ALCOA INC.
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November 10, 2008

Chief, New York Remediation Branch
Attention: Mr. Michael A. Walters, Superfund Site Remedial Project Manager
Emergency and Remedial Response Division
U.S. Environmental Protection Agency, Region II
290 Broadway, 20th Floor
New York, New York 10007-1866

CERTIFIED MAIL – 7007 0710 0003 2300 2561

Re: Revised Updated Conceptual Model
Alcas Cutlery Corporation Site, Olean Well Field

Dear Mr. Walters:

Per our agreement, enclosed please find the above referenced document. Should you have any questions or comments concerning this document, please call Timothy White at 281-493-9005 or me at 865-977-3811.

Sincerely,

Timothy H. White
for

Robert A. Prezbindowski
Alcoa Remediation

cc: Mr. Michael Walter – US EPA, Region II (3 copies)
Mr. Vivek Nattanmai – NYDEC (4 copies) (*Certified Mail –7007 0710 0003 2300 2578*)
Mr. Eric W. Wohlers - Cattaraugus County Health Department
Mr. Carey Litteer – Cutco Corp.

UPDATED SITE EVALUATION AND CONCEPTUAL MODEL REPORT

ALCAS CUTLERY CORPORATION PROPERTY

OLEAN WELL FIELD SUPERFUND SITE
OLEAN, NY

Revised November 10, 2008
Previously Submitted February 8, 2008

Prepared For:

U.S. Environmental Protection Agency, Region II
Emergency and Remediation Response Division
290 Broadway, 20th Floor
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1.0 Executive Summary

The original site conceptual model for the Alcas Property is inferred in the OU 2 ROD for the Olean Well Field Superfund Site (hereinafter referred to as the site) in Olean, NY. The model is based on surrounding investigation of the site, regional geologic assessment, and limited investigation of the Alcas Property geared for assessment of source potential to the Site. The model did not include site-specific characterization of the Alcas Property in terms of underlying site geology, hydrogeology or source constituents and associated phase-derivatives.

Since development of the original OU 2 ROD, significant new information became available through additional investigations and comprehensive reevaluation of new information combined with historical data. This report therefore provides an update of the site conceptual model of the Alcas Property, which identifies significant differences from the original model.

2.0 Olean Well Field Superfund Site Background

2.1 Site Description

The Alcas Cutler Corporation facility (hereinafter referred to as the Alcas Property) is located within the Olean Well Field Superfund Site ("Site"). The Site is located in the eastern portion of the City of Olean ("City") and west and northwest of the Towns of Olean and Portville in Cattaraugus County, New York. The Site incorporates three municipal wells and spans approximately 800 acres of property principally occupied by industrial facilities. The Allegheny River flows through the southwest and south portion of the Site, and State Routes 16 and 417 provide access to the area.

Groundwater in the Site's upper and lower ("City") aquifer is impacted with trichloroethene (TCE) and other chlorinated compounds. To meet drinking water standards prior to distribution into the City of Olean, air strippers treat the groundwater drawn from municipal well 18M (north of the Allegheny River) and 37M and 38M (south of the Allegheny River). Potentially responsible parties (PRPs) residing within the Site boundary and found to be contributing to the groundwater impact include the Alcas Property, AVX Corporation (AVX), and McGraw-Edison.

2.2 Site History

The following presents a brief history of activities conducted at the Site, followed by an overview of Site history specific to the Alcas Property.

2.2.1 Olean Well Field

TCE and other chlorinated solvents were detected above drinking water standards in the City of Olean municipal wells in 1981. The wells were then shut down, and a former surface-water treatment facility was reactivated to supply the City of Olean with water. Following an investigation of the contamination, the U.S. Environmental Protection Agency (EPA) added the Olean Well Field to the National Priorities List in September 1983.

Between 1983 and 1985, the EPA conducted additional investigations of the Site and undertook some early removal actions and supplied carbon adsorption filters to owners of impacted private wells. The agency additionally implemented a broad-scale remedial investigation and feasibility study (RI/FS), conducted a focused feasibility study, and implemented initial remedial measures (IRM) including regular monitoring of private wells and installation of carbon adsorption units as needed. Pursuant to administrative orders issued in 1984, PRPs (McGraw-Edison, AVX, and Alcas) also conducted investigations at their respective facilities. The results of the EPA and PRP investigations concluded that soil and groundwater at each of the facilities was contaminated with TCE and other chlorinated constituents, with established pathways of migration to the Lower Aquifer.

Based on the results of the early studies and interim actions, the EPA issued the Operable Unit (OU) 1 Record of Decision (ROD) in September 1985. The ROD required six principal actions:

- Installation of air strippers at municipal wells 18M and 37M/38M,
- Extension of the City's public water supply,
- Inspection/repair of an industrial sewer at McGraw-Edison,
- Recommendation for institutional controls to restrict withdrawal of contaminated groundwater,
- Institution of a Site Monitoring Plan, and
- Initiation of a Supplemental RI/FS to evaluate source control measures at PRP facilities.

The agency issued a unilateral administrative order in February 1986, requiring the PRPs to carry out the actions in the ROD. To implement the Supplemental RI/FS, the PRPs conducted investigations of their respective facilities and the EPA conducted studies of 10 additional properties. The Supplemental RI/FS conducted pursuant to the ROD identified four areas on Site as apparent sources of VOC contamination to the groundwater: the Alcas Property, Loohn's Dry Cleaners and Launderers, AVX, and McGraw-Edison facilities.

Following implementation of the OU 1 ROD, the agency issued an OU 2 ROD in September 1996. This ROD set forth selected remedies for the four source areas. The remedies involved combinations of vacuum enhanced recovery (VER), groundwater pump-and-treat, and excavation technologies. The remedy decisions were based on an inferred Site Conceptual Model reflected in the ROD. The selected remedial action for Alcas was VER for the soils and Upper Water-Bearing Zonce with no additional groundwater treatment necessary due to the groundwater capture of 18M in the City Aquifer.

2.2.2 Alcas Property Operations and Solvent Release History

The Alcas Cutlery facility has manufactured cutlery and sporting knives at the Olean site since 1949. The plant used TCE in vapor degreasers as part of finishing operations. The quantity of TCE used annually has been estimated at 4,000 gallons to 6,500 gallons in the late 1970's and early 1980's. Beginning in the mid 1980's usage decreased to 4,000 to 5,000 gallons per year until 1989 when TCE usage stopped. To mitigate any potential for ongoing releases, all TCE storage vats were removed from the property. The quantity of distillation residues disposed of from 1949 to 1980 was approximately one 55-gallon drum per month containing approximately 10 percent TCE.

New TCE was shipped and sorted in 55-gallon drums in an area along the eastern portion of the main building. The plant operated five vapor degreasers in the main building. Reportedly, during normal manufacturing operations *de minimis* loses of TCE occurred to the floor of the building. In addition, more significant loses of TCE are believed to have occurred periodically from the vapor degreasers. One degreaser is particular, located in the southwest portion of the main building, was reported to leak continuously. Historically, spilled TCE would normally be collected in floor drains, which discharged into the sanitary sewer system. The sanitary sewer lines generally drained southward to a truck line that ran westward along the south perimeter of the main building. The sanitary line exits the site from a manhole located at the southwest corner of the main building through the southern edge of the property. Figure 2-1 shows the location of the vapor degreasers, stormwater, and sanitary sewer drain lines within the main building area. Possible TCE release points beneath the main building exist throughout the floor drainage system, along the sanitary sewer line and through cracks and seams in the floor.

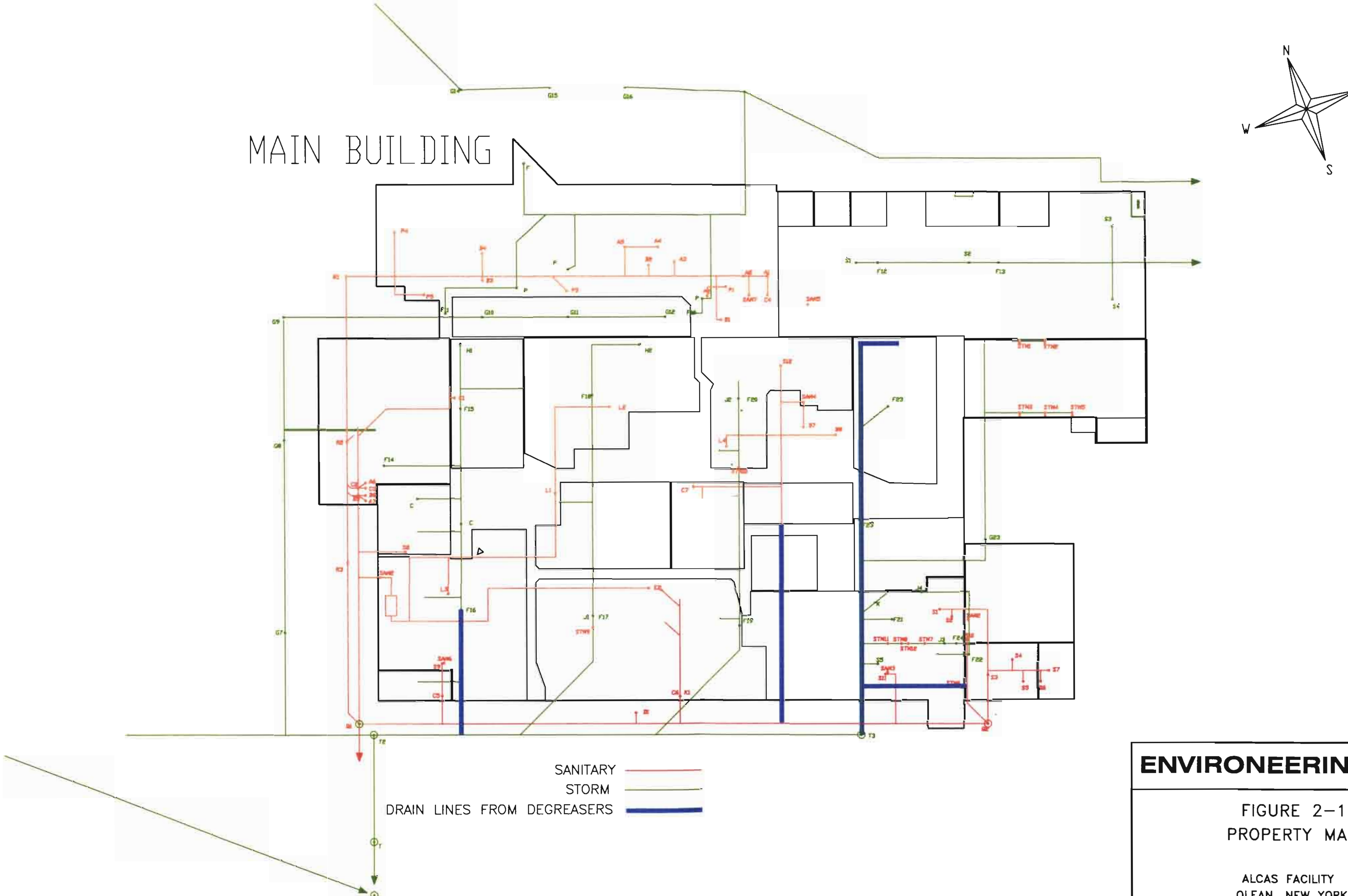
Exterior to the building, waste TCE was reportedly used as a weed killer along the fence on the northern side of the plant from 1975 to 1979. The quantity applied was estimated at 25 to 40 gallons per year. The leftover waste TCE used for week killing was most likely disposed of at various points at or around the storage building. The number or specific location of these entry points is unknown.

Considering the facility history, the persistence of DNAPL in the subsurface and conditions at other facilities with very similar histories, it is reasonable to expect that DNAPL (residual and possible free phase) is present at the Alcas Property both below the main building and in areas exterior to the building. Considering the mass release potential over an approximately 40-year period, it would be expected that a significant source might exist from under the main building. This source may be substantial in comparison to the potential of point sources located outside the buildings.

2.2.3 Actions Specific to the Alcas Property

Since the issuance of the OU 2 ROD numerous investigations of the Alcas site have been conducted to further characterize the site and assess the impact. A summary of Olean Well Field Superfund Site investigative and remedial activities relevant to the Alcas property is provided in Table 2-1.

Table 2-1 History of Activities Alcas Cutlery Corporation Facility Site Olean, New York	
Date	Action
January 1981	Contamination discovered in municipal wells
September 1983	Olean Well Field Site added to NPL list - Alcas listed as PRP
1984	Administrative Order issued to Alcas by EPA requiring investigation of facility
September 1985	Record of Decision issued by EPA for Operable Unit One (OU1)
November 1989	Administrative Order issued to Alcas by EPA requiring removal of 10 cubic yards of TCE-contaminated soil (former weed killer area)
June 1991	Administrative Order issued by EPA for Supplemental RI/FS
November 1994	VER Pilot Test Conducted by Geraghty and Miller
September 1996	Record of Decision issued by EPA for Operable Unit Two (OU2)
March 1998	Consent Decree entered for implementation of OU 2 ROD
March 1999	Remedial Design/Remedial Action Work Plan approved
July 1999	Phase 1 Predesign Investigation conducted
October 1999	Phase 2 Predesign Investigation conducted
September 2000	Phase 3 Predesign Investigation conducted
September 2001	Phase 4 Investigation conducted
May 2002	Post ROD Summary Report Issued
July 2004	Additional Investigation (AI) conducted
September 2007	Groundwater Sampling event



ENVIRONEERING, INC.

FIGURE 2–1
PROPERTY MAP

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY: LMG/KLW/JLN	DATE:	PROJ. NO.

3.0 New Information

The sections that follow contain new information discovered after the issuance of the OU 2 ROD, which is relevant to the Alcas Property conceptual model. This new information includes recent investigations, advances in the understanding of chlorinated solvent releases to the environment, and release at the Alcas property, and reevaluation of site conditions based on the results of this new information.

3.1 Site Investigations at Alcas Property

Investigative data collected since the original ROD to date is summarized below. This data summary consists of soil, soil-gas, and groundwater sampling results.

3.1.1 Phase 1 Predesign Investigation

Pursuant to the original ROD, and for the purpose of obtaining better site definition, a predesign investigation was performed at the Alcas Property. This investigation was conducted in two phases. The Phase 1 investigation was performed in accordance with Section 4 and Appendix B of the Remedial Design/Remedial Action Work Plan for the Alcas Property (ICF Kaiser, March 1999). Soil samples were collected for Target Compounds List (TCL) VOCs. Groundwater samples were collected from each boring for analysis of TCL VOCs, metals, and inorganics. The metals and inorganic compounds were analyzed because they would be indicative of potential equipment fouling. The results of the Phase 1 predesign investigation were transmitted to the EPA on August 31, 1999.

3.1.2 Phase 2 Predesign Investigation

Because the results of the Phase 1 investigation did not sufficiently enable characterization of source constituents and impacted media and suggested that geological conditions at the facility are inconsistent with the original site conceptual model inferred in the ROD, Alcoa submitted a work plan for a Phase 2 investigation of the site on September 19, 1999. Phase 2 investigation activities included a screening-level passive soil gas survey. Passive soil gas detectors were installed on approximate 100-foot center grid pattern throughout the area south of the main plant building. Additional borings were also drilled, and several existing borings were extended to the top of the City Aquifer. Also, the new soil borings were located to coincide with selected passive soil gas sampling locations. Each soil boring was continually logged and select samples were collected for TCL VOC and geotechnical analysis. The field investigation included the collection of groundwater samples from wells both on and off the facility, screened in both the Upper and Lower Aquifers, for VOC analysis. Five of the groundwater wells sampled were also monitored for parameters that would measure the natural attenuation of the chlorinated compounds. Results of the Phase 2 predesign investigation were transmitted to the EPA on December 7, 1999. Overall, the predesign (Phase 1 & 2) investigation consisted of 19 soil borings, 98 soil samples, 43 passive soil gas sampling modules, and 13 groundwater well samples, eight open bore hole water samples, and 19 geotechnical soil samples.

3.1.3 Phase 3 Predesign Investigation

In September 2000, a Phase 3 Predesign Investigation was designed and conducted to assist in updating the Site Conceptual Model. The objectives of the Phase 3 were to collect additional data to further verify that a DNAPL source is beneath the main Alcas building and to determine groundwater flow direction and the off-site extent of affected groundwater in the Upper Groundwater Bearing Unit.

To complete the objective outlined in the Phase 3, a total of 12 micro-wells were installed on and off the Alcas Property. The borings for the monitor wells were advanced using a Geoprobe unit. The borings were continuously sampled using the Macro Core open sampler.

Soil samples were collected from each boring and sent to a laboratory for geotechnical testing. Three to seven samples were collected from each boring. The samples were collected from different stratigraphic zones to ensure that each zone was classified properly. No soil samples were sent to the laboratory for chemical analysis.

Groundwater samples taken from the new wells were analyzed for site-specific chlorinated organic constituents including; tetrachloroethene, trichloroethene, cis and trans 1,2-dichloroethene, and vinyl chloride.

The Phase 3 Predesign Investigation Report was submitted to the EPA in January 2001.

