wash solution for complex wastes.	Medium	Not Retained
		Thermal Desorption	Effective form of treatment for and sediment soils with low to high levels of organic contamination. Proven effective at full scale.	Implementable on-site and off-site.	Low to Medium (Depending on throughput)	Retained
		IWT-Advanced Chemical Treatment *(Innovative)*	Effective form of *in-situ* "stabilization". Limited testing at full scale.	Potentially implementable. Innovative technology.	Medium	Not Retained
		Slurry Phase Bioremediation Treatment	Relatively effective at the bench scale for soils. Not effective for purifier material due to woodchips and complexed CN. Carcinogenic PAHs reduced 6 to 45% during bench scale. Addition of Fenton's Reagent will increase reduction of higher-ringed PAHs.	Potentially implementable.	Medium	Not Retained
		Stabilization	Fly-ash/lime, cement kiln dust, and lime proven effective at stabilizing PAHs, BTEX, and metals i soils. Lack of long-term leaching data in soils.	Potentially implementable either *ex-situ* or *in-situ* using large diameter augers.	Low to Medium	Not Retained

TABLE 7.1
SCREENING OF REMEDIAL TECHNOLOGIES FOR SOILS
ASSOCIATED WITH THE FOURTH STREET SITE

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST [1]	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION [2]
Treatment (Cont'd)	Onsite treatment (Cont'd)	Sulchem Process (Innovative)	Limited effectiveness at bench scale. Effective at destroying organic compounds with boiling points above 350°C.	Innovative technology. No full-scale data. Potentially implementable.	Medium	Not Retained
	Offsite treatment	Incineration	Effective for destruction of organic compounds. Destruction removal efficiency for inorganics (metals and cyanide) is typically high. Dependent on physical/chemical properties of individual compounds.	Implementable for offsite treatment. Proven technology. Permitting and treatability testing may be time consuming.	High	Not Retained
	Recycle/Reuse	Thermally Desorbed Soil in Hot/Cold-Mix Asphalt (Bituminous Concrete)	Proven effective. Potential for leaching from asphalt without pretreatment. Asphalt products meet NYSDOT specifications. No long-term data available. Not time- or cost-effective for large quantities of soil due to low solids blending rate relative to asphalt feedstock.	Potentially implementable. A limited number of facilities are technically prepared and permitted to process.	Medium	Retained. (Applicable also to Purifier Soil)
		Cold-Mix Asphalt without Thermal Pretreatment (Bituminous Concrete)	Proven effective. TCLP extracts of asphalt mixes do not consistently meet NYSDEC groundwater quality standards. Not time- and cost-effective fo large quantities of soil due to low solids blending rate at the inlet. No long-term data available.	Potentially implementable; not fully proven. Asphalt must be used within one year of generation.	Medium, allowing for significant levels of aggregate	Retained.
		Brick Manufacture	Proven effective. Not time- and cost-effective for large quantities of soil due to low solids blending rate at inlet. No long-term data available.	Potentially implementable. Difficulty identifying a facility that is technically prepared and permitted to process residuals and has systems in place for soil storage and runoff disposal.	Low to Medium	Retained.
		Cement Manufacture	Proven effective. Not time- and cost-effective for large quantities of soil due to low solids blending rate at inlet. No long-term data available.	Potentially implementable. Difficulty identifying a facility that is technically prepared and permitted to process material and has systems in place for soil storage and runoff disposal.	Medium	Retained.
		Co-Burning in a Utility Boiler	Proven to be a technically effective method of remediation. No long-term data available. Not time- and cost-effective for large quantities of soil due to low solids blending rate at the inlet.	Potentially implementable. Acknowledged by EP at least until Land Ban Phase II is revised (1997) An environmental assessment of the impacts from process residuals may be initiated by the EPA.	Low to Medium	Retained.
		Fuel Recovery	Proven effective. Effects of vouable quantities or in flow rates appear to be minimal.	Potentially implementable at least one facility in New York State is permitted uncer RCRA.	Variable	Retained

TABLE 7.1
SCREENING OF REMEDIAL TECHNOLOGIES FOR SOILS
ASSOCIATED WITH THE FOURTH STREET SITE

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST [1]	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION [2]
Disposal	Off-Site	Permitted Landfill	Reliable and effective for disposal of non-hazardous material and soil in a permitted landfill. Does not destroy chemicals of concern.	Potentially implementable for disposal of non-hazardous materials.	Low	Retained
		Hazardous Waste Landfill	Effective if managed properly at a RCRA-permittedlandfill for isolating wastes from exposur to human health or the environment via groundwater.	Implementable for disposal of hazardous wastes. Some RCRA hazardous wastes may require treatment prior to disposal.	Medium	Retained
	On-Site	Landfill	Effective given proper construction of onsite landill. Compounds are not treated but left on-site.	Time consuming to implement. Requires handling of excavated soils. Difficulty obtaining permits to construct in a floodplain.	Variable	Not Retained

NOTES:

1. The cost presented represents the cost to implement a technology and does not represent the overall remedial cost to achieve a remedial action objective. The relative cost of technologies is presented as follows:
   - "None"
   - "Inadequate Information"
   - "Variable"
   - "Low": Less than $100/ton | Less than $150/CY | Less than $2/SF of land area
   - "Medium": $100-$300/ton | $150 to $450/CY | $2 to $5/SF of land area
   - "High": More than $300/ton | More than $450/CY | More than $5/SF of land area

   A typical conversion factor of 1.5 tons per CY was assumed to generate the cost categories based on CYs.
   Overall cost represents design, construction, and O&M costs of the core process that defines each technology, exclusive of mob/demob, and pre- and post-treatment including transportation. Rating levels based on tonnage are based on EPA/542/B-93/005 document, Remediation Technologies Screening Matrix and Reference Guide, July 1993.
2. Technologies "not retained" will not be considered for further evaluation at the Site.

