Seattle Regional Office

Formerly HAZCON, INC.

4636 E. Marginal Way S.
Suite 215
Seattle, WA 98134
(206) 763-7364
Fax (206) 763-4189

Clayton
ENVIRONMENTAL
CONSULTANTS

Independent Remedial Action Program Report
at
Ross Plaza, Federal Way, WA
for
Balcor Management Services

August 20, 1997

Clayton Project No. 75-97357.00

CONTENTS

FIGURES

TABLES

APPENDICES

1.0 INTRODUCTION

Clayton Environmental Consultants, Inc. (Clayton) is pleased to present this Independent Remedial Action Program (IRAP) report of the subsurface investigations conducted at the Ross Plaza in Federal Way, Washington (Figure 1). Mr. Ellis of Ellis Partners, Inc. retained Clayton to conduct a Phase I Environmental Site Assessment and subsurface investigation of the property in March and April, 1997 to evaluate the property prior to purchase. The Phase I Assessment identified three onsite areas and one offsite area with a potential to have impacted the subsurface environment. The areas included a former gasoline station, a former dry cleaners and a currently operating dry cleaners located onsite and an offsite LUST site (Figure 2). Subsurface contamination was identified at one location, Crystal Cleaners, during the investigation and Ellis Partners declined to purchase the property. Subsequently, Mr. Robert O'Neill of Balcor Management Services, Inc., representing the owners of the property, retained Clayton to conduct additional investigation of Crystal Cleaners to determine the source and extent of contamination and remedial options.

The objectives of the investigations were to:

- Assess soil and groundwater conditions in the areas of a former dry cleaner facility, a currently operational dry cleaner (Crystal Cleaners) and a former gasoline station located on the subject property;
- Determine the extent and magnitude of groundwater contamination at the Crystal Cleaners site;
- Assess remediation options at Crystal Cleaners; and
- Provide a report summarizing the work performed and our findings and conclusions.

The purpose of this report is to summarize subsurface investigations at the subject property and to enter into the Washington State Department of Ecology (Ecology) IRAP. The legal description for the property is: Lots 7, 8, 11, 12, and 13 of the Century Plat, King County, Washington (Figure 3). The client desires to pursue a No Further Action (NFA) designation for Lots 8, 11, 12 and 13. The former gasoline station and former dry cleaners were located on Lots 11 and 13. Crystal Cleaners is located on Lot 7 and this area is excluded from the NFA request at this time. The client plans to pursue remedial actions at Crystal Cleaners and once the remedial action is completed, a report will be submitted to Ecology to request a NFA designation for Lot 7 of the subject property.

1.1 BACKGROUND

Ross Plaza, the subject property, is located at the intersection of Pacific Highway South and South 320th Street in Sea-Tac, Washington (Figure 1). The plaza is located one block to the west of Sea-Tac Mall (Figure 2). The main occupants of Ross Plaza currently include Safeway, Cocos, Michaels, Fabricland, and Seafirst Bank (Figure 2). The main arterials, Pacific Highway South and South 320th, are commercially developed with retail outlets. The area to the west of Ross Plaza is residential. The plaza was constructed in the late 1970s and early 1980s.

Clayton conducted a Phase I Environmental Site Assessment of the subject property in March 1997 in association with potential property transactions (Appendix A). The Phase I investigation identified three onsite and one offsite area with potential environmental impact

including: a former dry cleaners facility now occupied by Fabricland, Crystal Cleaners (a current occupant), a former gasoline station since replaced by Seafirst Bank, and the Arco leaking underground storage tank (LUST) site north of Seafirst Bank (Figure 2).

Based on the Phase I investigation, Clayton recommended subsurface investigations of the three onsite site areas to assess whether halogenated volatile organic compounds (HVOCs) or petroleum hydrocarbons had impacted the subsurface environment. Assessment of the potential impacts from the offsite area (Arco LUST site) were conducted during evaluation of the former onsite gasoline station. Clayton collected soil gas samples, soil samples and groundwater samples between April and June, 1997. A survey for underground storage tanks (USTs) at the former gasoline station was also conducted. Once the conditions of the areas were assessed, Clayton conducted additional subsurface investigation at Crystal Cleaners to determine the aquifer characteristics and options for remediation.

The details of the investigations are described below. Section 2.0 presents the investigative procedures, Section 3.0 presents the investigation results and Section 4.0 presents our conclusions and recommendations.

2.0 INVESTIGATION PROCEDURES

2.1 SOIL GAS INVESTIGATION

Between March 21 and 25, 1997 Clayton conducted a soil gas investigation of the current and former dry cleaner facilities onsite. The objectives of the investigation were to collect soil gas samples from around the perimeter of the dry cleaner sites to assess the subsurface conditions for halogenated volatile organic compounds (HVOCs).

Cynthia Torzynski, a Clayton geologist, installed eight Emuflux soil gas collection units along the accessible perimeters of the two dry cleaner sites on March 21, 1997. The soil gas sample locations are shown in Figure 4. Four inch diameter holes were cut in the asphalt and the soil gas collection units were installed approximately eight inches below the surface. The soil gas collectors were in place for approximately four days. The units were retrieved on March 25, 1997. The units were analyzed for HVOCs by Quadrel Service, Inc. of Clarksburg, Maryland. Quadrel's analytical report is included in Appendix B. The investigation results are discussed in Section 3.0.

2.2 GEOPHYSICAL SURVEY FOR UNDERGROUND STORAGE TANKS

Clayton contracted GeoRecon International to conduct a geophysical survey of the former gasoline station on April 20, 1997, to attempt to locate any remaining USTs. Details of their investigation are presented in their report included in Appendix C. Aerial photographs reviewed during Clayton's Phase I investigation indicated that the gasoline station building was located in approximately the same location as the current Seafirst building. The geophysical survey covered the area surrounding the Seafirst building and extended approximately 60 feet north, south, east and west of the building to roughly correspond with the property lines of the former gasoline station. The survey did not include the area beneath the Seafirst building. However, the Phase I information indicates that the Seafirst building has a substantial basement, indicating that any USTs present beneath the building would have been removed.

The geophysical survey included a magnetic survey followed by a ground penetrating radar (GPR) survey. The magnetic survey covers a broad area and depicts the general location of metallic objects, but gives little to no information on the shape, size or depth of the object.

The magnetic survey is conducted at spot locations placed along a systematic grid pattern over the area of interest. The grid pattern used at the site was spaced five feet apart. The GPR survey was conducted along the same grid pattern, but concentrates on those areas where the magnetic survey detects metallic objects. The GPR survey provides a continuous subsurface profile along each grid line. The investigation results are discussed in Section 3.0.

2.3 SOIL AND GROUNDWATER INVESTIGATION

Between April and June of 1997 Clayton conducted soil and groundwater investigations of the three onsite areas at the Ross Plaza. The primary objectives of the investigation were to collect and analyze soil and groundwater samples for total petroleum hydrocarbons (TPHs) or halogenated volatile compounds (HVOCs) to evaluate the subsurface conditions. Secondary objectives included characterization of the extent and magnitude of contamination at Crystal Cleaners, and evaluation of the aquifer characteristics with respect to remediation options.

2.3.1 Soil Boreholes, Samples and Laboratory Analyses

Prior to drilling activities Clayton contacted Call-Before-You-Dig and Utility Locating Inc. to locate public and private utilities in the work area. The utility locator marked the locations of identified utilities on the ground with spray paint.

During the initial subsurface investigation, soil borings and monitoring wells were installed by Cascade Drilling, Inc. (Woodinville, Washington) under the supervision of Ms. Torzynski. The locations of the thirteen boreholes, B1-B13, installed at the site are shown in Figure 5. The placement of the boreholes were based on the locations of the current and former dry cleaner facilities, the former gasoline station, the offsite LUST site, and the anticipated direction of shallow groundwater flow to the south. One borehole, boring B1, was installed to a depth of 85 feet bg in an attempt to find groundwater and the other twelve borings were drilled to a maximum depth of 20 feet bg. Borehole logs are included in Appendix D.

Soil samples were collected from each boring at five foot intervals using a split spoon sampler. All soil samples were logged in the field, field screened and classified using the ASTM Standard 2488, Standard Practice for Description and Identification of Soils. Field screening results were used to select samples for laboratory analysis.

Laboratory soil samples were placed in 8 ounce glass jars with Teflon-lined caps. The jars were labeled, and placed on ice in an insulated cooler for transport to CCI Analytical Laboratories, Inc. (Everett, Washington), for chemical analysis. Appropriate chain-of-custody documentation procedures were followed for the transport of soil samples to the laboratory.

Groundwater was encountered in only three of the 13 borings, B3, B5 and B7, and groundwater samples were collected using a temporary well screen, tubing and a peristaltic pump to pump water to the surface. Because of the limited amount of water contained in the borings, the tight soil conditions and likelihood of slow infiltration, the boreholes were not purged prior to sample collection. Water was pumped to the surface and directly into a laboratory supplied sample bottles. The samples were labeled, placed on ice in a cooler, and delivered with the proper chain-of-custody to CCI for subsequent analysis. New tubing was used for each borehole and the screen was decontaminated after sampling each borehole.

Following sample collection, Cascade Drilling abandoned each boring by using tremie grouting with bentonite grout (for deeper borings) and/or bentonite chips. Boring abandonment was completed with a concrete surface seal.

2.3.2 Monitoring Well Installation, Sampling and Analysis

Following the initial investigation, a second round of investigation was conducted to further evaluate and clarify the initial results. Prior to commencement of field work, Cascade Drilling obtained permits (start cards) from Ecology for the installation of monitoring wells. Three temporary monitoring wells, MW1, MW2 and MW3 were installed at the former gasoline station and eleven permanent monitoring wells, MW4 through MW14, were installed at Crystal Cleaners (Figures 6 and 7). The wells were constructed to a depth of 20 to 28 feet using 2-inch diameter polyvinyl chloride (PVC) casing. One well, MW13 was constructed with 4 inch diameter PVC casing. Well construction details are included on the boring logs in Appendix D.