3.1.4 Phase 4 Investigation

In September 2001, a Phase 4 Investigation was conducted to update the Site Conceptual Model. Nine micro-wells were installed on and off the Alcas Property. Soil samples were collected from four borings and sent to laboratories for geotechnical and analytical testing. The soil samples were tested for chlorinated organic constituents including; tetrachloroethene, trichloroethene, cis and trans 1,2-dichloroethene, and vinyl chloride.

Groundwater samples taken from the new wells were analyzed for site-specific chlorinated organic constituents including; tetrachloroethene, trichloroethene, cis and trans 1,2-dichloroethene, and vinyl chloride.

3.1.5 Additional Investigation

In July 2004, an Additional Investigation (AI) was conduction to gather information to update the Site Conceptual Model. The objectives of the AI consisted of:

- Conduct soil and groundwater sampling under the Main Building to determine the presence of DNAPL;
- Delineate of the shallow UWBZ plume south and west of the Main Building;
- Assess groundwater chemistry within the City Aquifer to determine if a DNAPL mass is present at the lower portion of the unit;
- Evaluate the impact of the City Production Wells M18 and M37/38 upon groundwater flow within that unit;
- Start the installation of a permanent monitor well network in the UWBZ; and
- Determine if chlorinated volatile organic compounds ("*CVOCs*") are impacting the indoor air quality at workstations within the Main Building.

To accomplish the AI project objectives, 7 soil borings were installed within the main building to determine the presence of DNAPL. Soil samples were collected from the borings and an open borehole water sample was collected.

Fifteen monitor wells were installed to collect groundwater in the Upper Aquitard (UA) and at the top and bottom of the City Aquifer (UC and BC). The samples collected were analyzed for VOCs using EPA Method 8260.

Four sample locations within the manufacturing area of the Main Building, and one in the first floor office area were tested using passive sample collection techniques. The 3M Method, using a GC/MS was utilized for the analysis of the following CVOCs as outlined in the AI Workplan; tetrachlorethene, trichloroethene, cis and trans 1,2-dichloroethene, vinyl chloride, and 1,1,1-trichloroethane.

The AI results and report was first submitted to the EPA in July 2005.

3.2 Advances in the Understanding of Chlorinated Solvent Releases

In recent years there have been significant advances in the understanding of chlorinated solvent releases and the behavior of these releases in the subsurface.

When released into the environment, chlorinated organic solvents that are heavier than water are commonly referred to as dense nonaqueous phase liquids or DNAPLs. Because they are heavier than water, DNAPLs can readily migrate downward and through groundwater deep into the subsurface. DNAPL can exist in the subsurface as free-phase and residual DNAPL. When released, free-phase DNAPL will move downward through the subsurface under the force of gravity or laterally along the surface of sloping fine-grained soil units. Point release types of equal mass, will typically travel much deeper than release types that are spread over greater surface areas. Free-phased DNAPLs will distribute in the subsurface as both disconnected blobs and ganglia of liquid referred to as "residual", and in larger accumulations referred to as "pools." The portion of the subsurface where DNAPLs are located, either free or residual, is commonly referred to as the DNAPL zone. The DNAPL zone is that portion of the subsurface where the released immiscible liquids (via free-phase DNAPL migration and chemical diffusion) are present within the subsurface media.

Free DNAPL refers to the presence of DNAPL at saturations higher that residual DNAPL. Free DNAPL is distinctive from residual DNAPL in that free DNAPL is still potentially capable of traveling in the environment.

The trailing end of migrating DNAPL being trapped in pore spaces or fractures by capillary forces forms residual DNAPL. The amount of residual DNAPL contained in the subsurface is a function of the DNAPL's density, viscosity, and interfacial tension and the geologic characteristics of the site such as, soil pore size, permeability, capillary pressure, root holes, small fractures, and slickensides found in silt, clay layers, etc.. The subsurface DNAPL distribution is typically impossible to locate or delineate accurately. DNAPL migrates preferentially through selected pathways and is affected by small-scale changes in the stratigraphy. Therefore, the ultimate path taken by DNAPL can be very difficult to characterize and predict.

Both free and residual DNAPLs give rise to contaminant vapors in the unsaturated zone and as dissolved phase plume in the saturated zone (below the water table). Groundwater flowing past the DNAPL slowly dissolves soluble components of the DNAPL, forming a dissolved or aqueous phase plume zone downgradient of the DNAPL zone. Contributing to evaporation and aqueous dissolution, with time some chemical diffusion of the DNAPL can occur into the surrounding soil matrix. These DNAPL depleting mechanisms typically operate very slowly under natural conditions; thus subsurface DNAPL tends to persist as long-term source of dissolved phase derivatives into groundwater. Complete dissolution of DNAPL in the saturated zone can take decades or centuries due to the limits of chemical solubility, groundwater velocity and vertical dispersion.

The aqueous plume zone is that portion of the groundwater surrounding and downgradient of the DNAPL zone where DNAPLs are not present. The plume originates from and extends beyond the DNAPL zone as it progressively migrates with groundwater flow for as long as the DNAPL zones persist. Within both the DNAPL and plume zones there is a quazi-equilibrium between aqueous contamination and that portion sorbed to the soils, especially organic carbon. From a mass perspective, typically the mass of free or residual DNAPL significantly exceeds that which is sorbed to soils, dissolved in the groundwater or present as vapors in the vadose zone. Depending on the volume of the release and site-specific subsurface characteristics, the plume zone may extend over a large distance from the entry zone and the underlying DNAPL zone. The migration of constituents in these plumes is subject to advection, dispersion, sorption, and degradation.

The residual or free DNAPL in the saturated zone will eventually deplete through dissolution. Dissolution will however be influenced by several factors including:

- Solubility of DNAPL components;
- DNAPL volume vs. water contact area;

- Groundwater seepage velocity; and molecular diffusivity of DNAPL in water (vertical dispersion).

These factors indicate that dissolution of residual ganglia will produce a high chemical concentration in the groundwater and depletion will occur more rapidly than from a free DNAPL pool. The approximate time to dissolve the residual DNAPL will typically take decades to centuries in the saturated zone (Cohen and Mercer).

The plume zone will often include a light vapor phase just above the water table. The volatilization of the residual DNAPL and from the dissolved plume will from a sinking, density driven vapor plume that can condense on the surface of the water table. The time for volatilization of DNAPL to occur is highly variable and will fluctuate with changing site conditions (e.g. dry/wet soils, discontinuous channels, voids, and coarse/fine-grained soils).

The DNAPL zone is typically the source areas of dissolved and vapor phase transport of chlorinated compounds, which affect soil within the plume zones to the extent the plume migrates. While it represents a fraction of contaminant mass and vehicle for continuing transport of dissolved phase compounds, the plume-affected media itself is not the governing source component at chlorinated sites in terms of generation and persistence, except where all residual liquids in the original DNAPL zone have dissipated.

The presence of DNAPL (free liquid and residual) at a site poses potential problems for the spreading of contaminants through invasive site activities. EPA Publication 9355.4-07FS, "Estimating Potential for Occurrence of DNAPL at Superfund Sites" warns that the risk of spreading contaminants increases with the proximity to a potential DNAPL zone. Special precautions should be taken to ensure that invasive site activities (i.e. drilling, excavation, etc.) does not mobilize DNAPL-laden media or create pathways for continued vertical migration of DNAPLs.

4.0 Site Geologic/Hydrogeologic Setting

The geologic and hydrogeologic setting at the Olean Superfund Site was researched and described in various Site documents on a regional scale.

4.1 Site Surface Water Hydrology

The town of Olean is located in the Allegheny River Valley near the border of the northwestern Allegheny plateau. The Allegheny River, a principle tributary of the Ohio River, flows north-northwest through the southern portion of the Site. Olean and Haskell Creeks, tributaries of the Allegheny, are located to the west and east of the Site, respectively. Surface runoff, direct precipitation, and groundwater inflow sustain the annual river/stream systems.

The size, shape and occurrence of modern-day surface water features are largely the result of past geologic and climatological processes. The major drainage feature in Olean is the Allegheny River which flows to the north and west and ranges in depth from 0 feet on sand and gravel bars to as deep as 15 feet in the center of the channel. At least 12 major floods have occurred on the Allegheny River since the early 1900's. Because of the flood hazard to the population in Olean, the Army Corps of Engineers raised the levees along the northern bank of the river. Storm water sewers from Olean passed through the dike via check-valved culverts so that back flow can be prevented during flood events.

Two major creeks feed the Allegheny River in the vicinity of Olean. Olean Creek begins at the confluence of Old Creek and Ischua Creek near Hinsdale, New York, and flows south through the City of Olean. Haskell Creek has its headwaters near South Cuba, New York, flows south to southwest along Haskell Road, and eventually empties into the Allegheny River approximately one half mile west of the town of Weston Mills.

A less predominant topographic feature near the Alcas Property is a linear ditch behind the Alcas Property on East State Street. This is the remnant of a historic canal, which at one time was a shallow (approximately 3-5 foot deep) barrage canal that runs roughly parallel to and north of the Allegheny River. Today, most of the canal is partially filled and/or drained so that there is no standing water.

4.2 Site Geology

The following discussion of regional geology is based on information from Muller (1975), McClintock and Patel (1944), NYSGA (1977), and Muller (1977) as summarized by Engineering-Science (1985).

The City of Olean is located in the Appalachian Highland Physiographic province, an upland moderate relief underlain by sedimentary rocks dipping south at approximately 2 degrees. Several continental ice sheets have covered most of this region during the

Pleistocene Epoch (1,600,000 to 10,000 years before the present). The glaciers, however, never progressed south of the Allegheny River Valley in western New York. The nonglaciated area, called the Salamanca Re-entrant, is the northernmost area in the easter United States to escape Pleistocene glaciation. The Salamanca Re-entrant is bounded on the north, east and west by terminal moraines. Remnants of the Olean Terminal Moraine, which reflects the maximum southerly position of the ice sheet in this area, are found on the south bank of the Allegheny River in the vicinity of Olean.

The bedrock valley floor in the vicinity of Olean occurs as deep as 300 feet. The Bedrock consists of an Upper Devonian blue-green shale belonging to the Conewango Group.

Geologic and geophysical analysis of borehole data reveal that the upper 100 feet of sediment can be divided into 5 lithologic units, distinguished primarily on the basis of color, texture, grain size, and mode of deposition. These units are identified as Units A through E, from oldest to youngest (deepest to shallowest) and discussed below.

With the exception of Unit E, the sediments described are probably associated with a late Wisconsinian glaciation. At some time during this period, the edge of an ice sheet progressed southward down the Olean Creek and Haskell Creek Valleys. These ice lobes dammed the northward flowing Allegheny River, creating a lake in from of the ice sheet suitable for deposition of the glacio-lacustrine sediments, Unit A.

The lithology of Unit B is very similar to samples taken from an outcrop of the Olean Terminal Moraine south of the Allegheny River. The Olean Terminal Moraine has been mapped as a kame complex; therefore, deposition of Unit B is likely glacial outwash associated with the melting of large blocks of disintegrating (stagnant) ice. The unsorted sand, gravel, and silt portions of the unit may actually be a melt-out till, which has retained many of the material properties of the sediment derived from the glacial ice. The sandier lenses, some of which are stratified, either reflect channelized deposition from braided streams emanating from these ice blocks or kame-like cavity fillings.

The till unit (Unit C) is identifiable by its olive to olive-gray appearance and poorly sorted texture. Grain size curves, from wet sieve and hydrometer analysis, clearly distinguish Unit B as much coarser than Unit C with Unit C containing a large percentage (>50%) of silt and clay in addition to gravel and sands. Another distinguishing feature on this material is its high density, and as such, it may be a lodgment till, formed during a minor, local re-advance of ice, which entrained and subsequently deposited locally-derived siltstone and shale fragments that were consolidated by the weight of the advancing ice.

The sequence of sediments deposited above Unit C appears to be fluvial in origin, although the sequence can be subdivided into 2 units. Coarse sandy gravel directly overlying Unit C has been classified as glacio-fluvial materials, probably associated with decaying ice as the ice retreated from the Olean area (Unit D). Fine sands and silts and occasional clay or gravel deposits have been grouped as recent alluvium, implying deposition by modern river processes of the Allegheny River, Olean and Haskell Creeks (Unit E). Construction fill and waste materials have also been lumped into Unit E.

4.3 Site Hyrogeology

Hydrogeologic units are units of consistent hydraulic properties. They may be composed of one lithologic unit, a group of lithologic units, or parts of a unit. Consequently, lithologic and hydrogeologic units may not coincide.

The five lithologic units identified in the area have been grouped into four hydrogeologic units: an upper aquifer, a lower aquifer, an upper aquitard, and a lower aquitard. Unit D (glacial fluvial sands and gravel) and Unit E (recent fluvial deposits including fine sands and silts and some fill) comprising the Upper Aquifer, although local clay lenses may act as discontinuous semi-confining layers. Unit B (glacial outwash), combined with sandy lenses in the upper part of Unit A, forms the Lower Aquifer. Unit C (till, perhaps more specifically a lodgment till) comprises the upper aquitard, which separates the two aquifers. The layered glaciolacustrine silts and clays of Unit A form a lower aquitard beneath the Lower Aquifer separating this aquifer from the bedrock below.

4.4 Alcas Property Geology

Based on the results of the Alcas Property investigation the following reflects the current understanding of the geology at the Alcas facility. The Site geology generally follows the regional geology described in Section 4.2. At the Site, all five lithologic units have been identified. To illustrate the Site geology, three geological cross sections were constructed. The location of the cross sections is shown on Figure 4-1. The symbols representing the different stratigraphies used in the cross sections are shown on Figure 4-2. The lithologic units logged during this investigation are shown in Cross-Section A-A', B-B', and C-C' on Figures 4-3, 4-4, and 4-5, respectively.

The lowest geologic unit encountered during this investigation is the glacio-lacustrine clays (Unit A), situated below the glacial outwash unit (Unit B) at approximately 82 to 97 feet below land surface ("*bls*"). Based on the sieve analyses, the percentage of fines in this unit ranged from 97 to 100 percent silt and clay. Glacial outwash (Unit B) was encountered from approximately 25 to 35 feet bls, and where encountered, varies in thickness across the Site between 54 and 72 feet. This unit is very permeable, and yields significant quantities of water. Based on the historical sieve analyses, the percentage of sand in this unit ranged from 92 to 95 percent sand. The City Aquifer hydrogeologic unit is primarily contained within the glacial outwash geologic unit at the Site.

The overlying glacial till unit (Unit C) was encountered at approximately 0 to 12 feet bls, and varies in thickness across a majority of the Site between 16 and 29 feet. The overlying till unit was identified by its olive gray color and/or the gravel content. This unit contained 50 to 97 percent clay based on the historical sieve analyses. The thickness of this unit is highly variable across the Site. As shown on Cross-Section C-C', a thick (15 to 20 feet) silty sand sequence was observed in place of the till unit in soil borings across the southern portion of the Site. This thicker and coarser sequence of sediments may provide a preferential pathway for water and constituent migration. The Upper Aquitard hydrogeologic unit is primarily contained within the glacial till unit at the Site.

The fluvial sands and gravel (Unit D) and recent fluvial deposits (Unit E) units were encountered at or near surface, and vary in thickness across the Site between 0 and 12 feet. The Upper Water-Bearing Zone has been historically identified in these units during Site activities, primarily appearing as discontinuous, channelized stream deposits and fill material.

4.5 Alcas Property Hydrogeology

Based on the results of the Alcas Property investigation the following reflects the current understanding of the hydrogeology at the Alcas facility. The Site hydrogeology generally follows the regional geology described in Section 4.3. At the Site, all four hydrogeologic units have been identified, and are identified on the geological cross sections. The lowermost glacio-lacustrine clays (Unit A) form the Lower Aquitard beneath the City Aquifer separating this aquifer from the underlying bedrock. The glacial outwash unit (Unit B) combined with sandy lenses in the upper part of the glacio-lacustrine clays form the City Aquifer. The Upper Aquitard, which separates the two primary water-bearing units is generally comprised of the till unit (Unit C), perhaps more specifically a lodgment till. The fluvial sands and gravel (Unit D) and recent fluvial deposits (Unit E) comprise the Upper Water-Bearing Zone, although local clay lenses may act as discontinuous semi-confining layers.

At the beginning of the Remedy Update process, it was believed that D-2 was completed in the Upper City Aquifer. The well never produced much water, and could be bailed dry during the quarterly sampling events. The lack of production from D-2 raised some doubt that this well was completed in the Upper City Aquifer. It was believed that D-2 may have been completed too shallow. Alcoa drilled and installed RU-18 to better define the geology at and below D-2. RU-18 was completed 10 feet deeper than D-2. RU-18 and D-2 had similar water levels and both could be bailed dry during sampling. During this investigation, several Upper City wells were drilled and installed in a deeper zone within the Upper City Aquifer. It was discovered that the zone 10 to 30 feet below the Upper Water-Bearing Zone contained a significant amount of silt and clay mixed with the coarse sand. It is believed that the silt and clay in this zone reduces the hydraulic conductivity of the sediments resulting in significantly less flow in this zone. The new Upper City wells were screened below this interval with the exception of UC-2. The screened interval for D-2 and RU-18 and the stratigraphy of this region are shown in Figure 4-4. This zone contained no silt and clay, and was coarser grained than the interval screened by D-2 and RU-18. The production of water from these new wells was significantly higher, which better represents the yield from the Upper City Aquifer. It is believed that this 10-foot to 30-foot zone is part of a transitional area for the Upper City Aquifer, which is now referred to as the Transitional Zone.