TABLE 7.2
SCREENING OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER AND FILTRATE AT THE FOURTH STREET SITE

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST [1]	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION [2]
No Action/ Limited Action	None	None	Achievement of remedial action objectives is dependent on compounds detected. Allows natural attenuation to occur.	Readily implementable.	None	Retained for comparative purposes (with monitoring)
Institutional Controls	Access Control	Alternate Water Supply	Effective at minimizing exposure to the contaminated water source. Allows natural attenuation to occur.	Implementable. There are no public water supply wells located within the vicinity of the Site. Private wells within a 3-mile radius are used for industrial purposes or not used at all.	Variable	Not Retained
		Deed Restrictions	Depends on future site use and enforcement. Does not reduce contamination. Allows natural attenuation to occur.	Readily implementable. Legal requirements and authority needed.	Variable	Retained
	Monitoring	Groundwater Monitoring	Effective in documenting changes in chemical characteristics over time, requires preparation of a monitoring plan. Allows natural attenuation to occur.	Readily implementable.	Variable	Retained
Containment	Barrier Walls	Slurry Trenches with perimeter groundwater collection	Effective in containing contaminant plume. Hydraulic controls can increase effectiveness. Chemical compatibility may be a concern. Should have a confining layer to tie into.	Implementable. Depth range limited.	Low to Medium	Not Retained
		Sheetpile Barrier Wall with perimeter groundwater collection	Effective in containing contaminant plume. Hydraulic controls can increase effectiveness. Continuity is a concern between separate sheetpiles. Requires a confining layer to tie into.	Implementable. Depth range limited (less tha 30'); can be impeded by large subsurface objects.	Medium to High	Not Retained
		Vibrating Beam Barrier Wall *(Innovative)*	Effectiveness questioned due to concem with continuity between each injection. Must have a confining layer to tie into.	Readily implementable due to it being an in situ process. Depth range limited (less than 30').	Low	Not Retained

TABLE 7.2
SCREENING OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER AND FILTRATE AT THE FOURTH STREET SITE

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST (1)	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION (2)
Containment (Cont'd)	Barrier Walls (Cont'd)	Geomembrane Barrier Wall	Effective at resisting chemical attack. Not effective at staying leakproof and tear free. Must have a confining layer to tie into.	Implementable. Problems in past during installation.	Medium to High	Not Retained
	Extraction	Extraction Wells (Horizontal or Vertical)	Reliable and effective for capture of groundwater.	Readily implementable. Locations need to be predetermined.	Variable	Not Retained
		Extraction (Collection) Trenches	Effective at collecting groundwater.	Implementable. Locations need to be predetermined. Depth limited to <30 ft.	Variable	Not Retained
Treatment	Physical/Chemical Treatment	Activated Carbon	Proven effective with organic constituents, including BTEX, coal, petroleum, and chlorinated based constituents. Should be used in conjunction with other technologies. Disposal or regeneration of spent carbon required.	Readily implementable.	High	Not Retained
		Air Stripping	Effective for VOCs, including BTEX, chlorinated VOCs, and low molecular weight PAHs. Pretreatment required. Works well in conjunction with other technologies.	Readily implementable.	Low	Not Retained
		Alkaline Hydrolysis *(Innovative)*	Limited testing of effectiveness at a full scale.	Potentially implementable.	Inadequate Information	Not Retained
		Bag Filtration	Effective at filtering out solids from the untreated aqueous stream.	Implementable.	Low	Not Retained
		Chemical Oxidation	Effective for converting chlorinated, petroleum, and coal-based constituents to less harmful residuals. Not cost effective for high concentrations due to large amounts of oxidizing agents required.	Implementable.	Low	Not Retained
		Chemical Precipitation	Effective as a pretreatment for the removal of metals. Used successfully during the GAC-FBR NMPC Demonstration.	Implementable.	Low	Not Retained
		Coagulation/Flocculation	Effective at removing suspended matter from an aqueous discharge stream.	Implementable.	Low	Not Retained

TABLE 7.2
SCREENING OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER AND FILTRATE AT THE FOURTH STREET SITE

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST [1]	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION [2]
Treatment (Cont'd)	Physical/Chemical Treatment (Cont'd)	Dissolved Air/Froth Flotation	Effective as a pretreatment for removal of insolubles so that more expensive downstream operations are not affected. Effective over gravity separation when the specific gravity of the suspended media is very close to that of water.	Implementable.	Inadequate Information	Not Retained
		In-situ Air Sparging	Effective at removing volatile compounds, including BTEX and other VOCs from perimeter groundwater.	Implementable.	Low	Retained
		Ion Exchange	Sorbplus proven effective at onsite water treatment system.	Implementable.	Inadequate Information	Not Retained
		Neutralization	Effective at adjusting the pH of a an aqueous stream to a neutral level required for discharge.	Implementable.	Variable	Not Retained
		Oil/Water Separator	Effective at removing free floating oil, grease, and settleable oily coated solids from oil-water mixtures.	Implementable.	Low	Not Retained
		UV/Chemical Oxidation *(Innovative)*	Effective for iron-cyanide complexes from purifier materials. Also effective for VOCs and petroleum constituents. Not cost effective for high compound concentrations due to cost of chemicals.	Implementable.	Medium	Not Retained [3]
	Biological Treatment	Activated Sludge	Effective when used at POTWs for the co-treatment of groundwaters containing petroleum and coal-based constituents. Site groundwater will in many cases be too dilute to support an activated sludge system.	Implementable. Influent water typically requires pretreatment for removal of suspende solids and free phase oil and tars. High maintenance.	Low to Medium	Not Retained
		Fluidized Bed Biological Treatment	Effective. Typically part of a treatment train. Used successfully at the lab, pilot, and full scales.	Implementable.	High	Not Retained
		In-Situ Bioremediation	Effective for the remediation of BTEX and some chlorinated constituents. Not proven effective for carcinogenic PAHs and complexed cyanide. Innovative.	Readily implementable. May require the introduction of nonindigenous microbes and reagents.	Low	Not Retained

TABLE 7.2
SCREENING OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER AND FILTRATE AT THE FOURTH STREET SITE

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST (1)	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION (2)
Treatment (Cont'd)	Biological Treatment (Cont'd)	Intrinsic Bioremediation	Effectiveness is site-specific and constituent-specific. Best when used at sites with land buffer around source area. Works well in conjunction with other technologies. Proven effective not as source remediation, but for residual plumes.	Readily implementable. Treatment time typically in the order of years.	Low	Retained
		Reactive Barrier Wall *(Innovative)*	Limited proven effectiveness. Constituent-specific based on treatment media used.	Implementable at shallow levels in areas where there is no gross NAPL.	Inadequate Information	Not Retained
		Sequencing Batch Reactor	Proven effective at the laboratory scale on waters similar to site waters. Effective treatment of petroleum and chlorinated constituents. Effective at resisting fluctuations in the influent.	Implementable. Very high maintenance. Time and labor intensive.	Inadequate Information	Not Retained
		Wetlands Development	Limited effectiveness at hazardous waste sites. May be effective in polishing treatment of water from dewatered sediments.	Potentially implementable.	Inadequate Information	Not Retained
Disposal	Offsite Discharge	POTW	Reliable and effective with proper maintenance and operation. Proven effective for the treatment of groundwaters containing petroleum or coal-based constituents at POTWs with activated sludge units.	Readily implementable. Pretreatment may be required to meet discharge limits. Permit required.	Based on User Fees	Not Retained
		SPDES Discharge to Surface Water	Reliable and effective.	Implementable. Will typically require a SPDE permit. Pretreatment typically required to meet SPDES discharge limits.	Variable	Not Retained
		Permitted Treatment Facility	Effective disposal method.	Implementable if there is a nearby permitted treatment facility.	Variable	Not Retained
	Onsite Discharge	Land Application	Not effective for floodplain areas. Need a large land area. Gloversville site located adjacent to 100-year floodplain.	Readily implementable.	Variable	Not Retained
		Surface Water	Effective form of discharge.	Implementable. Pretreatment may be required No surface waterbody exists onsite.	Variable	Not Retained

