

**PRELIMINARY MULTIPLE SOURCE
GROUNDWATER RESPONSE PLAN REPORT**

**INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS**

**For
U.S. Environmental Protection Agency**

**By
Halliburton NUS Corporation**

**EPA Work Assignment No. 11-1L07
EPA Contract No. 68-W8-0117
HNUS Project No. 2250**

August 1997



PRELIMINARY MULTIPLE SOURCE
GROUNDWATER RESPONSE PLAN REPORT

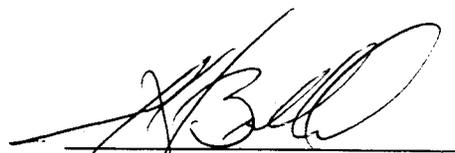
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

For
U.S. Environmental Protection Agency

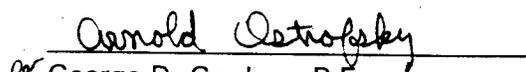
By
Halliburton NUS Corporation

EPA Work Assignment No. 11-1L07
EPA Contract No. 68-W8-0117
HNUS Project No. 2250

August 1997



Gordon H. Bullard
Project Manager



George D. Gardner, P.E.
Program Manager

**TABLE OF CONTENTS
PRELIMINARY MULTIPLE SOURCE
GROUNDWATER RESPONSE PLAN REPORT
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS**

<u>SECTION</u>	<u>PAGE</u>
1.0 INTRODUCTION	1-1
1.1 Industri-Plex Site Background.....	1-2
1.2 Current Site Status	1-3
1.2.1 Soil Cover Remedy and Air Remedy	1-4
1.2.2 Interim Groundwater Remedy	1-4
1.2.3 Groundwater/Surface Water Investigation Plan (GSIP).....	1-5
2.0 DEFINITION OF THE STUDY AREA	2-1
2.1 Bedrock	2-4
2.2 Groundwater Flow	2-5
2.2.1 Groundwater Discharge Areas	2-6
2.2.2 Groundwater Recharge Areas	2-7
2.3 Evolution of Surface Water Flow	2-7
2.3.1 Mishawum Lake.....	2-8
2.3.2 Aberjona River	2-9
2.3.3 Atlantic Avenue Drainway	2-10
3.0 LAND USE	3-1
3.1 Historical Land Use	3-1
3.1.1 Woburn Sanitary Landfill	3-2
3.1.2 Allstate Sand and Gravel Dump.....	3-3
3.1.3 Former Tanneries	3-3
3.2 Current Zoning	3-4
3.3 Current Land Use	3-5
4.0 WATER USERS	4-1
4.1 Groundwater Users	4-1
4.1.1 Potential Aquifer Yield	4-1
4.1.2 Historical Groundwater Users	4-3
4.1.3 Current Groundwater Users	4-4
4.1.4 MADEP Classification of Area Groundwater	4-5
4.1.5 Potential Groundwater Users	4-6
4.2 Surface Water Users	4-7
4.2.1 Surface Water Withdrawal.....	4-7
4.2.2 NPDES Permitted Discharges	4-7

**TABLE OF CONTENTS
PRELIMINARY MULTIPLE SOURCE
GROUNDWATER RESPONSE PLAN REPORT
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS**

<u>SECTION</u>	<u>PAGE</u>
5.0 POTENTIAL GROUNDWATER CONTAMINATION SOURCES.....	5-1
5.1 Confirmed 21E Sites.....	5-2
5.2 Site Summaries.....	5-5
5.2.1 Area A Sites North of the Industri-Plex Site	5-8
5.2.2 Area B Sites Northwest and West of the Industri-Plex Site.....	5-13
5.2.3 Area C Sites Southwest of the Industri-Plex Site	5-15
5.2.4 Area D Sites Southeast of the Industri-Plex Site.....	5-19
5.2.5 Area E Sites South of the Industri-Plex Site.....	5-21
5.2.6 Area F Outside the Vicinity of the Industri-Plex Site.....	5-23
5.2.7 Area G Sites Not Requiring Further Investigation.....	5-25
5.3 CERCLIS Sites	5-28
5.4 East Drainage Ditch.....	5-29
5.5 Former Mishawum Lake	5-29
5.6 MIT Research Summary.....	5-30
6.0 SUMMARY AND CONCLUSIONS	6-1

TABLES

<u>NUMBER</u>	<u>PAGE</u>
3-1 MANUFACTURING SUMMARY FOR THE STUDY AREA.....	3-6
5-1 SUMMARY OF SITES.....	5-4
5-2 REGULATORY STANDARDS AND ACTION LEVELS.....	5-7

REFERENCES

ACRONYMS

FIGURES

<u>NUMBER</u>	<u>PAGE</u>
1-1 SITE LOCATION	Map Pocket
2-1 ABERJONA WATERSHED STUDY AREA.....	Map Pocket
2-2 BEDROCK CONTOURS.....	Map Pocket

**TABLE OF CONTENTS
PRELIMINARY MULTIPLE SOURCE
GROUNDWATER RESPONSE PLAN REPORT
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS**

<u>NUMBER</u>	FIGURES	<u>PAGE</u>
2-3	GROUNDWATER FLOW DIRECTION.....	Map Pocket
2-4	SURFACE WATER FEATURES, PRE-1969.....	Map Pocket
2-5	EXISTING SURFACE WATER FEATURES AND FLOW DIRECTION.....	Map Pocket
3-1	LOCATION OF FORMER LEATHER TANNERIES, FINISHING COMPANIES, AND LANDFILLS	Map Pocket
3-2	WOBURN ZONING MAP.....	Map Pocket
4-1	GROUNDWATER CLASSIFICATION MAP	Map Pocket
5-1	SITES WITH GROUNDWATER OR SURFACE WATER CONTAMINATION...	Map Pocket
5-2	SITES WITH SOIL AND SEDIMENT CONTAMINATION	Map Pocket

1.0 INTRODUCTION

A Record of Decision (ROD) for the Industri-Plex site was signed in 1986, addressing on-site soil, sediment, and groundwater contamination. The Remedial Investigation (RI) that supported the ROD focused on site-specific groundwater problems and did not attempt to identify other possible sources of either upgradient or cross-gradient groundwater contamination. To fully understand the area-wide groundwater issues, the ROD and the Consent Decree (between the EPA and the Settling Defendants), discussed the need to perform additional studies. The recommended studies were the Multiple Source Groundwater Response Plan (MSGRP) and the Groundwater/Surface Water Investigation Plan (GSIP).

According to the Industri-Plex site ROD, the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), "...guidance recognizes that specific decisions about groundwater remedial actions resulting from a CERCLA site should be made in conjunction with the resolution of the larger area-wide groundwater problem." The study to comprehensively investigate area-wide groundwater contamination, as discussed in the ROD, is referred to as the MSGRP. The overall purpose of the MSGRP is to conduct an RI of the general area-wide contamination as it affects or potentially affects the groundwater and surface water in the Aberjona Watershed, and if necessary, to prepare a Feasibility Study (FS) to evaluate remedial alternatives to restore the watershed and support a ROD.

Understanding the site-related portion of groundwater contamination within the aquifer is being performed by the Settling Defendants. This investigation is called the GSIP. As stated in the Consent Decree, "The GSIP has two objectives: 1) evaluation of the potential for future, off-site migration of metals through the surface water pathway and 2) collection of information needed by EPA for the site related portion of the Multiple Source Groundwater Response Plan...". This information will be incorporated into the MSGRP and will assist EPA in making the decision as to whether a long term groundwater remedial action is required.

Other information that supports the MSGRP comes from several previous studies and investigations. These investigations include the RI; the Preliminary Design Investigation (PDI), conducted by the Settling Defendants to support the soil remedy; and this report, the Preliminary MSGRP Report.

As a component of the final MSGRP RI/FS, the purpose of the Preliminary MSGRP Report is to conduct additional research and compile information obtained during previous investigations including: the "Draft Definition of Study Area" (NUS Corporation, March 1991); the "Draft User/Contributor Report" (NUS Corporation, October 1991); the "Draft Potential Source Areas Report" (Halliburton NUS Corporation, October 1996); state enforcement files; as well as other data bases, and attempt to identify other potential contamination sources that may contribute to surface water, sediment, or groundwater contamination at or adjacent to the Industri-Plex site or to contamination off site. Once identified, these sites may be referred for further investigation to determine if they are contributors to the overall degradation of the watershed.

1.1 Industri-Plex Site Background

The Industri-Plex site is located in Woburn, Massachusetts, and encompasses approximately 245 acres (see Figure 1-1). Contamination at the site was caused by several chemical companies that produced sulfuric acid, arsenic, and organic chemicals from 1853 to 1931. From 1934 to 1969, the site was used to manufacture glue from raw animal hides and waste chrome-tanned hides. During the 1970s the property was developed by private parties into an industrial park. In 1979, the United States Environmental Protection Agency (EPA) obtained a court order to stop development activities on the site and in 1981 the site was listed on the Superfund Interim List of 115 Top Priority Hazardous Waste Sites. The primary contaminants associated with the Industri-Plex site are volatile organic compounds (VOCs), heavy metals, and gaseous emissions from the East Hide Pile.

In September 1986, a ROD was signed that addressed contaminated soils by grading and capping contaminated areas (soil cover remedy), treating VOC-contaminated groundwater

"hot spot" areas (interim groundwater remedy), and treating gaseous emissions from the East Hide Pile (air remedy).

A consortium of responsible parties formed the Industri-Plex site Remedial Trust (ISRT) and, in 1989, entered into a Consent Decree with EPA to assume responsibility for site remediation, which included the following:

- Design and construct permeable caps over soils and sediments contaminated with arsenic, lead, and chromium with concentrations in excess of 300 parts per million (ppm), 600 ppm, and 1,000 ppm, respectively.
- Design and construct an impermeable cap, and a gas collection and treatment system over the East Hide Pile.
- Design and construct an interim groundwater treatment system using air-stripping technology to treat "hot spot" areas of groundwater contaminated with benzene and toluene.
- Perform a Groundwater and Surface Water Investigation Plan (GSIP) to evaluate the impacts of the site contaminants to groundwater and surface water.
- Design and implement institutional controls to preserve the effectiveness of the remedy through land use restrictions and to assign the responsibility for maintaining the remedy, in perpetuity.

1.2 Current Site Status

This section presents a brief summary of the current site status with regard to the work required under the ROD and Consent Decree for the Industri-Plex site.

1.2.1 Soil Cover Remedy and Air Remedy

Following completion and EPA approval of a remedial design, in 1992 the ISRT began construction of the soil remedy. In 1996, EPA approved a permeable cover design modification to accommodate the construction of a regional transportation center (RTC) on approximately 36 acres of the site. This design modification was entitled "Regional Transportation Center - Alternate Cover Design".

As of July 1997, construction of the soil cover remedy, including the RTC Alternate Cover Design, was substantially complete. However, several "punch list" work items remain to be completed prior to receiving EPA certification that the soil cover remedy has been completed. Remaining work includes completing the permeable cover on one of the hide piles and submitting as-built records and operation and maintenance plans.

Construction of a thermal oxidation system (air remedy) at the East Hide Pile was completed in 1996; it has been operating intermittently since that time. The ISRT is currently developing design modifications to automate the system.

The ISRT has also prepared and submitted a draft version of the institutional controls required by the Consent Decree. This document is currently under review by EPA.

1.2.2 Interim Groundwater Remedy

Implementation of the interim groundwater remedy has undergone several starts/stops since 1992. Because of effluent treatment standards and subsequent projected operation and maintenance costs, the ISRT withdrew their 95 Percent Design for an area-wide groundwater extraction and treatment system and reverted to the requirements of the ROD and Consent Decree. These documents required that the ISRT only treat three "hot spot" groundwater plumes that were contaminated with benzene and toluene as an interim groundwater remedy. A comprehensive remedy would be determined at the conclusion of further area-wide investigations.

The ISRT received EPA approval to design and install an in-situ air-sparging treatment system. The system was installed and briefly operated in the spring of 1994. Because of operational problems related to uncontrolled air excursions, the system was immediately abandoned.

During the remainder of 1994, the ISRT completed three pilot studies to evaluate different in-situ treatment technologies. The ISRT subsequently selected oxygen injection methods, and designed and modified the existing air sparging system to accommodate the new technology. In September of 1995, the ISRT submitted a proposed plan to operate the system for one year to evaluate performance prior to selecting the technology as the final remedy. In May of 1997, the EPA met with the ISRT to discuss technical comments regarding using the proposed oxygen injection technology. Based on the available data, EPA expressed concerns that this technology may not be technically applicable or cost effective at this site. However, EPA approved an 18-month pilot study with a more extensive groundwater monitoring program to determine the effectiveness of the technology prior to establishing it as a permanent system. EPA is awaiting a response from ISRT regarding the conditional approval.

1.2.3 Groundwater/Surface Water Investigation Plan (GSIP)

The objective of the GSIP, as presented in the Consent Decree is, "...design and implementation of a groundwater/surface water investigation plan to examine whether or to what extent Hazardous Substances at the Site contaminate or threaten to contaminate groundwater and or surface water...". The GSIP was to be conducted in two phases. EPA approved the first phase GSIP work plan on February 2, 1990.

The ISRT completed the first phase of the GSIP and submitted their findings in a report dated June 7, 1991. Following their review, EPA identified several areas of concern regarding the report conclusions and supporting data. The major areas of concern included the interpretation of groundwater flow; groundwater and contaminant distribution at the West Hide Pile, and at the Halls Brook Holding Area (HBHA), and the interaction between the overburden and bedrock aquifers. Also, concerns were raised regarding the appropriateness of surface water/sediment sampling locations, interpretation of sediment transport data, and the reported extent of surface water and sediment contamination. EPA

granted a conditional approval of the GSIP Phase I report on April 3, 1991. The conditions of approval included completing additional work to fully characterize the nature and extent of groundwater, surface water, and sediment contamination; resolving the concerns EPA had raised; and submitting an addendum to the GSIP Phase I report. The conditions would then be met after EPA's satisfactory review of the revised report. EPA granted approval of the GSIP Phase II work plan on August 7, 1991.

The ISRT completed the GSIP Phase II work and submitted their findings in a report dated May 29, 1992. EPA submitted comments on the GSIP Phase II report on December 13, 1996 and again expressed significant concerns with the findings presented in the report. As with the GSIP Phase I report, the major concerns with the GSIP Phase II report included the interpretation of the groundwater flow, the contaminant distribution model, the interpretation of the overburden bedrock interface, and the conclusion that all groundwater from the site discharges to the HBHA. Additional concerns expressed related to the ecological risk methods and interpretation of the results, including the extent of sediment contamination and sediment toxicity. Since ISRT failed to resolve the issues raised in the GSIP Phase I and GSIP Phase II, EPA concluded that a third phase of investigation would be required. EPA met with the ISRT on May 22, 1997 to discuss the concerns and outline a proposal for a GSIP Phase III investigation.

On July 22, 1997, ISRT notified EPA that they had fulfilled their obligations under the Consent Decree and that they did not believe that a GSIP Phase III was necessary. Consequently, EPA has initiated action to implement the GSIP Phase III investigation as outlined at the May 22, 1997 meeting.

The ISRT also announced that, unknown to EPA, they had initiated additional investigations. The ISRT has urged EPA not to pursue implementing a GSIP Phase III investigation until the ISRT submits the results of their investigations. After EPA has reviewed ISRT's voluntary investigation data, they will meet again to discuss the results and potential GSIP Phase III requirements.

2.0 DEFINITION OF THE STUDY AREA

The limits of the Aberjona Watershed study area were delineated in three phases. The first phase was conducted to determine the Aberjona River drainage basin upstream of the City of Woburn water supply Wells G and H. The second phase of the study involved data gathering and limited field observations to determine the potential for the Aberjona Aquifer to extend outside the surface water basin. The third phase was to further refine the Aberjona Watershed study area when evaluating potential contaminant sources to support the preliminary MSGRP investigation.

Phase I

The first phase in defining the portion of the Aberjona Watershed for the MSGRP study was conducted to determine the Aberjona River drainage basin upstream of Wells G and H. This was accomplished through the review of published United States Geological Survey (USGS) geologic and hydrogeologic reports and USGS topographic maps of the Reading, Wilmington, Lexington, and Boston North quadrangles.

Figure 2-1 illustrates the north, east, south, and west boundaries of the Aberjona Watershed study area (Delaney and Gay, 1980). This boundary is a bedrock-controlled topographic surface water divide. The surface water within this area generally flows toward the center of the basin and in a southerly direction into the Aberjona River.

The Aberjona Watershed study area extends southward to the southernmost boundary of the Wells G & H Superfund Site, and includes all areas of surface water contribution to the Aberjona River as far south as the southern boundary of the Wells G & H Site. The southern boundaries of the Aberjona Watershed study area were determined by review of appropriate topographic maps. Surface water drainage in this area is largely controlled by man-made structures (canals, railroads, ponds) and other engineered drainage structures. Field observations were conducted to confirm surface drainage patterns and recharge areas.

As depicted on Figure 2-1, the boundaries of the surface water basin may not necessarily coincide with the groundwater aquifer boundary in some areas. Areas of aquifer potentially outside of the surface water basin may be the result of permeable geologic deposits that may transmit water into or out of the basin. The existence of engineered structures such as canals, roads, railroads, buried utilities, and site development activities also can create a hydraulic connection between otherwise separate geologic units.

A review of the surficial geologic data indicated that the Aberjona Watershed drainage basin boundary was coincident with glaciofluvial features at several locations. These locations represent portions of the northern border of the Aberjona Watershed study area and are indicated on Figure 2-1 by the dashed boundary line. The remainder of the basin boundary is coincident with the tops of the valley walls, which are mapped as till and bedrock outcrop (Castle, 1959 and Oldale, 1962).

Phase II

The second phase of determining the limits of the Aberjona Watershed for this study involved data gathering and limited field observations to determine the potential for the Aberjona Aquifer to extend outside the surface water basin. An evaluation was made that included review of studies available through the Massachusetts Department of Environmental Protection (MADEP) and water resource studies performed by towns.

Hydrogeologic data is available through several sources in the public sector. Site investigations, conducted as part of property transactions, which determine the presence of oil or hazardous materials must be reported to MADEP. This reporting is required under Massachusetts General Laws Chapter 21E (21E). The 21E laws define the property owner's liability relating to hazardous wastes, causing lending institutions to require site investigations as part of a property transaction.

The reports from sites located along the basin boundary were reviewed for groundwater flow direction data. This data supported the basin boundary, as indicated on Figure 2-1, except for the area that abuts the basin boundary to the north at Eames Street in Wilmington, which

is directly east of the railroad embankment. The groundwater flow direction reported in this area is toward the south and in the direction of the drainage ditch that parallels the railroad embankment (GZA 1983). Surface water flow in this drainage ditch has also been reported to be southerly (Fitzgerald, 1990). This area has therefore been designated on Figure 2-1 as "potential aquifer outside of the watershed". The volume of water entering the basin from this area is not known, but may be determined in future tasks to support the MSGRP.

The potential significance of the glaciofluvial deposits present along the boundary of the basin was investigated by contacting town public works departments for information regarding groundwater conditions and flow directions determined during groundwater resource evaluations. Information obtained from the Town of Wilmington (Paulding, 1982) indicates that groundwater in the vicinity of Mill Pond flows into the Aberjona River basin. This flow is probably due in part to the Mill Pond dam, which would cause an alteration in the natural groundwater flow patterns. The volume of water entering the basin at this location is not known.

A review of the topographic maps used to determine the southern limit of the Aberjona Watershed study area indicated the need for a field check of the surface water drainage pattern in the southwest portion of the Aberjona Watershed study area. Field observations indicated that the flow of the brook in the area southwest of the Route 128/38 interchange (the former Middlesex Canal) is controlled by a culvert at Wyman Street. The flow direction of the brook north of Wyman Street was observed to be toward the north; south of Wyman Street the brook flows south. This observed divide could change during periods of high flow. The groundwater flow pattern in the area of this brook is unknown, but is assumed to mirror the surface water flow direction.

Phase III

For the third phase, the Aberjona Watershed study area was narrowed to evaluate potential contaminant sources to support the preliminary MSGRP investigation. This area is called the Preliminary MSGRP study area. As previously determined through discussions with EPA, the boundaries of the Preliminary MSGRP study area are defined as Interstate 93 to the east;

Route 128 to the south; Route 38 to the west; and slightly north of the Woburn/Wilmington town line. The Preliminary MSGRP study area, toward the north, includes a cluster of known disposal sites near the Woburn/Wilmington town line. More information regarding the evaluation of sites within the Preliminary MSGRP study area is presented in Section 5.0.

2.1 Bedrock

Information available from studies performed at the Industri-Plex and Wells G and H Superfund Sites was reviewed to determine bedrock elevations throughout the Aberjona Watershed study area. These data were supplemented by information from USGS surficial geologic maps that indicate areas of bedrock outcrop, and by field observations conducted along Route 128 and Interstate 93. The bedrock elevation between outcrops was estimated assuming that the till, which blankets the hills forming the valley walls, is approximately 15 to 20 feet thick. This assumption was made in order to establish a preliminary bedrock surface. Additional site-specific bedrock elevation data may be obtained during the course of the MSGRP study to supplement and refine this draft bedrock elevation contour map, which is presented as Figure 2-2.

The bedrock surface within the Aberjona Watershed study area generally slopes from a high along the basin walls to a low in the center of the basin where it forms a trough. This trough dips toward the south, except for a rise in the area of Route 128. Bedrock outcrops are more frequent along the boundary of the Aberjona Watershed study area and particularly in the northern portion of the basin. Outcrops are also commonly found along road cuts. The lowest bedrock elevations in the Aberjona Watershed study area are located in the vicinity of Wells G and H, adjacent to the Aberjona River.

The trough or bedrock valley has a general north-south strike, which is consistent with regional structural features such as faults and fractures. This trough may represent the pre-glacial water course of the Aberjona River (Chute, 1959).

2.2 Groundwater Flow

The groundwater flow directions in the Aberjona Watershed study area were interpreted from available reports and site investigations, and are shown on Figure 2-3. The Industri-Plex and Wells G and H Superfund Site investigations provided information on groundwater flow, but were limited to the center of the Aberjona Watershed study area. Additional groundwater flow data was collected from a hydrogeologic study obtained from the Town of Wilmington and from studies of MADEP sites located along the northern boundary of the Aberjona Watershed study area.

The data obtained from the Town of Wilmington includes a groundwater flow map (Paulding, 1982) that was prepared as part of a groundwater protection study. The area studied includes a portion of Burlington and indicates that groundwater in the area of Mill Pond flows into the Aberjona Basin. This flow could be a result of man-made impacts on the natural groundwater flow patterns related to the damming of Mill Pond.

