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FEASIBILITY STUDY REPORT

CHEMICAL LEAMAN TANK LINES, INC.
TONAWANDA, NY FACILITY

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JULY 2005

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ACRONYMS

ACM	asbestos-containing material
amsl	above mean sea level
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylene
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cm	centimeter
CPC	chemical of potential concern
E	east
EM	electromagnetic
FID	flame ionization detector
FM	fill material
FP	fill pile
FS	feasibility study
ft	foot

ACRONYMS (Continued)

FWIA	fish and wildlife impact analysis
HDPE	high density polyethylene
Hg	mercury
hr	hour
HRA	health risk assessment
ID	inner diameter
kg	kilogram
Koc	organic carbon-water partition coefficient
Kow	octanol-water partition coefficient
L	liter
µg	microgram
MCDOH	Monroe County Department of Health
MEK	methyl ethyl ketone
mm	millimeters
mR	millirem
N	north
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NTU	nephelometric turbidity unit
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
P	palustrine
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
ppm	part per million
PVC	polyvinyl chloride
Q	quality assurance
RCRA	Resource Conservation and Recovery Act

ACRONYMS (Continued)

RI	remedial investigation
SARA	Superfund Amendments and Reauthorization Act
SCG	standards, criteria, and guidance values
sec	second
SVOC	semivolatile organic compound
TAGM	*Technical and Administrative Guidance Memorandum*
TAL	Target Analyte List
TCLP	toxicity characteristic leaching procedure
TCL	Target Compound List
TN	terrestrial natural
URS	URS Corporation
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

1.0 INTRODUCTION

1.1 Purpose of Report

The Environmental Services Department of Quality Distribution, Inc. (QDI), has retained URS Corporation (URS) to perform a Remedial Investigation/Feasibility Study (RI/FS) at the former Chemical Leaman Tank Lines (CLTL) site in the City of Tonawanda, New York. Quality Carriers, Inc (QCI) is the successor to CLTL and is a subsidiary of QDI. The site is currently classified by the New York State Department of Environmental Conservation (DEC) as a Class 2 inactive hazardous waste disposal site. Pursuant to an Order on Consent with the DEC, QCI is undertaking this RI/FS to evaluate whether contamination remains onsite at actionable levels and, if so, what types of remedial measures are appropriate to protect human health and the environment. The RI was intended to collect sufficient data for the performance of the above evaluations. The RI field activities at the CLTL site were performed in four phases spanning the period from approximately August 2000 to September 2004. The purpose of the FS is to identify and evaluate various remedial alternatives that address site contamination and to recommend a preferred alternative for implementation at the site. This report presents a summary of the potential remedial alternatives developed for this site, an evaluation of these alternatives and the rationale for selection of the preferred alternative.

1.2 Site Description

The CLTL site is located at 470 Fillmore Avenue, on the southwest corner of the intersection of Fillmore and Wales Avenues, in the City of Tonawanda, Erie County, New York (Figure 1-1). The site, approximately 16 acres in size, is zoned light industrial/commercial. It is bordered by Fillmore Avenue to the north, Wales Avenue to the east, Ellicott Creek to the south, and an open field to the west, beyond which is located Route 425 (a large, divided highway.)

1.3 Site History

Prior to 1959, the site was undeveloped and was owned by a succession of parties including railroad companies, real estate companies and private parties. In 1959 CLTL purchased the property. CLTL was a common carrier transporting bulk chemical commodities by tank truck. By 1963 CLTL had constructed several buildings and made other improvements at the facility, and began operating the site as a tank truck terminal. CLTL's operations at the site included tank truck dispatching, maintenance and cleaning. Prior to 1987, rinse waters from these operations were discharged to a series of three unlined surface settling lagoons, or surface impoundments, located in the central area of the site (Figure 1-2). These lagoons remained in use until 1987, when a new wastewater treatment facility was constructed at the site. The retired lagoons were dewatered, excavated, backfilled and closed in 1989. Prior to and during closure, remedial activities were completed at the three lagoons. These included the excavation and offsite disposal of approximately 4,000 cubic yards of stabilized sludge and underlying soil from the impoundment area. Subsequent to lagoon closure, CLTL's operations at the site continued until 2001, when truck dispatching, maintenance and cleaning activities ceased, and the onsite wastewater treatment facility was decommissioned. The site is presently owned by QCI, but unused and unoccupied except for leasing a car parking area along Fillmore Avenue.

Figure 1-2 also shows the location of six groundwater monitoring wells installed at the site prior to this RI. Four of these wells (B-1 through B-4) were installed in August 1981 (Anderson Drilling Company, 1981), and the remaining two (B-5 and B-6) were installed in March 1991 (Ecology and Environment, Inc., 1991). Previous sampling of these six wells indicated the presence of groundwater contamination at several onsite well locations, both upgradient and downgradient of the former lagoons. A number of organic compounds and metals were detected at concentrations exceeding DEC Class GA groundwater standards.

On June 21, 1999, CLTL entered into an Order on Consent with the DEC to perform a RI/FS at the Tonawanda facility. Pursuant to the terms of that Order, URS, on behalf of CLTL, developed a Work Plan for the RI/FS dated October 1999, which was approved by DEC and finalized by way of a June 16, 2000 Addendum. This Work Plan covered Phase I of the RI. Subsequently, the Work Plan was modified for Phase II RI activities by Addendum #2 (March 16, 2001), and for the Phase III RI by Addendum #3 (November 2, 2001). The results of the RI are presented in the, "*Remedial Investigation Report – Chemical Leaman Tank Lines, Inc. Tonawanda, New York Facility*" prepared by URS, dated August 2002.

The results of the RI indicated that the highest levels of groundwater contamination at the site have historically occurred on the east side of the property, as measured in well B-05R (Figure 1-2). It was concluded that the groundwater contamination in this east area appeared to be related to soil contamination by volatile organic compounds (VOCs) occurring within an essentially linear, well-defined and generally shallow pattern along the east property line.

Groundwater data collected during the RI indicated that the groundwater flow direction is predominantly to the south toward Ellicott Creek, with a gradient steepening across the site in a southward direction. Superimposed on this general groundwater flow pattern was a pronounced mounding effect, resulting in outward radial flow, that appeared to coincide with spring-like conditions when the water table is relatively high (Figure 1-3). The location of the mound varied somewhat, but was generally in the central portion of the site in the vicinity of the former lagoons. It has been speculated that the flow to the east, away from the former lagoon area, toward Wales Avenue might be explained by the presence of a storm sewer beneath the road that acts as a local hydraulic sink. It was further speculated that the Wales Avenue storm sewer might intercept groundwater during mounding conditions and discharge it to Ellicott Creek.

In order to determine whether contamination might be migrating offsite to the east into the storm sewer under mounding conditions, a Supplemental Investigation (SI) program was developed to collect additional groundwater and analytical data from the eastern portion of the CLTL site. The Supplemental Investigation program was initiated in June 2003 and was essentially completed in July 2004. The results of the Supplemental SI are presented in the, "Supplemental Remedial Investigation, Phase IV – Eastern Area Report – Chemical Leaman Tank Lines, Inc. Tonawanda, New York Facility" prepared by URS, dated September 2004.

The results of the SI indicated that groundwater contamination does not appear to be moving offsite in a southward direction toward Ellicott Creek. Likewise, it appears that contaminant migration offsite to the east and/or into the storm sewers along Wales Avenue is unlikely during most of the year, and could only occur under mounding conditions in the Spring when groundwater flow is to the east. During the remainder of the year, groundwater flow is to the south, parallel to the storm sewer alignment, or to the southwest towards the site. Whereas, the water in the storm sewers discharges to Ellicott Creek, the contaminant concentration does not contravene any surface water standards.

The FS described in this report has been performed in compliance with the approved Work Plan, and with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) of March 8, 1990 (40 CFR Part 300), and all appropriate federal and state guidance documents.

1.4 Site Characteristics

1.4.1 Surface Features

The CLTL site, located in the Tonawanda Industrial Park, is approximately 16 acres in size and rectangular in shape. The primary above-grade facilities are located in the northeast corner of the property, near the intersection of Fillmore and Wales Avenues. They consist of an office building, shop, several truck washing/cleaning bays, equipment and boiler rooms, and a drum storage pad (Figure 1-2). Located to the west of these buildings are a 10,000-gallon diesel aboveground storage tank (AST) and dispensing system, and an area north of the three former lagoons that contains a wastewater treatment building, wastewater mixing tank and drum storage pad. The main facility car parking area is located along the north side of the site at the Fillmore Avenue entrance. The east side of the site, in addition to the buildings and facilities described above, consists primarily of a gravel parking area for trucks; the west side consists primarily of an open field. The site extends southward approximately 950 feet from Fillmore Avenue (north boundary) to Ellicott Creek (south boundary.) Prior to use by Chemical Leaman, an old trolley train line ran north-south through the site along an elevated embankment. Most of the embankment has been removed except for approximately 100 feet adjacent to Ellicott Creek. The southwest corner or the site is low and marshy. Most of the site's southern border, along Ellicott Creek, is wooded with large willow trees. CLTL discontinued use of the site and decommissioned the wastewater treatment plant in 2001, and closed and removed the diesel AST and dispensing system in 2002.

1.4.2 Site Topography and Surrounding Land Use

The original ground surface of the site sloped southward toward Ellicott Creek, but subsequent filling has created a relatively level surface across the northern two-thirds of the property (Engineering-Science, January 1986). A mild linear depression trending north-south exists in the center of the site, and generally divides the formerly active portion of the facility from the open field to the west. There is no surface water on the site.

The site is bordered to the west by Route 425, a large divided highway also known as the Twin Cities Memorial Highway, to the north by Fillmore Avenue across which is located a small stainless steel fabricating facility, to the east by Wales Avenue across which occurs a multiple-occupancy office building and warehouse, and to the northeast by a jewelry shop. There are no residences adjacent to or within the immediate vicinity of the site.

1.4.3 Site Drainage and Surface Water Hydrology

The north and central portions of the site are relatively flat, with overland flow occurring primarily to the south toward Ellicott Creek, to the east toward a 30-inch storm sewer underlying Wales Avenue, and toward a slight north-south depression that separates the east and west sides of the site. The ground surface gradient increases in the southern portion of the site approaching Ellicott Creek, which ultimately receives all surface water drainage from the property. Ellicott Creek is a significant watercourse, flowing in a westerly direction along the southern site boundary. The Creek discharges to the Niagara River approximately two miles downstream from the CLTL site. The nearest United States Geological Survey (USGS) stream gage on Ellicott Creek is located approximately nine miles upstream from the site, at Sheridan Drive in the Town of Amherst (USGS Station Number 04218518). This gage has a contributing drainage area of 81.6 square miles, a mean discharge of approximately 133 cubic feet per second (cfs), and a maximum recorded discharge of 3,640 cfs.

1.4.4 Geology and Hydrogeology

Regional Geology

The following description of regional geology is based upon the Phase I Investigation of the CLTL site, performed for the New York State DEC (Engineering-Science, January 1986).

The site is located in the Erie-Ontario lowlands physiographic province. The bedrock of this region is predominantly limestone, dolostone and shale. Most of the rocks are deep aquifers with regional flow to the south.

In the recent past, most of New York State, including the site, has been repeatedly covered by a series of continental ice sheets. The activity of the glacier widened pre-existing valleys, and deposited widespread accumulations of till. The melting of ice, ending approximately 12,000 years ago, produced large volumes of meltwater. This water subsequently shaped channels and deposited thick accumulations of stratified, granular sediments.

As glacial ice retreated from the region, meltwater formed lakes in front of the ice margin. This region is covered by both lake sediments and morainal materials. Sediments associated with Lake Tonawanda are especially widespread in this region. Lake Tonawanda was a shallow elongate lake that occupied an east-west valley and drained north into Lake Iroquois. The sediments consist of beach ridges and lacustrine silts and clays (indicating quiet or deeper water deposition).

Granular deposits in this region frequently act as shallow aquifers, whereas lacustrine clays, as well as tills, often inhibit groundwater movement. However, fine-grained, water-lain sediments such as silts and clays frequently contain horizontal laminations and sand seams. These internal features facilitate lateral groundwater movement through otherwise low-permeability materials.

Site Stratigraphy

The site stratigraphy was described in general terms by Engineering-Science (January

1986) as part of its Phase I Investigation report. This general description is recounted in the following paragraph, since it includes unconsolidated materials down to the bedrock surface, whereas soil borings performed during the RI/SI did not extend through the "red clay" aquitard that overlies bedrock.

Soil stratigraphy reflects the proximity of the site to the former Lake Tonawanda. A generalized soil column, based on previous USGS borings in the area, is as follows:

Soil Type	Depth (feet bgs)
Mixed fill, topsoil	0 – 7
Layered fine sand, silts and clay	7 – 20
Red Clay	20 – 34
Fine sand	34 – 35
Top of bedrock	35

Bedrock beneath the site is expected to be the Camillus Shale (Salina Group). The upper surface of the bedrock is likely to be highly weathered and fractured. Above the bedrock there is a thin layer of fine sand, deposited as Lake Tonawanda began to flood the area. This sand may grade vertically upward into the thick red clay unit. This Lake Tonawanda sediment is soft and grades upward into a layered gray fine sand, silt and clay. In the southwest corner of the site, this lacustrine material is predominantly silt.

Borings performed during the RI/SI are consistent with the above general description of site stratigraphy. This stratigraphy is illustrated by geologic cross-sections in Figures 1-4 to 1-6.

Fill material occurs across most of the site at thicknesses ranging from approximately 2 to 4 feet. The fill consists of varying amounts and proportions of crushed stone, gravel, silty sand and clay, brick fragments, coal, concrete pieces and slag. Fill is generally absent in the west and southeast areas of the property, beyond the limits of CLTL operations. On the other hand, the fill thickness is much greater (varying from approximately 10 to 13 feet) in the three former lagoons, which were backfilled as part of the 1989 closure.

Underlying the fill material, and occurring across the entire site, is a unit consisting of layered fine sand, silt and clay. On the north side of the site, this unit extends to a depth of approximately 28 feet bgs. It becomes shallower across the site in a southerly direction, extending to a depth of approximately 21-24 feet bgs in the former lagoon area, and 16-18 feet bgs in the southern area of the site near Ellicott Creek (near monitoring wells B-08, B-09 and B-10). Although this unit is variable, it consists primarily of a poorly sorted silty sand material (Unified Soil Classification System (USCS) classification "SM").

A "red clay" unit underlies the layered sand/silt/clay layer continuously across the site. Although none of the RI/SI or previous onsite investigation borings fully penetrated this unit, its thickness is estimated to be approximately 14 feet on average (see general description above). From the RI borings, the unit is described as a moist, soft (i.e., low blow count) material with a reddish brown color and silty clay texture (USCS classification "CL"). The material appears to have a very low permeability, as discussed further in the following section.

Hydrogeology

The thick red clay layer described in the previous section is lacustrine in origin. Lake clays in the Erie-Niagara region are characterized by very low yields (0-1 gallons per minute) and permeabilities (approximately 0.8 gallons per day per square foot) (Erie and Niagara Counties Regional Planning Board, October 1978. *Report 13: Ground Water Problems / Analysis*). The low permeability of the unit is evidenced not only by its texture, but also by its resistance to downward contaminant migration. Soil samples were collected from the top of the red clay layer beneath each of the three former onsite lagoons. Despite relatively high levels of soil contamination in the overlying layered sand/silt/clay unit, organic compound concentrations were non-detectable to very low in each of the three clay samples, and in all cases below DEC soil cleanup criteria. The red clay acts as an effective aquitard across the site, and the aquifer of concern occurs within the overlying layered sand/silt/clay unit. (Hereafter in this report, the term "aquifer" refers to the layered sand/silt/clay.)

Hydraulic Conductivity

Each of the fifteen onsite monitoring wells (B-01 through B-15) are screened within the sand/silt/clay aquifer. During the RI, slug tests (rising and falling head) were performed on these wells, and hydraulic conductivity was calculated using the Bouwer-Rice method. The results are summarized on Table 1-1. As indicated by Table 1-1, hydraulic conductivity of the aquifer varies from approximately 6.4×10^{-5} centimeters per second (cm/s, or 0.2 feet per day (ft/d)) to 3.2×10^{-3} cm/s (9.0 ft/d), with an average value of approximately 7.3×10^{-4} cm/s (2.1 ft/d). This is typical of the fine sands and silts that make up a large part of the aquifer. It should be noted that slug tests are primarily a measure of horizontal hydraulic conductivity, and that because of the layered nature of this unit, its vertical hydraulic conductivity is likely to be significantly less.

Groundwater Flow

During the RI/SI, groundwater depths and elevations were obtained on as many as 24 separate dates: The results are shown on Table 1-2. The observed range of depths to groundwater was approximately 2 feet bgs to 14 feet bgs, depending upon the time of year and the location onsite. At monitoring well B-01, located near the center of the site, the observed depth to groundwater varied from approximately 2.2 feet (March 2004) to 8.98 feet (September 2003).

The direction of groundwater flow has been evaluated by plotting groundwater contour maps for each of the monitoring events. In general, groundwater flow was southerly across the site towards Ellicott Creek, with the gradient steepening in the southern portion of the site (i.e. south of monitoring wells B-02, B-03 and B-04). The groundwater surface appears to be reflective of surficial topography in that it is flat in the area north of monitoring wells B-02, B-03 and B-04, wherein the ground surface is very level, and slopes steeply in that portion of the site south of monitoring wells B-02, B-03 and B-04, wherein the ground surface slopes steeply toward the creek. From the location of the former lagoons to Ellicott Creek, the gradient varies from approximately 0.01 feet per foot (ft/ft) to 0.05 ft/ft. Superimposed upon this general groundwater flow pattern is a pronounced mounding effect, resulting in outward radial flow, that appears to coincide with spring-like conditions when the water table is relatively high. The location of this mound tends to shift somewhat, however, it is generally centered around the former lagoons.

It was speculated that the flow towards Wales Avenue during the mounding periods might be explained by the presence of the storm sewers beneath the road that acts as a local hydraulic sink (Ecology and Environment, 1991). This aspect was more thoroughly investigated during the SI.

Beginning with the March 22, 2004 readings and continuing through June 3, 2004, groundwater mounding at the site was evident. Although the location of the mound varied somewhat during this period, it was generally centered in the vicinity of the former lagoons. This is consistent with the groundwater data collected in the spring months during the first three Phases of the RI (e.g. Figure 1-3, April 2001).

Based on the information gathered during the SI, it appears that the inverts of the four storm sewer catch basins and the interconnecting pipes along Wales Avenue are above the water table during most times of the year. The ground elevation around B-05R and B-13 is about 574 ft. The catch basins in this area are only about 2.5 – 3.0 feet below ground surface, or roughly elevation 571 - 571.5 feet. This places the bottom of the catch basins about the same elevation as the top of the groundwater surface (typically 571 $\pm$ feet) during mounding conditions. During the remainder of the year, when the groundwater surface is lower, the storm sewers would not intersect the groundwater at all. As a result, the storm sewers are not likely to act as a groundwater "sink" as initially speculated, with the possible exception of during mounding conditions. And even then, the influence on groundwater flow is likely to be minimal. In any case, since the storm sewer discharges to Ellicott Creek at the foot of Wales Avenue, the ultimate outlet for groundwater flowing across the CLTL site is the Creek.

1.5 Nature and Extent of Contamination

1.5.1 Soil Contamination

The following discussion of soil contamination at the CLTL site is subdivided by site area as follows: (1) the former lagoon area; (2) the area north of the former wastewater treatment plant (i.e., north of the former lagoons), including the area in the vicinity of well B-01 and the diesel pump island area; and (3) the "east area" of the site in the vicinity of well B-05R. The RI/SI locations in each of these areas are shown on Plate 1.

Former Lagoon Area

The three former lagoons were initially excavated to a depth of approximately 10 feet bgs. During their closure in 1988 and 1989, the lagoons were excavated as deep as possible below the water table, to a typical depth of approximately 14 to 16 feet bgs. Although post-excavation soil sampling showed some degree of residual contamination within the lagoons, further excavation was not possible due to the rapid infiltration of groundwater into the excavation and the possibility of sidewall collapse, with undermining of the adjacent parking lot and wastewater treatment plant. Lagoon sludges and associated soil were stabilized, excavated and disposed of offsite; and the lagoons themselves were backfilled to grade (Ecology and Environment, Inc., 1991).

During the RI, a total of 18 soil samples were collected from the former lagoon area and analyzed for the full suite of parameters (VOCs, SVOCs, Pest/PCBs, Metals, Cyanide).

Based upon soil analytical results, visual observations and PID readings during RI drilling activities, the following conclusions have been drawn concerning the nature and extent of soil contamination in the former lagoon area. In this discussion, comparisons are made with New York State soil cleanup criteria, which are contained in DEC's *Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Levels* (January 24, 1994, HWR-94-4046), referred to hereafter as "TAGM 4046."