NOTES:

(1) The cost presented represents the cost to implement a technology and does not represent the overall remedial cost to achieve a remedial action objective. The relative cost of technologies is presented as follows:
- "None"
- "Inadequate Information"
- "Variable"
- "Low": Less than $3.00 / 1,000 gallons | Less than $10 per vertical SF
- "Medium": $3.00-$10.00 / 1,000 gallons | $10 to $20 per vertical SF
- "High": More than $10.00 / 1,000 gallons | More than $20 per vertical SF

Overall cost represents design, construction, and O&M costs of the core process that defines each technology, exclusive of mob/demob, and pre- and post-treatment. Rating levels based on gallons are based on EPA/542/B-93/005 document; Remediation Technologies Screening Matrix and Reference Guide, July 1993.

(2) Technologies "not retained" will not be considered for further evaluation at the Gloversville site. Generally, the "retained" technologies would need to be used in conjunction with one or more of the other retained technologies in the form of a groundwater treatment train to achieve desired cleanup goals.

(3) Considered primarily because workable options for cyanide removal are limited at this time.

TABLE 7.3
POTENTIALLY APPLICABLE TECHNOLOGIES RETAINED FOR REMEDIATING SOILS
FOURTH STREET SITE

INSTITUTIONAL CONTROLS	CONTAINMENT	SOURCE REMOVAL	PREPARATION/ TREATMENT	DISPOSAL
Access Control - Deed restrictions - Fencing/Posting Runoff Controls - Revegetation - Grading	Soil Capping - Soil cover cap	Excavation of Soils and Sediment - Mechanical excavation	Soil/Sediment Preparation - Solidification - Soil Blending - Soil Screening Offsite Treatment - Thermal desorption Recycle/Reuse - Hot-Mix Asphalt (thermally pretreated) - Cold-Mix Asphalt (thermally pretreated) - Cold-Mix Asphalt (without thermal pretreatment) - Brick Manufacture - Cement Manufacture - Co-burning in a utility boiler - Fuel Recovery	Offsite - Permitted landfill - Hazardous waste landfill

TABLE 7.4
POTENTIALLY APPLICABLE TECHNOLOGIES RETAINED FOR REMEDIATING GROUNDWATER AND FILTRATE
FOURTH STREET SITE

INSTITUTIONAL CONTROLS	CONTAINMENT	TREATMENT	DISPOSAL
Access Control - Deed restrictions Monitoring - Groundwater monitoring	(none retained)	Physical/Chemical Treatment - *In-situ* Air Sparging - Biological Treatment - Intrinsic Bioremediation	(none retained)

SECTION 8
DEVELOPMENT OF REMEDIAL ALTERNATIVES

8.1 INTRODUCTION

This section presents the development of three remedial alternatives for the onsite soil and groundwater. The remedial alternatives incorporate the elements of institutional controls, removal, containment, treatment, and disposal. The basis for these alternatives consists of the extent of PRG exceedances in the soil and groundwater and the technologies retained from Section 7 for remediating these media.

The Superfund regulations guiding remedial alternative evaluation efforts for CERCLA Sites are contained in the National Contingency Plan (NCP) under 40 CFR Part 300. Primary expectations of the NCP particularly relevant for developing and evaluating remediation alternatives, using CERCLA guidance, are as follows:

- Treatment of "principal threat wastes," comprised of liquids and highly mobile or high-risk toxic wastes, must be provided. This Site does not appear to contain such principal threat wastes.

- Engineering controls (i.e. containment) should be used for materials that are not a principal threat.

- Institutional controls should be considered to supplement other actions and further reduce public health and ecological impacts.

- Complementary use of remedial technologies for more cost-effective overall remedies, such as combining containment of low threat wastes with institutional controls, should be evaluated.

8.2 ONSITE SOIL/GROUNDWATER ALTERNATIVES

Soil PRG exceedances are found onsite at depths of up to 12 feet below ground surface (BGS). PRG exceedances in onsite soil exist primarily in the center of the Site where the historical structures, such as the purifying house, gas holders, sulfur plant, and retort house, were once located. Two samples, one near the tennis court and one near Fourth Street, also contain PRG exceedances. However, none of these soils pose a significant risk based on the results of the human health risk assessment summarized in Section 5.

Monitoring wells with groundwater PRG exceedances fall just outside the areas exhibiting onsite soil PRG exceedances. These groundwater exceedances (at MW-03, MW-04, and MW-05) consist of BTEX compounds only. MW-09, which is located on the southeast side of the school, had both BTEX and phenol exceedances. However, as mentioned in Section 4, this well is located outside the area of influence of the Site.

The potentially applicable technologies for remediating the soil and groundwater associated with the Site have all been incorporated into the three alternatives described in this Section. A critical point about one of the technologies not retained for the FS, the pump-and-treat system, is its ineffectiveness in meeting groundwater PRGs. Over the last several years, the lack of effectiveness of pumping and treating groundwater for the purpose of groundwater remediation has been acknowledged. In 1989, the USEPA, in a directive about groundwater remediation at Superfund sites, stated what had become widely accepted: that pumping groundwater cannot reduce groundwater concentrations to levels that are below typical site PRGs for groundwater (USEPA, 1989a). A study published in 1991 by Oak Ridge National Laboratory further confirmed that groundwater pumping is ineffective for restoring groundwater quality to health-based concentrations. This is due primarily to decreases in desorption of compounds from soil to groundwater, and to the existence of immobile constituents either in the non-aqueous phase or trapped in low hydraulic conductivity subsurface zones (Doty and Travis, 1991). It appears that groundwater has not been remediated at any former MGP site to concentrations below health-based PRGs using pump and treat remediation.

Based on the above discussion, groundwater pumping and treatment at the Site is not practical. Achievement of groundwater PRGs at the Site using this technology will not be possible. There are, however, no identified groundwater users at or downgradient of the Site. Therefore, a performance goal of attaining water quality standards at the downgradient property boundary will be used.

