United States Environmental Protection Agency
Office of Emergency and Remedial Respc·ıse
EPA/ROD/R10-85/006
September 1985

Superfund Record of Decision:

Ponders Corner, WA
(Second Remedial Action, 09/30/85)

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

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16. ABSTRACT

Ponders Corner, or the Lakewood site as it is identified in the National Priorities List, is located in Pierce County, Washington, south of the city of Tacoma. In July 1981, EPA sampled drinking water wells in the Tacoma, WA area for contamination with purgeable halocarbons. The sampling showed that Lakewood Wells H1 and H2 were contaminated with 1,2-dichloroethylene (1,2 DCE), trichloroethylene (TCE), and tetrachloroethylene. In mid-August 1981 Lakewood water district took wells H1 and H1 out of production.

It was determined that the septic tanks and the ground disposal area of a commercial cleaners were the probable source of well water contamination. Solvents used in the dry cleaning process were disposed in the septic tank and liquid wastes consisting of solvent-contaminated sludges and water draw-off were disposed on the ground outside the cleaners. Initial Remedial Measures (IRMs) implemented in June 1984 at the site included the construction of air stripping towers for wells H1 and H2. The recommended alternative for this second remedial action includes: operation of the H1-H2 treatment system to continue cleanup of the aquifer; installation of variable-frequency controllers on the well pump motors; changing fan drives to reduce treatment tower air flow; installation of additional monitoring wells, upgrading existing wells, and continuing routine sampling and analysis of the aquifer; placement of administrative/institutional (see spearate sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision Ponders Corner, WA (Second Remedial Action) Contaminated Media: gw, soil Key contaminants: 1,2-dichloroethylene (1,2 DCE), trichloroethylene (TCE), tetrachloroethylene, solvents		

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)* None	21. NO. OF PAGES 69
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Abstract - continued

restrictions on the installation and use of wells; excavation and removal of the septic tanks and drainfield piping on the cleaners property, and placement of administrative restrictions on excavation into the contaminated soils to reduce the risks associated with uncontrolled excavation. Total capital cost for the selected remedial action is estimated to be $334,970 with O&M costs approximately $85,700 per year. The aquifer cleanup level will be addressed in a later decision, based on data gathered during the operation of the selected remedial action.

Record of Decision
Remedial Alternative Selection

SITE

Ponders Corner, Washington

DOCUMENTS REVIEWED

I am basing my decision primarily on the following documents describing the analysis of the cost and effectiveness of the remedial alternatives for the Ponders Corner Site.

- Public Comment Remedial Investigation Report Appendices, Ponders Corner, Washington.
- Public Comment Feasibility Study Ponders Corner, Washington
- Summary of Remedial Alternatives Selection
- Responsiveness Summary

DESCRIPTION OF SELECTED REMEDY

- Continue operation of the H1-H2 treatment system to continue cleanup of the aquifer. The aquifer cleanup level will be addressed in a later decision, based on data gathered during this operation.
- Install variable-frequency controllers on the well pump motors to reduce energy requirements and thereby reduce costs.
- Change fan drives to reduce treatment tower air flow to reduce energy requirements and thereby reduce costs.
- Install additional monitoring wells, upgrade existing wells, and continue routine sampling and analysis of the aquifer to monitor the progress of its cleanup and to provide an early warning of potential new aquifer contaminants.
- Place administrative restrictions on the installation and use of wells to minimize the potential for use of contaminated groundwater.
- Excavate and remove the septic tanks and drain field piping on the Plaza Cleaners property to reduce the risks associated with uncontrolled excavation by removing the most contaminated soil, and comply with other environmental laws.
- Place administrative restrictions on excavation into the contaminated soils to reduce the risks associated with uncontrolled excavation.

DECLARATIONS

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and the National Contingency Plan (40 CFR Part 300), I have determined that the above Description of Selected Remedy at the Ponders Corner site is a cost-effective remedy and provides adequate protection of public health, welfare, and the environment. The State of Washington has been consulted, and is presently reviewing the approved remedy.

I have also determined that the action being taken is appropriate when balanced against the availability of Trust Fund monies for use at other sites. In addition, the continued operation of the H1 - H2 treatment system modified with variable frequency controllers and reduced fan speed, and excavation of the septic tanks and drain fields for off-site transport, treatment, and secure disposal are more cost-effective than other remedial actions, and are necessary to protect public health, welfare, or the environment. All off-site disposal shall be in compliance with the policies stated in Jack W. McGraw, Acting Assistant Administrator, Office of Solid Waste and Emergency Response's May 6, 1985, memorandum entitled Procedures for Planning and Implementing Off-site Response Actions.

The remedial action includes the maintenance of institutional controls with which to prohibit withdrawals of groundwater from the area of the plume of contamination, and the selection of the endpoint of groundwater and soil treatment at the source area.

Selection will take into account the site specific and regional characteristics and will be protective of the public health and the environment. The endpoint levels of treatment are to be evaluated by the Regional Administrator after two years from the execution of this document.

The Regional Administrator shall have the authority to approve modifications to the choice and operation of certain aspects of the remedy as discussed in the Summary of Remedial Alternatives Selection insofar as those modifications are equivalent in effectiveness and cost or are necessary for the protection of health or the environment.

In addition, the action may require future operation and maintenance (O & M) activities, not including the O & M for the stripping towers, to ensure the continued effectiveness of the remedy. These activities will be considered part of the approved action and eligible for Trust Fund monies until such time that the Regional Administrator makes the decision regarding the endpoint level of treatment for soils and groundwater. At the time when the levels are set, the Regional Administrator will also decide on the future status and funding of O & M.

If additional remedial actions are determined to be necessary, a Record of Decision will be prepared for approval of the future remedial action.

SEPT 30 1985
Date

Ernesta B Barnes
Regional Administrator

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

Ponders Corner, Washington

SITE LOCATION AND DESCRIPTION

Ponders Corner, or the Lakewood site as it is identified in the National Priorities List, is located in Pierce County, Washington, south of the city of Tacoma and adjacent to Interstate Highway 5 (Figure 1).

The Ponders Corner site includes the property upon which a business known as Plaza Cleaners has operated for several years on South Tacoma Way just north of the interstate, and the regional aquifer within about a 2,000-foot radius of Plaza Cleaners (Figure 2).

This area is predominantly residential to the north of the Burlington Northern Railroad tracks, and commercial and light industrial along Pacific Highway. Lakewood Water District has two of its production wells (H1 and H2) on a fenced site immediately south of Interstate 5 and east of New York Avenue. Residential property lies to the east of the well site, and McChord Air Force Base is south of the wells bordering on New York Avenue. The Lakewood wells are the location of the recently completed EPA Ponders Corner Initial Remedial Action (IRM), consisting of two air stripping towers, a pumphouse, a clear well, and associated piping and equipment.

SITE HISTORY

Groundwater Contamination Discovery

In July 1981, EPA sampled drinking water wells in the Tacoma, Washington, area for contamination with purgeable halocarbons. The sampling showed that Lakewood Wells H1 and H2 were contaminated with 1,2-dichloroethylene (1,2 DCE), trichlorethylene (TCE), and tetrachloroethylene, often called perchloroethylene (PERC). The chemicals tetrachloroethylene, trichloroethylene and 1,2 (trans.) dichloroethylene, which were released into the environment at the site are "hazardous substances" pursuant to 42 U.S.C. 9601(14). In mid-August 1981 Lakewood Water district took wells H1 and H2 out of production, notified its customers of the well contamination, and requested that a water conservation plan be followed.

Wells H1 and H2 make up the Ponders Corner well field. Both wells are approximately 110 feet deep and together can supply up to 2,600 gallons per minute (gpm). Before the wells were taken out of production because of contamination, they supplied water to the Ponders Corner/Nyanza Park area, provided over 10 percent of the district's needs, and were a critical service for fire protection.

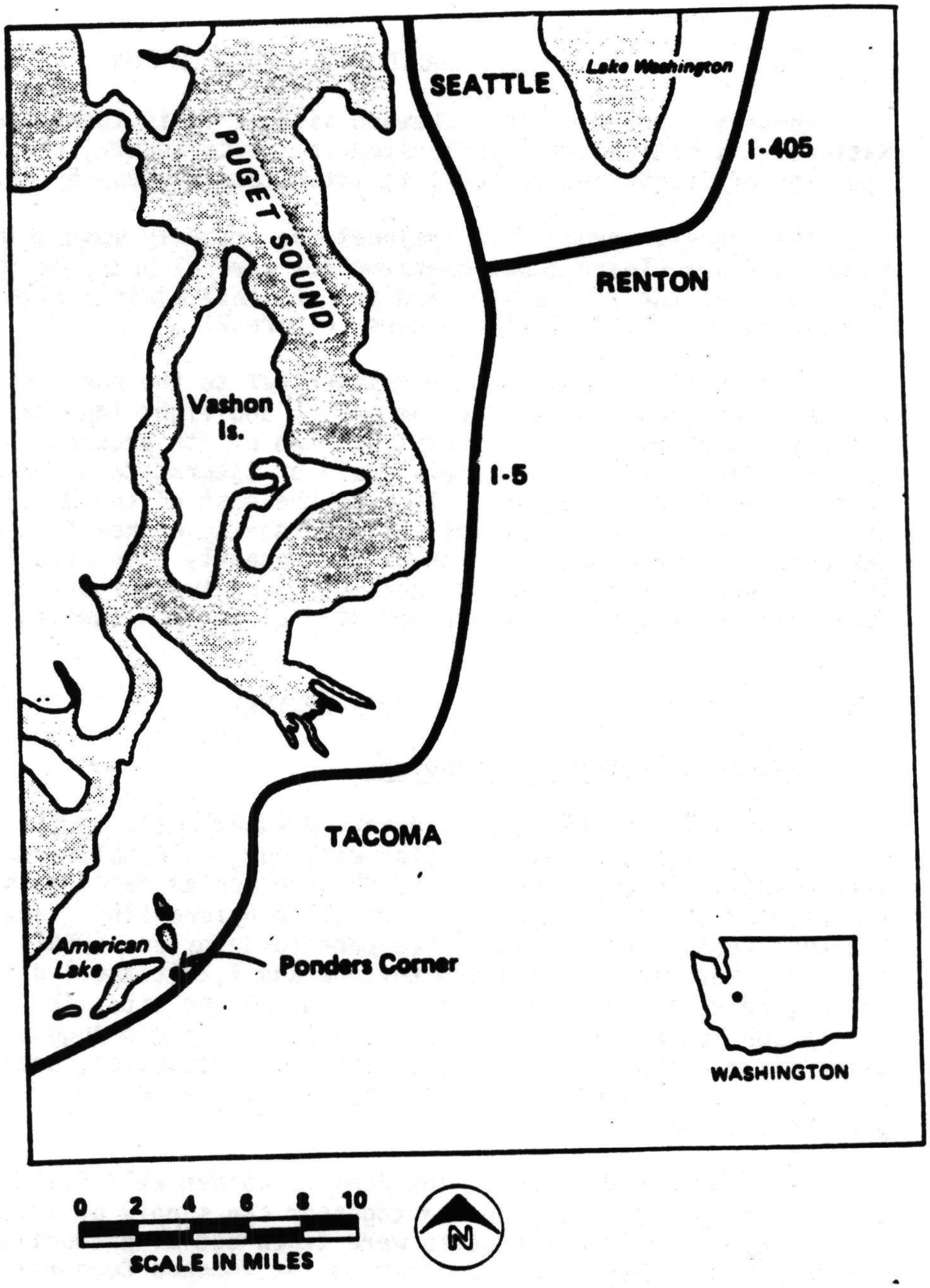
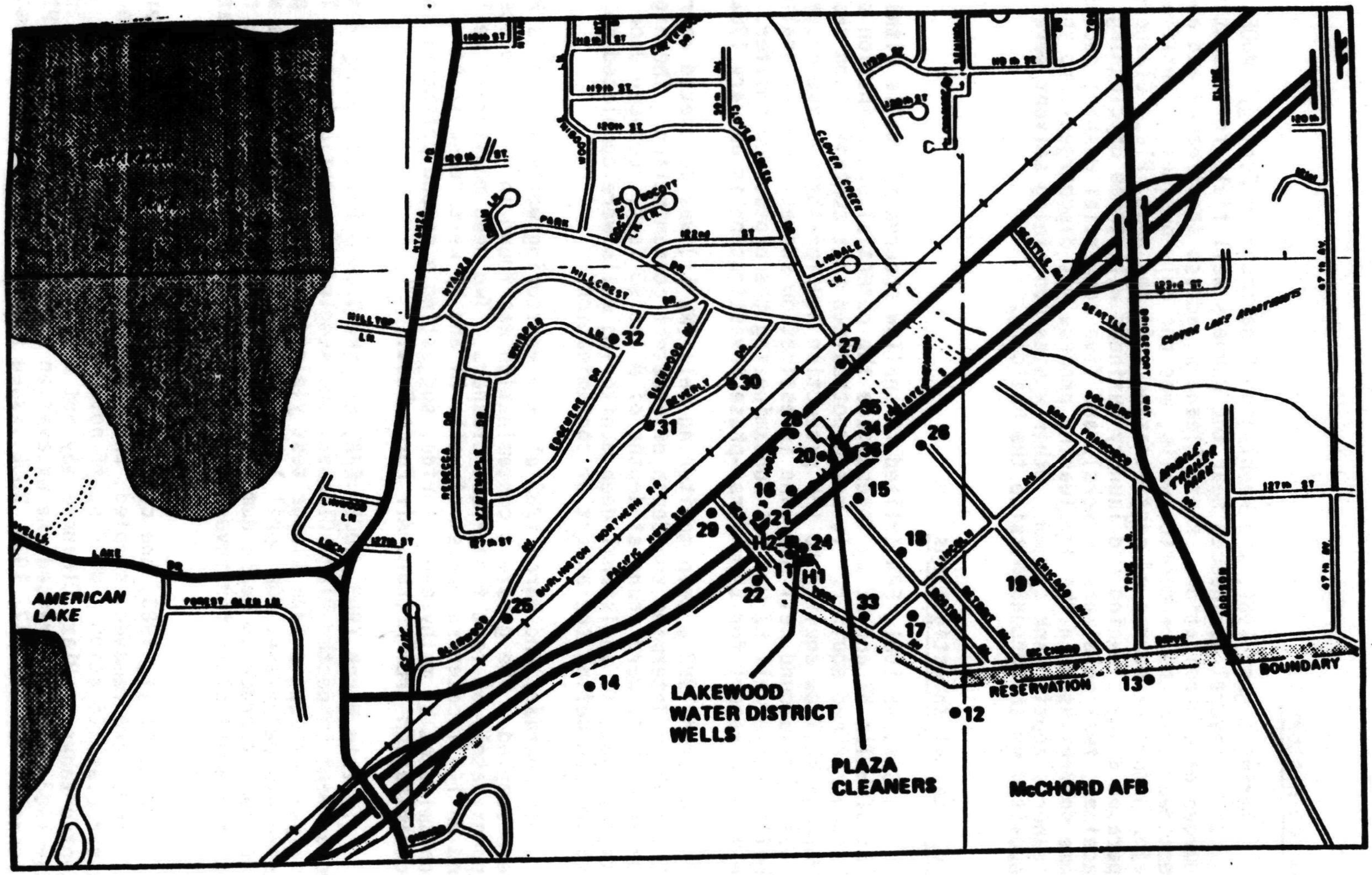