Data collected from reports on a site located immediately outside of the northwest boundary of the Aberjona Watershed study area basin in Wilmington (GZA, 1983) indicates that groundwater flows south. This site also abuts the Boston and Maine Railroad, which parallels a drainage ditch (East Drainage Ditch). Surface water flow in this ditch has also been observed to be toward the south (Fitzgerald, 1990) into the Aberjona Watershed study area. Natural groundwater and surface water flow directions in this area may have been altered by the railroad and drainage ditch construction. Topographic maps indicate that the bedrock that forms the northern boundary of the Aberjona Watershed study area was removed in the area of the railroad construction.

A second man-made feature in the Aberjona Watershed study area that could potentially affect groundwater flow direction is the former Middlesex Canal. This partially filled canal, which forms part of Halls Brook, may allow some groundwater to exit the basin at Wyman Street in Woburn. Site-specific groundwater flow direction data for this portion of the Aberjona Watershed study area was not available for this study.

The following assumptions were made in constructing the groundwater flow map (Figure 2-3):

- surface water bodies, including ponded areas, wetlands, rivers, and streams represent discharge areas.
- groundwater flow will generally mirror ground surface topography and the bedrock surface; this implies that the bedrock is not a significant contributor to flow in the basin.
- recharge areas are limited to the more permeable deposits in the basin.

The assumption regarding the water transmitting ability of the bedrock was necessary because of the complex nature of flow in bedrock and the minimal flow data available for the bedrock. It should be noted, however, that in localized areas bedrock may have a significant role in the groundwater flow regime. This is demonstrated by a bedrock well, located just south of Wells G and H, which has a pumping capacity of 100 gallons per minute (Myette, Olimpio, and Johnson, 1987).

In areas where data on groundwater flow conditions are lacking, the flow direction is assumed to follow the ground topography, the top of bedrock, and the surface water flow direction.

2.2.1 Groundwater Discharge Areas

Surface water bodies within the Aberjona Watershed study area are assumed to represent groundwater discharge areas. It is also possible for these surface water bodies to represent groundwater recharge areas, particularly during "high water" periods, such as spring flood conditions. However, this seasonal variation is likely to be short term and the volume of recharge limited. In addition, it is assumed that for the Aberjona Watershed study area, the bedrock aquifer does not contribute significantly to the total volume of groundwater in the

overall basin. The actual volume contribution of the bedrock aquifer is variable and would have to be evaluated on a site-by-site basis.

2.2.2 Groundwater Recharge Areas

The recharge areas of the basin were interpreted based on the characteristics of the surficial deposits and the slope of the land surface. These considerations limit the primary areas of recharge to the more permeable sands and gravels that occupy the lower, gently sloping areas of the basin. The hills that define the basin boundary are typically blanketed by glacial till deposits. Glacial till has a much lower hydraulic conductivity than the sands and gravels that generally occupy the valley floor. Additionally, the steeper topography near the basin rim will result in a higher percentage of runoff during precipitation events than in the more gently sloping valley floor. It is recognized that some recharge will occur in areas of less permeable till and bedrock formations; however, it is assumed that the volume of this recharge is small in relation to the recharge of the valley floor deposits. The exposed bedrock may locally provide recharge to the bedrock aquifer. The impact of this localized recharge to the basin as a whole may need to be evaluated as part of a complete resource evaluation.

2.3 Evolution of Surface Water Flow

Based on a review of historical USGS topographical survey maps, the surface drainage paths surrounding the Industri-Plex site remained largely unchanged from 1944 through 1965 (see Figure 2-4). The surface water bodies that have most significantly been impacted by property development activities are: the Aberjona River entering the site from the east, including the North and South Ponds, which enter the site from the north; the Atlantic Avenue Drainway exiting the site to the south; and the former Mishawum Lake (currently the HBHA). These surface water bodies have undergone significant changes as a result of property development activities that occurred from 1970 through 1983. All development activities at the Industri-Plex site ceased in 1983 when the site was listed on the National Priorities List (NPL) as a Superfund site. The current surface water features and flow direction are illustrated on Figure 2-5.

2.3.1 Mishawum Lake

Mishawum Lake was originally formed as a mill pond during the 1700s by the damming of the Aberjona River. The flow control structures (dam, sluice, spillway) were constructed to form a pond to support a mill located just south of the current Mishawum Road. The mill was replaced by another mill in the 1800s. The pond was named Richardson's Mill Pond. The mill was destroyed by fire in the late 1890s but the dam remained intact. The mill pond was later re-named Mishawum Lake.

In 1969, the Mark-Phillip Trust submitted a Notice of Intent to the Massachusetts Department of Natural Resources to significantly alter surface waters in order to develop properties in the vicinity of Mishawum Lake. The proposed work included constructing flood control structures (Halls Brook drainage and storage channel, i.e. HBHA) from Halls Brook to Mishawum Road, draining Mishawum Lake, and re-routing the Aberjona River along a proposed roadway (Commerce Way). Several designs were subsequently submitted to support the permit application and, in 1970, an Order of Conditions was approved.

Construction work began almost immediately and continued through 1976. This construction work resulted in the existing surface water features. Now cut off from the HBHA, the southeastern portion of the former Mishawum Lake had become a wetland and flood plain for the re-directed Aberjona River.

In 1980, further development plans included filling this wetland area to accommodate construction of an office building and parking areas. Designs and permit applications were submitted to various regulatory agencies. Permits were issued in the fall of 1980 and early 1981. Construction of the office building was completed in 1983. During the construction, and as a condition of permit, HBHA embankment was elevated to increase flood storage capacity.

2.3.2 Aberjona River

Prior to 1965, two branches of the Aberjona River (North and South Branch) flowed from North Reading, joined at a point to the south of what is currently the Industri-Plex Site, and discharged to Mishawum Lake (see Figure 2-4). The Aberjona River resumed flow at the southern end of Mishawum Lake near Mishawum Road.

As discussed in Section 2.3.1, during the period between 1970 and 1976, areas surrounding the Industri-Plex site underwent development to accommodate several industrial parks that contain light manufacturing and commercial properties. The original development design called for culverting the Aberjona River parallel to Commerce Way. The culvert outfall would discharge to an open channel that would eventually flow to the southern portion of the HBHA. However, final construction of Commerce Way resulted in the Aberjona River being directed into a continuous open channel flowing between two lanes of Commerce Way. Currently, the Aberjona River joins the southern portion of the HBHA and continues to flow south (see Figure 2-5).

Development plans also called for filling the North and South Ponds. During the 1970's, the Mark-Phillip Trust (Industri-Plex site developer) excavated a drainage channel from the South Pond to the Aberjona River at Commerce Way to begin draining the two ponds. Beginning in 1974, the Mark-Phillip Trust began to fill the North and South Ponds with borrow materials excavated from other areas of the site. According to reports from the Woburn Conservation Commission, these fill materials included animal hide wastes and chemical sludges (D'Annolfo, 1977). Because of concerns regarding contamination to the Aberjona River and the depletion of flood storage areas, a federal court issued an injunction and ordered the Mark-Phillip Trust to discontinue filling the wetlands until a proper permit was obtained from the US Army Corps of Engineers in July 1979 (US District Court, 1979).

In 1980, the Mark-Phillip Trust entered into a Consent Decree and an Agreement for Judgment with the US Army Corps of Engineers and the MADEP, respectively. Under these agreements, the Mark-Phillip Trust was to discontinue site development and make alterations to the surface waters to protect the Aberjona River from site contamination and to prevent

potential flood control problems. The work included constructing a holding area (capacity of 70-acre feet) for the Aberjona River called “Phillips Pond” and constructing a drainage channel along the western side of Interstate 93 to direct the Aberjona River (North Branch) southward to Phillips Pond. Current site conditions indicate that Phillips Pond and the drainage channel along Interstate 93 were completed. However, based on site inspections conducted by EPA in 1997, it was observed that, due to improper grading in the drainage channel, the hydraulic connection from the Aberjona River (North Branch) to Phillips Pond was never made. (Refer to Figure 2-5 for stream flow directions.)

No records were available to confirm the construction completion date. Based on the performance schedules detailed in the Consent Decree and Administrative Order, it is assumed that the work was completed by 1982.

In 1996, as part of the “100 Percent Design” for the soil remedy prepared by the ISRT, a portion of the flow from the North and South Ponds was diverted to a compensatory wetland (Created Wetland) that discharges to the Atlantic Avenue Drainway.

2.3.3 Atlantic Avenue Drainway

As early as 1944, industrial waste ponds were shown to exist in the southern portion of the Industri-Plex. During investigations that were conducted in the late 1970s, these waste ponds were named the “chromium lagoons” (see Figure 2-4). Overflow drainage from the chromium lagoons flowed to an open drainage channel that discharged to Mishawum Lake.

During construction of Atlantic Avenue and development of the area, an open channel/ditch (Atlantic Avenue Drainway) was constructed to receive surface drainage from the street and the surrounding developed properties. The Atlantic Avenue Drainway (AAD) was connected to the existing drainage channel just south of the chromium lagoons and continued to HBHA (see Figure 2-4).

As part of the wetlands compensatory design for the soil remedy portion of the remedial design (constructed in 1996), a portion of the surface flow from the South Pond was diverted

to the Created Wetland. Flow from the Created Wetland now discharges to the upper portion of the AAD such that the AAD is now an active stream channel to HBHA rather than an intermittent drainage channel (see Figure 2-5).

3.0 LAND USE

The following sections generally discuss the types of businesses and industry that have occupied the land within the Aberjona Watershed study area and may have impacted the groundwater or surface water and sediments.

3.1 Historical Land Use

Historical land uses within the study area have included agricultural, industrial, and residential uses. Agricultural activities included operating piggeries and raising cattle and crops. The Roketenetz piggery, located at the confluence of Halls Brook and the Aberjona River (see also Site C-2, Section 5.2.3.2), and the Murphy piggery located approximately 1,500 feet northeast of Well H, had been reported to be the source of some pollution in the form of stock yard runoff to Woburn surface waters (CDM, 1967).

Historically, the leather industry was a significant industry in Woburn. The earliest tannery was built in Woburn in 1666. Nearly 100 tanneries, rendering factories, and leather-finishing companies have operated in Woburn, Stoneham, and Winchester at various times between 1838 and 1988. Surface water contamination was reported as early as 1871. This contamination was the result of the direct discharge of waste into Woburn surface waters (Durant, Zemach and Hemond 1990).

After the completion of a Metropolitan District Commission sewer extension in 1932, much of the tannery wastes from the facilities in north Woburn were discharged to a sewer system; however, capacity limits and periodic plugging of the sewer lines from high concentrations of solids in the tannery wastewaters resulted in periodic overflows. Settling lagoons were eventually used to pretreat the tannery wastewater prior to discharge into the sewers. These lagoons created a large volume of dense sludges that were periodically removed and disposed of in landfills or in on-site dump sites (Durant, Zemach and Hemond 1990). The location and nature of these sludge disposal sites are not well known, and represent a significant potential source of contamination to the watershed.

Significant tannery activity and landfill operations within the Aberjona Watershed study area are described in the following sections.

3.1.1 Woburn Sanitary Landfill

The Woburn Sanitary Landfill, located off Merrimac Street in Woburn (Figure 3-1), is a 54-acre solid waste disposal area and is considered to be a potential source of groundwater and surface water contamination within the study area. The site was originally mined for sand and gravel through the 1960s. The site was used as a landfill beginning in 1966, when it received tens of thousands of cubic yards of refuse mined from an existing landfill (the Allstate Sand and Gravel Dump) that was being developed into the Woburn Industrial Park (Fugro, 1997). The refuse material was used to fill the erratic topography left by the sand and gravel mining operation. The landfill was closed to operations in June of 1986; however, unauthorized dumping may have occurred since that time.

It is not known if disposal of hazardous waste has occurred at the landfill, although typical "landfill leachate" generation and migration is expected to occur at this site, which may potentially impact groundwater or surface water quality in the area. An investigation conducted in 1982 revealed that two perimeter brooks intercept most of the groundwater and leachate flow from the landfill, acting as "leachate collection drains", and that "deeper underflow is believed to represent only a small fraction of the total leachate discharging from the landfill" (Reed, 1982). These brooks flow to the New Boston Street Drainway, which discharges into Halls Brook.

In 1988, the City of Woburn entered into a consent order with the MADEP to investigate and formally close the landfill. The City of Woburn submitted a hydrogeologic study and a closure plan to the MADEP. Following their review, the MADEP expressed many comments on the closure plan and subsequently disapproved the submittal. Following several years of inactivity, the City of Woburn and the MADEP began negotiations and, in 1995, entered into another consent order in June of 1996. The new consent order included a schedule for report submissions with provisions for stipulated penalties and required that the landfill closure be

completed by September of 2000. An Initial Site Assessment was completed in January 1997. The City of Woburn completed the first quarterly sampling round in March of 1997 to support a Comprehensive Site Assessment. The findings of these investigations are discussed in Section 5.2.2.2.

3.1.2 Allstate Sand and Gravel Dump

During the period 1953 to 1965, the City of Woburn disposed of its solid waste at an open dump operated by Allstate Sand and Gravel. The dump was located north of Mishawum Road, southeast of New Boston Street, and west of the Boston & Maine (B&M) Railroad (Figure 3-1) (Geotrans, 1987). The Massachusetts Department of Public Health conducted an investigation of the Aberjona Watershed in 1956 to locate sources of contamination to the Aberjona River. At that time, the dump was identified as a source of pollution to the river.

The dump was operated as an open burning dump until May of 1962 when the owners entered into an agreement with the Woburn Board of Health, requiring that the trash be covered with earthen materials and not be burned. Despite the agreement, the owners continued to allow the dump to burn. The Massachusetts Department of Public Health issued an order to stop open burning at the dump on November 28, 1962. In an effort to control or stop the spontaneous fires, the owners left a fire hose running all night to control the fires. This practice increased the production of leachate from the refuse.

In June of 1968, one last fire was reported at the dump. Hundreds of 55-gallon drums were reportedly disposed of at the dump the evening prior to the fire. The dump was finally closed by order of the state in 1968. (See also Section 5.2.5.5 - Site C-5)

3.1.3 Former Tanneries

In addition to John J. Riley Company (a former leather tannery located at the southern-most portion of the Aberjona Watershed study area) and Stauffer Chemical Company (a former rendering factory and part of the Industri-Plex Superfund Site), 14 other leather

tannery/finishing/rendering factories have been located within the Aberjona Watershed study area (see Figure 3-1). The earliest operating tannery in the area began in approximately 1875; a few leather tanneries or finishers continued operating into the 1960's. Hazardous compounds typically associated with the leather industry include chromium, copper, lead, and zinc; "tannery and rendering factory sludges were commonly disposed of on site or at centrally located dumping areas" (Durant, Zemach, and Hemond, 1990). These fourteen former leather industry sites are considered to be potential sources of metals and solvents contamination to groundwater, surface water, or soil.

3.2 Current Zoning

The current zoning within the Woburn portion of the Aberjona Watershed study area is mixed and includes residential, industrial park, business interstate, business highway, and office park classifications (1985 Zoning Ordinance with Amendments Incorporated, 1991 Edition, City of Woburn, Woburn City Council). The zoning laws permit a wide range of land uses within the study area. A general summary of the zoning types is presented below. A zoning map for the City of Woburn is included as Figure 3-2.

Residential zoning includes both single and two-family uses. Residential areas are typically located along the boundaries of the study area; industrial/commercial areas are generally located toward the center of the basin.

Industrial park zoning allows all activities typically associated with an industrial park, including light and heavy manufacturing. Gasoline stations, repair garages, warehouse distribution centers, and research businesses require special permits from the city.

Business interstate and business highway zoning allow activities similar to those for industrial park zoning; however, manufacturing is not permitted in these areas. It appears that this zoning designation primarily includes retail sales, restaurants, and hotels (which may require a special permit).

Office park zoning allows for office space; light manufacturing and research facilities in this zoning area require a special permit.

The distribution of these permitted land uses and their associated business types has a significant impact on groundwater resources. The industrial park land use represents the greatest threat to groundwater quality because of the hazardous materials potentially associated with industrial activities. The primary location of this land use, toward the center of the watershed where the potential for groundwater development is greatest, limits the potential for future development of the aquifer.

3.3 Current Land Use

The Aberjona Watershed study area is highly urban, including portions of the towns and cities of Burlington, Reading, Stoneham, Wilmington, and Woburn as well as portions of two major highways (Interstate 93 and Route 128). Land use is mixed, including residential, industrial, and commercial office park, with the majority of the area developed as industrial park.

The industrial land use represents the most significant threat to groundwater and surface water quality in the study area because of the wide variety of associated activities that use and dispose of chemicals and other hazardous compounds. The majority of the industrial land use in Woburn is in the northern portion of the city. An industrialized area is also located in the southern portion of the Town of Wilmington at the northern boundary of the study area.

Based on a review of "The Directory of New England Manufacturers, 1997", the types of manufacturers or businesses that are located in Woburn and are expected to be found within the Aberjona Watershed study area are presented in Table 3-1. The actual quantity and type of manufacturers in the study area are expected to vary from those listed. A discussion of potential associated hazardous materials and potential impacts on water quality for each manufacturing type is presented below.

TABLE 3-1
MANUFACTURING SUMMARY FOR THE STUDY AREA
MULTIPLE SOURCE GROUNDWATER RESPONSE PLAN
INDUSTRI-PLEX SUPERFUND SITE

Type of Manufacturers	Number of Facilities
Food Processing	4
Machine Shops	14
Equipment Handling and Warehouse	2
Data Control Equipment	14
Microwave and Semi-Conductor	2
Leather Industry	1
Electro-Manufacturing	3
Chemical Manufacturing and Distribution	3
Equipment Repair	1
General Manufacturing	35
Printing	20
Plating	2
Wood Recycling	1
Pharmaceutical Research & Design	6
Computer & Office Equipment	5

Food manufacturers may represent a potential source of thermal pollution within the watershed because of possible cooling water discharges to surface water; however, food manufacturers in Woburn are believed to represent a relatively minor threat to water quality in the basin.

Machine shops use cutting oils and solvents as part of the machining process. These materials, along with trace metals they may contain, represent a potential threat to water quality in the event of a release.

Equipment handling and warehouses are difficult to evaluate for potential groundwater or surface water contamination. Warehouses may contain a wide variety of materials and products, some of which may represent a threat to water quality if released to the environment. The nature and type of products stored or handled in warehouses located within the study area was not investigated as part of this study.

Manufacturers of data control equipment are believed to be small businesses that custom design and build electronic components. Building these components may involve chemical etching of circuit boards and other parts. Some hazardous materials used in etching, such as acids and solvents, represent a potential threat to the water quality in the study area, in the event of a release.

Microwave and semiconductor manufacturers are also believed to use etching methods in the manufacture of their products. Since higher revenues were listed for these manufacturers, they are likely to be larger operations than the data control companies, and therefore potentially handle larger quantities of hazardous materials.

One leather manufacturer reportedly remains in the Woburn area. (Specific activities of this firm were not confirmed as part of this study.) It is believed that this manufacturer may deal in a specialized market. However, leather processing methods have not changed significantly since the turn of the century. If leather processing is this firm's business, the byproducts produced by tanning and leather finishing, including metals, solvents, and sludges, represent a potential threat to water quality.

Information that would enable further definition of the nature of electro-manufacturers was not available. This manufacturing process may represent a potential threat to water quality.

Chemical manufacturers within the Aberjona Watershed study area produce specification adhesives, coatings, and possibly other products. These products and associated hazardous materials are used in a wide range of applications and represent a potential threat to water quality.

Materials used to repair equipment including spent oils, fuels, and cleaning agents represent a potential threat to water quality if released to the environment.

General manufacturing includes those companies that are not readily categorized into other manufacturing types, such as manufacturers of clothing, wooden cabinets, and steel fabricators. These manufacturers may represent a less significant threat to water quality in the study area than other manufacturing activities.

Several printing companies are also located in Woburn. The printing process involves use of inks and solvents. In particular, the printing of glossy book covers may use a variety of chlorinated organic compounds. These compounds represent a potential threat to water quality in the study area.

Hazardous materials associated with the metal plating industry include caustic and acid solutions, solvents, cyanide, and metals. These materials may represent a threat to water quality in the study area if released to the environment.

The wood recycling firm uses heavy equipment to process and handle large volumes of wood debris and compost materials, which are stockpiled on site. Releases of hydraulic fluids and lubricating oils caused by mechanical failure represent a potential threat to water quality.

As presented above, numerous industries that use or store hazardous materials are located within the Woburn portion of the Aberjona Watershed study area. Many other small businesses such as service stations, auto repair shops, photographic processors, and dry cleaners are present throughout the study area. These industries store or otherwise use hazardous materials that represent a potential threat to the groundwater and surface water in the study area, aquifer if released to the environment.

4.0 WATER USERS

Both surface and groundwater in the Aberjona Watershed study area have been used for industrial, municipal, agricultural, and domestic purposes. One of the earliest water uses was to water livestock raised on the many farms that occupied the Aberjona Watershed study area. The growth of industry in the Aberjona Watershed study area led to the development of groundwater resources that were principally used as process water by the tanning and chemical industries.

4.1 Groundwater Users

Groundwater from within the Aberjona Watershed study area has previously been used for municipal, industrial, and domestic purposes. The City of Woburn used groundwater withdrawn from the Aberjona Watershed study area for a portion of the City's drinking water supply until the closure of Wells G and H in 1979 because of contamination by VOCs. The City of Woburn still obtains its drinking water from groundwater; however, there are no active municipal supply wells located within the boundaries of the Aberjona Watershed study area. The other towns in the Aberjona Watershed study area do not use groundwater from the study area for drinking water purposes.

4.1.1 Potential Aquifer Yield

The potential yield of the aquifer was calculated as part of evaluating the potential resource that the Aberjona aquifer represents. The potential yield of a groundwater aquifer system is primarily a function of its transmissivity. Transmissivity is the hydraulic conductivity of the aquifer multiplied by its saturated thickness. This is usually expressed as "feet squared per day" (ft²/day), which is directly related to the ability of an aquifer to yield water.

The groundwater availability of the Aberjona River Basin was investigated by Delaney and Gay (1980), who found that the area adjacent to the Aberjona River has the highest potential to provide water to wells. The estimated rate of water withdrawal is between 100 to 300 gallons per minute (gpm). The higher withdrawal rates are for portions of the basin where the sand and gravel deposits are thicker and therefore have a higher transmissivity.

The estimated transmissivities of the aquifer range from less than 1,400 to greater than 4,000 ft²/day (Delaney and Gay 1980).

These estimates are considered minimum values since a single well at Stauffer Chemical Company, located in North Woburn, pumped 1.0 million gallons per day (CDM, 1967). This discharge rate for a single well indicates that the aquifer transmissivity must be greater than the above estimates. Information collected and analyzed by the USGS also indicates greater aquifer transmissivities than those presented above (Myette, Olimpio and Johnson, 1987). This USGS report, "Area of Influence and Zone of Contribution to Superfund Site Wells G and H, Woburn, Massachusetts," indicates that the aquifer transmissivity in the vicinity of Woburn supply Wells G and H is 29,700 and 17,600 ft²/day, respectively.