The soil/groundwater alternatives meet the soil/groundwater RAOs of eliminating contact with surface and subsurface soils exceeding PRGs, removing or controlling the potential impacts of identified sources (if any), monitoring groundwater to evaluate groundwater quality, and maintaining the current land use of the property. A brief description of each alternative is provided below:

Alternative 1 - Limited Action

1. Obtain a deed restriction, if needed, on the use of onsite groundwater.
2. Conduct short-term groundwater monitoring onsite and directly southwest of the Site to Year 5 to provide a baseline for natural attenuation..
3. Evaluate whether to enhance natural attenuation of groundwater onsite and directly southwest of the Site.

Alternative 2 - Containment

1. Place a soil cover with vegetation or an asphalt impermeable cap onsite to minimize exposure of soils to humans and the environment. A cross-section of

this cap is shown in Figure 7.1. The cap would cover the entire area of DNAPL occurrence (see Figures 4.4 and 8.1).

2. Obtain a deed restriction, if needed, on the use of onsite groundwater.
3. Conduct short-term groundwater monitoring with re-evaluation in Year 5.
4. Monitor groundwater to assess the potential for natural attenuation. Natural attenuation includes a monitoring program to evaluate whether various attenuation processes, particularly intrinsic bioremediation, are occurring. Enhance, if warranted, by implementing a contingency measure such as soil vapor extraction or air sparging.

Alternative 3 - Source Removal

Option A - Source Removal to One Foot Below the Water Table

1. Remove soil with PRG exceedances to depths of 1.5 to 9 feet below ground surface (bgs) (approximately 27,000 cubic yards of soil). (see Figures 4.4 and 6.1).
2. Transport and manage excavated material offsite.
3. Replace excavated material with clean fill to pre-excavation grade. Provide proper drainage and vegetate or pave area.
4. Conduct short-term groundwater monitoring with re-evaluation in Year 5.
5. Monitor groundwater to assess natural attenuation of groundwater.

Option B - Source Removal Based on Greatest Depth of PRG Exceedance

1. Remove soil exceeding PRGs to depths of 1.5 to 12 feet bgs (approximately 40,000 cubic yards of soil) (see Figures 4.4 and 6.1).
2. Dewater soil excavated from below the water table.
3. Transport and manage excavated material offsite.
4. Replace excavated material with clean fill to pre-excavation grade. Provide proper drainage and vegetate or pave area.
5. Conduct short-term groundwater monitoring with re-evaluation in Year 5.
6. Monitor groundwater to assess natural attenuation of groundwater.

8.3 EVALUATION CRITERIA

The detailed analysis of each alternative presented here uses the nine evaluation criteria outlined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Section 300.430; the USEPA "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA," (USEPA, 1988); and the

NYSDEC TAGM 4030, "Selection of Remedial Actions at Inactive Hazardous Waste Sites." Each alternative is assessed to determine if it meets the following criteria:

Threshold Criteria

- Overall protection of human health and the environment; and
- Compliance with SCGs.

Primary Balancing Criteria

- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume through treatment;
- Short-term effectiveness;
- Implementability; and
- Cost.

Modifying Criteria

- State acceptance; and
- Community acceptance.

For an alternative to be eligible for selection, the NCP requires that it meet the threshold criteria. If these criteria are met, the primary balancing criteria are evaluated to provide the best balance of trade-offs among alternatives. Of the five primary balancing criteria, emphasis is placed on long-term effectiveness and permanance and reduction of toxicity, mobility, or volume. In addition, consideration is given to principal threats and practicable remediation (see 40 CFR Section 300.430(a)(1)(iii)). USEPA defines the term "principal threats" as one of two conditions: (1) toxic concentrations several orders of magnitude above levels for unrestricted use; or (2) wastes that are both highly mobile and unable to be contained (USEPA, 1992). The term "practicable" is a site-specific, subjective term. The USEPA has defined practicability for specific sites based on cost-effectiveness, impacts, implementability, and the extent of SCG compliance. In making the final selection of a preferred remedy, the modifying criteria are also considered.

The threshold and primary balancing criteria are evaluated in this section for each of the remedial alternatives. In terms of state acceptance, Parsons ES and BURA have met with the NYSDEC and NYSDOH during the project, and the agencies will comment on this FS and then prepare the Proposed Remedial Action Plan and Record of Decision that specifies the Site remedy. To address community acceptance, BURA has made presentations at public meetings and solicited input from the community. Eventually, these modifying criteria will be evaluated in subsequent documents to be prepared by the State of New York: the Proposed Remedial Action Plan (PRAP) and the Record of Decision (ROD).

8.3.1 Overall Protection of Human Health and the Environment

The overall protection of human health and the environment criterion entails determining whether, considering the Site's characteristics and impacts, risks to human health and the environment are eliminated, reduced, or controlled. This assessment is based on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with SCGs.

8.3.2 Compliance with SCGs

This evaluation criteria is used to determine whether an alternative complies with the federal and state chemical-specific, location-specific, and action-specific SCGs identified in Section 6.

8.3.3 Long-term Effectiveness and Permanence

The long-term effectiveness and permanence of a remedial action depends on the following:

- Permanence of the remedial alternative;
- Magnitude of the risk remaining after remediation; and
- Adequacy and reliability of controls, if any, used to manage treatment residuals or untreated wastes that remain at the site following remediation.

8.3.4 Reduction of Toxicity, Mobility, or Volume

This criterion focuses on the impact of treatment technologies in eliminating any significant threats through destruction of toxic contaminants, reduction of their total mass, or irreversible reduction of the total volume of contaminated media. The reduction of toxicity, mobility, or volume criterion includes consideration of the following:

- Type of treatment or recycling process and type of materials;
- Amount of hazardous materials that would be destroyed or treated, including how principal threats would be addressed;
- Degree of expected reduction in toxicity, mobility, or volume estimated wherever reasonably possible as a percent reduction;
- Degree to which treatment would be irreversible;
- Type and quantity of residuals that would be present following treatment; and
- Fulfillment of the preference for treatment as a principal element.

8.3.5 Short-term Effectiveness

Short-term effectiveness encompasses the effects of an alternative on human health and the environment during the construction and implementation phase until RAOs are met. Short-term effectiveness considers the following:

- Protection of the community during remedial construction activities;
- Environmental impacts to Site employees, students at the nearby school, and remediation workers during remedial construction activities;
- Time until remedial response objectives are achieved; and
- Protection of workers during remedial construction activities.

8.3.6 Implementability

Implementability considers the technical and administrative feasibility of implementing an alternative and the availability of the services and materials required during its implementation. The implementability evaluation involves examining the issues of:

- Construction and operation;
- Reliability of technology;
- Monitoring considerations;
- Ease of undertaking additional remedial actions;
- Activities needed to coordinate with other offices and agencies, including onsite utility operations;
- Availability of adequate offsite treatment, storage capacity, and disposal services; and
- Availability of necessary equipment, specialists, skilled operators, and provisions to ensure any necessary additional resources.