FIGURE 1

LOCATION OF PONDERS CORNER



LEGEND

● MONITORING WELL

■ TEST OR PRODUCTION WELL

SCALE IN FEET

FIGURE 2

PONDERS CORNER STUDY AREA

Source History

During August 1981, the Washington Department of Ecology (WDOE) inspected several businesses near the Ponders well field for potential sources of contamination. Plaza Cleaners, across the freeway and about 800 feet away from the production wells, was the only business identified as a major potential source of contamination. In the past, Plaza Cleaners operated a dry cleaning and laundry business with three drycleaning machines, two reclaimers (dryers), and five commercial washing machines. Some solvent used in the drycleaning process was discharged into the cleaner's septic tank system. Other wastes containing solvent were deposited on the ground outside the building.

Supplemental Investigations

In October 1981, EPA drilled 10 shallow observation wells within 50 feet of wells H1 and H2 to investigate the potential contamination of a shallow perched aquifer. It was hypothesized that contamination traveled from the shallow aquifer to the production aquifer through the unsealed gravel pack around well H2. The investigation showed that the shallow aquifer above well H2 was not contaminating the production aquifer. USEPA released a report for this first-phase investigation in January 1982.

In March 1982 a deep monitoring well (MW 11) was completed near wells H1 and H2 to determine the depth of greatest contamination. The highest concentrations were found at depths of 85 to 95 feet. Between June 1982 and January 1983, 13 additional deep monitoring wells were completed to further explore and define the extent of contamination.

In February and March 1983 all the monitoring wells and wells H1 and H2 were sampled. The greatest contamination was found in MW 20, located approximately 50 feet from Plaza Cleaners. Two deep monitoring wells (MW 12 and MW 14) located southeast of wells H1 and H2 were found to be contaminated by methylene chloride, suggesting a second potential source of contamination from McChord Air Force Base.

In late March 1983, WDOE, EPA, and the Tacoma-Pierce County Health Department inspected Plaza Cleaners and sampled its septic tanks. The analysis of septic tank sludge test yielded results as high as 483 ppm of tetrachloroethylene. On April 1, 1983, WDOE issued Plaza Cleaners an enforcement order to cease dumping solvent-containing material and to submit and implement plans for investigating and eliminating the contamination problem.

On April 11, 1983, the contents of the three septic tanks at Plaza Cleaners were removed, sampled, and placed in temporary storage pending their classification. WDOE staff noted in their inspection report that the septic tanks at Plaza Cleaners may not have impermeable bottoms. In early May 1983, WDOE supervised the excavation and sampling of soils at Plaza Cleaners. On June 17, 1983, WDOE issued Plaza Cleaners an enforcement order to eliminate all discharges to the ground and groundwater by July 1, 1983. On September 7, 1983, WDOE and the present and former owners of Plaza Cleaners signed an agreement before the State Pollution Control Hearings Board stipulating that Plaza Cleaners would cease discharging laundry and dry cleaning wastes onsite, would remove contaminated soils, and would cooperate with WDOE to protect the aquifer from contaminants released at the site.

Plaza Cleaners has since stopped disposal of solvents to the ground and septic tanks, and some of the surrounding soil has been replaced with noncontaminated soil. Plaza Cleaners is no longer using their septic system as they are currently connected to Lakewood's sewage system. It is not known, however, whether all sources of contamination have been removed.

Ponders Corner FFS/IRM

In March 1984, EPA authorized a Focused Feasibility Study (FFS) of treatment alternatives that could be implemented by mid-1984 on wells H1 and H2 to restrict the spread of the contaminants in the aquifer and restore normal water service in the surrounding area. An air stripping system was recommended and designed. Construction was authorized in July 1984, and the system started up in late September. Well water contamination was in the range of 100 to 500 micrograms per liter (ug/L) of tetrachloroethylene at startup, decreased rapidly after several days pumping, and has continued to decrease.

Contamination levels in early March 1985, were about 50 and 10 ug/L of tetrachloroethylene in wells H1 and H2, respectively. Treated water concentrations of the contaminants have been well below the established discharge limits since startup and are also consistently below the laboratory detection limits.

Remedial Investigation/Feasibility Study

A Remedial Investigation (RI) was initiated to better identify the extent and source of contamination. Field work began in December of 1984 and was completed in February of 1985. The results of the RI are presented in the Public Comment Remedial Investigation, Ponders Corner, Washington, Report. Groundwater elevation and water quality sampling continued during March, April, and May 1985.

The Feasibility Study was initiated to develop and evaluate alternatives which would remediate the contamination at this site, defined by the Remedial Investigation. The Public Comment Feasibility Study, Ponders Corner, Washington, report contains the results of this evaluation.

CURRENT SITE STATUS

Remedial Investigation Activities and Objectives

The purpose of the Remedial Investigation (RI) was to obtain sufficient data in the area of Ponders Corner to determine the extent and source of the contamination so that the need or the effectiveness of remedial measures could be quantitatively evaluated during the Feasibility Study (FS). The majority of the field work for the RI was completed in December 1984, through February 1985. The field work completed included the following work elements:

-investigation of site conditions by installing nine deep and three shallow monitor wells to provide a comprehensive picture of the groundwater regime (e.g., flow patterns, hydraulic connections between layers), and to determine the nature and extent of groundwater contamination and confirm the sources of contamination;

-excavation of the waste line at Plaza Cleaners and drilling of seven soil borings to determine the extent and character of remaining sources of contamination at Plaza Cleaners, and to determine if other sources are contributing to the problem; and

-collection of samples for field and laboratory analysis to determine the extent and concentration of contamination in the soil and aquifers in the study area.

Hydrogeology

Ponders Corner is situated on an upland drift plain that slopes gently to the northwest, terminating at Puget Sound. The area around Ponders Corner has a maritime climate with cool, wet winters and warm, dry summers. Average annual precipitation is 40 inches, 85 percent of which falls during the months of September through April. Mean lake evaporation is about 23 inches per year. Most of the evaporation occurs during the months with lowest precipitation, indicating a strong seasonal trend for groundwater recharge and surface runoff.

Local annual recharge for the open area immediately behind Plaza Cleaners is estimated to be about 17 inches, or about 40 percent of the total precipitation. Recharge in areas adjacent to Plaza Cleaners will be less because much of the area is paved and drained to storm sewers. A visual inspection of these areas found that about 50 percent are paved or drain to a sewer.

The four hydrogeological units of interest which underlie the Ponders Corner area are as follows:

-The permeable sands and gravels of the recessional outwash deposits, known as the Steilacoom gravels

-The semiconfining silt and clay-rich Vashon till that contains lenses of clean gravel in places

-The highly stratified, yet permeable, advance outwash deposits that form the primary aquifer

-The generally less permeable Colvos sand that grades to a clayey sand or blue clay at its base.

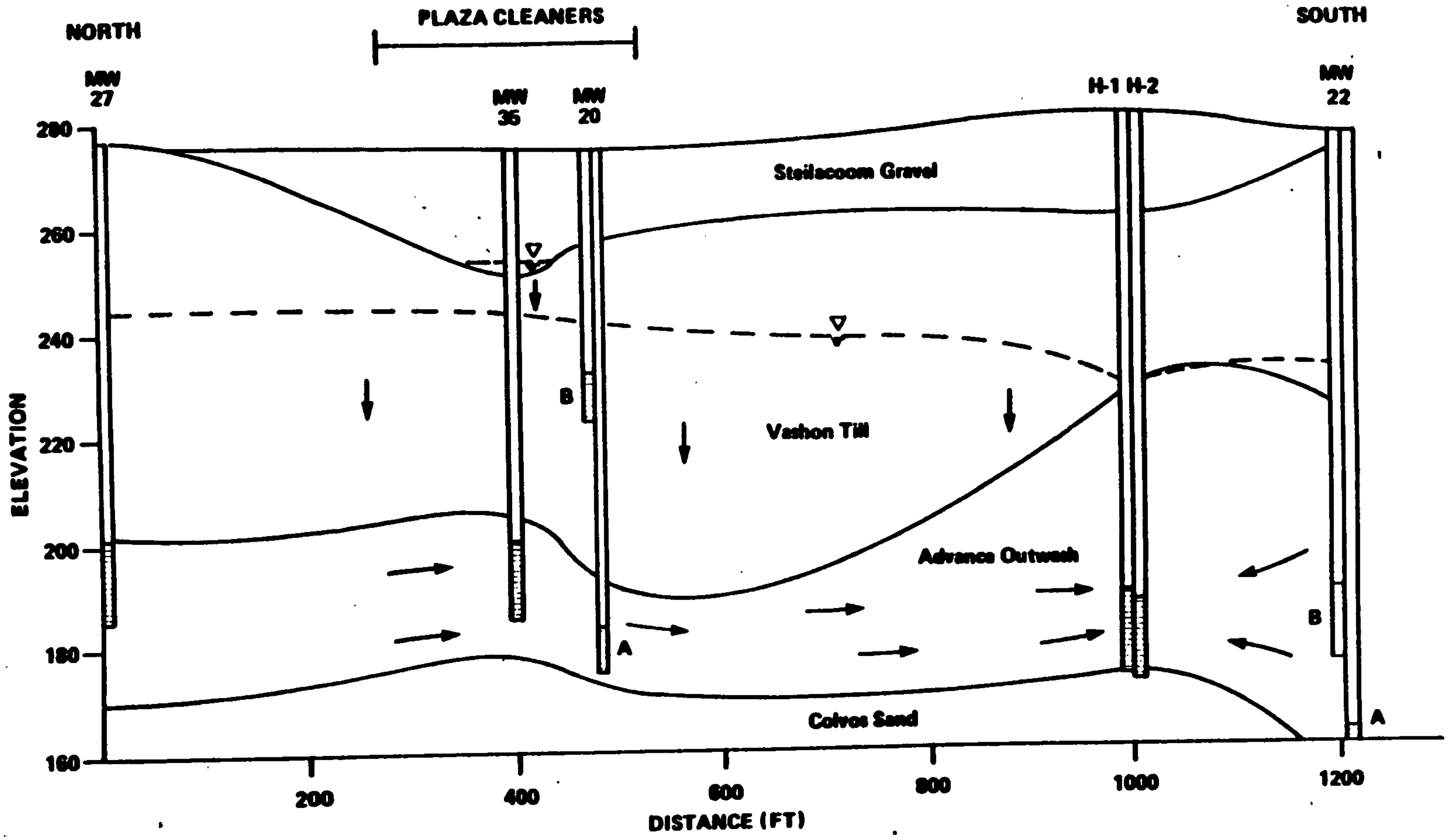
Figure 3 is a north-south cross section connecting the Plaza Cleaners property with the Lakewood wells H1 and H2. This figure shows typical groundwater elevations and directions of groundwater movement under pumping conditions.

The Steilacoom gravels vary in thickness from 1 to 58 feet in the Ponders Corner area. The gravels are typically unsaturated, except in an area east of Plaza Cleaners and near wells H1 and H2. In these areas perched, saturated zones several feet thick can exist. These zones are capable of yielding several tens of gallons per minute. Limited water level data from monitoring wells screened in the gravels indicate that the direction of flow is to the south near Plaza Cleaners and to the northwest near wells H1 and H2.

