PROPOSED REMEDIAL ACTION PLAN
Pall Corporation Site
Operable Unit No. 1
Surface and Shallow Subsurface Contamination
City of Glen Cove, Nassau County
New York
Site No. 1-30-053B

February 2004

Prepared by:

Division of Environmental Remediation
New York State Department of Environmental Conservation

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SECTION 1: SUMMARY AND PURPOSE OF THE PROPOSED PLAN

The New York State Department of Environmental Conservation (NYSDEC), in consultation with the New York State Department of Health (NYSDOH), is proposing a remedy for the Pall Corporation ("Pall") Site - Operable Unit (OU) 1. OU1 includes on-site and off-site surface and shallow subsurface contamination. In this Proposed Remedial Action Plan (PRAP), shallow subsurface contamination is defined as all contamination within 60 feet of the ground surface. The presence of hazardous waste has created significant threats to human health and/or the environment that are addressed by this proposed remedy. As more fully described in Sections 3 and 5 of this document, discarding of solvents and Freon from previous industrial operations have resulted in the disposal of hazardous wastes, including volatile organic compounds (VOCs). These wastes have contaminated the soil, groundwater, surface water and aquatic sediment at the site, and have resulted in:

- a significant threat to human health associated with this site's contravention of groundwater standards in a sole source aquifer.
- a significant environmental threat associated with the impacts of contaminants to a sole source aquifer.

To eliminate or mitigate these threats, the NYSDEC proposes in-situ chemical oxidation to remediate the site. The remedy would include the following elements:

- A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program. The design program would include pilot testing to determine the number of injection wells and the oxidant.
- Installation of additional on-site and off-site injection wells to actively treat the contaminated groundwater.
- Injection of a chemical oxidant into the injection wells to destroy groundwater contaminants. Post-injection sampling would be performed to determined if additional injection events are needed.
- Remediation of contaminated soil by excavation and off-site disposal or in-situ chemical oxidation.

- The operation of the components of the remedy would continue until the remedial objectives have been achieved, or until the NYSDEC determines that continued operation is technically impracticable or not feasible.

- Development of a site management plan to: (a) address residual contaminated soils that may be excavated from the site during future redevelopment. The plan would require soil characterization and, where applicable, disposal/reuse in accordance with NYSDEC regulations; (b) evaluate the potential for vapor intrusion for any buildings developed on the site and above the contaminant plume, including provision for mitigation of any impacts identified; and (c) identify any use restrictions.

- The property owner would provide an annual certification, prepared and submitted by a Professional Engineer or environmental professional acceptable to the NYSDEC, which would certify that the institutional controls and engineering controls put in place, are unchanged from the previous certification and nothing has occurred that would impair the ability of the control to protect public health or the environment or constitute a violation or failure to comply with any operation and maintenance or site management plan.

- Imposition of an institutional control in form of an environmental easement that would: (a) require compliance with the approved site management plan, (b) limit the use and development of the property to commercial or industrial uses only; (c) restrict use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the Nassau County Department of Health; and, (d) require the property owner to complete and submit to the NYSDEC an annual certification.

- Since the remedy results in untreated hazardous waste remaining at the site, a long term monitoring program would be instituted. Several on-site and off-site groundwater monitoring wells would be sampled quarterly during and after injections. The monitoring wells would be chosen during the remedial design, but the sampling plan could be adjusted based on site conditions. Monitoring would continue until New York State groundwater standards are met. This program would allow the effectiveness of the in-situ chemical oxidation remedy to be monitored and would be a component of the operation, maintenance, and monitoring for the site.

The proposed remedy, discussed in detail in Section 8, is intended to attain the remediation goals identified for this site in Section 6. The remedy must conform with officially promulgated standards and criteria that are directly applicable, or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, criteria and guidance are hereafter called SCGs.

This PRAP identifies the preferred remedy, summarizes the other alternatives considered, and discusses the reasons for this preference. The NYSDEC will select a final remedy for the site only after careful consideration of all comments received during the public comment period.

The NYSDEC has issued this PRAP as a component of the Citizen Participation Plan developed pursuant to the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR)

Part 375. This document is a summary of the information that can be found in greater detail in the April 1999 "Preliminary Focused Remedial Investigation Data Report," the July 13, 2000 "Phase II Remedial Investigation Report" (RI), the October 15, 2001 "Feasibility Study Report" (FS), and other relevant documents. The public is encouraged to review the project documents, which are available at the following repositories:

NYSDEC Central Office
625 Broadway
Albany, New York 12233-7015
Contact: Jeffrey Dyber, Project Manager
Phone: (518) 402-9621
Hours: 8:30 a.m. to 4:45 p.m.

NYSDEC Region 1 Office
S.U.N.Y. Campus
Loop Road, Building 40
Stony Brook, New York 11790-2356
Contact: William Fonda
Phone: (631) 444-0350
Hours: 8:30 a.m. to 4:45 p.m.

Glen Cove Public Library
4 Glen Cove Avenue
Glen Cove, New York 11542
Phone: (516) 676-2130
Hours: Mon to Thurs – 9 a.m. to 9 p.m.
Fri & Sat – 9 a.m. to 5 p.m.
Sun – 1 p.m. to 5 p.m.

The NYSDEC seeks input from the community on all PRAPs. A public comment period has been set from February 27, 2004 through March 29, 2004 to provide an opportunity for public participation in the remedy selection process. A public meeting is scheduled for March 10, 2004 at the Glen Cove High School (Room 123) beginning at 7:00 p.m.

At the meeting, the results of the RI/FS will be presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period will be held, during which verbal or written comments may be submitted on the PRAP. Written comments may also be sent to Mr. Dyber at the above address through March 29, 2004.

The NYSDEC may modify the preferred alternative or select another of the alternatives presented in this PRAP, based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives identified here.

Comments will be summarized and addressed in the responsiveness summary section of the Record of Decision (ROD). The ROD is the NYSDEC's final selection of the remedy for this site.

SECTION 2: SITE LOCATION AND DESCRIPTION

The Pall site is located at 30-36 Sea Cliff Avenue in the City of Glen Cove, Nassau County. The site is situated on the north side of Sea Cliff Avenue and is approximately 4.6 acres in size. Glen Cove Creek forms the western property border. See Figure 1 for a site location map.

The Pall site contains two industrial buildings. Tweezerman, a company that manufactures and maintains personal care products, currently occupies the building at 30 Sea Cliff Avenue. August Thomsen, a pastry bag manufacturer, currently occupies the building at 36 Sea Cliff Avenue. The rest of the site is almost entirely paved with asphalt. See Figure 2 for a site map.

Residential, commercial and industrial properties are located in the vicinity of the Pall site. A day care center borders the Pall site on the north. Adjacent to the day care center is the inactive Carney Street public water supply well field. One well at the well field is still viable for potable use and is 168 feet deep. This well has been out of service since 1978.

Two other inactive hazardous waste disposal sites are adjacent to the Pall site. The Photocircuits Corporation ("Photocircuits") site (site no. 1-30-009) is located southeast of the Pall site. The Pass and Seymour site (site no. 1-30-053A) is located southwest of the Pall site. The Photocircuits and Pass and Seymour sites are across Sea Cliff Avenue from the Pall site. As the groundwater flow direction at the Pall site is north-northwest, the Photocircuits site is hydraulically upgradient of the Pall site.

Operable Unit (OU) No. 1, which is the subject of this PRAP, consists of on-site and off-site surface and shallow subsurface contamination. In this PRAP, shallow subsurface contamination is defined as all contamination within 60 feet of the ground surface. An operable unit represents a portion of the site remedy that for technical or administrative reasons can be addressed separately to eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination.

The remaining operable unit for this site is deep groundwater contamination. As detailed in Section 5, some of the groundwater contamination beneath the Pall site originated at the Photocircuits site.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

The building at 30 Sea Cliff Avenue was constructed in 1918 and was used as an ice house. In 1953, Pall Corporation purchased and occupied the building until 1999. In 1958, Pall Corporation constructed the building at 36 Sea Cliff Avenue and occupied the building until 1971, when Pall Corporation sold the building to August Thomsen.

Pall Corporation used both industrial buildings in manufacturing filtration products. Nassau County industrial chemical profiles indicate that Pall Corporation used tetrachloroethylene (PCE) and trichloroethylene (TCE) at the site. PCE and TCE were found in the unsaturated soils beneath the Pall site. As these chemicals are not naturally occurring, their presence in the soil beneath the Pall site is evidence of past disposal. Nassau County records also indicate that Pall Corporation used Freon at the site, which was found in on-site groundwater samples.

3.2: Remedial History

In 1996, the NYSDEC listed the site as a Class 2 site in the Registry of Inactive Hazardous Waste Disposal Sites in New York (the Registry). A Class 2 site is a site where hazardous waste presents a significant threat to the public health or the environment and action is required. As detailed in the remainder of this section, the site was listed in the Registry because:

- Pall Corporation used PCE and TCE at the site;
- Soils beneath the site contained PCE and TCE, indicating past disposal;
- Groundwater beneath the site contained TCE, PCE and other VOCs exceeding New York State groundwater standards; and
- On-site VOC concentrations in groundwater were significantly higher than VOC levels at the upgradient edge of the site.

The listing of the site was based on past investigations of the site and surrounding area. In the late 1970's, VOCs were discovered in the water pumped from the Carney Street public water supply wells. These wells are northwest and downgradient of the Pall and Photocircuits sites. The three wells have been out of service since 1978. According to an engineering report prepared for the City of Glen Cove in November 2000, two of the three wells have been abandoned and cannot be redeveloped. The third well is 168 feet deep and has an approved capacity of 1,400 gallons-per-minute (gpm). However, drinking water cannot be provided to the public without meeting New York State drinking water standards.

In 1990, Nassau County published the results of an investigation of groundwater contamination in the vicinity of the Pall site. The document was entitled, "Investigation of Contaminated Aquifer Segment, City of Glen Cove, Nassau County." Although no monitoring wells were installed on the Pall site during the study, a pair of monitoring wells was installed at the Carney Street well field. Maximum concentrations of PCE, TCE, and 1,2 dichloroethylene (DCE) in these wells were 3,700 parts-per-billion (ppb), 500 ppb, and 1,300 ppb. The New York State groundwater standard for each of these contaminants is 5 ppb.

The report also summarized data from groundwater samples obtained from the Carney Street public wells after the well field was closed. Maximum TCE concentrations during 1977-1980, 1981-1984, and 1985-1988 were 300 ppb, 380 ppb and 690 ppb, respectively. Maximum PCE concentrations during 1977-1980, 1981-1984, and 1985-1988 were 375 ppb, 64 ppb and 46 ppb, respectively.

In 1994, the Nassau County Department of Public Works submitted a Preliminary Site Assessment (PSA) to the NYSDEC for the Sea Cliff Industrial Area. This PSA evaluated several properties, including the Pall site. As several previous studies had already collected environmental data, the PSA relied on data from these past studies rather than collecting new data. For the Pall site, the PSA evaluated data collected in a report prepared in 1992 for the Photocircuits Corporation entitled, "Source Area Investigation, Sea Cliff Industrial Area, Glen Cove, New York".

The PSA report presented analytical results from soil and groundwater samples taken at the Pall site. The maximum total xylenes concentration in on-site soils were 4.4 parts-per-million (ppm), exceeding the NYSDEC guidance value of 1.2 ppm. Maximum PCE and TCE levels in on-site soils were 1.0 ppm and 0.040 ppm, respectively. Although the PCE and TCE concentrations in the PSA did not exceed NYSDEC guidance values, their presence in the soil is evidence of past disposal.

The PSA also evaluated the results of on-site groundwater sampling. Maximum PCE, TCE and 1,2-DCE concentrations were 880 ppb, 1,600 ppb and 3,400 ppb, respectively. These concentrations exceed New York State groundwater standards. A monitoring well at the upgradient edge of the site had TCE and 1,2-DCE levels of 12 ppb, and 25 ppb, respectively.

After the site was listed, Pall Corporation sued the NYSDEC to remove the site from the Registry. The NYSDEC successfully defended the lawsuit.

SECTION 4: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

The NYSDEC and the Pall Corporation entered into a Consent Order on March 1, 1999. The Order obligates the responsible party to implement an RI/FS remedial program. Upon issuance of the ROD the NYSDEC will approach the PRPs to implement the selected remedy under an Order on Consent.

SECTION 5: SITE CONTAMINATION

A remedial investigation/feasibility study (RI/FS) has been conducted to evaluate the alternatives for addressing the significant threats to human health and the environment.

5.1: Summary of the Remedial Investigation

The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site. The RI was conducted between February 1998 and July 2000. The field activities and findings of the investigation are described in the RI report. Additional investigations were performed after the RI report was finalized. The results of these investigations were reported in the October 2001 Feasibility Study Report and the October 2003 Phase I Pilot Test Report.

The following activities were conducted during the RI:

- Research of historical information;
- Installation of 97 soil borings and 32 monitoring wells for analysis of soils and groundwater as well as physical properties of soil and hydrogeologic conditions;
- Sampling of 51 new and existing monitoring wells;
- Collection of approximately 116 discrete groundwater samples using a direct push technique;
- A survey of public and private water supply wells in the area around the site;
- Collection of three surface water samples;
- Collection of three aquatic sediment samples;
- Collection of three indoor air samples. The NYSDOH collected and analyzed the air samples.

To determine whether the soil, groundwater, surface water, aquatic sediment and indoor air contain contamination at levels of concern, data from the investigation were compared to the following SCGs:

- Groundwater, drinking water, and surface water SCGs are based on NYSDEC "Ambient Water Quality Standards and Guidance Values" and Part 5 of the New York State Sanitary Code.
- Soil SCGs are based on the NYSDEC "Technical and Administrative Guidance Memorandum (TAGM) 4046; Determination of Soil Cleanup Objectives and Cleanup Levels".
- Sediment SCGs are based on the NYSDEC "Technical Guidance for Screening Contaminated Sediments."
- The air SCG for PCE is based on the NYSDOH "Tetrachloroethene (PERC) in Indoor and Outdoor Air Fact Sheet."

Based on the RI results, in comparison to the SCGs and potential public health and environmental exposure routes, certain media and areas of the site require remediation. These are summarized below. More complete information can be found in the RI report.

5.1.1: Site Geology and Hydrogeology

Three geologic units underlie the site: the upper glacial aquifer, the Port Washington aquifer and the Lloyd aquifer. The upper glacial aquifer is directly beneath the surface and ranges from 260-440 feet thick in the vicinity of the site. The upper zone of this aquifer consists of sandy and silty till deposits. The lower zone consists of sand, gravel and discontinuous silt and clay lenses.

All subsurface samples collected during the RI were from the upper glacial aquifer. The groundwater contamination included in this operable unit is also entirely within the upper glacial aquifer. Soil sampling indicates that the subsurface is mostly sand mixed with gravel, silt and/or clay. However, some discontinuous clay layers were found at the site. These clay layers do not appear to have appreciably influenced the flow of contaminants. Groundwater at the site was encountered from 2-6 feet below ground surface (bgs) and generally flows north-northwest.

The other two deeper aquifers were not investigated during the RI. The Port Washington aquifer is 50-200 feet thick and consists of sand with some silt, clay and sandy clay lenses. The Lloyd aquifer is beneath the Port Washington aquifer and is 0-550 feet thick. The Lloyd aquifer contains fine to coarse sand and gravel with a clayey matrix with some layers of silty or solid clay. Bedrock underlies the Lloyd aquifer.