Once well construction was completed, each well was surged using the drill rig and a surge block. The wells were purged by pumping three well casings of water from the well. Once purging was completed the well was allowed time to equilibrate prior to sampling.

Each well was monitored prior to sampling. The depth to groundwater was measured to the nearest 0.01 feet using a electronic water meter. The north side of the top of the well casings were marked for reference. Groundwater conditions are discussed below.

One water sample was collected from each monitoring well. Water samples from the wells were collected using a peristaltic pump and tubing or stainless steel bailer. The sample tubing was replaced and the bailer was decontaminated between samples. Water was collected in laboratory supplied containers with no air trapped inside the containers. The samples were labeled, placed on ice in a cooler, and delivered with the chain-of-custody to CCI for analysis. Specific laboratory analyses performed are discussed below.

Following collection of the groundwater samples, the temporary wells MW1-MW3, were abandoned in place by Cascade Drilling by tremie grouting the screened section with bentonite grout and completing the abandonment with bentonite chips. After the bentonite chips were hydrated, the well was sealed with a concrete surface seal.

2.3.3 Topographic Survey of Borings and Monitoring Wells

A topographic survey of the borings, monitoring wells and select reference points was completed by Larsen Land Surveying of Tacoma, Washington. Surveying data was combined with groundwater monitoring data to provide relative groundwater elevations and gradient information for the former gasoline station and Crystal Cleaners. No true elevation benchmarks were within a reasonable distance from the surveyed areas. A benchmark of an assumed elevation of 100.00 feet was set in asphalt 2 feet east of the east edge of extruded curbing on the west edge of the parking area south of Crystal Cleaners. All surveyed elevations were tied to this benchmark.

3.0 INVESTIGATION RESULTS

3.1 GEOLOGIC AND HYDROLOGIC CONDITIONS

The subject property sits on the rolling uplands plateau of the Puget Sound Drift Plain. The general topography of the subject site vicinity is a flat to undulating upland plain dominated by glacial landforms. Depressions and small lakes are common throughout the area. A topographic survey of a portion of the property indicates that the elevation ranges from approximately 400 feet to 430 feet above mean sea level (Figure 1). The western boundary of the subject property is near the hill crest and the property slopes downward toward the east and southeast corner of the property. Puget Sound is located approximately 2 miles to the northwest of the subject property. The closest body of surface water is Steel Lake, located approximately one mile northeast of Ross Plaza.

According to the Geologic Map of the Poverty Bay Quadrangle (1961) the surficial sediments in the area are characterized by ground moraine deposits, chiefly compact Vashon till. Vashon till is generally a gravelly, sandy silt to silty sand with varied quantities of clay, cobbles, and boulders. The Vashon till was deposited beneath the Vashon glacier and is dense and compact. It is often referred to as "hard pan". In the project area the till is often overlain by a discontinuous mantle of sand and gravel.

The Lake Haven Utility District provides drinking water for the Ross Plaza area. The utility district has 21 wells that are used to supply drinking water. The majority of the wells are located west of Pacific Highway South or east of Interstate 5 and are most more than 1 mile from the subject property. Four of their wells are located upgradient and approximately one-half of a mile to the northwest of Ross Plaza. None of the Lake Haven wells are located downgradient and within one mile of the subject property. The depth to the aquifers in the area ranges from 100 to 1,000 feet.

Department of Ecology well logs indicate that eleven wells are located within a one mile radius of Ross Plaza, however only three of the wells are located south and downgradient of Ross Plaza and they are more than one-half mile away from the subject property.

Local shallow groundwater flow appears to be influenced by the valley that runs north south through the area and is paralleled by Pacific Avenue South (Figure 1). The surface elevations at the Arco LUST site is approximately 420 feet above sea level and the elevation 3.5 miles to the south is 50 feet above sea level. Data from the Arco LUST site verify that shallow groundwater flow is to the south and southwest.

The groundwater conditions in the northeast (former gas station), central (former dry cleaner), and southwest (Crystal Cleaners) portions of the property are quite variable and are summarized below.

No sensitive receptors, surface water bodies or wells, are located within one half mile of the subject property.

3.2 FORMER GASOLINE STATION

A geophysical survey of the former gasoline station was conducted by GeoRecon (Section 2.2). They interpreted the area surveyed to be free of USTs.

3.2.1 Site Conditions

Site soils are characterized by gravelly silts and sands from the surface to a depth of 20 feet bg.

The groundwater in the northeast corner of the property, at the gasoline station, appeared to be perched and localized. Groundwater was only detected in borings or wells along the topographically lower, east side of the property. Groundwater was encountered at a depth of 13 to 15 feet bg (Table 1). Survey and monitoring data indicate the groundwater flow direction is to the south. The depth to groundwater and flow direction is consistent with information obtained from the Arco LUST site located to the north of the subject property.

3.2.2 Analytical Results

A total of four borings (B3-B6) and three temporary monitoring wells (MW1-MW3) were installed at the former gasoline station (Figure 6). The borings and monitoring wells were installed to a depth of 18 to 20 feet bg. Soil and groundwater samples collected from the gasoline station were analyzed for total petroleum hydrocarbons as gasoline (TPH-G), diesel (TPH-D), and heavy oil (TPH-O), as well as benzene, toluene, ethylbenzene and xylenes (BTEX) using test methods WTPH-G, WTPH-D extended, and EPA Method 8020, respectively. Analytical results are summarized in Table 3. Laboratory reports are included in Appendix E.

Soil samples from borings B3, B5 and B6, and wells MW1, MW2, and MW3 contained no detectable hydrocarbons (Table 3). One soil sample from boring B4 contained 410 parts per million (ppm) TPH-G and 66 ppm TPH-O. The gasoline concentration is above the Washington Model Toxics Control Act (MTCA) Method A cleanup level for gasoline of 200 ppm and the heavy oil concentration is below the MTCA Method A cleanup level of 200 ppm.

Groundwater was detected in only two of the four borings onsite. Groundwater samples from boring B4 had a TPH-G concentration of 1.9 ppm which is above the MTCA Method A cleanup level of 1.0 ppm. The BTEX concentrations were below the MTCA Method A cleanup levels. The groundwater sample from boring B3 contained no detectable TPH-G, and BTEX concentrations were below the MTCA Method A cleanup levels. Groundwater was not encountered in borings B5 and B6.

Three temporary monitoring wells were installed at the former gasoline station following the detection of TPH-G at concentrations above the MTCA Method A cleanup level in boring B4. Two attempts were made to install a well on the south side of B4, however the auger met refusal at shallow depths. Due to traffic flow constraints and the presence of a storm drain, the well (MW2) was eventually installed approximately 8 feet north of boring B4. Groundwater samples collected from MW1, MW2, and MW3, had TPH-G, TPH-D and TPH-O concentrations below the analytical detection levels. Except for the toluene concentration of 0.002 ppm in MW1, all BTEX concentrations in MW1, MW2 and MW3 were below the analytical detection limits. The MTCA Method A cleanup level for toluene in groundwater is 0.040 ppm.

The monitoring wells were installed to confirm TPH concentrations detected in the groundwater sample from boring B4. Analysis of two water samples from MW2, collected on different days, indicate that TPH concentrations are below the analytical detection limits. It appears that the groundwater contamination detected in the grab sample from boring B4 was not representative of the true groundwater conditions as represented by well MW2.

3.2.3 Adjacent Offsite LUST site

Arco Station #5243, a LUST site is located at 31855 Pacific Highway South. The site is approximately 110 feet north and upgradient of the subject property (Figure 2). The WDOE files contained several reports for the site completed by Pacific Environmental Group (PEG) between August 1993 and July 1996. PEG's reports indicate the existing facility represents a complete demolition and rebuild of a prior existing service station in early 1987. PEG's investigations detected soil and groundwater contamination on-site. Quarterly groundwater monitoring has occurred on-site since February 1995. The depth to groundwater has varied from 5 feet to 12 feet below grade. The predominant groundwater flow direction is to the south and southwest. Total petroleum hydrocarbons (TPH-G) and benzene concentrations in groundwater are above the Washington State Model Toxics Control Act (MTCA) cleanup levels. No remediation has been implemented at the site.

The results of the subsurface investigation at the former gasoline station at Ross Plaza (Section 3.2.3) indicate that it is unlikely that the subject property has been impacted by the Arco site.

3.3 FORMER DRY CLEANERS

3.3.1 Site Conditions

Site soils are characterized by gravelly and clayey silts/fine sands from the surface to a depth of 85 feet bg. The soils are hard, dense till and are typical of many areas of Puget Sound.

Groundwater in the central portion of the property, at the former dry cleaners site, is absent to a depth of 85 feet. No groundwater was encountered in the six borings installed around the former dry cleaners. One boring extended to a depth of 85 feet bg and five were drilled to a maximum depth of 20 feet bg.

3.3.2 Analytical Results

A total of four soil gas collectors (S1 - S4) and six borings (B1, B2, B8, B9, B10, and B11) were installed at the former dry cleaners site (Figures 4 and 5). The borings were drilled to a depth of 18 to 20 feet, except for B1 which was completed to 85 feet. No groundwater was detected in any of the borings.

Soil and soil gas samples were analyzed for HVOCs using test method EPA 8010. Analytical results for soil and soil gas samples are summarized in Tables 4 and 5.

Laboratory analyses of the soil gases collected at the former dry cleaners facility detected tetrachloroethene (PCE), a typical dry cleaning fluid, in samples S2, S3 and S4. PCE concentrations ranged from 0.03 to 1.74 nanogram per liter (ng/L). Trichloroethene (TCE), a breakdown product of PCE, was also detected in sample S4, the sample with the highest PCE concentration.