The underlying Vashon till is highly variable in thickness and moisture content. Over the study area, the till can range from 8 to 92 feet in thickness. It is thickest to the north and west of Plaza Cleaners and becomes quite thin, and possibly discontinuous, southeast of wells H1 and H2. While the upper portion of the till is generally unsaturated, saturated zones can be found elsewhere, particularly near the bottom of the till and in gravel lenses found in this zone.

One of these lenses appears to be large in lateral extent, covering an area including Plaza Cleaners property. This lens is saturated and appears to be hydraulically interconnected with the Steilacoom gravels. Drawdowns in shallow monitoring wells screened in the Steilacoom gravel unit were observed during a 72-hour aquifer test of well H2. The rate and direction of water movement in the till are difficult to estimate.

The surface contact between the till and the underlying advance outwash is found at a depth of 25 to 84 feet. In the immediate vicinity of Plaza Cleaners and to the north, the outwash is relatively thin (on the order of 20 feet). South of Plaza Cleaners and near wells H1 and H2 the outwash thickness increases to over 90 feet.



TYPICAL GROUNDWATER ELEVATIONS UNDER PUMPING CONDITIONS

DIRECTION OF GROUNDWATER MOVEMENT UNDER PUMPING CONDITIONS

NORTH-SOUTH CROSS-SECTION BETWEEN PLAZA CLEANERS AND H1 AND H2

FIGURE 3

Under nonpumping conditions (that is, when wells H1 and H2 are not operating) the general direction of flow in the advance outwash is to the northwest. The average gradient across the Ponders Corner area is 0.0035 foot per foot, or about 18 feet of vertical drop per mile (Figure 4).

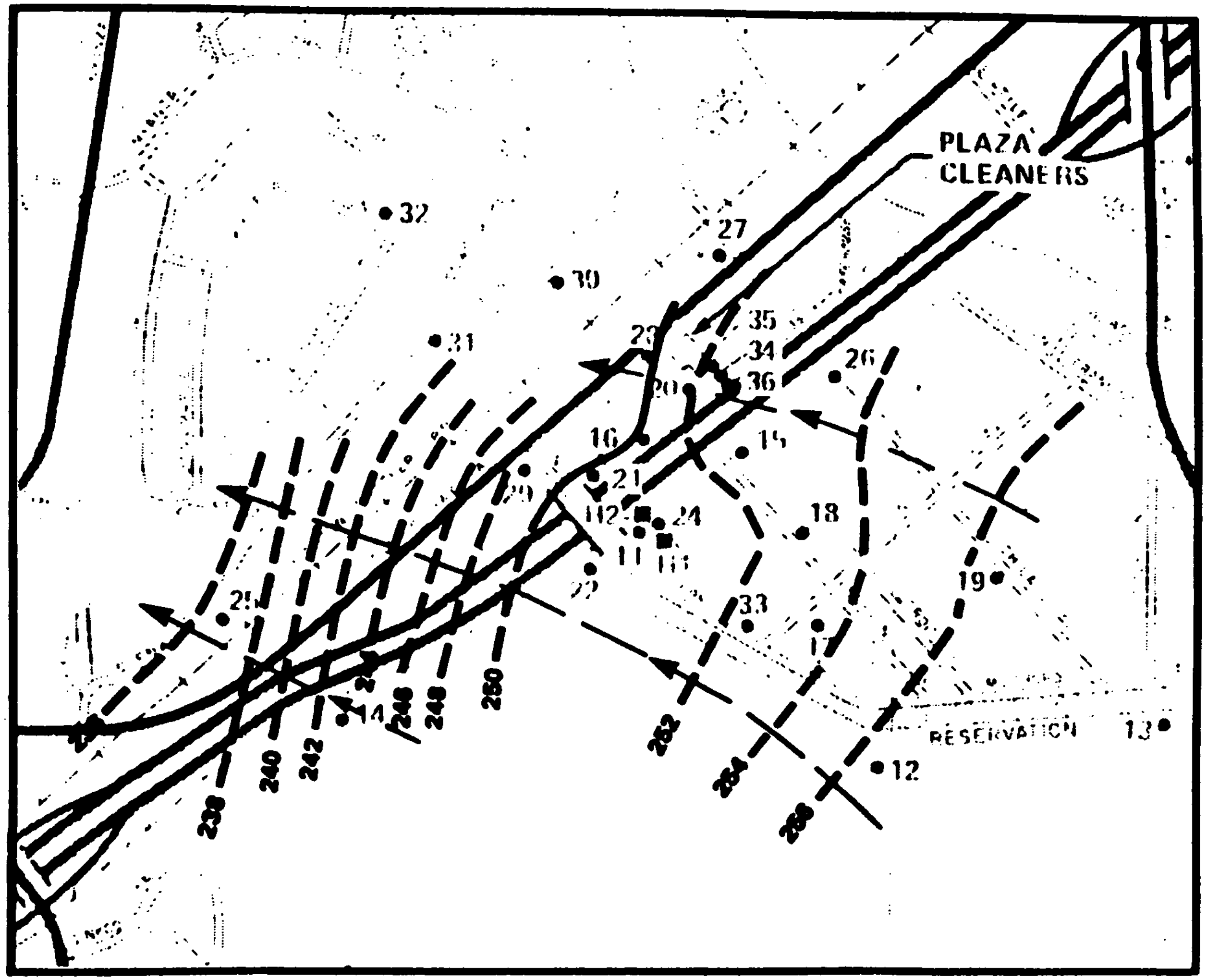
Under pumping conditions, a zone of capture forms around wells H1 and H2. Wells H1 and H2 had been pumping a total of approximately 2,000 gpm continuously since September 26, 1984. The approximate location of the zone of capture formed by these two wells is shown in Figure 5. Theoretically, groundwater within the zone of capture will ultimately be extracted by the wells. Groundwater outside the zone of capture will continue to move toward Gravelly Lake.

Local recharge to the advance outwash is mainly from precipitation that percolates down through the Steilacoom gravel and Vashon till zones. The primary point of local discharge is Gravelly Lake. The lake has no surface inlet or outlet.

Groundwater Contamination Migration

Contamination of the site and groundwater resulted from effluent discharges from septic tanks behind Plaza Cleaners and sludge disposal on the land surface. Between 15,000 and 20,000 gallons of effluent were discharged on a daily basis. Data on contamination levels in the effluent are limited; however, sampling by the WDOE found that supernatant in the dry cleaner's septic tank system contained 550 ug/L tetrachloroethylene and 29 ug/L trichloroethylene. At a flow rate of 20,000 gallons per day (gpd) and assuming the supernatant contamination levels are indicative of the levels discharged to the drain field, loading of PERC and TCE may have been as high as 0.09 and 0.005 pound per day, during the years of the operation of the cleaners.

Effluent discharge from the drain field provided a significant driving force for contaminant migration. The flow rate cited above is about 40 times greater than the estimated recharge rate of 17 inches per year for the area immediately behind Plaza Cleaners. Based on the available soils and geologic data, it appears that the effluent migrated vertically through the Steilacoom gravels. Upon reaching the surface of the Vashon till, it may have migrated laterally along the surface of the till until it reached a conduit into the till (Figure 6). Possible conduits through the till include the gravel lenses known to exist in the vicinity of Plaza Cleaners, discontinuities in the till where it thins to the southeast, or the suspected but never substantiated presence of dry well(s). The contamination then worked its way vertically and laterally through the till into the advance outwash. Once in the advance outwash, the contamination moved laterally towards well H1 and H2 (Figure 7).



LEGEND

- ● MONITORING WELL
- ■ TEST OR PRODUCTION WELL
- WATER LEVEL-CONTOUR. SOLID WHERE APPROXIMATE, DASHED WHERE INFERRED. ELEVATION IN FEET ABOVE MEAN SEA LEVEL.
- → GROUNDWATER FLOW DIRECTION

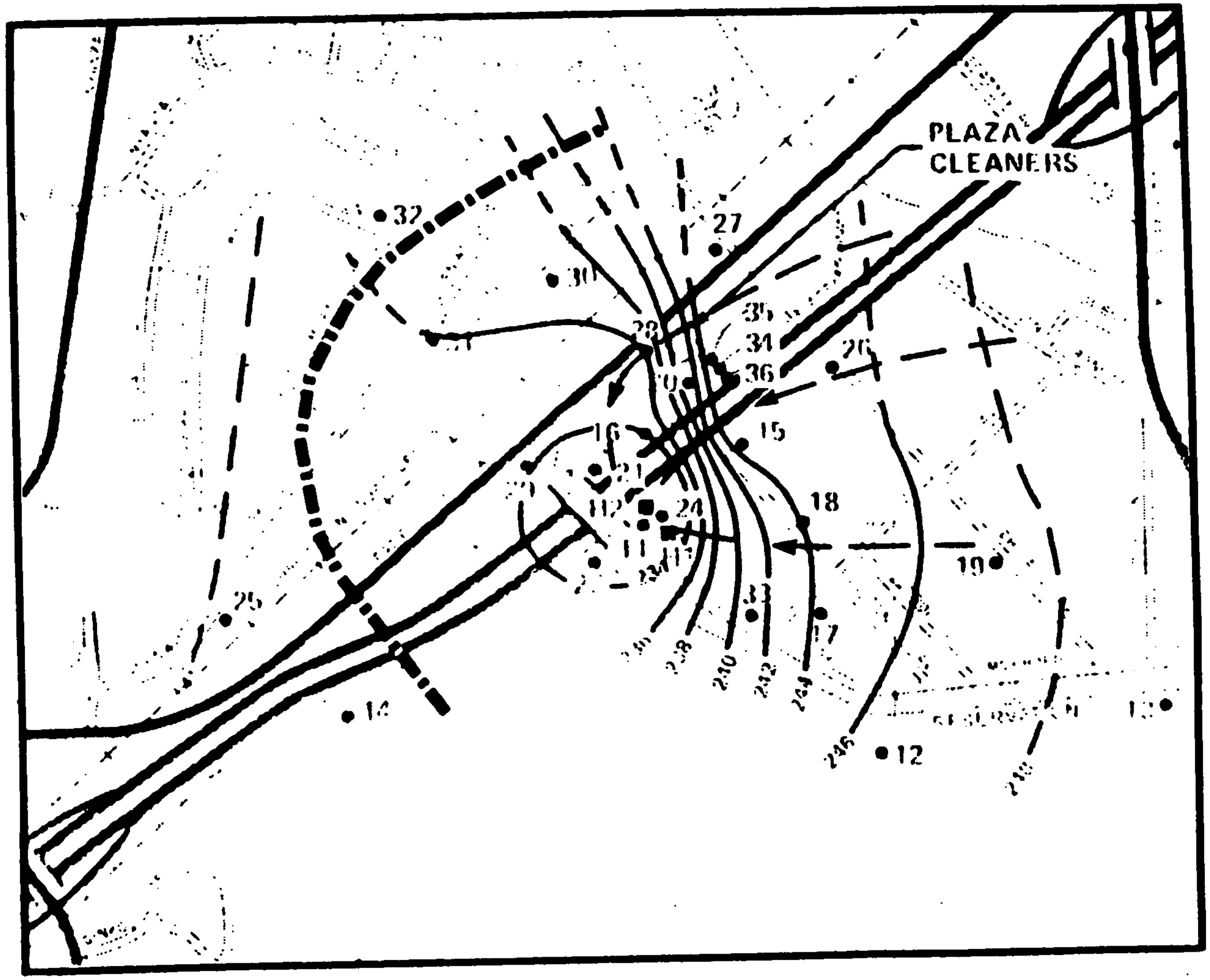
N

0 500 1000

SCALE IN FEET

WATER–LEVEL CONTOUR MAP OF THE ADVANCE OUTWASH AQUIFER, JULY 23,1984

RE 4



LEGEND

- ● MONITORING WELL
- ■ TEST OR PRODUCTION WELL
- ——— — — WATER LEVEL CONTOUR. SOLID WHERE APPROXIMATE, DASHED WHERE INFERRED. ELEVATION IN FEET ABOVE MEAN SEA LEVEL.
- ←— GROUNDWATER FLOW DIRECTION
- ▪▬▪ APPROXIMATE LIMITS OF ZONE OF CAPTURE