In September 2007, groundwater levels were measured to construct potentiometric surface contour maps for the UWBZ and the City Aquifer. These contours were used to evaluate the impact of the City Production Wells 18M and 37/38M upon groundwater flow within those units. Groundwater levels were collected from all located wells at the Site and selected regional wells associated with the Olean Well Field Superfund Site. A summary of groundwater elevation data with well construction details is presented in Table 4-1.

The potentiometric surface for the lower portion of the City Aquifer wells is shown on Figure 4-6. Monitoring well CW-15 was utilized as a regional reference point for the groundwater levels in the lower City Aquifer. The contours show groundwater east of the Main Building flowing to the east toward City Production Well 18M. These figures show that City Production Well 18M captures groundwater east of the Main Building, with potential to capture groundwater up to and beyond the westward boundary of the Main Building, thus capturing affected groundwater in the City Aquifer. Groundwater contours generally indicate a steeper eastern trending gradient near 18M shallowing to the west towards CW-15. A divide for groundwater flow most likely occurs to the west of wells CW-15, BC-1, and BC-2. Groundwater west of the divide would be outside of the capture of 18M and would resume the regional groundwater flow to the west.

Table 4-1 Well Construction Details Alcas Cutlery Corporation Facility Site Olean, New York						
Well Number	Installation Date	Total Well Depth (ft. bls)	Top of Casing Elevation (ft. msl)	Screen Interval (ft. bls)	Water Level Elevations January 2005	Water Level Elevations September 2007
18M	2/28/74	75	1426.00	67-77	1402.00	1398.00
CW-15	6/16/84	76	1418.24	66-76	N.G	1401.85
CW-15A	6/16/84	40	1418.50	28-38	N.G	1406.19
CW-10	7/2/84	97	Unknown	84-97	N.G	N.G
CW-10A	7/2/84	34	Unknown	26-34	N.G	N.G
CW-13	7/20/84	97	1419.02	80-90	1406.29	1401.08
CW-13A	7/20/84	17	1419.72	7-17	N.G	1413.76
Alcas D-2	11/14/84	35	1426.60	30-35	N.G	1401.92
P-1	Unknown	18.3	1425.58	Unknown	N.G	1418.54
P-2	Unknown	9.65	1425.20	Unknown	N.G	1423.45
B-1	11/15/84	15	1428.43	10-15	N.G	1419.20
B-2	11/27/84	42	1427.65	30-35	N.G	1401.68
RU-1	9/28/00	32	1429.35	23-32	1417.78	1413.87
RU-2	9/28/00	29	1427.45	20-29	N.G	1401.49
RU-3	9/27/00	28	1428.72	19-28	1413.19	1409.86
RU-4	9/26/00	32	1424.88	19-28	1417.12	1412.84
RU-5	10/2/00	24	1424.48	15-24	1416.96	1412.77
RU-6	9/27/00	24	1424.95	15-24	1416.52	1412.71
RU-7	9/26/00	28	1429.10	19-28	1406.96	< 1401.54
RU-8	10/1/00	24	1423.92	13-24	N.G	1415.52
RU-9	9/29/00	17	1420.72	8-17	1419.15	1411.38
RU-10	9/30/00	17	1421.07	8-17	1419.10	1411.09
RU-11	9/30/00	19	1420.07	10-19	1418.13	1411.04
RU-12	9/29/00	13	1419.28	4-13	1419.28	1416.71
RU-13	9/5/01	20	1427.50	11-20	1424.80	N.G
RU-14A	9/6/01	13	1428.50	3-13	N.G	1420.56
RU-14B	9/5/01	25	1428.50	16-25	1413.56	1409.84
RU-15	9/6/01	16	1422.95	7-16	N.G	1414.33
RU-16	9/6/01	18	1419.56	9-18	N.G	N.G
RU-17A	9/6/01	13	1427.03	3-13	1419.84	1419.99
RU-17B	9/5/01	24	1426.77	15-24	N.G	1413.28
RU-17C	9/5/01	45	1427.09	35-45	N.G	1401.47
RU-18	9/7/01	43.8	1424.90	35-43.8	N.G	1401.36
SW-14	Unknown	19	1423.83	7-17	N.G	N.G
RW-1	Unknown	Unknown	1423.60	Unknown	N.G	N.G
VERMW-1	Unknown	Unknown	1424.36	Unknown	N.G	N.G
VERMW-2	Unknown	Unknown	1424.41	Unknown	N.G	N.G
VERMW-3	Unknown	Unknown	1424.00	Unknown	N.G	N.G
VERMW-4	Unknown	Unknown	1424.51	Unknown	N.G	N.G
UA-1	11/30/04	20	1420.27	5-20	1418.37	1413.50
UA-2	12/1/04	20	1419.87	5-20	1418.79	1410.63
UA-3	12/1/04	20	1419.29	5-20	1418.54	1410.55
UA-4	8/3/04	30	1430.54	20-30	1406.96	1401.50
UA-5	8/2/04	28	1428.08	18-28	1416.60	1412.80
UC-1	10/30/04	49	1419.38	39-49	1406.73	1401.22
UC-2	8/3/04	38	1429.50	28-38	1406.64	1401.59
UC-3	10/29/04	57.5	1419.31	47.5-57.5	1406.71	1401.11
UC-4	10/30/04	56	1424.76	46-56	1406.70	1401.27
UC-5	10/30/04	60	1429.61	50-60	1406.50	1401.09
BC-1	10/30/04	92	1419.44	82-92	1406.73	1401.20
BC-2	10/30/04	97	1427.08	87-97	1406.49	1401.38
BC-3	10/30/04	86	1419.20	76-86	1406.71	1401.11
BC-4	10/26/04	84	1424.86	74-84	1406.67	1401.23
BC-5	10/28/04	98	1429.72	88-98	1406.50	1401.11

"ft. bls" - estimated feet below land surface

N.G. - Not Gauged

The potentiometric surface for the upper portion of the City Aquifer wells is shown on Figure 4-7. A regional reference point for the groundwater levels in the upper City Aquifer was not available, however a comparison of paired wells suggest that the groundwater level in the upper portion of the City Aquifer follows a similar flow pattern to the lower portion of the City Aquifer. A comparison of these paired wells is presented in Table 4-2.

Table 4-2
Water Level Elevations by Pairing of City Aquifer Wells
Alcas Cutlery Corporation Facility Site
Olean, New York

Well Number	Water Level Elevation (ft., msl)	Well Number	Water Level Elevation (ft., msl)
UC-1	1401.22	UC-4	1401.27
BC-1	1401.20	BC-4	1401.23
UC-3	1401.11	UC-5	1401.09
BC-3	1401.11	BC-5	1401.11
RU-17C	1401.47		
BC-2	1401.38		

"ft." - feet
"msl" - mean sea level

Water levels in the upper portion of the City Aquifer are nearly the same or slightly higher than the lower portion of the City Aquifer for four of the five well pairs. Differences could easily be accounted for with measurement or instrument error. Given that the upper and lower portions of the City Aquifer have the same or nearly the same water-level elevations, the groundwater elevation in the upper portion of the City Aquifer near the location of monitoring well CW-15 should be similar if not slightly higher than the value in the lower portion of the City Aquifer. Given that CW-15 has a groundwater elevation of 1401.85, a similar or slightly higher groundwater elevation at this location in the upper portion of the City Aquifer would create a topographic contour high and establish a more defined eastern trending gradient towards 18M. This assumption would show that City Production Well 18M captures groundwater around the Main Building, with potential to capture groundwater up to and beyond the westward boundary of the Main Building.

Potentiometric surfaces for the lower and upper portions of the City Aquifer from 2005 are presented on Figures 4-8 and 4-9. Based on current and historical potentiometric surfaces, flow regimes in the upper and lower portions of the City Aquifer appear generally consistent between 2005 and 2007. This was expected since the City Production Wells have been in continuous service since 1990. Given that the City

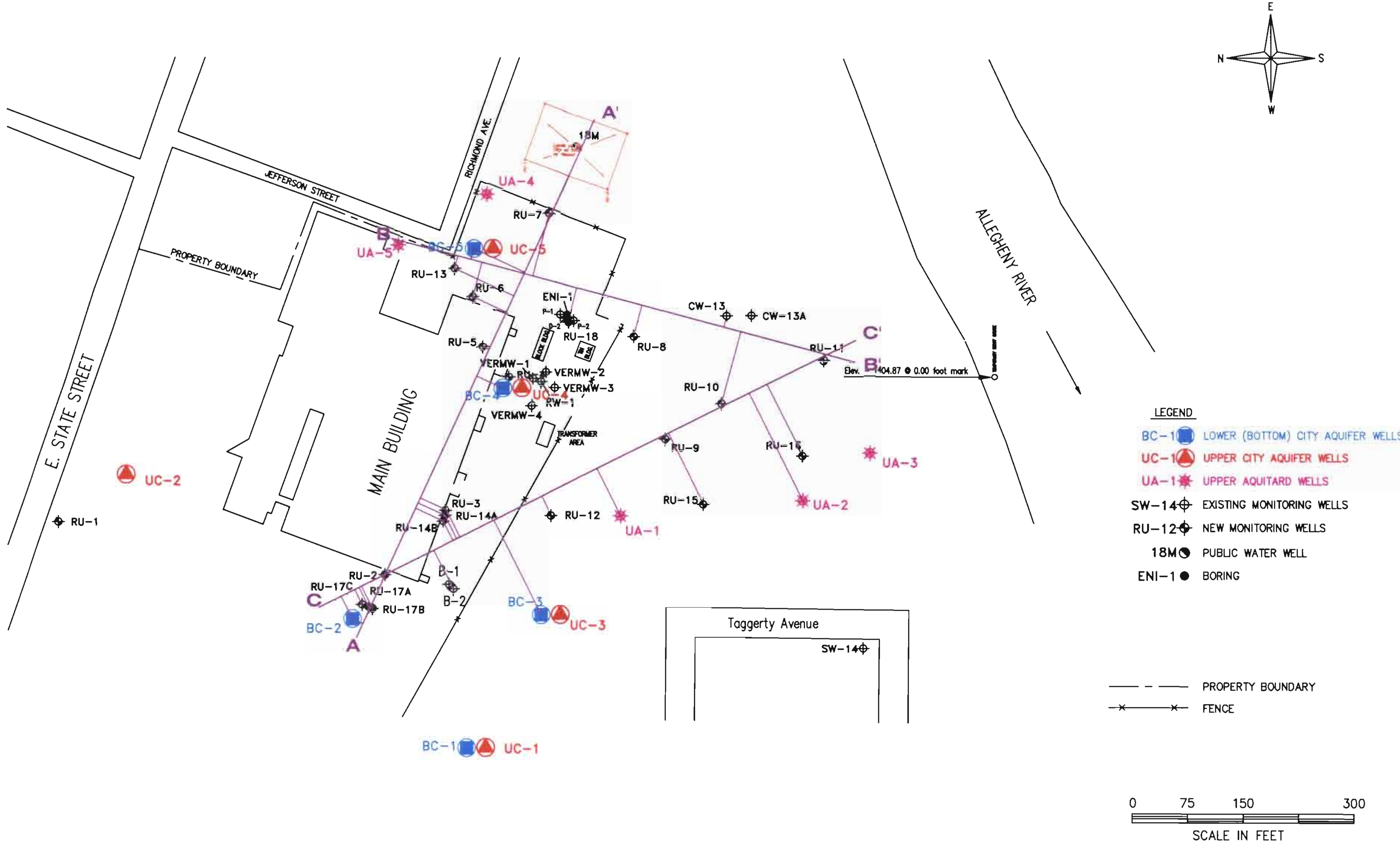
Production Wells have been pumping for the last 17 years, the flow regime in the City Aquifer has most likely reached steady state. This means that the shape of the contours in the City Aquifer will not change unless the pumping in City Production Wells 18M and 37/38M is reduced or stopped.

The potentiometric surface for the UWBZ wells is shown on Figure 4-10. Monitoring well CW-15A was utilized as a regional reference point for the groundwater levels in the UWBZ. The contours show groundwater on the east side of the building and under the building generally flowing to the east as affected by City Production Well 18M. Outside of the radius of influence of City Production Well 18M and south of the property, groundwater flow in the UWBZ generally trends towards the river.

Several anomalies exist in the UWBZ water levels. Monitoring wells RU-3 and RU-14B have historically shown low water-level elevations, and may be the result of limited surficial recharge due to the building. These wells also may have a limited hydraulic connectivity to the surrounding UWBZ due to an increased prevalence of silty to sandy clay between these wells and BC-3 and BC-4 to the south and east. A water level high was observed at monitoring well P-1, as well as a majority of wells south of the property. This high may be attributed to the combining effects of long term pumping from 18M and the lack of surficial recharge via infiltration due to buildings and asphalt versus grass covered areas to the south.

Historical potentiometric surface maps have also shown a component of flow in the UWBZ toward the river. A potentiometric surface for the UWBZ from 2005 is presented on Figures 4-11. Based on current and historical potentiometric surfaces, flow regimes in the UWBZ appear generally consistent between 2005 and 2007. Outside of the radius of influence of City Production Well 18M, groundwater flow in the UWBZ generally trends towards the river.

Due to the water level highs south of the property and the localized depression under the building, UWBZ groundwater flow from under the building is generally towards the City Production Well 18M.



Notes:

This plat was completed on Oct 12, 2000
from an instrument survey on Oct. 6, 1999 & Oct2 & 4, 2000.
2000 Robert C. Ackerman, P.L.S No. 49845

All elevations were taken on the top of the 2" PVC pipe casing around the 1" PVC well pipe and were marked thereon with a black marker pen.

Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

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FIGURE 4-1

LINES OF GEOLOGIC CROSS SECTIONS

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO. 137-20

E1372004

1. PAVEMENT, CONCRETE, &/OR FILL
2. SILTY CLAY
3. SILTY CLAY W/GRAVEL
4. SILTY, SANDY CLAY
5. SANDY CLAY
6. CLAYEY SAND
7. SILTY SAND
8. CLAY W/GRAVEL
9. CLAYEY SILT
10. GRAVEL
11. GRAVEL W/SAND & SILT
12. SHALE
13. SANDY CLAY W/ GRAVEL
14. CLAYEY SILT W/ GRAVEL
15. SAND W/GRAVEL & SILT
16. CLAY W/GRAVEL & SAND
17. SILT W/GRAVEL
18. CLAY
19. GRAVEL W/CLAY
20. SAND
21. SILT
22. SILTY CLAYEY SAND W/GRAVEL
23. SAND W/GRAVEL
24. GRAVEL W/SAND
25. SILTY CLAYEY GRAVEL
26. GRAVELLY SAND
27. SILTY SANDY GRAVELLY CLAY
28. SILTY CLAYEY SANDY GRAVEL
29. CLAYEY SANDY GRAVEL
30. SANDY SILT

NOT TO SCALE

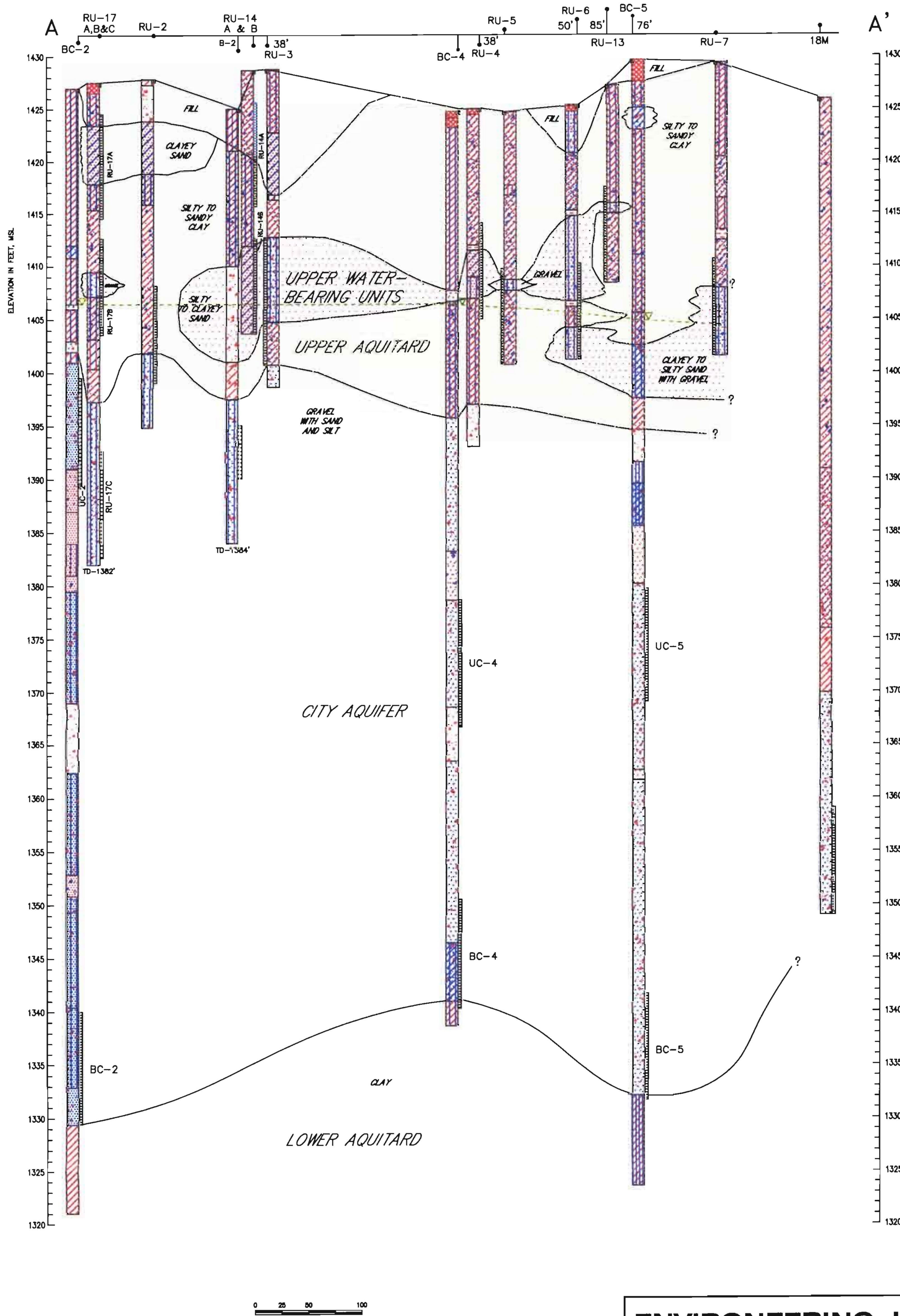
NOTE:
RED INDICATES PREDOMINANT LITHOLOGY.
BLUE INDICATES SECONDARY LITHOLOGY.