5.1.2: Nature of Contamination

As described in the RI report, many soil, groundwater, indoor air, surface water and sediment samples were collected to characterize the nature and extent of contamination. As summarized in Table 1, the main categories of contaminants that exceed their SCGs are VOCs.

The VOCs of concern are chlorinated solvents such as tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE), vinyl chloride (VC), trichloroethane (TCA) and dichloroethane (DCA). TCE, DCE and VC are breakdown products of PCE. DCA is a breakdown product of TCA. 1,1,2-trichlorotrifluoroethane (Freon-113) is also a VOC of concern. Other VOCs of concern are acetone, 2-pentanone, bromoform and gasoline constituents such as benzene, toluene, ethylbenzene and xylene.

5.1.3: Extent of Contamination

This section describes the findings of the investigation for all environmental media that were investigated.

Chemical concentrations are reported in parts per billion (ppb) for water, parts per million (ppm) for soil and sediment, and micrograms per cubic meter ($\mu g/m^3$) for air samples. For comparison purposes, where applicable, SCGs are provided for each medium.

Table 1 summarizes the degree of contamination for the contaminants of concern in soil, sediment, indoor air, groundwater and surface water and compares the data with the SCGs for the site. The following are the media which were investigated and a summary of the findings of the investigation.

Subsurface Soil

Soil samples were obtained at the Pall site in two phases. During the Phase 1 RI, maximum concentrations of PCE, TCE and DCE were 0.7 ppm, 0.029 ppm and 0.048 ppm, respectively. These levels were all below SCGs. Xylenes were detected at a maximum level of 2.3 ppm, which exceed the SCG of 1.2 ppm. Benzene (0.082 ppm) also exceeded the SCG of 0.060 ppm at one location. No SCGs were exceeded in any other Phase 1 soil samples, including the three samples obtained beneath the floor of the 30 Sea Cliff Avenue building. Refer to the Phase 1 RI Report for the locations of the Phase 1 soil samples.

Additional soil samples were obtained during the Phase 2 RI, as shown on Figures 3 through 5. Please note that the sampling data in these figures are expressed in micrograms per kilogram ($\mu g/kg$), which is equivalent to parts-per-billion (ppb). To convert the chemical concentrations on these figures to ppm, divide the chemical concentrations on the figures by 1,000. As shown on Figure 4, PCE (950 ppm), TCE (19 ppm), 1,2-DCE (4.124 ppm) and 1,1,1-TCA (0.98 ppm) exceeded their SCGs of 1.4 ppm, 0.7 ppm, 0.3 ppm and 0.8 ppm, respectively, at boring 5-SB-15. These contaminant levels were the maximum concentrations found at the site. As shown on Figures 4 and 5, several soil samples were taken near boring 5-SB-15 to delineate the extent of soil contamination. The sampling results indicate that the areal extent of the soil contamination was limited to within 30 feet of 5-SB-15.

Phase 2 soil sampling results also exceeded SCGs at three other locations at the site. At two of these locations (SB-5 and SB-7), adjacent sampling results indicated that the areal extent of the soil contamination is limited to within 15 feet of the sample. Also, the contaminant levels at these two locations are 100 times less than the contaminant levels at 5-SB-15. The third sample, SB-1, was below the water table and would be more efficiently remediated by a comprehensive groundwater contamination remedy. Therefore, no soil remediation is proposed for the contamination at SB-1, SB-5 and SB-7.

Sediments

During the Phase 1 RI, three sediment samples were obtained from Glen Cove Creek on the west side of the Pall site. The creek flows from southeast to northwest. No VOCs were detected in the upstream and midstream sediment samples. However, PCE (2.1 ppm) and TCE (0.1 ppm) exceeded their SCGs of 0.0034 ppm and 0.0085 ppm, respectively, in the downstream sample (SED-3R). Refer to the Phase 1 RI Report for the locations of the sediment samples.

The SCGs that the sediment sample exceeded are based on human consumption of fish. It is very unlikely that this portion of the creek could support a fish population, as the creek flows underground after leaving the industrial area. Thus, human consumption of fish is very unlikely. Therefore, the contaminated sediment is not considered a threat to human health or the environment and does not require remediation.

Shallow Groundwater

The operable unit for this PRAP, OU1, includes shallow groundwater contamination. The shallow groundwater interval for the purposes of this PRAP is from 0-60 feet bgs. Although this subsection distinguishes between shallow (water table) and intermediate (45-60 feet bgs) contamination, all contamination above 60 feet bgs is covered by this PRAP.

Five rounds of groundwater sampling were conducted prior to the groundwater remediation pilot test (see Section 5.2). In general, the highest site-related groundwater concentrations were detected at the north end of the site. Upgradient concentrations were near or below SCGs at shallow depths but increased with depth. Table 2 compares on-site VOC concentrations with upgradient levels for the Phase 2 RI, FS, and baseline samples for the groundwater pilot test.

During the Phase1 RI, groundwater samples were obtained in February and March 1998 from direct push borings and existing monitoring wells. Refer to the Phase 1 RI Report for the locations of the groundwater samples. Sampling depths for the direct push borings ranged from 8-68 feet bgs. The highest VOC concentrations were in the shallow groundwater at the north (downgradient) end of the site. The maximum on-site PCE, TCE, 1,2-DCE and VC concentrations were 140,000 ppb, 9,600 ppb, 15,000 ppb, and 1,000 ppb, respectively. The SCG for PCE, TCE and 1,2-DCE in groundwater is 5 ppb. The SCG for VC in groundwater is 2 ppb.

Several groundwater samples were taken at the upgradient edge of the site during the Phase1 RI. Shallow samples (6-13 feet bgs) were below SCGs, but several intermediate depth samples exceeded SCGs. The highest PCE, TCE, and 1,2-DCE levels at the upgradient edge of the site were 36 ppb, 81 ppb, and 300 ppb, respectively.

In April 1999, Pall Corporation's consultant installed several new monitoring wells and obtained samples from existing and new wells. Figures 6 and 7 show the results of the shallow, and intermediate groundwater sampling. Some of the wells shown on these figures were not installed until after this round of sampling; therefore, no test results are listed for these wells. In general, on-site shallow and intermediate wells are 5-15 feet bgs and 45-55 feet bgs. Please keep in mind that although this operable unit addresses "shallow" groundwater contamination, the operable unit includes all groundwater contamination to 60 feet bgs.

In April 1999, the highest concentrations in the shallow groundwater were near the north (downgradient) end of the site. Maximum on-site PCE, TCE, 1,2-DCE and VC concentrations were 200 ppb, 230 ppb, 3,657 ppb, and 250 ppb, respectively. Although not on the analyte list during this round of sampling, Freon-113 was detected as a tentatively identified compound (TIC) in some samples with a maximum level of 480 ppb. This level exceeds the SCG of 5 ppb. Of the three wells at the upgradient edge of the site, 1,2-DCE (10 ppb) exceeded its SCG in one well. No other VOCs exceeded their SCGs in the shallow wells at the upgradient edge of the site.

Although the shallow wells at the upgradient edge of the site had low levels of VOC contamination in April 1999, the highest intermediate VOC concentrations were in MW-6P, located on the upgradient edge of the site. This well had total VOC, 1,2-DCE and TCE levels of 1,330 ppb, 924 ppb, and 150 ppb, respectively. In comparison, highest total VOC level found at the downgradient edge of the site was 614 ppb. Freon-113 was found on-site as a TIC at 470 ppb, but was not found in any upgradient sample.

To determine the extent of off-site groundwater contamination, direct-push samples were obtained in April 1999 and monitoring wells were sampled in May 1999. Five direct push borings were installed in the area directly north of the site, which includes the day care center and the inactive public water supply well field. Shallow (9-10 feet bgs) and intermediate (55 feet bgs) samples were taken from each boring. Figure 8 shows the locations of the borings along with the sampling results. Chlorinated solvents (i.e., PCE, TCA and their breakdown products) exceeding SCGs were found in the shallow and intermediate depths for all five borings, with a maximum chlorinated solvent concentration of 2,950 ppb. In addition, benzene, toluene, ethylbenzene and xylene (BTEX) were detected at a maximum total concentration of 4,600 ppb. BTEX compounds are typically found in petroleum. Although BTEX compounds exceeded SCGs in some of the on-site soil samples, on-site BTEX groundwater concentrations did not exceed 36 ppb.

In May 1999, existing off-site groundwater monitoring wells were sampled. Figure 9 depicts the sampling results. The shallow well located in the rear of the water district property, GC-3S, had PCE, TCE and 1,2-DCE levels of 340 ppb, 150 ppb and 543 ppb, respectively. In comparison, none of the shallow wells located downgradient of the water district property had total VOC concentrations exceeding 50 ppb.

Three additional rounds of groundwater samples were obtained before the groundwater remediation pilot test occurred (see Section 5.2). All three rounds of data were evaluated in determining the nature and extent of contamination. As the results of the three sampling events were similar, this PRAP will only discuss the December 2000 groundwater samples. Figures 10 and 11 depict the test results for the shallow and intermediate groundwater samples. As Freon-113 was added to the list of analytes, the total VOC results for the December 2000 sampling event should not be compared to the April 1999 sampling results by examining the tables in the FS Report.

In December 2000, the most contaminated shallow wells were at the downgradient (north) end of the site. The maximum PCE, TCE, 1,2-DCE and Freon-113 concentrations in the shallow groundwater were 580 ppb, 1,700 ppb, 1,500 ppb and 1,240 ppb, respectively. In contrast, none of the wells on the upgradient edge of the site exceeded SCGs.

The highest VOC concentrations in the intermediate depth wells were also found at the downgradient edge of the site during the December 2000 sampling event. The maximum PCE, TCE, 1,2-DCE and Freon-113 levels were 1,400 ppb, 770 ppb, 2,400 ppb, and 565 ppb, respectively. The highest upgradient PCE, TCE, and 1,2-DCE levels were 34 ppb, 63 ppb, and 410 ppb, respectively. Freon-113 was not found in the upgradient wells.

Deep Groundwater

Although this PRAP does not propose a remedy for deep groundwater contamination, the deep groundwater sampling results are presented to provide a complete account of the site conditions. On-site deep monitoring wells were screened from approximately 90-100 feet bgs.

In April 1999, the highest total VOC levels in the deep groundwater were detected at the downgradient end of the site. The well with the highest VOC levels at the downgradient end of the site (MW-5PD) had total VOC levels of 695 ppb, with 54 ppb of PCE, 270 ppb of TCE and 242 ppb of 1,2-DCE. However, a well on the upgradient edge of the site (MW-6PD), had a total VOC concentration of 431 ppb, with 32 ppb of PCE, 53 ppb of TCE and 222 ppb of 1,2-DCE. The April 1999 groundwater sampling results are depicted on Figure 12.

In December 2000, the highest total VOC levels in the deep wells were in a monitoring well at the upgradient edge of the site (2,228 ppb). This well (MW-6PD) had 130 ppb of TCE, 1,700 ppb of 1,2-DCE, 170 ppb of VC, and 120 ppb of 1,1-DCA. At the downgradient end of the site, the highest total VOC concentration was 1,941 ppb at MW-12PD, including 990 ppb of TCE and 880 ppb of 1,2-DCE. The December 2000 groundwater sampling results are depicted on Figure 13.

Surface Water

Three surface water samples were obtained from Glen Cove Creek during the Phase 1 RI. No VOCs were detected in the upstream and midstream samples. However, PCE, TCE, 1,2-DCE and VC were detected in the downstream sample at 77 ppb, 29 ppb, 28 ppb and 2 ppb, respectively. PCE exceeded its SCG of one (1) ppb. The surface water may be hydraulically connected to the adjacent groundwater, which had high levels of VOCs. Refer to the Phase 1 RI Report for the locations of the surface water samples.

The SCG that the surface water sample exceeded is based on human consumption of fish. It is very unlikely that this portion of the creek could support a fish population, as the creek flows underground after leaving the industrial area. Thus, human consumption of fish is very unlikely. Therefore, the contaminated surface water is not a threat to human health or the environment and does not require remediation.

Air

In June 2002, the NYSDOH obtained air samples at the day care center adjacent to the site. Only Freon-113 was detected in the two samples taken inside the building. Both samples had a Freon-113 concentration of 1.4 $\mu g/m^3$. In the crawl space beneath the day care center, PCE, TCE, 1,2-

DCE and Freon-113 levels were 6.6 $\mu g/m^3$, 2.1 $\mu g/m^3$, 5.4 $\mu g/m^3$ and 1.5 $\mu g/m^3$, respectively. One outdoor air sample was collected, and Freon-113 (1.1 $\mu g/m^3$) was the only compound detected. The concentrations of Freon-113 detected inside and outside the building were similar to typical background levels. Of the detected compounds, only PCE has an indoor air SCG. Although the SCG for PCE is 100 $\mu g/m^3$, reasonable and practical actions should be taken to reduce PCE exposure when indoor air levels are above background. PCE did not exceed its SCG in any of the samples and was not detected in any of the samples obtained inside the day care center.

5.2: Interim Remedial Measures

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS.

Pall Corporation performed two pilot tests at the site that remediated the on-site soil contamination and some of the on-site groundwater contamination. In August 2000, Pall Corporation installed a soil vapor extraction (SVE) system at the site to remediate some of the soil contamination in the vicinity of boring 5-SB-15. In December 2002, Pall used in-situ chemical oxidation to remediate some of the on-site groundwater contamination.

The SVE system consisted of one vapor extraction well and a vapor treatment system. The extraction well removed the VOCs from the soil by vacuuming the VOC-laden vapor from the pore spaces in the soil. As the vapor-phase VOCs were removed from the pore spaces, additional liquid-phase VOCs vaporized and were vacuumed into the SVE well. The SVE well was installed horizontally at approximately 3 feet bgs. The location of the SVE well is shown on Figure 4.

After the VOC-rich air was vacuumed into the SVE well, the VOCs were removed from the air stream using vapor-phase granulated activated carbon. The treated air was then discharged to the atmosphere.

In January 2002, Pall obtained confirmatory soil samples to evaluate the performance of the SVE system. The soil sample obtained at the most contaminated location had a PCE concentration of 40 ppm. Although the PCE concentration in the confirmatory sample exceeded the SCG, the PCE level decreased 95% from the concentration found during the RI. As Pall turned off the SVE system after receiving the confirmatory sample results, additional soil remediation will be required.

A pilot test was also performed on the on-site shallow groundwater contamination to a depth of 60 feet bgs. The pilot test was performed in November and December of 2002 and consisted of in-situ chemical oxidation using potassium permanganate. A 2% potassium permanganate solution was injected into 10 on-site injection wells. The locations of these wells are shown in Figure 14. Five wells were screened in the shallow zone (5-25 feet bgs) and five wells were screened in the intermediate zone (35-55 feet bgs). The potassium permanganate reacted with organic contaminants to form nontoxic byproducts such as carbon dioxide, manganese dioxide and water. A process schematic is shown on Figure 15.

Groundwater samples were obtained in April 2003 after the pilot test injections. The sampling results are summarized on Figure 1. The injections were more successful in the intermediate depth groundwater (45-60 feet bgs) than in the shallow groundwater (water table). Within the calculated area of influence of the pilot test, maximum post-injection PCE, TCE, DCE and Freon-113 levels at the intermediate depth were 27 ppb, 18 ppb, 19 ppb and 15 ppb, respectively. However, an intermediate depth well downgradient of the zone of influence had 130 ppb of PCE. In the shallow zone, most of the wells within the area of influence were cleaned to near or below SCGs. However, one well within the calculated area of influence still had 330 ppb of PCE, 490 ppb of TCE, 300 ppb of DCE and 580 ppb of Freon-113. In addition, a shallow well downgradient of the zone of influence had 220 ppb of TCE, 270 ppb of DCE and 230 ppb of Freon-113.