8.3.7 Cost

A cost evaluation has been prepared that includes both capital, and operation and maintenance costs over a 30-year operating period, in accordance with USEPA RI/FS guidance. Current or future land value was not quantitatively addressed or factored into the cost estimates. It cannot be accurately predicted, and can vary depending on a number of factors, including: type of future land use and condition of site, future use of adjacent properties, and future neighborhood development initiatives.

8.4 EVALUATION OF ALTERNATIVE 1 - LIMITED ACTION

8.4.1 Description

This limited action alternative has been evaluated as a baseline to compare the overall effectiveness of each remedial alternative. A security fence would be constructed to prevent unauthorized access into the property. A deed restriction will be obtained to restrict the use of onsite groundwater. Groundwater would be monitored for five years to determine the baseline groundwater quality. Enhancement of intrinsic bioremediation in the groundwater onsite and directly southwest of the Site would be evaluated and conducted as warranted.

8.4.2 Overall Protection of Human Health and the Environment

Alternative 1 would not contain or eliminate the impacted soils or groundwater. Surface soil would continue to affect local plants and animals when they come in contact with the soil. However, if soil is not accessible, it would not impact human health. The existing vegetative cover will continue to be maintained in its current condition to limit fugitive dust. In addition, the extent of impacted groundwater has been defined, and groundwater from this Site would not impact human health because it is not used downgradient of the Site for domestic or industrial purposes.

8.4.3 Compliance with ARARs

Chemical-specific ARARs for soil and groundwater would not be met because no containment or removal of these media would occur under this alternative.

8.4.4 Long-term Effectiveness and Permanence

This alternative is not considered a permanent remedy. Human health risks from potential ingestion or dermal exposure to surface soil would be controlled by the installation of a security fence and the acquisition of a deed restriction for onsite groundwater. The fence would be susceptible to wear and vandalism, so annual inspection and repair would be required.

No direct engineering controls would be used to prevent migration of and exposure to impacts from subsurface soil and groundwater. Groundwater monitoring would track groundwater quality for five years, and intrinsic bioremediation would be enhanced, as warranted, to improve groundwater quality to the extent reasonably possible. As noted above, no groundwater users currently exist, and no risk from the impacted groundwater is anticipated.

8.4.5 Reduction of Toxicity, Mobility, or Volume

A reduction in the toxicity, mobility, or volume of the impacted soil and groundwater would not be achieved.

8.4.6 Short-term Effectiveness

No remedial action would be implemented for soil or groundwater, so no construction-related impacts on workers or the surrounding community would occur. In the short term, this alternative would be effective in restricting human access and exposure to the impacted media at the Site. Maintenance of the fence and enforcement of the deed restriction would be necessary to ensure the reliability of this alternative.

8.4.7 Implementability

Technical feasibility would not be a problem. In terms of administrative feasibility, the deed restriction can be implemented by BURA, and short-term groundwater monitoring would require yearly data management and assessment for five years.

8.4.8 Cost

Below are the costs for this alternative. Detailed cost estimates are presented in Appendix H.

Total Capital Costs	$61,000
Total O&M Present Worth	$100,000
Total Present Worth of Alternative	$160,000

8.5 EVALUATION OF ALTERNATIVE 2 - CONTAINMENT

8.5.1 Description

The containment alternative would consist of an impermeable cap with a vegetative or asphalt cover (see Figure 8.1). Deed restrictions, and short-term groundwater monitoring, as described in Alternative 1, would be included in this alternative, and groundwater would be monitored to assess intrinsic bioremediation processes.

8.5.2 Overall Protection of Human Health and the Environment

This alternative would significantly reduce potential risks to human health and the environment. It would eliminate contact by human and ecological receptors with onsite surface soils, and minimize infiltration of precipitation into the subsurface soil and groundwater. Furthermore, no downgradient users of groundwater exist. Thus, protection of human health and the environment would be provided under this alternative.

8.5.3 Compliance with ARARs

This alternative would not meet the groundwater or soil ARARs. Groundwater at the Site exceeds the proposed PRGs for BTEX only, but as noted earlier, no groundwater users exist, and groundwater monitoring will be performed to track the contamination levels and assess occurrence of intrinsic bioremediation.

8.5.4 Long-term Effectiveness and Permanence

BTEX and PAHs would continue to exist in the groundwater and soil, but an asphalt cap, if properly maintained, would act as an effective barrier against contact with site residuals for the long term. No impacts to the elementary school from NAPL, BTEX or PAHs in soil and groundwater, have been documented. Information from MW-10, a soil boring and monitoring well adjacent to the northern wall of the school building, showed that no detectable concentrations of BTEX or PAHs were present in the soil, nor were detectable levels of PAHs present in the groundwater at MW-10. The total BTEX concentration in the groundwater at MW-10 was 1.1 µg/L. No NAPL was found at MW-10. Drilling records indicate that the borings containing NAPL are 100 to 120 feet north to northwest from the school building.

8.5.5 Reduction of Toxicity, Mobility, or Volume

The toxicity, mobility, and volume of the impacted groundwater and soil would not be reduced. However, no groundwater users exist downgradient of the Site, and soil is not expected to be exposed once the impermeable cap is in place. Although this alternative would provide long-term effectiveness, it would not be a permanent remedy. The impacted soil and groundwater would remain, and the impacted groundwater may migrate downgradient while the impacted soil may contribute to groundwater impacts. Unconfined groundwater flow is generally to the west-southwest, and underground utility trenches and conduits may serve as potential preferential pathways for groundwater flow away from the Site. As stated in Section 4, however, potential migration of dissolved PAHs and BTEX from the Site appears to be very limited. Furthermore, the groundwater pathway is not complete, as groundwater in the vicinity is not used as a potable drinking water supply, and no primary aquifers are located within two miles of the Site. Groundwater flow is west-southwesterly, away from the school. The nearest residential areas are upgradient, and not expected to be impacted from the Site groundwater.

8.5.6 Short-term Effectiveness

No significant short-term effects would be anticipated from placement of the impermeable cap. In the short term, the cap would be effective and reliable, requiring little maintenance.

8.5.7 Implementability

The impermeable cap would be easily implemented.

8.5.8 Cost

Below are the costs for this alternative. Detailed cost estimates are presented in Appendix H.

Total Capital Costs	$550,000

Total O&M Present Worth	$130,000 to $350,000*
Total Present Worth of Alternative	$680,000 to $900,000*

*The range of costs accounts for a potential groundwater monitoring period ranging from five to 30 years (see Appendix H for details).