ENVIRONEERING, INC.

FIGURE 4-2
STRATIGRAPHIC COLUMN DESCRIPTIONS

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.



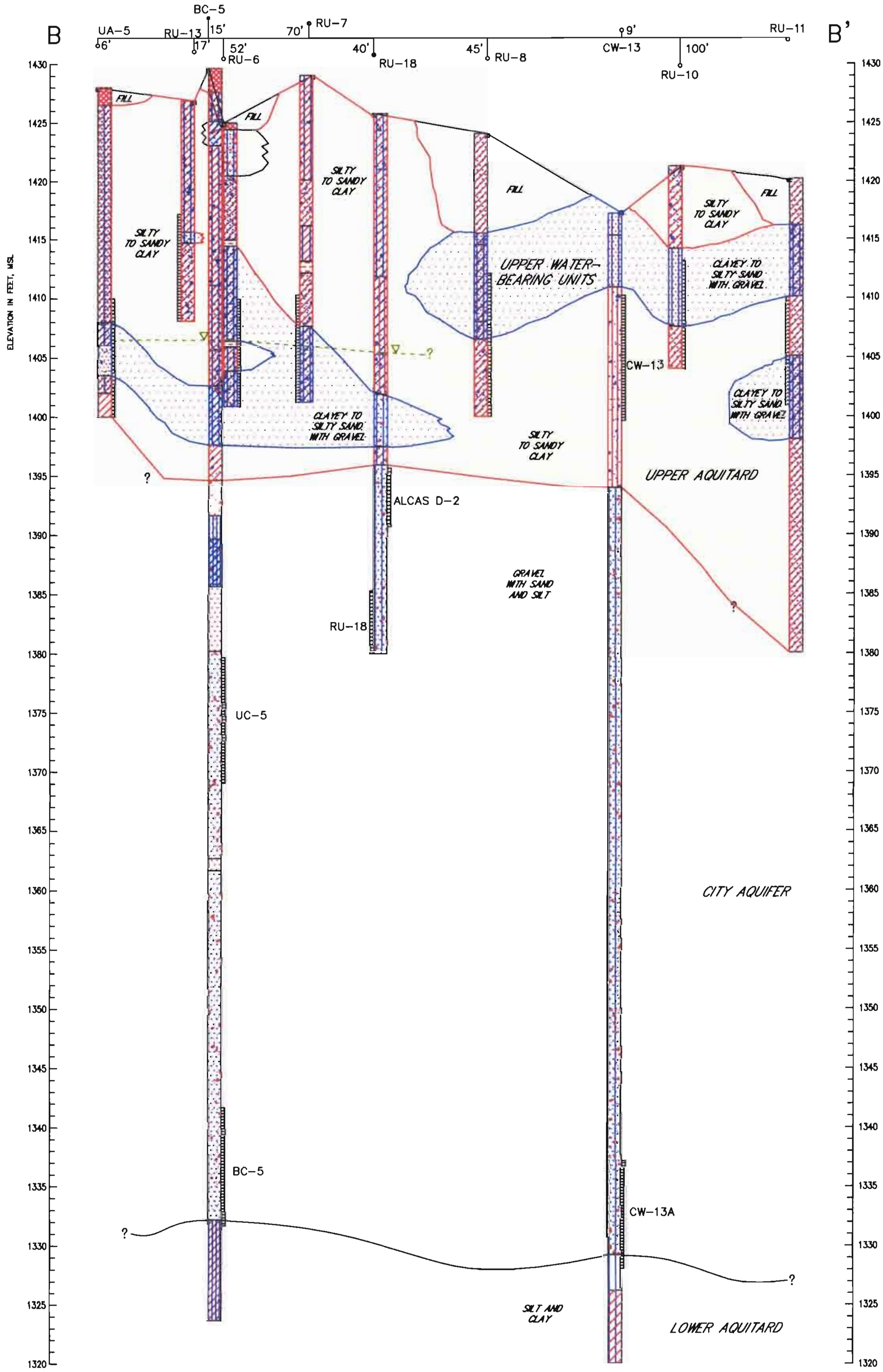
NOTE:
RED INDICATES PREDOMINANT LITHOLOGY.
BLUE INDICATES SECONDARY LITHOLOGY.
GREEN INDICATES UPPER CITY AQUIFER POTENTIOMETRIC SURFACE.

ENVIRONEERING, INC.

FIGURE 4-3
GENERALIZED GEOLOGIC CROSS-SECTION A – A'
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.

E1371516



NOTE:
RED INDICATES PREDOMINANT LITHOLOGY.
BLUE INDICATES SECONDARY LITHOLOGY.
GREEN INDICATES UPPER CITY AQUIFER POTENTIOMETRIC SURFACE.

ENVIRONEERING, INC.

FIGURE 4-4
GENERALIZED GEOLOGIC CROSS-SECTION B – B'
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.

E1371516

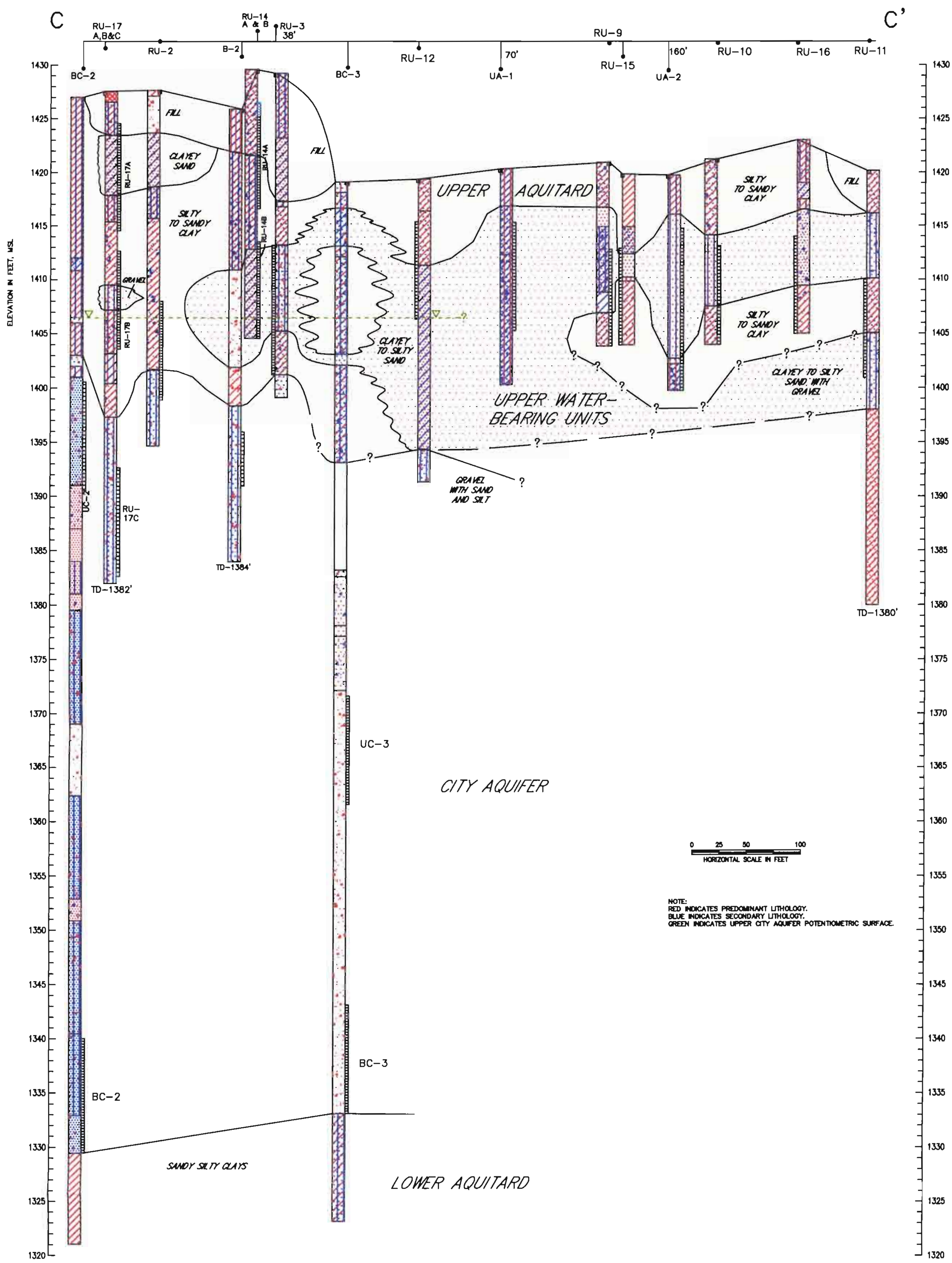


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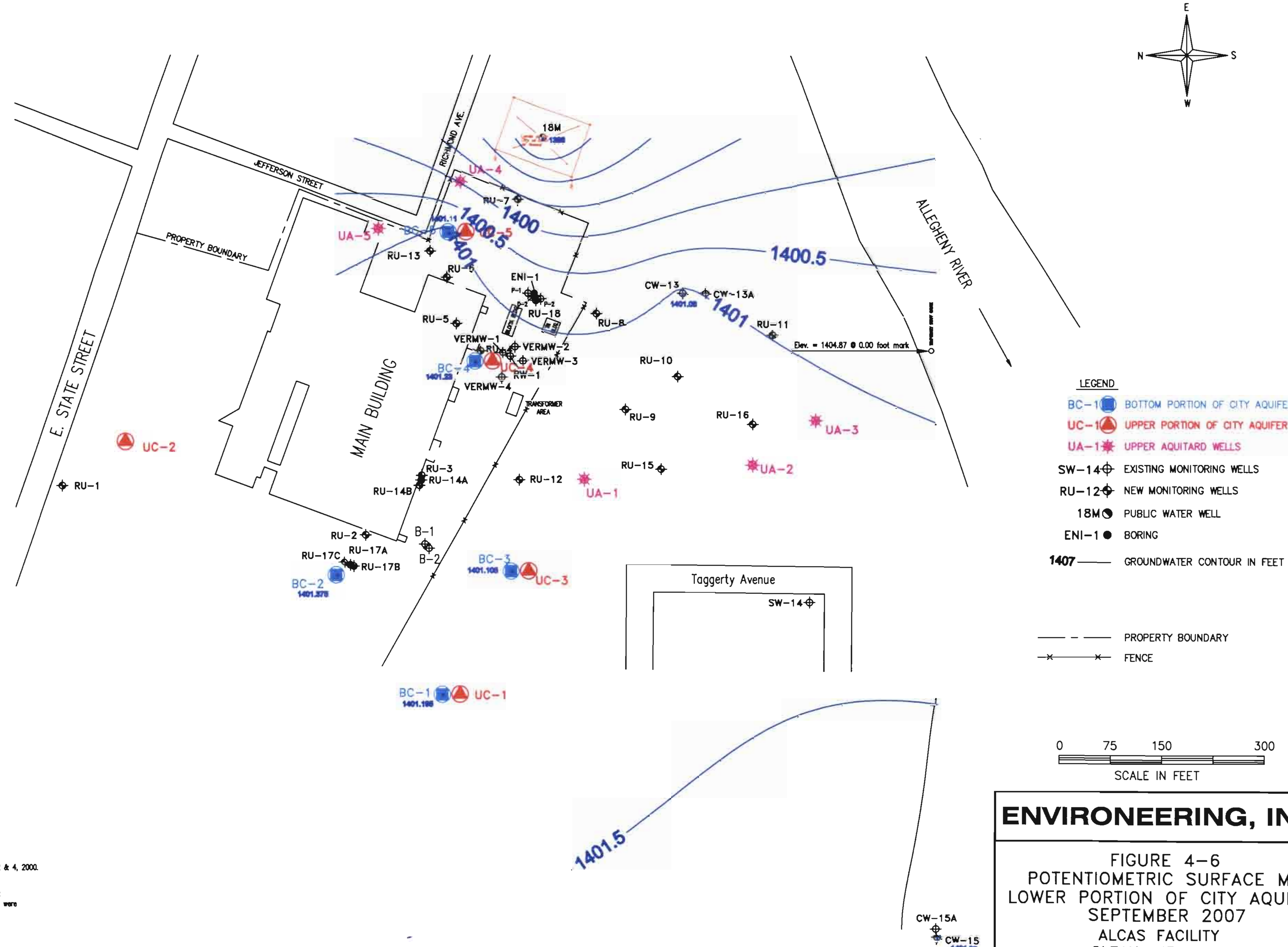
FIGURE 4–5
GENERALIZED GEOLOGIC CROSS–SECTION C – C'
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.



Notes:

This plot was completed on Oct 12, 2000 from an instrument survey on Oct. 6, 1999 & Oct2 & 4, 2000. 2000 Robert C. Ackerman, P.L.S No. 49845

All elevations were taken on the top of the 2" PVC pipe casing around the 1" PVC well pipe and were marked thereon with a black marker pen.

Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

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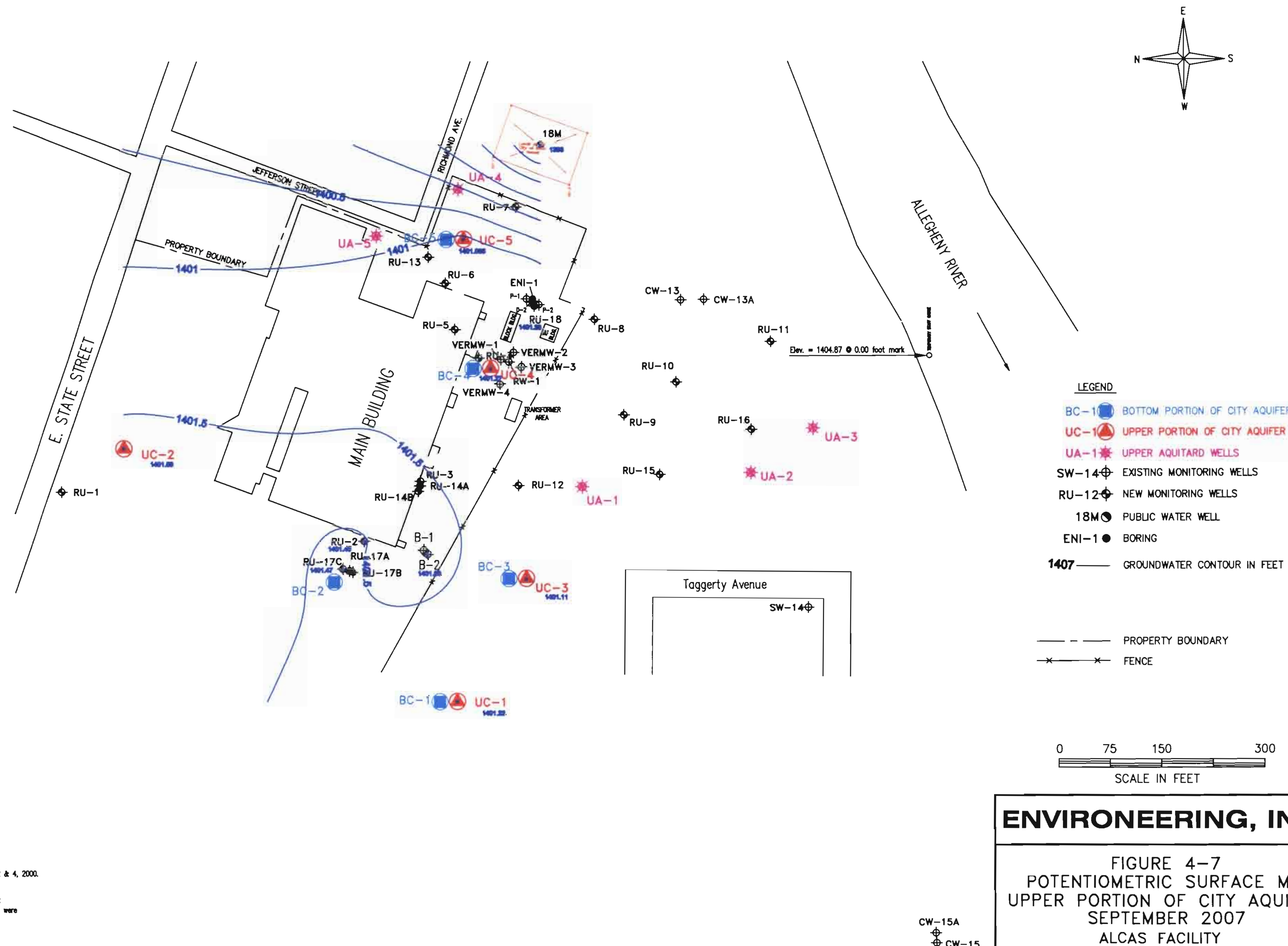
FIGURE 4-6
POTENTIOMETRIC SURFACE MAP
LOWER PORTION OF CITY AQUIFER
SEPTEMBER 2007
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE: Sept 2007	PROJ. NO.