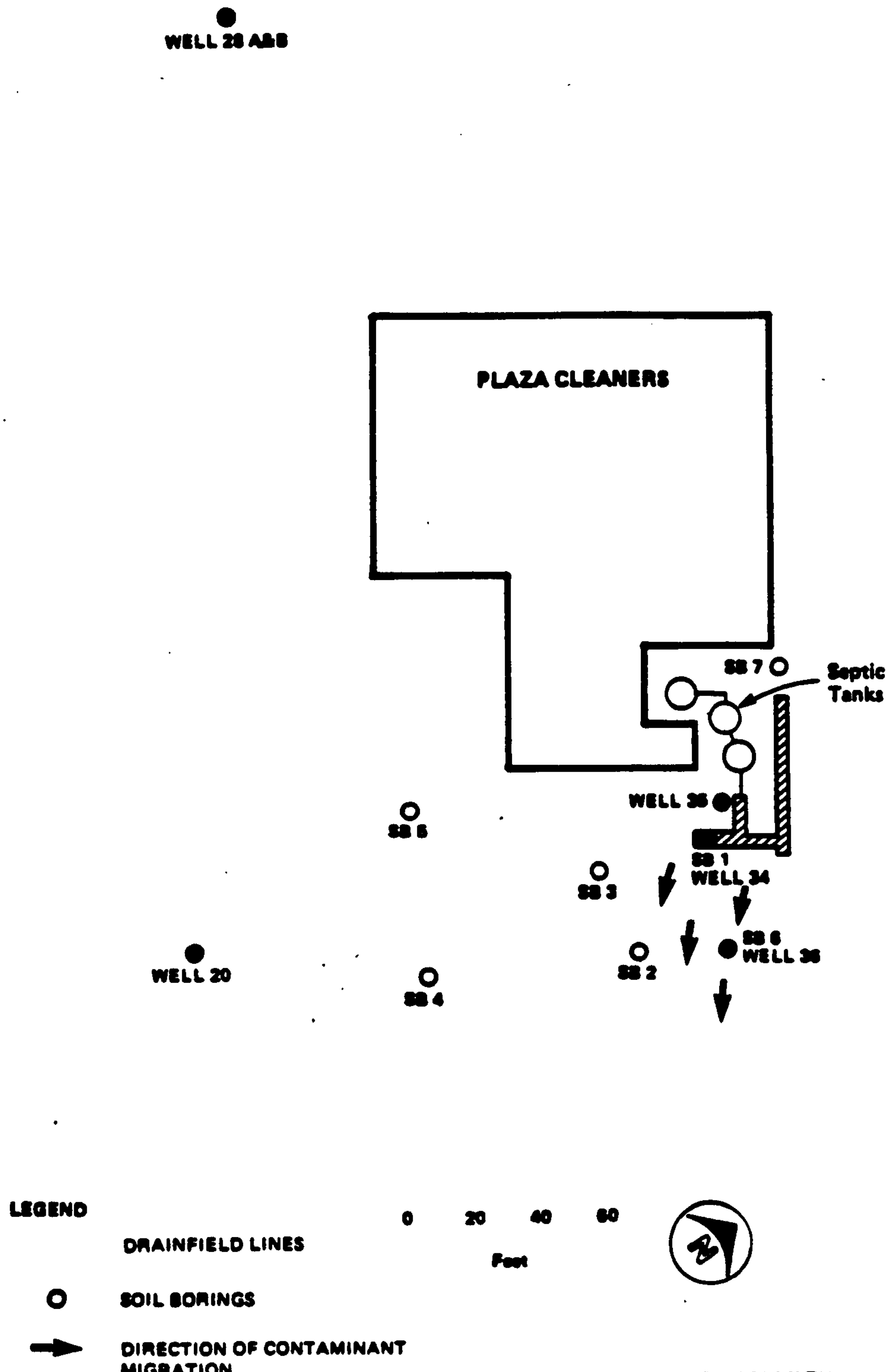
N

0 500 1000

SCALE IN FEET

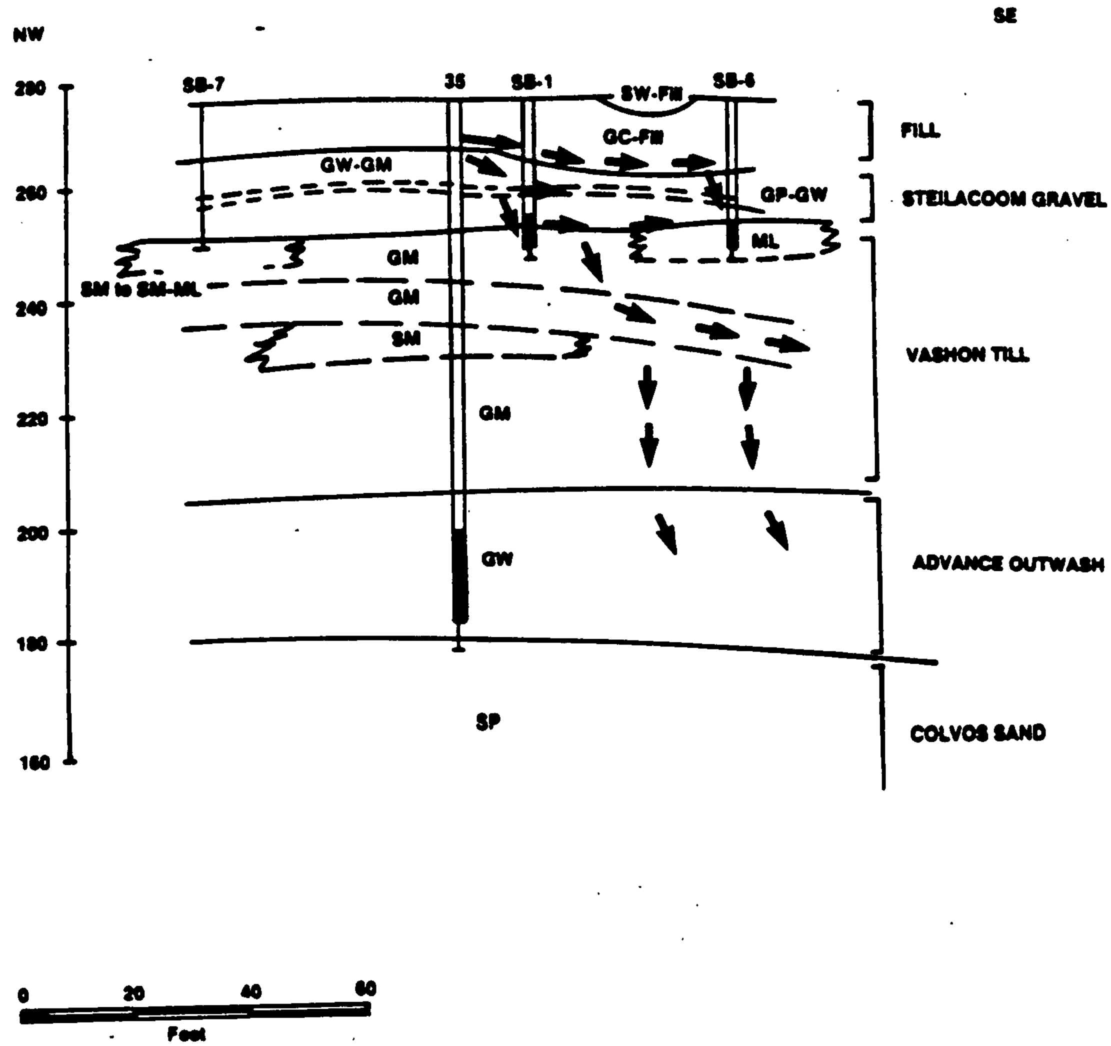
FIGURE 5

ZONE OF CAPTURE FOR WELLS H1 AND H2



PLAN VIEW OF CONTAMINANT MIGRATION

FIGURE 6



DIRECTION OF CONTAMINANT MIGRATION

GW GRAVEL, WELL GRADED
GP GRAVEL, POORLY GRADED
GM SILTY GRAVEL
GC CLAYEY GRAVEL
SW SAND, WELL GRADED
SMP SAND, POORLY GRADED
SM SILTY SAND
ML SILT, LOW LIQUID LIMIT

CROSS-SECTION VIEW OF CONTAMINANT MIGRATION

FIGURE 7

During the time when wells H1 and H2 were taken out of service, contaminant migration in the advance outwash was mainly to the northwest in response to the regional flow gradient. During this time some contamination appears to have migrated beyond the zone of capture for wells H1 and H2.

The rate of contaminant migration in the Steilacoom gravels and Vashon till has probably decreased substantially following the cessation of discharges from the Plaza Cleaners septic tanks in July of 1983. Contaminant migration in these zones is now controlled by local natural recharge.

Units of Contamination

The two relatively distinct units of contamination at Ponders Corner are the near-surface soils and the aquifer.

Soils Unit

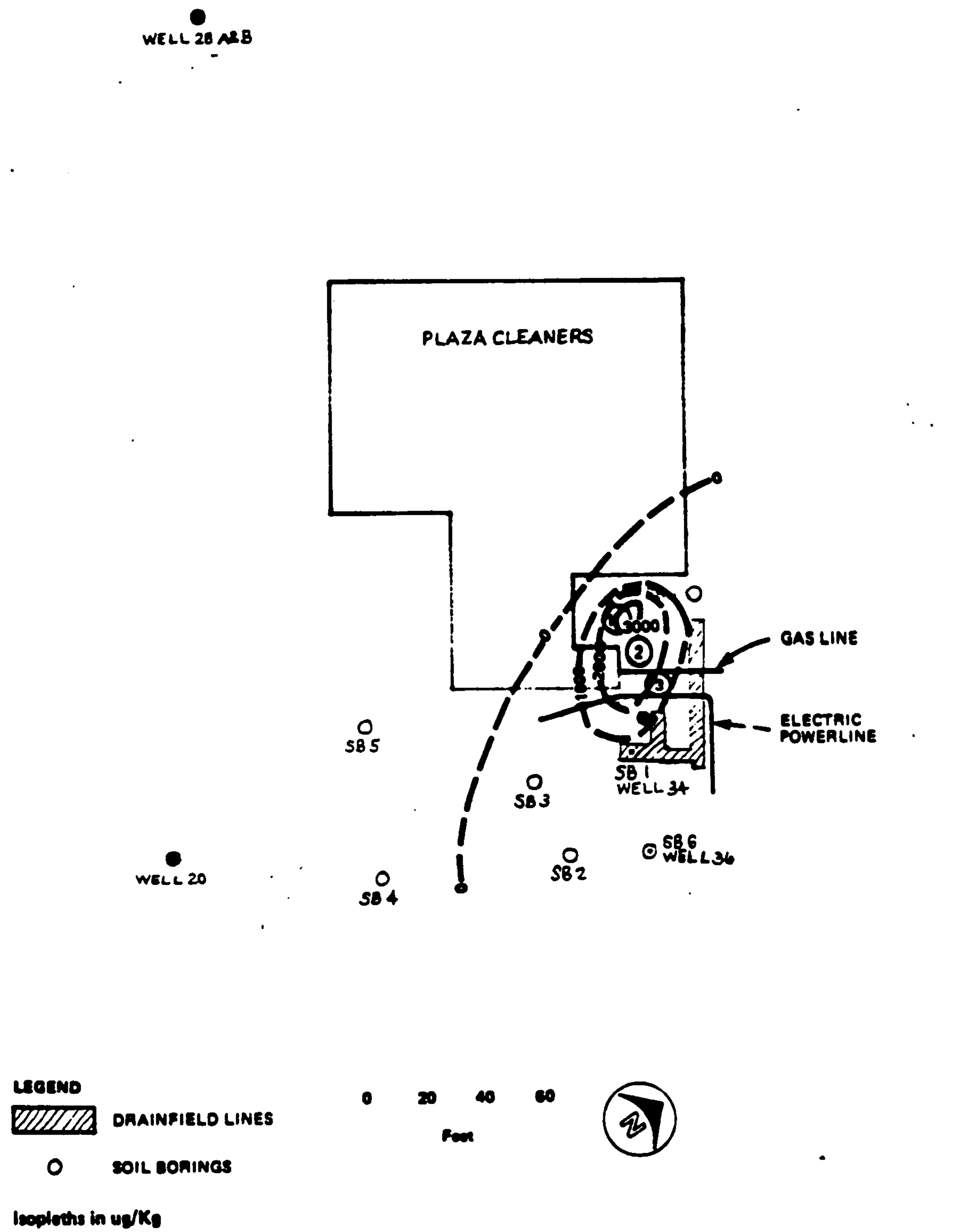
The near-surface soils on the Plaza Clearners property were characterized with seven soil borings and six shallow test pits. Soil samples from each boring and test pit showed PERC contamination in the upper 12 to 13 feet of soil in the immediate vicinity of the dry cleaner's septic tanks and drain field known to have received solvent-contaminated wastewater. Smaller pockets of contamination were found to a depth of 25 feet near borings SB2 and SB7.

Figure 8 shows the inferred PERC distribution in the upper 5 feet of soil. The highest concentrations are near the back entrance to Plaza Cleaners where solvent-contaminated wastes were diposed on the ground surface.

Figure 9 shows the inferred PERC distribution along the main axis of the drain field. Except for several small pockets of contamination, most of the PERC is located in the upper 12 to 13 feet of soil.