8.6 EVALUATION OF ALTERNATIVE 3 - SOURCE REMOVAL

8.6.1 Description

Under this alternative, a total of approximately 27,000 (Option A) or 40,000 (Option B) cubic yards of soil with PRG exceedances would be excavated and removed from the Site (see Figure 6.1). Excavation areas are identical for Options A and B, and were determined based on the halfway point between samples with PRG exceedances and "clean" samples. Excavation depths are either one foot below the water table (Option A), or one foot below the greatest depth at which PRG exceedances were detected during investigation efforts (Option B), therefore, soil would be excavated to depths between 1.5 and 12 feet below ground surface (bgs). A number of underground utilities, including an 8-foot diameter sewer line, intersect the excavation area and may have to be temporarily re-routed for excavation to occur.

All saturated soils would be dewatered, as needed, because excavation would occur below the water table, which is approximately 7 to 8 feet bgs in the excavation areas. The water separated from the excavated soil would be properly treated and discharged via a sanitary sewer or directly to the Buffalo Sewer Authority wastewater treatment plant for final treatment. Excavated soil would be treated as needed and landfilled as a solid or hazardous waste. Imported, clean fill would be used to backfill the excavated areas. An asphalt cover would be installed over the area of excavation so that use of the parking lot may continue.

8.6.2 Overall Protection of Human Health and the Environment

This alternative would provide overall protection of human health and the environment by eliminating most or all of the identified soil with PRG exceedances. Groundwater would be monitored for five years following soil removal. As warranted, intrinsic bioremediation of groundwater downgradient of the excavation area could potentially be enhanced to further reduce groundwater BTEX and PAH concentrations. Residents and workers may be exposed to odors during soil excavation, therefore odor suppression controls may be required.

8.6.3 Compliance with ARARs

This alternative would partially to completely comply with the soil and groundwater ARARs by removing approximately 75 percent (Option A) or all (Option B) of the soil that has been identified as having exceeded the PRGs.

8.6.4 Long-term Effectiveness and Permanence

Removal of the soil with PRG exceedances would be a permanent remedy and would substantially reduce the magnitude of risk remaining after remediation. No significant controls would be needed because little to no soil with impacts would remain. Groundwater would be monitored for five years to ensure the effectiveness of soil removal.

8.6.5 Reduction of Toxicity, Mobility, or Volume

Offsite treatment and/or disposal of the excavated soil and water would nearly eliminate the onsite toxicity, mobility, and volume of impacted material. The extent of overall toxicity reduction would depend on the extent of treatment provided. Mobility would be restricted to within the offsite disposal area where remedial wastes would eventually be disposed (e.g. a non-hazardous or hazardous waste landfill).

8.6.6 Short-term Effectiveness

This alternative would be both effective and reliable in the short term. Short-term risks associated with this alternative would be minimized by controlling storm water runoff, fugitive dust, odor generation, and spill potential. Dust and odor suppression controls, such as simultaneous excavating and backfilling, and covering stockpiled excavated materials, would be implemented. Ambient air monitoring would be performed to monitor particulate and organic vapor emissions during remediation. Odors resulting from excavating areas with MGP residuals can be significant if not properly controlled.

Trucks containing the excavated soil would leave the Site and pass through adjacent commercial areas on their way to I-190. Assuming that the capacity of a truck is 20 cubic yards, 900 truckloads would be required for transport under Option A, and 1,200 truckloads would be required under Option B.

8.6.7 Implementability

These excavations, which are relatively small in size and go down to a maximum of 6 feet below the water table under Option B, can be effectively conducted. (Option A would only go down to one foot below the water table, which would result in shallower excavation and less dewatering.) In the short term, underground utilities would have to be rerouted, and alternate arrangements for vehicle parking would be needed. Due to soil removal below the water table, it would likely be necessary to excavate 1:3 side slopes, dewater the excavation, and stockpile and dewater the soil. Wastewater generated from dewatering of the excavation area and filtrate generated from the dewatering of saturated soils would be managed at an onsite pre-treatment system, and discharged to the local publicly-owned treatment works (POTW) at the Buffalo Sewer Authority plant, if the plant agrees to this arrangement. Placement of an asphalt cover would be easily implementable. Also, odor suppression measures would have to be implemented.

8.6.8 Cost

Option A

Total Capital Costs	$3,300,000
Total O&M Present Worth	$100,000
Total Present Worth of Alternative	$3,400,000

Option B

Total Capital Costs	$4,900,000
Total O&M Present Worth	$100,000
Total Present Worth of Alternative	$5,000,000

8.7 COMPARISON OF ALTERNATIVES

The soil/groundwater alternatives evaluated for the BURA Site are summarized in Table 8.1. In this section, the three alternatives are compared based on the CERCLA evaluation criteria A summary of this comparative analysis is presented in Table 8.2.

The relative performances of Alternatives 1 and 2 could vary with the success or failure of the control of human access and the integrity of the asphalt cap, respectively. The failure of either control could result in exposure of impacted soil to humans, whereas the success of either control could prevent any human exposure to impacted soil.

Alternative 3 (Options A or B) would pose less uncertainty because impacted soil would be permanently removed from the Site. In addition, the removal of any substantial amount of impacted soil would greatly reduce the toxicity and volume of the material and minimize the potential for further impacts on soil and groundwater.8.7.1 Overall Protection of Human Health and the Environment

Potential exposure to chemical constituents would be substantially reduced with Alternatives 2 and 3. Alternatives 3a and 3b would result in the removal of more MGP constituents than Alternative 2 because a significant amount of soil would be removed. Under Alternative 3b, all of the soil exceeding PRGs would be removed to the extent possible. Alternative 2, however, would limit infiltration and would contain impacted soil, which has remained in-place for many decades since MGP operations ended.

Alternative 1 would leave impacted media essentially unchanged, but human access would be controlled.

8.7.2 Compliance with ARARs

Alternatives 1 and 2 do not meet the soil or groundwater ARARs. Alternative 3a meets ARARs for most of the impacted soil and groundwater. Alternative 3b would eliminate all detected soil PRG exceedances, and prevent the further contamination of groundwater by the soil.

As explained in the beginning of Section 8, achieving all groundwater standards for this Site would not be possible. Groundwater pumping and treatment cannot achieve groundwater PRGs based on experience at many other sites. Furthermore, no current or reasonably anticipated future use of groundwater at or downgradient of the site exists. Thus, none of the proposed alternatives meet the groundwater ARARs, but attainment of water quality standards at the downgradient property boundary will be used as a performance goal. Each of the groundwater constituents associated with former MGP operations can be reduced naturally within the subsurface via natural attenuation.