An aquifer pump test was conducted by the ISRT within the Industri-Plex site. The ISRT submitted, and EPA approved, a work plan in 1991. Data collected during the test indicated that the transmissivity of the aquifer ranged from 1,755 ft²/day to 29,279 ft²/day (Golder, 1991).

It can be concluded that the aquifer included within the Aberjona Watershed study area boundaries has the ability to produce large quantities of groundwater from wells. Wells with the largest production capabilities would be located in those portions of the aquifer where the thickest sand and gravel deposits occur. These areas generally coincide with highly industrialized areas that include the associated handling and storage of hazardous materials and increased potential for groundwater contamination.

A second consideration when estimating aquifer yields is the ability of the aquifer to maintain that yield for extended periods (usually measured in years). This is known as the "safe yield" of the aquifer. For the aquifer to continue to supply water to wells for extended periods of time, the aquifer must receive recharge at a rate that is no less than the rate of withdrawal. This recharge can occur at different times of the year as long as the total recharge rate exceeds the rate of withdrawal. If the rate of withdrawal or pumping exceeds the rate of recharge, the groundwater elevations in the aquifer will decline. This variation does occur seasonally; however, a long-term decline in groundwater elevations within an aquifer is known as "mining" of the aquifer.

The groundwater pumped from wells will not be stored in the aquifer and will not be available for recharging streams to help maintain stream flow during dry, low-flow conditions. This results in exaggerated seasonal low-flow stream condition. This lower minimum stream flow may have adverse impacts to aquatic life and stream aesthetics.

The potential impacts of decreased stream flows and associated adverse impacts on aquatic life and aesthetics of the streams should be considered in determining a "safe" groundwater withdrawal rate in the Aberjona Watershed study area. Historically, the Stauffer Chemical Company wells (CDM, 1967) and City of Woburn Wells G and H have pumped a combined discharge of 2.5 million gallons per day (mgd) with apparently minimum impacts to aquatic life and aesthetics. This may indicate that the Aberjona Watershed study area aquifer could sustain a withdrawal of at least 2.5 mgd. A more definitive "safe" yield of the aquifer could be determined through additional analysis of stream discharge data.

4.1.2 Historical Groundwater Users

The Aberjona River Watershed Committee commissioned a study of the Aberjona River. The study was performed by Camp, Dresser and McKee (CDM) and presented to the Committee in November 1967. Included in this study was an evaluation of groundwater withdrawal rates from the Aberjona Watershed study area. The CDM report indicates that approximately 1.32 mgd were pumped from wells located within the Aberjona Watershed study area, including Stauffer Chemical Company (1.0 mgd), John J. Riley Leather Company (0.30 mgd), and Johnson Brother's Roses (0.02 mgd). The CDM report indicates that the Aberjona River watershed supplied 15.77 mgd of water from wells and that more water was available.

The City of Woburn Wells G and H, located within the Aberjona Watershed study area, were developed after the submittal of the CDM report, supporting their conclusion that additional groundwater resources could be developed in the basin. (Wells G and H were capable of pumping at a combined rate of 1,100 gallons per minute.)

4.1.3 Current Groundwater Users

Currently, there are few, if any, major groundwater users in the Aberjona Watershed study area. Interviews with MADEP Water Supply personnel indicated that since the installation of the Wells G and H, no new applications have been received for future water withdrawal within the Aberjona Watershed study area (Mayor, August 1997). The Water Management Act of Massachusetts requires submission of applications for surface water or groundwater withdrawal for rates equal to or greater than 100,000 gallons per day (gpd). For water withdrawals less than the 100,000 gpd limit, permits are not required.

The City of Woburn is the only registered potential groundwater drinking water supply in the Aberjona Watershed study area and is registered for a total water withdrawal of up to 4.07 million gallons per day (mgd) city-wide. However, Woburn is not now withdrawing water from within the Aberjona Watershed study area because of the closure of Wells G and H, discussed above. Woburn currently receives its water supply from seven groundwater wells located near Horn Pond (Boston Harbor River Basin), south of the Aberjona Watershed study area. According to conversations with the Woburn Plumbing Inspector and the Woburn Board of Health Agent (Mayor-1997) installation of private drinking water wells is strongly discouraged and made difficult through a tedious permitting and inspection process. It should be noted, however, that other potential users of groundwater may exist within the Aberjona Watershed study area at unrecorded locations. Based on approved plumbing permits, the known locations where groundwater wells exist include:

- Johnson's Roses (formerly Johnson Brother's Roses) - The original location was at 72 Wyman Street in Woburn. A deep well was re-furbished at this site. This site was sold in 1993, apparently to a developer who de-activated the well.

Johnson's Roses also maintained a business at another location on Washington Street (south of the Aberjona Watershed study area). This property was sold to Cummings Property in the mid-1970s. A well is located at this site. It is not known if it is still active.

- Charles Ice Cream (located at the old Riley Tannery site south of the Aberjona Watershed study area) - On June 5, 1997, the plumbing inspector found that the company connected their well to their domestic supply. The inspector ordered that the well supply be disconnected from the domestic supply and removed from the building. The well water reportedly is now used for irrigation purposes only.
- 17 Presidential Way - A well was installed in 1997 for irrigation purposes only.
- 13 Presidential Way - A well was installed in 1997 for irrigation purposes only.
- 39 Dragon Court - Christian Learning Center. A well was installed in approximately 1990. Current use of the well is unknown.

4.1.4 MADEP Classification of Area Groundwater

In June of 1997, the MADEP issued a “Draft Final Industri-Plex Groundwater Use and Value Determination” for the aquifer surrounding the Industri-Plex Site. As shown on Figure 4-1, except for a small strip of land beneath power lines, MADEP has classified the area from the Industri-Plex site south to Interstate 95, as a Non-Potential Drinking Water Source because of its concentrated industrial development. In making the determination, MADEP considered many factors including aquifer quantity and yield, water quality, existing drinking water supplies, existing private drinking water supplies, likelihood for future drinking water use, other potential groundwater uses, ecological value, and public opinion.

In addition, MADEP determined that the classification of the area, described above, was both GW-2 and GW-3. For risk assessment purposes, GW-1 classification must meet drinking water standards. A GW-2 classification is less protective and is defined as one that identifies areas where contamination may exist but where there is a potential for migration of vapors from contaminated groundwater. A GW-2 classification applies to locations where groundwater is located at an average depth of 15 feet or less (below ground surface) and there is an occupied building or structure within a 30-foot radius of that groundwater. A GW-3 classification is the least protective and only considers risk to surface water resulting from groundwater discharges.

4.1.5 Potential Groundwater Users

The potential major groundwater users in the Aberjona Watershed study area include industrial, municipal, domestic and agricultural users. Based on local permitting policies, the potential for domestic use of groundwater is limited. Municipal water supplies presently available within the basin further discourage the installation of private drinking water wells. The potential for additional agricultural development is limited since a relatively small percentage of land remains undeveloped and available for agricultural expansion.

Groundwater could potentially be used for industrial purposes not requiring water that meets drinking water standards, such as industrial make-up water or cooling water. The used process water, however, may require treatment prior to disposal if it exceeds any of the Maximum Contaminant Levels (MCLs) for groundwater discharge, as indicated in Title 5 of the Massachusetts Environmental Code.

For future municipal supply purposes, groundwater would require treatment and frequent water quality monitoring. The permitting process for new source approval requires a survey involving the identification of known sites that have had a release of oil or hazardous materials. As discussed in Section 5.0, much of the Aberjona aquifer in the Preliminary MSGRP study area has been impacted by releases of oil or hazardous materials, making new source approval in this area difficult under current MADEP policy.

Because costs for domestic water and sewer use rates have increased dramatically over the past decade, private homes and businesses are beginning to install groundwater wells to use for irrigation purposes. As a result, potentially contaminated groundwater could be brought to the surface. Depending on the contaminant concentration, the water could present both ecological and human health risks through direct contact exposure hazards, potential contamination of surface soils, and potential contamination of adjacent surface waters through runoff.

4.2 Surface Water Users

This section discusses the potential uses and impacts to surface water because of surface water withdrawal to either support manufacturing processes (cooling water) or the use of the surface water bodies as a waste discharge location.

4.2.1 Surface Water Withdrawal

Surface water within the Aberjona Watershed study area was used in the past for agricultural purposes such as the watering of livestock. Present day agricultural activity within the Aberjona Watershed study area is limited. Currently, there are no known surface water withdrawals from the Aberjona River within the Aberjona Watershed study area.

It has been determined that Wells G and H received a portion of their water from induced infiltration of river water (Myette, Olimpio and Johnson 1987); however, this source is considered to be groundwater under the regulatory framework. This represents an indirect withdrawal of surface water and has a small effect on stream flow. (The installation of additional pumping wells along the river could potentially affect stream flow.)

4.2.2 NPDES Permitted Discharges

The National Pollutant Discharge Elimination System (NPDES) is the enforcement mechanism legislated by the Clean Water Act of 1977. NPDES permits are issued to municipal and industrial dischargers to ensure that pollutant discharges do not result in a violation of water quality standards. A NPDES permit contains technology-based treatment requirements for domestic or industrial facilities and for phased improvements in technology to allow higher levels of treatment. State and federal monitoring, inspection, and enforcement programs ensure compliance with standards and permits.

Based on a review of the EPA NPDES permit data base, there were no facilities in Woburn or Wilmington that historically or currently have a NPDES-permitted surface water discharge within the Aberjona Watershed study area. The lack of permit activity may be due to the availability of sanitary sewer service within the developed areas.

5.0 POTENTIAL GROUNDWATER CONTAMINATION SOURCES

This section identifies and evaluates possible sites containing hazardous substances that may:

- potentially impact groundwater or surface water quality at the Industri-Plex site
- potentially contribute to the overall degradation of the Aberjona Watershed in the vicinity of the Industri-Plex site

The site boundaries for the Preliminary MSGRP study area are Route 128 to the south, Interstate 93 to the east, Route 38 to the west, and within 0.5 miles north of the Woburn/Wilmington town line to the north. The data used to evaluate potential groundwater and surface water contamination sources were gathered from three primary sources: the MADEP site assessment files, EPA's Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) files, and Aberjona River research studies performed by the Massachusetts Institute of Technology (MIT). Much of the analytical data obtained from MADEP site files are more than five years old and were generated by a myriad of consultants, scientists, and engineering firms. The quality assurance/quality control methods could not be verified. Consequently, the data were accepted for this study only on a qualitative basis. The information compiled from these sites will help to focus future investigative efforts supporting the MSGRP RI/FS, the GSIP Phase III, and ongoing MADEP site investigations.

MADEP 21(E) Site Assessment files were reviewed for sites within the study area that had or may have had one or more releases of oil and/or hazardous materials. Based on available information in MADEP files, sites within the Preliminary MSGRP study area were evaluated for their potential past, current, or future impact on environmental media, including groundwater, surface water, soil, and sediment.

As previously determined in discussions with EPA, analytical data available in the site files were included for further evaluation in this MSGRP study only if they indicated the presence

of elevated levels of one or more of the following contaminants, including Industri-Plex-related contaminants of concern (COCs): arsenic, chromium, lead, mercury, benzene, toluene, trichloroethylene (TCE), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH).

Files available both for "new releases" (post-1993) and the historical site files within the selected study area were reviewed using a screening process to evaluate, where possible:

- if available site sampling data have at any time indicated the presence of one or more COCs at levels above federal Maximum Contaminant Levels (MCLs) (for groundwater); or above the following Industri-Plex action levels (established only for arsenic (300 parts per million - ppm), chromium (1,000 ppm), and lead (600 ppm) (for soils).
- if the site or new release had been sufficiently remediated, with no probable remaining contamination or historical contamination that could have potentially migrated in environmental media, based on available file materials at the time of the file review.

If one or more COCs were noted in sampling data at levels exceeding the standards discussed above, and if the site was not screened out for other reasons, such as the site has been remediated with little probability of contaminant migration, then the site was considered to be a potential current and future source of contamination in the vicinity of the Industri-Plex site, and was included in this study. A detailed discussion of each site is included in the following sections.

5.1 Confirmed 21E Sites

This section presents a summary of the potential contamination sources that were identified during the review of MADEP site files. Two types of listings from the MADEP database system were consulted, including:

- The "sites" database, which includes sites with release tracking numbers (RTNs) first listed at MADEP between approximately 1987 and 1993.

- The "front end" database (formerly called "spills" or "new releases"), which includes sites/releases since 1993 (listing as of October 13, 1995).

Each site included in this report is listed in Table 5-1. The sites are presented by category (described in Section 5.2) with an assigned reference number. For each site, the MADEP RTN is also indicated (some properties have more than one RTN). Also listed is the site name and address, the Massachusetts Contingency Plan (MCP) "transition status", and a brief description of the site's known or potential contaminant source.

Several different types of sites or releases are indicated under "transition status", as defined by MADEP below:

- Confirmed: Confirmed by MADEP as a disposal site where a release has occurred. This is a pre-1993 MCP term; the site may have been listed previously as an LTBI (see below), or may have entered the system as a known release/emergency response action, or notification of a release.
- Waiver: Confirmed, non-priority sites prior to 1993 (when the MCP was significantly revised) could apply for a Waiver of Departmental Approvals, meaning that cleanup action was undertaken without direct MADEP oversight. Many waivers are still in effect and have been grandfathered into the new MCP process.
- LTBI: Location to be Investigated. This is a pre-1993 MCP term for sites where it was not clear whether a release of oil and/or hazardous materials occurred, and further investigation may be warranted.
- Remedial: Pre-1993 MCP sites that did not make the 1993 Transition List because remedial action had been completed and no further remedial actions were required.

**TABLE 5-1
SUMMARY OF SITES
CONTAMINATION SOURCE AREAS REPORT
MULTIPLE SOURCE GROUNDWATER RESPONSE PLAN
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS**

W97713F

5-4

Industri-Plex, MA

SITE NO.	SITE NAME	ADDRESS	MCP TRANSITION STATUS	RELEASE TRACKING NUMBER	KNOWN OR POTENTIAL CONTAMINANT SOURCE
A-1	Fuel Transfer & Storage Facility (E&G Inc.)	324 New Boston St - WOBURN	LTBI	3-0004547	Gas, diesel, #6 oil; Former ASTs for fuel transfer
			New Release	3-0012666	Unknown
A-2	Undercoverwear (Lots 4 and 4A)	Presidential Drive - WOBURN	Waiver	3-0002518	Possible poor quality fill brought onsite for grading purposes
A-3	Industrial Property	30 Industrial Way - WILMINGTON	Waiver	3-0003797	Chemical/solvent storage area (mfg. of steel parts; printing co.)
A-4	Olin Chemical	51 Eames Street - WILMINGTON	Confirmed	3-0000471	Onsite sulfate landfill, lagoons, acids ponds
A-5	Ritter Trucking (former)	856 Woburn Street - WILMINGTON	Confirmed	3-0000009	Petroleum USTs and wastewater settling tank (tank truck terminal/wash)
B-1	Blox/Brussard	100 Ashburton Ave - WOBURN	Waiver	3-0000473	Former leather tanning industry (hides, lagoons, sludge)
B-2	Woburn Sanitary Landfill	Merrimac Street - WOBURN	Unlisted	3-0001733	Household, industrial, construct./demolition
C-1	North Woburn Industrial Park	Gill St & Sixth Rd - WOBURN	Confirmed	3-0000150	Soil at catch basin; possible unidentified source(s)
C-2	Globe Ticket Co	166 New Boston St - WOBURN	LTBI	3-0000671	Fill (hides, bones, debris)
C-3	3-C Company "Formerly Continental Chemical"	181 New Boston St - WOBURN	Confirmed	3-0000478	10 former USTs
			New Release	3-0010859	Unknown
C-4	Ace Disposal Service Commercial	22 North Maple St - WOBURN	Waiver	3-0001867	Drywell
			New Release	3-0012123	Recurring release of motor oil; truck engine cleaning
C-5	Atlantic Plywood	Roessler Road - WOBURN	Reserved	3-0001147	Land previously used as open burning dump
C-6	(Keramas) Property	19 Sixth Road - WOBURN	LTBI	3-0000021	Possible dumping of plating waste (alleged by former employee)
D-1	Property (Marshall's)	83 Commerce Way - WOBURN	Confirmed	3-0010002	Former UST (No. 2 fuel oil)
D-2	Chomerics	8 Commonwealth Ave - WOBURN	Confirmed	3-0000121	ASTs, USTs, pipelines
E-1	Industrial	10 Commerce Way - WOBURN	New Release	3-0010847	Formerly Mishawum Lake (subsurface peat contaminated)
E-2	Woburn Mall, Wetland Area	300 Mishawum Rd - WOBURN	Waiver	3-0003794	Formerly Mishawum Lake (subsurface peat, downgradient of IP)
F-1	MBTA Property	Mishawum Rd - WOBURN	Remedial	3-0001735	Drums found in 1979, hides, urban fill
F-2	Property	299 Mishawum Rd - WOBURN	LTBI	3-0004015	Petroleum USTs (diesel fuel, #2,4,6 oil and waste oil)
F-3	Mobil Station	2 West Street - READING	Waiver	3-0003245	Gasoline station - petroleum hydrocarbons release
G-1	Commercial/Industrial Property	268 Mishawum Rd - WOBURN	LTBI	3-0004336	Petroleum/oils (spills/leaks from drums/vehicles)
G-2	Winn Trucking Terminal	195 New Boston St - WOBURN	Confirmed	3-0000480	Unknown
G-3	Undercoverwear (Lot 2A)	1 Presidential Drive - WOBURN	LTBI	3-0001890	Leaked hydraulic fluids and "poor quality fill" (TPH)
G-4	Industrial Property	3 Industrial Way - WILMINGTON	Reserved	3-0003670	No documented release (solvent storage); Possible upgradient VOC release
G-5	AGFA (Compugraphics) Property	65 Industrial Way - WILMINGTON	LTBI	3-0003688	Spills from former AST and possible solvents disposal to drywell
			Unknown (Tier 2/Phase 2)	3-0011399	Unknown

- Unlisted: Pre-1993 site tracking term indicating that the listed site was a duplicate of a site already being tracked.
- Reserved: At this time, MADEP presumes these sites are closed (no further action required). The existing information on these sites tends to be limited. If new information showing a threat or reportable condition exists, the PRP may be required to notify MADEP, or the MADEP could bring the site into the system.
- New Release: Releases of oil and/or hazardous materials that have occurred since 1993.

5.2 Site Summaries

This section presents a summary of each site listed on Table 5-1. The summary is based on information obtained from MADEP site files during file reviews conducted in December 1995, August 1996, and May 1997. Discussions of contaminants present at these sites include only those COCs identified for this MSGRP study. However, other contaminants may also be present at these sites.

The approximate location of each site is indicated on Figures 5-1 and 5-2. These figures also indicate the maximum concentration for each COC detected at each site, if applicable, with the corresponding sampling date. Some of the sites have been undergoing monitoring and some have been in active cleanup for the past several years. If file information indicated that lower contaminant levels were found after the maximum concentrations were detected, the more recent data are also presented.

Figure 5-1 includes data for COCs detected in groundwater and surface water. Figure 5-2 includes data for COCs in soil and sediment. The majority of analytical data available, as evidenced on Figures 5-1 and 5-2, was for groundwater and soil. Based on a review of files from all sites included in this study, only two sites with surface water samples and one site with sediment sample data were identified.

All site summaries and analytical data presented are limited to information that was available in the MADEP site files at the time of the file review. No assumptions should be made that all information or data generated for all sites were available in the MADEP files. Much of the data is not recent, as indicated in Figures 5-1 and 5-2. More recent data may have been generated for some sites; however, if not present in the MADEP files, these data are not known and have not been included. In addition, no evaluation by Halliburton NUS Corporation has been made regarding data quality, the use of approved sampling or analytical methods, data validation, or other quality control procedures. Therefore, the use of this information is strictly for general overview purposes.

Table 5-2 includes regulatory standards and Industri-Plex site action levels for COCs in:

- Groundwater: MCLs and MADEP/MCP GW-2 classification standards (if there were no GW-2 standards, then GW-3 standards would apply).
- Surface water: Ambient Water Quality Criteria (AWQC) and Industri-Plex site surface water discharge action levels.
- Soils: MADEP/MCP S-2/GW-2 classification standards and Industri-Plex site action levels.

The most conservative regulatory standards are indicated; however, they may not be applicable to all sites. Whereas most of the site-specific data are not current and site classifications under the MCP vary, these standards are presented for reference and qualitative comparison purposes only.

The sites are organized into six areas based on geographic proximity to the site and the potential to either impact the Industri-Plex site, be impacted by the Industri-Plex site, or potentially only impact the Aberjona River Watershed. The six areas include:

AREAs A through E: Sites that may impact the Industri-Plex site, may be contributing to the degradation of the Aberjona River Watershed, or may require further investigation.

**TABLE 5-2
REGULATORY STANDARDS AND ACTION LEVELS
DRAFT POTENTIAL SOURCE AREAS REPORT
MULTIPLE SOURCE GROUNDWATER RESPONSE PLAN
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS**

Contaminants of Concern	Soil		Groundwater		Surface Water		
	IP Action Level (1) (mg/kg)	MCP: S1/GW1 (2) (mg/kg)	MCL (3) (mg/l)	MCP: GW-1 (4) (mg/l)	IP Action Level (1) (mg/l)	AWQC (5) (mg/l)	Tier II (6) (mg/l)
arsenic	300	30	0.05	0.05	0.19	0.19	NA
chromium	1000	1000	0.1	0.1	0.21	0.18**	NA
lead	600	300	0.015	0.015	0.0082	0.0025**	NA
mercury	NA	10	0.002	0.002	NA	0.000012	NA
benzene	NA	10	0.005	0.005	NA	NA	0.046
toluene	NA	90	1	1	NA	NA	0.13
TCE	NA	0.4	0.005	0.005	NA	NA	0.35
PAHs	NA	NA	NA	NA	NA	NA	NA
TPH	NA	500*	NA	1*	NA	NA	NA

(1) Industri-plex Action Level (action levels for arsenic and chromium are chronic AWQC limits; action level for lead is the acute AWQC limit as established in 1992).

(2) Massachusetts Contingency Plan (MCP): Soil Category S-1 applicable to soil where the groundwater is categorized as GW-1.

Refer to MCP 310 CMR 40.0000, November 19, 1993.

(3) Maximum Contaminant Level (40 CFR 141-142).

(4) Massachusetts Contingency Plan (MCP): Groundwater Category GW-1.

Refer to MCP 310 CMR 40.0000, November 19, 1993.

(5) Ambient Water Quality Criteria (fresh chronic criteria, May 1995).

(6) Values calculated using Great Lakes Water Quality Initiative Tier II methodology (40 CFR 9 et al.). Values shown are as calculated in Suter and Mabrey, 1994.

* = TPH excluding benzene, toluene, ethylbenzene, xylenes AND specific PAHs, and expressed as a weighted average of the individual constituents if sufficient analytical and toxicological data are available.