Soil within the layered sand/silt/clay unit underlying former Lagoon #1, Lagoon #2 and (to a much lesser extent) Lagoon #3 is contaminated to levels exceeding New York State DEC TAGM 4046 criteria. The primary contaminants of concern are a variety of aromatic hydrocarbons, chlorinated hydrocarbons and ketones. Typical contaminants include: benzene, toluene, ethylbenzene, xylene (BTEX), chlorobenzene, 1,2- and 1,4-dichlorbenzene (DCB), 1,2,4-trichlorobenzene (TCB), nitrobenzene, tetrachloroethene (PCE), trichloroethene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), chloroform, 2-butanone (MEK) and acetone. This contamination extends downward from the bottom of the former lagoons (i.e., from the bottom of the backfill used to close the lagoons, approximately 14 - 16 feet bgs) to the top of the red clay aquitard underlying the lagoons, approximately 22-24 feet bgs. The backfill material itself and the underlying clay are essentially clean. The sand/silt/clay unit has also been contaminated in an area extending approximately 50-70 feet westward from Lagoon #1.

Area North of Former Wastewater Treatment Plant

The area north of the former wastewater treatment plant was included within the investigation initially to evaluate a potential source for the low-level groundwater contamination that has been observed in this area (well B-01) during previous investigations and the RI. The investigation was extended during Phase III to include the area around the diesel pump island in the north-central part of the site.

During the RI, a total of eight soil samples were collected from the area around well B-01 and analyzed for the full suite of parameters. In addition, two soil samples were collected from the diesel pump island area and analyzed for fuel oil parameters (New York State DEC, 1992, *STARS Memo #1, Petroleum-Contaminated Soil Guidance Policy.*)

Based upon soil analytical results, visual observations and PID readings during RI drilling activities, the following conclusions have been drawn concerning the nature and extent of soil contamination in area north of the former wastewater treatment plant:

Soil in the quadrant northwest of well B-01, especially in the area of borings GP-04W and GP-04WA, is contaminated by a variety of aromatic and chlorinated hydrocarbons. These contaminants include: BTEX, chlorobenzene, 1,2,4-TCB, 1,2-, 1,3- and 1,4-DCB, hexachlorobenzene, TCE and vinyl chloride. In addition, 2,4,5-Trichlorophenol, PAHs, and several metals (arsenic, chromium, zinc) occur at elevated concentrations in the shallow (2-4 feet bgs) sample from GP-04W. Although there is some evidence of a past fuel release from the diesel pump island, soil concentrations in the vicinity of the diesel pump dispenser do not exceed TAGM 4046 criteria, and the release does not appear to be a significant one or to warrant further action. Furthermore, there is no evidence of soil contamination in the area east of well B-01, toward the former truck washing bays.

East (Well B-05R) Area

The highest levels of groundwater contamination at the site have historically occurred on the east side of the property, as measured in well B-05 (replaced in 2000 by well B-05R). The purpose of the soil investigation in this area was to determine a possible source for this groundwater contamination. During Phase II of the RI, numerous geoprobe borings were advanced in the east area. Additionally, five monitoring wells (B-11 to B-15) were installed in this area during the SI. A total of 6 soil samples and 15 groundwater samples were collected during the RI/SI and analyzed for TCL VOCs. Based upon these investigation activities and results, the following conclusions have been drawn about the nature and extent of contamination in the east area:

- Soil contamination was encountered in the area immediately to the east of well B-05R. This contamination may be the source of ongoing groundwater contamination in the B-05R area.
- No soil contamination was observed in the area between the lagoons and B-05R (i.e. B-11 to B-15) with the exception of B-13, which exhibited three zones of black stained soil between 1.5 and 8.5 feet and elevated PID readings down to a depth of about 8 feet.
- PID readings were especially elevated in geoprobe borings GP-01, GP-02, GP-04 and GP-08. In each of these borings, the highest PID readings were obtained near the ground surface, suggesting the possibility of a past spill or spills in this area.
- Soil samples collected in GP-01, GP-04 and GP-08, at a depth interval of 2-4 feet bgs, indicated the presence of numerous organic compounds exceeding TAGM 4046 criteria, including: BTEX, chlorobenzene, 1,2,4-TCB, 1,2-, 1,3-, and 1,4-DCB, Vinyl chloride, and Phenol.
- The other three soil samples in this area were relatively clean, except the sample from a 4-6 foot depth interval in GP-28, which showed elevated concentrations of four aromatic hydrocarbons.

- Soil contamination in the East (Well B-05R) Area consists primarily of VOCs occurring within an essentially linear, well-defined and generally shallow pattern along the east property line. Inasmuch as there were no operations conducted in this area of the site, it is suspected that historic spills and/or fill materials placed in this area may be the source of the contamination.

1.5.2 Groundwater Contamination

Based on the groundwater data collected during the RI/SI, the following conclusions have been drawn concerning the nature and extent of groundwater contamination at the CLTL site. For ease of review, the applicable sections of the RI Report that discuss groundwater quality in the various areas of the site have been reproduced below. Each section from the RI is followed by a discussion of the results from the SI. Additionally, a discussion of the changes that occurred, if any, from the RI to the SI is presented.

Upgradient and Sidegradient Areas (Wells B-07 and B-06):

Wells B-07 and B-06 are located hydraulically upgradient and sidegradient, respectively, from the formerly active portion of the CLTL facility, based on a predominant north-to-south groundwater flow direction (i.e. during non-mounding periods).

RI Results: Groundwater at the location of these wells has not been impacted by site activities, as indicated by the fact that there were no exceedances of Class GA groundwater standards in either well by organic compounds (VOCs, SVOCs, Pest/PCBs); and the only compounds detected in either well (Acetone and bis(2-Ethylhexyl)phthalate) occurred at trace levels and are common laboratory contaminants. Several metals exceeded Class GA standards in one or both wells, including: Antimony, Iron, Lead, Magnesium, Manganese, Sodium and Thallium. However, based upon the location of the wells and the absence of organic contaminants within them, it is concluded that these metals are not site-related contaminants.

SI Results: No VOCs were detected in either of these wells during the SI. Consequently, the conclusion reached during the RI that groundwater at the location of these wells has not been impacted by site activities is still valid.

Area North of Former Wastewater Treatment Plant:

Well B-01 is located in this area, which is upgradient from the former lagoons under predominant groundwater flow conditions.

RI Results: Organic contaminants detected in this well at concentrations exceeding Class GA criteria were: Benzene (10 and 11 micrograms per liter (μg/L), or parts per billion (ppb)); Chlorobenzene (240 and 290 μg/L); and 4,4'-DDT (0.21 μg/L during the first Phase I groundwater sampling event only). The Class GA criteria for these compounds are 1 μg/L (Benzene), 5 μg/L (Chlorobenzene), and 0.2 μg/L (4-4'-DDT). The only metals exceeding criteria were also detected as exceedances in the upgradient and sidegradient wells, and are not considered to be site-related. The above results are similar to those observed during the 1991 and 1993 sampling of well B-01 for aromatic hydrocarbons (Benzene and Chlorobenzene). However, the chlorinated hydrocarbons exceeding Class GA standards during the previous sampling (1,2-Dichloroethene and Vinyl Chloride) were not detected during the RI. The pesticide 4,4'-DDT is not considered to be a significant groundwater contaminant in the area, since it exceeded its Class GA standard (0.20 μg/L) only marginally during the first Phase I sampling event, and was not detected at all during the second.

SI Results: During the SI, the only VOCs detected in B-01 at concentrations exceeding Class GA standards were benzene and chlorobenzene at 16.4 μg/L and 280 μg/L, respectively. These are the same two aromatic hydrocarbons that were detected in B-01 during the RI. The concentrations were relatively unchanged from the previous concentrations (i.e. 11 μg/L and 290 μg/L).

Area South of Former Lagoons

Six wells were monitored in the area south (downgradient) of the former lagoons area: B-02, B-03, B-04, B-08, B-09 and B-10.

RI Results: Wells B-02 through B-04 were installed in 1981 and are located along a line approximately 150 feet south of Lagoon #3 (Figure 1-2). The following compounds exceeded

Class GA standards in one or more of these three wells: Benzene (6 μg/L); Chlorobenzene (23 μg/L); Vinyl Chloride (6 μg/L); 1,2,4-TCB (9 μg/L); 1,3-DCB (4 μg/L); 4-Methylphenol (4 μg/L); 4,4'-DDT (0.24 μg/L); beta-BHC (0.044 μg/L); and generally the same set of metals that exceeded standards in the upgradient and sidegradient wells.

The above (maximum) concentrations for benzene and chlorobenzene are much less than observed during the 1991 and 1993 sampling events. For example, benzene was previously detected in well B-03 at 130 μg/L in 1991 and 710 μg/L in 1993, versus 3 μg/L and 6 μg/L during the two RI Phase I sampling events. On the other hand, the other RI organic compound exceedances, though very low-level, were not observed during 1991 or 1993 sampling events. Vinyl chloride was not used or handled at the site, and may be a natural attenuation daughter product of the chlorinated organic contaminants detected in site soils and groundwater.

Wells B-08 through B-10, which were installed during the Phase III RI, are located along a line between wells B-02 through B-04 and Ellicott Creek (Figure 1 - 2). Analytical results from these wells during the RI indicate that the only organic compounds exceeding Class GA standards were Vinyl Chloride (4 μg/L in well B-10) and Hexachloropentadiene (21 μg/L in well B-08). The latter compound has not been detected in any other onsite well except B-09 (at 5 μg/L), nor in any of the soil samples from the site.

SI Results: During the SI the following VOCs exceeded the Class GA standards in one or more of wells B-02 to B-04: benzene (4.36 μg/L); chlorobenzene (6.98 μg/L); vinyl chloride (19.0 μg/L). These compounds were previously detected in these wells at similar or slightly higher concentrations. The aromatic hydrocarbons previously detected in these wells (i.e. 1,2,4-trichlorobenzene and 1,3-dichlorobenzene). were not detected this time. Additionally, the following chlorinated hydrocarbons, which were not previously observed at concentrations exceeding the SCGs, were detected: 1,1-DCA (11.3 μg/L); 1,2-DCA (3.66 μg/L); cis-1,2-DCE (5.73 μg/L); and, TCE (10.3 μg/L).

The only VOCs detected in wells B-08 through B-10 at concentrations exceeding Class GA standards were vinyl chloride (26.8 μg/L) in well B-10 and cis-1,2-DCE (7.91 μg/L) in well B-08. No compounds exceeding Class GA standards were detected in well B-09.

The above data indicate that groundwater contamination from the CLTL site is not moving at significant concentrations toward, or discharging into, Ellicott Creek via the predominant north-to-south flow pathway across the site.

East Area (Wells B-05R and B-11 to B-15)

Well B-05R and wells B-11 to B-15 are located in the area east of the lagoons, between the lagoons and Wales Avenue.

RI Results: Groundwater on the east side of the site remains contaminated, as indicated by the data from well B-05R (Figure 1-7). Metals are not a concern, since they occur at similar concentrations in upgradient and sidegradient wells. However, there are numerous organic compounds that exceed Class GA groundwater standards in this well. The following list indicates the categories of these contaminants and the maximum concentrations of individual compounds within each category that exceed Class GA criteria:

Aromatic hydrocarbons – Benzene (440 μg/L); Toluene (44 μg/L); Ethylbenzene (92 μg/L); Xylenes (30 μg/L); Chlorobenzene (890 μg/L); 1,2,4-TCB (82 μg/L); 1,2-DCB (6,200 μg/L); 1,3-DCB (1,200 μg/L); 1,4-DCB (3,600 μg/L)

Chlorinated hydrocarbons – PCE (250 μg/L); TCE (140 μg/L); 1,1,2-Trichloroethene (2 μg/L); cis-1,2-Dichloroethene (250 μg/L); trans-1,2-Dichloroethene (12 μg/L); Vinyl Chloride (320 μg/L)

Phenolic compounds – Phenol (2 μg/L); 2-Methylphenol (2 μg/L)

SI Results: During this SI, the VOCs detected at concentrations exceeding the Class GA standards included the following:

Aromatic hydrocarbons – Benzene (2.21 μg/L); Chlorobenzene (8.45 μg/L); 1,2-DCB (54.0 μg/L); 1,3-DCB (12.0 μg/L); 1,4-DCB (30.0 μg/L)

Chlorinated hydrocarbons – PCE (56.5 μg/L); TCE (35.6 μg/L); cis-1,2-Dichloroethene (12.2ug/L); Vinyl Chloride (6.90 μg/L)

Based on the recent data, the number and concentrations of VOCs detected in B-05R has reduced considerably. There are only five aromatic hydrocarbons vs nine previously, and the concentrations are about two orders of magnitude lower. Similarly, only four chlorinated hydrocarbons vs. six previously were detected, and the concentrations were only about 20 percent of the previous levels.

This would indicate that contamination in groundwater in the vicinity of B-05R, is still present, however, at considerably reduced levels. It appears that the contaminants are being naturally attenuated.

With respect to monitoring wells B-11 through B-15, which were installed in the area bounded by the former lagoons on the west, Wales Avenue on the east, B-05R to the north and B-04 to the south (Figure 1-8) to investigate contamination in the east area of the site, several VOCs were detected in these wells. The following list indicates the categories of these contaminants and the maximum concentrations of individual compounds within each category that exceed the SCGs:

Aromatic hydrocarbons – Benzene (1420 μg/L)

Chlorinated hydrocarbons – TCE (17.8 μg/L); cis-1,2-Dichloroethene (6640 μg/L); trans-1,2-Dichloroethene (62.4 μg/L); Vinyl Chloride (758 μg/L); 1,1-DCA (19.4 μg/L); 1,1-DCE (8.98 μg/L).

For the most part, these compounds are not the same as those detected in the shallow soils along the eastern edge of the site. They are similar to some of the constituents detected in well B-05R, although they are generally at higher concentrations. Additionally, the aromatic hydrocarbons detected in B-05R, with the exception of benzene, are not present in the five east area wells. Benzene and TCE were observed in the soils associated with the lagoons. Benzene was observed at similar concentrations to those observed in groundwater in B-11 to B-15. TCE was observed at much high concentrations (590,000 μg/L) in the Lagoon 2 area. The remaining chlorinated hydrocarbons observed in wells B-11 to B-15 are typical daughter products resulting from TCE degradation. In that wells B-11 to B-15 are downgradient of the lagoons during periods of mounding and cross gradient during the rest of the year, it is possible that the source of the benzene and chlorinated hydrocarbons is the soils under the lagoon. Alternatively, based on the fact that the concentrations of the VOCs in the five east area wells are typically higher than the concentrations observed in the soils along the eastern edge of the site and/or the groundwater in B-05R, it is possible that localized spills or leaks associated with tanker trucks parked in the east area may have been the source of the contamination.

Storm Sewer Along Wales Avenue and Outfall to Ellicott Creek

As shown on Figure 1-8, there are catch basins located on the north and south sides of Fillmore Avenue, the west and east sides of Wales Avenue, and the north and south sides of Vickers Avenue. These catch basins are interconnected and ultimately discharge via a 30-inch diameter corrugated metal pipe (CMP) to Ellicott Creek. Two catch basins on the west side of the street (CB-NW and CB-SW) and two on the east side of the street (CB-NE and CB-SE) were utilized to collect the samples. The two northernmost basins are located almost directly east of the Truck Wash Building, and are essentially upgradient of the study area during non-mounding periods of the year. The two southern basins are located east of monitoring well B-04, and essentially downgradient of the study area during non-mounding periods of the year.

RI Results: These storm sewers/catch basins were not sampled during the RI.

SI Results: VOCs were detected in the water samples in all four catch basins located along Wales Avenue and the outfall to Ellicott Creek. The catch basins on Fillmore Avenue and Vickers Avenue were not sampled during the SI. However, only cis-1,2-DCE was detected in CB-NW and the outfall at concentrations (i.e. 6.84 and 5.32 μg/L, respectively) that slightly exceed the Class GA standards (i.e. 5.0 μg/L). (There is no surface water standard for this compound). This compound was observed at higher concentrations in B-05R and all five of the east area wells. It was not observed in the soils associated with the lagoons.

Throughout most of the year (i.e. non-mounding periods), the groundwater surface elevation is below the storm sewer invert elevation. It is possible that there is some very limited migration of VOCs from the site to the east towards Wales Avenue and into the storm sewers during mounding periods. During the remainder of the year, groundwater flow is to the south, parallel to the storm sewer alignment, or to the southwest, towards the site. During these periods, it is unlikely that any VOCs are discharged to the east and/or into the storm sewers. It also is possible that the VOCs detected in the storm sewers are from other sources located upstream of the CLTL site.

1.5.3 <u>Summary and Conclusions:</u>

Based on the results from the RI/SI the following conclusions were made regarding the nature and extent of groundwater contamination at the site:

- Groundwater on the north (upgradient) and west (sidegradient) sides of the CLTL site has not been impacted by site operations. In the area north of the former lagoons and wastewater treatment plant, groundwater is contaminated by two aromatic hydrocarbons (Benzene and Chlorobenzene) that exceed Class GA groundwater standards.
    - Downgradient from the lagoons, approaching Ellicott Creek, contaminant concentrations diminish, and there does not appear to be any significant evidence of groundwater contaminant migration offsite to the Creek via the primary north-to-south groundwater flow pathway.
    - Groundwater on the east side of the site, at well B-05R, remains contaminated, by a number of aromatic hydrocarbons and chlorinated hydrocarbons. However, no phenolic compounds were observed during the latest round of sampling. Additionally, the number of organic constituents detected and the concentrations were considerably less than in earlier sampling events. Inasmuch as there were no operations conducted in this area of the site, it is suspected that historic spills and/or fill materials placed in this area may be the source of the contamination.
    - Groundwater in the area east of the lagoons (Wells B-11 to B-15) is contaminated by a number of aromatic hydrocarbons and chlorinated hydrocarbons that exceed the Class GA standards. For the most part these constituents include benzene and TCE

and a number of daughter products typical of TCE degradation. During the RI, Benzene, PCE and TCE were detected in soils under the lagoons, but were not detected in soils along the eastern edge of the site. The source of the contaminants may be the soils under the lagoons and/or possible spills or leaks that may have occurred historically in the tanker truck parking area.

- Water samples collected from the storm sewer (CB-NW) along Wales Avenue and the outfall to Ellicott Creek under mounding conditions, indicated concentrations of one VOC (cis-1,2 – dichloroethene) at levels that just slightly exceed the Class GA standards. There is no standard for this compound for surface waters.
- The analytical data indicates that some organic contaminants may be entering the storm sewer along Wales Avenue during mounding periods. However, throughout most of the year (i.e. non-mounding periods) the groundwater surface is below the storm sewer invert elevation. The storm sewers do not typically act as a groundwater 'sink'. Therefore, the source of the organic contaminants is uncertain, and may in fact be coming from other upstream sources.

In general, groundwater contamination does not appear to be moving offsite in a southward direction toward Ellicott Creek. Likewise, it appears that contaminant migration offsite to the east and/or into the storm sewers along Wales Avenue is unlikely during most of the year, and could only occur under mounding conditions in the Spring when groundwater flow is to the east. During the remainder of the year, groundwater flow is to the south, parallel to the storm sewer alignment, or to the southwest towards the site. Whereas, the water in the storm sewers discharges to Ellicott Creek, the contaminant concentration does not contravene any surface water standards.

Exceedances of soil and groundwater criteria by organic compounds across all areas of the site are summarized on Figures 1-7 and 1-8.

1.6 Contaminant Fate and Transport

This section describes the fate and transport of contaminants identified at the CLTL site, as well as potential receptors who might be exposed to contamination under existing conditions and in the future. Contaminant fate and transport depends not only upon the properties of the individual contaminants, but also upon the site-specific conditions and migration pathways available at the site. Table 1-3 summarizes the organic compounds and metals detected in soil and groundwater at the CLTL site at concentrations exceeding their respective standards, criteria and guidance (SCG) values. As previously mentioned, these SGC values are based upon New York State TAGM 4046 criteria for soil, and New York State TOGS 1.1.1 Class GA (potable water) groundwater. Table 1-4 indicates the physical properties of the organic compounds that exceeded SCG values. Organic compounds are generally much more mobile in the environment than metals, and the properties listed in Table 1-4 are indicators of this mobility, as discussed below.

1.6.1 Migration Pathways

Migration pathways are determined by the physical characteristics of the site, and the distribution and types of contaminants present. These pathways have been evaluated for each of the two environmental media addressed during the RI/SI, soil and groundwater. Contaminant migration pathways can include more than one medium. For example, soil contaminants can migrate into groundwater via leaching from precipitation.

Soil Migration Pathways

Three possible migration pathways for soil contaminants were evaluated: volatilization to air, leaching to groundwater, and erosion via either wind or water.

Volatilization from soil and subsequent migration through air is one possible migration pathway for contaminants in the soil at this site. The degree of volatilization is directly related to a contaminant's vapor pressure. Contaminants with relatively high vapor pressures (greater than 10 mm Hg) are more likely to volatilize than contaminants with low vapor pressures (less than 1 mm Hg) at room temperature. Most VOCs at the site exhibit relatively high vapor pressures and would be expected to volatilize. Volatilization is not a major pathway of concern, however, except potentially in the east area of the site, near well B-05R, where PID readings and shallow soil samples indicated the presence of VOCs close to the ground surface. Elsewhere onsite, soil contamination is deeper. VOC contaminants in the deeper soil are less of a concern, since the rate of volatilization from the deeper contamination is slowed by the diffusion of vapor through the soil. The potential for vapor intrusion to onsite and/or offsite buildings also is considered minimal. The only buildings onsite are the truck wash, the wastewater treatment building and the storage shed. These are all constructed as slab-on-grade structures. The slabs are generally in good conditions (i.e. no major cracks) and the Truck Wash building contains open bays. Consequently, the potential for vapor intrusion into these structures is considered minimal. Furthermore, the risk associated with vapor intrusion into these buildings is considered low, in that these buildings are no longer in use. Should these buildings be reused in the future, it may be necessary to conduct a soil gas survey and/or interior air sampling in the buildings to determine if any vapor intrusion is occurring.