8.7.3 Long-term Effectiveness and Permanence

Alternative 1 would not provide long-term effectiveness and permanence. Untreated, impacted soils would be left in place, and monitoring of the groundwater would be required. Alternative 2 would contain groundwater and soil. Groundwater monitoring would take place, and any offsite impacts of the soil and groundwater could be observed and later addressed, if warranted, to protect human health and the environment. Alternatives 3a and 3b would be an effective means of ensuring long-term protection by substantially reducing risk to both human health and the environment because soil with PRG exceedances would be excavated from the Site. Alternative 3b, in particular, would provide the most reduction in risk because all of the soil with PRG exceedances would be excavated to the extent possible None of the alternatives would provide a permanent solution except to the extent that treatment of soil is provided under Alternative 3 following removal.

8.7.4 Reduction of Toxicity, Mobility, or Volume

Alternative 1 would not reduce the onsite toxicity, mobility, or volume of the constituents in the soil and groundwater. Alternative 2 would help reduce the mobility of impacted groundwater and soil. Alternatives 3a and 3b would virtually eliminate the toxicity, mobility, and volume of the constituents in the soil at the Site by transferring the soil to an approved disposal facility. Also, it would reduce impacts to groundwater by removing soil that affects the groundwater quality.

8.7.5 Short-term Effectiveness

For Alternative 2 and 3, short-term risks to the community, the environment, or remediation workers, would be controlled by implementing a construction phase Health and Safety Plan in accordance with OSHA Hazardous Waste Operations regulations. For Alternative 1, remedial actions will not take place, whereas for Alternative 2, limited construction-related activity will occur. For Alternatives 3a and 3b, odor generation and other potential concerns associated with excavating soil below the water table will require implementation of special controls, such as dust and odor control, and air monitoring. Alternative 1 would be somewhat effective in the short term, whereas Alternatives 2 and 3 would be very effective in the short term, assuming the successful implementation of controls for construction-related risks.

8.7.6 Implementability

Alternative 1 would be very easy to implement. Alternative 2 is also implementable and would require some construction, namely asphalt cap placement. Alternatives 3a and 3b are implementable, but would require a significant amount of construction including deep soil excavation, excavation of 1:3 side slopes, and soil dewatering. Also, underground utilities would have to be temporarily rerouted, which would add to the difficulty of implementing these alternatives. In particular, a 4-foot diameter sewer line begins 8 feet below ground surface, in a portion of the excavation area. In this area, the excavation depth is 9 feet under Option A, and 10 feet under Option B. Under Alternatives 2 and 3, temporary alternate arrangements for vehicle parking would have to be made as well. Under all three alternatives, administrative work for a deed restriction, data management, and reporting on groundwater monitoring would be required.

8.7.7 Cost

The least expensive soil/groundwater alternative is Alternative 1, with an estimated present worth of $160,000. The most expensive alternative is Alternative 3 at an estimated present worth of $3,400,000 for Option A and $5,000,000 for Option B. Alternative 2, with an estimated present worth of $680,000 to $900,000, is more expensive than Alternative 1, but significantly less expensive than Alternatives 3a and 3b. The significant soil excavation effort in Alternatives 3a and 3b contributes to its relatively high present worth, and the utility relocation efforts will add to the costs.