The post-injection sampling results show that the pilot test partially remediated the VOC contamination near the injection wells. Additional groundwater remediation will be required.

5.3: <u>Summary of Human Exposure Pathways</u>:

This section describes the types of human exposures that may present added health risks to persons at or around the site. A more detailed discussion of the human exposure pathways can be found in Section 6.1 of the Phase 2 RI report.

An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: [1] a contaminant source, [2] contaminant release and transport mechanisms, [3] a point of exposure, [4] a route of exposure, and [5] a receptor population.

The source of contamination is the location where contaminants were released to the environment (any waste disposal area or point of discharge). Contaminant release and transport mechanisms carry contaminants from the source to a point where people may be exposed. The exposure point is a location where actual or potential human contact with a contaminated medium may occur. The route of exposure is the manner in which a contaminant actually enters or contacts the body (e.g., ingestion, inhalation, or direct contact). The receptor population is the people who are, or may be, exposed to contaminants at a point of exposure.

An exposure pathway is complete when all five elements of an exposure pathway exist. An exposure pathway is considered a potential pathway when one or more of the elements currently does not exist, but could in the future.

Currently, there are no known complete exposure pathways involving contamination from the Pall site. In the past, there was a completed exposure pathway related to the use of water from the City of Glen Cove's Carney Street public water supply wells. This exposure pathway was cut off when the contaminated wells were taken out of service in 1978.

There is no longer a complete exposure pathway involving the public water supply that serves the site and the surrounding area. Even though the site contamination has not impacted any active public water supply wells, the entire public water supply is routinely monitored and treated, if necessary, to ensure that it complies with federal and state drinking water standards.

Potential exposure pathways at the site involve:

- use of contaminated groundwater,
- contact with contaminated soil
- contact with contaminated surface water and sediment in the creek near the site
- consumption of fish from the creek near the site; and
- inhalation of vapors in air.

No one is currently using shallow groundwater at the site for drinking or other uses, but groundwater could be used in the future. Although possible, it is not likely that the contaminated water would be used for drinking because a public water supply serves the surrounding area.

Small areas of contaminated soil remain beneath the parking lot at the site. As the parking lot is paved, employees and visitors at the site would not contact contaminated soil. However, construction workers could be exposed to the contaminated soil if the parking lot is excavated.

Contact with surface water and sediment in the small creek near the site is possible, but it does not appear likely that people are regularly accessing the creek in this industrial area. If there were edible fish in the creek, human consumption of fish could lead to exposures. However, the creek flows underground after passing through the industrial area, making the existence of fish in this portion of the creek very unlikely.

Inhalation of contaminated indoor air is possible because of the high concentrations of contaminants in groundwater at and near the site. These contaminants could volatilize into soil gas and affect the indoor air in buildings on and near the site.

5.4: Summary of Environmental Impacts

This section summarizes the existing and potential future environmental impacts presented by the site. Environmental impacts include existing and potential future exposure pathways to fish and wildlife receptors, as well as damage to natural resources such as aquifers and wetlands.

The surface water and sediments in the Glen Cove Creek are contaminated with VOCs at the downstream end of the site. Although PCE and TCE exceeded their SCGs for sediments and PCE exceeded its SCG in surface water, these SCGs are based on human consumption of fish. There are no SCGs for aquatic life for the VOCs detected in the creek. As the creek is shallow, becomes an underground storm sewer downstream of the contaminated sample, and is in an industrial area, human consumption of fish is unlikely.

Although the contamination in Glen Cove Creek is not a completed pathway, site contamination has impacted the groundwater resource in the upper glacial aquifer, which is designated a sole source aquifer in Nassau County.

SECTION 6: SUMMARY OF THE REMEDIATION GOALS

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375-1.10. At a minimum, the remedy selected must eliminate or mitigate all significant threats to public health and/or the environment presented by the hazardous waste disposed at the site through the proper application of scientific and engineering principles.

The remediation goals for this site are to eliminate or reduce to the extent practicable:

- VOC contamination in on-site soil;
- VOC contamination in on-site and off-site groundwater;
- Off-site migration of contaminants in groundwater; and
- The potential for exposures of persons at or around the site to VOCs in indoor air.

Further, the remediation goals for the site include attaining to the extent practicable:

- ambient groundwater quality standards

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

The selected remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. Potential remedial alternatives for the Pall Site were identified, screened and evaluated in the FS report which is available at the document repositories identified in Section 1.

The alternatives in the FS report were developed for on-site remediation only. However, the description of alternatives in the FS applies to the expanded treatment area. Costs have been updated in this PRAP to account for the on-site and off-site treatment.

A summary of the remedial alternatives that were considered for this site are discussed below. The present worth represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring would cease after 30 years if remediation goals are not achieved.

7.1: Description of Remedial Alternatives

Except for Alternative 1 (No Further Action), all of the remedial alternatives would involve active groundwater treatment. These alternatives would actively treat all of the groundwater contamination beneath the Pall site, the adjacent day care center and the Carney street well field to a depth of 60 feet bgs. The boundaries of proposed active treatment are shown on Figure 16. The furthest downgradient shallow well (MW-3S) within the proposed treatment area had a total VOC level of 1,156 ppb. In contrast, the highest total VOC level recorded downgradient of the proposed active treatment area was 156 ppb. Therefore, all shallow groundwater contamination downgradient of the treatment area would be remediated by monitored natural attenuation.

Alternatives 2, 3, and 4 would evaluate the potential for soil vapor intrusion into buildings above the groundwater contaminant plume. If necessary, mitigative measures such as subslab ventilation would be employed.

Finally, Alternatives 2, 3, and 4 would include remediation of contaminated soil in the vicinity of sample location 5-SB-15. The soil remediation would be accomplished by either excavation and off-site disposal or in-situ chemical oxidation. With in-situ chemical oxidation, a chemical oxidant would be applied directly to the contaminated soil to react with the contaminants. The treatment would result in nontoxic byproducts. Soil samples would be obtained following remediation to confirm that contaminant levels are below SCGs.

The following potential remedies were considered to address the contaminated groundwater at the site.

Alternative 1: No Further Action

The No Further Action alternative recognizes remediation of the site conducted under previously completed IRMs. To evaluate the effectiveness of the remediation completed under the IRM, only continued monitoring is necessary.

The soil vapor extraction (SVE) and in-situ chemical oxidation IRMs remediated some of the contaminated soil and groundwater. However, contaminants remain in the soil and groundwater at levels exceeding SCGs. This alternative would leave the site in its present condition and would not provide any additional protection to human health or the environment.

Alternative 2: Air Sparging/Soil Vapor Extraction

Present Worth: *$5,383,666*
Capital Cost: *$2,061,886*
Annual OM&M:
(Years 1-3): *$940,125*
(Years 4-20): *$78,200*

The air sparging/soil vapor extraction (AS/SVE) system would be used to remove VOC contamination from groundwater. This system would remediate contaminated groundwater and prevent further migration of contaminants. A compressor would inject air into several air sparge wells screened at 60-65 feet bgs. The air would bubble through the formation and strip the VOCs from the groundwater. A blower would create a vacuum in the SVE wells, which would capture the air bubbles as they reached the water table. As the water table is shallow, the SVE wells would be installed horizontally 1-2 feet above the water table. The vacuumed vapors would pass through a moisture separator and would be treated with vapor phase carbon before being discharged to the atmosphere. This remedy would require approximately one year to design, two years to construct, three years of operation and 17 years of long-term monitoring

The SVE pilot test IRM revealed a complication in implementing this alternative. While the SVE system was operating, the water table occasionally submerged the SVE well and flooded the moisture separator. The flooding resulted in occasional shutdowns of the system and decreased efficiency. As SVE is part of this alternative, flooding of the SVE wells could hinder operation of the system. The operation and maintenance cost estimate for the first three years provides for additional labor and materials to manage flooding of the SVE system.

Alternative 3: In-situ Chemical Oxidation

Present Worth: *$1,970,530*
Capital Cost: *$320,275*
Annual OM&M:
(Years 1-2): *$441,600*
(Years 3-20): *$78,200*

In-situ chemical oxidation would involve injecting oxidant chemicals into the contaminated aquifer. The chemicals would react with the contaminants to form nontoxic byproducts such as carbon dioxide and water. This system would remediate contaminated groundwater and therefore prevent further off-site migration of contaminants.

Including the ten injection wells used in the pilot test, Pall Corporation has already installed 36 injection wells, 18 shallow (5-25 feet bgs) and 18 intermediate (35-55 feet bgs). These wells would remediate the on-site groundwater contamination on the north side of the site. Additional injection wells would be installed on-site and off-site to remediate the rest of the plume. The number and location of these wells would be determined during the design phase. Figure 15 shows a process schematic for potassium permanganate injection. The process would be similar if a different oxidant is used.

A pilot test has already been performed using potassium permanganate. The pilot test was successful in remediating the VOCs near the injection wells. Although Freon-113 levels downgradient of the injection wells decreased during the post-injection sampling, bench scale testing during the FS indicated that potassium permanganate may not efficiently destroy Freon-113. Therefore, the final choice of oxidant(s) would be determined during the design phase after additional pilot testing and/or bench scale testing. Alternate oxidants would include sodium permanganate, Fenton's Reagent (hydrogen peroxide with an iron catalyst), and ozone.

The remedy would require approximately six months to design, six months to construct, 2 years of injections, and 18 years of long-term monitoring. The NYSDEC estimates that the remedy will achieve remedial goals within 20 years. The operation and maintenance cost estimate for the first two years includes the cost of the oxidant chemicals.

Alternative 4: Groundwater Extraction and Treatment

Present Worth: *$18,995,217*
Capital Cost: *$4,711,447*
Annual OM&M:
(Years 1-20): *$1,146,167*

In this alternative, groundwater would be pumped from the aquifer to an aboveground treatment system. Extraction wells would be screened from 5-55 feet bgs. The treatment system would remove VOCs from the groundwater and the clean groundwater would be reinjected into the aquifer. This system would remediate contaminated groundwater and prevent further migration of contaminants. The remedy would require two years to design, two years to construct and 20 years to remediate the contaminated groundwater.

7.2 Evaluation of Remedial Alternatives

The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375, which governs the remediation of inactive hazardous waste disposal sites in New York State. A detailed discussion of the evaluation criteria and comparative analysis is included in the FS report.

The alternatives in this PRAP address both on-site and off-site contamination. Although the alternatives presented in the FS Report address only on-site groundwater contamination, the analysis is valid for the increased scope of remediation.

The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the NYSDEC has determined to be applicable on a case-specific basis.

The next five "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Short-term Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

4. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

5. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

7. Cost-Effectiveness. Capital costs and operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision. The costs for each alternative are presented in Table 3.

This final criterion is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

8. Community Acceptance. Concerns of the community regarding the RI/FS reports and the PRAP are evaluated. A responsiveness summary will be prepared that describes public comments received and the manner in which the NYSDEC will address the concerns raised. If the selected remedy differs significantly from the proposed remedy, notices to the public will be issued describing the differences and reasons for the changes.

SECTION 8: SUMMARY OF THE PROPOSED REMEDY

The NYSDEC is proposing Alternative 3, In-Situ Chemical Oxidation as the remedy for OU1 of this site. The elements of this remedy are described at the end of this section.

The proposed remedy is based on the results of the RI and the evaluation of alternatives presented in the FS.

Alternative 3 is being proposed because, as described below, it satisfies the threshold criteria and provides the best balance of the primary balancing criteria described in Section 7.2. It would achieve the remediation goals for the site by actively remediating the contaminated soil and groundwater. The active remediation would eliminate off-site migration of contaminated groundwater by treating on-site soil contamination and on-site and off-site groundwater contamination. The active remediation would also restore soil and groundwater quality to soil cleanup guidance values and ambient water quality standards, respectively, to the extent practicable, which would comply with SCGs and protect human health and the environment. Alternative 3 would ensure that people are not exposed to airborne contaminants by evaluating the potential for vapor intrusion for any buildings beneath the contaminant plume and mitigating any impacts identified. Alternatives 2 and 4 would also comply with SCGs and protect human health and the environment by actively treating contaminated soil and groundwater, and by evaluating and addressing the potential for vapor intrusion. Alternative 1 was removed from consideration because it would not remediate contaminated groundwater and therefore would not satisfy either of the threshold criteria.

Because Alternatives 2, 3, and 4 satisfy the threshold criteria, the five balancing criteria are particularly important in selecting a final remedy for the site.

Alternatives 2 (AS/SVE), 3 (in-situ chemical oxidation), and 4 (extraction and treatment) all have short-term impacts which could easily be controlled. As the natural attenuation of downgradient groundwater contamination would take about the same amount of time for each alternative and would take as long as any of the active remedies, all three alternatives would meet ambient water quality standards in the same amount of time. However, Alternative 3 would prevent off-site migration of contaminants in the shortest time period.

Alternatives 2, 3, and 4 would be equally effective in remediating the contaminated groundwater. All three alternatives would actively treat the contaminated groundwater.

Alternative 3 is favorable in that it is readily implementable. Some of the injection wells for Alternative 3 were already installed as part of the pilot test. Alternative 4 would also be implementable. Alternative 2 would be more difficult to implement because the SVE system would be shut down when the water table submerges the SVE wells.

Alternatives 2 (AS/SVE), 3 (in-situ chemical oxidation), and 4 (extraction and treatment) would reduce the toxicity and volume of the contaminants at the site. As each alternative would directly remove contaminants from the groundwater, the toxicity and volume of contaminants would be reduced. Alternative 4 would reduce the mobility of contaminants through hydraulic control. Alternatives 2 and 3 would not decrease the mobility of contaminants, but they would remediate the contamination.

Alternative 3 would be the least expensive remedy and would have lower capital and annual operation and maintenance costs than Alternatives 2 and 4.

The estimated present worth cost to implement the remedy is $1,970,530. The cost to construct the remedy is estimated to be $320,275 and the estimated average annual operation, maintenance, and monitoring costs for 2 years is $441,600. An additional 18 years of long-term monitoring at an annual cost of $78,200 is also included.

The elements of the proposed remedy are as follows:

1. A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program. The design program would include pilot testing to determine the number of injection wells and the oxidant.

2. Installation of additional on-site and off-site injection wells to actively treat the entire area shown in Figure 16.

3. Injection of a chemical oxidant into the injection wells to destroy groundwater contaminants. Post-injection sampling would be performed to determined if additional injection events are needed.

4. Remediation of contaminated soil by excavation and off-site disposal or in-situ chemical oxidation.

5. The operation of the components of the remedy would continue until the remedial objectives have been achieved, or until the NYSDEC determines that continued operation is technically impracticable or not feasible.

6. Development of a site management plan to: (a) address residual contaminated soils that may be excavated from the site during future redevelopment. The plan would require soil characterization and, where applicable, disposal/reuse in accordance with NYSDEC regulations; (b) evaluate the potential for vapor intrusion for any buildings developed on the site and above the contaminant plume, including provisions for mitigation of any impacts identified; and (c) identify any use restrictions.

7. The property owner would provide an annual certification, prepared and submitted by a Professional Engineer or environmental professional acceptable to the NYSDEC, which would certify that the institutional controls and engineering controls put in place, are unchanged from the previous certification and nothing has occurred that would impair the ability of the control to protect public health or the environment or constitute a violation or failure to comply with any operation and maintenance or site management plan.