Infiltrating precipitation, which mobilizes soluble compounds from the soil, serves as a second pathway for migration. In this process, compounds in the soil with moderate to high water solubilities and low organic carbon-water partition coefficient (K_{oc}) values (low tendency to adsorb onto soil) are dissolved by precipitation and transported through the soil to groundwater. Most VOCs, as well as the phenol compounds, have moderate solubilities and low K_{oc} values (Table 1-4) and, thus, are the most likely to migrate. The potential for migration of soil contaminants to groundwater is also higher in areas where the groundwater table is high. For example, in the east area of the site, where groundwater contamination is the most significant, the depth to groundwater is less than elsewhere onsite (see Table 1-2).

The third possible migration pathway is for chemicals adsorbed on surface soils to be transported mechanically by water and wind erosion. This migration pathway would apply to all contaminants that are adsorbed onto the soil particles, including the inorganic contaminants. The site is generally very flat, so water erosion is not considered to be a significant transport factor. Likewise, the potential for air-borne transport of particulate contaminants is considered to be generally low, except in the east area of the site where contamination occurs near the surface.

Groundwater Migration Pathways

Groundwater contaminants will travel through an aquifer via transport mechanisms such as advection and dispersion. The extent of travel depends on the flow of the groundwater and on the contaminant properties. VOCs, which are moderately soluble in water, are the most likely to migrate. Precipitation percolating through contaminated soil in unpaved areas may solubilize additional contamination, with resulting transport downward to the groundwater.

At the CLTL site, groundwater discharges to Ellicott Creek. During most of the year, the predominant groundwater flow direction across the site is from north to south, toward the Creek. However, during periods when the groundwater table at the site is high (e.g., spring), a mounding effect occurs beneath the central portion of the property, with radial flow outward. The most important component of this seasonal radial flow pattern is eastward toward Wales Avenue. The lagoon area and the east (well B-05R) area are approximately 400 feet and 600 feet north of Ellicott Creek, respectively. Based upon the low contaminant concentrations observed in monitoring wells between these areas and the Creek (wells B-02 through B-04, B-09 and B-10), it appears that groundwater contamination in the formerly active areas of the site is naturally attenuated in a downgradient (southerly) direction, to the point where there does not appear to be any significant migration of groundwater contaminants toward Ellicott Creek via the primary north-to-south groundwater flow pathway.

Data from the SI indicated that during periods of mounding some limited migration of contaminants from the site to the east towards Wales Avenue could occur. Additionally, since the invert of the storm sewers is about the same elevation as the groundwater surface during mounding periods, there is some potential for infiltration into the storm sewers. (Only one VOC was detected at low concentrations in the water samples collected from the storm sewers during the SI). In this event, groundwater would still discharge to Ellicott Creek.

1.6.2 <u>Potential Human Exposure Pathways</u>

The CLTL site is located in an industrial park within the City of Tonawanda. Previous investigations have indicated that there are no ecologically sensitive environments within a one-mile radius of the site (NUS Corporation, 1989). For these reasons, the following discussion is focused upon potential human exposures to site-related contaminants.

A completed exposure pathway is defined as one that includes all three of the following components: (a) a contaminated medium of concern; (b) a potential route of exposure; and (c) a potentially exposed population. These components are discussed and evaluated separately below.

1.6.3 Contaminated Media of Concern

As previously discussed, the two environmental media of concern at the CLTL site are contaminated soil and groundwater. Across most of the site, soil contamination occurs at depth. For example, in the former lagoon area, surface soil is clean, but there is significant contamination below the depth of excavation during lagoon closure (i.e., 14-16 feet bgs). On the other hand, the east area of the site (near well B-05R) exhibits soil contamination at or near the ground surface, as indicated by elevated PID readings and soil sample results.

Groundwater occurs at depths ranging from approximately 2.2 to 14.0 feet bgs across the site, depending upon location and time of year. The highest levels of groundwater contamination occur in the east area of the site.

1.6.4 Potential Routes of Exposure

Soil – The site is presently unused and access is unrestricted. Under existing conditions, the primary routes of potential exposure to soil contaminants are through incidental ingestion, dermal adsorption or inhalation of soil-borne contaminants. Potentially exposed individuals could be those using the site for various surface activities, or working at the site in such a way as to involve excavation in contaminated areas (e.g., construction or utility workers). The former would be exposed to soil contaminants only in the east area of the site, where contamination occurs at or near the surface. Workers could be exposed anywhere onsite where soil contamination occurs within the depth of excavation. Under future conditions, potential exposure routes depend upon land use. They include the scenarios described above, plus any other activities that require excavation and contact with contaminated subsurface soils, either by occasional site workers, permanent site workers or residents.

Groundwater – There are no residential wells in the area, and no industrial wells within a two-mile radius (NUS Corporation, 1989). Therefore, under existing conditions, there is no potential for the ingestion of groundwater contaminants associated with long-term, potable use. Nor, under existing conditions, are dermal absorption or inhalation of groundwater contaminants a potential concern, except through excavation (e.g., by construction or utility workers) in those areas (e.g., near well B-05R) where groundwater contamination occurs at shallow depths (e.g., less than 3 feet bgs). The potential for future exposure to groundwater contaminants also depends upon land use. Since potable use of onsite groundwater in the future is highly unlikely, given the site's location and the availability of public water, the most significant potential future exposure to groundwater contamination is through the construction of subsurface facilities (e.g., structures with basements), or through the worker scenario described above.

Air – As indicated, VOCs in the soil and/or groundwater may volatilize to the atmosphere and/or into onsite structures. There are no onsite workers at present, therefore under existing conditions, there is no potential for inhalation of VOCs, except through excavation (e.g. by construction or utility workers) in those areas where groundwater and/or soil contamination occurs at shallow depths (e.g. east area). The potential for future exposure to VOCs in air depends on the rates of volatilization and potential vapor intrusion rates into onsite buildings

1.6.5 Potentially Exposed Populations

As indicated above, the CLTL site is presently unused and access is unrestricted. Although the property is located in an industrial park, residential areas are nearby. The estimated population within a one-mile radius is over 70,000 (NUS, 1989), and the nearest residence to the site is approximately 0.2 miles distant (Engineering-Science, 1986). Therefore, under existing conditions, the potentially exposed populations include authorized onsite workers and trespassers from the nearby residential areas.

2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

2.1 General Procedure

This section describes the general procedure used for the identification and screening of remedial technologies at the CLTL Site. The procedure, which is applied separately to each environmental medium (e.g., soil and groundwater), includes the following three steps: (1) development of remedial action objectives; (2) establishment of general response actions; and (3) identification and screening of remedial technologies and, where applicable, process options. Each of these three steps is described in general terms below, and applied to specific environmental media in the following section.

2.1.1 Development of Remedial Action Objectives

Remedial action objectives are medium-specific goals for protecting human health and the environment. The primary potential human and ecological risks at the site derive from potential exposure to surface or subsurface soil contamination through incidental ingestion, dermal adsorption or inhalation of soil-borne contaminants under existing land use conditions, and direct contact with contaminated soil and/or groundwater under a future land use scenario that requires construction of subsurface facilities. The remedial action objectives for the site, as described subsequently, are intended to prevent or minimize the degree of these risks.

2.1.2 Establishment of General Response Actions

General response actions are broad remedial action categories that encompass general types of remedial technologies while satisfying the site-specific remedial action objectives. For example, at the CLTL site, general response actions that have been identified for the various environmental media include: no action, institutional controls, monitoring, removal/offsite disposal, containment, and in-situ treatment of soil and groundwater.

2.1.3 Identification of Remedial Technologies and Process Options

In this report, the term "technologies" refers to general remediation categories (e.g., in-situ soil treatment); and "process options" refer to specific applications within the technology category (e.g., chemical oxidation). As part of the procedure for developing remedial alternatives, technologies have been identified under each general response action and, where further refinement is appropriate, broken down into process options.

2.2 Application to Site-Specific Environmental Media

In this section, the general technology/screening procedure described above is applied to the specific impacted environmental media at the CLTL Site. As discussed below, some remedial approaches have been screened out at various levels (e.g., remedial action objective, general response, technology) and for various reasons. The end result of the screening is a list of technologies and process options that, alone or in combination, has been incorporated into sitewide remedial alternatives (Section 3.0).

Soil/Fill Material – A considerable amount of VOC-contaminated soils still exist below the former lagoons. During remediation of the lagoons, it was not possible to extend the excavations below about 14 – 16 feet due to the high groundwater inflow rates. Consequently, these materials were left in place. The elevated levels of VOCs in these soils constitutes the primary source of contaminants on the site. Because these contaminants could potentially impact groundwater, the following remedial action objective has been identified for it: prevent or minimize migration of contaminants to groundwater. Although groundwater data collected during the RI indicated some impact on groundwater from these soils in areas to the south and east of the lagoons, the degree of these impacts appears to be low (i.e. no evidence of migration to Ellicott Creek and/or to east towards Wales Avenue). Therefore, "no action" with respect to these soils under the lagoons is considered to be one of several feasible general response actions. Another general response action, excavation and offsite disposal, is not considered to be feasible due to the large volume and depth of these soils below the groundwater surface. The third general response, containment, would involve construction of a low-permeability cap over the lagoon area. Capping is considered feasible in meeting the remedial action objective for this medium in that it would minimize the amount of precipitation that infiltrates into the backfill materials in the former lagoons thereby reducing or eliminating the mounding that typically occurs during the spring months. Elimination or reduction of the mounding would reduce the potential for radial flow away from the lagoon area, and more specifically to the east towards Wales Avenue. However, in that mounding only occurs in the spring for 1 –2 months, and there is no confirmed evidence that contaminants from the site actually migrate into the storm sewers during this period, capping will have minimal impact on overall contaminant migration associated with the site. The other general response action, in-situ treatment of the soils by chemical oxidation, also is considered feasible.

Hot Spots – In addition to the lagoon area discussed above, two distinct "hot spots" were identified during the RI/SI. These hot spots are discussed separately in the following paragraphs.

The first and most significant hot spot is the linear area along the east property line, near B-05R, where elevated levels of VOCs were detected in the near-surface (i.e. 0 – 4 feet) soils. This zone is characterized by elevated PID readings in the upper two feet and by the presence of numerous organic compounds exceeding TAGM 4046 criteria, including BTEX, chlorobenzene, 1,2-, 1,3-, and 1,4-DCB, 1,2,4-TCB, vinyl chloride and phenol. This area extends from approximately borings GP-05/GP-13 on the north to GP-33 on the south (i.e. about 220 feet) and averages about 30 feet in width, beginning at the east property line (Figure 2-1). Within this area, the boring logs indicate that contamination occurs typically in the 2 –4 foot range, extending to a maximum of about 8 feet below ground surface.

A second hot spot was encountered in the area northwest of well B-01, especially in the area of borings GP-14W and GP-04WA. Soils in this area are contaminated by a variety of aromatic and chlorinated hydrocarbons including: BTEX, chlorobenzene, 1,2-, 1,3-, and 1,4-DCB, 1,2,4-TCB, hexachlorobenzene, TCE and vinyl chloride. The overall extent of the impacted area extends from GP-07N on the north (just north of the diesel pump dispensers) to GP-04W on the south (about 200 feet) and from GP-06D on the east to GP-25W on the west (about 140 feet) (Figure 2-1). Within this area, the boring logs indicate that contamination occurs typically in the 6 - 8 foot range, extending to a maximum of about 16 feet below ground surface.

The following remedial action objectives have been developed for the soils under the lagoons and the two known hot spots: *prevent direct contact with contaminated materials and reduce contaminant concentrations and/or migration potential.* Considering that the higher concentrations of contaminants are generally detected in the subsurface soils thereby minimizing the potential risks of direct contact and there are currently no significant impacts to groundwater, the "no action" response is considered to be a feasible response.

Containment by capping also is considered feasible for these two hot spots. Although this option does not reduce the contaminant concentrations, it will prevent contact with the contaminated soils and reduce the potential for migration. Excavation and disposal of these soils offsite will meet the remedial action objectives and is considered feasible due to the relatively limited quantities of materials to be excavated and the fact that most of the contaminated soils in both areas are above the groundwater surface. In-situ treatment of the contaminated soil by chemical oxidation may meet the remedial action objectives and is considered feasible. However, it is not considered very cost-effective for the relatively small volume of soil to be treated and the relatively low concentrations of contaminants present.

<u>Groundwater</u> – Groundwater on the north and west sides of the CLTL site has not been impacted by site operations. Downgradient (south) from the lagoons, approaching Ellicott Creek, contaminant concentrations diminish, and there does not appear to be any significant evidence of groundwater contaminant migration offsite to the Creek via the primary north-to-south groundwater flow pathway. Groundwater on the east side of the site, at wells B-05R, and B-11 to B-15 is contaminated by a number of aromatic hydrocarbons and chlorinated hydrocarbons that exceed the Class GA standards. For the most part these constituents include benzene and TCE and a number of daughter products typical of TCE degradation.

Water samples collected from the storm sewer along Wales Avenue and the outfall to Ellicott Creek indicate that some organic contaminants may potentially be entering the storm sewer along Wales Avenue during mounding periods. The concentration of one VOC (i.e. cis-1,2 – dichloroethene) was detected at levels that just slightly exceed the Class GA standards. However, throughout most of the year (i.e. non-mounding periods) the groundwater surface is below the storm sewer invert elevation.

The remedial action objective for this environmental medium is: *reduce contaminant concentrations and prevent the migration of contaminated groundwater to the Creek or to the storm sewers along Wales Avenue.* Considering the lack of any apparent impact to date on the Creek, and the seasonal nature of the groundwater migration to the storm sewers, "no action" (with long-term monitoring) is considered to be one feasible response for groundwater. Excavation (i.e. withdrawal and treatment) of the groundwater is not considered feasible considering the apparent current lack of impacts to site groundwater. Likewise, containment (i.e. capping) is considered feasible although this option is not considered cost-effective. In-situ treatment of the groundwater using chemical oxidation also is considered feasible. However, this option is not considered to be cost-effective, in that there are limited impacts to site groundwater, and no contaminants are migrating to the Creek or offsite to the storm sewer.

Whereas, capping of the lagoon area will reduce infiltration of precipitation and minimize the formation of mounding in the lagoon area and leaching of contaminants from soil to groundwater, it is not considered cost effective. This is due to the following:

- Mounding only occurs 1 – 2 months during the spring. Therefore the primary benefits from capping would only be realized during this limited period.
- There is no concrete evidence that contaminants migrating east from the site actually enter the storm sewers during mounding periods, or any other time of the year. Consequently, capping may have little, or no, impact on eliminating or minimizing contaminant migration to the east.
- The data indicates that contaminants in soils under the lagoon are not currently migrating south to Ellicott Creek. Consequently, it is not likely that capping will improve this situation.

Inasmuch as the overall benefits derived from capping the lagoon area are considered to be minimal, capping will not be considered further in this evaluation.

3.0 DEVELOPMENT OF REMEDIAL ALTERNATIVES

3.1 Rationale for Alternative Development

In this section, the general response actions and remedial technologies that survived the preliminary screening in Section 2.0 have been combined into sitewide remedial alternatives for the CLTL Site. These alternatives span a range of options for the management of onsite media. Although all of the alternatives (except "no action") are generally intended to be protective of human health and the environment, they accomplish this intent using different approaches and to different degrees. For example, for the different impacted environmental media, the alternatives include a broad range of response types, such as: engineering controls, treatment of soil and groundwater, excavation with offsite disposal, and institutional controls.

Five remedial alternatives have been identified for detailed analysis as part of this Feasibility Study. The "No Action" alternative (Alternative 1) serves as a baseline for comparison with the other, pro-active alternatives. In general, the alternatives represent sequentially (i.e., from No. 1 to No. 5) more comprehensive sitewide remedial approaches, increasing levels of detail and complexity, higher overall levels of health and environmental protection, and greater cost. These progressive alternatives are described briefly below, then evaluated in detail in Section 4.0.

3.2 Identification of Remedial Alternatives

3.2.1 Alternative 1 – No Action

Evaluation of the "no action" alternative is required by CERCLA, and serves as an indicator of site conditions in the absence of remediation, and a baseline for comparison with the other active remedial alternatives.

3.2.2 Alternative 2 – Institutional Controls

At present, QDI has no plans to redevelop and/or sell the site. However, should future development occur, there are several areas of the site that may need to be remediated before some types of development could proceed. An alternative method for preventing exposure to these contaminated areas would be to impose development restrictions on the site, including restrictions against future residential development and or use of groundwater. Additionally, institutional controls including access restrictions and controls for future workers who might encounter contaminated soil, groundwater, and/or organic vapors.

3.2.3 Alternative 3 – Monitored Natural Attenuation

Alternative 3 relies on natural attenuation processes such as biodegradation, dispersion, dilution, sorption, volatilization, etc. to reduce mass, toxicity, mobility, volume or concentration of contaminants within soil and groundwater at the site. Long term monitoring would be implemented to verify the effectiveness and progress of the natural attenuation and provide a warning if conditions change. Data collected during the RI/SI have indicated that natural attenuation is presently occurring on the site (i.e. significant reduction in onsite concentrations of contaminants) and that site conditions are conducive to the various natural attenuation processes. The monitoring program would include groundwater analysis for the VOC contaminants of concern as well as natural attenuation indicators such as dissolved oxygen, pH, conductivity, and oxidation-reduction potential. In addition to groundwater monitoring, this alternative would also include institutional controls and a provision to evaluate and implement additional remedial measures should conditions become worse.

3.2.4 Alternative 4 –Excavation and Offsite Disposal of Contaminated Soils Along East Property Line

Alternative 4 includes institutional controls (as in Alternative 2) and monitored natural attenuation (as in Alternative 3) plus excavation of the most highly contaminated soils in the linear area located near well B-05R with disposal in an offsite, permitted landfill. This area of shallow contaminated soils is thought to be the probable source of contaminants in groundwater east of well B-05R (i.e. along the east property line). The limits of excavation for the majority of the highly contaminated soils would be determined in the field based on PID readings, visual and olfactory evidence in conjunction with the Department.

3.2.5 Alternative 5 – In-situ Treatment of Soils Under Lagoon Area and Excavation of Soils Along East Property Line

Alternative 5 includes all the components of Alternative 4, plus in-situ treatment of contaminated soils and groundwater beneath the lagoon. The soils under the lagoons (i.e. below the base of backfill materials placed in the excavation during initial remediation) contain the highest concentrations of VOCs anywhere on the site and provide the source for contaminants in groundwater in areas east of the lagoons (wells B-11 to B-15). Chemical oxidizing reagents would be injected into the contaminated soils and groundwater below the former lagoons to reduce the volume and toxicity of the contaminants present. Monitoring would be implemented to determine the success of the oxidizing agents in reducing contaminant concentrations.

4.0 DETAILED ANALYSIS OF ALTERNATIVES

4.1 Description of Evaluation Criteria

In Section 4.2, each of the remedial alternatives developed for the CLTL Site is analyzed with respect to the following seven evaluation criteria, as required by 6 NYCRR Part 375.

Overall Protection of Human Health and the Environment: This criterion serves as a final check to assess whether each alternative meets the requirements that are protective of human health and the environment. The overall assessment of protection is based on a composite of factors assessed under other evaluation criteria, including: long-term effectiveness and permanence, short-term effectiveness, and compliance with New York State Standards, Criteria and Guidelines (SCGs). This evaluation focuses on how each alternative achieves protection over time and how site risks are reduced.

Compliance with SCGs: This evaluation criterion is used to determine how each alternative complies with applicable or relevant and appropriate New York State Standards, Criteria and Guidelines. Standards and criteria are cleanup standards, standards of control and other substantive environmental protection requirements, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance. Guidelines include non-promulgated criteria and guidance that are not legal requirements, but should be considered in terms of applicability to the site, based on professional judgment. The actual determination of which requirements are applicable or relevant and appropriate is made by the NYSDEC in consultation with the NYSDOH.

SCGs are classified as chemical-specific, action-specific or location-specific. Chemical-specific SCGs apply to the nature of the contaminants, irrespective of the remedial actions considered to address them. Action-specific SCGs, on the other hand, represent requirements that correspond to specific remedial activities. Location-specific SCGs are similar to action-specific SCGs, and address requirements or limitation that may be necessary for certain remedial activities due to the presence of nearby features, such as (for example) points of historical interest, or habitat for endangered species.

The following list contains the principal chemical- and action-specific SCGs that have been identified for the CLTL Site. No location-specific SCGs have been identified.