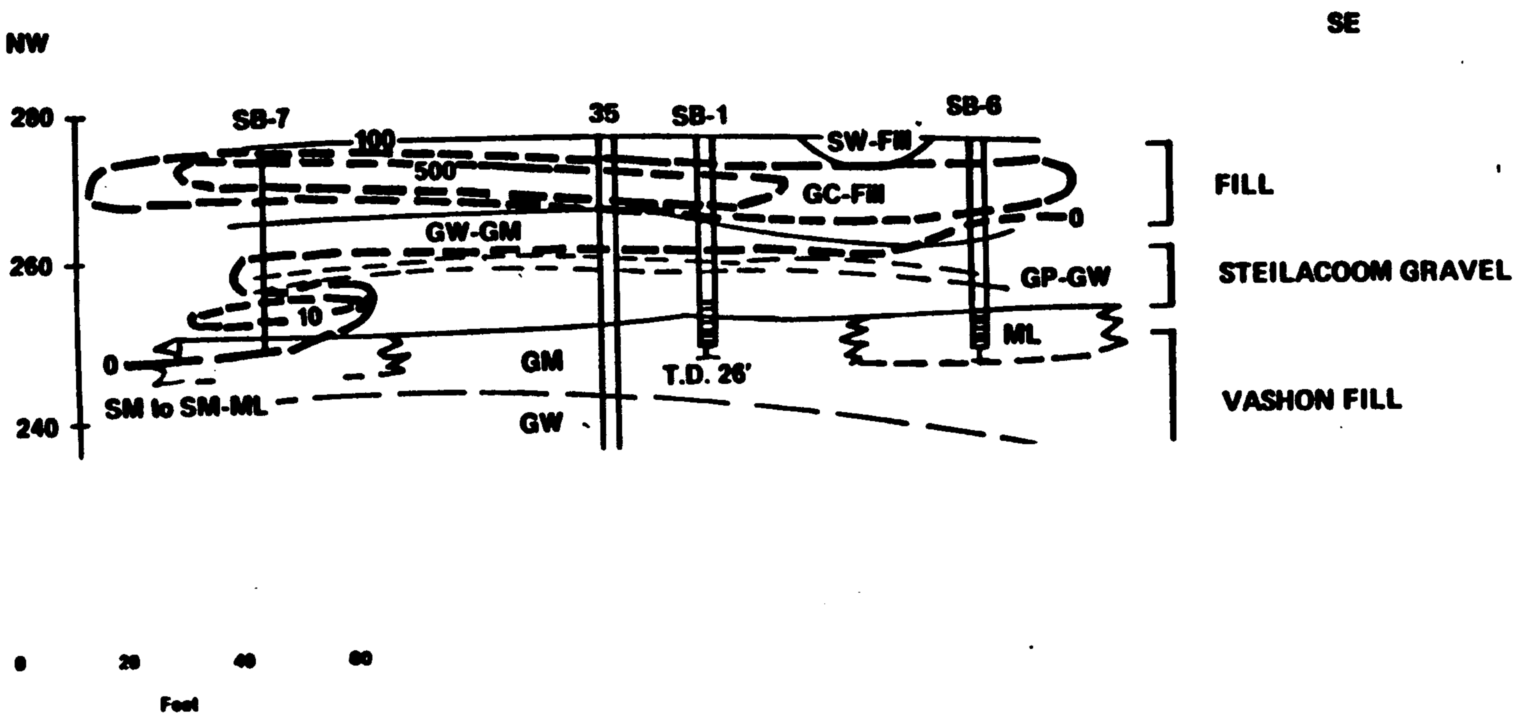
Based on the inferred lateral and vertical extent of soil contamination, about 83,000 cubic feet (3,100 cubic yards) of soil are contaminated with approximately 5 pounds of PERC. This equates to an average soil concentration of 500 ug/kg. Where it was detected, PERC concentrations range from 11 to 3,880 ug/kg.

Given an estimated recharge rate of 17 inches per year over the area of soil contamination (approximately 9,000 square feet), the current rate of PERC leaching from the soils unit is 0.001 pound per day. This calculation assumes an average soil concentration of 500 ug/kg and a soil-water partition coefficient of 0.45 mL/gm.



CONCENTRATION DISTRIBUTION OF PERC IN THE 0.0 TO 5.0-FT DEPTH INTERVAL

FIGURE 8



Isopleths in ug/Kg

GW GRAVEL, WELL GRADED
GMP GRAVEL, POORLY GRADED
GM SILTY GRAVEL
GC CLAYEY GRAVEL
SW SAND, WELL GRADED
ML SILT, LOW LIQUID LIMIT

CONCENTRATION DISTRIBUTION OF PERC ALONG MAIN AXIS OF DRAINFIELD

FIGURE 9

This rate of leaching will decrease over time as soil contamination levels decrease. Assuming PERC is lost from the soil unit only through natural leaching, it will take about 20 years for soil concentrations to decrease below a detection limit of 20 ug/kg.

Aquifer Unit

Contamination in the groundwater unit is actually a composite of the contamination in the saturated portions of the Steilacoom gravels, Vashon till, and advance outwash.

The magnitude and lateral extent of contamination in the Steilacoom gravel and Vashon till zones are difficult to estimate because data are so limited, particularly in the immediate vicinity of Plaza Cleaners.

In addition to the limited number of wells which were screened in these zones, sampling of MW 28B, MW34 and MW36 has yielded little or no water since being installed. Water was initially encountered in all three wells during drilling and well construction. The lack of water in the Steilacoom gravel can be attributed to the limited precipitation during the winter of 1985, and the cessation of discharges to the Plaza Cleaners septic tanks and drain field. In addition, sanitary and storm sewer systems for the area around Plaza Cleaners were recently completed.

The magnitude of contamination in the Steilacoom gravel zone in shown in Table 1 in terms of both average, minimum, and maximum groundwater concentrations. These results were obtained by combining the concentrations measured in MW 34 and MW 36. Although both wells are screened in the Steilacoom gravel and Vashon till, most of the water in the wells comes from the Steilacoom gravel unit.

The magnitude of contamination in the Vashon till zone is shown in Table 1 in terms of average, maximum and minimum concentrations. Only the concentrations measured at MW 20B were used because it is the only well in the till where contamination has been detected.

The magnitude and lateral extent of contamination in the advance outwash zone are better defined and continue to change with time in response to the extraction of groundwater at H1 and H2. Table 1 lists the average and maximum and minimum concentrations based on water quality data collected during February, March, and May of 1985. Over these 4 months, average PERC concentrations decreased from 33 ug/L in February to 13 ug/L in May. TCE concentrations have also decreased. As of May 1985, TCE was detected only at low levels in MW 16A. 1,2-DCE was detected in July 1984. Since that time no 1,2-DCE has been detected in the advance outwash.

TABLE 1
ESTIMATED QUANTITIES OF CONTAMINATION IN EACH ZONE OF THE GROUNDWATER UNIT

	Steilacoom Gravel			Vashon Till			Advance Outwash		
	1,2 DCE	TCE	PERC	1,2 DCE	TCE	PERC	1,2 DCE	TCE	PERC
Average Concentration (μg/L)	ND	42	110	ND	58	2,500	ND	3	16
Number of Observations	--	1	2	--	2	3	--	5	28
Minimum/Maximum Concentration (μg/L)	--	--	83-139	--	12-103	570-4,866	--	1.5-6.3	0.5-110
Total Volume of Contaminated Media (cu ft)	$7.5x10^5$	$7.5x10^5$	$7.5x10^5$	$2.0x10^6$	$2.0x10^6$	$2.0x10^6$	$4.5x10^7$	$4.5x10^7$	$4.5x10^7$
Approximate Mass of Contamination (lb)	--	4	20	--	14	1,300	--	16	180

ND = not detected.
1,2 DCE = 1,2-dichloroethylene.
TCE = trichloroethylene.
PERC = tetrachloroethylene.
μg/L = micrograms per liter.

Table 1 also shows the volume of aquifer contaminated as of February 1985 and the approximate mass of each contaminant present in the zone. This volume estimate is based on a lateral extent of contamination of 900,000 square feet for PERC and an average saturated thickness of 50 feet. The lateral extent of contamination continues to decrease, particularly at the higher concentration levels. Figures 10, 11 and 12 show the concentration distribution for PERC in February, March, and May of 1985. Similar figures were not constructed for TCE because it was detected only in MW 16A.

IRM (H1, H2) Performance

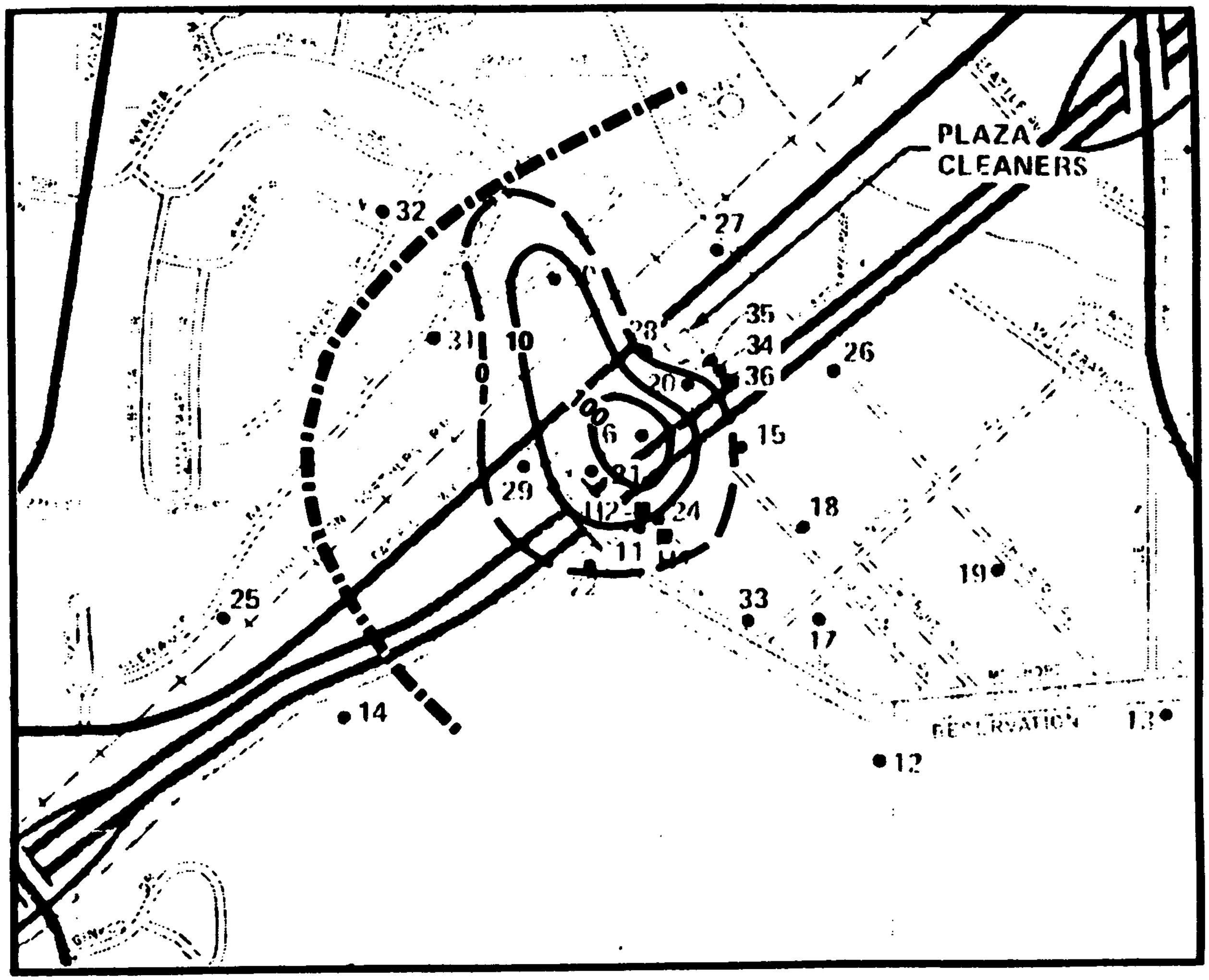
Influent PERC and TCE concentrations from the advance outwash at H1 and H2 have steadily decreased over the operating period of the stripping towers. As of March 5, 1985, PERC concentrations at H1 and H2 were 9.7 and 52 ug/L, respectively. TCE concentrations were 0.45 and 1.7 ug/L in H1 and H2, respectively, on the same date. Average performance characteristics of the treatment system from January to March 1985 are shown in the table below.

Table 2
H1-H2 PERFORMANCE
JANUARY TO MARCH 1985

	H1 Well	H2 Well	Two Towers	Treated Water	Stack Discharge
Flow	800 gpm	1,200 gpm	2,000 gpm	2,000 gpm	60,000 cfm total
PERC	8.54 ug/L	71 ug/L	46 ug/L	0.12 ug/L	--
	--	--	1.04 lb/day	0.003 lb/day	1.101 lb/day
TCE	0.43 ug/L	2.1 ug/L	1.43 ug/L	0.07 ug/L	--
	--	--	0.034 lb/day	0.002 lb/day	0.032 lb/day
TOTALS	--	--	1.138 lb/day	0.005 lb/day	1.133 lb/day
	--	--	--	--	210 ug/m^3

Groundwater Contamination Outside of the Zone of Capture for H1 and H2

As shown on Figures 11 and 12, a portion of the contaminant plume has migrated beyond the estimated zone of capture for H1 and H2. Because concentrations at MW 30 have decreased since February 1985 and no contamination has been detected at MW 31, it appears that the contamination at MW 32 is an isolated portion of the plume that migrated beyond MW 30 during the period of time H1 and H2 were shut down.