8. Imposition of an institutional control in form of an environmental easement that

would: (a) require compliance with the approved site management plan, (b) limit the use and development of the property to commercial or industrial uses only; (c) restrict use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the Nassau County Department of Health; and, (d) require the property owner to complete and submit to the NYSDEC an annual certification.

9. Since the remedy results in untreated hazardous waste remaining at the site, a long term monitoring program would be instituted. Several on-site and off-site groundwater monitoring wells would be sampled quarterly during and after injections. The monitoring wells would be chosen during the remedial design, but the sampling plan could be adjusted based on site conditions. Monitoring would continue until SCGs are met. This program would allow the effectiveness of the in-situ chemical oxidation remedy to be monitored and would be a component of the operation, maintenance, and monitoring for the site.

TABLE 1
Nature and Extent of Contamination
February 1998 to November 2002

SUBSURFACE SOIL	Contaminants of Concern	Concentration Range Detected (ppm)[a]	SCG[b] (ppm)[a]	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	Tetrachloroethene	ND[c] to 950	1.4	1 of 96
	Trichloroethene	ND to 19	0.7	1 of 96
	1,2-Dichloroethene	ND to 4.1	0.3	3 of 96
	Benzene	ND to 0.082	0.06	1 of 96
	Xylenes	ND to 3.1	1.2	2 of 96
	1,1,1-Trichloroethane	ND to 0.98	0.8	1 of 96
SEDIMENTS	**Contaminants of Concern**	**Concentration Range Detected (ppm)[a]**	**SCG[b] (ppm)[a]**	**Frequency of Exceeding SCG**
Volatile Organic Compounds (VOCs)	Tetrachloroethene	ND to 2.1	0.0034	1 of 3
	Trichloroethene	ND to 0.1	0.0085	1 of 3
GROUNDWATER	**Contaminants of Concern**	**Concentration Range Detected (ppb)[a]**	**SCG[b] (ppb)[a]**	**Frequency of Exceeding SCG**
Volatile Organic Compounds (VOCs)	Tetrachloroethene	ND to 140,000	5	168 of 281
	Trichloroethene	ND to 9,600	5	200 of 281
	1,2-Dichloroethene	ND to 15,000	5	220 of 281
	1,1-Dichloroethene	ND to 350	5	72 of 281
	Vinyl Chloride	ND to 1,000	2	135 of 281
	1,1,1-Trichloroethane	ND to 420	5	47 of 281
	1,1,2-Trichloroethane	ND to 22	1	6 of 281
	1,1-Dichloroethane	ND to 390	5	132 of 281
	1,2-Dichloroethane	ND to 22	0.6	56 of 281
	Chloroethane	ND to 9	5	3 of 281
	1,1,2-Trichlorotrifluoroethane (Freon-113)	ND to 150,480	5	78 of 196
	Acetone	ND to 16,000	5	22 of 196
	Methylene Chloride	ND to 52	5	8 of 281

TABLE 1
Nature and Extent of Contamination
February 1998 to November 2002

GROUNDWATER	Contaminants of Concern	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)[a]	Frequency of Exceeding SCG
	Benzene	ND to 7	0.6	24 of 281
	Toluene	ND to 290	5	8 of 281
	Ethylbenzene	ND to 840	5	4 of 281
	Xylenes	ND to 3,470	5	11 of 281
	2-Hexanone	ND to 1,700	50	1 of 196
	Bromoform	ND to 61	50	1 of 281
	Chlorobenzene	ND to 7	5	1 of 281
	1,2-Dichloropropane	ND to 6	1	4 of 281
GROUNDWATER POST-IRM	**Contaminants of Concern**	**Concentration Range Detected (ppb)[a]**	**SCG[b] (ppb)[a]**	**Frequency of Exceeding SCG**
Volatile Organic Compounds (VOCs)	Tetrachloroethene	ND to 330	5	7 of 19
	Trichloroethene	ND to 490	5	8 of 19
	1,2-Dichloroethene	ND to 300	5	9 of 19
	1,1-Dichloroethene	ND	5	0 of 19
	Vinyl Chloride	ND to 38	2	8 of 19
	1,1,1-Trichloroethane	ND to 4	5	0 of 19
	1,1,2-Trichloroethane	ND	1	0 of 19
	1,1-Dichloroethane	ND to 28	5	1 of 19
	1,2-Dichloroethane	ND to 4	0.6	1 of 19
	Chloroethane	ND	5	0 of 19
	1,1,2-Trichlorotrifluoroethane (Freon-113)	ND to 580	5	7 of 19
	Acetone	ND to 75	5	2 of 19
	Methylene Chloride	ND	5	0 of 19
	Benzene	ND	0.6	0 of 19
	Toluene	ND	5	0 of 19

TABLE 1
Nature and Extent of Contamination
February 1998 to November 2002

GROUNDWATER POST-IRM	Contaminants of Concern	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)[a]	Frequency of Exceeding SCG
	Ethylbenzene	ND	5	0 of 19
	Xylenes	ND	5	0 of 19
	2-Hexanone	ND	50	0 of 19
	Bromoform	ND	50	0 of 19
	Chlorobenzene	ND	5	0 of 19
	1,2-Dichloropropane	ND	1	0 of 19
SURFACE WATER	**Contaminants of Concern**	**Concentration Range Detected (ppb)[a]**	**SCG[b] (ppb)[a]**	**Frequency of Exceeding SCG**
Volatile Organic Compounds (VOCs)	Tetrachloroethene	ND to 77	1	1 of 3
	Trichloroethene	ND to 29	40	0 of 3
	1,2-Dichloroethene	ND to 28	210	0 of 3
	1,1-Dichloroethane	ND to 1	2,100	0 of 3
	Vinyl Chloride	ND to 2	980	0 of 3
	Acetone	14 to 28	50,000	0 of 3
	1,1,2-Trichlorotrifluoroethane (Freon-113)	ND to 25	None	N/A
AIR	**Contaminants of Concern**	**Concentration Range Detected ($\mu g/m^3$)[a]**	**SCG[b] ($\mu g/m^3$)[a]**	**Frequency of Exceeding SCG**
Volatile Organic Compounds (VOCs)	Tetrachloroethene	ND to 6.6	100/ Background[d]	0 of 4
	Trichloroethene	ND to 2.1	None	0 of 4
	1,2-Dichloroethene	ND to 5.4	None	0 of 4
	1,1,2-Trichlorotrifluoroethane (Freon-113)	1.1 to 1.5	None	0 of 4

[a] ppb = parts per billion, which is equivalent to micrograms per liter, µg/L, in water;
ppm = parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil;
$\mu g/m^3$ = micrograms per cubic meter

TABLE 1
Nature and Extent of Contamination
February 1998 to November 2002

[b] SCG = standards, criteria, and guidance values

[c] ND = not detected

[d] The NYSDOH "Tetrachloroethene in Indoor and Outdoor Air" fact sheet states, "Reasonable and practical actions should be taken to reduce PERC [Tetrachloroethene] exposure when indoor air levels are above background, even when they are below the guideline of 100 $\mu g/m^3$... The goal of the recommended actions is to reduce PERC levels in indoor air to as close to background as practical."

Table 2
Comparison of Total VOCs - On-site vs. Upgradient

Depth	Date	Highest On-site[1] Concentration	Highest Upgradient[2] Concentration
Shallow[3]	April 1999	4,300[4]	18
Shallow	January 2000[5]	3,078	5
Shallow	December 2000	3,775	94
Shallow	Oct/Nov 2002	14,437	46
Intermediate[6]	April 1999	614	1,330
Intermediate	January 2000	2,009	332
Intermediate	December 2000	4,952	713
Intermediate	Oct/Nov 2002	3,306	167
Deep[7]	April 1999	695	431
Deep	January 2000	12,711	1,751
Deep	December 2000	1,941	2,228
Deep	Oct/Nov 2002	4,500	1,604

[1]Does not include wells at the upgradient edge of the Pall site

[2]Includes wells at the upgradient edge of the Pall site

[3]Shallow wells are water table wells. Water table is about 5 feet deep

[4]For April 1999 and January 2000 sampling events, total VOCs does not include Freon-113. For December 2000 and Oct/Nov 2002 sampling events, Freon 113 is included in total VOCs

[5]The January 2000 sampling occurred while the City was pump testing the Carney Street well, which was formerly used as a public water supply well

[6]Intermediate wells are about 60 feet deep

[7]Deep wells are about 100 feet deep

Table 3
Remedial Alternative Costs

Remedial Alternative	Capital Cost	Annual OM&M	Total Present Worth
1: No Further Action	$29,900	Years 1-30: $78,200	$1,232,026
2: Air Sparge/Soil Vapor Extraction	$2,061,886	Years 1-3: $940,125 Years 4-20: $78,200	$5,383,666
3: In-Situ Chemical Oxidation	$320,275	Years 1-2: $441,600 Years 3-20: $78,200	$1,970,530
4: Extraction and Treatment	$4,711,447	Years 1-20: $1,146,167	$18,995,217

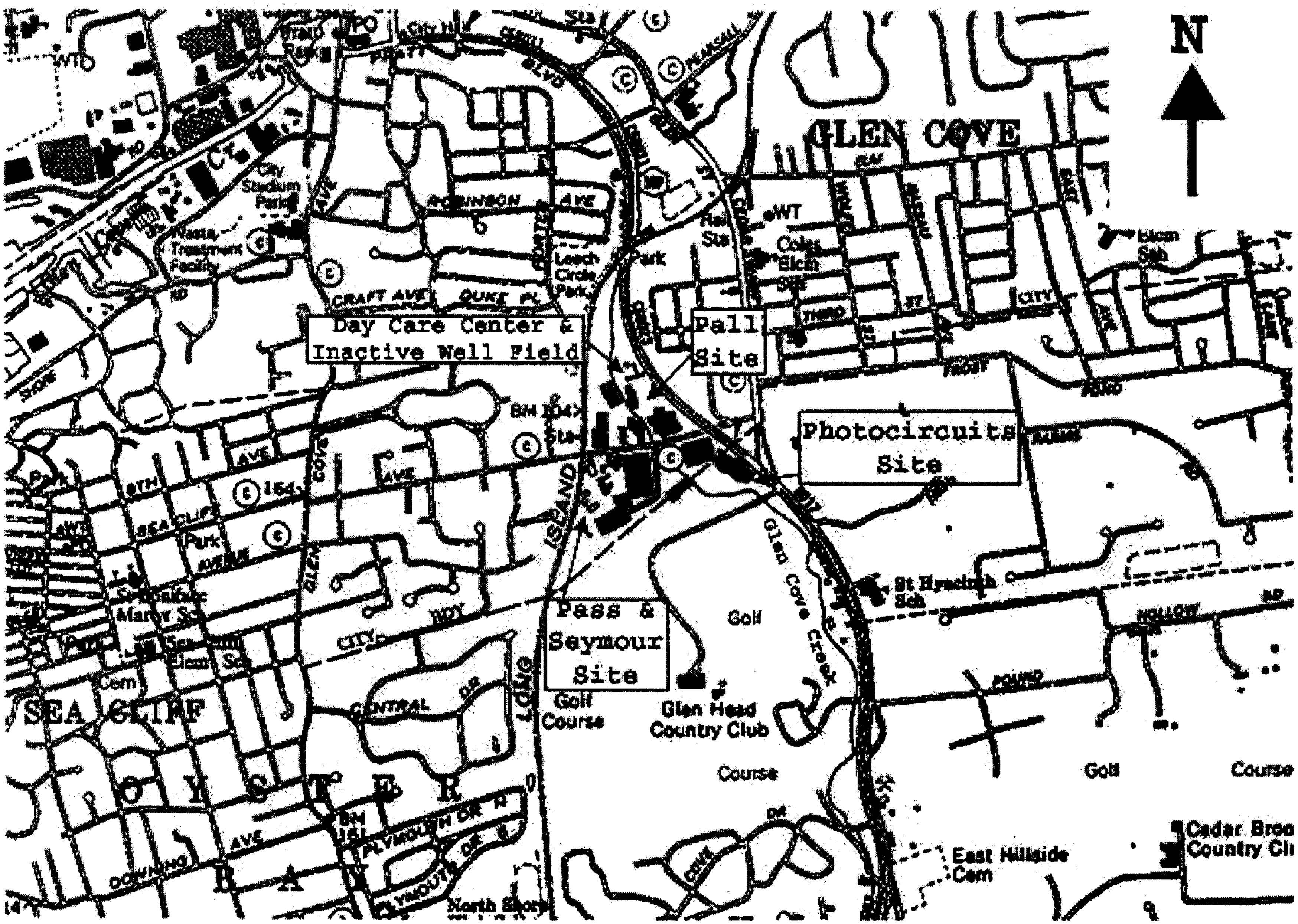
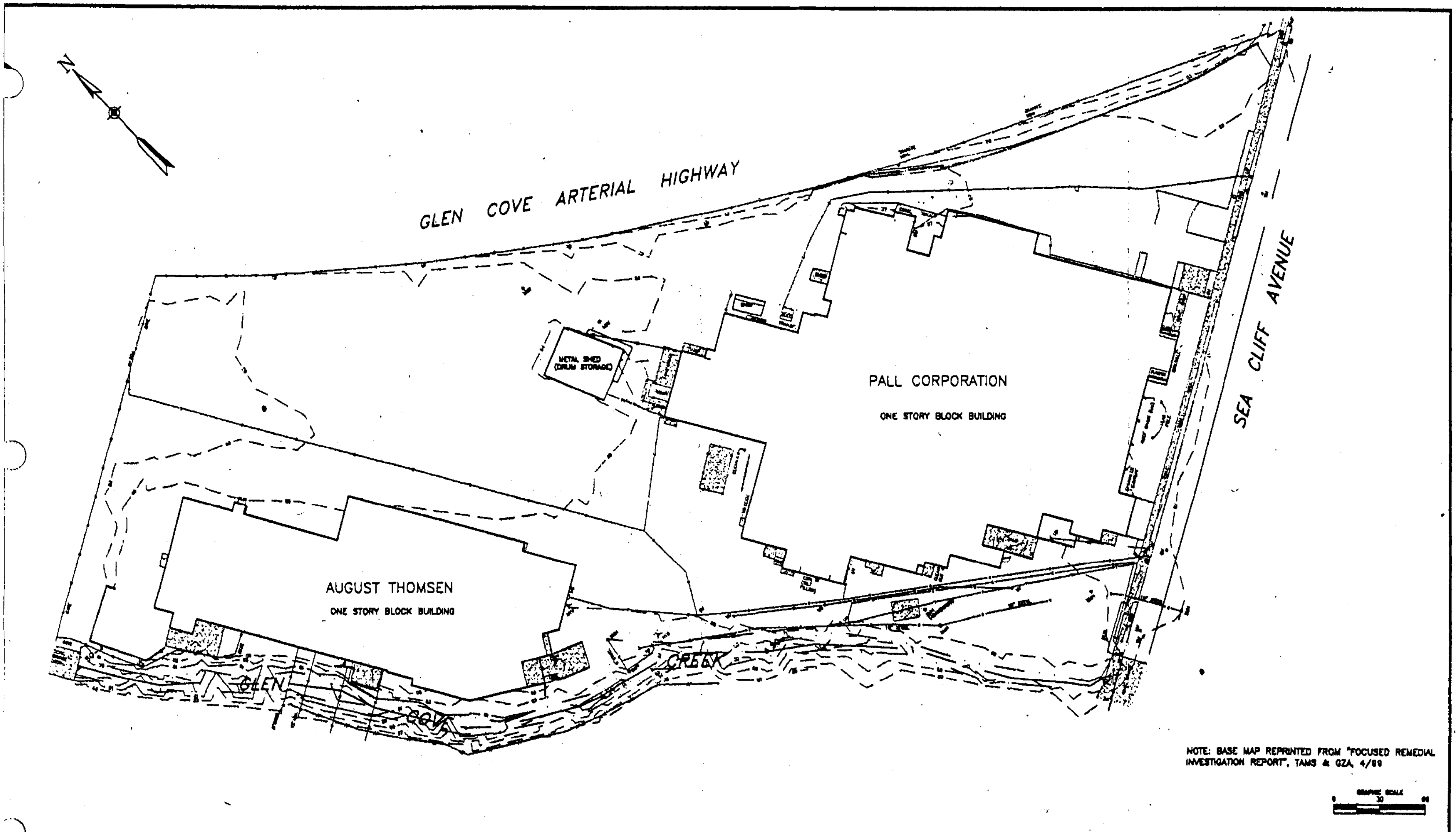
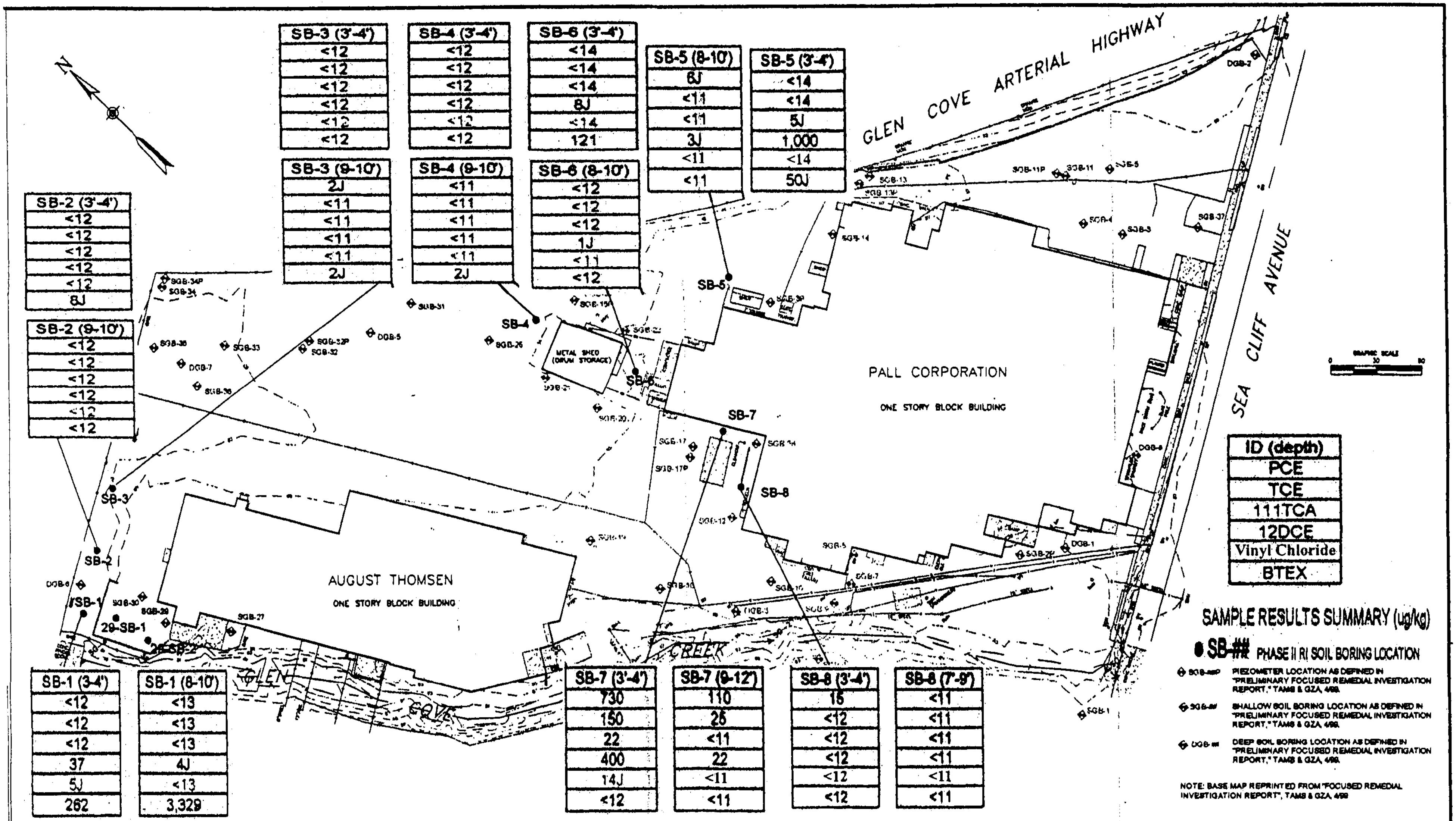