E1372004



Notes:

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Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

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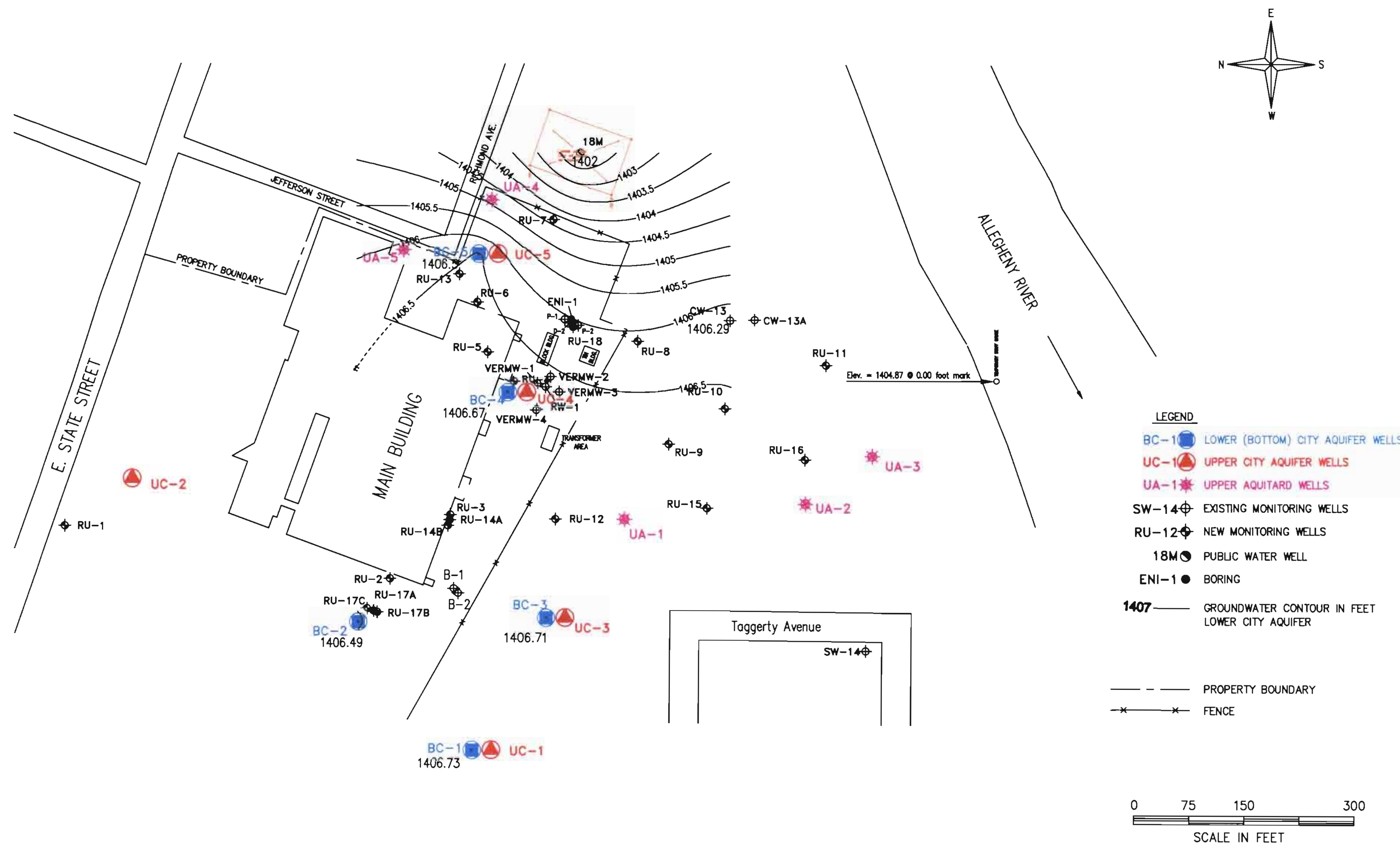
FIGURE 4-7
POTENTIOMETRIC SURFACE MAP
UPPER PORTION OF CITY AQUIFER
SEPTEMBER 2007
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE: Sept 2007	PROJ. NO.

E1372004



Notes:

This plat was completed on Oct 12, 2000 from an instrument survey on Oct. 6, 1999 & Oct2 & 4, 2000. 2000 Robert C. Ackerman, P.L.S No. 49845

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Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

CW-15A

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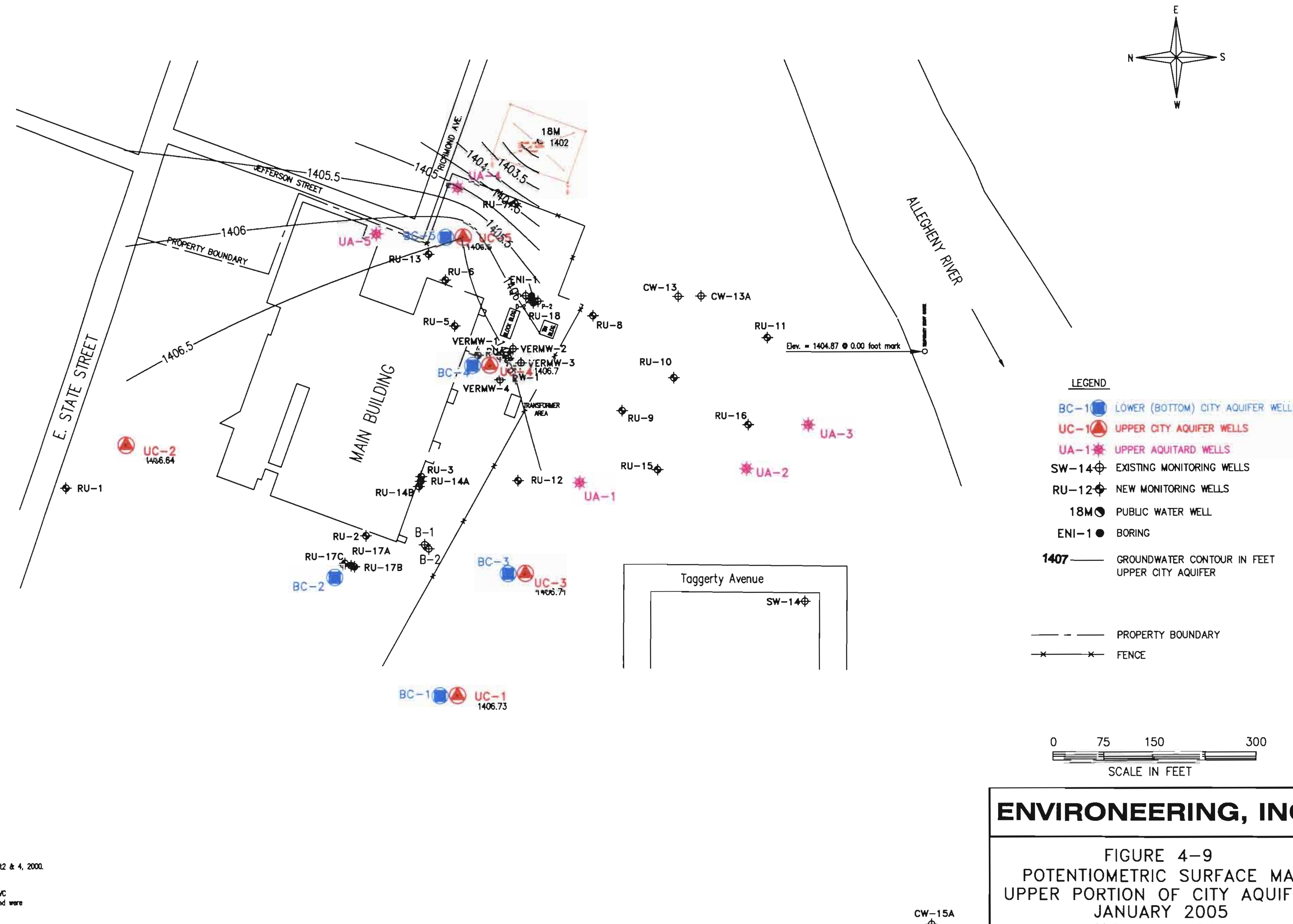
FIGURE 4-8
POTENTIOMETRIC SURFACE MAP
LOWER PORTION OF CITY AQUIFER
JANUARY 2005
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.

E1372004



Notes:

This plat was completed on Oct 12, 2000
from an instrument survey on Oct. 6, 1999 & Oct2 & 4, 2000.
2000 Robert C. Ackerman, P.L.S No. 49845

All elevations were taken on the top of the 2" PVC pipe casing around the 1" PVC well pipe and were marked thereon with a black marker pen.

Elevation datum from the City of Olean,
Engineering Office, Olean, NY. Base being USGS.

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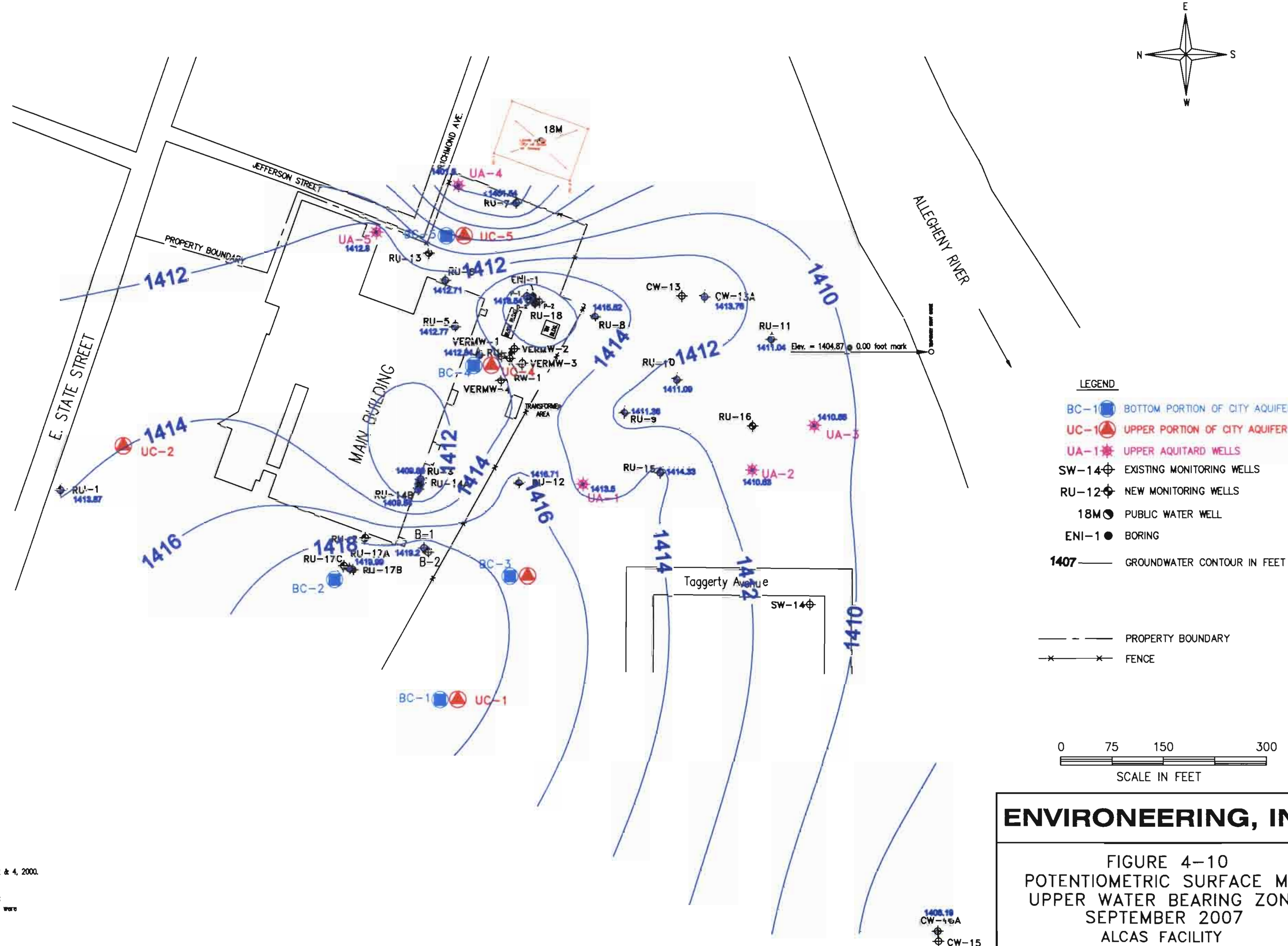
FIGURE 4–9
POTENTIOMETRIC SURFACE MAP
UPPER PORTION OF CITY AQUIFER
JANUARY 2005
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.

E1372004



Notes:

This plat was completed on Oct 12, 2000
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2000 Robert C. Ackerman, P.L.S No. 49845

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Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

E1372004

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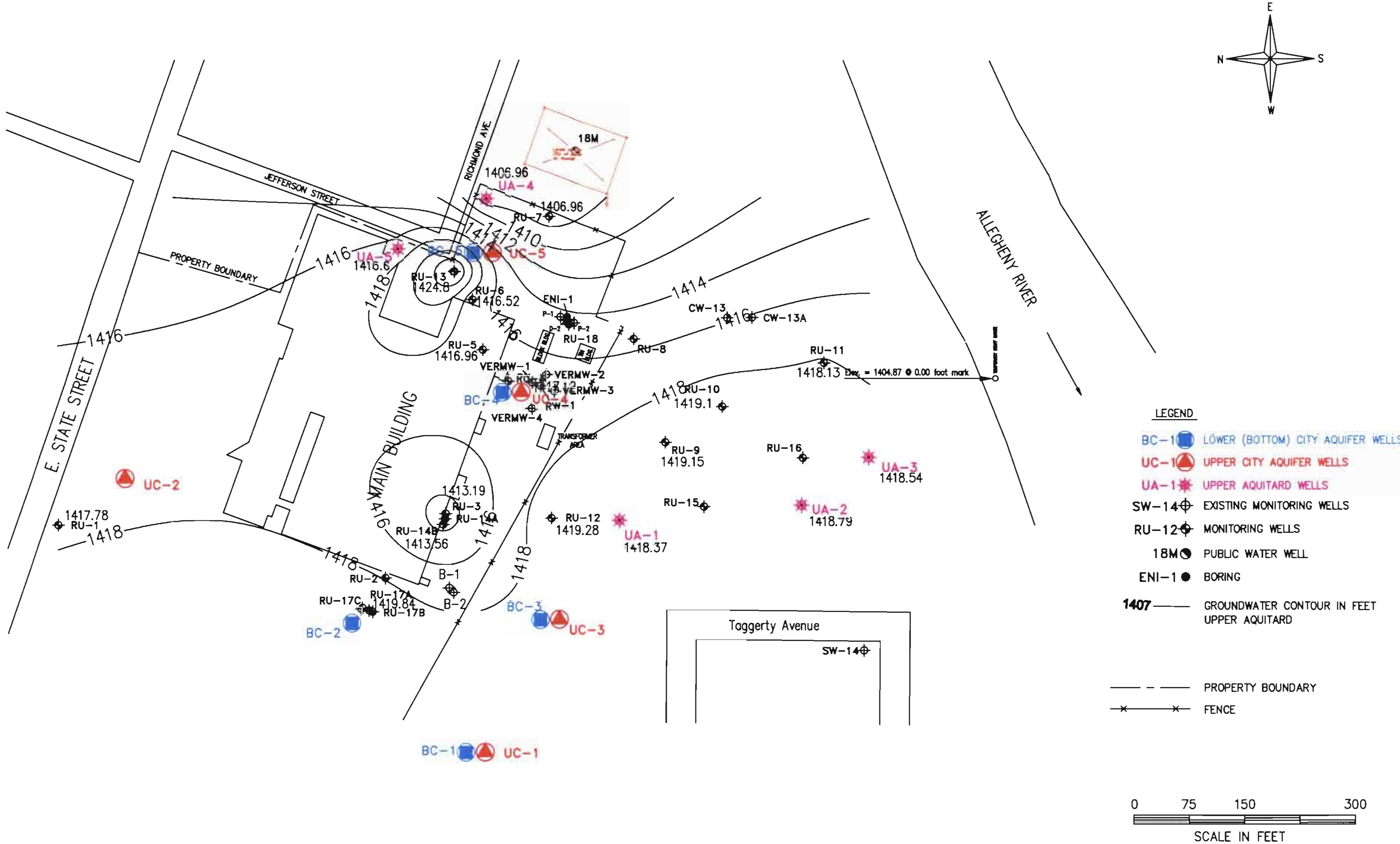
FIGURE 4-10
POTENTIOMETRIC SURFACE MAP
UPPER WATER BEARING ZONE
SEPTEMBER 2007
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE: Sept 2007	PROJ. NO.