<u>**Chemical-Specific SCGs**</u>

- NYSDEC Division of Hazardous Waste Remediation, Technical and Administrative Guidance Memorandum (TAGM) 4046, Determination of Soil Cleanup Objectives and Cleanup Levels
- 6 NYCCR Parts 700-706, Water Quality Regulations for Surface Water and Groundwater
- NYSDEC Division of Water, Technical and Operations Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance values and Groundwater Effluent Limitations
- 40 Code of Federal Regulations (CFR) 141, Safe Drinking Water Act Maximum Contaminant Levels
- 40 CFR 131, Clean Water Act, Water Quality Standards

<u>**Action-Specific SCGs**</u>

- 6 NYCRR Parts 200, 201, 212, 257 Prevention and Control of Air Contamination
- 6 NYCRR Parts 364, 371, 372, 375, 376, Hazardous Waste Identification, Transportation, and Disposal
- NYSDEC New York State DAR-1, Guidelines for the Control of Toxic Ambient Air Contaminants
- 40 CFR 400-469, Clean Water Act

<u>Short-Term Impacts and Effectiveness:</u> This evaluation criterion assesses the effects of the alternative during the construction and implementation phase. Alternatives are evaluated with respect to their effects on human health and the environment during the implementation of the remedial action. The factors considered under this criterion include: protection of the community during remedial actions; environmental impacts as a direct result of remedial actions; time until

the remedial response objectives are achieved; and protection of workers during the remedial actions.

Long-Term Effectiveness and Permanence: This evaluation criterion addresses the results of a remedial action in terms of its permanence and quantity/nature of waste or residual remaining at the site after response objectives have been met. The primary focus of this criterion is the extent and effectiveness of the controls that may be required to manage the waste or residual remaining at the site, and the operating system necessary for the remedy to remain effective. The factors considered under this criterion include: magnitude of remaining risk; adequacy of controls used to manage residual waste; and reliability of controls used to manage residual waste.

Reduction of Toxicity, Mobility and Volume: This evaluation criterion assesses each remedial alternative's use of technologies that provide a permanent and significant onsite reduction of toxicity, mobility or volume of hazardous wastes. It considers: the amount of hazardous materials that will be destroyed or treated; the degree of expected reduction in toxicity, mobility or volume; the degree to which the treatment will be irreversible; and the type and quantity of residuals that will remain following treatment.

Implementability: This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. The evaluation includes: feasibility of construction and operation; the reliability of the technology; the ease of undertaking additional remedial action; monitoring considerations; activities needed to coordinate with other offices or agencies; availability of adequate off-site treatment, storage and disposal services; availability of equipment; and the availability of services and materials.

Cost: This criterion addresses the cost of each alternative, expressed in terms of capital costs (direct and indirect), annual operation and maintenance (O&M) costs, and total present worth.

In addition to the above seven evaluation criteria, community acceptance will also be considered prior to the selection of a final remedy for the site.

4.2 Detailed Analysis of Alternatives Individually

In this section, each of the alternatives developed for the CLTL Site is analyzed in terms of the seven evaluation criteria identified in Section 4.1. Each subsection below begins with a description of the alternative, including its physical layout, primary system components, and key assumptions related to configuration and cost of implementation. This description is followed by an assessment of how the alternative "measures up" to each of the evaluation criteria. The results of each individual alternative analysis are applied in Section 4.3 to evaluate all of the alternatives on a comparative basis, leading ultimately to the selection of a single recommended alternative for the site.

4.2.1 Analysis of Alternative 1 – No Action

Description: The "no action" alternative is just what it says. Under this alternative the site would be left in its existing condition with no effort or activities being implemented to treat, contain or otherwise address site contamination.

Overall Protection of Human Health and the Environment: Alternative 1 provides no change to existing conditions at the site and, therefore, results in a continuation of the existing potential human and ecological exposures to site-related contamination. Specifically, under existing conditions, trespassers or persons using the site casually, may be exposed to surface soil contamination. There are no existing site users/workers. In the future, residents and/or workers at the site could be exposed to contamination from the same media, and also to the relatively higher levels of subsurface contamination occurring in site hot spot areas, including the linear area along the east property line, near B-05R. Shallow, contaminated groundwater, primarily in the eastern portion of the site, also represents a potential future exposure route.

Compliance with SCGs: The "no action" alternative would result in the continued exceedance of some SCGs, as described below:

- Under existing conditions, TAGM 4046 values are exceeded for shallow soils in the linear area near well B-05R along the eastern property line and in the area northwest of well B-01. Exceedances include BTEX, chlorobenzene, 1,2-, 1,3-, and 1,4-DCB, 1,2,4-TCB Vinyl Chloride and phenol

- TAGM 4046 values are also exceeded in subsurface soils, particularly in the area below the former lagoons. Exceedances in this area include BTEX, chlorobenzene, 1,2-, 1,4-DCB, 1,2,4-TCB, PCE, TCE, 1,1,1-TCA, chloroform, MEK and acetone.
- Class GA groundwater standards are exceeded for shallow groundwater in the areas immediately north and south of the lagoons, and the entire eastern portion of the site. Exceedances in these areas include benzene, chlorobenzene, 1,2-, 1,3- and 1,4-DCB, TCE, 1,1-DCA, 1,2-DCA, cis-1,2-DCE, PCE and vinyl chloride

Short-Term Impacts and Effectiveness: Since this alternative involves no active remedial measures, there are no short-term impacts to the community, environment or remediation workers associated with its implementation. It does not provide a short-term remedy for any of the existing, potential human/ecological exposures to contaminated media, and does not affect the existing exceedances of SCGs.

Long-Term Effectiveness and Permanence: Alternative 1 provides no active remediation of onsite contamination. Other than as a result of natural attenuation over long time periods, the nature and extent of contamination at the site are unchanged, and the risk remaining after implementation of the remedy is equal to the existing risk. No controls are employed to manage this residual (i..e., existing) risk, so the reliability of controls is not relevant.

Reduction of Toxicity, Mobility and Volume: The alternative provides no treatment of contaminated media, and therefore no reduction of toxicity, mobility and volume (TMV).

Implementability: The "no action" alternative is, for obvious reasons, fully implementable.

Cost: In that this alternative involves no active remedial measures, the implementation cost is zero. The estimated cost for implementation of Alternative 1 is as follows:

- Capital Cost = $0.00
- Annual O&M Cost = $0.00
- Total Present Worth = $0.00

4.2.2 Analysis of Alternative 2 – Institutional Controls

Description: Alternative 2 consists of institutional controls to prevent future human exposure to soil and groundwater contamination found in some areas of the site. This will be accomplished by the preparation and enactment of enforceable deed restrictions prohibiting future residential development of the site or other activities that might potentially result in exposure through excavation or disturbance of contaminated subsurface soil and groundwater.

Overall Protection of Human Health and the Environment: Although institutional controls would reduce the likelihood of future contact with soil and groundwater contaminants, they are not as certain a method of protection, and therefore not as protective an approach, as actual site cleanup measures.

Compliance with SCGs: Institutional controls would not reduce the SCG exceedances described under Alternative 1 – No Action.

Short-Term Impacts and Effectiveness: Institutional controls would involve no significant impacts to the community or environment. There would be no worker risk as this alternative does not involve any active onsite remediation. The response objectives for institutional controls are very limited, however, the length of time required to achieve them is uncertain. It depends upon the time required to enact the institutional controls from an administrative and legal standpoint, and, subsequently, upon the degree to which they are enforced.

Long-Term Effectiveness and Permanence: The long-term effectiveness and permanence of institutional controls is doubtful. The legal and administrative feasibility of preventing future site development, as well as subsurface excavation activities that would result in exposure to contaminated soil and groundwater, is uncertain even at the present time, and even more so into the future. Contaminated soil and groundwater would not be affected by such controls, and could remain at the site for long periods as residual contamination.

Reduction of Toxicity, Mobility and Volume: Alternative 2 involves no reduction of TMV.

Implementability: The type of institutional controls required to prevent future development or excavation at the site, and the indefinite period of time over which these controls would be required, make implementation of this measure very uncertain from both administrative and legal standpoints.

Cost: As presented in Appendix A, the estimated cost for implementation of Alternative 2 is:

- Capital Cost = $10,000
- Annual O&M Cost = $0
- Total Present Worth = $10,000

4.2.3 Analysis of Alternative 3 – Monitored Natural Attenuation

Description: Natural attenuation processes relate to the capacity of indigenous microorganisms to degrade organic contaminants under aerobic or anaerobic conditions. At the CLTL site natural attenuation can effectively degrade organic chemicals that are dissolved in the groundwater, if the site geochemistry (e.g., temperature, pH, and nutrient levels) supports microbial activity under anaerobic conditions and sufficient electron donors are present. Groundwater flushing, dilution, and dispersion also reduce concentrations. Under this alternative, concentrations of individual VOCs and their degradation products would be monitored in several monitoring wells until the removal action objective is attained.

This alternative includes the following components:

- Monitoring – Groundwater would be monitored using six existing monitoring wells in the contaminated area (i.e. B-01, -02, -04, –05R, -13, and -14). Samples would be analyzed for TCL VOCs, and select natural attenuation parameters twice per year for years 1 to 3, and once per year for years 4 and 5.
- Site Reviews – The DEC and QDI would review and assess data generated by the monitoring program at regular intervals (e.g., semi-annually), to evaluate the effectiveness of natural attenuation in achieving the removal action objective.

Overall Protection of Human Health and the Environment: This alternative consists of tracking the levels of VOCs by monitoring as natural attenuation occurs. Groundwater monitoring would be used to verify that the site contaminants do not spread from the site and that they decrease with time, as natural biodegradation processes consume the contaminants. This alternative is protective of human health and the environment as it will provide warnings if any significant changes occur.

Compliance with SCGs: This alternative will reduce the SCG exceedances by natural attenuation processes over a long period of time.

Short-Term Impacts and Effectiveness: Since this alternative involves no active remedial measures, there are no short-term impacts to the community, environment or remediation workers associated with its implementation. It does not provide a short-term remedy for any of the existing, potential human/ecological exposures to contaminated media, and does not affect the existing exceedances of SCGs in the short-term.

Long-Term Effectiveness and Permanence: Alternative 3 provides no active remediation of onsite contamination. The nature and extent of contamination at the site will be reduced over time as a result of natural attenuation processes. The risk remaining after implementation of the remedy will be gradually reduced as the contaminants degrade. Additionally, the monitoring results will provide warning if significant changes occur. This alternative does not preclude implementation of other more aggressive remedial alternatives should changes in site conditions in the future warrant them.

Reduction of Toxicity, Mobility and Volume: This alternative provides no active remediation of site contamination. However, the TMV of contaminants will be reduced gradually over time as a result of the natural attenuation processes.

Implementability: Monitored natural attenuation is easily implemented. There is ample availability and capacity of environmental consultants/contractors and laboratories to collect the groundwater samples, perform the required analyses and evaluate the data.

Cost: As presented in Appendix A, the estimated cost for implementation of Alternative 3 is:

- Capital Cost = $20,000
- O&M Cost = $44,040(years 1 – 3)

  = $14,680(years 4 and 5)
- Total Present Worth = $78,720

4.2.4 Analysis of Alternative 4 –Excavation and Offsite Disposal of Soils in the East Area With Monitored Natural Attenuation

Description: This alternative includes excavation of near-surface contaminated soils in the linear area located near well B-05R along the eastern property line and offsite disposal in a permitted landfill. Monitored natural attenuation (as in Alternative 3) also will be implemented. Remediation of this area will remove the contaminated soils thereby eliminating the potential for future human exposure, by onsite workers or trespassers, to soil contamination. The soils in this area will be excavated to a depth of about four feet, loaded into transport vehicles and shipped offsite for disposal at a permitted landfill. Soils will be disposed as hazardous or non-hazardous based on results of RCRA characterization testing. Following excavation, the area will be backfilled with 'clean' offsite borrow material and graded to promote drainage. Long-term monitoring will provide data on the progress and effectiveness of the soil removal on overall site conditions.

Overall Protection of Human Health and the Environment: Excavation of the most highly contaminated soils along Wales Avenue with offsite disposal would permanently eliminate the health risks associated with these soils. It also would eliminate these soils as a potential source of contaminants leaching into groundwater. This alternative would provide a slight increase in the amount of protection of human health and the environment over Alternative 3 in that the only area onsite with contaminated soils being exposed at, or near, the ground surface would be eliminated. It does not eliminate the risks associated with residual contaminated soils in this area at depths greater than four feet. It also does nothing to reduce the risks associated with other areas of soil and groundwater contamination onsite.

Compliance with SCGs: In terms of compliance with SCGs, Alternative 4 through excavation and offsite disposal of contaminated near-surface soils, will eliminate, or significantly reduce, SCG exceedances in the eastern area along Wales Avenue. It does nothing to reduce contaminant concentrations in the other impacted areas of the site.

Short-Term Impacts and Effectiveness: Because this alternative involves excavation of contaminated soils, there is potential for worker risk during remediation. However, these risks are manageable through development and implementation of an effective health and safety plan (HASP). In addition, this alternative involves the transportation of about 475 cy of contaminated soils using local roads. In that the site is located in an industrial park, and there is direct access to major transportation routes without having to go through residential areas, these risks are minimal. In any case, the potential risks to the community associated with this activity can be controlled through the use of standard transport safety practices during hauling. The duration of the transport activities also is very short. The objectives for this action would be achieved immediately after its implementation, which is estimated to require no longer than several weeks.

Long-Term Effectiveness and Permanence: Excavation and offsite disposal of contaminated soils provides a permanent and effective remedy for the most highly contaminated soils along Wales Avenue. After implementation, there would still be some residual contaminated soils left in this area at depths greater than four feet. Additionally, this alternative has no impact on contaminants in soils and/or groundwater in other areas of the site.

Reduction of Toxicity, Mobility and Volume: This alternative provides the reduction of onsite waste volume by excavation of contaminated soils along Wales Avenue and disposal offsite at a permitted landfill. It also reduces the volume and mobility of contaminants in groundwater in this area by eliminating the most highly contaminated portion of the source of the contaminants transported to groundwater via leaching. This alternative does nothing to reduce the TMV of contaminated soils and groundwater in other areas of the site (e.g. under the lagoons).

Implementability: Excavation and offsite disposal of contaminated soils is easily implemented. There is ample availability and capacity of equipment, contractors and offsite disposal facilities necessary for the implementation of this measure. The earthwork and transportation technologies necessary for its implementation are proven and reliable, and agency coordination and approvals are not expected to be an issue.

Cost: As presented in Appendix A, the estimated cost for implementation of Alternative 4 is:

- Capital Cost = $160831
- O&M Cost = $44,040 (years 1 – 3)

  = $14,680 (years 4 and 5)
- Total Present Worth = $219,551

4.2.5 Analysis of Alternative 5 – In-situ Chemical Oxidation of Soils Under Lagoons, Excavation and Offsite Disposal of Soils in East Area, With Monitored Natural Attenuation

Description: This alternative is identical to Alternative 4, with the addition of in situ treatment of the contaminated soils located under the lagoons by chemical oxidation. In the lagoon area, chemical oxidizing reagents would be injected into the contaminated soils located under the lagoon footprint and in the area extending about 50 – 70 feet west of Lagoon #1. It is anticipated that approximately 401 injection points, in a 10 X 10 foot grid pattern would be installed. Long-term monitoring would be utilized to gauge the effectiveness of the approach in reducing the residual VOC concentrations.

Overall Protection of Human Health and the Environment: This alternative provides a marginally higher level of protection than Alternatives 3 and 4. Whereas this alternative has the potential to result in a significant reduction in the residual VOCs under the lagoons, there is minimal risk to human health and the environment posed by these soils in their present condition.

Compliance with SCGs: Alternative 5 provides a significant improvement over Alternative 4 in terms of SCG compliance. In addition to the benefits provided by Alternative 4, this alternative would significantly reduce, the most significant SCG exceedances at the site.

Short-Term Impacts and Effectiveness: The injection of chemical oxidizing reagents into soils under the lagoons would not be expected to pose any significant short-term risks to the community, environment or onsite workers as all of the contaminated soils will be left in place. Potential risks associated with contamination being brought to the surface by the drilling/injection equipment would be minimal and could be controlled by implementation of a HASP and proper decontamination procedures. The short-term effectiveness of this alternative is very uncertain, and will be very dependent on the nature and extent of the contamination and the distribution of the chemical oxidizing agents achieved by the injections.

Long-Term Effectiveness and Permanence: The chemical oxidation of VOCs in soils under the lagoons would be effective in the long-term and permanent. However, the timeframe required to achieve the remedial action objectives would be very difficult to calculate. Furthermore, it is anticipated based on site conditions that multiple phases of injection would be required to achieve the remedial action objectives.

Reduction of Toxicity, Mobility and Volume: This alternative would provide a significant increase over alternative 4 in the reduction of TMV of contaminants at the site. Chemical oxidation of soils under the lagoons would significantly reduce, the volume of the most highly contaminated soils on the site.

Implementability: The implementability of this alternative is the same as Alternative 4 with the addition of in-situ treatment of soils under the lagoons. There is ample availability and capacity of equipment, contractors and offsite disposal facilities necessary for the implementation of this measure. The chemical reagents and injection equipment/methods necessary for its implementation are proven and reliable, although the results are highly dependent on geologic conditions. Chemical oxidation is typically less effective in low permeability soils or stratified units of varying permeability and continuity. Agency coordination and approvals are not expected to be an issue.

Cost: As presented in Appendix A, the estimated cost for implementation of Alternative 5 is:

- Capital Cost = $1,136,743
- O&M Cost = $44,040 (years 1 – 3)

  = $14,680 (years 4 and 5)
- Total Present Worth = $1,195,463

4.3 Comparative Analysis of Alternatives

Table 4-1 presents a comparative evaluation of the five remedial alternatives considered for the CLTL site, in terms of the seven evaluation criteria that were described in Section 4.1 and utilized in Section 4.2 as part of the detailed evaluation process. As indicated by the table, there is no single alternative that is "best" in terms of all evaluation criteria. Rather, the selection of a remedy for the site will require a balancing of evaluation factors that are in some cases aligned, and in others competing. From a very broad perspective, the five alternatives can be summarized comparatively as follows:

- Alternative 1 – No Action: This alternative involves no active site remedial measures. It does nothing to address potential risks under existing or future conditions, nor does it bring the site any closer to compliance with presently exceeded SCGs. Its estimated total present worth is $0.00.
- Alternative 2 – Institutional Controls and Surface Cleanup: This alternative provides institutional controls to prevent future residential development or excavation at the site. It does not, however, address contaminated areas of the site in an active manner, nor does it achieve compliance with any currently exceeded SCGs. The feasibility, permanence and implementability of institutional controls that would be required to provide a suitable level of protection are very uncertain. The estimated total present worth of Alternative 2 is $10,000.
- Alternative 3 – Monitored Natural Attenuation: Alternative 3 consists of tracking the levels of VOCs by monitoring as natural attenuation occurs. It does not involve any active site remediation activities. This alternative is protective of

human health and the environment as it will provide warnings if any significant changes occur. This alternative will reduce waste volume and SCG exceedances by natural attenuation processes in the long-term. There are no short-term impacts, it is fully implementable, and it does not preclude implementation of more aggressive remedial alternatives should changes in site conditions in the future warrant them. Its estimated present worth is $ 78,720.

- Alternative 4 – Excavation and Offsite Disposal of Soils in the East Area With Monitored Natural Attenuation: Alternative 4 includes excavation of near-surface soils along the eastern property line with offsite landfilling. Remediation of this area will remove the most highly contaminated portion of the source with the greatest potential risk for human exposure and a significant source of current SCG exceedances. This alternative provides a reduction of waste volume onsite. It involves proven technologies and is effective over both the short- and long-term, permanent and fully implementable. However, it leaves some residual contaminated soils in place and it does little to reduce the risks and TMV of contaminated soil and/or groundwater in other areas of the site. Its estimated present worth is $ 219,551.

- Alternative 5 - In-situ Treatment of Soils Under Lagoon Area and Excavation of Soils Along East Property Line: This alternative is identical to Alternative 4, with the addition of in situ treatment of contaminated soils located under the lagoons by chemical oxidation. This alternative would significantly reduce the only area onsite with contaminated soil being exposed at, or near, the ground surface and addresses the most significant source of SCG exceedances at the site. The short-term effectiveness is uncertain. However, it should be effective in the long-term and permanent, although the effectiveness is highly dependent on geologic conditions controlling injection/distribution of the chemical reagents. Its estimated total present worth is $ 1,195,463.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the above discussions, the following conclusions were reached:

- Alternative 1 does not meet the remedial action objectives for the site.
- Alternative 2 provides slightly more protection than Alternative 1. However, it does nothing to reduce contaminants at the site and does not meet the remedial action objectives.
- Alternative 3 does not actively address contaminated areas of the site. However, it does meet the remedial action objectives by reducing the volume and potential migration of contaminants offsite through natural attenuation processes. It is very cost-effective, will provide warnings if significant changes in site conditions occur, and does not preclude implementation of more aggressive alternatives should future conditions warrant them.
- Alternative 4 meets the remedial action objectives and provides a marginal increase in protection over Alternative 3 in that it actively addresses an area of contaminated soil onsite that is exposed at, or near, the ground surface. However, inasmuch as there are no workers on site, there is minimal risk associated with these soils under present conditions. This alternative also is considerably more costly than Alternative 3.
- Alternative 5 meets the remedial action objectives and provides a further increase in protection over Alternatives 3 and 4, in that it actively addresses the primary source of contaminants on the site (i.e. soils under the lagoons). However, as with Alternative 4, there is minimal risk associated with these soils under present conditions and no evidence on contaminant migration from this area to the Creek and/or storm sewers. This alternative is the most costly to implement.

5.2 Recommendations

Based on the detailed evaluation of alternatives it is recommended that Alternative 3 – Monitored Natural Attenuation be implemented at the site. This alternative is the most cost-effective in meeting the remedial action objectives for the site. Additionally, it will provide warnings if any significant changes in site conditions occur and does not preclude implementation of more aggressive remedial alternatives should they be warranted in the future.