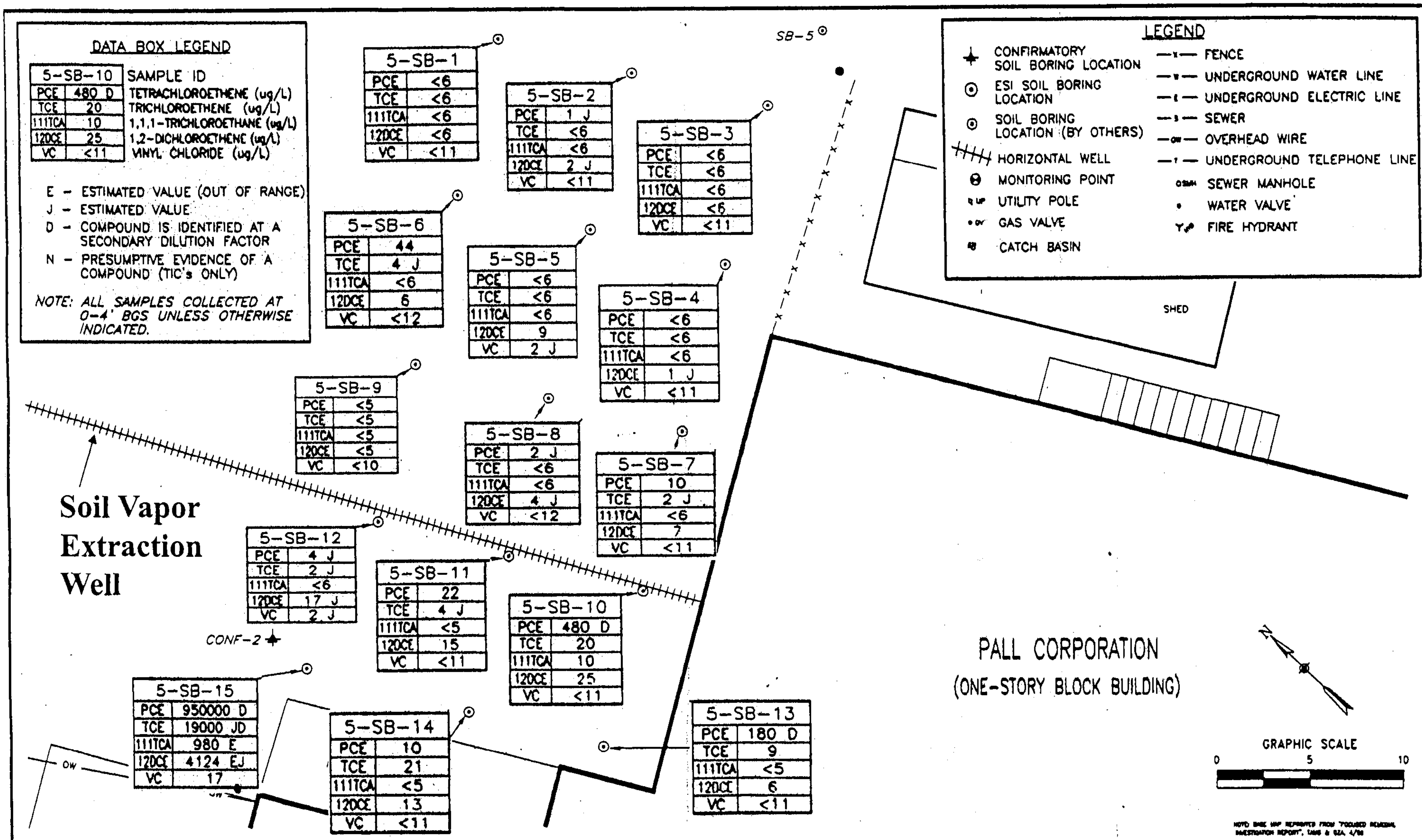
Figure 1: Site Location Map



ENVIRO-SCIENCES, INC. 312 EAST MAIN STREET PATCHOGUE, NEW YORK 11772 PHONE: 631-207-9005 FAX: 631-207-3614	PALL Pall Corporation 30 Sea Cliff Avenue Glen Cove, New York 11542	Pall Corp. / August Thomsen Site Plan	DATE: 03/09/00	DRAWN: DJS	FIGURE: 2
			REV. NO. 1	DESIGNED: DJS	
			PROJECT NO. MT&E-PALL-M371	FILE: FIGURE1-2.DWG	



ENVIRO-SCIENCES, INC 312 EAST MAIN STREET PATCHOGUE, NEW YORK 11772 PHONE: 631-207-9005 FAX: 631-207-3614	PALL Pall Corporation 30 Sea Cliff Avenue Glen Cove, New York 11542	Phase II Soil Investigation Results *(VOC Summary)*	DATE: 3/17/00 REV. NO. 1 PROJECT NO. MT&E-PALL-M371	DRAWN: DJS DESIGNED: DJS FILE: FIGURE3-2FS.DWG.	FIGURE: 3



ENVIRO-SCIENCES, INC.
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PATCHOGUE, NEW YORK 11772
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PALL

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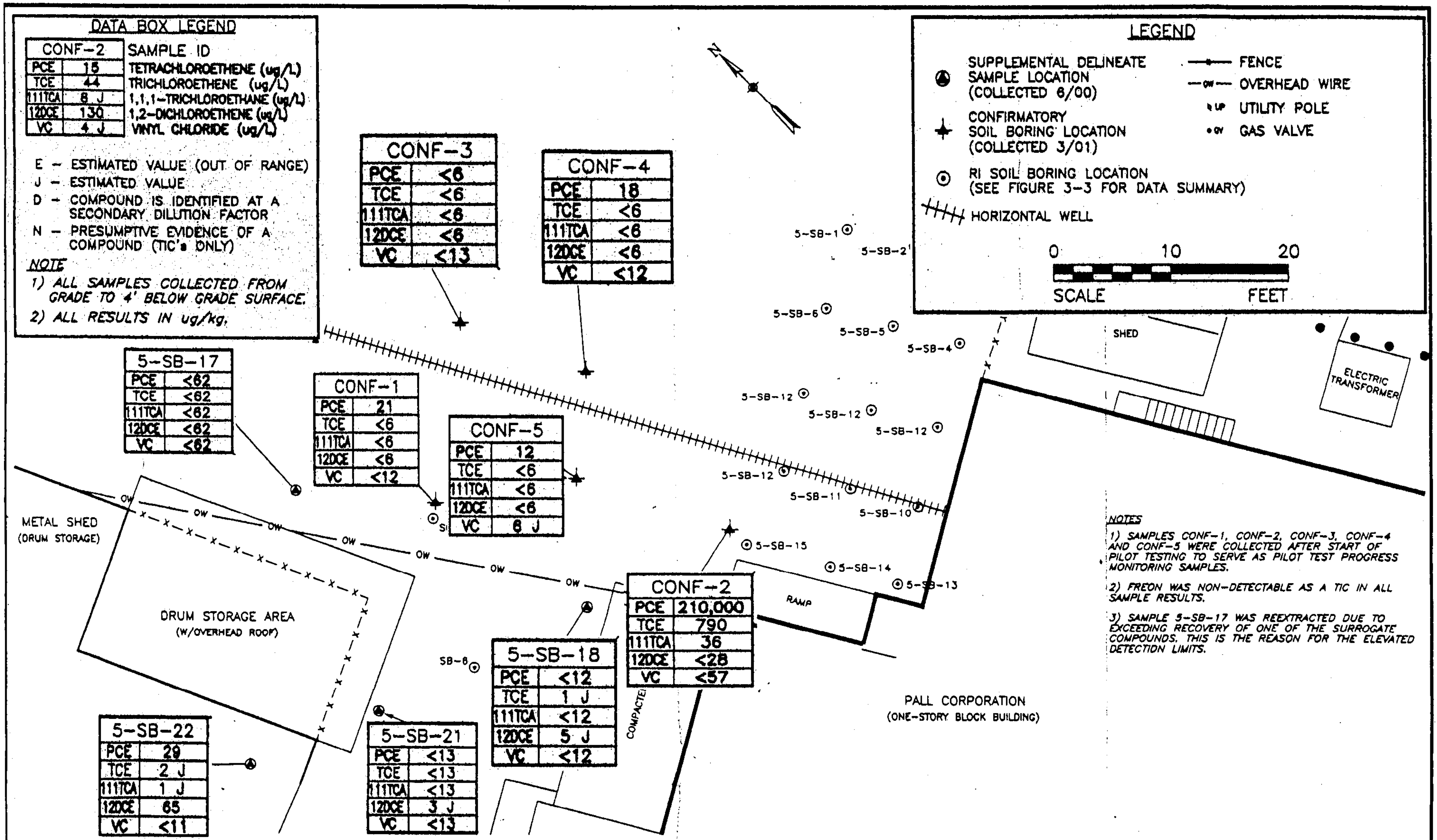
30 Sea Cliff Avenue
Glen Cove, New York 11542

AREA SB5
Soil Sample Results Summary
(Samples Collected August 1999)