HVOC concentrations in soil from five of the six borings (B2,B8, B9, B10, and B11) were below the analytical detection levels. One sample, B1-15, had a PCE concentration of 0.03 ppm and a TCE concentration of 0.01 ppm. Both concentrations are below the MTCA Method A criteria of 0.50 ppm.

3.4 CRYSTAL CLEANERS

3.4.1 Site Conditions

Soils at the Crystal Cleaners site are generally characterized by gravelly, sandy, and clayey silts with lenses of sand and gravelly silty sand (Figure 10). The sand lenses are located at depths of 10 to 27 feet bg and are overlain and underlain by the silts. The silts underlying the sands are dense and dry and act as an aquitard resulting in a localized perched water table.

Groundwater was encountered at a depth of 11 to 26 feet bg (Table 2, Figure 9). The perched water is approximately 12 to 18 feet thick in the locations were it was entirely penetrated by drilling (MW4 and MW11). Survey and monitoring data indicate the groundwater flow direction is to the east and with a gradient of approximately 8.0 ft per 100 ft (0.08/1.0).

Based on the groundwater flow direction and the highest HVOC concentrations in MW8, it appears that the source of the contamination is likely to be the landscaped area along the western property line of Crystal Cleaners. The aerial extent of contamination is approximately 110 feet by 80 feet. Vertical migration of contamination appears to be limited to the base of the clayey silts at a depth of 20 feet to 28 feet bg.

Based on the soil types, extent of migration, and the location of the subject area within the property, it appears unlikely that contamination will impact any additional properties.

3.4.2 Analytical Results

A total of four soil gas collectors (S5 - S8), three borings (B7, B12, and B13) and 11 monitoring wells (MW4 through MW14) were installed at Crystal Cleaners (Figures 4, 5, and 7). The borings and monitoring wells were installed to a depth of 17 to 29 feet bg.

Soil and groundwater samples from Crystal Cleaners were analyzed for HVOCs using test method EPA 8010. Analytical results for soil gas, soil and groundwater samples are summarized in Tables 6 and 7.

Laboratory analyses of the soil gas samples collected at Crystal Cleaners detected low levels of PCE and total halogenated hydrocarbons (THH) in samples S5, S7 and S8. One soil sample from boring B7 and one soil sample from each well (MW4 -MW14) were selected for analysis. All soil samples contained non-detectable concentrations of HVOCs.

Groundwater samples had detectable concentrations of trichloroethene (TCE) in wells MW4 (0.007 ppm), MW5 (0.020), MW8 (0.053), MW 11 (0.009 ppm) and MW13 (0.012 ppm). All of these detectable concentrations are above the MTCA Method A criteria of 0.005 ppm.

Groundwater samples had detectable concentrations of cis 1,2-dichloroethylene (DCE) in boring B7 (0.022 ppm) and Wells MW4 (0.073 ppm), MW5 (0.138 ppm), MW7 (0.014 ppm), MW8 (0.350 ppm), MW9 (0.020 ppm), MW 11 (0.022 ppm) and MW13 (0.085 ppm) (Table 7, Figure 8). The DCE concentrations in wells MW 5, MW 8, MW13 exceed the MTCA Method B criteria for groundwater of 0.080 ppm.

Tetrachloroethylene (PCE) was not detected in any groundwater sample.

3.4.3 Aquifer Tests

A vapor extraction and pump test were completed at Crystal Cleaners to assess remediation options. The vapor extraction test was conducted by Senior Geologist, Phil Price, of Clayton on July 11, 1997. Well MW-13 was subjected to 50-inches of water vacuum for 200 minutes. Vacuum measurements were periodically taken at the surrounding wells. The highest reading, 6.5 inches of vacuum, was detected at MW8, the well closest to MW13. Between 0.1 and 0.5 inches of vacuum was detected in wells MW4, MW9, MW11 and MW12 located in the central portion of the well field. Vacuum measurements ranged from 0.01 to 0.06 in the outermost wells, MW6, MW7, MW10, and MW14. The vacuum could not be measured in MW5 since the top of the well screen was below the water table. Preliminary data analysis indicates that there is approximately 50 to 60 feet of influence.

A constant rate pump test was conducted by Phil Price on July 11, 1997. Well MW-13 was pumped at a flow rate of less than 0.25 gallons per minute (gpm) for approximately 195 minutes. The well was pumped dry several times during the test and the pump was cycled on and off throughout the test. Water level measurements were periodically taken at the surrounding wells. A drawdown of 0.04 inches was detected in MW8 and a drawdown of 0.03 inches was detected in MW5. No drawdown was detected in any of the other wells. Preliminary data analysis indicates that MW13 can only produce approximately 160 gallons per day (gpd), about one-third (1/3) the volume that is flowing through the saturated zone in the area of contamination. The apparent zone of influence is estimated to be only 20-30 feet.

3.4.4 Proposed Remediation

The vapor extraction and groundwater pump tests conducted at Crystal Cleaners indicates that a dual phase remediation system would be efficient in remediating the site. The tight tills and perched water table indicate that the water table could be drawn down with minimal pumping and result in maximum exposure of soils for vapor extraction. Select wells, appropriately spaced, would be tied into the system. Based on HVOC concentrations and the geologic conditions, it appears that it may be possible to complete remediation within approximately one year.

4.0 FINDINGS AND RECOMMENDATIONS

Based on our subsurface investigations, our findings are as follows:

- Soils on the subject property are generally characterized by dense, hard till (generally silt) to a depth of at least 85 feet bg with shallow localized sand lenses. Shallow groundwater is discontinuous across the property and is present on the northeast edge of the property and the southwest corner of the property, and absent in the central portion of the property.

- No sensitive receptors, surface water bodies or wells, are within one-half mile of the subject property.

- Gasoline hydrocarbons were detected in groundwater from one of four borings at the former gasoline station. However, confirmation samples from three monitoring wells indicate the concentrations do not exceed the MTCA Method A cleanup levels. A TPH-G concentration of 410 ppm was detected in one soil sample collected on site. Shallow perched groundwater was encountered at a depth of 12 to 15 feet bg

and limited to the eastern portion of the former gasoline station property. The shallow groundwater flow direction is to the south. Gasoline hydrocarbons detected at the former gasoline station appear to be limited and the source does not appear to be the LUST site to the north.

- HVOCs were detected in one of six soil samples collected in the vicinity of the former dry cleaners, however the concentration was below the MTCA Method A cleanup level. No groundwater was encountered to a depth of 85 feet. The absence of shallow groundwater in the area of the former dry cleaners and HVOCs concentrations in soil samples below MTCA Method A cleanup levels suggests that impacts to the site from the dry cleaning operation is minimal.

- Shallow perched groundwater was encountered at a depth of 11 to 26 feet bg at Crystal Cleaners. The shallow groundwater flow direction is to the east. HVOCs were detected above MTCA Method A cleanup levels in 8 of the 11 monitoring wells. Based on the groundwater flow direction and the highest HVOC concentrations in MW8, it appears that the source of the contamination is likely to be the landscaped area along the western property line of Crystal Cleaners. The area of contamination is approximately 110 feet by 80 feet. Aquifer tests indicate that a dual phase remediation system would be effective at the site.

Based on these findings, Clayton recommends the following:

- Pursue a NFA designation for the Ross Plaza (excluding Lot 7, Crystal Cleaners) at this time.

- Pursue a NFA designation for Lot 7 (Crystal Cleaners) of Ross Plaza once remediation activities are completed.

5.0 LIMITATIONS

Work for this project was performed, and this report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities at the time the work was performed. Clayton's results and findings from the sampled areas do not necessarily reflect the subsurface conditions in site areas not investigated. This report is not meant to represent a legal opinion. No other warranty, expressed or implied, is made.

Any questions regarding our work are welcome and should be referred to the undersigned.

This report prepared by:

Linda Cochran for
Cynthia Torzynski, MS
Project Geologist
Environmental Management and Remediation