LEGEND

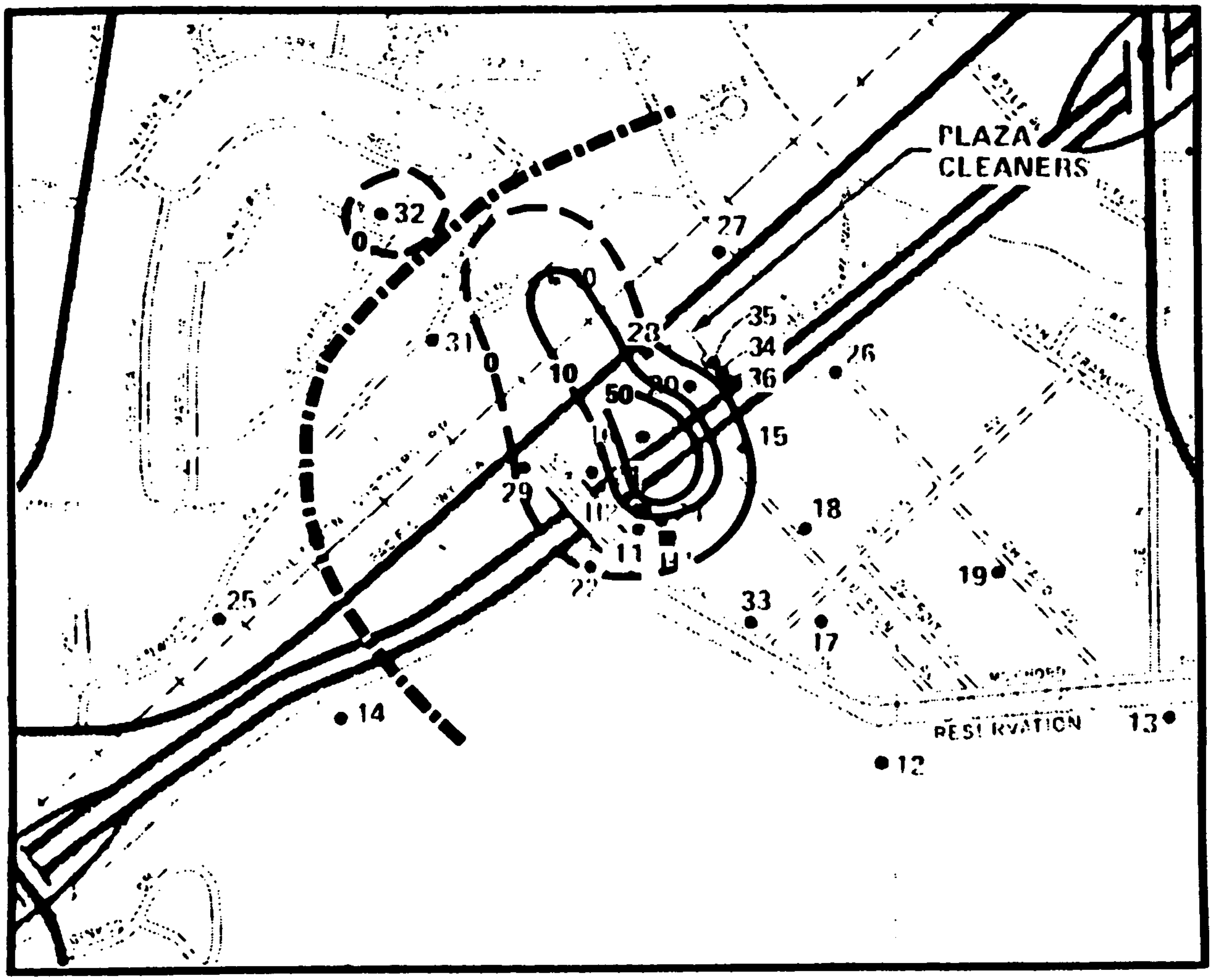
- ● MONITORING WELL
- ■ TEST OR PRODUCTION WELL
- ▬ ▬ CONCENTRATION ISOPLETH IN ppb
- ▬ • ▬ APPROXIMATE LIMITS OF ZONE OF CAPTURE

0 500 1000

SCALE IN FEET

CONCENTRATION CONTOURS FOR PERC, FEBRUARY 1985

.E 10



LEGEND

—10— CONCENTRATION, μg/L

● MONITORING WELL

■ TEST OR PRODUCTION WELL

— • — APPROXIMATE LIMITS OF ZONE OF CAPTURE

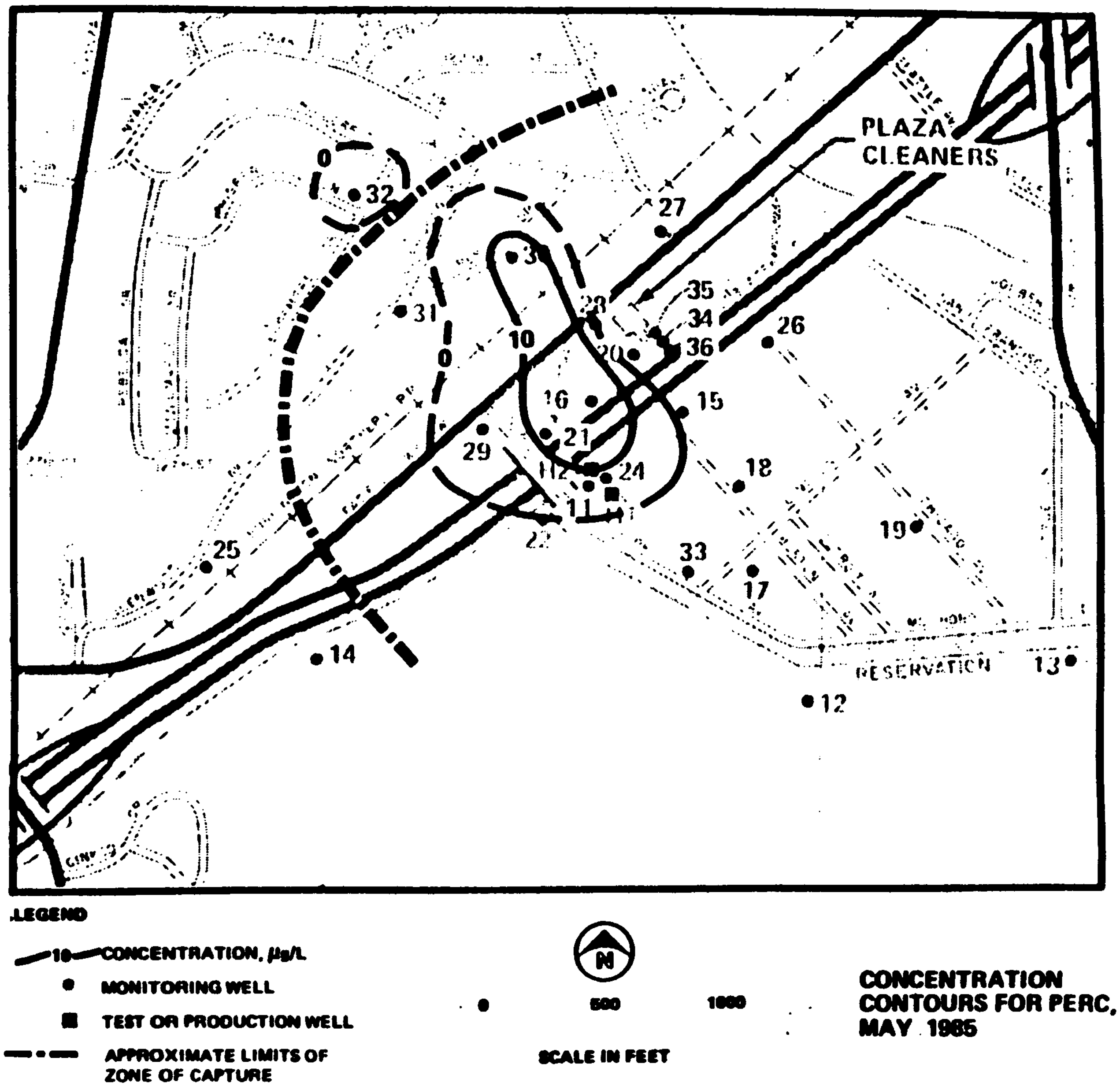
N

0 500 1000

SCALE IN FEET

CONCENTRATION CONTOURS FOR PERC, MARCH 1985

FIGURE 11



CONCENTRATION CONTOURS FOR PERC, MAY 1985

Measured concentrations at MW 32 during March, April, and May 1985 were 4.3, 5.0, and 6.9 ug/L, respectively. As this contamination migrates beyond MW 32 to Gravelly Lake, the concentration will decrease due to dispersion, dilution by recharge, adsorption, and possibly degradation. Groundwater contaminated at a level of about 7 ug/L at MW 32 is estimated to be at a level of about 1 ug/L at the edge of Gravelly Lake.

PUBLIC HEALTH EVALUATION

Health Effects

The three chemicals of concern at this site are tetrachloroethylene (PERC), trichloroethylene (TCE), and 1,2 dichloroethylene (1,2 DCE). Members of the chloroethylene series, including PERC, TCE, and 1,2-DCE, are central nervous system depressants. Acute exposure to these chemicals results in lassitude and mental fogginess. There have been reports of mild irritation, light-headedness, and mild headaches caused by exposure to these chemicals.

The long-term, low-dose effects on the central nervous system have not been well documented in the scientific literature. Acute exposure can, however, produce damage to liver and kidneys.

Although few studies have been performed, these three chlorinated ethylenes have not been found to be teratogenic in laboratory animals tested. All chemicals appear to require metabolic activation for any mutagenic effect. There is generally insufficient evidence on the mutagenicity of these chlorinated ethylenes. Both TCE and PERC have been shown to be liver carcinogens in at least one strain of mice, and EPA considers them to be suspected carcinogens. DCE is not believed to be carcinogenic. The International Agency for Research on Cancer (IARC) believes that there is inadequate evidence for classifying PERC and TCE as human carcinogens.

To date, there are no known reports of illness in the Ponders Corner study area attributed to the presence of PERC, TCE, or 1,2-DCE.

Exposure

All exposure and risk assessments were designed under the assumption that the stripping towers at H1 and H2 would continue to operate and provide a safe drinking water supply to the Lakewood Water District residents.

The potential routes for exposure from the contaminants at the Ponders Corner site include use of the untreated groundwater in the uncaptured portion of the plume, exposure to contaminated soils and vapors during any excavation at the Plaza Cleaners property, use of treated well water, and exposure to surface waters. The latter two routes were determined not to be significant exposure routes for the contamination at this site. Exposure to surficial soils on the Plaza Cleaners property was also not considered as a significant route of exposure, while the initial removal actions on site, and the remedial investigation, removed or aereated the most contaminated surface soils. Clean fill and gravel were used to recover the area. Subsequently, only if excavating occurs on site will there by significant potential for exposure to the contaminated soil.

The maximum and mean concentrations found in the soil and groundwater units are listed in the table below.

Table 3
MAJOR VOLATILE ORGANICS IN PONDERS CORNER STUDY AREA

1984-1985

Chemical	Detected Concentrations: Soils (ug/kg)[a] Max.	Soils Mean	Groundwater (ug/L) Max.	Groundwater Mean
Tetrachloroethylene (PERC)	3,880	500	922	16
Trichloroethylene (TCE)	5	3	57	3
1,2-(cis)dichloroethylene (DCE)	4	3	85	-

[a] Based on soil wet weight.

The three chemicals of concern are highly volatile and easily escape from contaminated materials upon exposure to air. This feature, especially where air concentrations can be diluted by winds, greatly reduces the potential vapor exposure of these chemicals.

In general, only PERC is considered as a major contaminant of the soil, and only PERC and TCE are considered as major contaminants of the groundwater.

Laboratory analyses of contaminants in the soils of the study area were conducted on soil borings and test pit samples. Where detected, concentrations of PERC ranged from 11 to 3,880 ug/kg and averaged 500 ug/kg. Small amounts of both DCE and TCE were detected. Concentrations found were 1 to 4 ug/kg of DCE and 1 to 5 ug/kg of TCE. All concentrations were based on wet weight of soils.

Exposure to contaminated soil can occur by ingestion, inhalation, and dermal contact. The evaluation of workers at an excavation site indicated that they would not receive significant exposure by directly ingesting the soil. Methodologies for estimating dermal exposure to contaminated soil are under development, and were therefore unavailable to quantify this exposure route. However, compared to the potential inhalation exposure, the amount of potential dermal exposure would be relatively small. The exposure route of concern in the soils unit was determined to be the potential for inhalation of entrained dust and vapors during excavation at the Plaza Cleaners site.

The absolute and realistic worst-case airborne concentrations of PERC associated with different soil contamination concentrations during excavation of a 4-foot deep by 4-foot wide by 120-foot-long trench across the property, were calculated. The absolute worst-case scenario is for excavation to occur under stagnant air conditions. For the realistic worst-case scenario wind speed would be 0.25 mph.

Under absolute worst-case conditions, that is, during stagnant air conditions, American Conference of Governmental-Industrial Hygienists (ACGIH) Threshold Limit Value-Time Weighted Average (TLV-TWA) criteria would be exceeded if excavation occurred in any area where the soil concentrations of PERC were in excess of about 150 ug/kg. Under similar absolute worst-case conditions, immediately dangerous to life or health (IDLH) criteria would be exceeded only in areas where PERC soil concentrations were above 1,500 ug/kg. Because the average subsurface soil concentration of PERC is 500 ug/kg in the study area, it is likely that, under stagnant air conditions, ACGIH TLV-TWA, but not IDLH, criteria would be violated.

The following table shows the probable PERC concentrations and exposure limits for inhalation during trench excavation.