DATE: 06/12/01	DRAWN: TRS	FIGURE:
REV. NO. -	DESIGNED: DJS	4
PROJECT NO. MT&E-PALL-M371	FILE: PALLSB5C.DWG	



ENVIRO-SCIENCES, INC.
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PATCHOGUE, NEW YORK 11772
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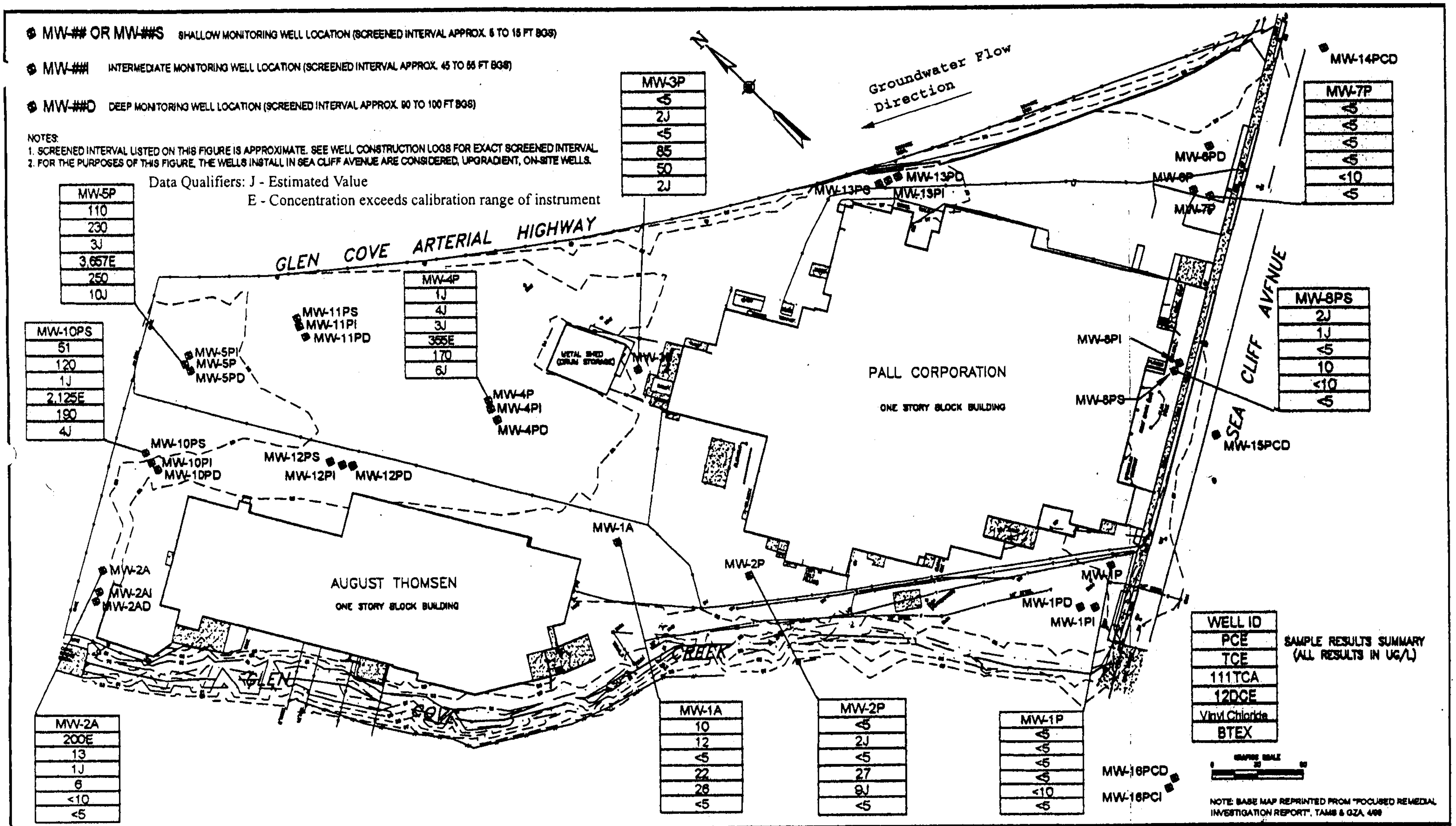
Pall Corporation
30 Sea Cliff Avenue
Glen Cove, New York 11542

PILOT TEST SOIL SAMPLE RESULTS (ADDITIONAL DELINEATION DATA)

DATE:	08/30/01	DRAWN:	TRS	FIGURE: 5
REV. NO.	-	DESIGNED:	DJS	
PROJECT NO.	MT&E-PALL-M371	FILE:	PALLCF37A.DWG	



ENVIRO-SCIENCES, INC.
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PATCHOGUE, NEW YORK 11772
PHONE: 631-207-9005 FAX: 631-207-3614

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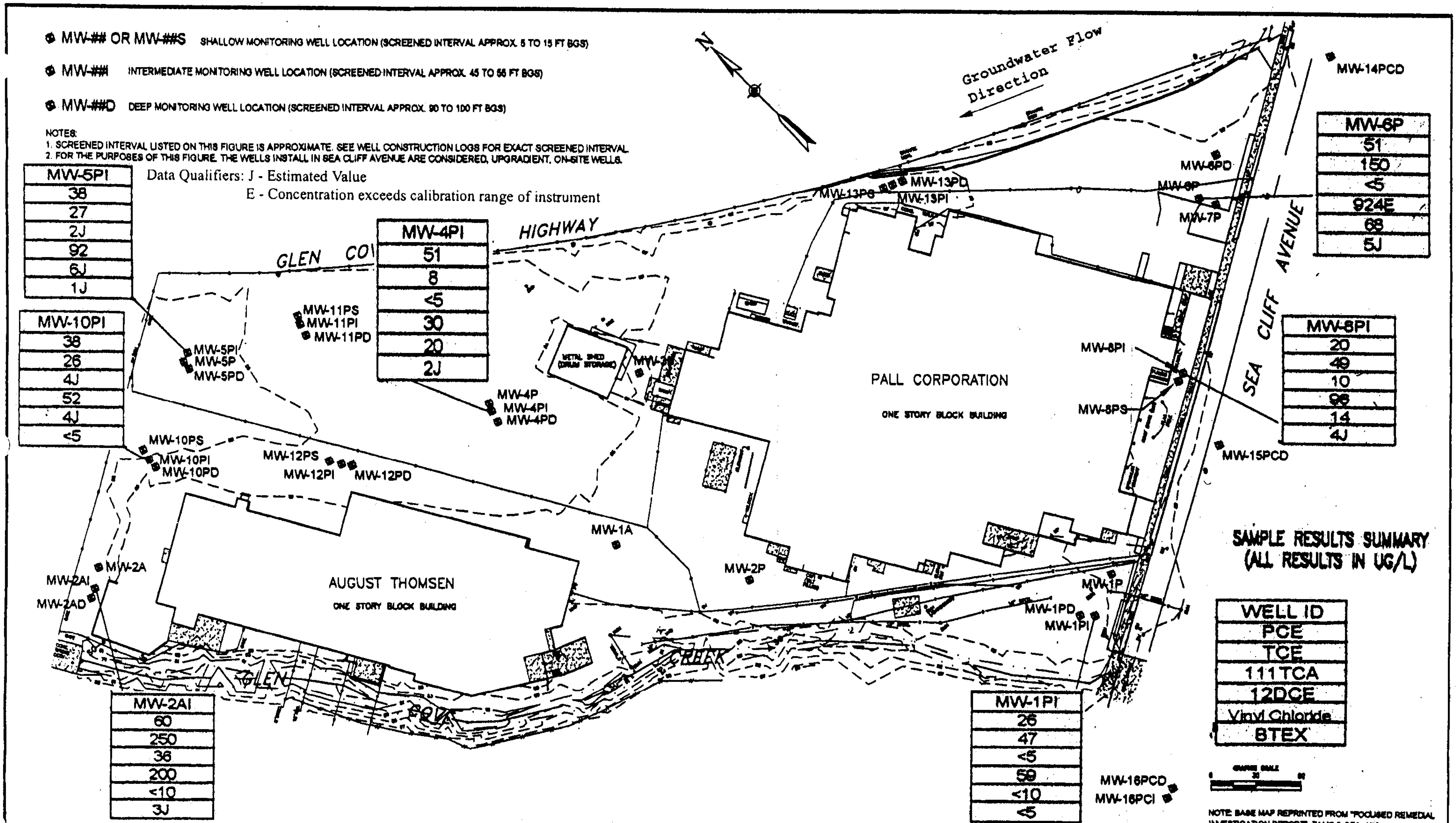
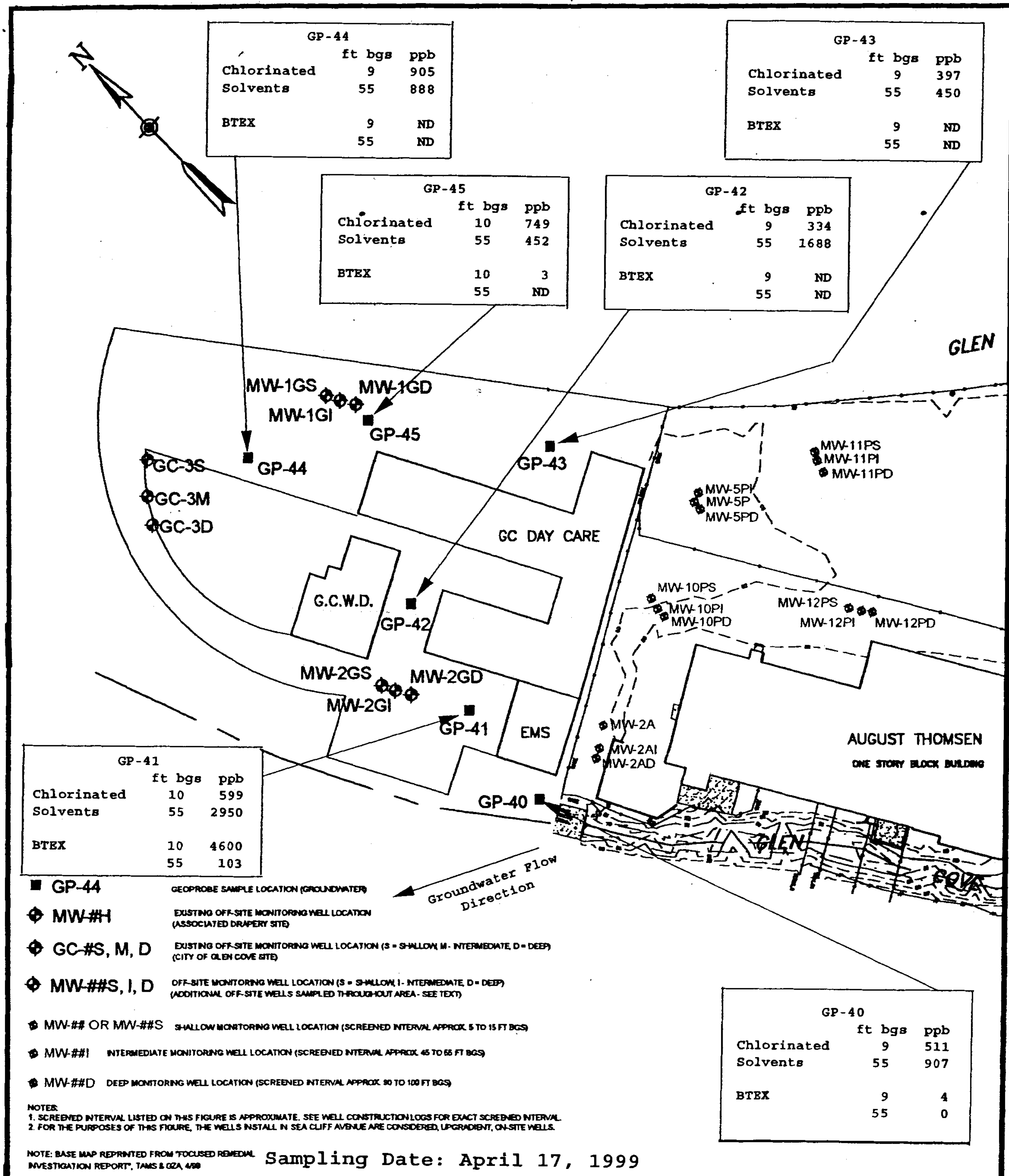
Pall Corporation
30 Sea Cliff Avenue
Glen Cove, New York 11542

Groundwater Sample Results Summary
(Shallow Wells, Samples Collected 4/99)

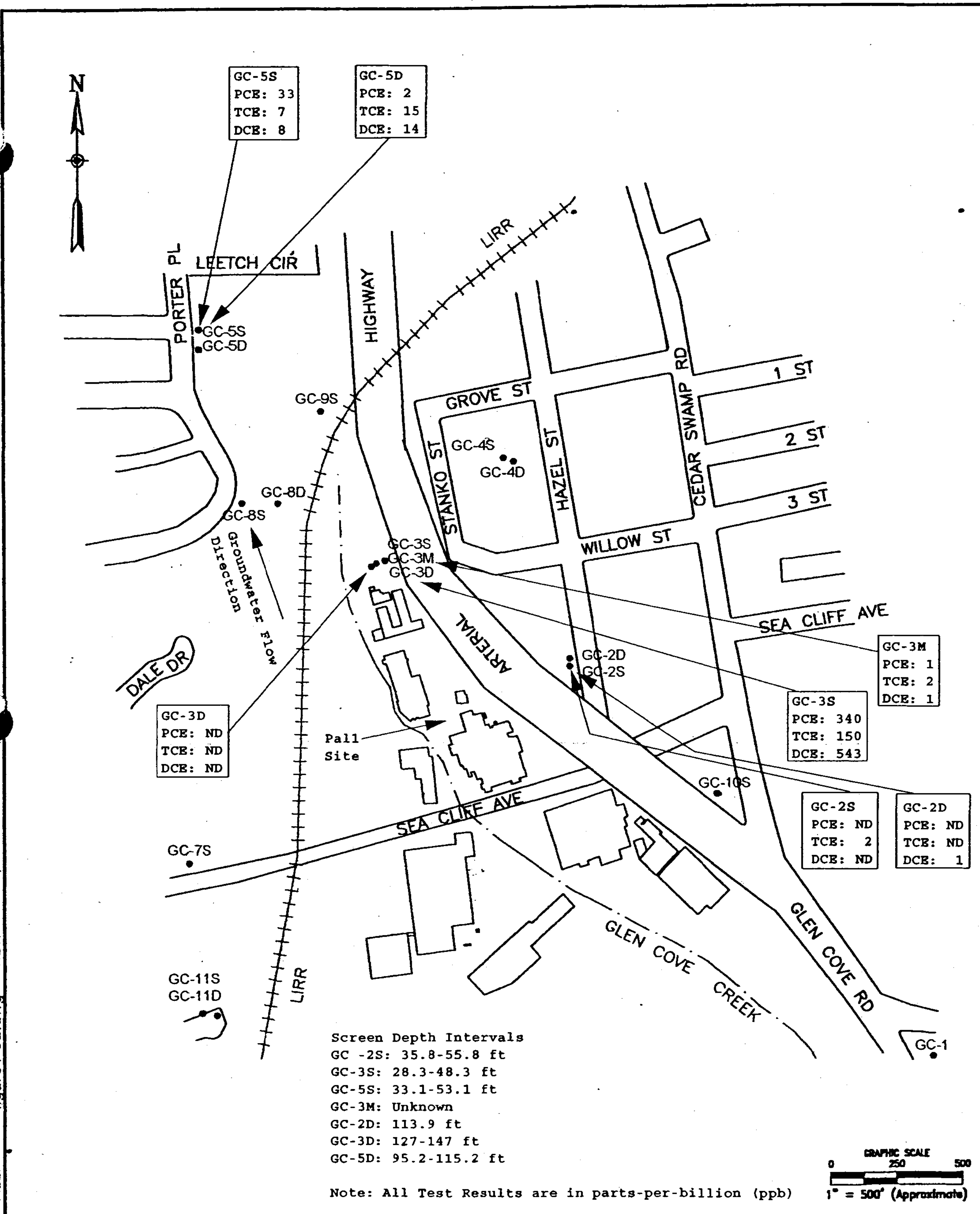
DATE:	06/29/00	DRAWN:	DJS	FIGURE:	6
REV. NO.	1	DESIGNED:	DJS		
PROJECT NO.	MT&E-PALL-M371	FILE:	FIGURE4-7.DWG		



ENVIRO-SCIENCES, INC. 312 EAST MAIN STREET PATCHOGUE, NEW YORK 11772 PHONE: 631-207-9005 FAX: 631-207-3614	PALL Pall Corporation 30 Sea Cliff Avenue Glen Cove, New York 11542	Groundwater Sample Results Summary (Intermediate Wells, Samples Coll. 4/99)	DATE: 6/29/00 REV. NO. 1 PROJECT NO. MT&E-PALL-M371	DRAWN: DJS DESIGNED: DJS FILE: FIGURE4-6.DWG	FIGURE: 7