** = Criteria are hardness-dependent (100 mg/l CaCO₃ used).

NA = not applicable or not established

mg/kg = milligrams per kilogram (or parts per million)

mg/l = milligrams per liter (or parts per million)

AREA F: Sites that may be contributing to the degradation of the Aberjona River Watershed.

AREA G: Sites that were impacted by upgradient contaminant sources or are currently being remediated and do not require further investigation.

5.2.1 AREA A - Sites North of the Industri-Plex Site

Five sites are located in Area A.

5.2.1.1 Site A-1: Fuel Transfer & Storage Facility (E&G, Inc.) (324 New Boston Street, Woburn)

The site is currently occupied by a one-story, slab on-grade warehouse and office building that was constructed in 1987. The building was formerly occupied by J. Amicone Company (JAMCO), which distributed baked goods and other food; ZBR Publications, Inc., which stored printed materials; and Whitney Barrel Company, which stored drums, empty tanks, and other containers. Whitney also used the site as a fuel transfer facility. The fuel transfer facility was equipped with two 500,000-gallon above-ground storage tanks.

No information was available as to when the tanks were constructed. However, the above-ground storage tanks were removed in July 1986 and some petroleum-contaminated soil was excavated and transported off site. Gasoline, diesel fuel, and No. 6 fuel oil have been associated with this site. Groundwater contamination has been detected in on-site monitoring wells, including elevated levels of the COCs mercury, benzene, TCE, and TPH. TPH has also been detected in soil.

Two RTNs are applicable to this property (see Table 5-1). The first was related to the discovery of petroleum products related to the fuel transfer facility. The second RTN was related to elevated concentrations of vinyl chloride that were discovered during subsequent sampling rounds.

A Release Abatement Measure (RAM) Completion Report was submitted to MADEP in February 1995. Based on a Method 2 (GW-2) risk characterization that was performed, the report concluded that no future monitoring or maintenance activities were necessary.

5.2.1.2 Site A-2: Undercoverwear - Lots 4 and 4A
(1 Presidential Way, Woburn)

The property was formerly owned by Woburn Process Company, Inc. in 1962 for pet food manufacturing. The site was then occupied by Usen Canning from 1965 to 1967 and in 1970 by Lipton Pet Foods, Inc. The property was transferred in 1979 to Augustine Sheehan, Inc. who subdivided the property into several large parcels. Lots 4 and 4A were located in undeveloped sections of the original property and not associated with the pet food manufacturing operations. In 1986, the sites were transferred to James Bond Realty Trust, which began developing the sites for their current use as an office and a warehouse.

A specific release of oil or hazardous materials was not noted to have occurred at this site. However, soil sampling conducted during site development (February 1991) indicated TPH concentrations up to 4,800 ppm, with PAHs and metals detected in fill materials below the topsoil. The contaminants are thought to have been brought on site in fill used to grade the area during site development. The volume of contaminated soil has been estimated to be approximately 10,600 cubic yards.

A consultant's report states that the contaminants appear to be relatively insoluble and immobile, adsorbing to soils. The report also states that the groundwater analytical results obtained during this study indicate that contaminants observed in the fill material are not impacting groundwater quality. Consequently, the consultant recommended that no further action be required. Groundwater flow is reported to be toward the south, and is believed to discharge into the adjacent wetlands.

5.2.1.3 Site A-3: Industrial Property
(30 Industrial Way, Wilmington)

This property was undeveloped land until approximately 1971 when the current building was constructed. An addition was constructed in 1974. The building was originally occupied by Market Forge (a division of Beatrice Foods) and later by Ferno Forge (also a division of Beatrice Foods). Both companies were manufacturers of stainless steel parts for the food industry. The site was later occupied by Acme Printing (date unknown). All of the companies had records indicating the use and storage of solvents on site, including toluene, toluene based paint thinners, TCE, 1,1,1-trichloroethane (TCA), methylene chloride, and tetrachloroethylene (PCE).

An Environmental Site Evaluation was conducted in October 1990. The report concluded that TCA, PCE, and TCE were present in groundwater at the site. Similar contaminants were found in groundwater during a Preliminary Assessment and Subsurface Investigation that was completed in September 1991.

Based on a 1994 Phase II Site Assessment Report, historical releases from the former chemical storage area are believed to be the most likely source of solvent (VOC) contamination identified in groundwater on site. The VOCs in groundwater include TCE and low concentrations of toluene. Based on a risk characterization, the report concluded that no further action was required.

5.2.1.4 Site A-4: Olin Chemical
(51 Eames Street, Wilmington)

The Olin Chemical site has been a chemical plant since 1953. It was formerly owned by National Polychemical Company (1953-1971) and Stepan Chemical Company (1971-1980), and was closed by Olin in September 1986. The facility has historically manufactured chemical blowing agents, stabilizers, antioxidants, and other specialty chemicals for the rubber and plastics industry. Former disposal areas include lagoons, acid ponds, and a sulfate landfill, which resulted in contamination of soil, groundwater, and surface water drainage

ditches. Various citations have been issued to site owners for improper discharges of wastes to waters of the Commonwealth, including the East Drainage Ditch.

A November 7, 1980 Administrative Order issued by the Commonwealth of Massachusetts charged that:

- from 1965-1971, chemical wastes were discharged into unlined pits (“acid pits”).
- from 1971-1972, Stepan discharged treated chemical wastes into the “acid pits”.
- from 1972 until 1980, Stepan mixed sulfate-bearing chemical wastes with calcium hydroxide to produce calcium sulfate sludge, and discharged the sludge to leaking PVC-lined lagoons that were constructed over the former “acid pits”.

Sludges have been eroded by rainfall and have washed into nearby wetlands. Oily discharges have also been previously reported at the site. Primary site contaminants consist of sulfate, chloride, ammonia, and chromium. Groundwater and surface water contaminants detected at the site include elevated levels of the COCs arsenic, chromium, and lead. Elevated levels of chromium have also been reported in soils and sediments at the site.

Previous investigations have indicated that a groundwater flow divide is located on the property, with groundwater flow directions both to the east and to the west, and the presence of both shallow and deep groundwater plumes at the site. As described in the Work Plan for Remedial Response Action by Conestoga-Rovers & Associates (October 1990), a general pattern of upward vertical groundwater flow near existing drainage ditches has been observed, indicating “a groundwater discharge component (i.e. upward flow) to the existing drainage ditches” in the area of the site.

5.2.1.5 Site A-5: Ritter Trucking (former)
(856 Woburn Street, Wilmington)

Prior to 1959, the site was residential. In 1961, all of the buildings were razed, the current structure (one-story masonry office/garage) was constructed and the site was leased to Ritter Transportation, Inc. A 6,000-gallon underground diesel fuel tank was installed in 1961. This

tank was found to be leaking and was replaced with a 10,000-gallon diesel underground storage tank (UST) in 1985. Reportedly, the 6,000-gallon UST was filled with sand and abandoned in-place. Also, a 6,000-gallon gasoline UST that was installed in 1961 was removed in July 1989. During the excavation of this tank, a 2,000-gallon UST was discovered and removed. This UST was suspected to have contained heating oil.

Ritter used the property as a trucking terminal, wash station, and maintenance area. Petroleum releases have been reported from USTs, spills, and from releases related to on-site underground settling tanks that were used to remove solids from wastewater prior to discharge into the sanitary sewer system. The wastewater was generated during tanker-trailer cleaning operations. The tanker-trailers were used to transport materials that reportedly included "latex chemicals". Groundwater contamination documented in the past has included petroleum-related compounds and chlorinated solvents, including the COCs benzene, toluene, and TCE. Elevated levels of TPH have also been detected in soils.

According to a 1989 report, "...levels of contaminants in groundwater have generally appeared to be attenuating..." and no further remedial actions were recommended at the time; however, continued groundwater monitoring and paving of the truck yard was recommended.

In 1991, MADEP noted in the file that groundwater was still contaminated from Ritter's former operation and that they had "...serious violations". A floating layer of petroleum product associated with two former underground storage tanks was found in groundwater. Solvents in groundwater were tentatively associated with the wastewater settling tank on site. Spilled epoxy residues were observed, and "a significant amount" of diesel fuel was released to the ground. USTs and some associated soils contaminated with petroleum and chlorinated solvents were excavated and removed from the site.

Data from a March 1997 groundwater sampling round indicated benzene concentrations at 14.4 µg/l. Toluene, however, was undetected.

5.2.2 AREA B - Sites Northwest and West of the Industri-Plex site

Two sites are in Area B.

5.2.2.1 Site B-1: Blox/Brussard (100 Ashburton Avenue, Woburn)

This property was formerly used by various leather tannery operators from at least 1912 to as late as 1938. Approximate dates of historical site ownership are as follows:

- 1912: H.W. Clark Leather Co. (patent leather and finished goods).
- 1918: Algonquin Leather Co. (patent leather and finished goods).
- 1937 - 1938: Lord's Tanning Co. (patent leather and finished goods).
- 1940s: Glick Bros. Poultry (poultry slaughterhouse).
- 1950s: Slotnick Surplus (military surplus).
- late 1960's - mid-1980's: Blox Industries Inc. (mothball manufacturing).
- 1984: Brussard bought the property (Amber Delivery Service - a dispatch service, later changed to Truck-Courier, Inc.) The property, which is owned by Applejack Realty Trust, is also leased by a publishing supply firm, a pallet rebuilding company, and a HVAC contractor.

Sources of soil and/or groundwater contamination include an animal hide scrap pile, former tannery waste lagoons and trickling filters, soil sludge areas, and a former drum area. COCs detected during a 1988 site investigation include arsenic, chromium, and lead in soil and groundwater, with mercury also detected in soil. During the tannery operations, waste was reported to have been directed to the Aberjona River through surface channels, as described by MADEP in a 1992 Site Investigation Prioritization (SIP) report:

"...The surface water pathway seems to have been an extensive route of contamination during the period when leather tanning occurred on-site, but there is no readily apparent surface-water pathway now. The 1930 M&E letter to Lord Tanning states that wastes were discharged to the Aberjona River

through surface channels. The modern consultant's assertion that infiltration exceeds runoff in the soils supports the assertion that little contamination reaches surface waters now. An unknown issue, however, is whether groundwater from the site discharges to nearby wetlands that may then yield seasonal surface water flows that would reach the Aberjona River through manmade channels to the east."

The 1992 SIP report by MADEP also describes the former wastewater treatment system as follows:

"A 1930 report by Metcalf & Eddy Engineers... indicates that primary waste treatment processes consisting of concrete sedimentation tanks, earthen sedimentation beds, and sludge-drying beds or lagoons were overburdened. Waste that was handled as intended was discharged through a ditch to the Aberjona River near the site of the Merrimack Chemical Co., now the Industri-Plex Superfund site."

No information was available as to whether additional studies have been conducted.

5.2.2.2 Site B-2: Woburn Sanitary Landfill (Merrimac Street, Woburn)

Waste disposal in the 54-acre landfill began approximately in 1966. The landfill has reportedly received various types of wastes including residential/commercial waste, raw sewage, burned waste, construction/demolition debris, and more than 20,000 cubic yards per year of "gelatin sludge" from General Foods (by-products from digestion of steer and pig hides). (See also Section 3.1.1.1) Only limited analytical data were available. Previous sampling (1988) indicated the presence of COCs in groundwater including lead, benzene, toluene, and PAHs. Brooks and wetlands border portions of the landfill, and reportedly, perimeter streams may receive much of the groundwater and surface water runoff leaving the site.

In accordance with a 1996 consent order, the first quarterly round of samples were collected in March 1997 to support a Comprehensive Site Assessment (Maguire Group, 1997). The analytical results indicated elevated concentrations of heavy metals, VOCs, and semi-volatile compounds in groundwater, surface water, and sediments. The highest concentrations of COCs were observed in stream sediment samples collected from the southeast portion of the landfill (arsenic at 330 mg/kg, chromium at 850 mg/kg, lead at 320 mg/kg, benzene at 20 µg/l). This stream flows to the New Boston Street Drainway, which discharges to Halls Brook. Groundwater flows in a general south/southeast direction toward Halls Brook and the HBHA.

5.2.3 AREA C - Sites Southwest of the Industri-Plex site

Six sites are in Area C.

5.2.3.1 Site C-1: North Woburn Industrial Park (Gill Street and Sixth Road, Woburn)

Historical land use at the property included a combination of a farm and piggery (Sousa Farm) from 1950 to the 1960s, and undeveloped woodland and wetlands. The property is currently occupied by a seven-building industrial park (construction of the industrial park began in 1968). There are no known USTs at the property.

Halogenated solvents were used and stored by various occupants of the industrial park in industries such as circuit board manufacturing, silk-screen printing, and machine repair. Chlorinated VOCs are present in groundwater, including a COC, TCE. The source of this contamination is not known for certain, but is believed to be partially related to a catch basin from which approximately 33 tons of contaminated soil was removed in 1987. This removal, plus "natural aquifer flushing" are believed to have decreased the VOC levels in this area. Another unknown source of VOC groundwater contamination may be present. However, it does not appear to be directly related to the former catch basin source area due to dissimilarity of constituents. No information is available as to whether additional studies have been conducted.

5.2.3.2 Site C-2: Globe Ticket Company
(166 New Boston Street)

Fill materials, including bones and hides, were found in test pits on the property. The property was a piggery before construction of the current building in 1976 (used to print event tickets). Sampling in 1986 indicated an elevated level of lead in groundwater, with a lower level reported in 1995. No indication of a potential on-site source (other than possibly the historical buried hides) was noted in the MADEP files. However, the printing company stores several chemicals used in the printing process, including solvents. Soil samples were analyzed using Extraction Procedure (EP) Toxicity test methods, not total metals analysis. This data should be considered inconclusive with respect to the presence of COCs.

5.2.3.3 Site C-3: 3-C Company
(Continental Chemical - 181 New Boston Street, Woburn)

A review of aerial photographs indicates that prior to 1966, the site was undeveloped and used as a pig farm, with portions of the site used as a private landfill. The property was sold to 3-C Company in 1973, which constructed the main building. 3-C Company was acquired by Continental Brands in 1987.

Two RTNs are applicable to this property (see Table 5-1). This property formerly contained 10 USTs that were installed in approximately 1973 and were removed under a Remedial Action Measure (RAM) in May of 1995. Groundwater samples collected during a site assessment in 1986 indicated elevated concentrations of toluene, methyl ethyl ketone, and TCE. A groundwater treatment system was installed in 1991.

A toluene spill in 1994 caused by a leaking UST supply line resulted in the site receiving a second RTN. In November 1995, 8,000 gallons of toluene-contaminated groundwater were removed from an area of excavated soil around the former USTs. Sampling indicated significant levels of toluene in groundwater. A pump and treat system (air stripper/GAC unit)

was approved in March 1996. The current status of this system is unknown. A site assessment report stated that groundwater flows toward HBHA.

The site continues to be a source of solvent contamination. Available data indicate that the principal contaminant is toluene. However, the detection limit for all other VOCs was 50,000 µg/l. Consequently, the data should be considered inconclusive as to whether or not other VOCs exist at the site in excess of MCLs or GW-2 standards.

5.2.3.4 Site C-4: Ace Disposal Service
(22 North Maple Street, Woburn)

The property was owned by the City of Woburn until 1961 when it was transferred to Malcom Sawyer. Also in 1961, the property was transferred to Wayne and David Goldman. In 1971, the property was conveyed to the Wayne Realty Trust (Wayne Goldman). That same year, the Woburn Redevelopment Authority assumed ownership of the property for non-payment of taxes and in order to develop an industrial park in the area. In 1972, the Woburn Redevelopment Authority sold the property to Stanley Realty Trust and the existing office/garage structure was constructed. Until 1984, the site was leased to Ace Disposal Service for office space and for the storing and servicing trucks and equipment used to collect and transport residential and commercial refuse. In 1984, Waste Management of Massachusetts, Inc. leased the property for its Boston/North Division office and garage where it services its vehicles and stores empty waste containers (dumpsters and roll-off containers).

Two RTNs are applicable to this property (see Table 5-1). Sampling conducted under the "waiver" RTN, filed under Ace Disposal Service, indicates VOC contamination in groundwater (including the COCs TCE and toluene), with a drywell as the apparent source. This drywell and surrounding contaminated soil were removed in October 1995. Groundwater flow direction is reportedly to the east-southeast, toward HBHA. According to MADEP file information, a groundwater pump and treat system (air stripper system) was planned for construction in 1996. No information regarding the construction or operation of the treatment system was available.

A "new release" RTN, was filed under Waste Management of Massachusetts in 1994. This RTN is for a recurring release of motor oil from vehicle maintenance activities (including steam cleaning of truck engines), causing soil and groundwater contamination. Some oil-contaminated soil was excavated and transported off site between December 1994 and March 1995. Additional excavation or in-situ treatment are being considered to remediate the residual oils. Treatment for the contaminated groundwater continues to be investigated.

5.2.3.5 Site C-5: Atlantic Plywood
(Roessler Road, Woburn)

In the 1960s, this property was part of larger parcel that was used as an open burning dump for municipal and other waste materials. The dump was known as the Allstate Sand and Gavel Dump (see also Section 3.1.2). Atlantic Gelatin sludge was also disposed here (treated rawhide scraps were used to manufacture gelatin). The file notes indicate that in 1968, the burning of tires and other combustibles took place, and that barrels of "off-spec. paints" caught fire. The dump was ordered closed soon after the fire.

In 1984, discolored soils from trenches were sampled during excavation for footings for a building addition. Soils contained elevated levels of contaminants, including the COC, lead. The file noted that available groundwater data showed no evidence that the contaminants were leaching from the soils. Recommendations were made to return the excavated material to the trenches and any excavated waste still exposed should be covered with clean fill pending assessment of the nature and extent of the contamination. No information is available as to whether additional studies have been conducted.

5.2.3.6 Site C-6: (Keramas) Property
(19 Sixth Road, Woburn)

Complaints have been registered with MADEP alleging disposal of chemicals on the property that may have included chromic acid, TCE, methyl ethyl ketone, and etching solutions. An inspection by MADEP did not indicate any obvious dumping or discharge of acids. An incident involving corrosion and replacement of a sewer pipe was reported in October 1982.

A site assessment was conducted in 1985 that included installation of five soil borings and one monitoring well. In 1986, groundwater sampling indicated the presence of several VOCs including one COC, TCE. A letter from MADEP stated that no enforcement action was anticipated at the time. No information is available as to whether additional studies have been conducted.

5.2.4 AREA D - Sites Southeast of the Industri-Plex site

Two sites are in Area D.

5.2.4.1 Site D-1: Marshall's (83 Commerce Way, Woburn)

According to a consultant's report, a 1966 aerial photograph indicated the land in the vicinity of this property was undeveloped or possibly used for agricultural purposes. Water and sewer service were installed to this area in April 1974, at the time the industrial park was initiated. Marshall's acquired the property in 1976.

Three USTs were previously located on the property, as follows:

Tank No. 1 (5,000-gallon - diesel fuel): Installation date is unknown; however, based on a review of the tank tightness test, the tank may have been installed at the time the property was first developed approximately in 1976); failed a tank tightness test in October 1987, but passed a re-test in January 1988. Tank was removed on September 30, 1993 as part of a general facility upgrade.

Tank No. 2 (5,000-gallon - diesel fuel): Installation date is unknown; however, based on a review of the tank tightness test, the tank may have been installed at the time the property was first developed (circa 1976); failed two tank tightness tests in October 1987 and January 1988. Tank was removed in February 1988.

Tank No. 3 (1,000-gallon - diesel fuel): installed in 1977; tank was not tested, but was removed in February 1988.

During the 1993 removal of Tank No. 1, (5,000-gallon UST for diesel fuel), contaminated soil and floating product were discovered. An Immediate Response Action (IRA) Plan was submitted in November 1993 and in December 1993/January 1994, approximately 50 tons of contaminated soil were removed and disposed. A Phase I Site Assessment was completed in September 1994. Free-product thickness, ranging from 0.5 inches to 3.5 feet, has been gauged in monitoring wells. Subsequent groundwater monitoring indicates that free product remains in one well. Soil gas results have indicated VOC contamination (benzene, toluene) to the property line.

The January 1996 RAM proposed the removal of additional soil and free product, followed by area monitoring. During July to August 1996, approximately 1,000 cubic yards of contaminated soil were removed from the former UST locations. Groundwater contains elevated levels of the COCs benzene and toluene, and flows toward the Aberjona River. Groundwater monitoring will continue in accordance with the RAM Plan.

5.2.4.2 Site D-2: Chomerics
(8 Commonwealth Avenue, Woburn)

Chomerics purchased the property (Broderick Building) in 1969, and was the first occupant and owner of the building. Additional buildings were purchased or leased by Chomerics in 1977 (Seeger Building), 1981 (Foster Building), and 1984 (Rothenberg Building). Manufacturing activities have been conducted in all buildings, either historically or presently, except for the Foster Building. Computer Processing Institute, Inc. leased one floor of the Foster Building from 1982 to 1986. Also, the Rothenberg Building, constructed in 1975, was initially occupied by the Diano Corporation (1975 to 1980), and then by Bausch and Lomb, Inc. (1980 to 1983). Both companies manufactured optical equipment. Chomerics was bought by W.R. Grace and Company in 1985.

A variety of solvents and other hazardous materials are stored and used in Chomerics' manufacturing process of electromagnetic interference (EMI) cover/gasket shields. The COCs, benzene (750 µg/l) and TCE (850 µg/l), as well as other VOCs such as acetone (7,000 µg/l) and 1,2-dichloroethylene (4,000 µg/l), have been detected in groundwater. Although no specific source has been identified, several potential sources of groundwater contamination are discussed in previous site studies, including unidentified possible historical spill(s), residual contamination from a former leaking sewer line, a former plating wastewater holding tank, and a possible off-site source that has migrated onto the property.

In October 1992, three gasoline USTs were removed from a concrete vault at the property. The tanks had been installed in 1981, and were comprised of two 10,000-gallon and one 5,000-gallon gasoline storage tanks (one of the 10,000-gallon tanks had been used for diesel fuel storage in the past). Approximately 60 cubic yards of petroleum-contaminated soil were also removed (from above the tanks) during the removal of the three gasoline USTs. The contaminated soils were thought to be the result of overfills and surface spills since the tanks appeared to be in good condition. Approximately 2,375 gallons of petroleum-contaminated groundwater were also pumped from the concrete vault and disposed at a treatment facility. The consultant report stated that no evidence existed to confirm that releases within the vault had migrated into surrounding soils or groundwater. Groundwater from the site reportedly discharges to the Aberjona River, located approximately 500 feet from the property boundary.

Woburn Fire Department records also indicated the registration of two 1,200-gallon tanks of hypochlorite (bleach solution), installed in concrete vaults in 1977. Bleach spills were reported from these tanks. Also, from 1969 to approximately 1975 or 1976, two underground holding tanks were used for process wastewater/plating waste and sanitary wastewater. These tanks were periodically emptied and disposed off site by a waste hauler.