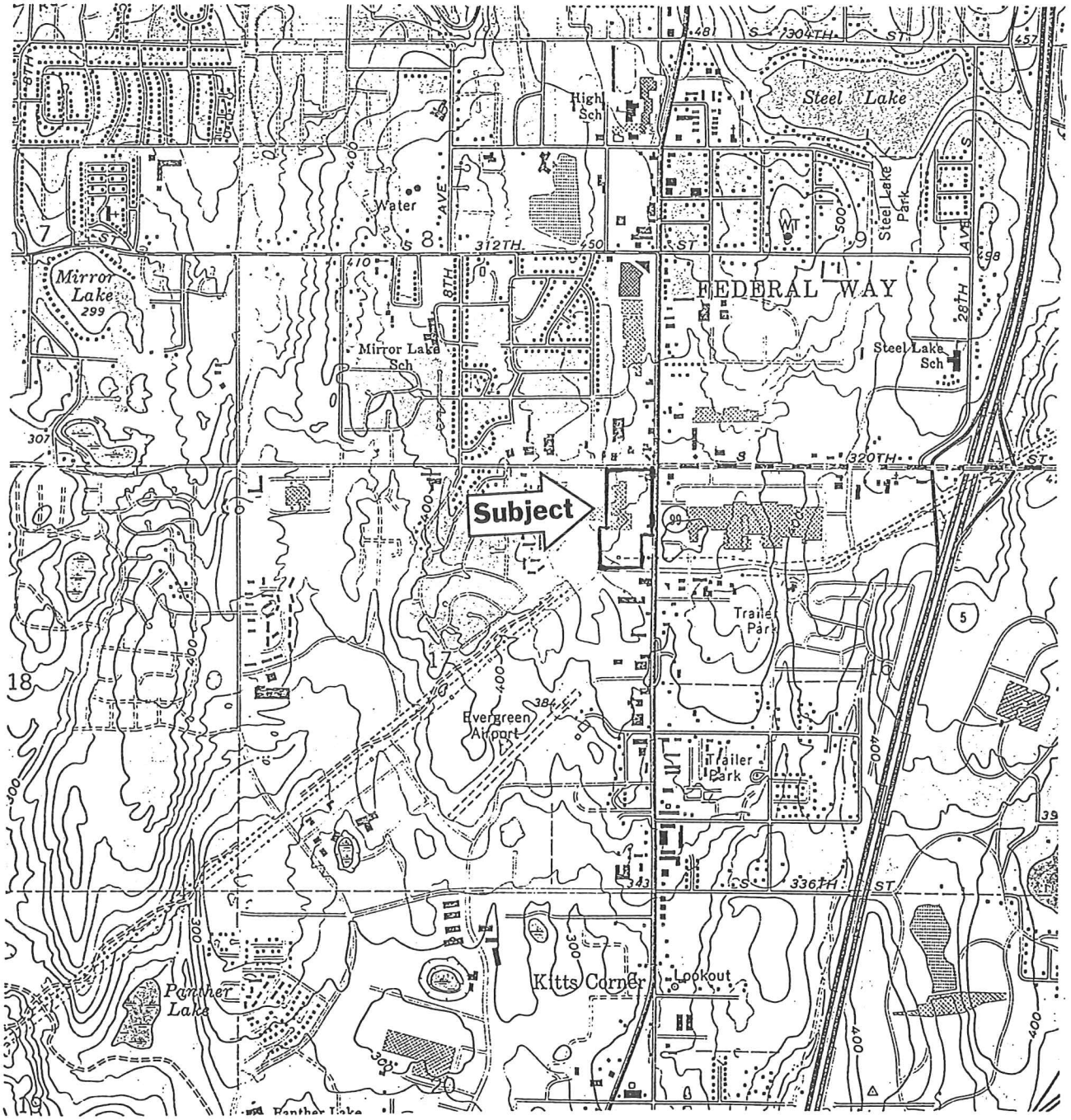
This report reviewed by:

Harlan Borow, MS, PE
Manager
Environmental Management and Remediation
Seattle Regional Office

FIGURES

TABLES

APPENDICES



N

1 inch= 2,000 ft

FIGURE 1	Site Location Map Ross Plaza Federal Way, Washington	Project No. 75-97357.00	**CLAYTON ENVIRONMENTAL CONSULTANTS**

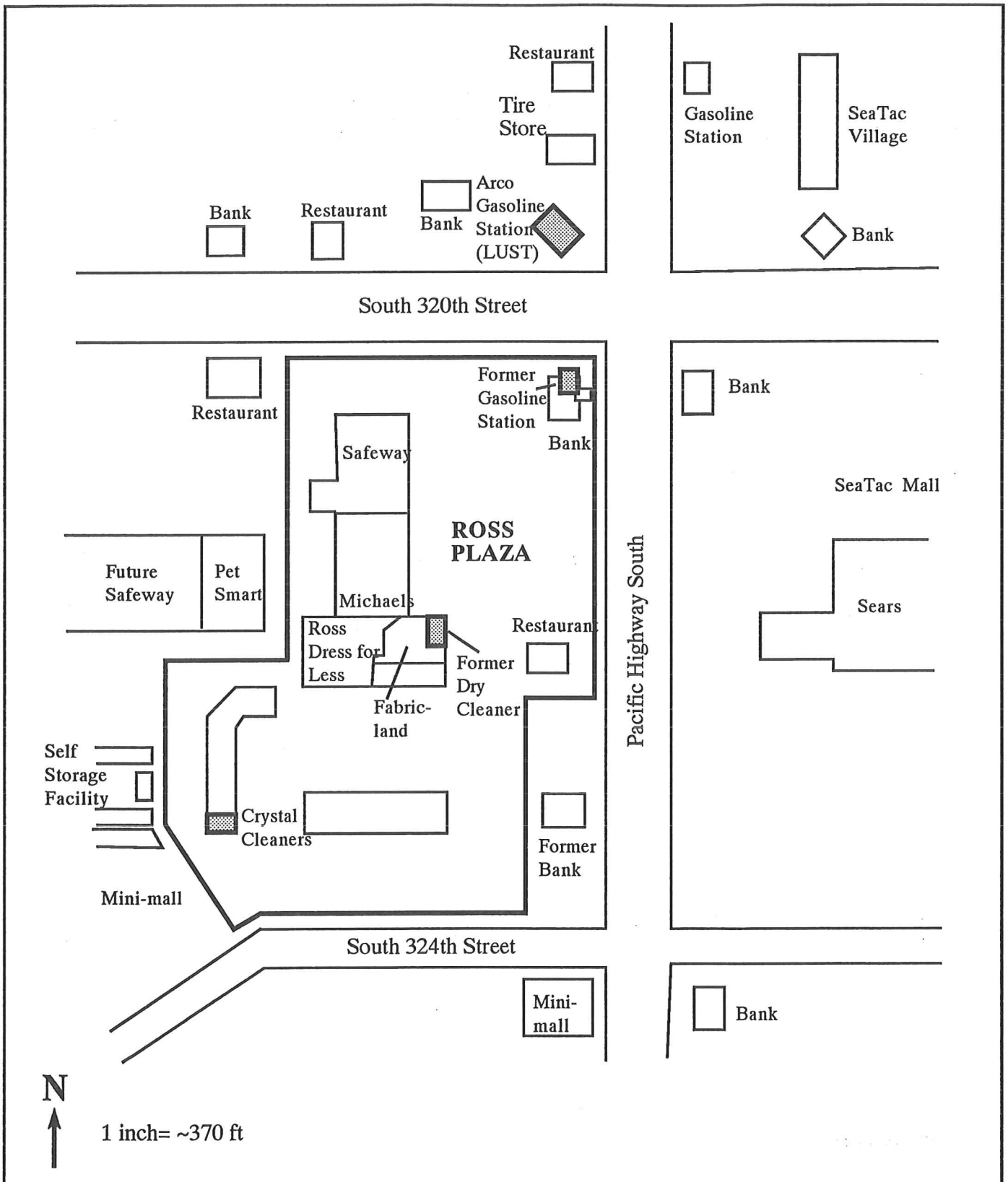


FIGURE 2	Site Plan and Adjacent Businesses Ross Plaza Federal Way, Washington	Project No. 75-97357.00	**CLAYTON ENVIRONMENTAL CONSULTANTS**