TABLES

TABLE 1-1
HYDRAULIC CONDUCTIVITY RESULTS
FOR LAYERED SAND/SILT/CLAY UNIT

Well	cm/sec			ft/min			ft/day		
	Average	Falling	Rising	Average	Falling	Rising	Average	Falling	Rising
B-1	2.45E-04	2.73E-04	2.17E-04	4.82E-04	5.38E-04	4.27E-04	0.7	0.8	0.6
B-3	3.18E-03	3.18E-03	3.18E-03	6.26E-03	6.26E-03	6.26E-03	9.0	9.0	9.0
B-4	3.66E-04	3.48E-04	3.84E-04	7.20E-04	6.85E-04	7.56E-04	1.0	1.0	1.1
B-5R	3.51E-04	3.69E-04	3.33E-04	6.90E-04	7.26E-04	6.55E-04	1.0	1.0	0.9
B-6	6.14E-04	4.76E-04	7.52E-04	1.21E-03	9.37E-04	1.48E-03	1.7	1.3	2.1
B-7	1.21E-03	1.24E-03	1.17E-03	2.37E-03	2.45E-03	2.30E-03	3.4	3.5	3.3
B-8	8.90E-05	8.68E-05	9.12E-05	1.75E-04	1.71E-04	1.80E-04	0.3	0.2	0.3
B-9	6.43E-05	7.53E-05	5.32E-05	1.27E-04	1.48E-04	1.05E-04	0.2	0.2	0.2
B-10	4.64E-04	4.87E-04	4.41E-04	9.13E-04	9.58E-04	8.68E-04	1.3	1.4	1.2

Well	Average		
	cm/sec	ft/min	ft/day
B-1	2.45E-04	4.82E-04	0.7
B-3	3.18E-03	6.26E-03	9.0
B-4	3.66E-04	7.20E-04	1.0
B-5R	3.51E-04	6.90E-04	1.0
B-6	6.14E-04	1.21E-03	1.7
B-7	1.21E-03	2.37E-03	3.4
B-8	8.90E-05	1.75E-04	0.3
B-9	6.43E-05	1.27E-04	0.2
B-10	4.64E-04	9.13E-04	1.3

TABLE 1-2
GROUNDWATER ELEVATION READINGS
CHEMICAL LEAMAN

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
B-01	1098309.179	1074132.709	574.54	576.46	576.28	A	0						
MNW								8/8/2000 0000	7.25	569.03	0.00	569.03	
MNW								9/29/2000 0000	7.50	568.78	0.00	568.78	
MNW								4/19/2001 0000	5.94	570.34	0.00	570.34	
MNW								4/24/2001 0000	6.10	570.18	0.00	570.18	
MNW								4/29/2001 0000	6.28	570.00	0.00	570	
MNW								4/4/2002 0000	4.64	571.64	0.00	571.64	
MNW								4/17/2002 0000	4.55	571.73	0.00	571.73	
MNW								6/13/2002 0000	6.37	569.91	0.00	569.91	
MNW								5/24/2003 0000	4.33	571.95	0.00	571.95	
MNW								6/17/2003 0000	5.63	570.65	0.00	570.65	
MNW								6/23/2003 0000	6.24	570.04	0.00	570.04	
MNW								7/15/2003 0000	7.36	568.92	0.00	568.92	
MNW								8/12/2003 0000	6.86	569.42	0.00	569.42	
MNW								8/19/2003 0000	7.38	568.90	0.00	568.9	
MNW								9/11/2003 0000	8.98	567.30	0.00	567.3	
MNW								10/3/2003 0000	7.78	568.50	0.00	568.5	
MNW								1/13/2004 0000	6.22	570.06	0.00	570.06	
MNW								2/11/2004 0000	6.41	569.87	0.00	569.87	
MNW								3/22/2004 0000	2.21	574.07	0.00	574.07	
MNW								4/2/2004 0000	4.21	572.07	0.00	572.07	
MNW								4/21/2004 0000	4.42	571.86	0.00	571.86	
MNW								5/3/2004 0000	5.03	571.25	0.00	571.25	
MNW								6/3/2004 0000	5.36	570.92	0.00	570.92	
MNW								7/22/2004 0840	6.05	570.23	0.00	570.23	
B-02	1097861.891	1073906.582	573.47	576.55	575.88	A	0						
MNW								8/8/2000 0000	8.50	567.38	0.00	567.38	

NM - No Measurement

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Geologic Zone:
A Aquifer

Type:
MNW Monitoring Well
PZ Piezometer

TABLE 1-2
GROUNDWATER ELEVATION READINGS
CHEMICAL LEAMAN

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
MNW								9/29/2000 0000	8.60	567.28	0.00	567.28	
MNW								4/19/2001 0000	6.27	569.61	0.00	569.61	
MNW								4/24/2001 0000	6.35	569.53	0.00	569.53	
MNW								4/29/2001 0000	6.45	569.43	0.00	569.43	
MNW								4/4/2002 0000	5.63	570.25	0.00	570.25	
MNW								4/17/2002 0000	5.73	570.15	0.00	570.15	
MNW								6/13/2002 0000	6.93	568.95	0.00	568.95	
MNW								5/24/2003 0000	6.16	569.72	0.00	569.72	
MNW								6/17/2003 0000	6.51	569.37	0.00	569.37	
MNW								6/23/2003 0000	6.78	569.10	0.00	569.1	
MNW								7/15/2003 0000	8.19	567.69	0.00	567.69	
MNW								8/12/2003 0000	9.09	566.79	0.00	566.79	
MNW								8/19/2003 0000	9.38	566.50	0.00	566.5	
MNW								9/11/2003 0000	11.26	564.62	0.00	564.62	
MNW								10/3/2003 0000	11.37	564.51	0.00	564.51	
MNW								1/13/2004 0000	11.01	564.87	0.00	564.87	
MNW								2/11/2004 0000	6.54	569.34	0.00	569.34	
MNW								3/22/2004 0000	5.41	570.47	0.00	570.47	
MNW								4/2/2004 0000	5.54	570.34	0.00	570.34	
MNW								4/21/2004 0000	5.61	570.27	0.00	570.27	
MNW								5/3/2004 0000	5.85	570.03	0.00	570.03	
MNW								6/3/2004 0000	6.83	569.05	0.00	569.05	
MNW								7/22/2004 0955	8.32	567.56	0.00	567.56	
B-03	1097849.433	1074063.551	574.75	576.99	576.79	A	0						
MNW								8/8/2000 0000	9.45	567.34	0.00	567.34	
MNW								9/29/2000 0000	9.00	567.79	0.00	567.79	
MNW								4/19/2001 0000	6.58	570.21	0.00	570.21	

NM - No Measurement

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Geologic Zone:
A Aquifer

Type:
MNW Monitoring Well
PZ Piezometer

TABLE 1-2
GROUNDWATER ELEVATION READINGS
CHEMICAL LEAMAN

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
MNW								4/24/2001 0000	6.82	569.97	0.00	569.97	
MNW								4/29/2001 0000	7.06	569.73	0.00	569.73	
MNW								4/4/2002 0000	5.39	571.40	0.00	571.4	
MNW								4/17/2002 0000	5.47	571.32	0.00	571.32	
MNW								6/13/2002 0000	7.79	569.00	0.00	569	
MNW								5/24/2003 0000	8.93	567.86	0.00	567.86	
MNW								6/17/2003 0000	7.22	569.57	0.00	569.57	
MNW								6/23/2003 0000	7.80	568.99	0.00	568.99	
MNW								7/15/2003 0000	9.67	567.12	0.00	567.12	
MNW								8/12/2003 0000	9.95	566.84	0.00	566.84	
MNW								8/19/2003 0000	10.61	566.18	0.00	566.18	
MNW								9/11/2003 0000	12.25	564.54	0.00	564.54	
MNW								10/3/2003 0000	12.10	564.69	0.00	564.69	
MNW								1/13/2004 0000	12.11	564.68	0.00	564.68	
MNW								2/11/2004 0000	7.11	569.68	0.00	569.68	
MNW								3/22/2004 0000	5.55	571.24	0.00	571.24	
MNW								4/2/2004 0000	5.14	571.65	0.00	571.65	
MNW								4/21/2004 0000	5.33	571.46	0.00	571.46	
MNW								5/3/2004 0000	5.70	571.09	0.00	571.09	
MNW								6/3/2004 0000	6.80	569.99	0.00	569.99	
MNW								7/22/2004 0948	9.17	567.62	0.00	567.62	
B-04	1097825.654	1074222.932	573.42	576.04	575.80	A	0						
MNW								8/8/2000 0000	9.40	566.40	0.00	566.4	
MNW								9/29/2000 0000	9.05	566.75	0.00	566.75	
MNW								4/19/2001 0000	4.96	570.84	0.00	570.84	
MNW								4/24/2001 0000	5.41	570.39	0.00	570.39	
MNW								4/29/2001 0000	5.83	569.97	0.00	569.97	

NM - No Measurement

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Geologic Zone:
A Aquifer

Type:
MNW Monitoring Well
PZ Piezometer

TABLE 1-2
GROUNDWATER ELEVATION READINGS
CHEMICAL LEAMAN

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
MNW								4/4/2002 0000	3.64	572.16	0.00	572.16	
MNW								4/17/2002 0000	3.65	572.15	0.00	572.15	
MNW								6/13/2002 0000	7.12	568.68	0.00	568.68	
MNW								5/24/2003 0000	4.28	571.52	0.00	571.52	
MNW								6/17/2003 0000	6.23	569.57	0.00	569.57	
MNW								6/23/2003 0000	7.22	568.58	0.00	568.58	
MNW								7/15/2003 0000	9.58	566.22	0.00	566.22	
MNW								8/12/2003 0000	9.58	566.22	0.00	566.22	
MNW								8/19/2003 0000	10.25	565.55	0.00	565.55	
MNW								9/11/2003 0000	11.91	563.89	0.00	563.89	
MNW								10/3/2003 0000	11.56	564.24	0.00	564.24	
MNW								1/13/2004 0000	11.32	564.48	0.00	564.48	
MNW								2/11/2004 0000	5.61	570.19	0.00	570.19	
MNW								3/22/2004 0000	3.74	572.06	0.00	572.06	
MNW								4/2/2004 0000	3.18	572.62	0.00	572.62	
MNW								4/21/2004 0000	3.36	572.44	0.00	572.44	
MNW								5/3/2004 0000	3.73	572.07	0.00	572.07	
MNW								6/3/2004 0000	5.63	570.17	0.00	570.17	
MNW								7/22/2004 0940	8.55	567.25	0.00	567.25	
B-05R	1098247.902	1074390.938	574.04	573.98	573.71	A	0						
MNW								8/8/2000 0000	5.00	568.71	0.00	568.71	
MNW								9/29/2000 0000	4.85	568.86	0.00	568.86	
MNW								4/19/2001 0000	4.28	569.43	0.00	569.43	
MNW								4/24/2001 0000	4.24	569.47	0.00	569.47	
MNW								4/29/2001 0000	4.21	569.50	0.00	569.5	
MNW								4/4/2002 0000	2.91	570.80	0.00	570.8	
MNW								4/17/2002 0000	3.58	570.13	0.00	570.13	

NM - No Measurement

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Geologic Zone:
A Aquifer

Type:
MNW Monitoring Well
PZ Piezometer

TABLE 1-2
GROUNDWATER ELEVATION READINGS
CHEMICAL LEAMAN

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
MNW								6/13/2002 0000	4.14	569.57	0.00	569.57	
MNW								5/24/2003 0000	1.11	572.60	0.00	572.6	
MNW								6/17/2003 0000	3.68	570.03	0.00	570.03	
MNW								6/23/2003 0000	4.16	569.55	0.00	569.55	
MNW								7/15/2003 0000	5.23	568.48	0.00	568.48	
MNW								8/12/2003 0000	4.18	569.53	0.00	569.53	
MNW								8/19/2003 0000	5.25	568.46	0.00	568.46	
MNW								9/11/2003 0000	6.66	567.05	0.00	567.05	
MNW								10/3/2003 0000	5.17	568.54	0.00	568.54	
MNW								1/13/2004 0000	4.86	568.85	0.00	568.85	
MNW								3/22/2004 0000	2.87	570.84	0.00	570.84	
MNW								4/2/2004 0000	2.18	571.53	0.00	571.53	
MNW								4/21/2004 0000	2.89	570.82	0.00	570.82	
MNW								5/3/2004 0000	3.24	570.47	0.00	570.47	
MNW								6/3/2004 0000	3.37	570.34	0.00	570.34	
MNW								7/22/2004 0920	3.97	569.74	0.00	569.74	
B-06	1098013.116	1073758.847	576.44	579.04	579.09	A	0						
MNW								8/8/2000 0000	11.60	567.49	0.00	567.49	
MNW								9/29/2000 0000	11.60	567.49	0.00	567.49	
MNW								4/19/2001 0000	9.43	569.66	0.00	569.66	
MNW								4/24/2001 0000	9.57	569.52	0.00	569.52	
MNW								4/29/2001 0000	9.80	569.29	0.00	569.29	
MNW								4/4/2002 0000	7.56	571.53	0.00	571.53	
MNW								4/17/2002 0000	7.70	571.39	0.00	571.39	
MNW								6/13/2002 0000	10.41	568.68	0.00	568.68	
MNW								5/24/2003 0000	6.13	572.96	0.00	572.96	
MNW								6/17/2003 0000	9.73	569.36	0.00	569.36	

NM - No Measurement

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Geologic Zone:
A Aquifer

Type:
MNW Monitoring Well
PZ Piezometer

TABLE 1-2
GROUNDWATER ELEVATION READINGS
CHEMICAL LEAMAN

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
MNW								6/23/2003 0000	10.31	568.78	0.00	568.78	
MNW								7/15/2003 0000	12.33	566.76	0.00	566.76	
MNW								8/12/2003 0000	12.04	567.05	0.00	567.05	
MNW								8/19/2003 0000	12.80	566.29	0.00	566.29	
MNW								9/11/2003 0000	14.02	565.07	0.00	565.07	
MNW								10/3/2003 0000	13.72	565.37	0.00	565.37	
MNW								1/13/2004 0000	12.93	566.16	0.00	566.16	
MNW								2/11/2004 0000	9.72	569.37	0.00	569.37	
MNW								3/22/2004 0000	5.23	573.86	0.00	573.86	
MNW								4/2/2004 0000	7.41	571.68	0.00	571.68	
MNW								4/21/2004 0000	7.59	571.50	0.00	571.5	
MNW								5/3/2004 0000	8.58	570.51	0.00	570.51	
MNW								6/3/2004 0000	9.50	569.59	0.00	569.59	
MNW								7/22/2004 000	11.52	567.57	0.00	567.57	
B-07	1098561.657	1074028.727	574.28	574.81	574.00	A	0						
MNW								8/8/2000 0000	5.45	568.55	0.00	568.55	
MNW								9/29/2000 0000	5.10	568.90	0.00	568.9	
MNW								4/19/2001 0000	4.39	569.61	0.00	569.61	
MNW								4/24/2001 0000	4.62	569.38	0.00	569.38	
MNW								4/29/2001 0000	4.75	569.25	0.00	569.25	
MNW								4/4/2002 0000	2.49	571.51	0.00	571.51	
MNW								4/17/2002 0000	2.89	571.11	0.00	571.11	
MNW								6/13/2002 0000	4.73	569.27	0.00	569.27	
MNW								5/24/2003 0000	2.88	571.12	0.00	571.12	
MNW								6/17/2003 0000	3.78	570.22	0.00	570.22	
MNW								6/23/2003 0000	4.49	569.51	0.00	569.51	
MNW								7/15/2003 0000	5.74	568.26	0.00	568.26	

NM - No Measurement

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Geologic Zone:
A Aquifer

Type:
MNW Monitoring Well
PZ Piezometer

TABLE 1-2
GROUNDWATER ELEVATION READINGS
CHEMICAL LEAMAN

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
MNW								8/12/2003 0000	3.84	570.16	0.00	570.16	
MNW								8/19/2003 0000	5.49	568.51	0.00	568.51	
MNW								9/11/2003 0000	6.97	567.03	0.00	567.03	
MNW								10/3/2003 0000	5.54	568.46	0.00	568.46	
MNW								1/13/2004 0000	5.06	568.94	0.00	568.94	
MNW								2/11/2004 0000	4.06	569.94	0.00	569.94	
MNW								3/22/2004 0000	2.95	571.05	0.00	571.05	
MNW								4/2/2004 0000	1.56	572.44	0.00	572.44	
MNW								4/21/2004 0000	2.48	571.52	0.00	571.52	
MNW								5/3/2004 0000	2.91	571.09	0.00	571.09	
MNW								6/3/2004 0000	3.29	570.71	0.00	570.71	
MNW								7/22/2004 0835	3.73	570.27	0.00	570.27	
B-08	1097730.257	1073940.94	572.26	574.26	574.12	A	0						
MNW								4/4/2002 0000	4.28	569.84	0.00	569.84	
MNW								4/17/2002 0000	4.31	569.81	0.00	569.81	
MNW								6/13/2002 0000	5.39	568.73	0.00	568.73	
MNW								5/24/2003 0000	4.60	569.52	0.00	569.52	
MNW								6/17/2003 0000	4.90	569.22	0.00	569.22	
MNW								6/23/2003 0000	5.14	568.98	0.00	568.98	
MNW								7/15/2003 0000	6.48	567.64	0.00	567.64	
MNW								8/12/2003 0000	7.68	566.44	0.00	566.44	
MNW								8/19/2003 0000	8.07	566.05	0.00	566.05	
MNW								9/11/2003 0000	11.11	563.01	0.00	563.01	
MNW								10/3/2003 0000	11.80	562.32	0.00	562.32	
MNW								1/13/2004 0000	11.29	562.83	0.00	562.83	
MNW								2/11/2004 0000	4.91	569.21	0.00	569.21	
MNW								3/22/2004 0000	3.24	570.88	0.00	570.88	

NM - No Measurement

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Geologic Zone:
A Aquifer

Type:
MNW Monitoring Well
PZ Piezometer

TABLE 1-2
GROUNDWATER ELEVATION READINGS
CHEMICAL LEAMAN

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
MNW								4/2/2004 0000	4.04	570.08	0.00	570.08	
MNW								4/21/2004 0000	4.18	569.94	0.00	569.94	
MNW								5/3/2004 0000	4.32	569.80	0.00	569.8	
MNW								6/3/2004 0000	4.56	569.56	0.00	569.56	
MNW								7/22/2004 0952	6.70	567.42	0.00	567.42	
B-09	1097700.44	1074101.86	571.99	574.28	574.00	A	0						
MNW								4/4/2002 0000	4.32	569.68	0.00	569.68	
MNW								4/17/2002 0000	4.62	569.38	0.00	569.38	
MNW								6/13/2002 0000	7.75	566.25	0.00	566.25	
MNW								5/24/2003 0000	6.65	567.35	0.00	567.35	
MNW								6/17/2003 0000	7.65	566.35	0.00	566.35	
MNW								6/23/2003 0000	8.00	566.00	0.00	566	
MNW								7/15/2003 0000	9.38	564.62	0.00	564.62	
MNW								8/12/2003 0000	10.05	563.95	0.00	563.95	
MNW								8/19/2003 0000	10.68	563.32	0.00	563.32	
MNW								9/11/2003 0000	13.05	560.95	0.00	560.95	
MNW								10/3/2003 0000	13.21	560.79	0.00	560.79	
MNW								1/13/2004 0000	13.03	560.97	0.00	560.97	
MNW								2/11/2004 0000	7.54	566.46	0.00	566.46	
MNW								3/22/2004 0000	6.09	567.91	0.00	567.91	
MNW								4/2/2004 0000	5.61	568.39	0.00	568.39	
MNW								4/21/2004 0000	5.96	568.04	0.00	568.04	
MNW								5/3/2004 0000	6.57	567.43	0.00	567.43	
MNW								6/3/2004 0000	7.18	566.82	0.00	566.82	
MNW								7/22/2004 0944	9.02	564.98	0.00	564.98	
B-10	1097721.39	1074348.21	571.97	574.03	573.63	A	0						
MNW								4/4/2002 0000	2.48	571.15	0.00	571.15	

NM - No Measurement

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Geologic Zone:
A Aquifer

Type:
MNW Monitoring Well
PZ Piezometer

TABLE 1-2
GROUNDWATER ELEVATION READINGS
CHEMICAL LEAMAN

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
MNW								4/17/2002 0000	2.75	570.88	0.00	570.88	
MNW								6/13/2002 0000	5.94	567.69	0.00	567.69	
MNW								5/24/2003 0000	4.22	569.41	0.00	569.41	
MNW								6/17/2003 0000	5.71	567.92	0.00	567.92	
MNW								6/23/2003 0000	6.30	567.33	0.00	567.33	
MNW								7/15/2003 0000	8.35	565.28	0.00	565.28	
MNW								8/12/2003 0000	7.81	565.82	0.00	565.82	
MNW								8/19/2003 0000	8.60	565.03	0.00	565.03	
MNW								9/11/2003 0000	10.26	563.37	0.00	563.37	
MNW								10/3/2003 0000	9.54	564.09	0.00	564.09	
MNW								1/13/2004 0000	9.33	564.30	0.00	564.3	
MNW								2/11/2004 0000	5.13	568.50	0.00	568.5	
MNW								3/22/2004 0000	3.60	570.03	0.00	570.03	
MNW								4/2/2004 0000	2.91	570.72	0.00	570.72	
MNW								4/21/2004 0000	3.57	570.06	0.00	570.06	
MNW								5/3/2004 0000	4.14	569.49	0.00	569.49	
MNW								6/3/2004 0000	5.24	568.39	0.00	568.39	
MNW								7/22/2004 0935	7.05	566.58	0.00	566.58	
B-11	1098160.58	1074283.33	575.40	575.40	575.26	A	0						
MNW								6/17/2003 0000	5.32	569.94	0.00	569.94	
MNW								6/23/2003 0000	5.78	569.48	0.00	569.48	
MNW								7/15/2003 0000	6.93	568.33	0.00	568.33	
MNW								8/12/2003 0000	6.34	568.92	0.00	568.92	
MNW								8/19/2003 0000	7.08	568.18	0.00	568.18	
MNW								9/11/2003 0000	8.37	566.89	0.00	566.89	
MNW								10/3/2003 0000	7.38	567.88	0.00	567.88	
MNW								1/13/2004 0000	7.64	567.62	0.00	567.62	