Notes:

This plat was completed on Oct 12, 2000
from an instrument survey on Oct. 6, 1999 & Oct2 & 4, 2000.
2000 Robert C. Ackerman, P.L.S No. 49845

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pipe casing around the 1" PVC well pipe and were
marked thereon with a black marker pen.

Elevation datum from the City of Olean,
Engineering Office, Olean, NY. Base being USGS.

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FIGURE 4-11
POTENTIOMETRIC SURFACE MAP
UPPER WATER BEARING ZONE
JANUARY 2005
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO. 137-20

E1372004

5.0 Nature and Extent of Site Impacts

With the information collected from investigations conducted since the issuance of the OU2 ROD, a more comprehensive and site-specific evaluation of the nature and extent of impacted media at the Alcas Property can be made.

5.1 Summary of Nature and Extent of Affected Media and Source Areas at the Alcas Property

In 2006, the USEPA requested a comprehensive data deliverable displaying current and historical data for the Site. BHE Environmental, Inc., in conjunction with ENI, developed a georeferenced database containing available current and historical data. Using ESRI's ArcGIS, a published map file ("pmf") was constructed from the database and a georeferenced aerial photograph. The pmf is viewable using ESRI's ArcReader, which provides basic tools for map viewing, printing and simple querying of spatial data. ArcReader is available for free download (http://www.esri.com/software/arcgis/arcreader/). System requirements are available on the ESRI website.

To access the pmf, move the entire "Olean Published Map File" file directory from the enclosed compact disc onto your computer system. The folder organization of the map document and its components must be preserved in order for the map to function correctly. The map doesn't store the spatial data displayed on it. Instead, it stores references to the location of these data sources—for example, geodatabases, coverages, shapefiles. To open the pmf, navigate to the pmf file using Windows Explorer then double-click the map file. If you already have ArcReader running, you can open it directly within that session using the file browser.

The pmf will open and display table of contents on the left and the data frame on the right. The table of contents shows the operator what layers the map contains and how the map symbolizes the geographic features in those layers. When viewing a map, the operator will use the table of contents primarily to toggle layers on and off. On the enclosed map, location labels will not appear on the data frame unless the operator is zoomed in closer than 1:1,500. Under the "View" pull-down menu, ArcReader provides two different ways to view a two-dimensional map: Data View and Layout View. The Data View allows the operator to browse geographic data on your map and has an easier use of the zoom feature and a wider viewing area. The Layout View displays a virtual page showing all the map elements and data frames and is more ideal for printing purposes. In Layout View, the scale is dynamic and will adjust its division value as the operator zooms in and out of the drawing.

The Identify tool can be used to bring up attribute information for each sample point. The attribute information will appear in a pop-up window organized by analyte. The window may display more than one record bearing the same analyte name, which would represent samples taken on different days. In addition, by using the drop down menu within the Identify tool, the operator can specify whether the operator would like attributes from the top layer, visible layers, or all layers. If the operator selects "samples", the operator will be able to access all sample points taken at that geographic location for each type of sample (e.g. soil, groundwater, soil gas).

Additional information about navigating and querying a pmf as well as printing the pmf can be found the ArcReader Help file, which can be accessed from the "Help" pull-down menu or using the F1 key.

5.1.1 Soil Gas

The Phase 2 investigation activities included a screening-level passive soil gas survey. Passive soil gas detectors were installed on approximate 100-foot center grid pattern throughout the area south of the main plant building. The investigation indicated the presence of vapor phase mass of chlorinated compounds (PCE, TCE, and DCE) at the Alcas site. One area identified was immediately west of the Main Building extending southeasterly to the corner of the property. A second area noted was a narrow band from just east of the southwest corner of the plant building extending southerly to the property line. These two areas are indicative of vapor phased derivatives from unsaturated source areas and/or dissolved phase transport in groundwater. The directions of the two bands of soil gas that extend in a north to south direction, south of the building, appear to follow the upper zone groundwater flow direction.

5.1.2 Soil Data

Several of the early investigations at the site involved the collection of soil samples from the southern/southeast portion of the site. The location and results from these borings are provided on the accompanying "pmf" file. As shown in the figure, this area of the site has impacted soils from near surface to a depth of approximately 36 feet below grade. These data indicate that the soils in this area are affected. However, the concentrations in the soil samples do not indicate residual DNAPL in this portion of the site. It is possible that some of the affected soils may be associated with small, nearby releases (*i.e.*, weed killing activities). The overall soil data are more indicative of impacts associated with the transport of phase derivatives originating from DNAPL zones.

Varying concentrations of COCs were detected in the soil samples collected from the borings installed within the Main Building. Most of the low concentrations of COCs identified are likely associated with the migration of gaseous vapors through the subsurface. However, concentrations of TCE as high as 280 milligrams per kilogram (mg/kg) were detected in boring B-3.

The current method of assessing the presence of residual DNAPL using concentrations in soil samples is based on soil/water partitioning relationships. The partitioning calculation tests the assumption that all organics in the subsurface are either dissolved in groundwater or adsorbed to soil. If the calculation results in dissolved phase concentrations that are greater than the effective solubility or pure phase solubility, then

DNAPL presence is likely in the area of the sample[1]. An example of the calculation for the highest concentration detected during from the indoor borings is shown:

Partitioning Equation – $C_w = (C_t \times \rho b) \div ((Kd \times \rho b) + \theta_w + (Hc \times \theta_a))$; where,

C_w = theoretical pore water concentration assuming no DNAPL (mg/l)
C_t = measured concentration of organic compound in soil (mg/kg)
ρb = dry bulk density of the soil (typical range from 1.8 to 2.1 kg/l)
Kd = partition coefficient between pore water and soil = $K_{oc} \times f_{oc}$
K_{oc} = organic carbon-water partition coefficient
f_{oc} = fraction of organic carbon in soil (mg/mg)
θ_w = water-filled porosity of soil
H_c = Henry's Law Constant
θ_a = air-filled porosity of soil

C_w is then compared to the pure phase solubility (S_i) of TCE, to assess the likelihood of DNAPL being present in the area of the sample. (The S_i of TCE is 1,100 mg/L.)

C_t = 280 mg/kg = the maximum concentration detected in the soil samples
ρb = 1.86 kg/l = bulk density value in the typical range
K_{oc} = 125.9 for TCE (from the literature)
f_{oc} = 0.001 = the estimated organic content of soil in non-impacted area
Kd = 125.9 x 0.001 = 0.126
θ_w = 0.184 = minimum porosity value determined from the soil samples
Hc = 0.163 for TCE (from the literature)
θ_a = 0.2 estimated air porosity
Therefore, the worst case, theoretical pore water concentration is determined:
C_w = (280 x 1.86) ÷((0.126 x 1.86) + 0.184 = (0.163 x 0.2)) = 1,155 mg/L

C_w (1,155 mg/L or 1,155,000 μg/L) > S_i for TCE (1,100 mg/L or 1,100,000 μg/L); therefore suggesting the presence of a residual DNAPL in the area of the soil sample.

This concentration represents the highest soil sample concentration of TCE detected at the site to date. The presence of this concentration of TCE beneath the building further substantiates the hypothesis that the DNAPL source area is under the building.

5.1.3 Groundwater Data

In 2004, vertical profiling of the groundwater at the site was conducted. Groundwater samples were collected at 10 foot intervals from two borings at depths ranging from approximately 30 feet to approximately 100 feet below grade.

[1] R.M. Cohen and J.W. Mercer, DNAPL Site Evaluation, R.S. Kerr Environmental Research Laboratory, U.S. EPA, Ada, OK, John Matthews-EPA Project Officer, C.K. Smoley, Boca Raton, Florida, 1993. (*Section 7, pages 7-1 through 7-11*

Boring BC-4 was located south/southwest of the Main Building, adjacent to the old loading dock. In boring BC-4, concentrations of TCE gradually decrease from 13 μg/L at the 31-36 foot interval to 2.2 μg/L at 81-86 feet. Low-level concentrations of PCE are seen throughout the formation, ranging from 0.19 μg/L to 0.59 μg/L.

Boring BC-5 was located directly in line from the suspected source zone to the City Well 18M. Laboratory analytical results indicate that TCE was detected at its highest concentration (1,300 μg/L) in the 41-46 foot interval and decreases to a concentration of 3.5 μg/L at the lower portion of the City Aquifer in the 101-106 foot interval.

Of the COCs at the site, TCE and PCE were the most prevalent. The profile data shows the TCE as a continuous release into the City Aquifer coinciding with the bulk of the solvent migrating vertically from beneath the building through the UA then traveling horizontally. Profiling samples from the bottom of the City Aquifer provide a characterization of water quality and determine that no free DNAPL existed at the bottom of this unit. Results suggest that the source of the material impacting 18M originates as a residual DNAPL in the Upper Aquitard not as a "pooled DNAPL" in the City Aquifer.

5.1.3.1 Upper Water Bearing Zone

The sampling results show several key components of the plume distribution at the Alcas facility. The wells around the southeast corner of the building (RU-4, RU-5, and RU-6) have TCE concentrations that exceed 1 percent of the solubility of TCE in water (solubility limit). This indicates that at or upgradient of this location is a DNAPL source. This places the likely source of DNAPL under the building.

The dissolved-phase plume extends from the southeast corner toward the river generally to the south. This direction of contaminant migration resulted from the periods before Well 18M was installed and during the shutdown of 18M during the 1970s. During the 1960s and post 1980, a portion of the groundwater flow is toward 18M. The portion of the site that has flow toward 18M in the Upper Water Bearing Zone is from under the eastern half of the building and between RU-8 and RU-9. The groundwater concentrations are decreasing from the building toward the east with TCE concentrations in RU-8 and RU-9 at 360 μg/L and 5.9 μg/L, respectively. Closer to the river, the TCE concentration increases to 2,800 μg/L in RU-10. This higher concentration in RU-10 may represent the migration of TCE prior to the installation of the 18M and during the shutdown of 18M during the 1970s. Once 18M was restarted, the TCE in the vicinity of RU-10 was outside the influence of 18M. Lower concentrations of TCE near RU-8 are likely a result of the continuous pumping of 18M since 1980. TCE isoconcentration contours in the UWBZ are included in Figure 5-1

The extent of affected groundwater has been delineated in the Upper Water Bearing Zone except for a small area around RU-13, which has a groundwater high believed to be caused by a leak in a utility line.

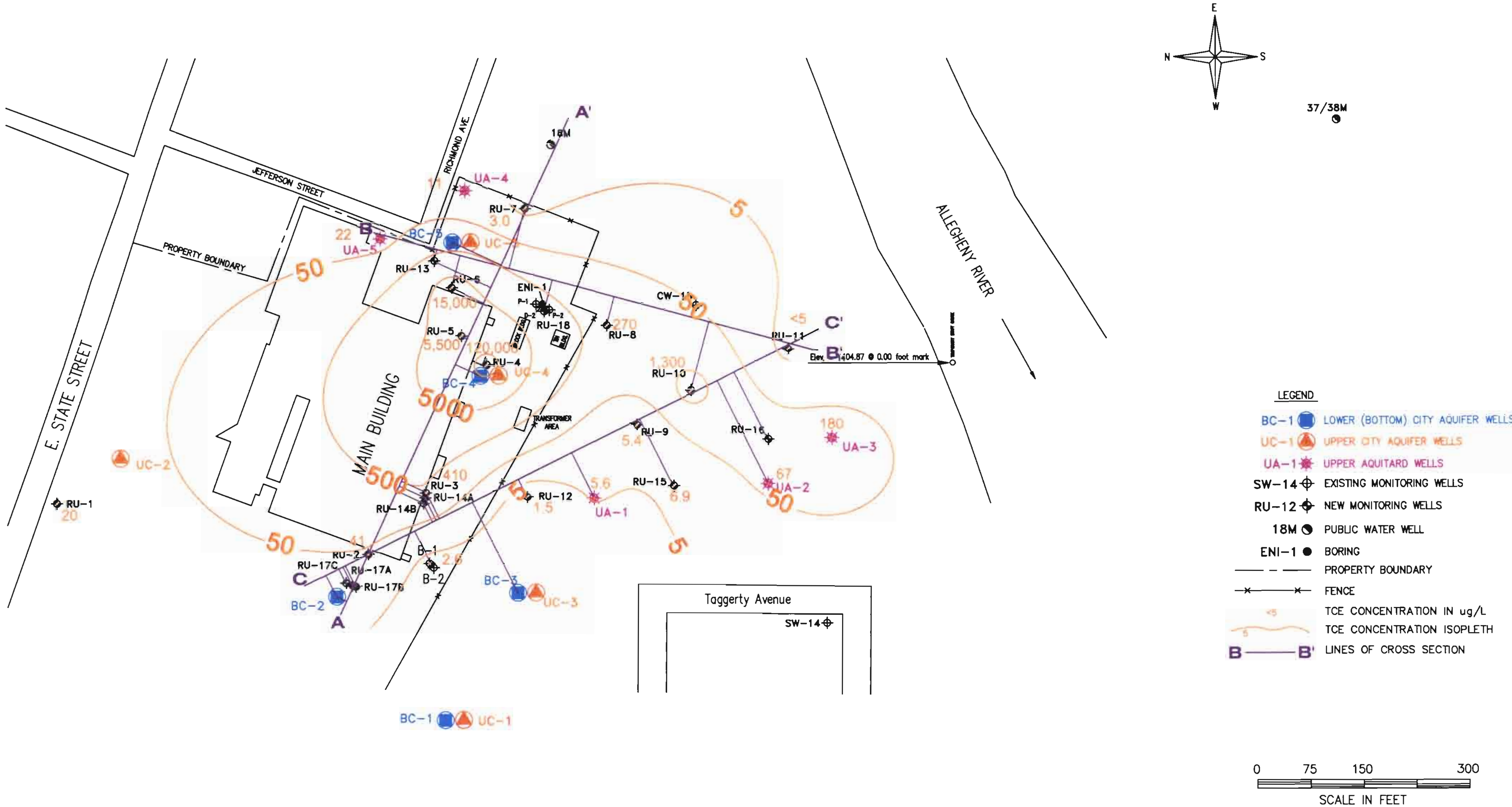
5.1.3.2 City Aquifer

The top of the City Aquifer is generally located 25 to 35 feet below grade in the western portion of the Site, dipping to the east and south. To assist in the assessment of groundwater quality in the upper portion of the City Aquifer, five monitor wells (UC-1 through UC-5) were installed on the Alcas property. To assess groundwater quality in the lower portion of the City Aquifer, five monitor wells (BC-1 through BC-5) were installed on the Alcas property. Groundwater quality profiling was conducted during the installation of borings BC-4 and BC-5 to the bottom of the City Aquifer. The results from the profiling helped to assess water quality and to determine the absence of DNAPL. In addition, monitor wells D-2, CW-13, B-2, RU-17C, RU-18 and UC-1 through UC-5 have been used to assess the impact to the upper portion of the City Aquifer. The location and results from the sampling of these wells are provided on the accompanying "pmf" file (pmf File included previously on February 8, 2008).

City well 18M is located east of the Alcas facility. TCE concentrations in 18M range from approximately 9 to 260 μg/L. A time trend plot of Well 18M's influent TCE concentration over the past nineteen years is shown on Figure 5-2. Wells screened in the upper portion of the City Aquifer (UC-1 through UC-5) contain TCE concentrations ranging from 6.9 μg/L in UC-1 to 64 μg/L in UC-5. TCE isoconcentration contours in the Upper City Aquifer are included in Figure 5-3.

In the lower portion of the City Aquifer, no detectable concentrations of TCE above the drinking water standard were observed in the last round of ground-water sampling (Sept 2007). Historically, CW-13 and BC-5 have detected TCE at concentrations of 9.3 μg/L and 5.3 μg/L. Also, groundwater profiling samples taken from the borehole of BC-5 observed TCE concentrations ranging from 1,300 μg/L at 41' to 46' feet below ground surface (bgs) to 3.5 μg/L at 101' to 106' bgs. Vertical TCE concentration profile are shown in cross-sectional Figures 5-4, 5-5, and 5-6.

In 1991, the EPA issued unilateral administrative order OU1 to the PRPs. As part of the OU1 order, EPA required groundwater samples be collected from selected wells around the Olean Well Field on a quarterly and semi-annual basis. Alcas D-2 and CW-13 are the two closest wells to the Alcas facility. D-2 has an average concentration of approximately 13,000 μg/L, and CW-13 has an average concentration of approximately 10 μg/L. The concentration of TCE in these wells has remained relatively unchanged for the past 12 years. Indicating that while 18M is in operation, a stable plume exists in the City Aquifer. To illustrate the plume stability, Figures 5-7 and 5-8 plot historical TCE concentrations in wells D-2 and CW-13.