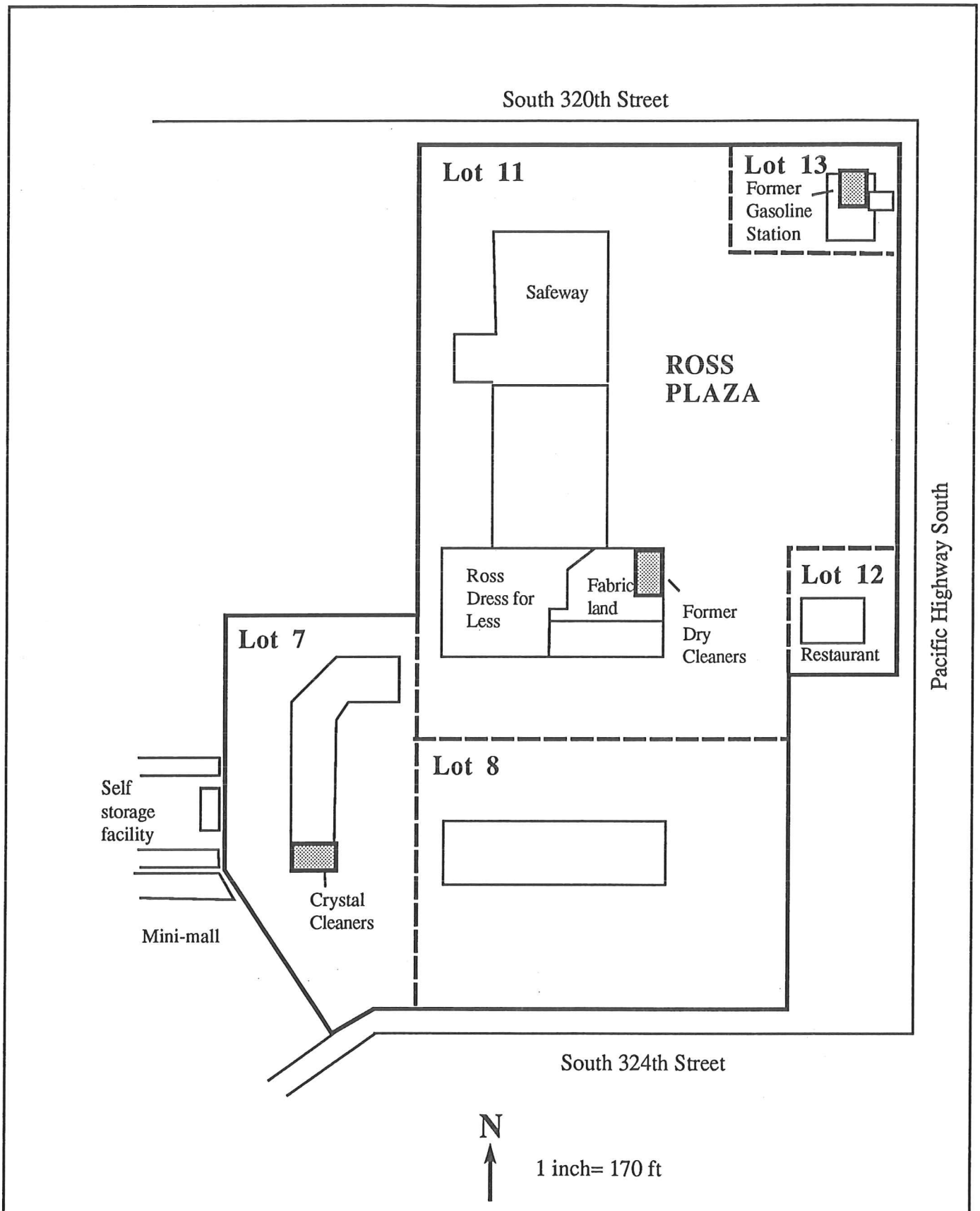
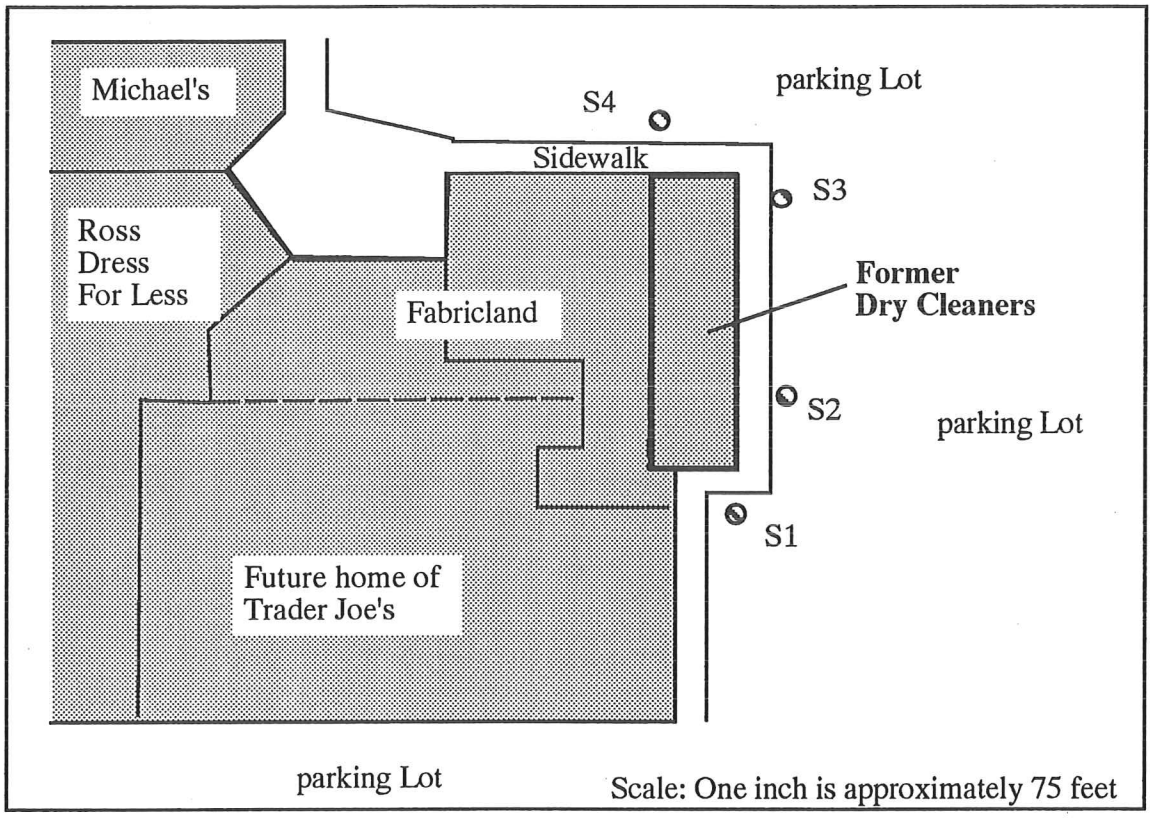
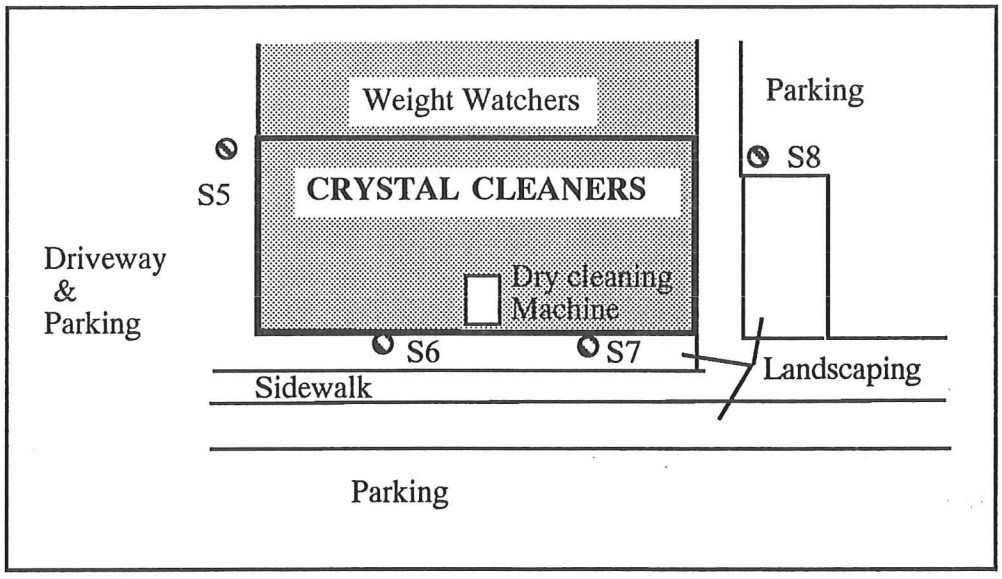


FIGURE 3	PLAT MAP FOR ROSS PLAZA Federal Way, Washngton	Project No. 75-97357.00	**CLAYTON ENVIRONMENTAL CONSULTANTS**





N

Scale: 1 inch = ~30 feet

LEGEND
S5 ⊘ Soil gas sample location and number

FIGURE 4	Soil Gas Sample Locations Former Cleaners and Crystal Cleaners Ross Plaza Federal Way, Washington	Project No. 75-97357.00	**CLAYTON ENVIRONMENTAL CONSULTANTS**

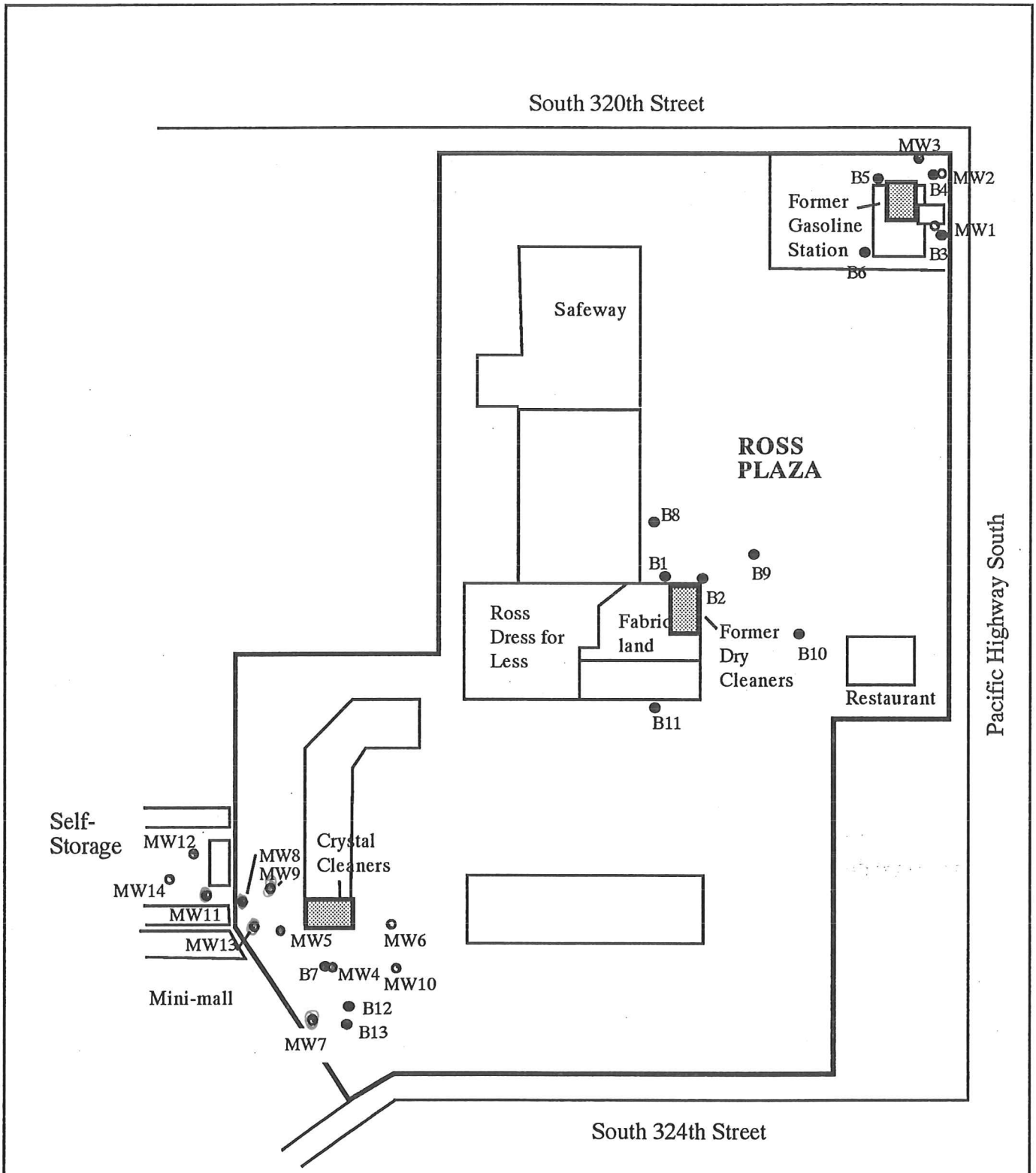


FIGURE 5	Boring and Monitoring Well Locations Ross Plaza Federal Way, Washington	Project No. 75-97357.00	**CLAYTON ENVIRONMENTAL CONSULTANTS**