5.2.5 AREA E - Sites South of the Industri-Plex site

Two sites are in Area E.

5.2.5.1 Site E-1: Industrial Property
(10 Commerce Way, Woburn)

This site was wetlands and undeveloped land until approximately 1983 to 1984 when a portion of the wetlands was dredged to remove river sediments and peat, and then filled with structural fill materials (sand and gravel) to support construction of an office building. During the design/permitting phase of the initial site development (1982), samples of the soils/peat to be dredged were analyzed using EP Toxicity analysis to determine disposal options. The analytical data indicated that the dredged materials were not hazardous. However, no data was available as to total metal concentrations. The wetlands is now covered with approximately 6 feet of sandy fill.

A 1991 Phase I Site Investigation reported soil contamination (elevated levels of the COCs arsenic, chromium, lead, mercury, and TPH) at a depth of 6 to 8 feet, which coincides with the former wetland surface (in the vicinity of the former lake bed of Mishawum Lake). Groundwater contamination (including arsenic and TCE) was also present.

The property received a RTN in 1995 when the MADEP was notified of the presence of VOCs and heavy metals in groundwater. This information was obtained from borings installed during the design phase of a proposed seven-story office building. No reports indicate an on-site source or potential source. Further investigations are pending.

5.2.5.2 Site E-2: Woburn Mall, Wetlands Area
(300 Mishawum Road, Woburn)

From 1961 to 1968 the property was owned by Stauffer Chemical Company. A review of aerial photographs indicates that the area was essentially undeveloped at this time. However, dirt roads were noted to exist running through this parcel. In 1968, this parcel was sold to William and Frank D'Annolfo (Mark-Phillip Trust) who retained the property until 1973 when it was sold to Cabot and Forbes Woburn Land Trust. In 1977, the property was transferred to the Woburn 128 Associates. Finally, in 1982, the property was sold to its current owner, Woburn Mall Associates.

The majority of the study area is within a filled area of the previous Lake Mishawum lake bed, and is reportedly hydraulically connected to the Industri-Plex site area. Data from soil samples collected at depths of 4 to 6 feet, indicate elevated levels of metals including the COCs arsenic, chromium, and mercury in the underlying sedimentary peat deposit associated with former Lake Mishawum. Arsenic was also reported at elevated levels in groundwater. No evidence exists of historical on-site waste generation or storage. Test pits, soil borings, and monitoring wells have been advanced at the site; a Phase II study was recommended to assess and characterize the type and quantity of hazardous material present within the study area. No information is available as to whether the study was implemented.

5.2.6 AREA F - Sites Outside the Vicinity of the Industri-Plex site

Three sites are in Area F.

5.2.6.1 Site F-1: MBTA Property (Mishawum Road, Woburn)

In May 1979, 184 drums of polyurethane resins and toluene diisocyanate were removed from the site. In 1986 and 1987, test pits were excavated and soil samples were collected. Soils in the eastern portion of the site contained elevated levels of metals, including the COCs chromium, lead, and mercury. Urban fill materials (cinder, ash, construction debris) were observed in several test pits, and animal hides were observed in one test pit. Soil sampling in a test pit in the former drum storage area indicated the presence of numerous base/neutral/acid (BNA) compounds, including PAHs. These compounds are believed to be the result of a small spill or leak from drums that were stored on site in 1979. The proximity of the site to Interstate 95 (Route 128) is also believed to contribute to the presence of PAHs (common products of combustion) in soil.

Based on MADEP files, no groundwater sampling information is available for the site. The site is currently covered with a paved parking lot. A consultant's report recommended that any soil that will not be paved over, or any soil that is to be excavated, be sampled for metals

and other contaminants. Also, no additional information was found on historical property ownership, either in the MADEP files or at the City Assessor's Office. A September 1987 MADEP memo to the file does state that "the general parking lot area had a good deal of construction debris and appeared to have been used as a dumping area over a period of years."

No information is available as to whether additional studies have been completed.

5.2.6.2 Site F-2: Commercial Property
(299 Mishawum Road, Woburn)

From 1958 to 1989, the site was owned by Brodie, Inc., a forklift and mechanical equipment sales and service facility. The site was sold to Toys"R"Us in 1989. The site originally contained six USTs used to store gasoline, diesel fuel, heating oils, lubricating oils, and waste oil. No information was available regarding the UST installation dates. Only three UST removals (March 1991) were documented in the MADEP files although "all were reportedly removed". The consultant who observed the removals reported a sheen on the groundwater surface in the diesel tank excavation and a small amount of floating product in the gasoline tank excavation. Records indicate that only 15 cubic yards of contaminated soils were removed.

Soil and groundwater have been impacted by petroleum releases related to former USTs at the property, as observed during tank removals. A sheen and a small amount of floating product were observed on the water table in former foundation excavations conducted in March of 1991 for a new Kids"R"Us building. Some petroleum-contaminated soil and peat were removed during tank removal activities, and in June of 1993 during excavation for a new foundation for the current "Just for Pets" building. Recommendations presented in a consultant's report include performing an additional investigation at the unexcavated areas of the site to determine the levels of remaining contamination, if any, in soil and groundwater. No information is available as to whether the study has been implemented.

5.2.6.3 Site F-3: Mobil Station
(2 West Street, Reading)

The property has been a gasoline service station since 1946. The facility has undergone several UST volume upgrades since 1946. Although the installation dates are not documented, the most recent indication of added storage capacity is noted to have occurred in 1982, when a license was granted to increase storage by 9,500 gallons.

A release of hydrocarbons was reported in 1989 during the removal of a UST used for waste motor oil. A Phase I investigation was completed in 1989, and a groundwater remediation system and a soil vapor extraction system (SVES) were installed in 1991. The groundwater recovery system had treated more than 600,000 gallons of groundwater between 1991 and 1995, removing an estimated 158 pounds of hydrocarbons. The SVES had extracted an estimated 375 pounds of hydrocarbons. The COCs detected in groundwater include lead, benzene, and toluene. TPH was also detected in soil.

5.2.7 AREA G - Sites Not Requiring Further Investigation

Five sites do not require any further study.

5.2.7.1 Site G-1: Commercial/Industrial Property
(268 Mishawum Road, Woburn)

Petroleum-contaminated soil from spills and leaks from stored drums and vehicles have been observed at the site. The petroleum sources include No. 2 fuel oil, motor oil, waste oil, and hydraulic fluid. Approximately 135 cubic yards of soil were removed and shipped to an asphalt batching plant in 1992. A consultant's report states that "groundwater is not significantly impacted" (analytical results for three monitoring wells sampled for VOCs and TPH in March 1992 were all "not detected"). However, in 1993, a MADEP "Review of Release Categorization Form" noted that "...additional investigation is warranted to determine the extent of soil contamination and groundwater quality at the site. Of the areas remediated, elevated TPH concentrations in area A-4 still exist." A sketch figure indicates

groundwater flow direction to the southeast. A 1992 site sketch also indicates the presence of two USTs ("fuel oil UST" and "former diesel oil UST"); however, no further information about these USTs is known. No information is available as to whether additional studies have been completed.

5.2.7.2 Site G-2: Winn Trucking Terminal
(195 New Boston Street, Woburn)

The existing structures were constructed in 1971 and 1972. At that time one 5,000-gallon diesel UST, one 5,000-gallon gasoline UST, and one 500-gallon waste oil UST were installed. According to the property owner, the waste oil tank was never used because the fill pipe was blocked.

During a 1985 sampling event, TCE and other VOCs were detected in Halls Brook, which crosses the property. A low level detection of another VOC (non-COC) was detected in on-site groundwater. Petroleum USTs are present on site; however, borings in the vicinity did not indicate any loss of product from these USTs. Based on existing file information, the property does not appear to be a source of contamination, but historical sampling has indicated the presence of low-level VOCs in surface water and groundwater on the property. Consultant reports have attributed this contamination potentially to the Industri-Plex site, which abuts the property to the east.

5.2.7.3 Site G-3: Undercoverwear - Lot 2A
(1 Presidential Drive, Woburn)

This property was apparently initially reported to MADEP in June of 1988 because of hydraulic fluids leaking from parked vehicles, resulting in petroleum-contaminated soils. Initially, TPH was reported up to 72,000 ppm in surface soil, although some soils were reportedly excavated to a depth of 8 feet during building construction. More recent sampling (1992) of the new fill brought onto the site also detected TPH, but at lower levels (TPH at 170 mg/kg at a depth of 5 to 7 feet). This TPH is presumed to be related to "... poor quality fill used to grade the site and other nearby properties." Groundwater sampling has not

shown significant contamination (levels are below MCLs and GW-1 standards). The site Massachusetts Licensed Site Professional (LSP) recommended that if excavation occurs in the future, an environmental professional should be retained to assess potential contaminated soils issues.

5.2.7.4 Site G-4: Industrial Property
(3 Industrial Way, Wilmington)

Development of the site first occurred in 1973. Additions to the initial buildings were made in 1975 and 1976. A portion of the property was leased to ZBR Publications in 1978.

Samples collected in May of 1991 indicated that VOCs, including the COC TCE (12 µg/l), were present in groundwater on site. Several different types of solvents used by this printing company were stored on site. However, no evidence of an on-site release and no known underground pathways originating from the building, such as floor drains or piping, were noted in a 1991 preliminary environmental assessment.

According to information presented in the assessment report, several upgradient properties have been identified as the source of groundwater contamination similar to that found on the subject site. The report concluded that the VOC groundwater contamination is likely originating from an off-site/upgradient source.

5.2.7.5 Site G-5: AGFA (Compugraphics)
(65 Industrial Way, Wilmington)

As documented in a 1991 report, a possible release of solvents into a drywell and/or historical overfills/spills from a former 1,1,1-trichloroethane above-ground storage tank caused VOC contamination of groundwater at this property, including TCE (12 µg/l). A RAM plan submitted to MADEP in December 1994 proposed vapor extraction and air sparging to treat groundwater. The groundwater treatment system was installed shortly thereafter and continues to operate. A November 1995 RAM status report indicates that the concentrations of VOCs in groundwater have continued to decrease with treatment and time.

5.3 CERCLIS Sites

CERCLIS is a database in which the EPA stores management information on all locations evaluated under the Superfund program. The sites are identified for placement in CERCLIS through a variety of mechanisms, including formal notification requirements and citizen telephone calls. A site's presence in CERCLIS does not imply a level of risk to the public health and environment. Sites are not removed from the database after completion of evaluations in order to document that these evaluations took place and preclude the possibility that they be needlessly repeated. Inclusion of a specific site in the database carries no local or regulatory consequence.

Preliminary Assessments (PAs) are performed by the EPA or states within one year of being entered into the CERCLIS database. Based on the results of the PA, additional investigations may be conducted. If a site is found to pose an environmental or public health threat significant enough to warrant remedial action under Superfund, then the site would be listed as an NPL site. The percentage of CERCLIS sites that become NPL sites is between 5 and 10 percent.

Only one site was found in the CERCLIS database that was not included in the MADEP 21E files and discussed in the previous sections. The site is New England Resins and Pigments located at 316 New Boston Street. The site was owned and operated by the Merrimac Chemical Company from 1853 to 1929. From 1915 to 1964, the site was occupied by a succession of fertilizer manufacturers. The previous owners operated a lagoon where "white powder" and other wastes were reportedly dumped. The lagoon has been filled with rubble, gravel, and what appears to be slabs of hardened resins. Although a PA and Site Inspection were performed by EPA in 1980 (Ecology & Environment, 1980), no samples have ever been taken from the former lagoon area.

5.4 East Drainage Ditch

The East Drainage Ditch is a surface water drainage system that runs parallel to the Massachusetts Bay Transportation Authority (MBTA) railroad tracks through heavily industrialized areas. The surface water in the ditch flows south to the New Boston Street Drainway, which eventually discharges to Halls Brook. The ditch passes through industrialized areas receiving surface runoff from both the east and west sides of the tracks. Although surface drainage patterns in the area of the East Drainage Ditch have not been confirmed as part of this study, runoff from confirmed disposal sites has the potential to flow to the ditch, based on site proximity and topography. These sites include Olin Chemical, E.C. Whitney & Sons, Inc., Ritter Trucking, Industri-Plex, and Raffi & Swanson (not included in this study).

Surface water samples collected from the East Drainage Ditch during a 1982 investigation by Ecology & Environment (Geotrans, Inc, 1987) indicated the presence of toluene; 1,2 trans-dichloroethylene; trichloroethylene; xylene; 1,1,1 trichloroethane; methyl ethyl ketone; and methyl isobutyl ketone. In addition, as discussed in the following section, MIT conducted several investigations of the Aberjona River and its tributaries, including the East Drainage Ditch. These studies also confirmed the presence of elevated concentrations of VOCs such as toluene, benzene, and TCE in the surface waters of the East Drainage Ditch.

5.5 Former Mishawum Lake

As discussed in previous sections, Mishawum Lake received surface water flow from the Aberjona River and Halls Brook. Runoff and drainage from the Industri-Plex site flows to the Aberjona River and Halls Brook. Settling ponds, known as the “chromium lagoons” also drained to a drainage ditch that discharged to the northern section of the former Mishawum Lake.

Based on GSIP Phase I and Phase II data, groundwater contaminated with arsenic was found to be discharging to the HBHA (formerly the northern section of Mishawum Lake). In

addition, sediments within all reaches of the HBHA have been found to be contaminated with elevated concentrations of arsenic.

It is strongly suspected that Mishawum Lake acted as a settling basin for contaminated suspended solids discharged from the Industri-Plex site through surface water or released from contaminated groundwater. This position is based on historic surface water flow patterns, the operations of the Merrimac Chemical Company (et al) from the early 1900s through the late 1960s, and known contamination at the Industri-Plex site and the HBHA.

During the 1970s and early 1980s, portions of Mishawum Lake bed were filled to accommodate development of several industrial parks. Consequently, much of former lake bed was filled/covered with sand and gravel. As data from 21E sites located in the area of the former Mishawum Lake indicate (see Sites E-1 and E-2), site-related heavy metals have been found in peat and sediment deposits of the former lake bed. These contaminated sediments may represent a potential continuing source of groundwater contamination and possibly surface water contamination.

5.6 MIT Research Summary

As summarized in several publications by researchers from MIT, significantly elevated concentrations of arsenic, chromium, and lead have been found in sediments of the Aberjona watershed, extending from the Industri-Plex site area, through the Aberjona River, the HBHA, further south to the Mystic Lakes.

Some of the MIT studies focus on the sources and distribution of arsenic. Specifically, in the HBHA, at the southern-central portion of the MSGRP study area, arsenic concentrations in sediments have been observed up to 9,800 ppm, averaging 1,400 ppm. Both surface water and groundwater were noted as important migration pathways for arsenic.

According to MIT's study, the northern end of the HBHA is recharged by springs; this groundwater recharge is believed to be the major source of arsenic to this water body "under moderate flow conditions". Surface water samples collected from this area contain arsenic

concentrations up to 80 parts per billion (ppb), or 0.08 ppm. Arsenic is stored, at least temporarily, in sediments of the HBHA. However, much of the arsenic is mobilized and transported downstream with suspended solids, especially during high flow events. Although these arsenic concentrations in surface water were below the regulatory screening standards established for this study, they do indicate areas that may have been impacted by the Industri-Plex site; associated transport mechanisms; the downgradient migration of COCs; and suspect areas that should be considered for future investigations.

In a study conducted to support a doctoral thesis, an MIT student researched the fate of VOCs discharging from a contaminated aquifer to a stream, specifically, the East Drainage Ditch. The East Drainage Ditch flows southward to Halls Brook. The reach that was studied is upgradient of the Industri-Plex site and was selected for the MIT study because of a known continuing source of toluene that was discharging from groundwater into the stream. Although the specific source of contamination was not identified, elevated concentrations of VOCs were found in surface water samples collected from the ditch. Maximum concentrations of detected VOC maximum concentrations included 12,000 ppb of toluene, 460 ppb of TCE, and 120 ppb of benzene. Numerous confirmed disposal sites are present in the vicinity of the upper reaches of the East Drainage Ditch, as discussed in Section 5.4. These sites may be impacting groundwater quality at the Industri-Plex site and may be contributing to area-wide groundwater contamination.

6.0 SUMMARY AND CONCLUSIONS

The overall purpose of the MSGRP is to conduct an RI of the general area-wide contamination as it affects or potentially affects the groundwater and surface water in the Aberjona Watershed, and if necessary, to prepare a Feasibility Study (FS) to evaluate remedial alternatives to restore the watershed and support a ROD. The RI will be supported by the GSIP, which defines the nature and extent of groundwater contamination at the Industri-Plex site, and by additional investigations that define the nature and extent of contamination from other sources that impact the Aberjona Watershed.

The purpose of the Preliminary MSGRP Report is to conduct additional research and compile information obtained during previous investigations and identify other potential contamination sources that may contribute to surface water, sediment, or groundwater contamination at or adjacent to the Industri-Plex site or to contamination off site. Once identified, these sites should be considered for further investigation, under the RI, to determine if they are contributors to the overall degradation of the watershed.

The Preliminary MSGRP study area has been the site of extensive industrial activities since the early 1800s. These industries have included tanneries, leather finishing companies, chemical manufacturers, landfills, open burning dumps, metal fabricators, and piggeries, which have contaminated groundwater, surface water, and/or sediments within the Aberjona Watershed. In addition, numerous sites within the watershed have contaminated groundwater and soils because of leaking USTs.

This report has presented summaries of more than 25 sites located within the Preliminary MSGRP study area that may be considered potential sources of environmental contamination to the Aberjona Watershed. As documented through research of site files at MADEP, these sites have had one or more COCs present at elevated levels, in one or more environmental media. Many of these sites potentially continue to be sources of contamination. The research also identified sites where COCs were discovered during routine property transfers or site development activities where the contaminants could not be attributed to previous site operations. In these situations, contamination was typically found at depth, either in overburden soils or groundwater, suggesting possible off-site sources.

Information available in the MADEP files is limited, and the site-specific studies reviewed generally do not identify the extent of migration associated with contamination beyond the property boundaries. Therefore, the actual contribution of these off-site sources to Industri-Plex contamination cannot be clearly defined. However, a general indication of areas of past contamination sources and associated COCs can be gained from a review of Figures 5-1 and 5-2.

Very little surface water/sediment sampling data were available from the MADEP site files. However, MIT publications presented data indicating that elevated levels of arsenic, chromium, and lead have been detected in sediments throughout the Aberjona Watershed study area and specifically, the Preliminary MSGRP study area.

Covered soils and sediments within the boundaries of the Industri-Plex site have been remediated and may longer represent a direct source of contamination to surface waters within the Aberjona Watershed due to erosion. Groundwater within the boundaries of the Industri-Plex site, however, continues to be investigated under the GSIP.

The information summarized in this report should be used to focus future investigations, conducted under the MSGRP RI/FS and the GSIP Phase III, in order identify potential contaminant sources located outside the boundaries of the Industri-Plex site that may be impacting the Aberjona Watershed. These data could also be used to support MADEP site investigations and expedite remedial site closure.

Based on the findings of the Preliminary MSGRP Report, the following areas should be considered for further study:

Lake Bed of the Former Mishawum Lake

In the past, Mishawum Lake served as a sediment deposition area for surface water from Halls Brook and the Aberjona River. The reaches of the river and streams upstream of

Mishawum Lake received runoff from industrialized sites, including the Merrimac Chemical Company (Industri-Plex site).

During the 1970s, a large portion of Mishawum Lake was filled to support area-wide development. Construction activities in the 1980s (see sites E-1 and E-2) led to the discovery of soils and peat deposits contaminated with arsenic, chromium, and lead. The contamination was located at the approximate depth of the former lake bed, suggesting potential impacts from Hall Brook Holding Area (HBHA) discharges or upgradient past chemical company operations. The area of the former Mishawum Lake bed should be considered for further investigation to determine the potential presence of elevated concentrations of heavy metals, if metals are contributing to either groundwater or surface water contamination in the HBHA or areas further downgradient, and if the concentrations of metals in the former lake bed pose a potential health risk to the public (construction workers who may be excavating contaminated soils).

East Drainage Ditch

The East Drainage Ditch is a surface water drainage system that historically and currently receives runoff from several industrial sites. Reportedly, the East Drainage Ditch is also a groundwater discharge location. Many of the nearby industrial sites are MADEP/MCP disposal sites and are on-going sources of soil and groundwater contamination. Impacts to the East Drainage Ditch from potential contaminated groundwater discharges or from surface runoff from these sites have not been evaluated. MIT has conducted studies within various reaches of the East Drainage Ditch and has identified VOC contamination in both sediment and surface water; however, a specific source or sources have not been identified.

Additional investigations should be performed within the East Drainage Ditch to determine the nature and extent of contaminated sediments and surface water within the ditch. These investigations would also be used to evaluate whether contaminated sediments are an on-going source of contamination to downstream receptors such as Halls Brook, HBHA, and the Aberjona River. This information would also support on-going MADEP-regulated,

site-specific remedial investigations and could expedite restoration of the East Drainage Ditch.

Allstate Sand and Gravel Dump

Historical records maintained by the Woburn Board of Health indicate that the Allstate Sand and Gravel Dump was a continuing source of pollution to groundwater, the Aberjona River, and Mishawum Lake during its period of operation (1953 to 1965) (Section 3.1.2). The exact locations where dumping and burning occurred is not clear. Except for the limited data available for one site (C-5, Section 5.2.3.5), no data are available to evaluate current conditions at the former dump. This area should be investigated to determine if contamination remains at the site and to evaluate potential impacts to on-site groundwater, downgradient areas, and surface water and sediment in the HBHA.

Sites Surrounding the Industri-Plex Site

The Industri-Plex site is surrounded by various disposal sites where contamination sources are known to exist. The investigation and remediation of these sites is currently regulated under the MCP. As previously discussed, most (if not all) of the site investigations do not extend beyond the individual site property boundaries, leaving the extent of potential off-site contamination undefined. The intent of the MCP is to remediate on-site sources of contamination at disposal sites; however, the downgradient impacts are not necessarily defined.

Rather than extend future investigative efforts to each of the disposal sites, an area-wide investigative approach could be implemented to evaluate impacts to the ultimate downgradient receptors. Samples should primarily be collected from groundwater, surface water, and sediments from areas adjacent to the HBHA and areas further downgradient, if necessary.

Ultimately, decisions made regarding the overall remediation of the Aberjona Watershed in the Preliminary MSGRP study area should consider the status, progress of remediation, and

downgradient impacts of sites located within the study area. It may not be necessary to focus additional watershed remedial efforts on individual disposal sites that are currently being remediated under the MCP. Rather, remedial efforts should focus on downgradient areas potentially impacted by disposal sites where contamination is contributing to impacts to the Aberjona Watershed in the vicinity of HBHA.

Since the GSIP investigation has not been completed, the extent of groundwater contamination from the Industri-Plex site has not been defined. The Preliminary MSGRP Report has identified potential contaminant sources south of the Industri-Plex site. Consequently, future RI investigations may be extended beyond the boundaries of the Preliminary MSGRP study area in order to fully characterize the nature and extent of contamination from these sources and understand the overall impacts to the Aberjona Watershed.