Notes:

This plot was completed on Oct 12, 2000 from an instrument survey on Oct. 6, 1999 & Oct2 & 4, 2000. 2000 Robert C. Ackerman, P.L.S No. 49645

All elevations were taken on the top of the 2" PVC pipe casing around the 1" PVC well pipe and were marked thereon with a block marker pen.

Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

NOTE:

ALL MONITOR WELLS WITH THE EXCEPTION OF RU-7 AND UA-4 WERE SAMPLED IN SEPTEMBER 2007. WELLS RU-7 AND UA-4 WERE DRY DURING THE SEPTEMBER 2007 SAMPLING EVENT. HISTORICAL ANALYTICAL DATA WAS UTILIZED FOR CONTOURING PURPOSES.

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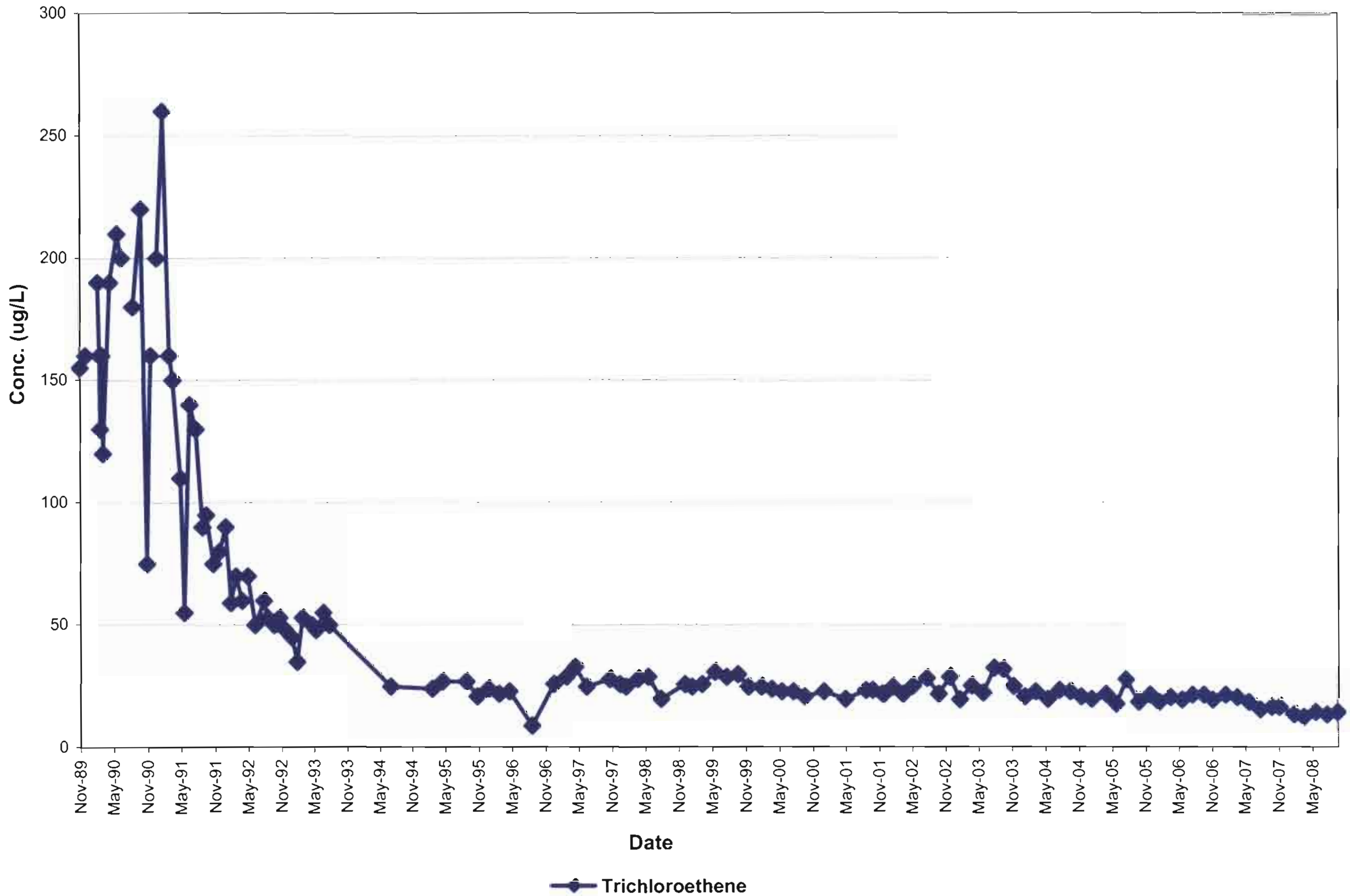
FIGURE 5-1

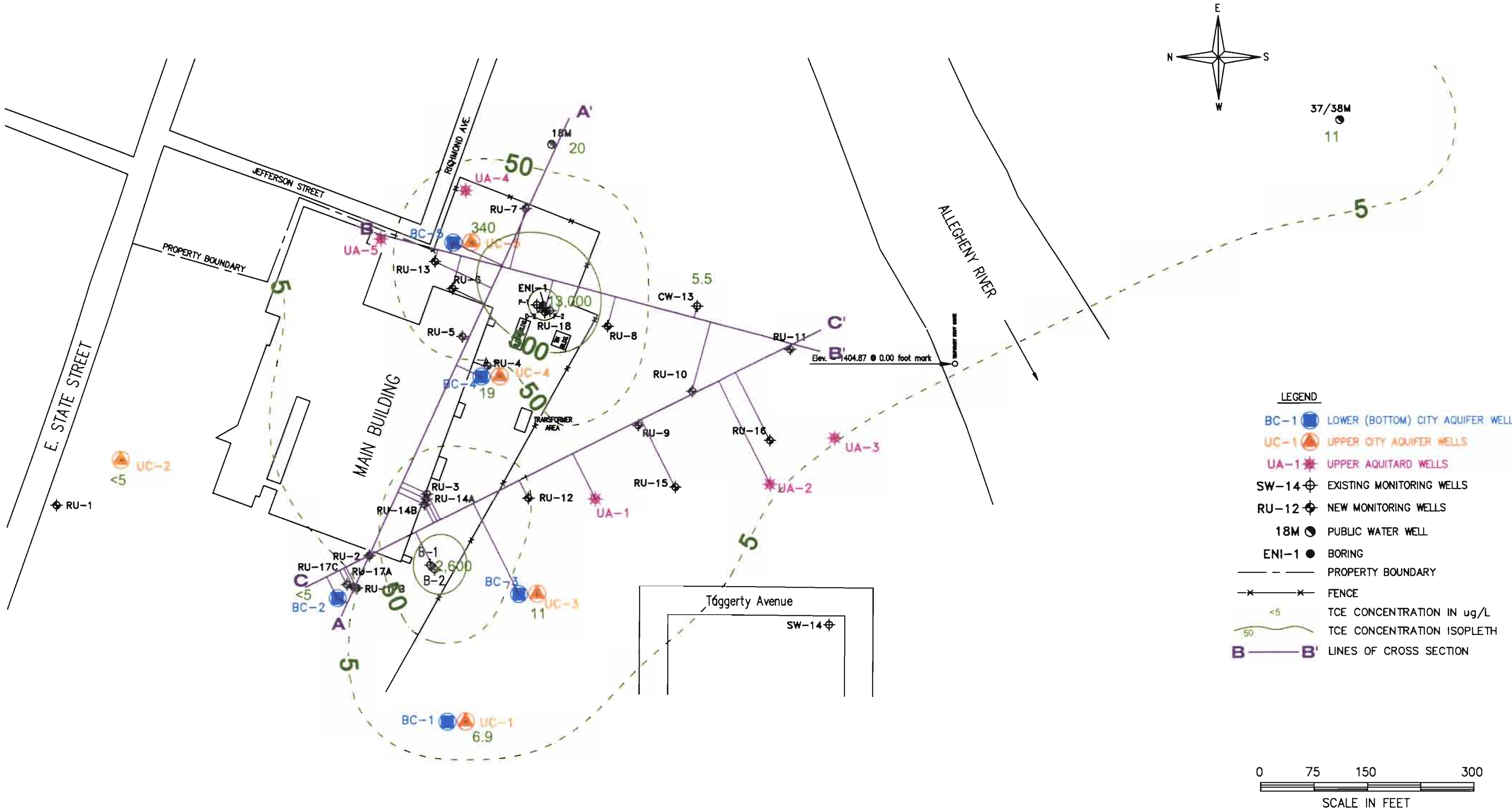
TCE IN THE UPPER WATER BEARING ZONE & LINES OF CROSS SECTION

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO. 137-20

Figure 5-2
Well 18-M TCE Influent Concentration
Time Trend Plot





Notes:

This plot was completed on Oct 12, 2000 from an instrument survey on Oct. 6, 1999 & Oct2 & 4, 2000. 2000 Robert C. Ackerman, P.LS No. 49845

All elevations were taken on the top of the 2" PVC pipe casing around the 1" PVC well pipe and were marked thereon with a black marker pen.

Elevation datum from the City of Olean, Engineering Office, Olean, NY. Base being USGS.

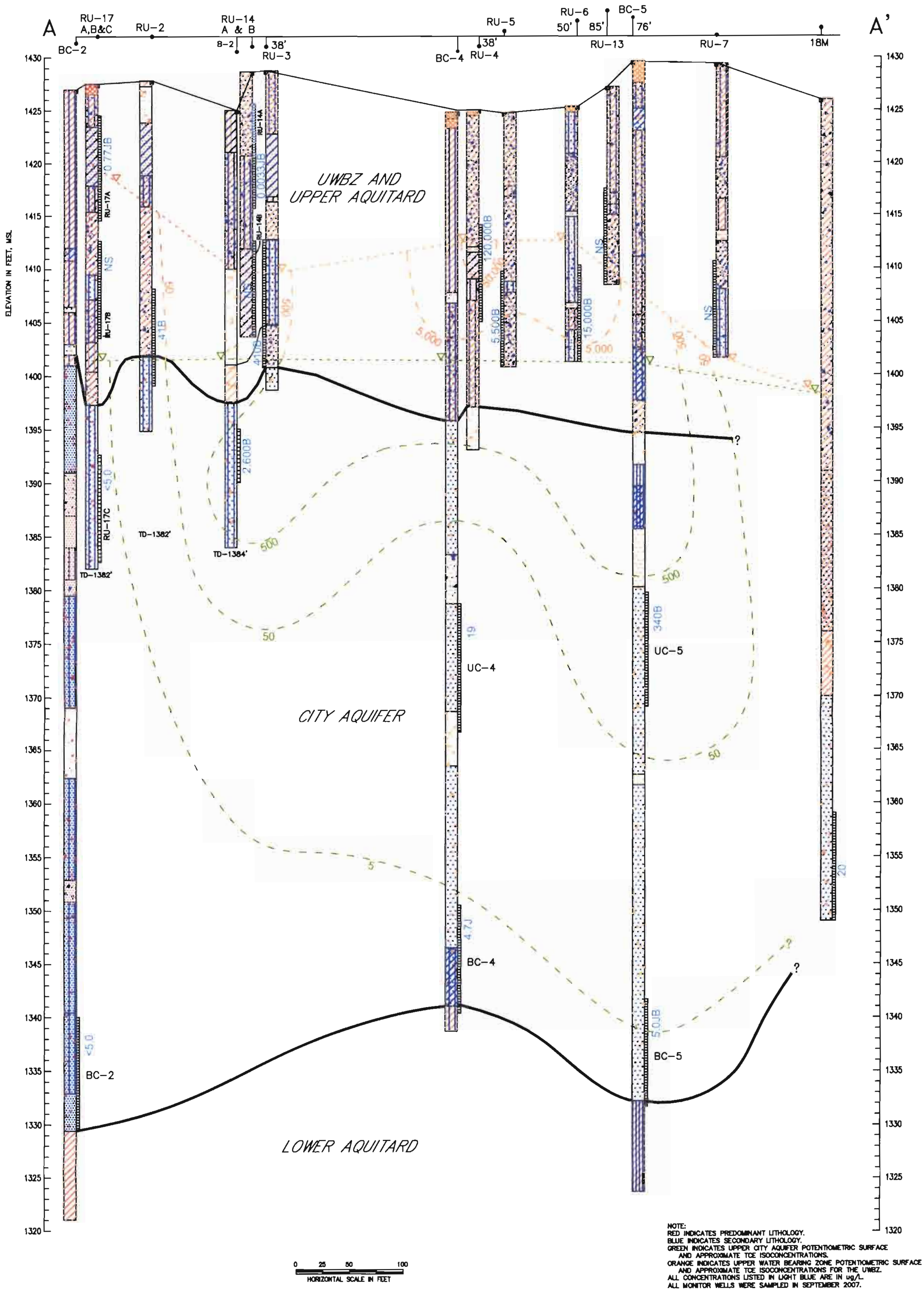
ENVIRONEERING, INC.

FIGURE 5-3

TCE IN THE UPPER CITY AQUIFER & LINES OF CROSS SECTION

ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO. 137-20



NOTE:
RED INDICATES PREDOMINANT LITHOLOGY.
BLUE INDICATES SECONDARY LITHOLOGY.
GREEN INDICATES UPPER CITY AQUIFER POTENTIOMETRIC SURFACE AND APPROXIMATE TCE ISOCONCENTRATIONS.
ORANGE INDICATES UPPER WATER BEARING ZONE POTENTIOMETRIC SURFACE AND APPROXIMATE TCE ISOCONCENTRATIONS FOR THE UWBZ.
ALL CONCENTRATIONS LISTED IN LIGHT BLUE ARE IN ug/L.
ALL MONITOR WELLS WERE SAMPLED IN SEPTEMBER 2007.

LEGEND:

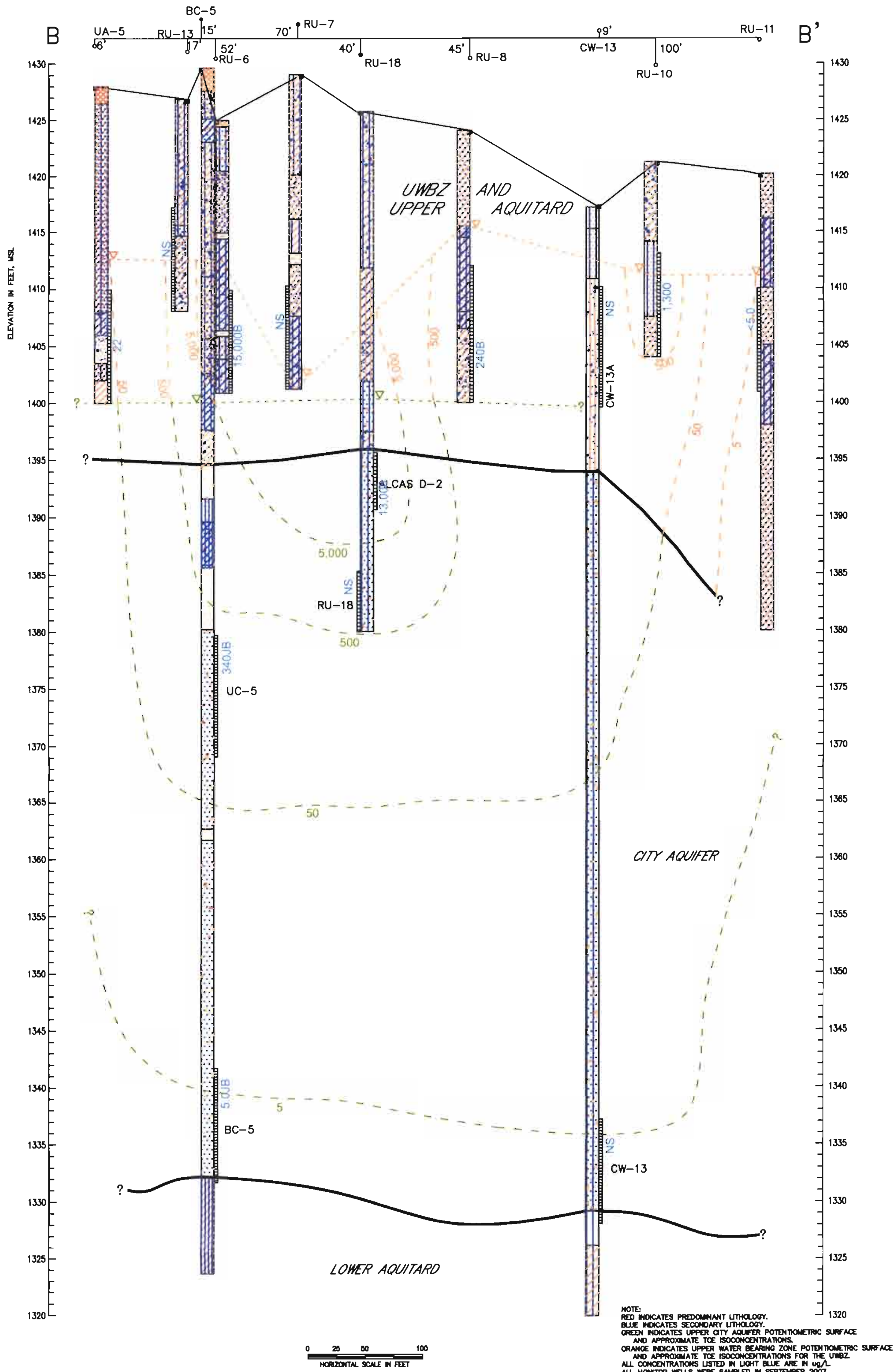
- POTENTIOMETRIC SURFACE FOR UWBZ
- POTENTIOMETRIC SURFACE FOR CITY AQUIFER
- <5.0 TCE CONCENTRATION IN ug/L
- 50 TCE CONCENTRATION ISOPLETH FOR UWBZ
- 50 TCE CONCENTRATION ISOPLETH FOR CITY AQUIFER

ENVIRONEERING, INC.