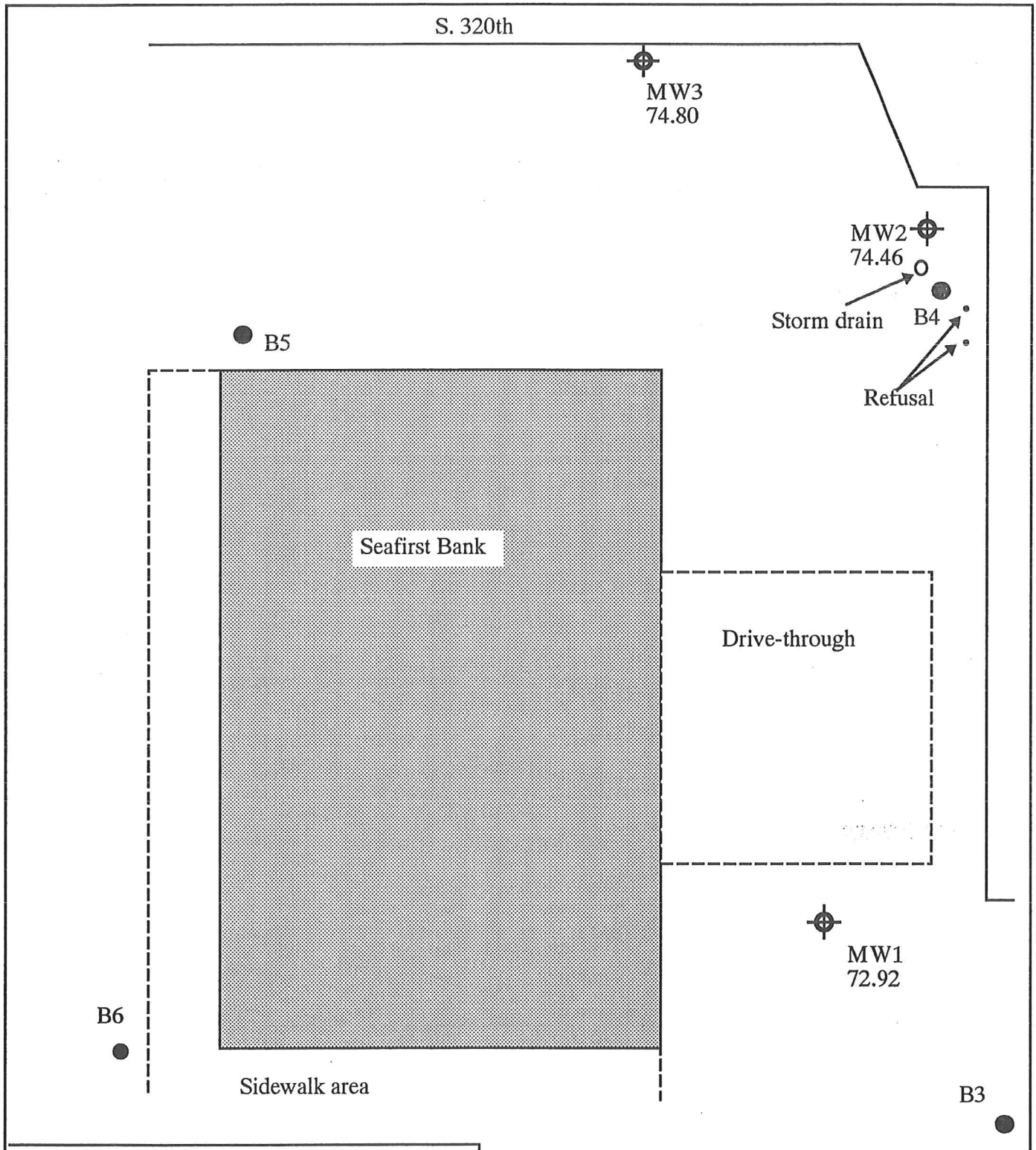


FIGURE 6	Boring and Monitoring Well Locations at the Seafirst site Ross Plaza Federal Way, Washington	Project No. 75-97357.00	**CLAYTON ENVIRONMENTAL CONSULTANTS**

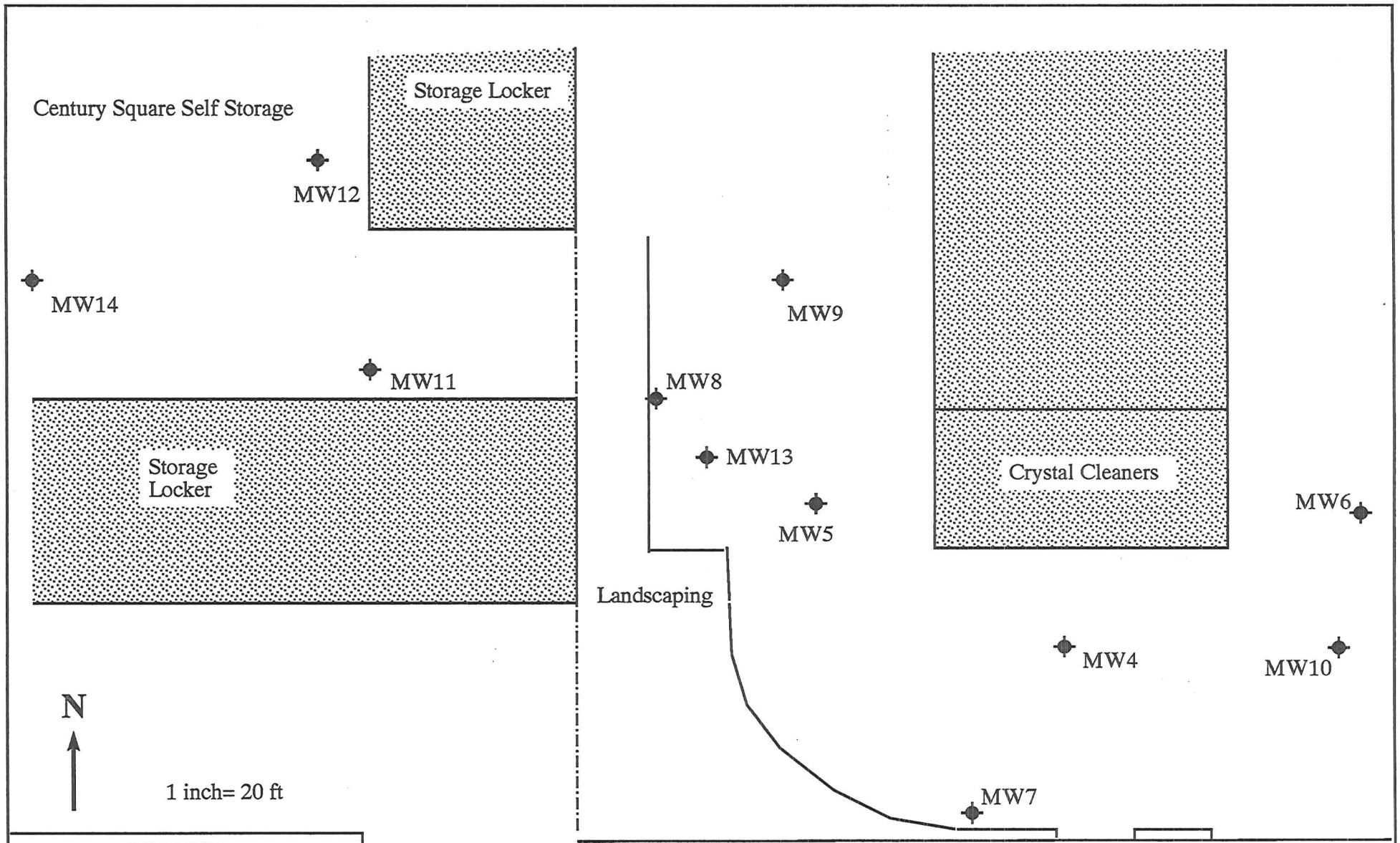


FIGURE 7	Monitoring Well Locations, Crystal Cleaners Ross Plaza Federal Way, Washington	Project No. 75-97357.00	**CLAYTON ENVIRONMENTAL CONSULTANTS**