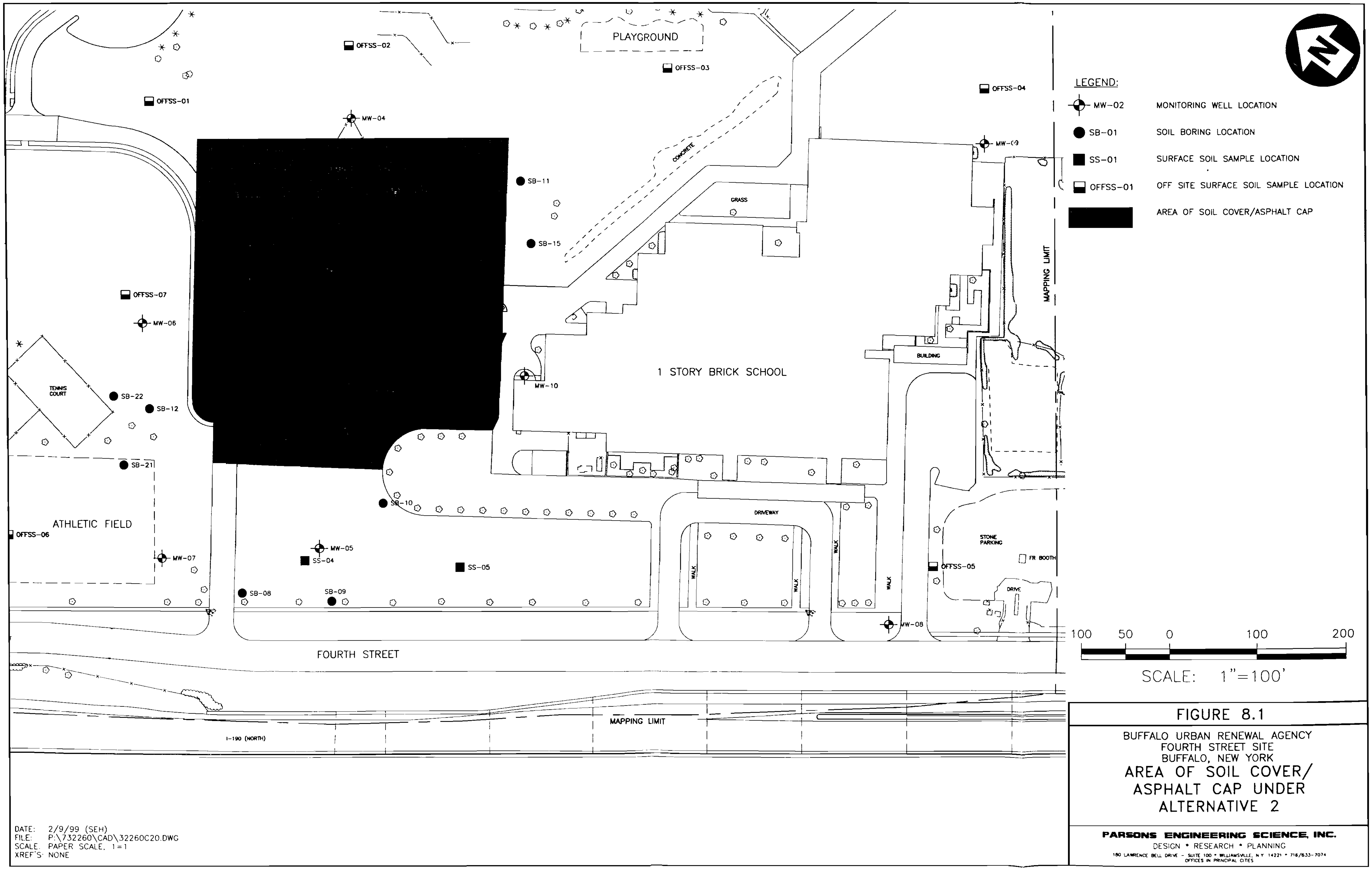


FIGURE 8.1

BUFFALO URBAN RENEWAL AGENCY
FOURTH STREET SITE
BUFFALO, NEW YORK
AREA OF SOIL COVER/ ASPHALT CAP UNDER ALTERNATIVE 2

TABLE 8.1
Soil/Groundwater Alternatives
BURA Site

Alternative	Institutional Controls/ Limited Action	Removal	Capping/ Containment of Soils	Groundwater Management	Treatment	Disposal
Alternative 1 Limited Action	Deed restriction by BURA. Construction and maintenance of security fence.	N/A	N/A	Annual groundwater monitoring for five years.	N/A	N/A
Alternative 2 Containment/Treatment	Deed restriction by BURA. Construction and maintenance of security fence.	N/A	Impermeable cap with vegetative or asphalt cover on the Site.	Annual groundwater monitoring for five years.	N/A	N/A
Alternative 3 Source Removal	N/A	Option A: Remove soil with PRG exceedances to one foot below water table. Option B: Remove soil with PRG exceedances to one foot below exceedances.	Asphalt cover on the Site.	No groundwater controls.	Offsite treatment of excavated soil. Collection and treatment of groundwater using a prefilter and activated carbon treatment system and discharge to local POTW for final treatment.	Excavated materials to be managed offsite.

Table 8.2 Summary of Comparative Analysis of Alternatives

Alternative	Protection of Human Health and Environment	Compliance with ARARs	Long-term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume	Short-term Effectiveness	Implementability	Cost
1	No	No	No	No	Yes	Yes	$160,000
2	Yes	No	Yes (long-term effective-ness), no (perma-nence)	Yes (mobility), no (toxicity, volume)	Yes	Yes	$730,000
3a	Yes	Yes (soil), no (ground-water)	Yes	Yes (if treatment is used)	Yes	Yes	$3.4 million
3b	Yes	Yes (soil), no (ground-water)	Yes	Yes (if treatment is used)	Yes	Yes	$5 million

SECTION 9

SECTION 9
RECOMMENDED ALTERNATIVE

9.1 DESCRIPTION OF THE RECOMMENDED ALTERNATIVE

From the evaluation presented in Section 8, the recommended alternative for the Site is Alternative 2. This alternative incorporates institutional controls, monitoring, and containment.

An impermeable cap with a vegetative or asphalt cover would be placed onsite. Deed restrictions, and short-term groundwater monitoring would be included in this alternative. Groundwater would be monitored for five years to determine the baseline groundwater quality and assess whether long-term groundwater monitoring is warranted.

The benefits of soil excavation under Alternative 3 does not justify the additional cost based on the following reasons:

- Impacts from soil should be adequately contained with placement of the impermeable cap and monitoring of groundwater;
- No groundwater users exist;
- No primary aquifers are located within two miles of the Site; and
- The difference in cost is greater than 4-fold: $730,000 (Alternative 2) versus $3,400,000 (Alternative 3, Option A) or $5,000,000 (Alternative 3, Option B). The costs for Alternative 3 do not include utility relocation. The need and feasibility of relocating utility lines have not been evaluated.

9.2 COMPARISON OF THE RECOMMENDED ALTERNATIVE TO EVALUATION CRITERIA

This section assesses the recommended alternative according to each of the nine National Contingency Plan and USEPA Feasibility Study evaluation criteria, including the modifying criteria of state and community acceptance

9.2.1 Overall Protection of Human Health and the Environment

According to the human health risk assessment (Section 5), carcinogenic and non-carcinogenic risks from constituents of potential concern (COPCs) identified in Site soils were below the USEPA threshold values. Although groundwater was not evaluated, it is not used as a potable drinking water supply, and no primary aquifers are located within two miles of the Site.

Alternative 2 would significantly reduce potential risks to human health and the environment. It would eliminate contact by human and ecological receptors with onsite surface soils, and by minimize infiltration of precipitation into the subsurface soil and groundwater. Thus, protection of human health and the environment would be provided under this alternative.

9.2.2 Compliance with ARARs

NYSDEC Class GA groundwater standards have been proposed as groundwater PRGs for this Site (Section 6). Proposed soil PRGs are either site-specific adjusted NYSDEC TAGM 4046 values or BUTLs, whichever is higher for a particular compound.

This alternative would not meet the groundwater and soil ARARs. Groundwater at the Site exceeds the proposed PRGs for benzene, ethylbenzene, and xylene only (see Table 6.9), but annual monitoring of groundwater should indicate the status of this impacted groundwater. Furthermore, no groundwater users exist downgradient of the Site. Impacted soil will remain, but the impermeable cap will minimize exposure to the soil, and the deed restriction will limit future access to the Site soil. The deed restriction should include language that protective measures and compliance with OSHA regulations will be needed for workers conducting repairs or replacement of utility lines, or other intrusive work.

9.2.3 Long-term Effectiveness and Permanence

The long-term effectiveness and permanence of a remedy is based on consideration of the magnitude of risk remaining after remediation, the adequacy and reliability of controls used to manage treatment residuals or untreated waste, and the permanence of the remedy. BTEX and PAHs would continue to exist in the groundwater and soil, but the asphalt cap, if properly maintained, should act as an effective barrier for the long term. Access to Site groundwater and soil would be further limited through administration of a deed restriction. Both items are effective in the long term as long as repairs and regular maintenance occur.

9.2.4 Reduction of Toxicity, Mobility, or Volume

The toxicity, mobility, and volume of the impacted groundwater and soil would not be significantly reduced. However, no groundwater users exist downgradient of the Site, and soil is not expected to be disturbed once the impermeable cap is in place.

9.2.5 Short-term Effectiveness

Short-term effectiveness pertains to risks and impacts to the neighboring community, workers, and environment during remedial activities contained in the recommended alternative. No significant short-term effects would be anticipated from placement of the impermeable cap. The cap would be very effective in the short term, and would be reliable with minimal maintenance.

9.2.6 Implementability

The impermeable cap would be easily implemented. The deed restriction would require implementation and possibly some negotiation on the part of BURA with the nearby school, given the proximity of the school building.

9.2.7 Cost

The total present worth of this recommended alternative is $680,000. The total capital cost associated with this alternative is $550,000, and the total O&M present worth is $130,000.

9.2.8 State and Community Acceptance

Acceptance of this alternative cannot yet be fully assessed for its acceptance by the state and community. It will be reviewed by the State of New York and then by the local community. Also, the general public will be provided an opportunity to comment on the selected alternative once the NYSDEC issues a Proposed Remedial Action Plan for the Site.

SECTION 10

SECTION 10
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