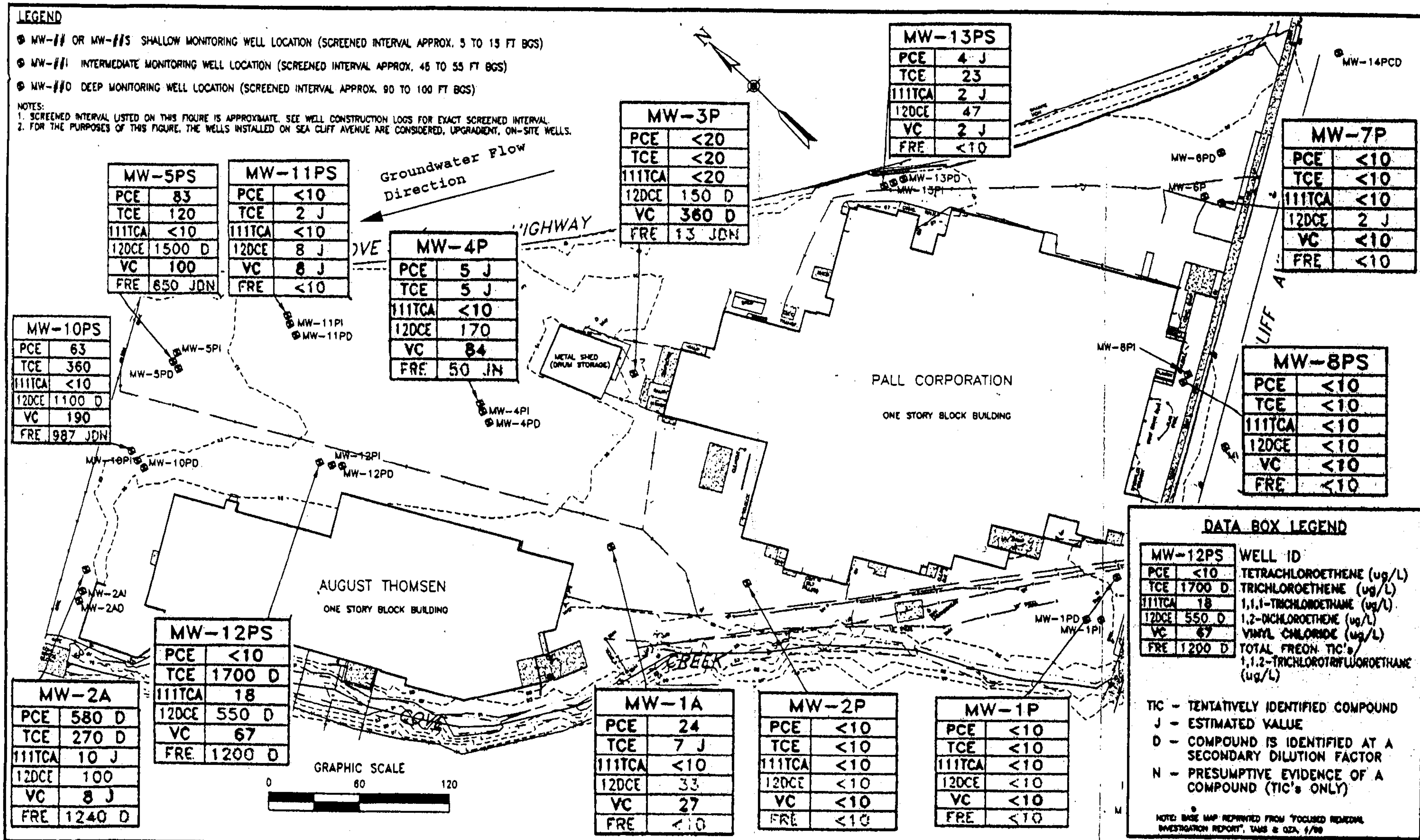


Downgradient Direct Push Groundwater Results	PALL Pall Corporation 30 Sea Cliff Avenue Glen Cove, New York 11542	Figure 8

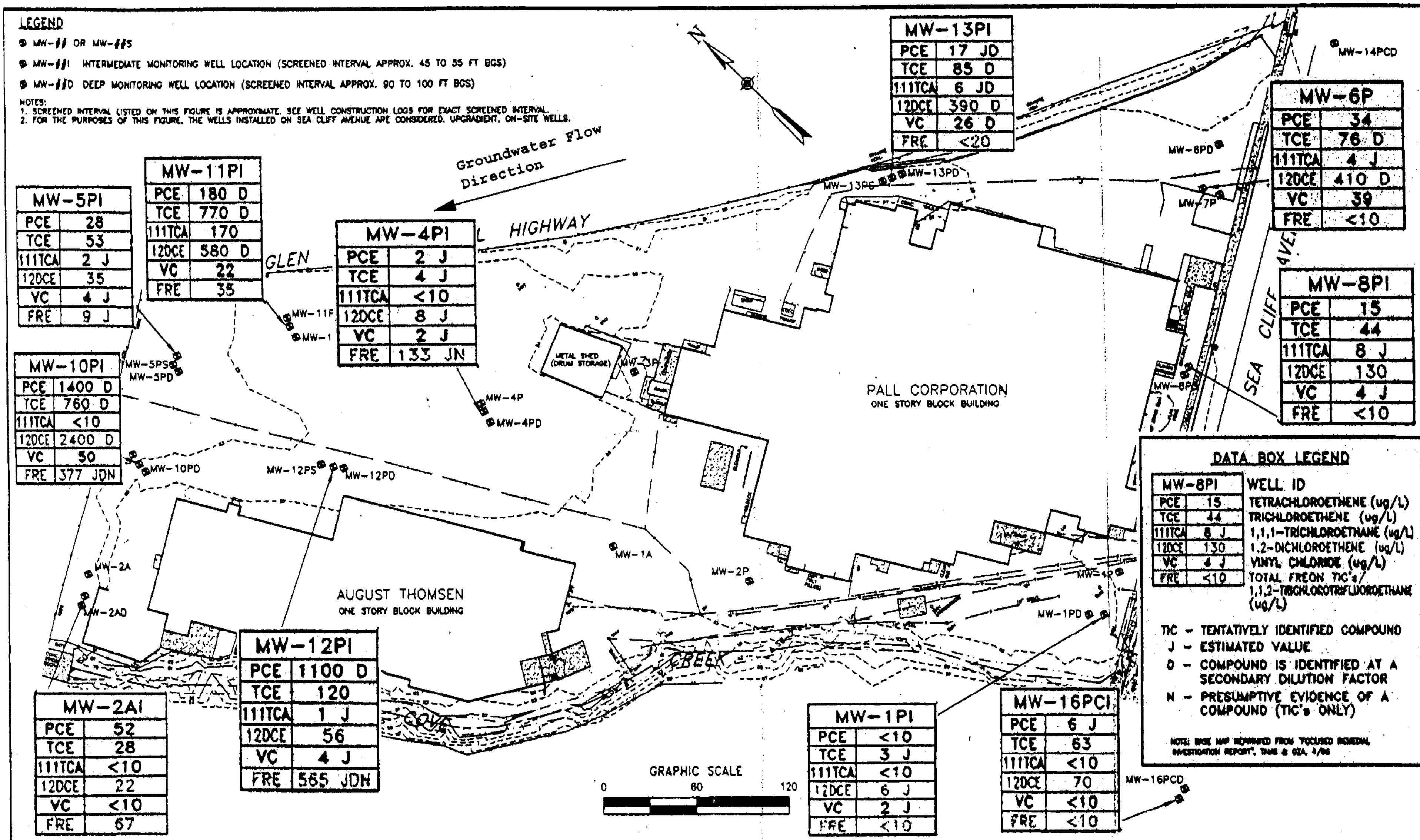


FILE: figure4-3a.dwg REV.# 1

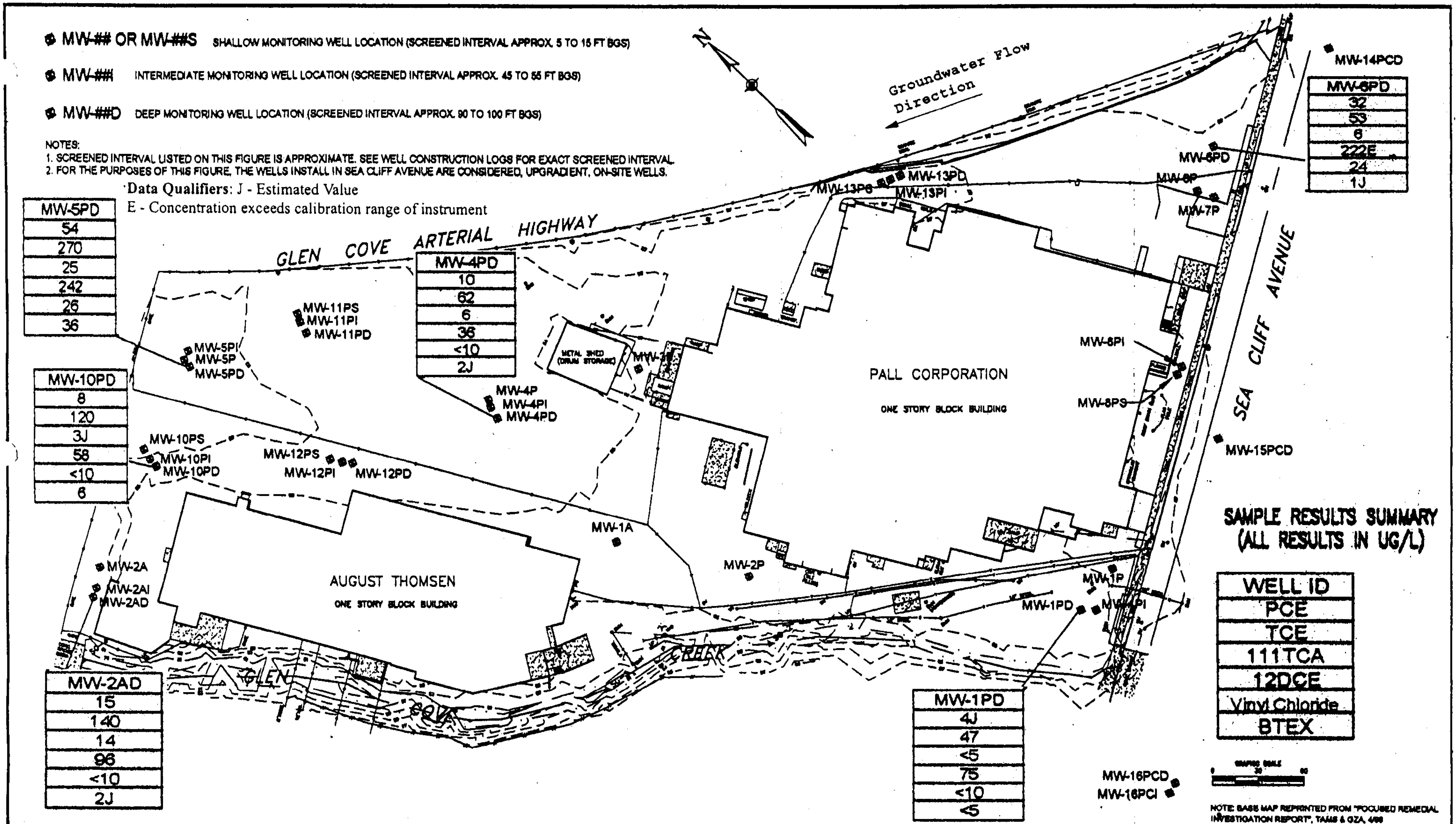
ENVIRO-SCIENCES, INC. 312 EAST MAIN STREET PATCHOGUE, NEW YORK 11772 PHONE: 516-207-9005 FAX: 516-207-3614	Pall Corporation Glen Cove, New York	DATE: 03/13/00 DRAWN: DJS	FIGURE:
	Off-Site, Public Monitoring Well Locations Near Site	DESIGNED: DJS MT&E-PALL-M371	9



ENVIRO-SCIENCES, INC. 312 EAST MAIN STREET PATCHOGUE, NEW YORK 11772 PHONE: 631-207-9005 FAX: 631-207-3614	PALL Pall Corporation 30 Sea Cliff Avenue Glen Cove, New York 11542	Groundwater Sample Results Summary (Shallow Wells, Samples Coll. 12/00)	DATE: 06/15/01	DRAWN: TRS	FIGURE: 10
			REV. NO. -	DESIGNED: DJS	
			PROJECT NO. MT&E-PALL-M371	FILE: PALLSS12.DWG	



ENVIRO-SCIENCES, INC. 312 EAST MAIN STREET PATCHOGUE, NEW YORK 11772 PHONE: 631-207-9005 FAX: 631-207-3614	PALL Pall Corporation 30 Sea Cliff Avenue Glen Cove, New York 11542	Groundwater Sample Results Summary (Intermediate Wells, Samples Coll. 12/00)	DATE: 06/12/01 REV. NO. - PROJECT NO. MT&E-PALL-M371	DRAWN: TRS DESIGNED: DJS FILE: PALLSI12.DWG
			FIGURE: 11	