REFERENCES

Baker, John A., H.G. Healy, and O.M. Hackett, 1964. Geology and Groundwater Conditions in the Wilmington-Reading Area, Massachusetts. Geological Survey Water Supply Paper 1964. U.S. Department of the Interior, Washington, D.C.

Camp, Dresser and McKee (CDM), 1967. Winchester - Aberjona River Study CDM 233-29R, Winchester - Woburn, Massachusetts.

Castle, Robert O., 1959. Surficial Geology of the Wilmington Quadrangle, Massachusetts, U.S. Geological Survey GQ-168, Washington, D.C.

Chute, Newton E., 1959. Glacial Geology of the Mystic Lakes - Fresh Pond Area, Massachusetts. U.S. Geological Survey 1061-F Washington, D.C.

D'Annolfo, William F., May 18, 1977. Letter to Joseph Igallo, Land Use Administrator, Department of Natural Resources, Case File P-988.

Delaney, David F. and F.B. Gay, 1980. Hydrology and Water Resources of the Coastal Drainage Basins of Northeastern Massachusetts. From Castle Neck River, Ipswich to Mystic River, Boston. U.S. Geological Survey HA509, Washington, D.C.

Ecology and Environment, Inc., 1982. Evaluation of the Hydrogeology and Groundwater Quality of East and North Woburn, Massachusetts. Volume I Final Report, TDD No. F1-8109-02. EPA Contract No. 68-01-6056.

Emerson, B.K., 1917. Geology of Massachusetts and Rhode Island. U.S. Department of Interior. U.S. Geological Survey Bulletin 597, Washington, D.C.

Fitzgerald, John, 1990. Massachusetts Department of Environmental Protection (MA DEP); Memorandum to James Persky, Water Supply, MA DEP, dated January 2, 1990; Subject: Wilmington - Raffi and Swanson, DEP Case No. 3-0470.

Geotrans, Inc., July 1987 (reprinted December 1989); Review of EPA Report Titled "Wells G & H Site Remedial Investigation Report.

Goldberg, Zoino and Associates, (GZA), 1983. Raffi and Swanson, Inc., Wilmington, Massachusetts.

Golder Associates, Inc., December 1991. Aquifer Pump Test; Industri-Plex Site; Woburn, Massachusetts; Prepared for Industri-Plex Site remedial Trust; Project No. 913-6744

Halliburton NUS Corporation, October 1996. Draft Potential Source Areas Report; Multiple Source Groundwater Response Plan; Industri-Plex Site; Woburn, Massachusetts; EPA Work Assignment No. 11-1L07; Contract No. 68-W8-0117; Project No. 2250; Document No. W96707D.

Marshall, Ann, 1991. Woburn Business Association; Personal Communication, September 5, 1991.

Massachusetts Department of Environmental Protection (MA DEP), Division of Water Supply, 1991. Water Withdrawal Permit Files, March 1991, Boston, Massachusetts.

Massachusetts Department of Environmental Protection (MA DEP), Division of Water Supply, 1991. Water Withdrawal Permit Files, March 1991, Boston, Massachusetts.

Massachusetts Department of Environmental Protection (MA DEP), Bureau of Waste Site Cleanup, 1991. List of Confirmed Disposal Sites and Locations to be Investigated - 1991, Parts 1 and 2.

Massachusetts Department of Environmental Protection (MA DEP), Division of Hazardous Waste. VSQG Generators by Region (Very Small Quantity Generators). Dated November 22, 1989.

Massachusetts Department of Environmental Protection (MA DEP), Spills Lists (Spills Lists Used: 1) Spills Up to 12/30/89; 2) 1990 Spills; 3) 1991 Spills (through 6/30/91).

Mayor, Anna 1997. Massachusetts Department of Environmental Protection; Personal Communication with Gordon Bullard (Halliburton NUS Corp., August 21, 1997).

Myette, Charles F., J.C. Olimpio, and D.G. Johnson, 1987. Area of Influence and Zone of Contribution to Superfund Site Wells G and H, Woburn, Massachusetts. Water Resources Investigations Report 87-4100. U.S. Geological Survey, Washington, D.C.

The New England Council, 1989. Directory of New England Manufacturers, 1989 - 1990, Boston, Massachusetts.

NUS Corporation, March 1991. Draft Definition of Study Area for the Multiple Source Groundwater Response Plan; Industri-Plex Site; Woburn, Massachusetts; EPA Work Assignment No. 11-1L07; Contract No. 68-W8-0117; Project No. 2250; Document No. W91067D.

NUS Corporation, October 1991. Draft User/Contributor Report; Multiple Source Groundwater Response Plan; Industri-Plex Site; Woburn, Massachusetts; EPA Work Assignment No. 11-1L07; Contract No. 68-W8-0117; Project No. 2250; Document No. W91110D.

NUS Corporation, 1991. Report No. 8: All Projects by City Location. NUS Corporation - FIT Region I, Bedford, Massachusetts.

Paulding, B.W., 1982. Groundwater Protection Study, Wilmington, Massachusetts.

Reed, Donald E., 1982. Hydrogeological Investigation, Woburn Sanitary Landfill, Woburn, Massachusetts.

U.S. District Court, July 5, 1979. Memorandum and Order on Preliminary Injunction; United States of America vs. William F. D'Annolfo, Mark-Phillip Trust; Civil Action 79-1247-Mc.

U.S. Environmental Protection Agency, Superfund Program, 1991. CERCLIS (Comprehensive Environmental Response Compensation and Liability Information System): List 1 - Site Location Listing; List 8 - Site/Event Listing. Dated March 21, 1991.

U.S. Environmental Protection Agency, 1991. RCRA Handlers in Industri-Plex and Wells G & H Vicinity. Computer Print-out dated June 7, 1991.

U.S. Geological Survey, 1985. Boston North Quadrangle, Massachusetts. 7.5 x 15 Minute Series (Topographic).

U.S. Geological Survey, 1979. Reading Quadrangle, Massachusetts. 7.5 x 15 Minute Series (Topographic). 1966, photorevised in 1979.

U.S. Geological Survey, 1979. Wilmington Quadrangle, Massachusetts. 7.5 x 15 Minute Series (Topographic). 1965, photorevised in 1979.

U.S. Geological Survey, 1944. Wilmington Quadrangle, Massachusetts. 7.5 x 15 Minute Series (Topographic).

U.S. Geological Survey, 1950 Wilmington Quadrangle, Massachusetts. 7.5 x 15 Minute Series (Topographic).

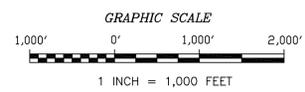
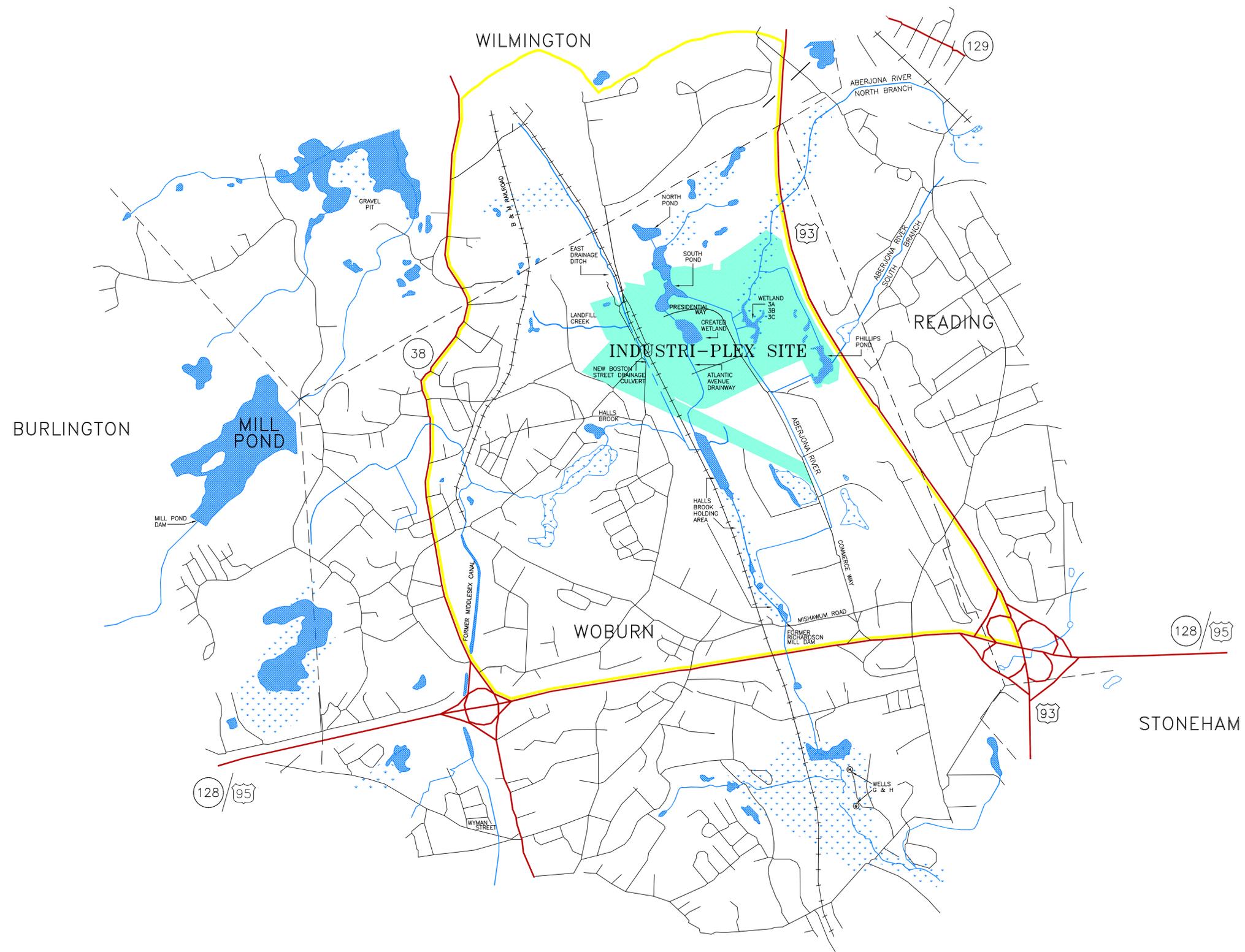
ACRONYMS

21E	310 Code of Massachusetts Regulations (CMR) Chapter 21E
BNA	base-neutral acid
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
COC	contaminant of concern
EMI	electromagnetic interference
EPA	United States Environmental Protection Agency
FS	Feasibility Study
gpd	gallons per day
gpm	gallons per minute
GSIP	Groundwater/Surface Water Investigation Plan
HBHA	Halls Brook Holding Area
ISRT	Industri-Plex Site Remedial Trust
IRA	Immediate Response Action
LSP	Licensed Site Professional
MADEP	Massachusetts Department of Environmental Protection
MBTA	Massachusetts Bay Transportation Authority
MCL	maximum contaminant limit
MCP	Massachusetts Contingency Plan
mgd	million gallons per day
mg/kg	milligrams per kilogram
MIT	Massachusetts Institute of Technology
NPL	National Priorities List
ppb	part per billion
ppm	part per million
PA	Preliminary Assessment
PAH	poly-nuclear aromatic hydrocarbons
PCE	tetrachloroethylene
RAM	Remedial Action Measure

RI	Remedial Investigation
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RTC	Regional Transportation Center
RTN	Release Tracking Number
SIP	Site Investigation Prioritization (report)
SVES	soil vapor extraction system
TCE	trichloroethylene
TPH	total petroleum hydrocarbons
µg/l	microgram per liter
USGS	United State Geologic Service
UST	underground storage tank
VOC	volatile organic compound



- LEGEND**
-  HIGHWAYS
 -  RIVER OR STREAM
 -  CULVERT
 -  PONDED AREA
 -  WETLAND AREA
 -  RAILROAD
 -  CITY / TOWN BOUNDARY

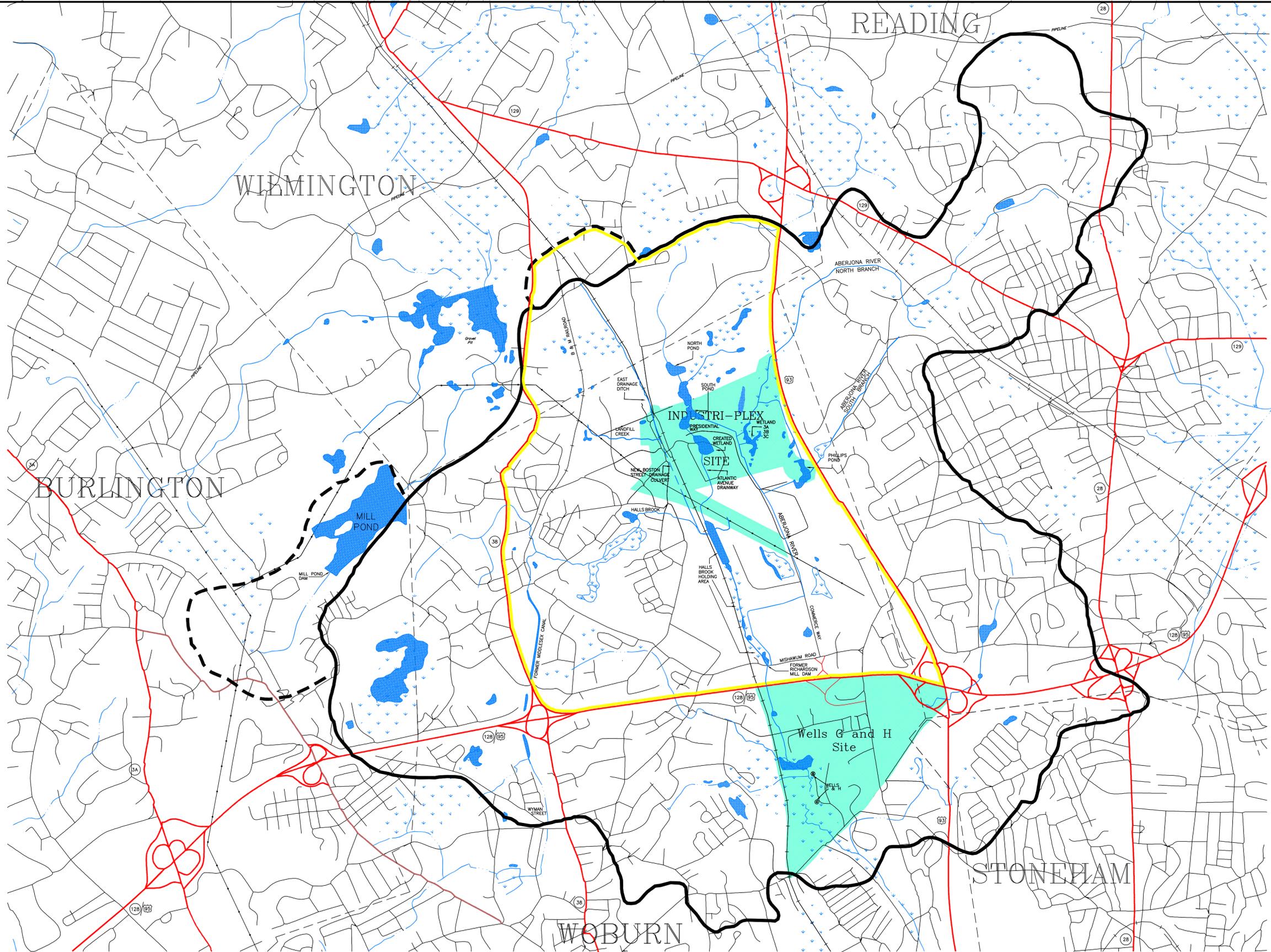


NOTE: BASE MAP FROM MASSACHUSETTS GEOGRAPHIC INFORMATION SYSTEM, 1996.

DRAWN BY: D.W. MACDOUGALL	TITLE: SITE LOCATION		
PREPARED BY: G. BULLARD	PRELIMINARY MSGRP STUDY		
CHECKED BY: G. BULLARD	INDUSTRI-PLEX		
	WOBURN, MASSACHUSETTS		
	SOURCE: USGS TOPOGRAPHIC MAP, WILMINGTON, MA, N4230-W7107.5/7.5, 1979.		
	SCALE: 1" = 1000'	DATE: AUGUST 25, 1997	PROJ. NO: 2250
PROJECT MANAGER: G. BULLARD	DRAWING NO: FIGURE 1-1	ACFILE NAME: C:\MSGRP\FIG_1-1.DWG	REV: 2
PROGRAM MANAGER: G. GARDNER			

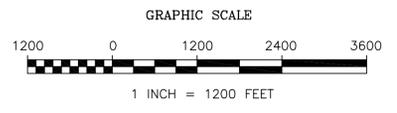


55 JONSPIN ROAD
 WILMINGTON, MASSACHUSETTS 01887
 (508)658-7899



LEGEND

- PRELIMINARY MSGRP STUDY AREA
- WATERSHED BOUNDARY
- POTENTIAL AQUIFER OUTSIDE OF WATERSHED
- HIGHWAY
- ROAD
- RIVER OR STREAM
- WETLANDS
- SUPERFUND SITE
- PIPELINE
- PONDED AREA
- POWERLINE
- RAILROAD
- CORPORATE BOUNDARY



DRAWN BY: D.W. MACDOUGALL
 PREPARED BY: M. HEALEY
 CHECKED BY: G. BULLARD

TITLE: ABERJONA RIVER WATERSHED AREA
 PRELIMINARY MSGRP STUDY
 INDUSTRI-PLEX
 WOBURN, MASSACHUSETTS

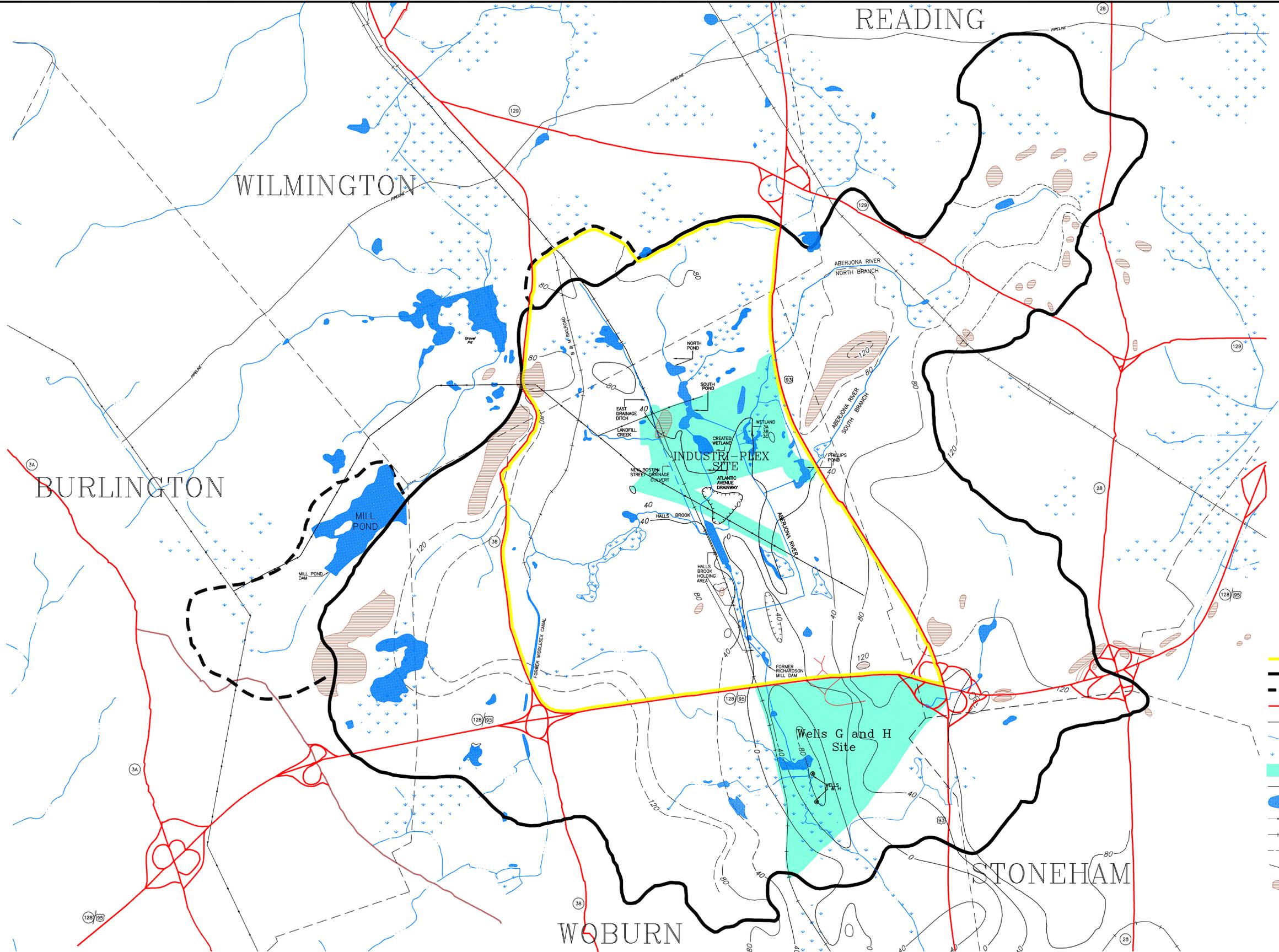
CLIENT: U.S. EPA

PROJECT MANAGER: G. BULLARD
 PROGRAM MANAGER: G. GARDNER
 CLIENT APPROVAL:

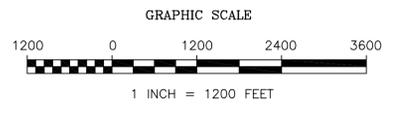
SCALE: 1" = 1200'
 DATE: AUGUST 25, 1997
 DRAWING NO: FIGURE 2-1

PROJ. NO: 2250
 ACFILE NAME: C:\DWG\IPLEXTMP\FIG_2-1.DWG
 REV: 2

187 BALLARDVALE STREET
 SUITE A-100
 WILMINGTON, MASSACHUSETTS 01887
 (508)658-7899



- LEGEND**
- PRELIMINARY MSGRP STUDY AREA
 - WATERSHED BOUNDARY
 - POTENTIAL AQUIFER OUTSIDE OF WATERSHED
 - HIGHWAY
 - ROAD
 - RIVER OR STREAM
 - WETLANDS
 - SUPERFUND SITE
 - PONDED AREA
 - PIPELINE
 - POWERLINE
 - RAILROAD
 - CORPORATE BOUNDARY
 - BEDROCK CONTOUR (DASHED WHERE INFERRED)
 - AREAS OF BEDROCK OUTCROPS