NM - No Measurement

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Geologic Zone:
A Aquifer

Type:
MNW Monitoring Well
PZ Piezometer

TABLE 1-2
GROUNDWATER ELEVATION READINGS
CHEMICAL LEAMAN

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
MNW								3/22/2004 0000	NM	-	NM	-	Unable to Locate
MNW								4/2/2004 0000	3.80	571.46	0.00	571.46	
MNW								4/21/2004 0000	4.28	570.98	0.00	570.98	
MNW								5/3/2004 0000	4.65	570.61	0.00	570.61	
MNW								6/3/2004 0000	5.07	570.19	0.00	570.19	
MNW								7/22/2004 0925	5.89	569.37	0.00	569.37	
B-12	1098047.73	1074301.41	574.31	574.31	574.18	A	0						
MNW								6/17/2003 0000	4.09	570.09	0.00	570.09	
MNW								6/23/2003 0000	4.61	569.57	0.00	569.57	
MNW								7/15/2003 0000	5.84	568.34	0.00	568.34	
MNW								8/12/2003 0000	5.50	568.68	0.00	568.68	
MNW								8/19/2003 0000	6.09	568.09	0.00	568.09	
MNW								9/11/2003 0000	7.41	566.77	0.00	566.77	
MNW								10/3/2003 0000	6.66	567.52	0.00	567.52	
MNW								1/13/2004 0000	6.27	567.91	0.00	567.91	
MNW								3/22/2004 0000	NM	-	NM	-	Unable to Locate
MNW								4/2/2004 0000	2.67	571.51	0.00	571.51	
MNW								4/21/2004 0000	2.92	571.26	0.00	571.26	
MNW								5/3/2004 0000	3.37	570.81	0.00	570.81	
MNW								6/3/2004 0000	3.95	570.23	0.00	570.23	
MNW								7/22/2004 0909	4.99	569.19	0.00	569.19	
B-13	1098158.65	1074382.45	574.33	574.33	574.15	A	0						
MNW								6/17/2003 0000	3.84	570.31	0.00	570.31	
MNW								6/23/2003 0000	4.62	569.53	0.00	569.53	
MNW								7/15/2003 0000	5.85	568.30	0.00	568.3	
MNW								8/12/2003 0000	4.71	569.44	0.00	569.44	
MNW								8/19/2003 0000	5.92	568.23	0.00	568.23	

NM - No Measurement

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Geologic Zone:
A Aquifer

Type:
MNW Monitoring Well
PZ Piezometer

TABLE 1-2
GROUNDWATER ELEVATION READINGS
CHEMICAL LEAMAN

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
MNW								9/11/2003 0000	7.21	566.94	0.00	566.94	
MNW								10/3/2003 0000	6.04	568.11	0.00	568.11	
MNW								1/13/2004 0000	5.81	568.34	0.00	568.34	
MNW								3/22/2004 0000	3.37	570.78	0.00	570.78	
MNW								4/2/2004 0000	2.59	571.56	0.00	571.56	
MNW								4/21/2004 0000	2.98	571.17	0.00	571.17	
MNW								5/3/2004 0000	3.36	570.79	0.00	570.79	
MNW								6/3/2004 0000	3.89	570.26	0.00	570.26	
MNW								7/22/2004 0917	5.01	569.14	0.00	569.14	
B-14	1098048.56	1074390.54	573.64	573.64	573.50	A	0						
MNW								6/17/2003 0000	3.56	569.94	0.00	569.94	
MNW								6/23/2003 0000	4.03	569.47	0.00	569.47	
MNW								7/15/2003 0000	5.23	568.27	0.00	568.27	
MNW								8/12/2003 0000	4.65	568.85	0.00	568.85	
MNW								8/19/2003 0000	5.40	568.10	0.00	568.1	
MNW								9/11/2003 0000	6.73	566.77	0.00	566.77	
MNW								10/3/2003 0000	5.84	567.66	0.00	567.66	
MNW								1/13/2004 0000	5.29	568.21	0.00	568.21	
MNW								3/22/2004 0000	2.21	571.29	0.00	571.29	Well Area Flooded
MNW								4/2/2004 0000	2.20	571.30	0.00	571.3	
MNW								4/21/2004 0000	2.49	571.01	0.00	571.01	
MNW								5/3/2004 0000	2.88	570.62	0.00	570.62	
MNW								6/3/2004 0000	3.37	570.13	0.00	570.13	
MNW								7/22/2004 0915	4.22	569.28	0.00	569.28	
B-15	1097931.74	1074341.17	572.90	576.29	576.10	A	0						
MNW								6/17/2003 0000	6.13	569.97	0.00	569.97	
MNW								6/23/2003 0000	6.77	569.33	0.00	569.33	

NM - No Measurement

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Geologic Zone:
A Aquifer

Type:
MNW Monitoring Well
PZ Piezometer

TABLE 1-2
GROUNDWATER ELEVATION READINGS
CHEMICAL LEAMAN

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
MNW								7/15/2003 0000	8.32	567.78	0.00	567.78	
MNW								8/12/2003 0000	7.58	568.52	0.00	568.52	
MNW								8/19/2003 0000	8.55	567.55	0.00	567.55	
MNW								9/11/2003 0000	9.98	566.12	0.00	566.12	
MNW								10/3/2003 0000	9.04	567.06	0.00	567.06	
MNW								1/13/2004 0000	8.97	567.13	0.00	567.13	
MNW								2/11/2004 0000	6.10	570.00	0.00	570	
MNW								3/22/2004 0000	NM	-	NM	-	No Access
MNW								4/2/2004 0000	4.37	571.73	0.00	571.73	
MNW								4/21/2004 0000	4.70	571.40	0.00	571.4	
MNW								5/3/2004 0000	5.04	571.06	0.00	571.06	
MNW								6/3/2004 0000	5.77	570.33	0.00	570.33	
MNW								7/22/2004 0913	7.07	569.03	0.00	569.03	
SG-01	1097681.761	1073462.153	NA	NA	564.94	A	0						
SG								8/8/2000 0000	0.00	564.94	0.00	564.94	
SG								9/29/2000 0000	0.04	564.90	0.00	564.9	
SG-02	1097566.611	1074471.014	NA	NA	566.88	A	0						
SG								6/17/2003 0000	2.16	564.72	0.00	564.72	
SG								6/23/2003 0000	1.64	565.24	0.00	565.24	
SG								7/15/2003 0000	2.21	564.67	0.00	564.67	
SG								8/12/2003 0000	2.15	564.73	0.00	564.73	
SG								8/19/2003 0000	1.83	565.05	0.00	565.05	
SG								9/11/2003 0000	2.25	564.63	0.00	564.63	
SG								10/3/2003 0000	2.5	564.38	0.00	564.38	Approx. Static Depth
SG								1/13/2004 0000	NM	-	NM	-	No Access Due To Snow
SG								3/22/2004 0000	2.23	564.65	0.00	564.65	26.75 Inches
SG								4/2/2004 0000	2.09	564.79	0.00	564.79	

NM - No Measurement

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Geologic Zone:
A Aquifer

Type:
MNW Monitoring Well
PZ Piezometer

TABLE 1-2
GROUNDWATER ELEVATION READINGS
CHEMICAL LEAMAN

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
SG								4/21/2004 0000	2.08	564.80	0.00	564.8	
SG								5/3/2004 0000	2.00	564.88	0.00	564.88	
SG								7/22/2004 0930	1.34	565.54	0.00	565.54	
SG-02A	1097566.611	1074471.014	NA	NA	564.84	A	0						
SG								8/8/2000 0000	-0.10	564.94	0.00	564.94	
SG								9/29/2000 0000	-0.04	564.88	0.00	564.88	
SG								4/19/2001 0000	0.12	564.72	0.00	564.72	
SG								4/24/2001 0000	-0.73	565.57	0.00	565.57	
SG								4/29/2001 0000	0.02	564.82	0.00	564.82	
SG								4/4/2002 0000	-0.31	565.15	0.00	565.15	
SG								4/17/2002 0000	0.02	564.82	0.00	564.82	
SG								6/13/2002 0000	0.02	564.82	0.00	564.82	
STANDPIPE	1098115.379	1074119.507	575.51	NA	579.60	A	0						
PZ								8/12/2003 0000	11.38	568.22	0.00	568.22	
PZ								8/19/2003 0000	11.34	568.26	0.00	568.26	
PZ								9/11/2003 0000	12.45	567.15	0.00	567.15	
PZ								10/3/2003 0000	12.69	566.91	0.00	566.91	
PZ								1/13/2004 0000	11.28	568.32	0.00	568.32	
PZ								2/11/2004 0000	9.51	570.09	0.00	570.09	
PZ								3/22/2004 0000	6.72	572.88	0.00	572.88	
PZ								4/2/2004 0000	6.44	573.16	0.00	573.16	
PZ								4/21/2004 0000	6.97	572.63	0.00	572.63	
PZ								5/3/2004 0000	7.62	571.98	0.00	571.98	
PZ								6/3/2004 0000	8.23	571.37	0.00	571.37	
PZ								7/22/2004 0905	10.48	569.12	0.00	569.12	

NM - No Measurement

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Geologic Zone:
A Aquifer

Type:
MNW Monitoring Well
PZ Piezometer

TABLE 1-2
GROUNDWATER ELEVATION READINGS
CHEMICAL LEAMAN

Location ID / Type	Northing	Easting	Ground Elevation (ft)	Casing Elevation (ft)	Meas.point (Riser)Elev.(ft)	Geol. Zone	Specific Gravity	Date / Time	Depth to Water (ft)	Water Elev. (ft)	Product Thick. (ft)	Corrected Water Elev. (ft)	Remark
TP-01	1098169.889	1074079.839	574.21	NA	577.46	A	0						
PZ								8/12/2003 0000	11.30	566.16	0.00	566.16	
PZ								8/19/2003 0000	9.31	568.15	0.00	568.15	
PZ								9/11/2003 0000	10.55	566.91	0.00	566.91	
PZ								10/3/2003 0000	11.91	565.55	0.00	565.55	
PZ								1/13/2004 0000	11.78	565.68	0.00	565.68	
PZ								2/11/2004 0000	7.58	569.88	0.00	569.88	
PZ								3/22/2004 0000	5.96	571.50	0.00	571.5	
PZ								4/2/2004 0000	5.61	571.85	0.00	571.85	
PZ								4/21/2004 0000	5.71	571.75	0.00	571.75	
PZ								5/3/2004 0000	6.20	571.26	0.00	571.26	
PZ								6/3/2004 0000	6.67	570.79	0.00	570.79	
PZ								7/22/2004 0850	8.38	569.08	0.00	569.08	
TP-02	1098046.975	1074076.420	575.40	NA	578.39	A	0						
PZ								8/12/2003 0000	12.19	566.20	0.00	566.2	
PZ								8/19/2003 0000	10.69	567.70	0.00	567.7	
PZ								9/11/2003 0000	11.68	566.71	0.00	566.71	
PZ								10/3/2003 0000	11.96	566.43	0.00	566.43	
PZ								1/13/2004 0000	11.91	566.48	0.00	566.48	
PZ								2/11/2004 0000	7.96	570.43	0.00	570.43	
PZ								3/22/2004 0000	6.01	572.38	0.00	572.38	
PZ								4/2/2004 0000	6.05	572.34	0.00	572.34	
PZ								4/21/2004 0000	5.99	572.40	0.00	572.4	
PZ								5/3/2004 0000	6.29	572.10	0.00	572.1	
PZ								6/3/2004 0000	7.01	571.38	0.00	571.38	
PZ								7/22/2004 0900	9.46	568.93	0.00	568.93	

NM - No Measurement

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Geologic Zone:

A Aquifer

Type:

MNW Monitoring Well

PZ Piezometer

TABLE 1-3
CONTAMINANTS EXCEEDING STANDARDS, CRITERIA, GUIDANCE (SCG) VALUES IN SOIL AND GROUNDWATER

Chemical Name	Soil			Groundwater
	Lagoon Area	North Area	East Area	
VOLATILE ORGANIC COMPOUNDS				
Aromatic Hydrocarbons				
Benzene	X	X	X	X
Toluene	X	X	X	
Ethylbenzene	X		X	
Xylenes	X	X	X	
Chlorobenzene	X	X	X	X
1,2,4-Trichlorobenzene	X	X	X	
1,2-Dichlorobenzene	X	X	X	X
1,3-Dichlorobenzene	X	X	X	X
1,4-Dichlorobenzene	X	X	X	X
Chlorinated Hydrocarbons				
Tetrachloroethene	X			X
Trichloroethene	X	X		X
1,1,1-Trichloroethane	X			
1,1,2-Trichloroethane				
1,1-Dichloroethene				X
cis-1,2-Dichloroethene				X
trans-1,2-Dichloroethene				X
Vinyl Chloride		X	X	X
Chloroform	X			
Ketones				
Acetone	X		X	
2-Butanone	X			
SEMI-VOLATILE ORGANIC COMPOUNDS				
Phenolics				
Phenol	X	X	X	
2-Methylphenol				X
4-Methylphenol				X
2,4,5-Trichlorophenol		X		
Polynuclear Aromatic Hydrocarbons				
Benzo(a)anthracene	X	X	X	
Benzo(a)pyrene	X	X	X	
Benzo(b)fluoranthene			X	
Chrysene	X	X	X	
Dibenz(a,h)anthracene	X	X	X	
Miscellaneous				
Hexachlorobenzene		X		
Hexachlorocyclopentadiene				X
Nitrobenzene	X			
PESTICIDES / PCBs				
Pesticides				
4,4'-DDT				X
beta-BHC				X
METALS				
Antimony				X
Arsenic		X	X	
Barium				X
Beryllium	X	X	X	
Cadmium	X	X	X	
Chromium	X	X	X	
Copper	X	X	X	
Iron	X	X	X	X
Lead				X
Mercury	X	X		
Magnesium				X
Manganese				X
Nickel	X	X	X	
Sodium				X
Thallium				X
Zinc	X	X	X	

TABLE 1-4
PHYSICAL PROPERTIES OF ORGANIC COMPOUNDS EXCEEDING SCG VALUES IN SOIL AND/OR GROUNDWATER

Chemical Name	Water Solubility (mg/L @ 25°C) unless otherwise indicated	Koc (unitless) unless otherwise indicated	Henry's Law Constant (atm-m³/mole)	Vapor Pressure (mm Hg @ 20°C) unless otherwise indicated	log Kow (unitless)
VOLATILE ORGANIC COMPOUNDS					
Aromatic Hydrocarbons					
Benzene	1,780 to 1,800	97	5.59E-03	9.52E+01 (25°C)	2.1
Toluene	5.35E+02	242	5.93E-03	2.87 E+01 (25°C)	2.7
Ethylbenzene	2.06E+02	622	6.44E-03	7.00E+00	3.2
Xylenes	146 to 175	363 to 588	6.12E-03	1.00E+01 (32°C)	3.12 to 3.20
Chlorobenzene	466 (20-30°C)	330 (ml/g)	3.72E-03	11.7 (20-30°C)	2.84
1,2,4-Trichlorobenzene	30 (20-30°C)	9200 (ml/g)	2.31E-03	0.29 (20-30°C)	4.3
1,2-Dichlorobenzene	100 (20-30°C)	1700 (ml/g)	1.93E-03	1.0 (20-30°C)	3.6
1,3-Dichlorobenzene	123 (20-30°C)	1700 (ml/g)	3.59E-03	2.28 (20-30°C)	3.6
1,4-Dichlorobenzene	79 (20-30°C)	1700 (ml/g)	2.89E-03	1.18 (20-30°C)	3.6
Chlorinated Hydrocarbons					
Tetrachloroethene	1.50E+02	364	2.59E-02	1.78E+01	2.6
Trichloroethene	1,100 (20°C)	152	1.17E-02	5.79E+01	2.3
1,1,1-Trichloroethane	480 To 4,400 (20°C)	105	4.92E-03	9.60E+01	2.2
1,1,2-Trichloroethane	4500 (20-30°C)	56 (ml/g)	1.17E-03	30 (20-30°C)	2.47
1,1-Dichloroethene	2250 (20-30°C)	65 (ml/g)	3.40E-02	600 (20-30°C)	1.84
cis-1,2-Dichloroethene	3500 (20-30°C)	49 (ml/g)	7.58E-03	208 (20-30°C)	0.70
trans-1,2-Dichloroethene	6300 (20-30°C)	59 (ml/g)	6.56E-03	324 (20-30°C)	0.48
Vinyl Chloride	2670 (20-30°C)	57 (ml/g)	8.19E-02	2660 (20-30°C)	1.38
Chloroform	8200 (20-30°C)	31 (ml/g)	2.87E-03	151 (20-30°C)	1.97
Ketones					
Acetone	Miscible	1	3.67E-05	2.31E+02 (25°C)	-0.24
2-Butanone	136	30	1.98E-05	9.26E+01 (25°C)	0.26
SEMI-VOLATILE ORGANIC COMPOUNDS					
Phenolics					
Phenol	93,000	52.5	1.30E-07	2.00E-01	1.5
2-Methylphenol	23000 (23°C)	22	1.23E-06	3.10E-01 (25°C)	1.9
4-Methylphenol	24,000 to 31,000	501	1.40E-06	1.00E+00 (38-53°C)	1.9
2,4,5-Trichlorophenol	1190 (20-30°C)	89 (ml/g)	2.18E-04	1.00E+00	3.72
Polynuclear Aromatic Hydrocarbons					
Benzo(a)anthracene	0.014	125,719	6.60E-07	5.00E-09	5.6
Benzo(a)pyrene	0.0038	282,185	1.26E-02	5.00E-09 (25°C)	6.0
Benzo(b)fluoranthene	0.0012	1,148,497	1.20E-05	1.00E-11 to 1.00E-06	6.6
Chrysene	0.002	420,108	7.26E-20	1.00E-11 to 1.00E-06	5.6
Dibenz(a,h)anthracene	0.0005	1,659,587	7.33E-09	1.00E-10 (25°C)	6.0
Miscellaneous					
Hexachlorobenzene	0.006 (20-30°C)	3900 (ml/g)	6.81E-04	1.09 E-05 (20-30°C)	5.23
Hexachlorocyclopentadiene	2.1 (20-30°C)	4800 (ml/g)	1.37E-02	0.08 (20-30°C)	5.04
Nitrobenzene	1900 (20-30°C)	36 (ml/g)		0.15 (20-30°C)	1.85
PESTICIDES / PCBs					
Pesticides					
4,4'-DDT	0.006	238,000	3.80E-05	1.90E-07	4.0
beta-BHC	0.24 (20-30°C)	3800 (ml/g)	4.47E-07	2.8 E-07 (20-30°C)	3.9

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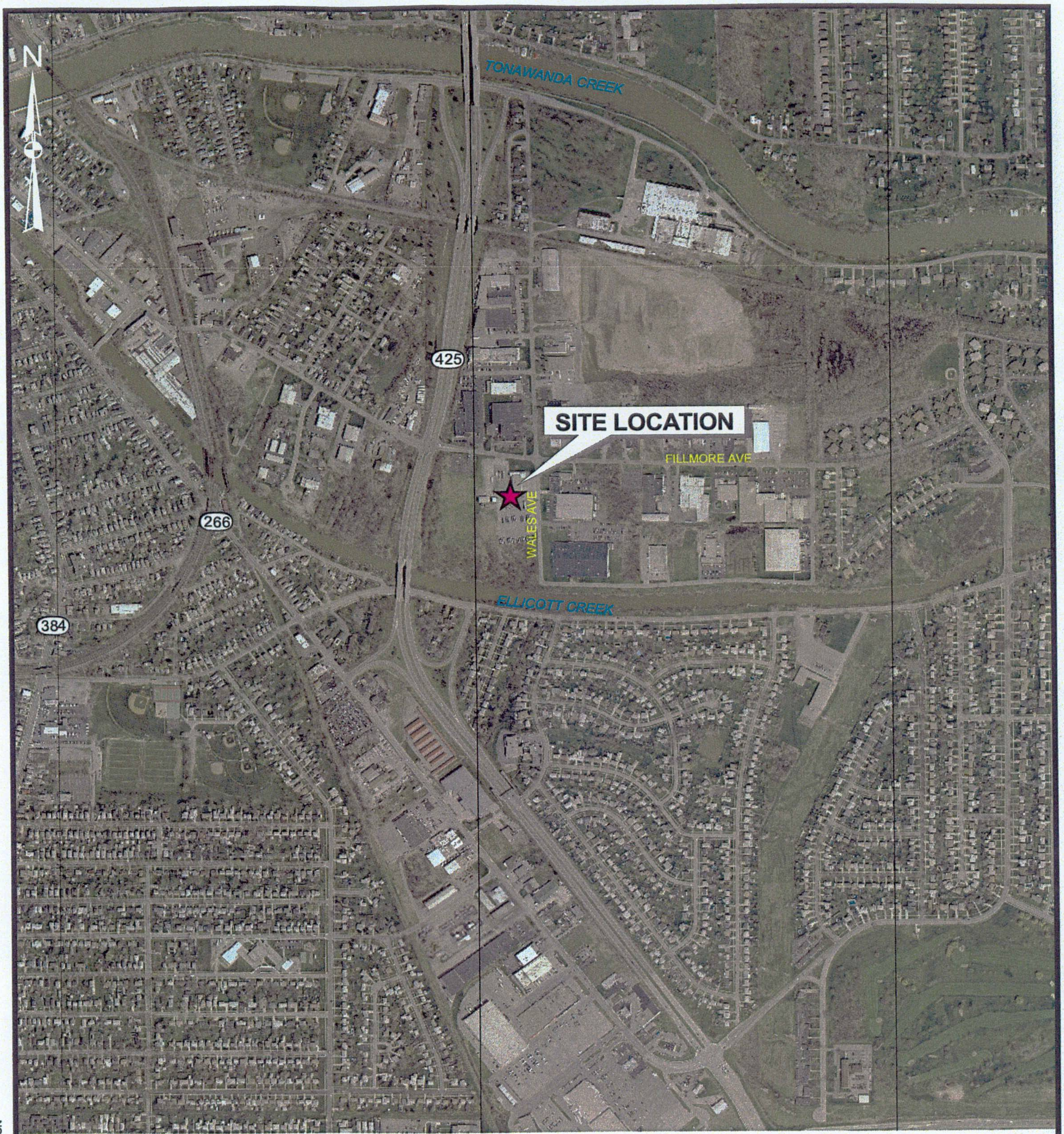
FIGURES



SOURCE: New York GIS Clearinghouse, Statewide Digital Orthoimagery Repository, 2002.