Table 4
PROBABLE PERC CONCENTRATION AND EXPOSURE LIMITS FOR INHALATION DURING TRENCH EXCAVATION[a]

Soil Concentration (ug/kg)	Absolute Worst-Case Airborne Levels of Vapors[b] (mg/m³)	Realistic Worst-Case Airborne Levels of Vapors[b] (mg/m³)	ACGIH[c] Maximum Recommended Air Levels: TLV-TWA[d] mg/m³	TLV-TWA[d] (ppm)	IDLH[e] mg/m³	IDLH[e] (ppm)
3,880	8,600	2	335	(50)	3,400	(500)
1,500	3,300	0.9	335	(50)	3,400	(500)
1,000	2,200	0.6	335	(50)	3,400	(500)
500	1,100	0.3	335	(50)	3,400	(500)
50	110	0.03	335	(50)	3,400	(500)
0[f]	40	0.01	335	(50)	3,400	(500)

[a]Assumes a trench 4 feet deep by 4 feet wide by 120 feet long.
[b]Assumes stagnant air conditions for absolute worst-case scenario and a wind speed of 0.25 mph for realistic worst-case scenario; average speed for Sea-Tac Airport is 9.1 mph.
[c]American conference of Governmental-Industrial Hygienists.
[d]Threshold limit value-time weighted average (8 hours); OSHA values are twice these amounts, that is, 670 mg/m^3 (100 ppm).
[e]Immediately dangerous to life or health.
[f]Approximate detection limit is 20 ug/kg.

The above calculations are evaluating exposures to the workers in the trench only. Due to dilution factors, there is no presumed exposure to the public. The airborne concentrations of PERC as a function of wind speed in the hypothetical trench are presented in the following table.

Table 5
AIRBORNE PERC CONCENTRATIONS FOR COMPLETE SURFACE SOIL REMOVAL AND TRENCH EXCAVATION AS A FUNCTION OF WIND SPEED

Scenario	PERC Soil Concentration (ug/kg)	Perc Air Levels (mg/m^3) for Wind Speed (mph) 0.25	1.0	5.0	9.1
Trench Excavation[a]	500	0.3	0.07	0.01	0.008
Trench Excavation[a]	3,800	2	0.5	0.1	0.1
Surface Soil Removal[b]	500	0.04	0.009	0.0025	0.001

[a]Assumes a trench 4 feet deep by 4 feet wide by 120 feet long.
[b]Assumes the upper 4 to 6 inches of clean soil were removed instantaneously.

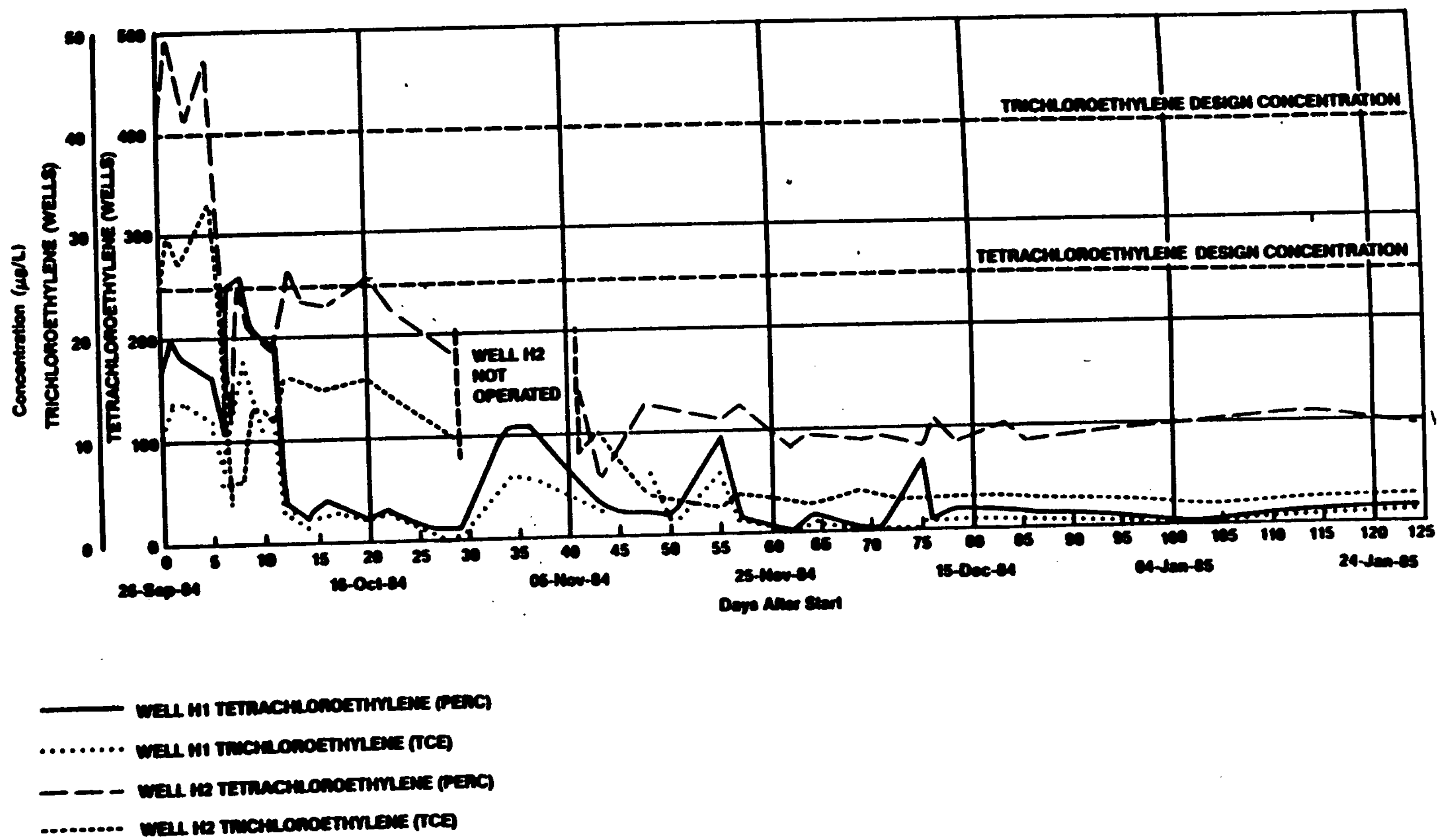
Note: ACGIH TLV-TWA is 335 mg/m^3.

The average wind speed for the study area is 9.1 mph. Using a conservative scenario of a 0.25 mph wind speed and the most contaminated soil (3,880 ug/kg) the airborne concentrations of PERC would be two orders of magnitude below the ACGIH TLV-TWA criteria, and therefore constitute a safe working environment.

There is no significant exposure associated with inhalation of windborne dust from the Plaza Cleaners property because the top 4 to 6 inches of surface ground materials have been replaced with new, clean materials.

The exposure route of untreated groundwater from the uncaptured portion of the contaminant plume assumed the installation of a new well. There are currently no known private well users in, or downgradient of the plume.

The exposure from any contamination in the water treated by the stripping towers at H1 and H2 has been carefully monitored. The pumping and treating of this contaminated aquifer, had, by January 1985, reduced the July 1984, concentrations of the contaminants of concern in the groundwater, as measured at H1 and H2 (Figure 13). PERC declined from 922 to 100 ug/L, TCE from 57 to 30 ug/L, and DCE from 85 ug/L to nondetectable levels. The currently operating aeration tower system for these two wells achieves average removal rates of 99.8 percent for PERC and 97 percent for TCE. The resulting



CONCENTRATION OF TCE AND PERC IN WELLS H1 AND H2, SEPTEMBER 1984 TO JANUARY 1985

FIGURE 13

concentrations in the drinking water of PERC and TCE are calculated to average 0.2 and 0.9 ug/L, respectively. They are nondetectable by laboratory analyses, as shown in the following table.

Table 6
CONCENTRATION OF VOLATILE ORGANICS IN GROUNDWATER FROM WELLS H1 AND H2 BEFORE AND AFTER AIR STRIPPING
JANUARY 1985

Chemical	Raw Well Water (ug/L)	Detection Limit (ug/L)	Treated Well Water (ug/L)
PERC	100	0.4	ND
TCE	30	1.5	ND
1,2-DCE	ND	0.3	ND

ND=Nondetectable.

The treated groundwater does not present a significant exposure route.

No significant potential environmental impacts to gravelly Lake, Clover Creek, and the immediate area around Plaza Cleaners were identified.

Risk Criteria

The EPA Office of Drinking Water, Criteria, and Standards Division and Tacoma-Pierce County Health Department have established health advisories for PERC, TCE, and 1,2-DCE, as shown in the following table.

TABLE 7
CRITERIA ASSOCIATED WITH DRINKING WATER ONLY CONTAMINANTS[a]
(ug/L)

Chemical Chronic	Excess Lifetime Cancer Risk (EPA) 10^{-7}	10^{-6}	10^{-5}[d]	Tacoma's Acceptable Criteria[b]	Considered Acceptable for Human Use[c] 1 Day	10 Days
PERC -	0.088	0.88	8.8	0.8	-	-
TCE -	0.28	2.8	28	2.7	-	-
1,2-DCE -	-	-	-	27	4,000	400

[a]Assumes consumption of 2 liters of drinking water per day over a 70-year period (EPA, 1980).
[b]Supplied by Tacome-Pierce County Health Department.
[c]Memorandum from William N. Hedeman, Jr., Director, Office of Emergency and Remedial Response, to Lee M. Thomas, Acting Assistant Administrator, Office of Solid Waste and Emergency Response, dated May 2, 1983.
[d]These factors represent the incremental increase of cancer risks over the 70 year lifetime, from this exposure.

The recommended occupational air levels for volatile organics for the three chemicals of concern are presented in the following table.

Table 8
MAXIMUM RECOMMENDED OCCUPATIONAL AIR LEVELS
FOR VOLATILE ORGANICS (mg/m^3)

Chemical	OSHA 8-hr TLV-TWA	Ceiling	IDLH	ACGIH 8-hr TLV-TWA	STEL
PERC	670(335)	1,340(670)	3,400	335	1,340
TCE	540	1,080(810)	5,400	270	1.080
1,2-DCE	790	990	16,000	790	1,000

TLV-TWA: Threshold limit value--time weighted average.
Ceiling: Maximum short-term exposure limit (15 minutes).
STEL: Short-term exposure limit (ranges from 5 to 15 minutes).
IDHL: Immediately dangerous to life or health.

Note: Assumes daily volume of inhaled air for an adult is 21 to 23 m^3. Values in parentheses are NIOSH recommendations.

The risk assessments evaluated the potential of exposure from four exposure routes, even though actual exposure from three of these routes had been determined to be insignificant. The four routes evaluated were: exposure from treated water from H1 and H2, untreated water from private wells, contact, ingestion or inhalation of contamination at the Plaza Cleaners site, and contact with surface waters downgradient from the Plaza Cleaners.

Excess lifetime cancer risks for drinking water, surface exposure, and inhalation related to the contaminants present in the Ponders Corner study area are summarized in Table 9.

Conclusions

The 10^{-6} risk level, which is the action level established by the Tacoma-Pierce County Health Department, is not being exceeded by the existing source-pathway-receptor system (treated drinking water). ACGIH TLV-TWA criteria would be exceeded for workers if subsurface excavation occurred, where PERC soil concentrations are in excess of about 50 ug/kg, during absolutely stagnant air conditions. The Plaza Cleaners site is not expected to contribute to increases in contamination levels of groundwater above present levels. While the dry cleaners is no longer discharging any additional contamination onto the Plaza Cleaners property, and the air stripping towers are in operation, future levels of contaminants in the groundwater are expected to continue to decrease.

ENFORCEMENT AND NEGOTIATIONS

Only the owners of the property at 12509 Pacific Highway S.W. and the operators of the Plaza Cleaners operating at that location have been identified as potentially responsible parties. Additional monitoring completed during the remedial investigation did not turn up any additional potential sources of the groundwater contamination. On September 30, 1983, EPA issued CERCLA notice letters to the property owner and the individual who was then the operator of the cleaners. WDOE then issued an administrative order and signed a stipulated agreement with these parties. When additional action was deemed necessary, EPA Region 10 and EPA Headquarters, in consultation with WDOE, determined that Superfund money would be used for the completion of the Remedial Investigation/Feasibility Study (RI/FS). When it was time to begin the field work for the Remedial Investigation, EPA and its contractors were denied access to the site by the property owner. The owner/operator of the drycleaning business had previously sold his interest to a new owner. The new owner/operator of the dry cleaners allowed EPA to complete any on-site work required, as long as permission had been obtained from the property owner. EPA applied for, and obtained a warrant in Federal District Court to have site access for the Remedial Investigation on December 18, 1984. The majority of the field work was completed from December 18, 1984, to January 20, 1985, the time period specified in the warrant. However, additional sampling of the monitoring wells placed

TABLE 9
SUMMARY OF PONDERS CORNER HEALTH EFFECTS[a]

Exposure Pathway	Increased Risk	Remark
Actual Use of Treated Well Water from H1-H2		
Drinking and cooking	$7x10^{-8}$	Recent measured concentrations
Gases from stripping towers	NS	Diluted by atmosphere
Gases from bathing water	NS	
Dermal exposure to bathing water	$1x10^{-7}$	
Potential Use of Untreated Well Water Near MW 32		
Drinking and cooking	$9x10^{-6}$	7 μg/L PERC, Well 32
Gases from bathing water	NS	Well below TLV-TWA levels
Dermal exposure to bathing water	$9x10^{-6}$	7 μg/L PERC, Well 32
Potential Exposure to Soil at Plaza Cleaners Site		
Ingestion of surface soil	NS	New, clean soil
Ingestion of subsurface soil	$6x10^{-9}$ to $4x10^{-8}$	500 μg/kg to 3,880 μg/kg PERC
Inhalation of surface dust	NS	New, clean soil
Dermal contact to surface soil	NS	New, clean soil
Dermal contact to subsurface soil	NQ	No methodology
Inhalation of gases during excavation	26 times ACGIH TLV-TWA 2.5 times IDLH	Maximum soil concentration of 3,880 μg/kg PERC; absolutely still air
	0.006 times ACGIH TLV-TWA	Maximum soil concentration of 3,880 μg/kg PERC, 0.25 mph wind speed
Exposure to Surface Waters		
Ingestion	$5x10^{-7}$ to $1x10^{-6}$	0.4 μg/L for Gravelly Lake only
Gases from bathing	NS	Well below TLV-TWA levels
Dermal contact	$5x10^{-7}$ to $1x10^{-6}$	0.4 μ/L for Gravelly Lake only

[a]Considerations are primarily for PERC and TCE in groundwater and for PERC in soils. DCE was not a major contaminant in the study area.