FIGURE 5-4
TCE CONCENTRATIONS ALONG CROSS-SECTION A – A'
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.

E1371516



NOTE:
RED INDICATES PREDOMINANT LITHOLOGY.
BLUE INDICATES SECONDARY LITHOLOGY.
GREEN INDICATES UPPER CITY AQUIFER POTENTIOMETRIC SURFACE AND APPROXIMATE TCE ISOCONCENTRATIONS.
ORANGE INDICATES UPPER WATER BEARING ZONE POTENTIOMETRIC SURFACE AND APPROXIMATE TCE ISOCONCENTRATIONS FOR THE UWBZ.
ALL CONCENTRATIONS LISTED IN LIGHT BLUE ARE IN ug/L.
ALL MONITOR WELLS WERE SAMPLED IN SEPTEMBER 2007.

LEGEND:

- POTENTIOMETRIC SURFACE FOR UWBZ
- POTENTIOMETRIC SURFACE FOR CITY AQUIFER
- <0.005 TCE CONCENTRATION IN ug/L
- 0.05 TCE CONCENTRATION ISOPLETH FOR UWBZ
- 0.05 TCE CONCENTRATION ISOPLETH FOR CITY AQUIFER

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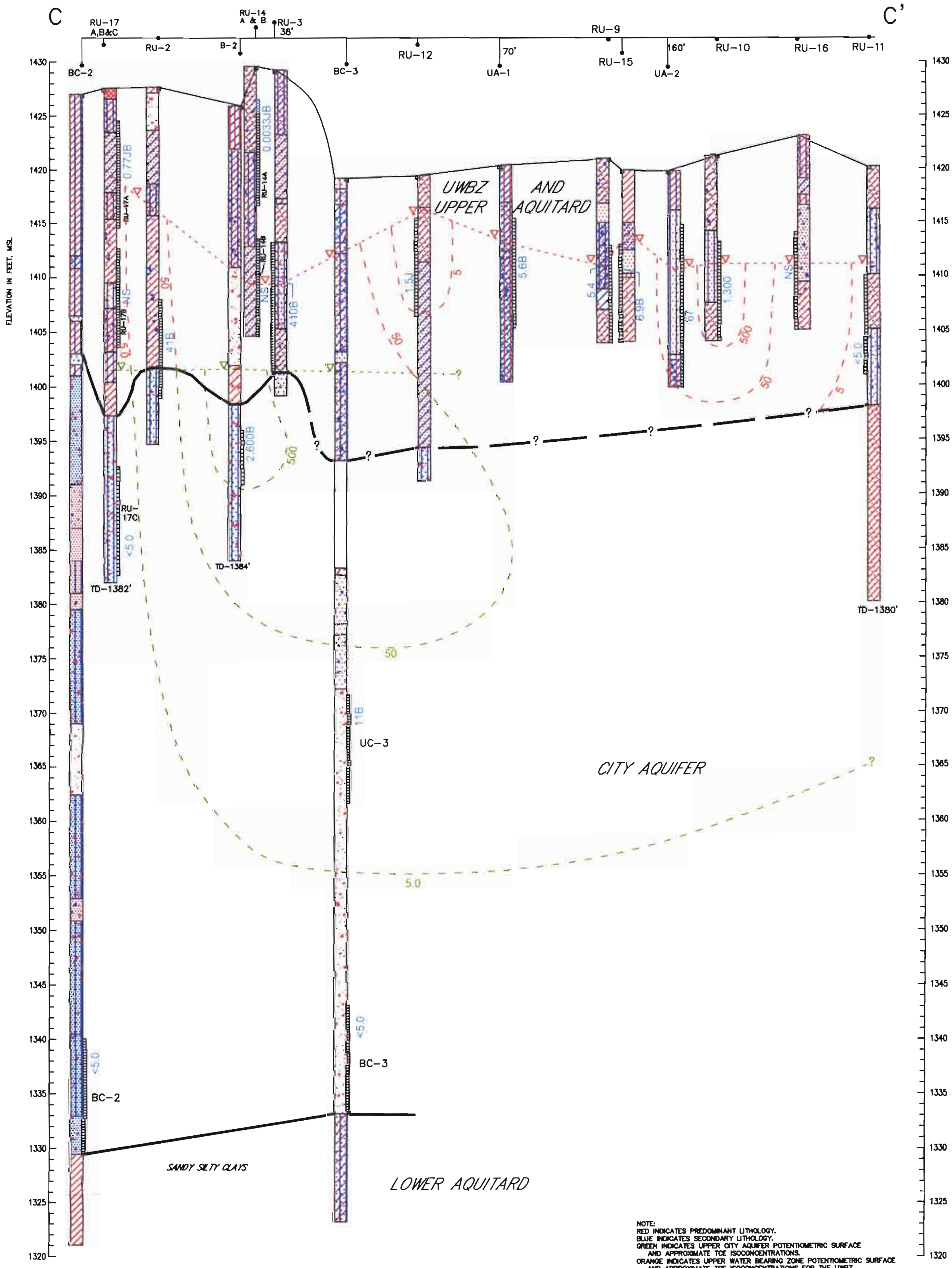
FIGURE 5-5
TCE CONCENTRATIONS ALONG CROSS-SECTION B - B'
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.



NOTE:
RED INDICATES PREDOMINANT LITHOLOGY.
BLUE INDICATES SECONDARY LITHOLOGY.
GREEN INDICATES UPPER CITY AQUIFER POTENTIOMETRIC SURFACE AND APPROXIMATE TCE ISOCONCENTRATIONS.
ORANGE INDICATES UPPER WATER BEARING ZONE POTENTIOMETRIC SURFACE AND APPROXIMATE TCE ISOCONCENTRATIONS FOR THE UWBZ.
ALL CONCENTRATIONS LISTED IN LIGHT BLUE ARE IN ug/L.
ALL WELLS WERE SAMPLED IN SEPTEMBER 2007.

0 25 50 100
HORIZONTAL SCALE IN FEET

LEGEND:

- POTENTIOMETRIC SURFACE FOR UWBZ
- POTENTIOMETRIC SURFACE FOR CITY AQUIFER
- <5.0 TCE CONCENTRATION IN ug/L
- 50 TCE CONCENTRATION ISOPLETH FOR UWBZ
- 50 TCE CONCENTRATION ISOPLETH FOR CITY AQUIFER

ENVIRONEERING, INC.

FIGURE 5-6
TCE CONCENTRATIONS ALONG CROSS-SECTION C – C'
ALCAS FACILITY
OLEAN, NEW YORK

DRAWN BY:	DATE:	PROJ. NO.

E1371517

Figure 5-7
Alcas D-2 Time Trend Plot

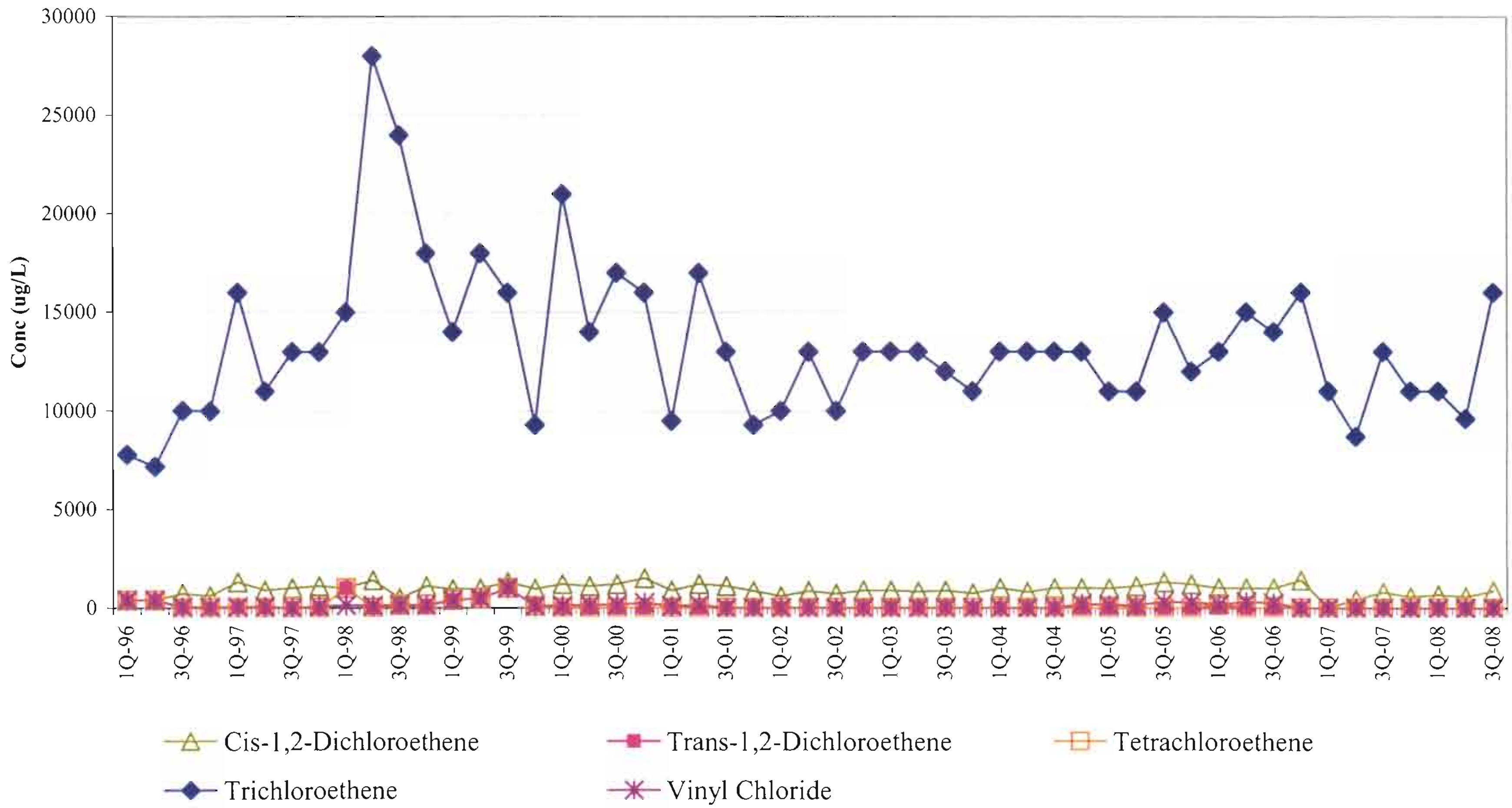
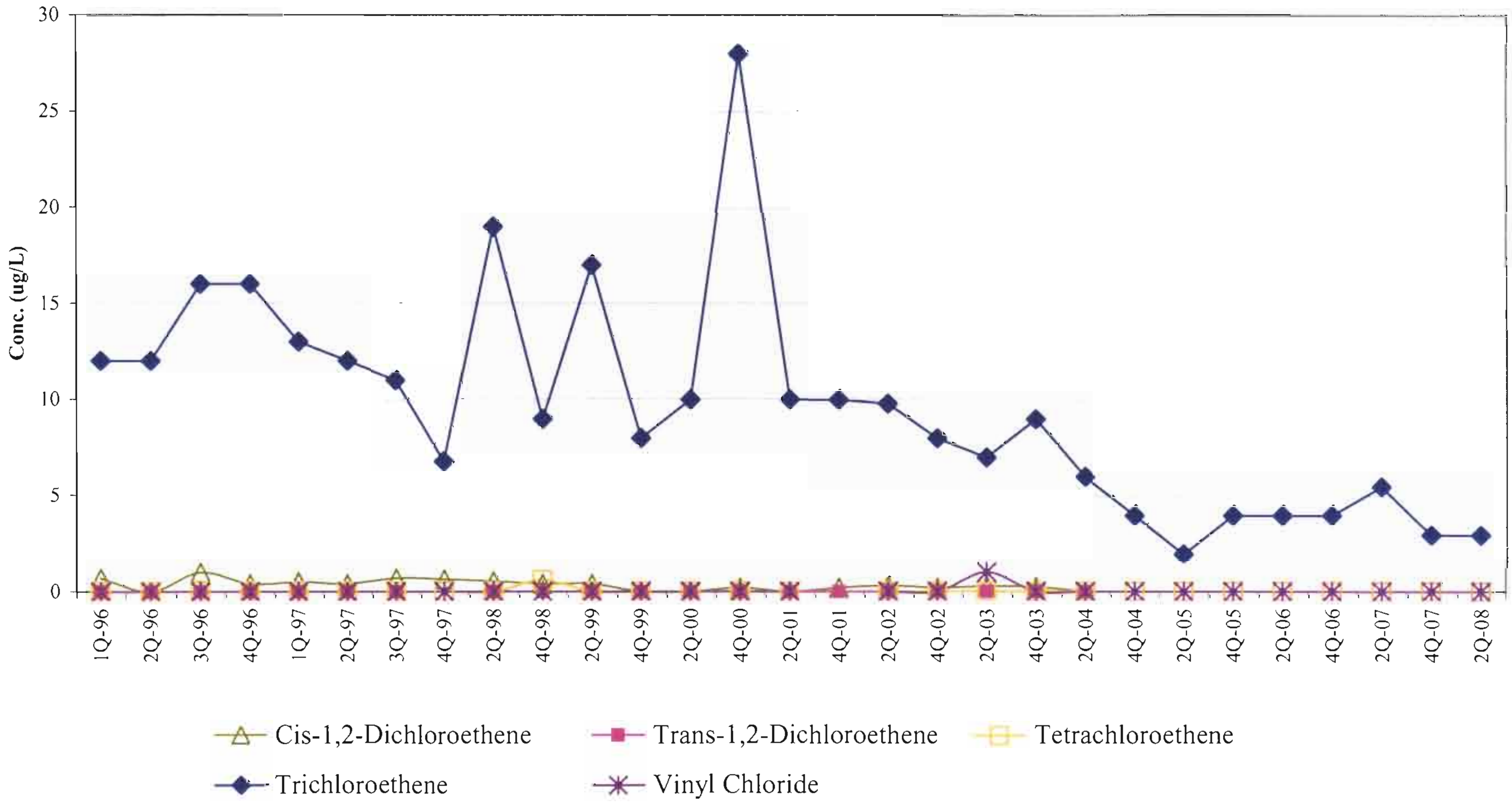


Figure 5-8
CW-13 Time Trend Plot



6.0 Revised Alcas Conceptual Model

The data and analysis required for effective remedial objectives and remedy decisions should be determined on a site-specific basis. While the OU2 ROD utilized some data collected from the Site for the selected remedy, the OU2 ROD did not take into consideration an Alcas specific conceptual model. When combined with historical data, this new information enables undated interpretation of the conceptual model as applied to the Alcas property.

6.1 Alcas Property Site-Specific Conceptual Model

The updated conceptual model can be summarized as follows:

- The source material is composed of residual chlorinated solvents which behave as DNAPL in the subsurface;
- The Upper Water Bearing Unit is a discontinuous unit comprised of predominantly of sand, primarily appearing as localized stream deposits and fill material;
- The Upper Aquitard is a very heterogeneous unit comprised of predominantly silty/clayey units with intermixed sandy units characterized by low permeabilities, thereby acting as an aquitard overlying the City Aquifer;
- In the City Aquifer, horizontal groundwater flow is the primary component of groundwater flow, and vertical groundwater flow is a secondary component;
- Both vertical and horizontal flow components are present in the UWBZ.
- At the Site, horizontal flow of groundwater in the Upper Water Bearing Zone is generally directed to the south toward the Allegheny River when the City Production Wells are not active;
- The governing source areas on the Alcas Property are DNAPL zones which generate plume zones consisting of dissolved and vapor phase derivatives that transport through the soil media;
- The primary source area consisting of one or more entry zones and associated DNAPL zones is located below the Main Building;
- Other, more minor, entry zones may also be present south of the Main Building;
- Dissolved phase concentrations in the Upper Water Bearing Zone south of the Main Building are indicative of a plume zone migrating downgradient of source areas under and near the Main Building toward the Allegheny River; and
- Over a large portion of the Alcas property, dissolved phase derivatives migrating from the DNAPL zones into the City Aquifer are influenced by the pumping of the City Production Wells.

This update suggests a probable DNAPL zone under the Main Building that will persist and continue to generate dissolved phase derivatives for unknown lengths of time as long as the source DNAPL persists. Overall, the DNAPL zones proposed by the updated conceptual model include a significantly larger area than originally specified in the OU2 ROD.