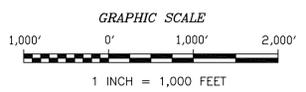
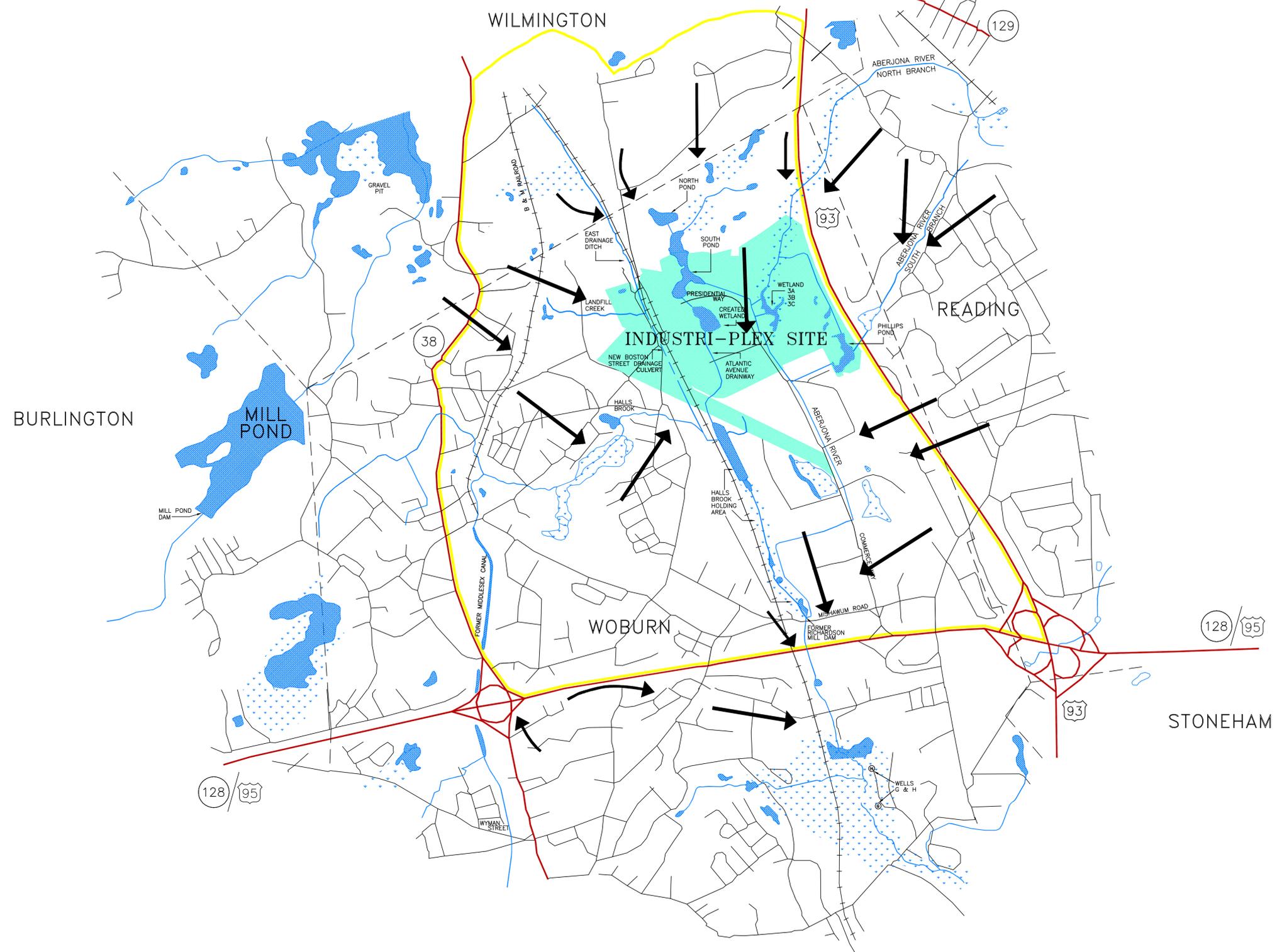
DRAWN BY: D.W. MACDOUGALL		TITLE: ABERJONA RIVER WATERSHED BEDROCK ELEVATION CONTOUR MAP	
PREPARED BY: M. HEALEY		PRELIMINARY MSGRP STUDY	
CHECKED BY: G. BULLARD		INDUSTRI-PLEX	
		WOBURN, MASSACHUSETTS	
		CLIENT: U.S. EPA	
PROJECT MANAGER: G. BULLARD	SCALE: 1" = 1200'	DATE: AUGUST 25, 1997	PROJ. NO: 2250
PROGRAM MANAGER: G. GARDNER	DRAWING NO: FIGURE 2-2	ACFILE NAME: C:\DWG\IPLXMP\FIG_2-2.DWG	REV: 2
CLIENT APPROVAL:			

Halliburton NUS CORPORATION

187 BALLARDVALE STREET
SUITE A-100
WILMINGTON, MASSACHUSETTS 01887
(508)658-7899



- LEGEND**
-  PRELIMINARY MSGRP STUDY AREA
 -  HIGHWAYS
 -  RIVER OR STREAM
 -  CULVERT
 -  PONDED AREA
 -  WETLAND AREA
 -  RAILROAD
 -  CITY / TOWN BOUNDARY
 -  INFERRED GROUNDWATER FLOW DIRECTION



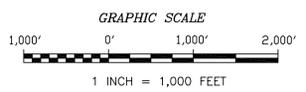
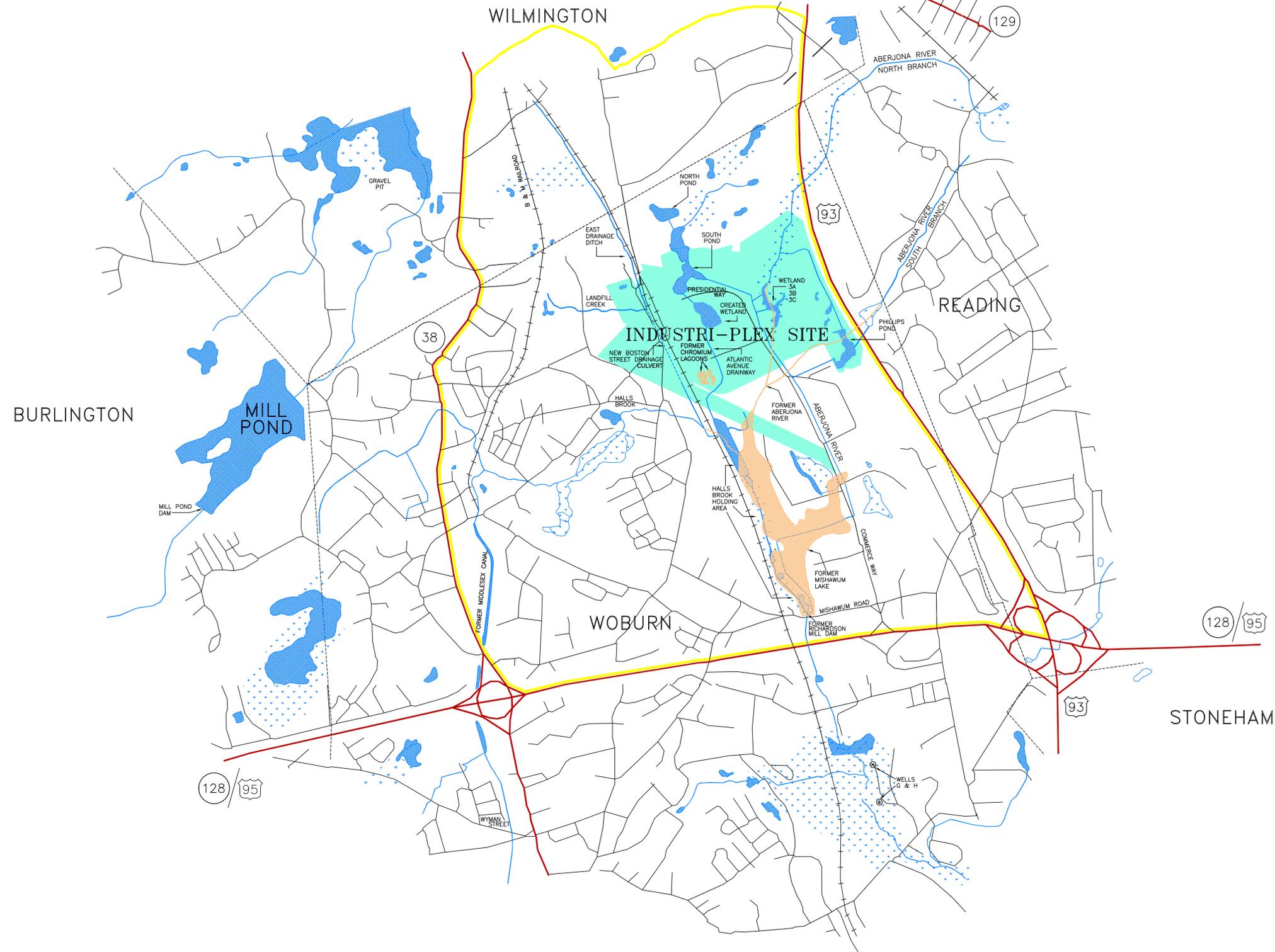
DRAWN BY: D.W. MACDOUGALL PREPARED BY: M. HEALEY CHECKED BY: G. BULLARD	TITLE: GROUNDWATER FLOW DIRECTION PRELIMINARY MSGRP STUDY INDUSTRI-PLEX WOBURN, MASSACHUSETTS	
SOURCE: USGS TOPOGRAPHIC MAP, WILMINGTON, MA, N4230-W7107.5/7.5, 1979.	SCALE: 1" = 1000'	
PROJECT MANAGER: G. BULLARD PROGRAM MANAGER: G. GARDNER	DATE: AUGUST 25, 1997	PROJ. NO.: 2250
DRAWING NO.: FIGURE 2-3	ACFILE NAME: C:\MSGRP\FIG_2-3.DWG	REV.: 2

55 JONSPIN ROAD
 WILMINGTON, MASSACHUSETTS 01887
 (508)658-7899



LEGEND

-  PRELIMINARY MSGRP STUDY AREA
-  HIGHWAYS
-  RIVER OR STREAM
-  PONDED AREA
-  WETLAND AREA
-  RAILROAD
-  CITY / TOWN BOUNDARY
-  HISTORIC RIVER
-  HISTORIC BODIES OF WATER



DRAWN BY: D.W. MACDOUGALL
PREPARED BY: G. BULLARD
CHECKED BY: G. BULLARD
PROJECT MANAGER: G. BULLARD
PROGRAM MANAGER: G. GARDNER

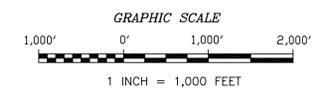
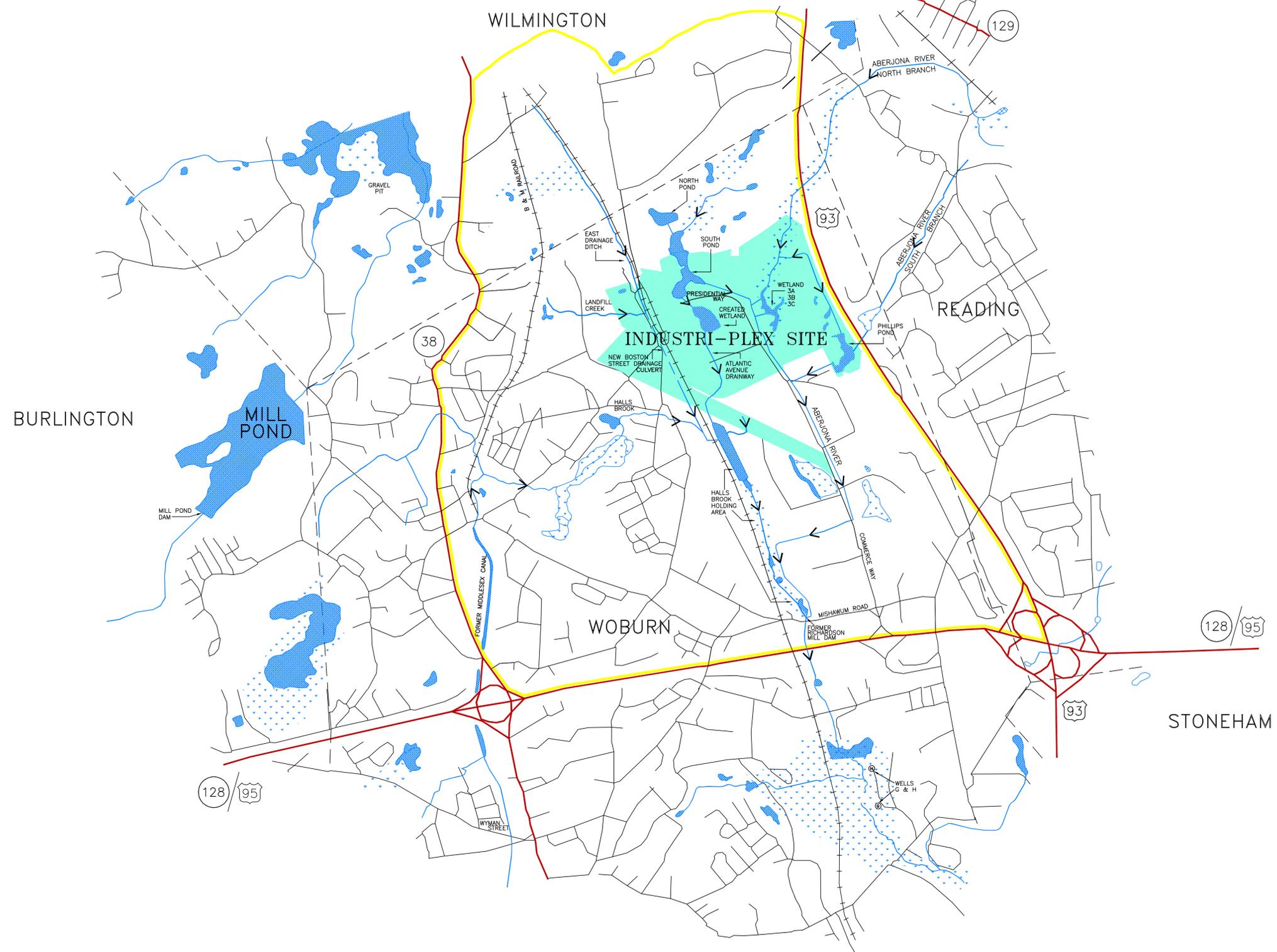
TITLE: HISTORICAL AND CURRENT SURFACE WATER CONDITIONS PRELIMINARY MSGRP STUDY INDUSTRI-PLEX WOBURN, MASSACHUSETTS		
SOURCE: USGS TOPOGRAPHIC MAP, WILMINGTON, MA, N4230-W7107.5/7.5, 1979.		
SCALE: 1" = 1000'	DATE: AUGUST 25, 1997	PROJ. NO.: 2250
DRAWING NO: FIGURE 2-4	ACFILE NAME: C:\MSGRP\FIG_2-4.DWG	REV: 2



55 JONSPIN ROAD
WILMINGTON, MASSACHUSETTS 01887
(508)658-7899

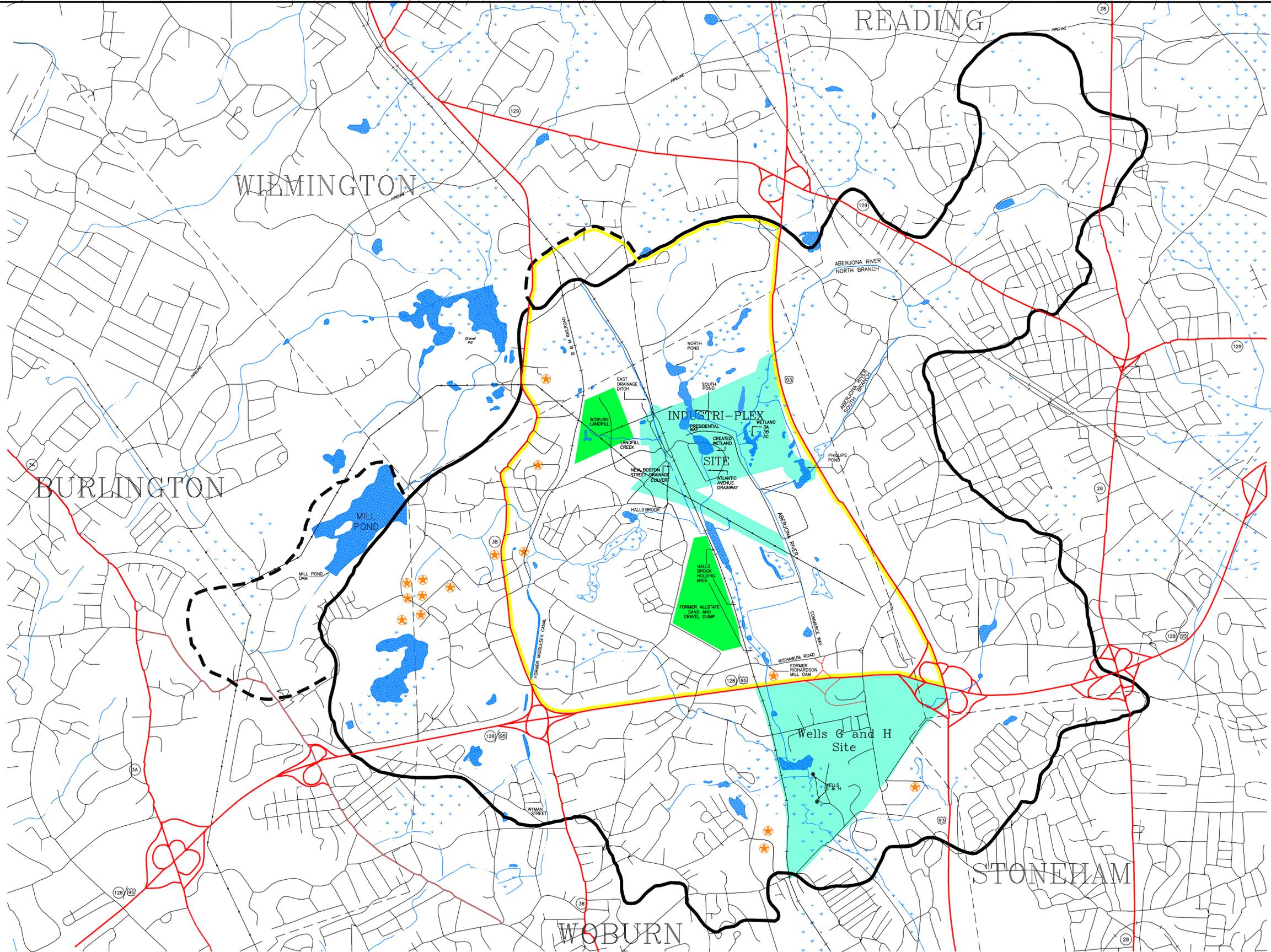


- LEGEND**
- PRELIMINARY MSGRP STUDY AREA
 - HIGHWAYS
 - RIVER OR STREAM
 - CULVERT
 - PONDED AREA
 - WETLAND AREA
 - RAILROAD
 - CITY / TOWN BOUNDARY
 - ← STREAM FLOW DIRECTION



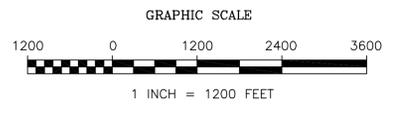
DRAWN BY: D.W. MACDOUGALL PREPARED BY: M. HEALEY CHECKED BY: G. BULLARD	TITLE: STREAM FLOW DIRECTION PRELIMINARY MSGRP STUDY INDUSTRI-PLEX WOBURN, MASSACHUSETTS
	SOURCE: USGS TOPOGRAPHIC MAP, WILMINGTON, MA, N4230-W7107.5/7.5, 1979.
	SCALE: 1" = 1000' DATE: AUGUST 25, 1997 PROJ. NO.: 2250
PROJECT MANAGER: G. BULLARD	DRAWING NO.: FIGURE 2-5 ACFILE NAME: C:\MSGRP\FIG_2-5.DWG REV: 2
PROGRAM MANAGER: G. GARDNER	

55 JONSPIN ROAD
 WILMINGTON, MASSACHUSETTS 01887
 (508)658-7899



LEGEND

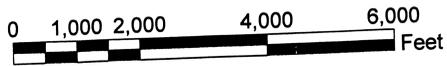
- PRELIMINARY MSGRP STUDY AREA
- WATERSHED BOUNDARY
- POTENTIAL AQUIFER OUTSIDE OF WATERSHED
- HIGHWAY
- ROAD
- RIVER OR STREAM
- WETLANDS
- SUPERFUND SITE
- PIPELINE
- PONDED AREA
- POWERLINE
- RAILROAD
- CORPORATE BOUNDARY
- FORMER LEATHER TANNERIES OR FINISHERS
- LANDFILL LOCATIONS



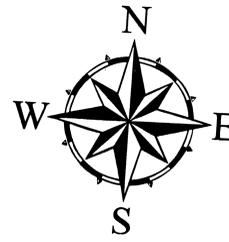
DRAWN BY: D.W. MACDOUGALL	TITLE: LOCATION OF FORMER LEATHER TANNERIES, FINISHING COMPANIES & LANDFILLS		
PREPARED BY: G. BULLARD	PRELIMINARY MSGRP STUDY		
CHECKED BY: G. BULLARD	INDUSTRI-PLEX		
	WOBURN, MASSACHUSETTS		
	CLIENT:	U.S. EPA	
PROJECT MANAGER: G. BULLARD	SCALE: 1" = 1200'	DATE: AUGUST 25, 1997	PROJ. NO: 2250
PROGRAM MANAGER: G. GARDNER	DRAWING NO: FIGURE 3-1	ACFILE NAME: C:\DWG\IPLEXP\FIG_3-1.DWG	REV: 0
CLIENT APPROVAL:			

187 BALLARDALE STREET
SUITE A-100
WILMINGTON, MASSACHUSETTS 01887
(508)658-7899

ZONING MAP OF THE CITY OF WOBURN



EFFECTIVE APRIL 19, 1985
REVISED THROUGH AUGUST 28, 2002



Legend	
RESEIDENTIAL	
	R-1 - SINGLE FAMILY
	R-2 - SINGLE & TWO FAMILY
	R-3 - TOWNHOUSE & GARDEN APTS.
	R-4 - APARTMENT, OTHER
BUSINESS	
	B-D - DOWNTOWN
	B-H - HIGHWAY
	B-I - INTERSTATE
	B-N - NEIGHBORHOOD
INDUSTRIAL	
	I-G - GENERAL
	I-P - INDUSTRIAL PARK
	I-P2 - INDUSTRIAL PARK 2
	O-P - OFFICE PARK
	O-P93 - OFFICE PARK
	S-I - MIXED USE
OPEN SPACE	
	OS - OPEN SPACE



Revisions	Date	
Open Space	1/1/2002	BFG
Open Space Rev.	4/3/2002	BFG
Open Space Rev	8/28/02	BFG

PREPARED BY THE CITY OF WOBURN
ENGINEERING DEPARTMENT

NRS SCORING MAP DATA SOURCES

AQUIFERS: USGS-WRD/MassGIS, 1:48,000. Automated by MassGIS from the USGS Water Resources Div. Hydrologic Atlas series manuscripts. The definitions of high and medium yield vary among basins. Source dates 1977 to 1988.