1000 0 1000 Feet

N:\11170332.00000\DB\GIS\chem_leaman.apr SITE LOCATION
6/2/2005

URS	CHEMICAL LEAMAN SITE LOCATION	FIGURE 1-1

Legend

Monitoring Well

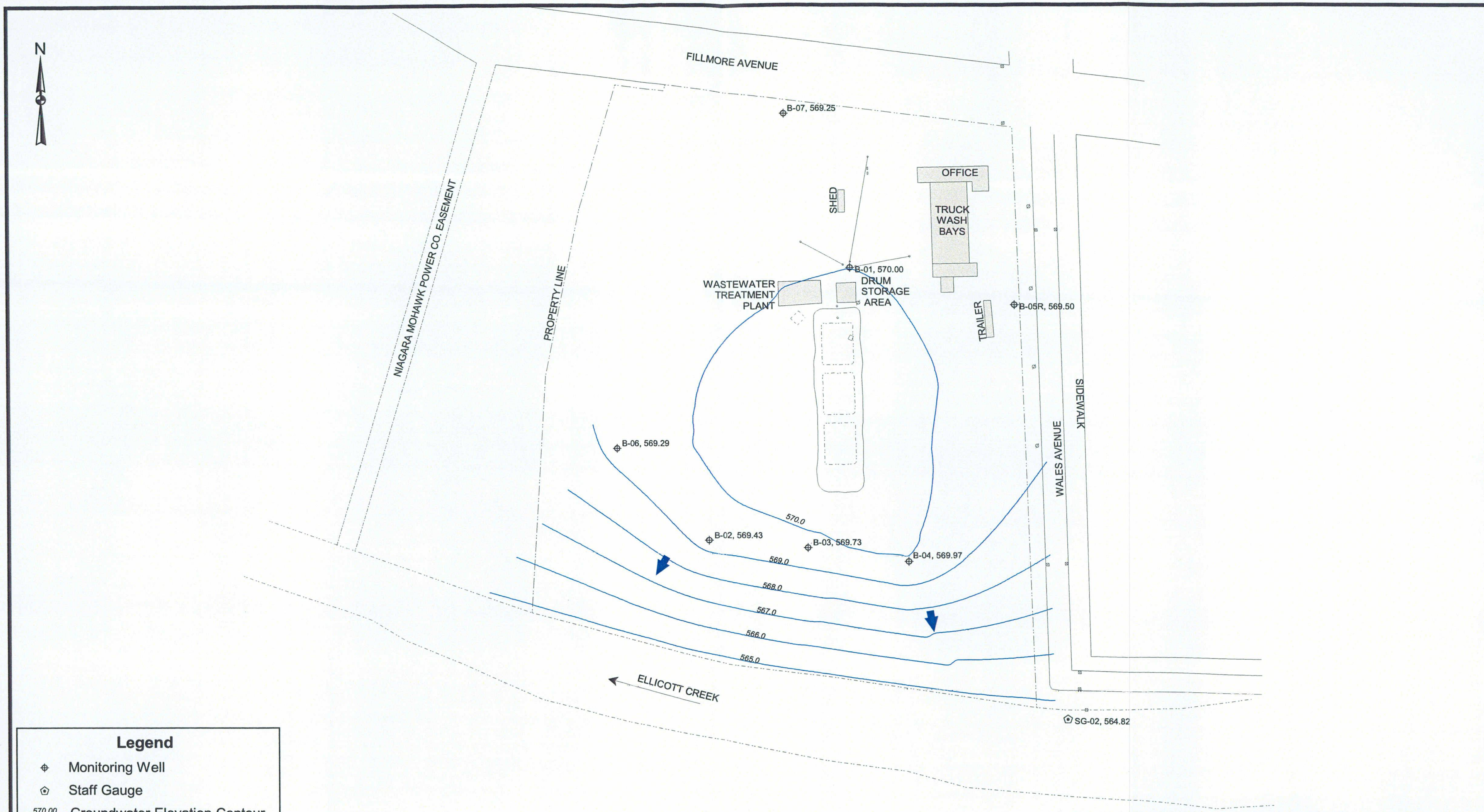
200 0 200 Feet

CHEMICAL LEAMAN
SITE PLAN

URS

FIGURE 1-2

N:\11170332.00000\DB\GIS\chem_leaman.apr SITE PLAN W/BORE LOCATIONS
6/6/2005



Legend

- Monitoring Well
- Staff Gauge
- 570.00 Groundwater Elevation Contour
- Groundwater Flow Direction

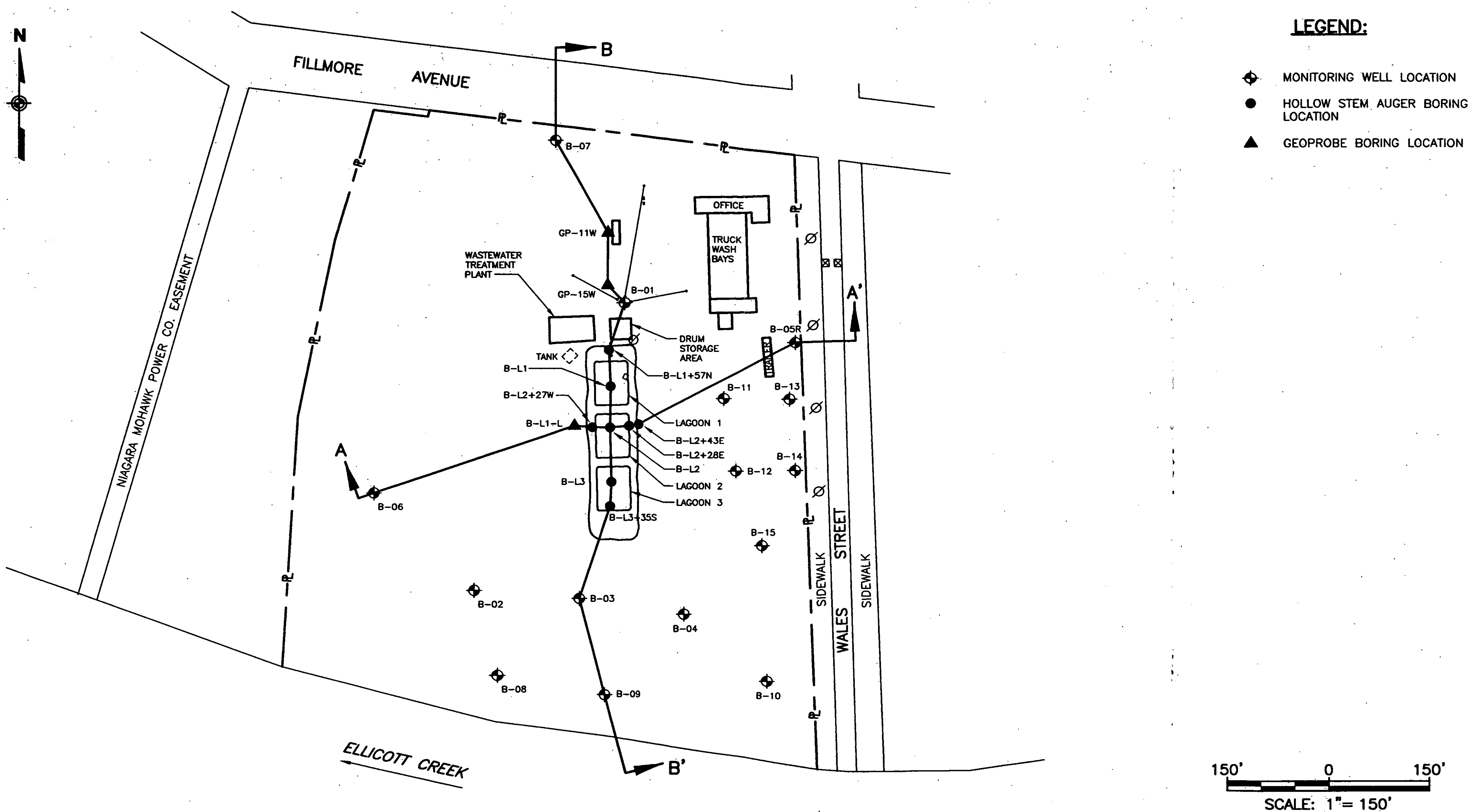
Location ID — B-02, 569.43 — Groundwater Elevation (ft)

CHEMICAL LEAMAN
GROUNDWATER ELEVATION CONTOUR MAP
(APRIL 29, 2001)

URS

FIGURE 1-3

N:\11170332.00000\DB\GIS\welev.apr 04/29/01 GROUNDWATER ELEVATION MAP
6/2/2005



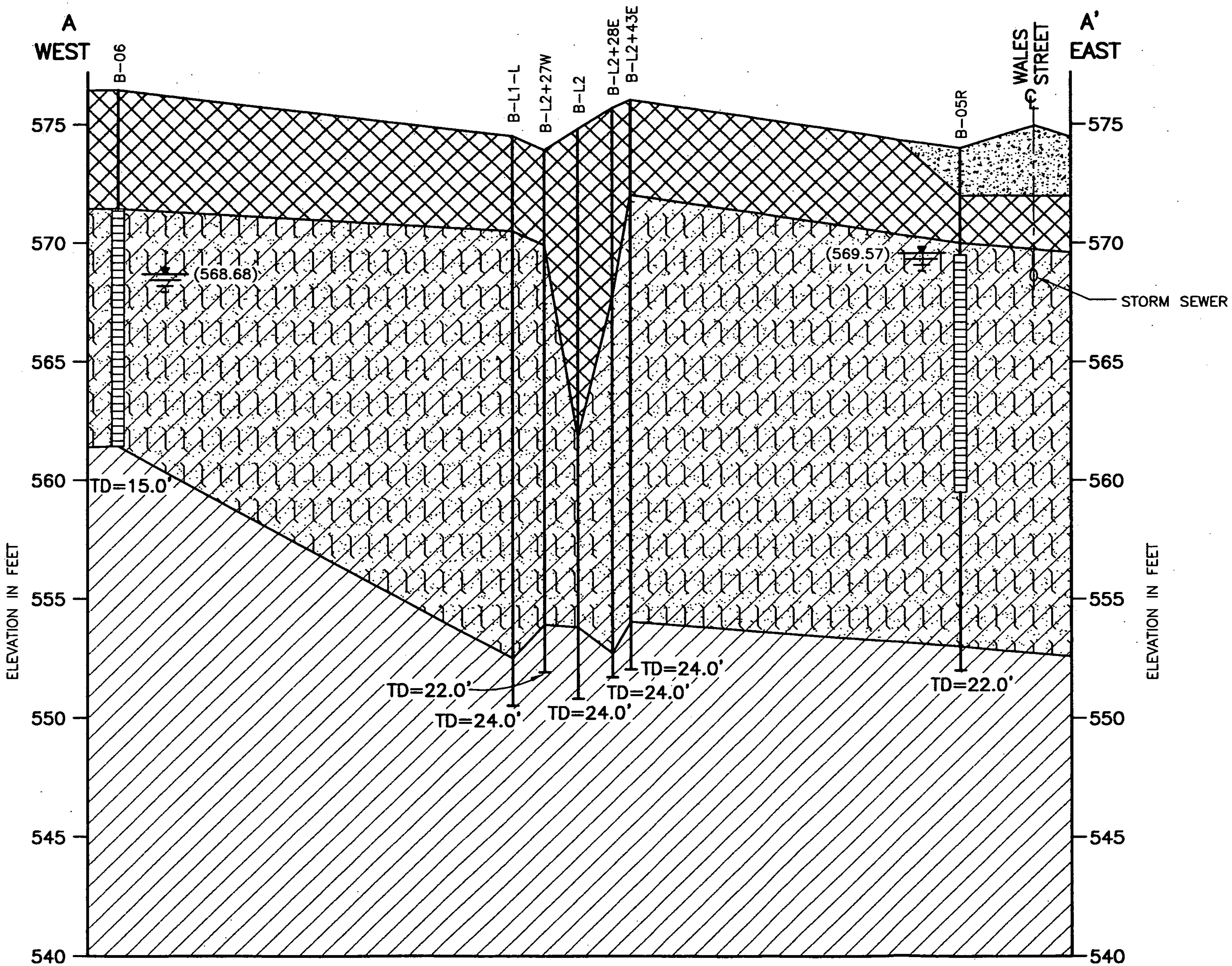
CHEMICAL LEAMAN
GEOLOGIC CROSS SECTION LOCATIONS

URS

FIGURE 1-4

N:\11170332.00000\CAD\DRAFT\ 1=5 6/2/05-1 RAL

CC-7323A



LEGEND

B-06 MONITORING WELL NUMBER

GROUNDWATER ELEVATION (6/13/02)

WELL SCREEN INTERVAL

TD=15.0' TOTAL DEPTH OF WELL BORING (FEET BELOW GRADE)

ASPHALT & SUBBASE

FILL

LAYERED FINE SAND/SILT/CLAY

RED SILTY CLAY

NOTES:

1. GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARDLY ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.
2. LOCATION OF CROSS SECTION IS SHOWN ON FIGURE 3-1.

100' 0 100'
HORIZ. SCALE: 1"= 100'

5' 0 5'
VERT. SCALE: 1"= 5'

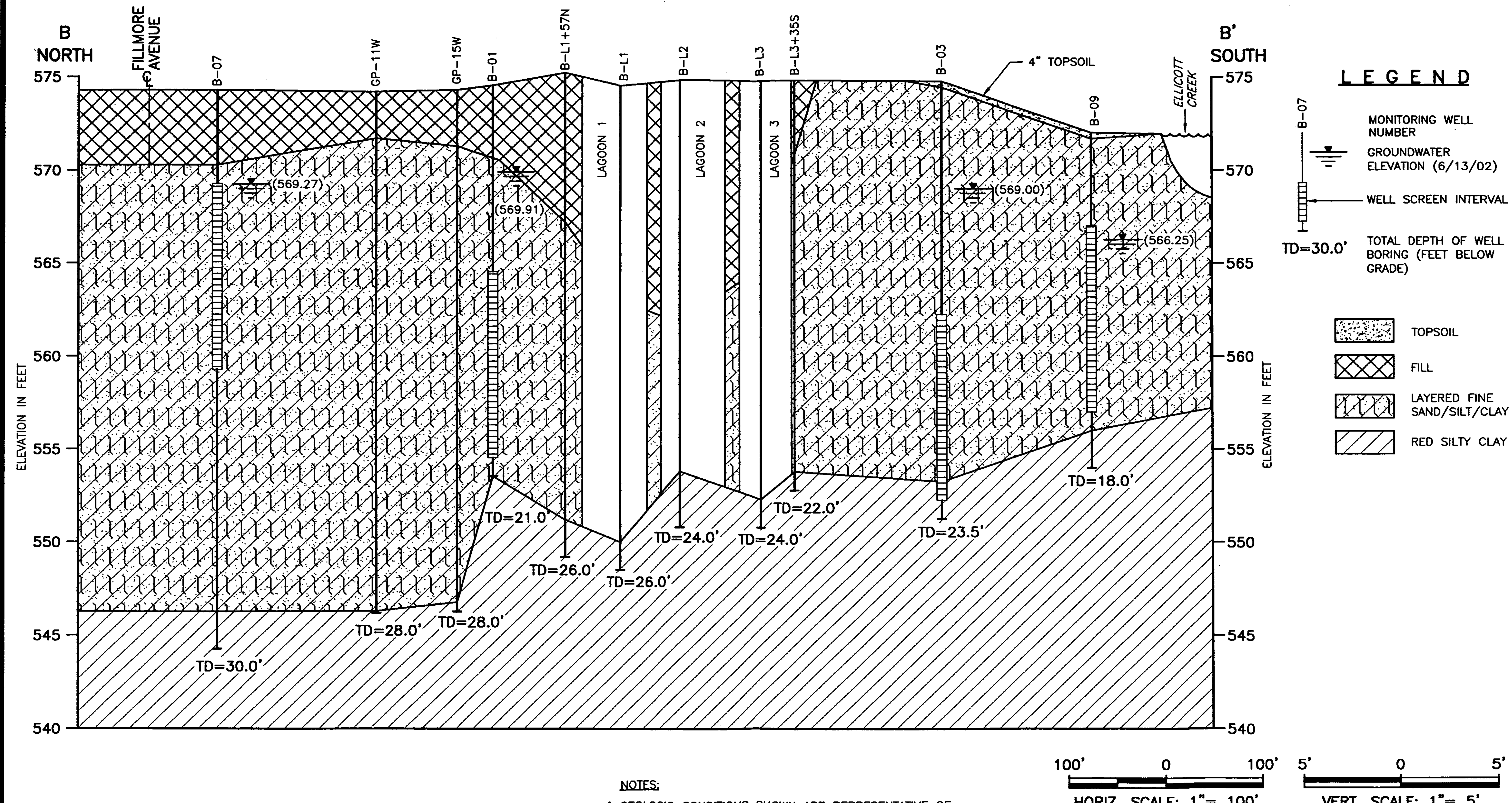
CHEMICAL LEAMAN
GEOLOGIC CROSS SECTION A-A'

URS

FIGURE 1-5

N:\11170332.00000\CAD\DRAFT\ 1=5 6/2/05-1 RAL

CC-7321A



NOTES:

1. GEOLOGIC CONDITIONS SHOWN ARE REPRESENTATIVE OF CONDITIONS ENCOUNTERED AT EACH BORING LOCATION TO THE DEPTH DRILLED. EXTRAPOLATIONS BETWEEN BORINGS HAVE BEEN INTERPRETED USING STANDARDLY ACCEPTED GEOLOGIC PRACTICES AND PRINCIPLES. ACTUAL CONDITIONS MAY VARY BETWEEN BORINGS FROM THOSE SHOWN.
2. LOCATION OF CROSS SECTION IS SHOWN ON FIGURE 3-1.