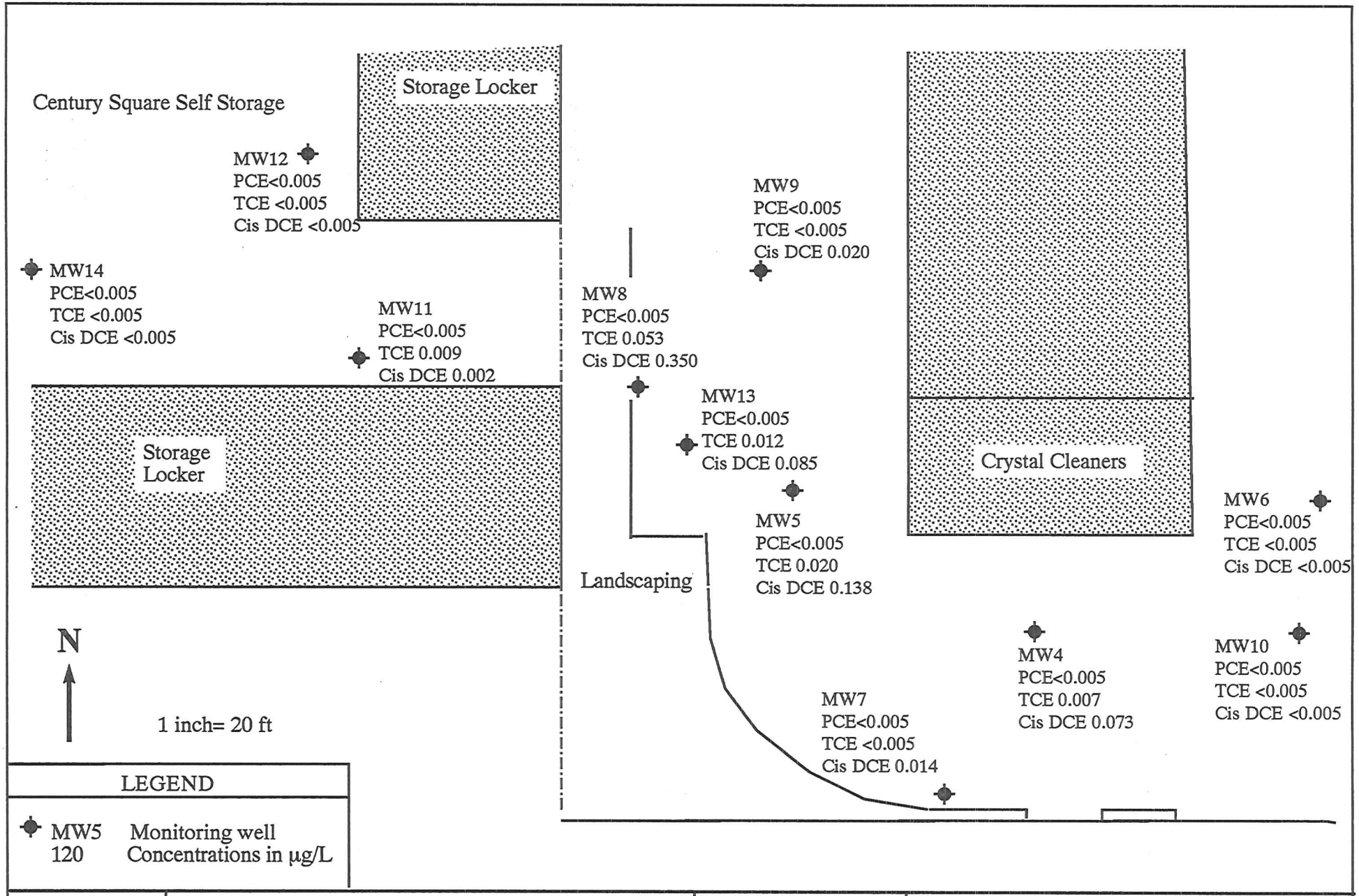


FIGURE 8	PCE, TCE and Cis-DCE Concentrations In Groundwater Crystal Cleaners Federal Way, Washington	Project No. 75-97357.00	**CLAYTON ENVIRONMENTAL CONSULTANTS**

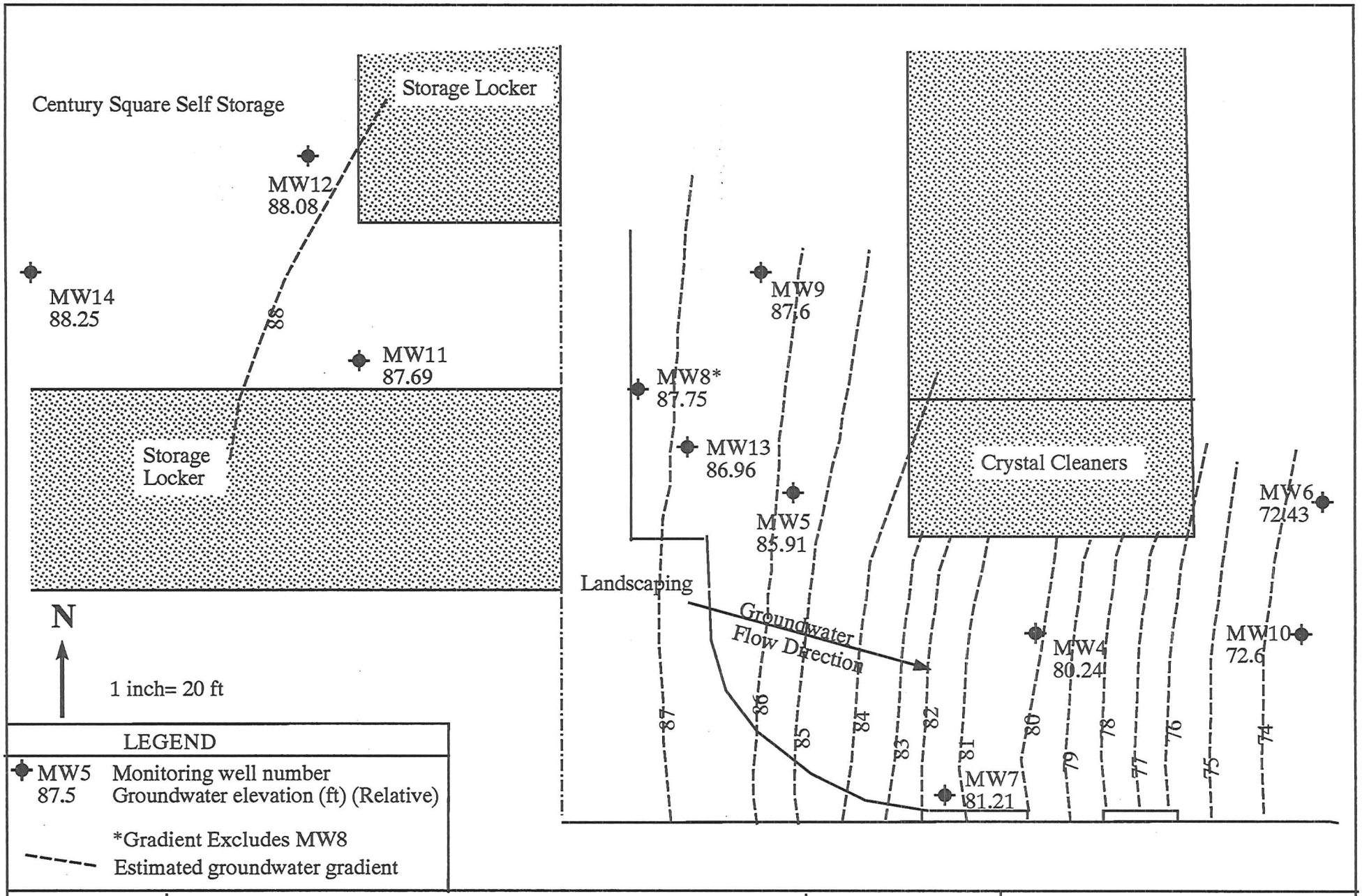


FIGURE 9	Groundwater Elevations And Flow Direction Crystal Cleaners Ross Plaza Federal Way, Washington	Project No. 75-97357.00	**CLAYTON ENVIRONMENTAL CONSULTANTS**

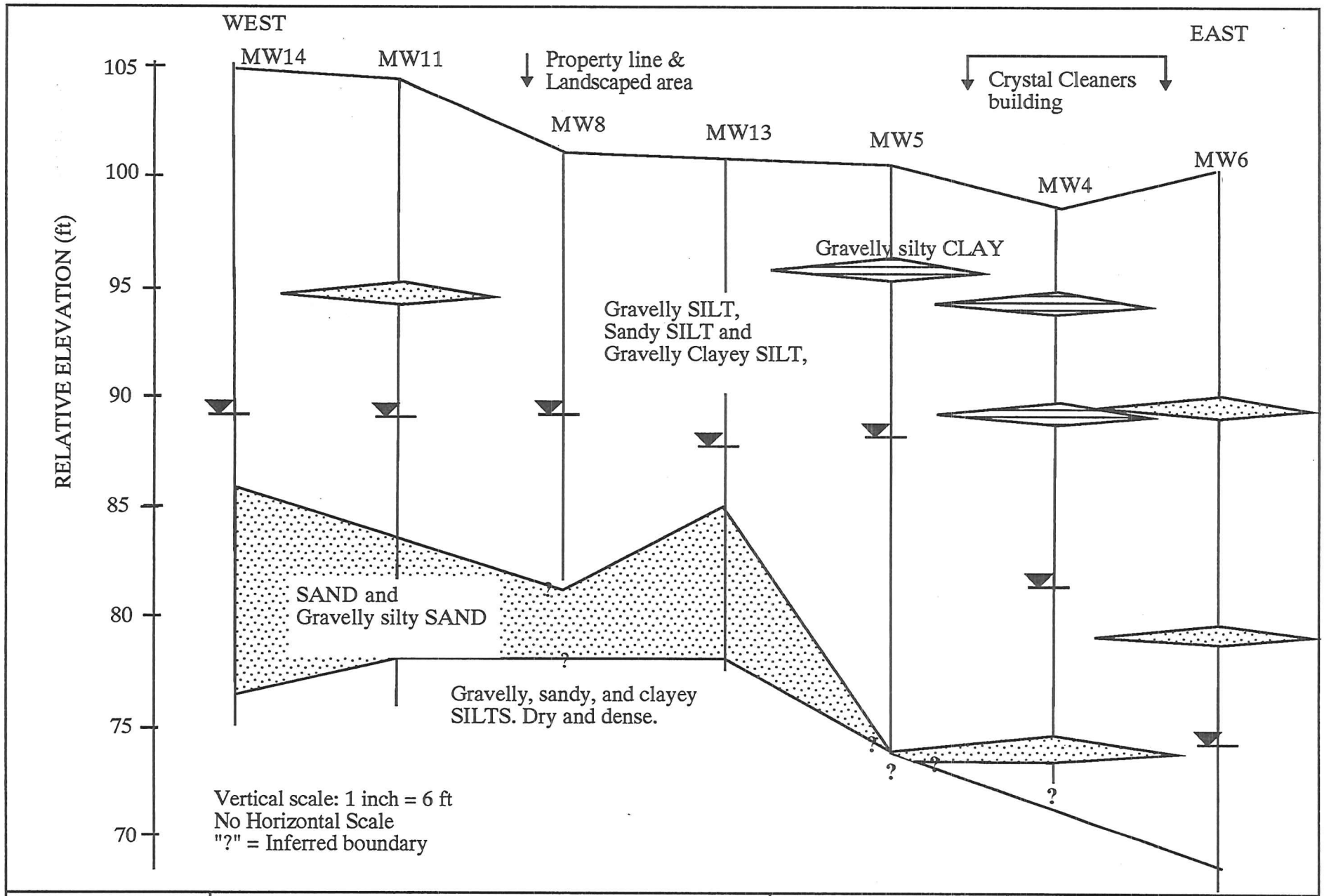


FIGURE 10	Geologic Cross Section Crystal Cleaners Ross Plaza Federal Way, Washington	Project No. 75-97357.00	**CLAYTON ENVIRONMENTAL CONSULTANTS**