SOLE SOURCE AQUIFERS: US EPA/MA DEP/MassGIS, various scales. They are defined by EPA as aquifers that are the 'sole or principal source' of drinking water for a given aquifer service area. Last updated July 1993.

NON POTENTIAL DRINKING WATER SOURCE AREAS: DEP-BWSC (Bureau of Waste Site Cleanup). Those portions of high and medium yield aquifers which may not be considered as areas of groundwater conducive to the locations of public water supplies. Please refer to the MCP guidelines for the definitions of these areas.

DEP APPROVED ZONE IIS: MA DEP, 1:25,000. As stated in 310 CMR 22.02 'that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated.' Digitized from data provided to DEP in approved hydrologic engineering reports. Data is updated continuously.

INTERIM WELLHEAD PROTECTION AREAS: DEP-DWS (Division of Water Supply), 1:25,000. These polygons represent an interim Zone II for a groundwater source until an actual one is approved by the DEP Division of Water Supply. The radius of an IWPA varies according to the approved pumping rate. Updated in parallel with the Public Water Supplies data.

PUBLIC WATER SUPPLIES: DEP-DWS, 1:25,000. Community and non-community surface and withdrawal points were field collected using Global Positioning System receivers. The attributes were added from the DEP Division of Water Supply database. Continuously updated.

HYDROGRAPHY: USGS/MassGIS, 1:25000 USGS Digital Line Graph (DLG) data, modified by MassGIS. Approximately 40% of the data was provided by USGS and the remainder was created by MassGIS to USGS specifications. Source dates 1977-1997.

DRAINAGE BASINS: USGS-WRD/MassGIS, 1:24,000. Automated by MassGIS from USGS Water Resources Division manuscripts with approximately 2400 sub-basins as interpreted from 1:24,000 USGS quadrangle contour lines. 1987-1993.

WETLANDS: UMass Amherst RMP/MassGIS, 1:25,000. Includes nonforested wetlands extracted from the 1971-1991 Land Use datalayer which was photointerpreted from Summer CIR photography. Interpretation was not done in stereo. Also includes, in most areas, forested wetlands from USGS Digital Line Graph (DLG) data.

PROTECTED OPEN SPACE: EOE (Executive Office of Environmental Affairs) MassGIS, 1:25,000. Includes federal, state, county, municipal, non profit, and protected private conservation and outdoor recreation lands. Ongoing updates.

ACECs: DEM, 1:25,000. Areas of Critical Environmental Concern are areas designated by the Secretary of EOE as having a number of valuable environmental features coexisting. Projects in ACECs are subject to the highest standards of review and performance. Last updated October 1996.

ROADS: USGS/MassGIS, 1:100,000. MassGIS extracted roads from the USGS Transportation DLG files. They generalized, modified, and updated this coverage. Major roads are part of the state, US or Interstate highway systems. Circa 1985.

POLITICAL BOUNDARIES: MassGIS/USGS, 1:25,000. This datalayer was digitized by MassGIS from mylar USGS quads. Source date is approximately 1985.

DEP PERMITTED SOLID WASTE FACILITIES: DEP-DSW (Division of Solid Waste), 1:25,000. Includes only facilities regulated since 1971. Data includes sanitary landfills, transfer stations and recycling or composting facilities. Facility boundaries were compiled or approximate facility point locations drafted onto USGS quadrangles and automated by the DEP Division of Solid Waste. Last updated 1997.

NHESP ESTIMATED HABITATS OF RARE WETLANDS WILDLIFE: Polygons show estimated habitats for all processed occurrences of rare wetlands wildlife. Data collected by Natural Heritage & Endangered Species Program and compiled at 1:24000 or 1:25000 scale. For use with Wetlands Protection Act Only. Effective Jan. 1, 1997 through Dec. 31, 1998.

NHESP CERTIFIED VERNAL POOLS: Points show all vernal pools certified by NHESP/MADFW (Fisheries and Wildlife) as of September 25, 1996. Data compiled at 1:24000 or 1:25000 scale. Effective January 1, 1997 through December 31, 1998.



SITE #A-4: 51 Eames St., Wilmington		
ANALYTE	MAX	RECENT
arsenic -GW	0.084 ('95-'97)	
arsenic -SW	0.25 ('92)	
chromium -GW	2800 ('95-'97)	
chromium -SW	9.9 ('92)	
lead -GW	0.1 ('95-'97)	
lead -SW	0.18 ('92)	

SITE #A-5: 856 Woburn St., Wilmington			
ANALYTE	MAX	RECENT	
benzene -GW	1.17 (3/89)	0.0144 (3/97)	
toluene -GW	2.34 (3/89)	ND (3/97)	
TCE -GW	0.51 (8/85)	NA	

SITE #G-4: 3 Industrial Way, Wilmington		
ANALYTE	MAX	
TCE -GW	0.012 (5/91)	

SITE #A-3: 30 Industrial Way, Wilmington		
ANALYTE	MAX	
TCE -GW	0.250 (3/91)	

SITE #G-5: 65 Industrial Way, Wilmington			
ANALYTE	MAX	RECENT	
TCE -GW	0.066 (10/94)	0.008 (8/95)	

SITE #A-1: 324 New Boston St.			
ANALYTE	MAX	RECENT	
mercury -GW	0.006 (6/94)	ND (1/95)	
benzene -GW	0.0062 (9/94)	ND (4/95)	
TCE -GW	0.174 (4/95)	NA	
TPH -GW	25.6 (9/94)	2.02 (1/95)	

SITE #B-2: Merrimac & New Boston Streets			
ANALYTE	MAX	RECENT	
lead -GW	0.160 (9/88)	Not Available	
benzene -GW	0.012 (9/88)	0.013 (3/97)	
toluene -GW	0.007 (9/88)	0.063 (3/97)	
PAHs -GW	0.072 (9/88)	Not Available	

SITE #B-1: 100 Ashburton Avenue		
ANALYTE	MAX	
arsenic -GW	0.25	
chromium -GW	2.4	
lead -GW	0.16	

SITE #C-4: 22 North Maple St.			
ANALYTE	MAX	RECENT	
toluene -GW	0.930 (4/88)	0.172 (12/93)	
TCE -GW	4.2 (4/88)	0.762 (12/93)	

SITE #G-2: 195 New Boston St.		
ANALYTE	MAX	
TCE -SW	0.012 (5/85)	

SITE #C-6: 19 Sixth Road		
ANALYTE	MAX	
TCE -GW	0.2 (12/86)	

SITE #C-1: Gill St. and Sixth Rd.			
ANALYTE	MAX	RECENT	
TCE -GW	0.44 (12/85)	0.2 (8/88)	

SITE #C-2: 166 New Boston St.			
ANALYTE	MAX	RECENT	
lead -GW	0.17 (9/86)	<0.006 (1995)	

SITE #C-3: 181 New Boston St.			
ANALYTE	MAX		
toluene -GW	750 (12/95)		

SITE #D-1: 83 Commerce Way		
ANALYTE	MAX	
benzene -GW	0.465	
toluene -GW	0.057	
TPH -GW	32,000 ('95)	

SITE #D-2: 8 Commonwealth Ave.		
ANALYTE	MAX	
benzene -GW	0.750 (8/88)	
TCE -GW	0.840 (7/88)	

SITE #F-3: 2 West St., Reading			
ANALYTE	MAX	RECENT	
lead -GW	0.05 (7/92)	NA	
benzene -GW	14.6 (6/94)	0.15 (5/95)	
toluene -GW	78.0 (1991)	0.099 (5/95)	

SITE #E-1: 10 Commerce Way			
ANALYTE	MAX	RECENT	
arsenic -GW	0.384 (10/90)	0.157 (2/95)	
TCE -GW	0.240 (10/90)	0.120 (2/95)	

SITE #E-2: 300 Mishawum Road		
ANALYTE	MAX	
arsenic -GW	0.0502 (8/90)	

SITE #F-2: 299 Mishawum Road		
ANALYTE	MAX	
TPH -GW	1.03 (1993)	

LEGEND

- PRELIMINARY MSGRP STUDY AREA
- HIGHWAYS
- RIVER OR STREAM
- CULVERT
- PONDED AREA
- WETLAND AREA
- RAILROAD
- CITY / TOWN BOUNDARY

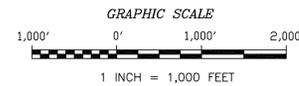
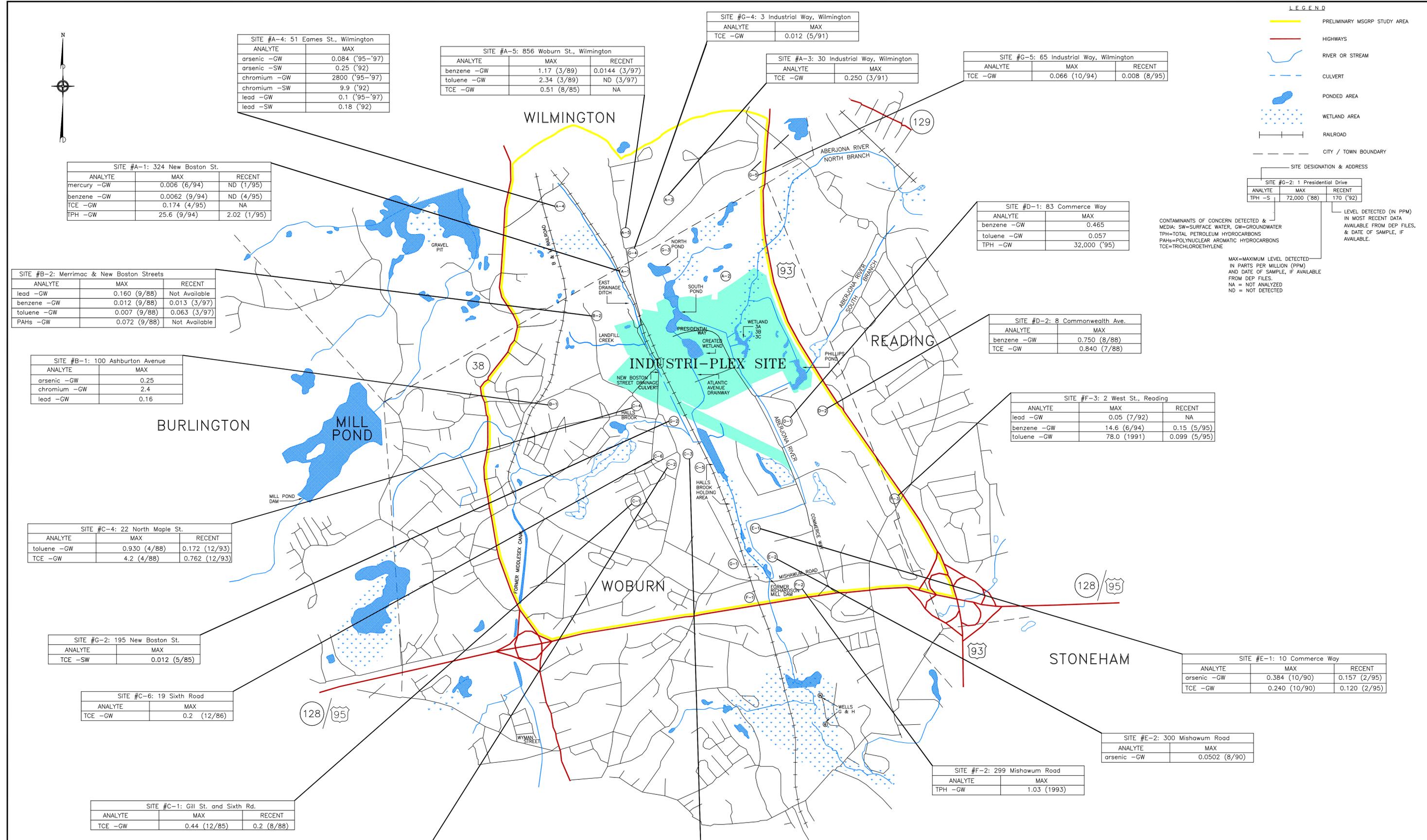
SITE DESIGNATION & ADDRESS

SITE #	ANALYTE	MAX	RECENT
SITE #G-2: 1 Presidential Drive	TPH -S	72,000 ('88)	170 ('92)

LEVEL DETECTED (IN PPM) IN MOST RECENT DATA AVAILABLE FROM DEP FILES, & DATE OF SAMPLE, IF AVAILABLE.

MAX=MAXIMUM LEVEL DETECTED IN PARTS PER MILLION (PPM) AND DATE OF SAMPLE, IF AVAILABLE FROM DEP FILES.
 NA = NOT ANALYZED
 ND = NOT DETECTED

CONTAMINANTS OF CONCERN DETECTED & MEDIA: SW=SURFACE WATER, GW=GROUNDWATER
 TPH=TOTAL PETROLEUM HYDROCARBONS
 PAHs=POLYNUCLEAR AROMATIC HYDROCARBONS
 TCE=TRICHLOROETHYLENE



DRAWN BY: D.W. MACDOUGALL		TITLE: SITE LOCATIONS & CONTAMINANTS OF CONCERN IN GROUNDWATER & SURFACE WATER	
PREPARED BY: R. CLEAVER		PRELIMINARY MSGRP STUDY	
CHECKED BY: G. BULLARD		INDUSTRI-PLEX	
		WOBURN, MASSACHUSETTS	
SOURCE: USGS TOPOGRAPHIC MAP, WILMINGTON, MA, N4230-W7107.5/7.5, 1979.		SCALE: 1" = 1000'	
PROJECT MANAGER: G. BULLARD		DATE: AUGUST 26, 1997	PROJ. NO.: 2250
PROGRAM MANAGER: G. GARDNER		DRAWING NO.: FIGURE 5-1	ACFILE NAME: C:\MSGRP\FIG_5-1.DWG
		REV: 2	



55 JONSPIN ROAD
 WILMINGTON, MASSACHUSETTS 01887
 (508)658-7899



L E G E N D

- PRELIMINARY MSGRP STUDY AREA
- HIGHWAYS
- RIVER OR STREAM
- CULVERT
- PONDED AREA
- WETLAND AREA
- RAILROAD
- CITY / TOWN BOUNDARY

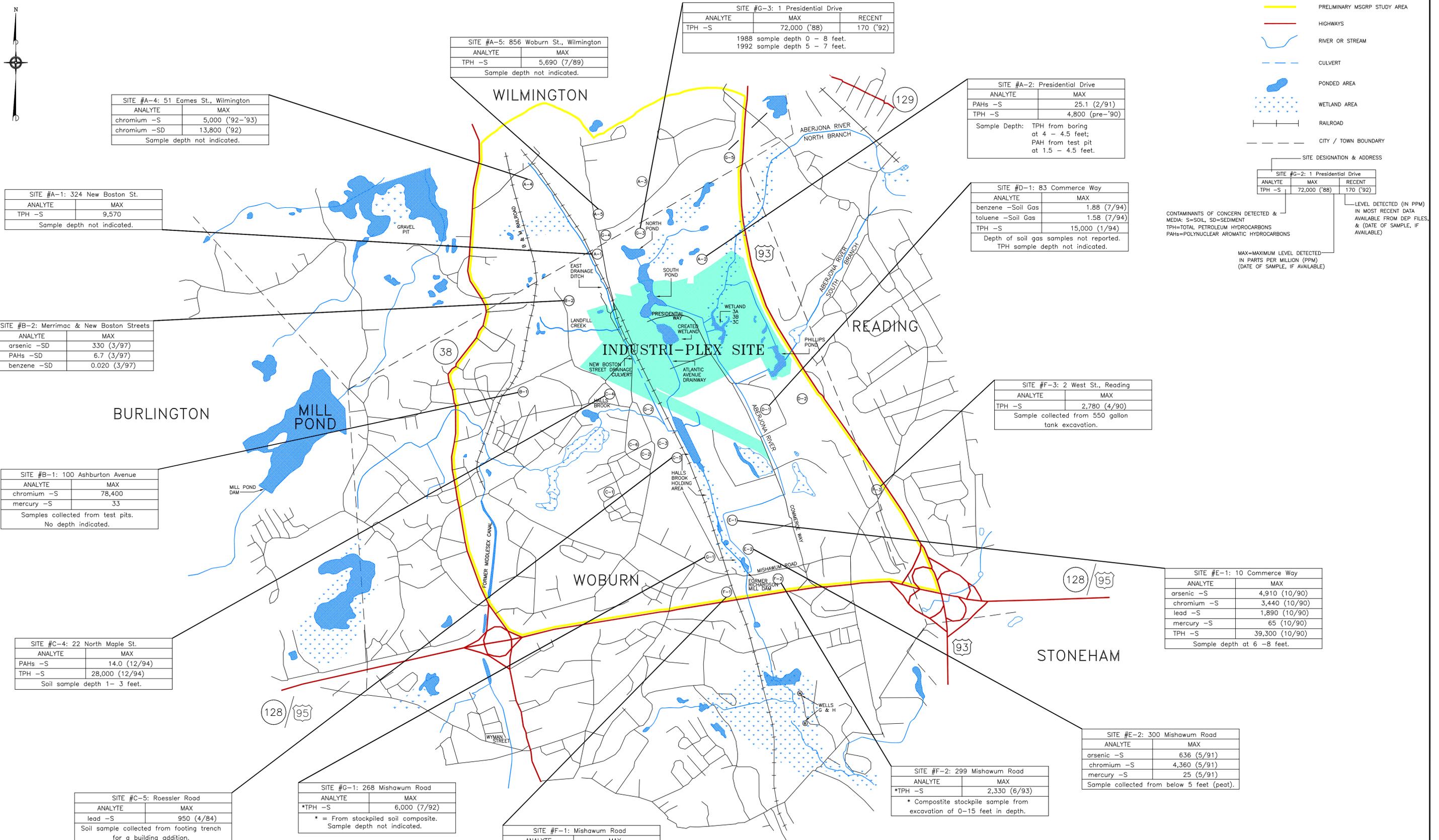
SITE DESIGNATION & ADDRESS

SITE #G-2: 1 Presidential Drive		
ANALYTE	MAX	RECENT
TPH -S	72,000 ('88)	170 ('92)

CONTAMINANTS OF CONCERN DETECTED & MEDIA: S=SOIL, SD=SEDIMENT
 TPH=TOTAL PETROLEUM HYDROCARBONS
 PAHs=POLYNUCLEAR AROMATIC HYDROCARBONS

LEVEL DETECTED (IN PPM) IN MOST RECENT DATA AVAILABLE FROM DEP FILES. & (DATE OF SAMPLE, IF AVAILABLE)

MAX=MAXIMUM LEVEL DETECTED IN PARTS PER MILLION (PPM) (DATE OF SAMPLE, IF AVAILABLE)



SITE #A-4: 51 Eames St., Wilmington	
ANALYTE	MAX
chromium -S	5,000 ('92-'93)
chromium -SD	13,800 ('92)

Sample depth not indicated.

SITE #A-5: 856 Woburn St., Wilmington	
ANALYTE	MAX
TPH -S	5,690 (7/89)

Sample depth not indicated.

SITE #G-3: 1 Presidential Drive		
ANALYTE	MAX	RECENT
TPH -S	72,000 ('88)	170 ('92)

1988 sample depth 0 - 8 feet.
 1992 sample depth 5 - 7 feet.

SITE #A-2: Presidential Drive	
ANALYTE	MAX
PAHs -S	25.1 (2/91)
TPH -S	4,800 (pre-'90)

Sample Depth: TPH from boring at 4 - 4.5 feet;
 PAH from test pit at 1.5 - 4.5 feet.

SITE #D-1: 83 Commerce Way	
ANALYTE	MAX
benzene -Soil Gas	1.88 (7/94)
toluene -Soil Gas	1.58 (7/94)
TPH -S	15,000 (1/94)

Depth of soil gas samples not reported.
 TPH sample depth not indicated.

SITE #A-1: 324 New Boston St.	
ANALYTE	MAX
TPH -S	9,570

Sample depth not indicated.

SITE #B-2: Merrimac & New Boston Streets	
ANALYTE	MAX
arsenic -SD	330 (3/97)
PAHs -SD	6.7 (3/97)
benzene -SD	0.020 (3/97)

SITE #B-1: 100 Ashburton Avenue	
ANALYTE	MAX
chromium -S	78,400
mercury -S	33

Samples collected from test pits.
 No depth indicated.

SITE #F-3: 2 West St., Reading	
ANALYTE	MAX
TPH -S	2,780 (4/90)

Sample collected from 550 gallon tank excavation.

SITE #E-1: 10 Commerce Way	
ANALYTE	MAX
arsenic -S	4,910 (10/90)
chromium -S	3,440 (10/90)
lead -S	1,890 (10/90)
mercury -S	65 (10/90)
TPH -S	39,300 (10/90)

Sample depth at 6 - 8 feet.

SITE #C-4: 22 North Maple St.	
ANALYTE	MAX
PAHs -S	14.0 (12/94)
TPH -S	28,000 (12/94)

Soil sample depth 1 - 3 feet.

SITE #C-5: Roessler Road	
ANALYTE	MAX
lead -S	950 (4/84)

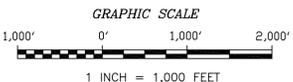
Soil sample collected from footing trench for a building addition.

SITE #G-1: 268 Mishawum Road	
ANALYTE	MAX
*TPH -S	6,000 (7/92)

* = From stockpiled soil composite.
 Sample depth not indicated.

SITE #F-1: Mishawum Road	
ANALYTE	MAX
chromium -S	1,406 ('86)
lead -S	2,371 ('86)
mercury -S	1.68 ('86)
PAHs -S	50.847 (4/87)

Samples collected from stockpile. Soil from the pit excavation 0 - 15 feet in depth.



DRAWN BY: D.W. MACDOUGALL
 PREPARED BY: R. CLEAVER
 CHECKED BY: G. BULLARD

TITLE: SITE LOCATIONS & CONTAMINANTS OF CONCERN IN SOIL AND SEDIMENT
 PRELIMINARY MSGRP STUDY
 INDUSTRI-PLEX
 WOBURN, MASSACHUSETTS

SOURCE: USGS TOPOGRAPHIC MAP, WILMINGTON, MA, N4230-W7107.5/7.5, 1979.

SCALE: 1" = 1000'
 DATE: AUGUST 26, 1997
 PROJ. NO: 2250
 DRAWING NO: FIGURE 5-2
 ACFILE NAME: C:\MSGRP\FIG_5-2.DWG
 REV: 2

Halliburton NUS CORPORATION

55 JONSPIN ROAD
 WILMINGTON, MASSACHUSETTS 01887
 (508)658-7899