ENVIRO-SCIENCES, INC.
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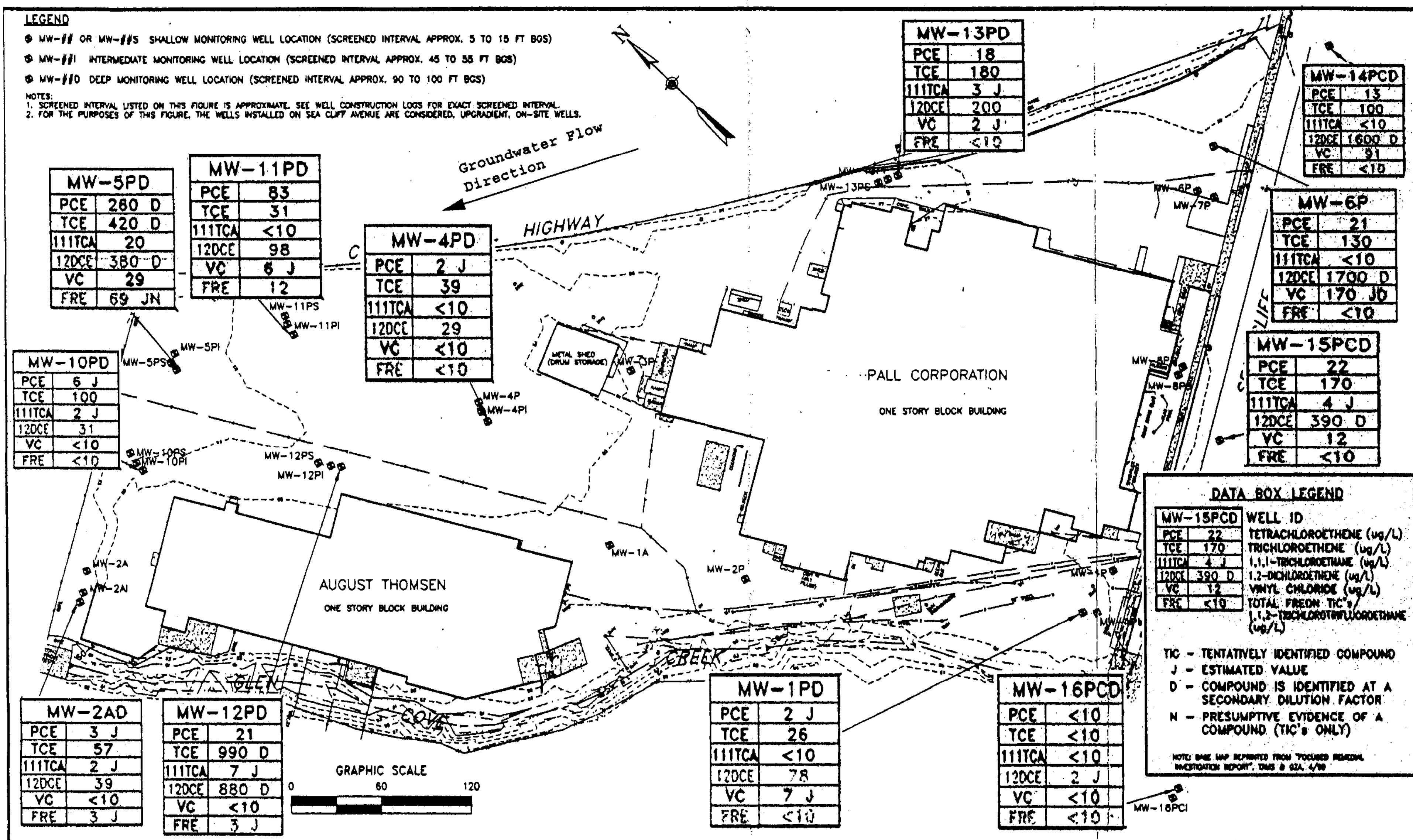
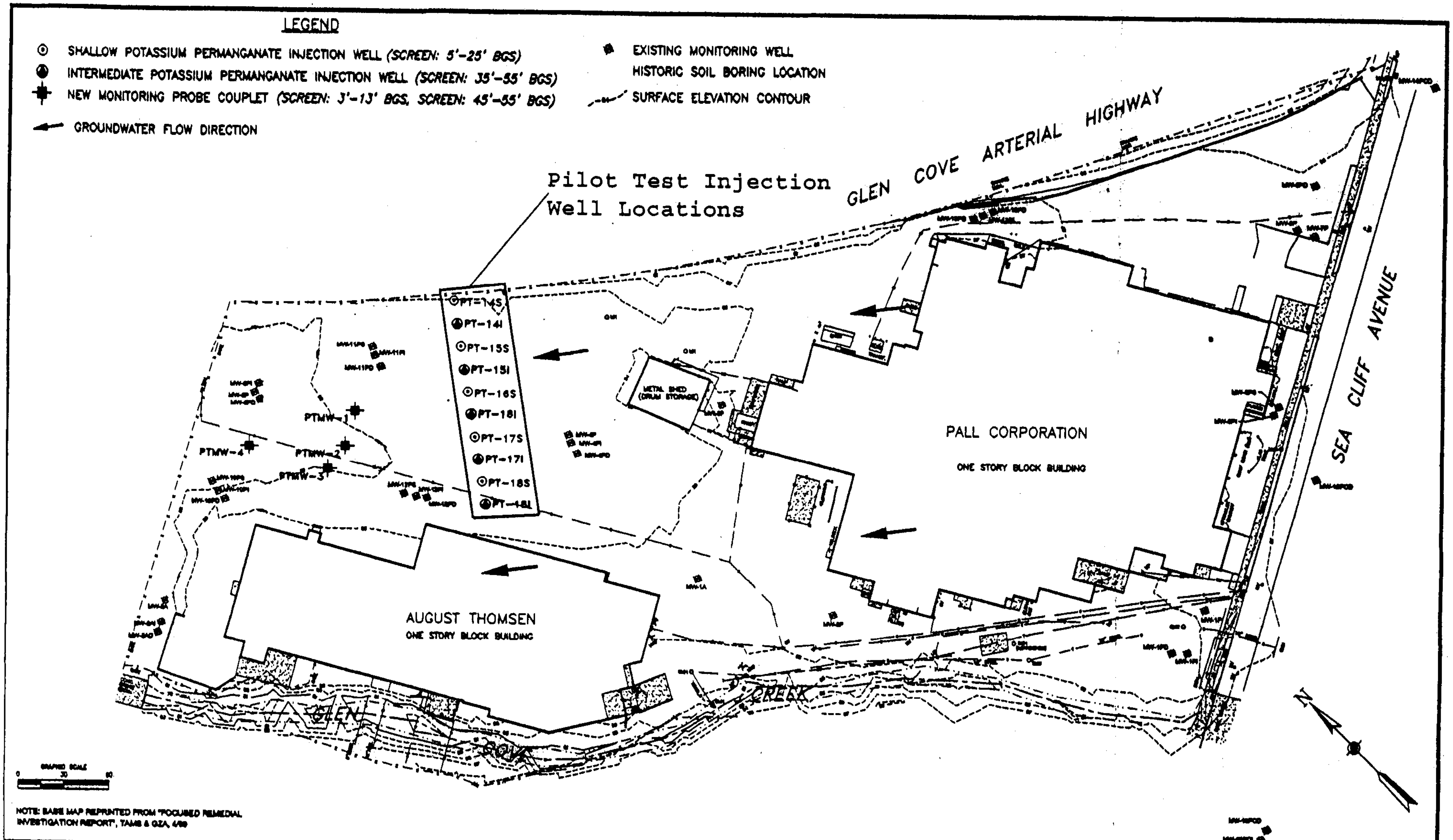
30 Sea Cliff Avenue
Glen Cove, New York 11542

Groundwater Sample Results Summary
(Deep Wells, Samples Collected 4/99)

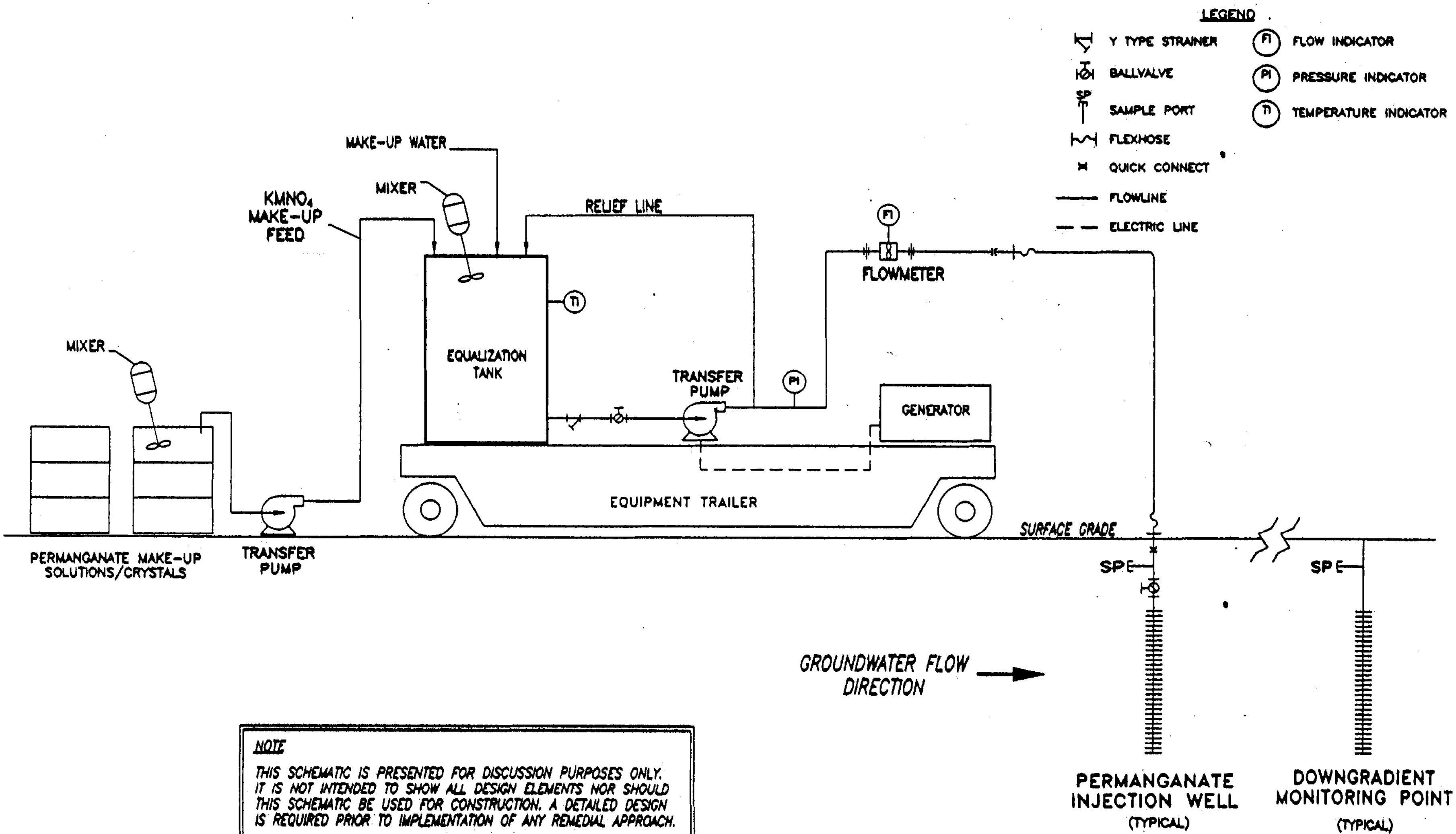
DATE:	6/29/00	DRAWN:	DJS	FIGURE:
REV. NO.	1	DESIGNED:	DJS	12
PROJECT NO.	MT&E-PALL-M371	FILE:	FIGURE4-13a.DWG	



ENVIRO-SCIENCES, INC. 312 EAST MAIN STREET PATCHOGUE, NEW YORK 11772 PHONE: 631-207-9005 FAX: 631-207-3614	PALL — Pall Corporation, 30 Sea Cliff Avenue, Glen Cove, New York 11542	Groundwater Sample Results Summary (Deep Wells, Samples Coll. 12/00)	DATE: 06/15/01; REV. NO. -; PROJECT NO. MT&E-PALL-M371	DRAWN: TRS; DESIGNED: DJS; FILE: PALLSD12.DWG; FIGURE: 13



ENVIRO-SCIENCES, INC. 312 EAST MAIN STREET PATCHOGUE, NEW YORK 11772 PHONE: 631-207-9005 FAX: 631-207-3614	PALL Pall Corporation 30 Sea Cliff Avenue Glen Cove, New York 11542	Pilot Test Injection Well Locations	DATE: 9/5/01	DRAWN: TRS	FIGURE:
			REV. NO. -	DESIGNED: DJS	14
			PROJECT NO. MT&E-PALL-M371	FILE: PALLALT3F8.DWG	



NOTE

THIS SCHEMATIC IS PRESENTED FOR DISCUSSION PURPOSES ONLY. IT IS NOT INTENDED TO SHOW ALL DESIGN ELEMENTS NOR SHOULD THIS SCHEMATIC BE USED FOR CONSTRUCTION. A DETAILED DESIGN IS REQUIRED PRIOR TO IMPLEMENTATION OF ANY REMEDIAL APPROACH.

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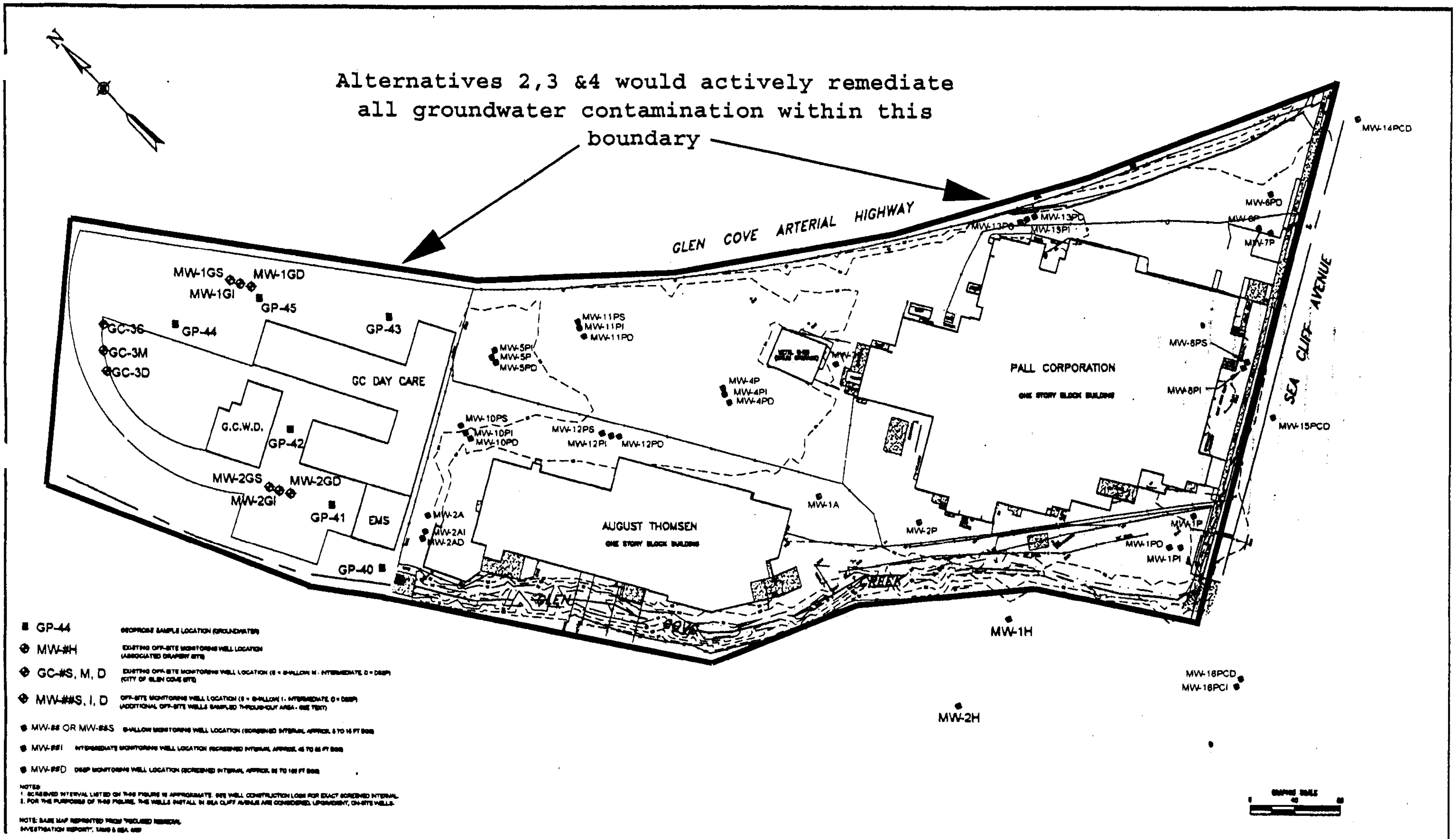

ENVIRO-SCIENCES, INC. 312 EAST MAIN STREET PATCHOGUE, NEW YORK 11772 PHONE: 631-207-9005 FAX: 631-207-3614	PALL — Pall Corporation 30 Sea Cliff Avenue Glen Cove, New York 11542	Boundaries for Active Groundwater Remediation	DATE: 6/29/00	DRAWN: DJS	FIGURE:
			REV. NO. 1	DESIGNED: DJS	16
			PROJECT NO. MT&E-PALL-M371	FILE: FIGURES-2.DWG	