Table 1
Summary of Monitoring Well Data for the
Former Gasoline Station
Ross Plaza site
Federal Way, Washington
Clayton Project No. 75-97357.00

Monitoring Well	Date	Elevation of Grade (ft)	Elevation* of Casing (ft)	Static water level (ft)	
				Depth (bg)	Elevation
Seafirst site					
MW1	4/23/97	87.41	87.12	14.49	72.92
MW2	4/23/97	86.49	86.12	12.03	74.46
MW3	4/23/97	87.48	87.21	12.68	74.80

*Base elevation referenced to ARCO LUST site well

Table 2
Summary of Monitoring Well Data for the
Crystal Cleaners Site
Ross Plaza
Federal Way, Washington
Clayton Project No. 75-97357.00

Monitoring Well	Date	Elevation of Grade (ft)*	Elevation of Casing (ft)	Static water level (ft)	
				Depth (bg)	Elevation
Crystal Cleaners					
MW4	5/6/97	98.81	98.42	18.01	80.80
	7/7/97			18.57	80.24
MW5	5/6/97	100.31	99.81	13.19	87.12
	7/7/97			14.4	85.91
MW6	5/6/97	99.74	99.24	26.38	73.36
	7/7/97			27.31	72.43
MW7	5/6/97	98.75	98.25	16.13	82.62
	7/7/97			17.54	81.21
MW8	5/7/97	100.96	100.44	11.81	89.15
	7/7/97			13.21	87.75
MW9	5/7/97	100.13	99.74	11.35	88.78
	7/7/97			12.53	87.6
MW10	5/7/97	97.38	97.07	24.16	73.22
	7/7/97			24.78	72.66
MW11	6/18/97	104.55	104.27	16.28	88.27
	7/7/97			16.86	87.69
MW12	6/18/97	105.07	104.83	16.61	88.46
	7/7/97			16.99	88.08
MW13	6/18/97	100.59	100.33	13.11	87.48
	7/7/97			13.63	86.96
MW14	6/18/97	104.71	104.27	15.84	88.87
	7/7/97			16.46	88.25

*Base elevation randomly set at 100 ft.

Table 3
Soil and Groundwater Analytical Results
for the
Former Gasoline Station Site
Ross Plaza
Federal Way, WA
Clayton Project No. 75-97357.00

Sample	Sample Depth	[1]Gaso-line	[3]BTEX ppm				[4]Diesel	[5]Heavy Oil
		[2]ppm	B	T	E	X	ppm	ppm
SOIL								
B3-15	15	ND	ND	ND	ND	ND	ND	ND
B4-10	10	**410**	ND	ND	2.0	3.0	29[6]	66
B5-5	5	ND	–	–	–	–	ND	ND
B6-17.5	17.5	ND	–	–	–	–	ND	ND
MW1-15[7]	15	ND	–	–	–	–	ND	ND
MW2-10[7]	10	ND	–	–	–	–	ND	ND
MW3-10[7]	10	ND	–	–	–	–	ND	ND
MTCA[8]		100	0.5	40.0	20.0	20.0	200	200
WATER								
B3-W	NA	ND	0.002	0.002	0.002	0.006	ND	ND
B4-W	NA	**1.9**	0.001	ND	0.008	0.007	ND	ND
MW1-W	NA	ND	ND	0.002	ND	ND	ND	ND
MW2-W	NA	ND	ND	ND	ND	ND	ND	ND
MW2-W[9]	NA	ND	ND	ND	ND	--	–	–
MW3-W	NA	ND	ND	0.001	ND	ND	ND	ND
MTCA[10]	NA	1.00	0.005	0.040	0.030	0.020	1.00	1.00

[1] Gasoline TPH, using test method WTPH-G

[2] ppm, parts per million, mg/kg

[3] Benzene, toluene, ethylbenzene, and xylene using test method EPA 8020

[4]Diesel TPH, using test method WTPH-D

[5]Heavy Oil TPH, using test method WTPH-Dextended

[6] Tail end of gasoline

[7] Gasoline, diesel and heavy oil using test method WTPH-HCID

[8] MTCA, Model Toxics Control Act Method A Soil cleanup levels

[9] A second sample was collected fromMW2 to confirm the concentrations detected in the first sample

[10] MTCA, Model Toxics Control Act Method A Groundwater cleanup levels

Bold text indicates concentration is above MTCA cleanup level

NA: Not applicable

--: Not analyzed

Table 4
Soil Gas Analytical Results
for the
Ross Plaza/Former Dry Cleaners Site
Federal Way, WA
Clayton Project No. 75-97357.00

Former Dry Cleaners				
	Sample Numbers			
Compound	S1	S2	S3	S4
	Concentrations (ng/L)			
Tetrachloroethene (PCE)	ND	0.03	0.34	1.74
Trichloroethene (TCE)	ND	ND	ND	1.02
Total Halogenated Hydrocarbons (THH)	ND	0.03	0.27	2.48

ng/L= nanograms per liter, equivalent to parts per trillion
ND= not detected

Table 5
Soil and Groundwater Analytical Results
for the
Former Dry Cleaners Site
Ross Plaza
Federal Way, WA
Clayton Project No. 75-97357.00

Sample	Sample Depth (ft)	[1]HVOC (ppm[2])	PCE (ppm)	TCE (ppm)
SOIL				
B1-15	15	ND	0.03	0.01
B2-15	15	ND	ND	ND
B8-20	20	ND	ND	ND
B9-20	20	ND	ND	ND
B10-15	15	ND	ND	ND
B11-10	10	ND	ND	ND
MTCA[3]		NA	0.5	0.5

[1] HVOC (halogenated volatile organic compound) using EPA Test Method 8010, does not include trichloroethene (TCE) and tetrachlorethene (PCE)

[2] ppm, parts per million, mg/kg

[3] MTCA, Model Toxics Control Act Method A Soil cleanup levels
Bold text indicates concentration is above MTCA cleanup level

Table 6
Soil Gas Analytical Results
for the
Ross Plaza/Crystal Cleaners Site
Federal Way, WA
Clayton Project No. 75-97357.00

Crystal Cleaners	Sample Numbers			
Compound	**S5**	**S6**	**S7**	**S8**
	Concentrations (ng/L)			
Tetrachloroethene (PCE)	0.03	ND	ND	0.02
Trichloroethene (TCE)	ND	ND	ND	ND
Total Halogenated Hydrocarbons (THH)	0.03	ND	0.10	0.02

ng/L= nanograms per liter, equivalent to parts per trillion
ND= not detected

Table 7
Soil and Groundwater Analytical Results
for the
Crystal Cleaners Site
Federal Way, WA
Clayton Project No. 75-97357.00

Sample	Sample Depth	[1]HVOC (ppm[2])	PCE (ppm)	TCE (ppm)	DCE* (ppm)
SOIL					
B7-10	10	ND	ND	ND	ND
B7-15	15	ND	ND	ND	ND
MW4-15	15	ND	ND	ND	ND
MW5-15	15	ND	ND	ND	ND
MW6-10	10	ND	ND	ND	ND
MW7-10	10	ND	ND	ND	ND
MW8-5	5	ND	ND	ND	ND
MW9-5	5	ND	ND	ND	ND
MW10-15	15	ND	ND	ND	ND
MW11-26	26	ND	ND	ND	ND
MW12-26	26	ND	ND	ND	ND
MW13-21	21	ND	ND	ND	ND
MW14-19	19	ND	ND	ND	ND
MTCA[3]		NA	0.5	0.5	NA
WATER					
B7-W	NA	ND	ND	ND	0.022
MW4-W	NA	ND	ND	**0.007**	0.073
MW5-W	NA	ND	ND	**0.020**	0.138
MW6-W	NA	ND	ND	ND	ND
MW7-W	NA	ND	ND	ND	0.014
MW8-W	NA	ND[4]	ND	**0.053**	0.350
MW9-W	NA	ND	ND	ND	0.020
MW10-W	NA	ND	ND	ND	ND
MW11-W	NA	ND	ND	**0.009**	0.022
MW12-W	NA	ND	ND	ND	ND
MW13-W	NA	ND	ND	**0.012**	0.085
MW14-W	NA	ND	ND	ND	ND
MTCA[5]			0.005	0.005	0.080[6]

[1] HVOC (halogenated volatile organic compound) using EPA Test Method 8010, not including results for trichloroethene(TCE), tetrachlorethene (PCE), Cis-1,2-Dichloroethene (DCE)

[2] ppm, parts per million, mg/kg

[3] MTCA, Model Toxics Control Act Method A Soil cleanup levels

[4] Transdichlorethene concentration of .010 ppm detected

[5] MTCA, Model Toxics Control Act Method A Groundwater cleanup levels

[6] MTCA, Model Toxics Control Act Method B Groundwater cleanup level

Bold text indicates concentration is above MTCA cleanup level

NA: Not applicable