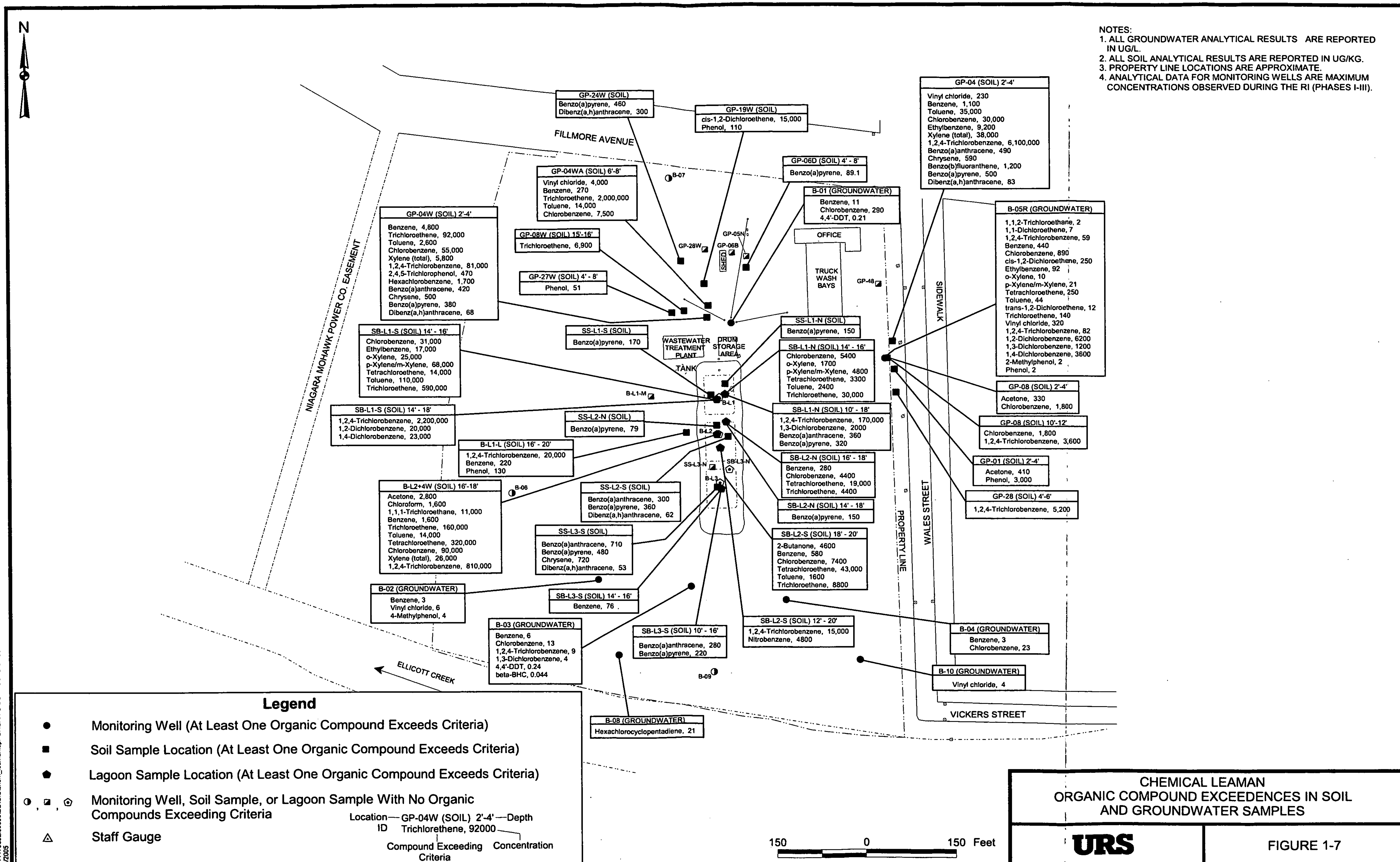
CHEMICAL LEAMAN
GEOLOGIC CROSS SECTION B-B'

URS

FIGURE 1-6

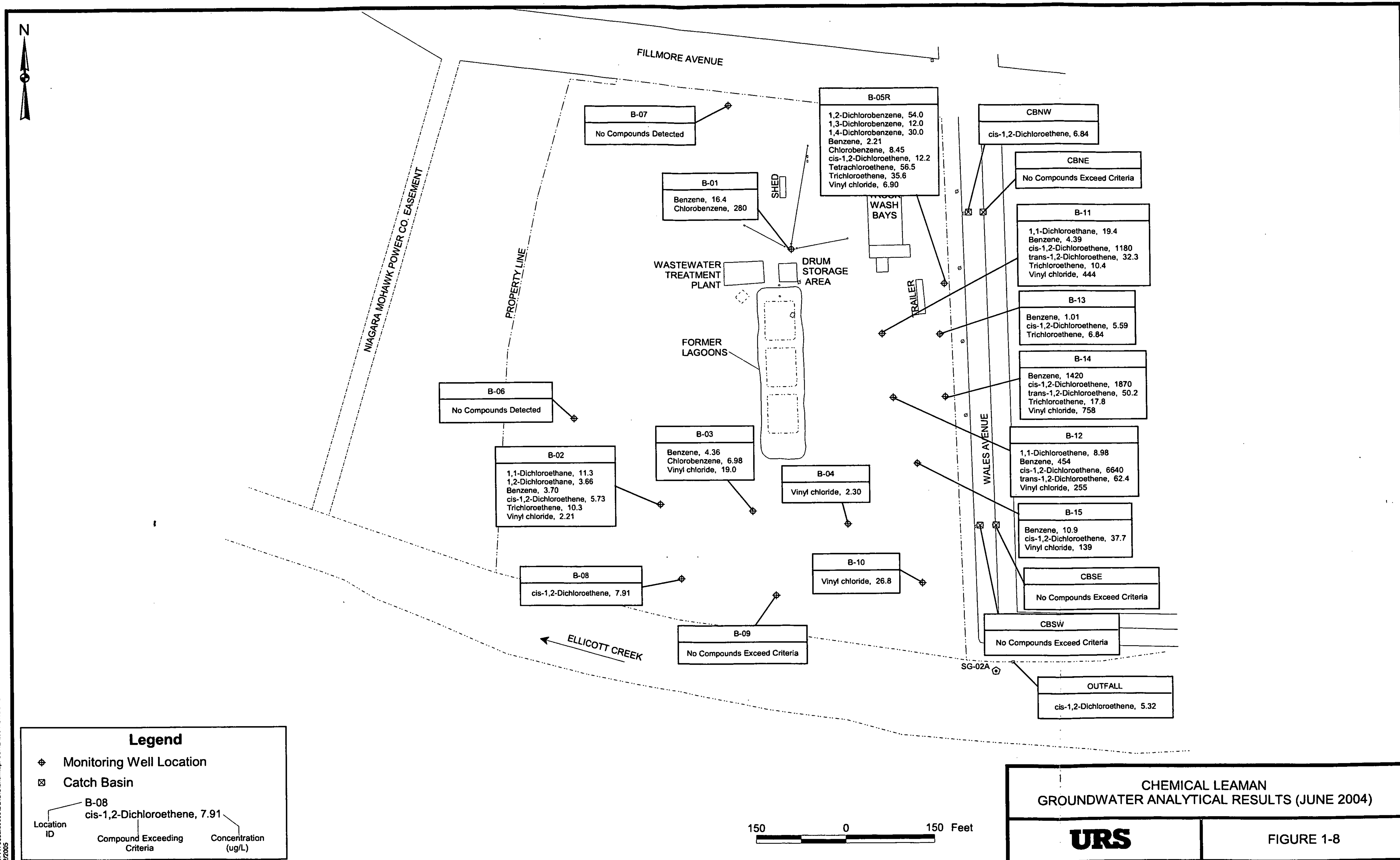
N:\11170332.00000\CAD\DRAFT\ 1=5 6/2/05-1 RAL

CC-7322A



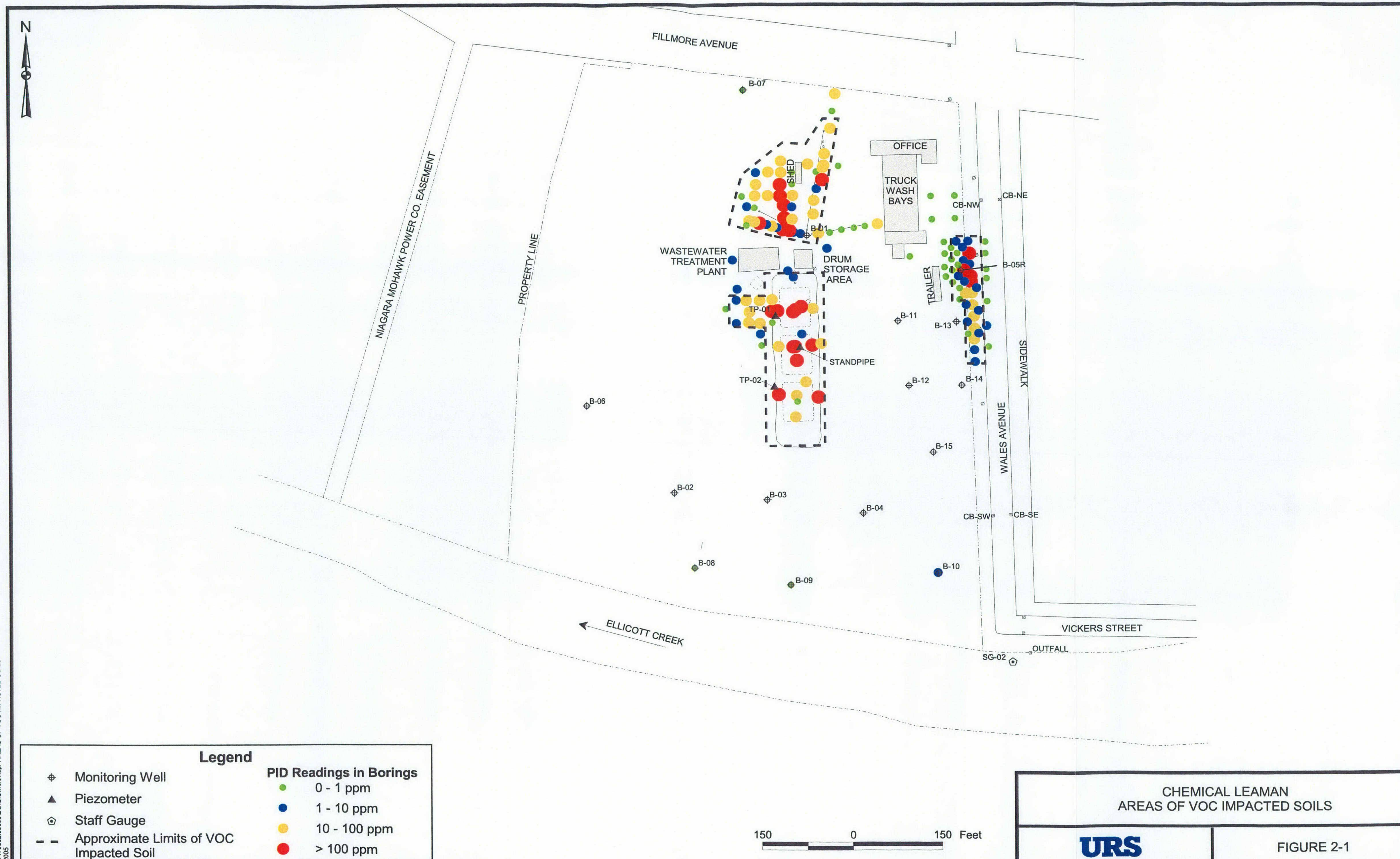
CHEMICAL LEAMAN
ORGANIC COMPOUND EXCEEDENCES IN SOIL AND GROUNDWATER SAMPLES

FIGURE 1-7



CHEMICAL LEAMAN
GROUNDWATER ANALYTICAL RESULTS (JUNE 2004)

FIGURE 1-8



CHEMICAL LEAMAN
AREAS OF VOC IMPACTED SOILS

URS

FIGURE 2-1

N:\11170332.00000\DB\GIS\welev.apr AREAS OF VOC IMPACTED SOILS
6/6/2005

PLATES

WARNING
IT IS VIOLATION OF SECTION 7209, SUBDIVISION 2, OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON OTHER THAN WHOSE SEAL APPEARS ON THIS DRAWING, TO ALTER IN ANY WAY AN ITEM ON THIS DRAWING. IF AN ITEM IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO THE ITEM HIS SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS SIGNATURE AND THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

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JOB No. 35665.01.20000

CHEMICAL LEAMAN
TOWN OF TONWANDA NEW YORK

REMEDIAL INVESTIGATION

REMEDIAL INVESTIGATION LOCATIONS
Scale: 1" = 60' - 0'
Date: JUNE 2005
PLATE 1

APPENDIX A

REMEDIAL ALTERNATIVE COST ESTIMATES

Appendix A
Remedial Alternative Cost Estimates
Chemical Leaman Tank Lines, Inc. Disposal Site

This appendix provides estimated costs for each of the alternatives considered in the Feasibility Study (FS) for the CLTL Site. In general, the cost estimates are expected to provide an accuracy of approximately +50 percent to –30 percent (i.e., more likely to err on the high side). The estimated costs for each alternative include the following:

- **Capital Costs:** Capital costs consist of direct (construction) and indirect (non-construction and overhead) costs. Direct costs include expenditures for the equipment, labor and materials necessary to install remedial actions. Examples of direct costs applicable to this project include: construction costs, equipment costs, and transportation/offsite disposal costs. Indirect costs include costs expenditures for engineering, financial and other services that are not part of actual installation activities but are required to complete the installation of remedial alternatives. Examples of indirect costs applicable to this project include: engineering design and construction management costs (estimated to be 15% of total direct capital costs), construction contingency allowances (estimated to be 25% of total direct capital costs), and legal/administrative costs (estimated to be 5% of total direct capital costs).

- **Annual Operation and Maintenance (O&M) Costs:** Annual O&M costs are post-construction costs necessary to ensure the continued effectiveness of a remedial action. They include long-term monitoring costs (labor and laboratory analytical), operating labor costs, maintenance costs and residue disposal costs.

- **Present Worth:** Present worth represents the amount of money that, if invested in the current year and disbursed as needed, would be sufficient to cover all costs associated with the remedial alternative over its planned life, including capital costs and the discounted value of future O&M costs. Inasmuch as a performance period of five years has been assumed for Alternatives 3 – 5, the annual O&M costs were assumed to be the same for each of the five years.

Each of the alternatives evaluated in this FS consists of one or more separate components. Table A-1 summarizes the total cost of each alternative and the components that it comprises. The following tables (Tables A-2 through A-6) provide a detailed breakdown of the costs for each individual component.

Table A-1
Remedial Alternative Cost Summary
Chemical Leaman Tank Lines, Inc. Site

Alt. No.	Component (Table)	Capital Cost	Annual O&M Cost	Total Present Worth
1	No Action (A-2)	$0.	$0.	$0.
	Total	$0.	$0.	$0.
2	Institutional Controls (A-3)	$10,000.	$0.	$10,000.
	Total	$10,000.	$0.	$10,000.
3	Institutional Controls (A-3)	$10,000.	$0.	$10,000.
	Monitored Natural Attenuation (A-4)	$10,000.	$58,720	$68,720
	Total	$20,000	$58,720.	$78,720.
4	Institutional Controls (A-3)	$10,000.	$0.	$10,000.
	Monitored Natural Attenuation (A-4)	$10,000.	$58,720	$68,720
	Soil Excavation East Area (A-5)	$140,831.	$0	$140,831.
	Total	$160,831.	$58,720.	$219,551
5	Institutional Controls (A-3)	$10,000.	$0.	$10,000.
	Monitored Natural Attenuation (A-4)	$10,000.	$58,720	$68,720
	Soil Excavation East Area (A-5)	$140,831.	$0.	$140,831.
	Chemical Oxidation (A-6)	$975,912.	$0	$975,912.
	Total	$1,136,743	$58,720.	$1,195,463

Table A-2
Component Cost Estimate: No Action
Chemical Leaman Tank Lines, Inc. Site

Item	Units	Quantity	Unit Cost	Total Cost
Direct Capital Costs (DCC)				
Total DCC				$0.
Indirect Capital Costs (ICC)				
Legal / Administrative Expenses				$0.
Total ICC				
Total Capital Costs (DCC + ICC)				$0.
Annual O&M Costs				
Total Annual O&M Costs				$0.
Present Worth of O&M Costs				$0.
Total Present Worth				$0.

Summary: Leave site in current condition with no institutional and/or active remedial activities being performed.

Table A-3
Component Cost Estimate: Institutional Controls
Chemical Leaman Tank Lines, Inc. Site

Item	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
Direct Capital Costs (DCC)				
Total DCC				$0.
Indirect Capital Costs (ICC)				
Legal / Administrative Expenses	EA	1	$10,000.	$10,000.
Total ICC				
Total Capital Costs (DCC + ICC)				$10,000.
Annual O&M Costs				
Total Annual O&M Costs				$0.
Present Worth of O&M Costs				$0.
Total Present Worth				$10,000.

Summary: Prepare and establish enforceable restrictions prohibiting future development of the site for residential use, or in any way that might involve excavation, disturbance or exposure to subsurface contamination at the site.

Table A-4
Component Cost Estimate: Monitored Natural Attenuation
Chemical Leaman Tank Lines, Inc. Site

Item	Units	Quantity	Unit Cost	Total Cost
Direct Capital costs (DCC)				
Total DCC				$0.
Indirect Capital Costs (ICC)				
Institutional Controls	EA	1	$10,000	$10,000
Prepare Work Plan	EA	1	$5,000	$5,000
Legal / Administrative Expenses	EA	1	$5,000	$5,000
Total ICC				$20,000
Total Capital Costs (DCC + ICC)				$20,000.
O&M Costs				
Per Event				
Labor (Sampling, Reporting)	HR	60	$55.00	$3,300
Expenses	EA	1	$540.00	$540
Lab Analytical (6 aqueous samples + QC)	EA	7	$500.00	$3,500
Total Cost Per Event				$7,340
O&M Costs (Years 1-3)	YR	3	14,680	$44,040.
O&M Costs (Years 4 and 5)	YR	2	7,340	$14,680.
Total O&M Costs				$58,720
Total Present Worth				$78,720.

Summary: Use 6 existing monitoring wells (B-01, -02, -04, -05R, -13 and -14). Sample all locations semi-annually for years 1-3, and annually for years 4 and 5. Perform laboratory analysis of all samples for TCL VOCs and natural attenuation parameters.

Table A-5
Component Cost Estimate: East Area Soil Excavation with Offsite Landfilling And Monitored Natural Attenuation
Chemical Leaman Tank Lines, Inc. Site

Item	Units	Quantity	Unit Cost	Total Cost
Direct Capital Costs (DCC)				
Monitored Natural Attenuation (A-4)				$0
Soil Excavation				
Mobilization/Demobilization	EA	1	$1,000.00	$1,000.
Decontamination Pad	EA	1	$500.00	$500.
Excavation Equipment & Operator	HR	40	$175.00	$7,000
Laborer	HR	40	$65.00	$2,600
Steam Cleaner	DAY	5	$150.00	$750
Misc. Supplies	LS	1	$1,000.00	$1,000.
Air Monitoring/Dust Control	Day	5	$600	$3,000
Post-Excavation Sampling	EA	10	$500	$5,000
Transportation & Offsite Disposal				
Waste Characterization	EA	5	$600	$3,000
Non-Haz Waste	TON	660	$40.00	$26,400
Haz Waste	TON	165	$200.00	$33,000
Dispose Decontamination Water				
Laboratory Analysis – Allow:	LS	1	$500.00	$500.
Transportation and Disposal	DRUM	4	$250.00	$1,000.
Replacement Fill (Provide and Apply)	TON	825	$15.00	$12,375.
Total DCC				$97,125
Indirect Capital Costs (ICC)				
Institutional Controls	EA	1	$10,000	$10,000
Monitored Natural Attenuation	EA	1	$10,000	$10,000
Engrg. Design/Const. Mgmt. (15% DCC)				$14,569
Construction Contingency (25% DCC)				$24,281
Legal / Admin (5% DCC)				$4,856
Total ICC				$63,706.
Total Capital Costs (DCC + ICC)				$160,831
O&M Costs				
Monitored Natural Attenuation (A-4)				

Years 1 – 3	YR	3	$14,680	$44,040.
Years 4 and 5	YR	2	$7,340	$14,680.
Total O&M Costs				$58,720
Total Present Worth				$219,551

Summary: Excavate 825 tons of contaminated soil from linear area east of B-05R along eastern property line. Load bulk soil into trucks for offsite disposal. Assume 80% of soil is non-hazardous and able to be landfilled at a Subtitle D facility; and 20% is hazardous by TCLP (characteristic), and able to be landfilled at a Subtitle C facility.

Table A-6
Component Cost Estimate: Chemical Oxidation of Soils Under Lagoons, East Area Soils Excavation with Offsite Landfilling and Monitored Natural Attenuation
Chemical Leaman Tank Lines, Inc. Site

Item	Units	Quantity	Unit Cost	Total Cost
Direct Capital Costs (DCC)				
Monitored Natural Attenuation (A-4)				$0.
East Area Soil Excavation (A-5)				$97,125.
Chemical Oxidation				
Mobilization/Demobilization	EA	1	$5,000.00	$5,000.
Health & Safety	EA	1	$6,000.00	$6,000.
Drilling Injection Points and Injection	DAY	50	$1,500.00	$75,000.
Chemical Reagents	LB	234,817	$2.50	$587,043
Total Chemical Oxidation				$673,043
Total DCC				$770,168.
Indirect Capital Costs (ICC)				
Institutional Controls	EA	1	$10,000	$10,000
Monitored Natural Attenuation	EA	1	$10,000	$10,000
Engrg. Design/Const. Mgmt. (15% DCC)				$115,525
Construction Contingency (25% DCC)				$192,542.
Legal / Admin (5% DCC)				$38,508.
Total ICC				$366,575.
Total Capital Costs (DCC + ICC)				$1,136,743.
Annual O&M Costs				
Monitored Natural Attenuation (A-4)				
Years 1 – 3	YR	3	$14,680	$44,040.
Years 4 and 5	YR	2	$7,340	$14,680.
East Area Soil Excavation (A-5)				$0.
Total O&M Costs				$58,720.

<u>Total Present Worth</u>				$1,195,463.

Summary: Perform soil excavation, handling, and fill replacement as with "Excavation and Offsite Landfilling" (Table A-5). Inject Chemical Oxidizing reagents into contaminated soils located under lagoons. Utilize monitoring to gauge progress of chemical oxidation and/or natural attenuation in remediating onsite contaminated soils.