NS = not substantial.
NQ = not quantifiable.

on site was required. Upon request, the property owner signed a consent for access to property statement on January 29, 1985, allowing EPA to continue the Remedial Investigation. On June 17, 1985, upon completion of the draft RI/FS, CERCLA notice letters were once again issued to the property owner and the former operator of the Plaza Cleaners. These letters encouraged the recipients to undertake the next phase of the corrective measures needed at the site. Neither recipient responded within 14 calendar days, nor has there been any correspondence subsequent to this time period.

ALTERNATIVES EVALUATION

Objectives

The objectives of the proposed remedial action are to:

1. Evaluate the potential health risks associated with the no-action alternative which assumes the status quo of stripping towers operation continued.

2. Reduce potential health risks associated with on-site excavation and use of contaminated groundwater below those for the no-action alternative.

3. Meet requirements of other environmental regulations.

4. Increase the efficiency of the existing IRM, to reduce energy requirements and thereby reduce costs.

Alternative Screening Process

Alternatives were screened separately for the soils and aquifer units. Criteria considered in the screening included technical feasibility, effectiveness, institutional requirements, costs, and other site and technology-related considerations. Table 10 lists the alternatives that were considered and whether or not they were considered for more detailed evaluation. Despite its high costs, soil excavation passed the screening process because it would reduce risks and provide an alternative for the soils unit that would satisfy Resource Conservation Recovery Act (RCRA), and exceed public health and environmental criteria. Vertical and horizontal barriers failed because they would provide no improvement in public health protection. Lack of technical feasibility was the primary reason that flooding failed. Finally, the alternative water supply was dropped because of the lack of known sources, high costs, and long implementation times.

Cost and noncost criteria were used to evaluate in detail each alternative that passed the screening step. Noncost criteria included technical feasibility, environmental impacts, institutional requirements, and public health impacts. Table 11 provides a description of each alternative, considered in detail, along with the EPA evaluation category that each alternative satifies. Tables 12 and 13 summarize the results of the detailed evaluation.

TABLE 10
ALTERNATIVES THAT PASSED SCREENING

Unit	Alternative	Sceening Result
Soil	Excavate or treat	Pass
Landfill	Cap	Pass
	Vertical barrier	Fail
	Horizontal barrier	Fail
	Flooding	Fail
	Administrative restrictions	Pass
	in-place treatment	Pass (conditionally)
	No action	Fail
Aquifer	Extraction & treatment	Pass
	Modify H1-H2 system	Pass
	Monitor	Pass
	Alternative water supply	Fail
	No action	Fail

TABLE 11
DESCRIPTION OF REMEDIAL ALTERNATIVES CONSIDERED IN DETAILED EVALUATION

Unit	Alternative Description	Variation	EPA Evaluation Category
Soil	S1 - Excavation of 29,200 CY to reduce PERC to nondetection limit	S1A - Disposal in offsite RCRA landfill	1
		S1B - Disposal by offsite RCRA incineration	1
		S1C - Disposal in onsite RCRA landfill	2
		S1D - Onsite treatment in kiln	3
	S2 - Excavation of 7,500 CY in zone of most probable future excavation to PERC nondetection limit	S2A - Disposal in offsite RCRA landfill	4
		S2B - Onsite treatment in kiln	4
	S3 - Excavation of 3,700 CY in zone of most probable future excavation to reduce PERC to 500 µg/kg	S3A - Disposal in offsite RCRA landfill	4
		S3B - Onsite treatment in kiln	4
	S4 - Excavation of 1,420 CY in zone of most probable future excavation to reduce PERC to 1,000 µg/kg	S4A - Disposal in offsite RCRA landfill	4
		S45 - Onsite treatment in kiln	4
	S5 - Cap	S5A - Clay/membrane cap	3
		S5B - Clay cap	2
		S5C - Asphalt cap	4
	S6 - Administrative restrictions on onsite excavation and well installation	--	5
	S7 - Vapor extraction	--	4
	S8 - No action	--	5
	S9 - Excavation of 900 CY and removal of septic tanks and some drain piping	--	4
Aquifer	A1 - Additional groundwater extraction near MW 32 to remove uncaptured portion of plume	A1A - Disposal in storm sewer	3
		A1B - Treatment by air stripping at new well	3
		A1C - Treatment by air stripping at H1/H2	3

TABLE 11
(continued)

Unit	Alternative Description	Variation	EPA Evaluation Category
	A2 - Extraction from till unit	A2A - Disposal in Storm Sewer	4
		A2B - Shipment by tanker to hazardous waste disposal facility	4
	A3 - H1-H2 change to reduce costs	A3A - Pump changes	5
		A3B - Variable frequency controllers	5
	A4 - Treatment system changes to reduce costs	A4A - Water flow increase	5
		A4B - Fan speed reduction	5
	A5 - Monitoring to track cleanup and detect contamination from other potential sources	--	5
	A6 - No action	--	5

TABLE 12
SUMMARY OF DETAILED EVALUATION FOR SOIL UNIT ALTERNATIVES

Remedial Alternative	Noncost Criteria: Technical Feasibility	Noncost Criteria: Environmental Impacts	Noncost Criteria: Institutional Requirements	Noncost Criteria: Public Health Impacts	Cost Criteria: Capital-$	Cost Criteria: O&M-$	Cost Criteria: Present Worth-$
S1 Deep Excavation							
S1A--Offsite Landfill	Feasible, safety threat during excavation	Minimal	Complies with requirements	Virtually eliminates excavation risk	7,540,000	--	7,540,000
S1B--Offsite Incineration	Feasible, safety threat during excavation	Minimal	Complies with requirements	Virtually eliminates excavation risk	70,835,000	--	70,835,000
S1C--Onsite Landfill	Feasible, safety threat during excavation, O&M requirements	Minimal	Acceptable disposal techniques for most wastes	Virtually eliminates excavation risk	3,165,000	24,000	3,200,000[b] (30 years)
S1D--Onsite Treatment	Treatment technology developmental	Minimal, except at treatment site	Subject to site-specific review	Virtually eliminates excavation risk	3,148,000	--	3,148,000
S2 Partial Excavation to PERC Detection Limit[a]							
S2A--Offsite Landfill	Feasible, safety threat during excavation, O&M requirements, treatment technology developmental	Minimal		Virtually eliminates excavation risk	2,340,000	--	2,340,000
S2B--Onsite Treatment	Feasible, safety threat during excavation, O&M requirements, treatment technology developmental	Minimal, except at treatment site	May not meet RCRA or WDOE cleanup levels	Virtually eliminates excavation risk	1,591,000	--	1,591,000
S3 Partial Excavation to 500 μg/kg PERC							
S3A--Offsite Landfill	Feasible, safety threat during excavation, O&M requirements, treatment technology developmental	Minimal	May not meet RCRA or WDOE cleanup levels	Reduces excavation risk	1,16,000	--	1,126,000
S3B--Onsite Treatment	Feasible, safety threat during excavation, O&M requirements, treatment technology developmental	Minimal, except at treatment site	May not meet RCRA or WDOE cleanup levels	Reduces excavation risk	853,000	--	853,000

[a]Detection limit approximately 20 μg/kg PERC.

[b]Term used for PW calculation.

TABLE 12
(continued)

Remedial Alternative	Noncost Criteria: Technical Feasibility	Environmental Impacts	Institutional Requirements	Public Health Impacts	Cost Criteria: Capital-$	O&M-$	Present Worth-$
S4 Partial Excavation to 1,000 μg/kg PERC							
S4A--Offsite Landfill	Feasible, safety threat during excavation, O&M requirements, treatment technology developmental	Minimal	May not meet RCRA or WDOE cleanup levels	Reduce excavation risk	479,000	--	479,000
S4B--Onsite Treatment	Feasible, safety threat during excavation, O&M requirements, treatment technology developmental	Minimal, except at treatment site	May not meet RCRA or WDOE cleanup levels	Reduce excavation risk	508,000	--	508,000
S5 Capping							
S5A--Clay/membrane	Feasible, O&M requirements	None	Complies with requirements	Reduce potential for inadvertent excavation	73,400	8,340[c]	152,000 (30 years)
S5B--Clay	Feasible, O&M requirements	None	Complies with requirements	Reduce potential for inadvertent excavation	60,000	6,900[c]	125,000 (30 years)
S5C--Asphalt	Feasible, O&M requirements	None	Complies with requirements	Reduce potential for inadvertent excavation	28,400	1,000[c]	37,000 (30 years)
S6 Administrative Restriction	Feasible	None	May not meet RCRA or WDOE cleanup levels	Reduce risk of excavation without worker protection	--		--
S7 Vapor Extraction	Promising, developmental	Air discharge	May not meet RCRA or WDOE cleanup levels	Virtually eliminates excavation risk	38,500	--	38,500
S8 No Action	--	None	May not meet RCRA or WDOE cleanup levels	Potential excavation risk	--	--	--
S9 Partial excavation, offsite landfill disposal	Feasible, safety threat during excavating, O&M requirements, treatment technology developmental	Minimal		Reduce excavation risk	231,200	--	231,200

[c] Average annual O&M.

TABLE 13

SUMMARY OF DETAILED ANALYSIS FOR AQUIFER UNIT

Remedial Alternative	Noncost Criteria: Technical Feasibility	Environmental Impacts	Institutional Requirements	Public Health Impacts	Cost Criteria: Capital	O&M	Present Worth
A1 Extraction Near MW 32							
A1A--Storm Sewer Disposal	Feasible, 5- to 7-year minimum cleanup time	None; eliminate PERC migration to Gravelly Lake	Water quality standards will be applied	Reduce groundwater use risk	78,000	8,500	125,300 (6 years)
A1B--Air Stripping	Feasible, 5- to 7-year minimum cleanup time, O&M requirements	None; eliminate PERC migration to Gravelly Lake	Complies with requirements	Reduce groundwater use risk	412,000	9,500	445,000 (6 years)
A1C--Treat at H1-H2	Feasible, 5- to 7-year minimum cleanup time, O&M requirements	None; eliminate PERC migration to Gravelly Lake	Complies with requirements	Reduce groundwater use risk	246,000	14,500	319,000 (6 years)
A2 Extraction From Till							
A2A--Storm Sewer Disposal	High probability of failure	None	Water quality standards will be applied	Potential groundwater use risk	2,000	3,500	23,000 (10 years)
A2B--Tanker Truck Disposal	High probability of failure	None	Complies with requirements	Potential groundwater use risk	16,000	73,000	462,000 (10 years)
A3 H1-H2 Modification							
A3A--Pump Change	Feasible, 10- to 12-year minimum cleanup time	None	Complies with requirements	Potential groundwater use risk	38,000	22,000	187,000 (10 years)
A3B--Variable-Frequency Controller	Feasible, 10- to 12-year minimum cleanup time	None	Complies with requirements	Potential groundwater use risk	58,000	18,500	162,000 (10 years)
A4 Treatment System Modification							
A4A--Water Flow Increase	Feasible, 8- to 9-year minimum cleanup time	None; reduce PERC migration to Gravelly Lake	Complies with requirements	Potential groundwater use risk	0	-[a]	(35,400)[b] (8 years)
A4B--Fan Speed Reduction	Feasible, 10- to 12-year minimum cleanup time	None	Complies with requirements	Potential groundwater use risk	2,000	35,300	219,000 (10 years)

[a]No change for 8 years. Reduces cleanup time by 2 years.

[b]Reduction in PW of O&M because of reduced term.

TABLE 13
(continued)

Remedial Alternative	Noncost Criteria: Technical Feasibility	Environmental Impacts	Institutional Requirements	Public Health Impacts	Cost Criteria: Capital	O&M	Present Worth
A5 Monitoring	Feasible, O&M requirements	None	May not meet RCRA and WDOE cleanup levels	Potential groundwater use risk	22,000	32,000	219,000 (10 years)
A6 No Action	Feasible, 10- to 12-year minimum cleanup time, O&M requirements	None	May not meet RCRA and WDOE cleanup levels	Potential groundwater use risk	--	--	--

Soil Unit Alternatives

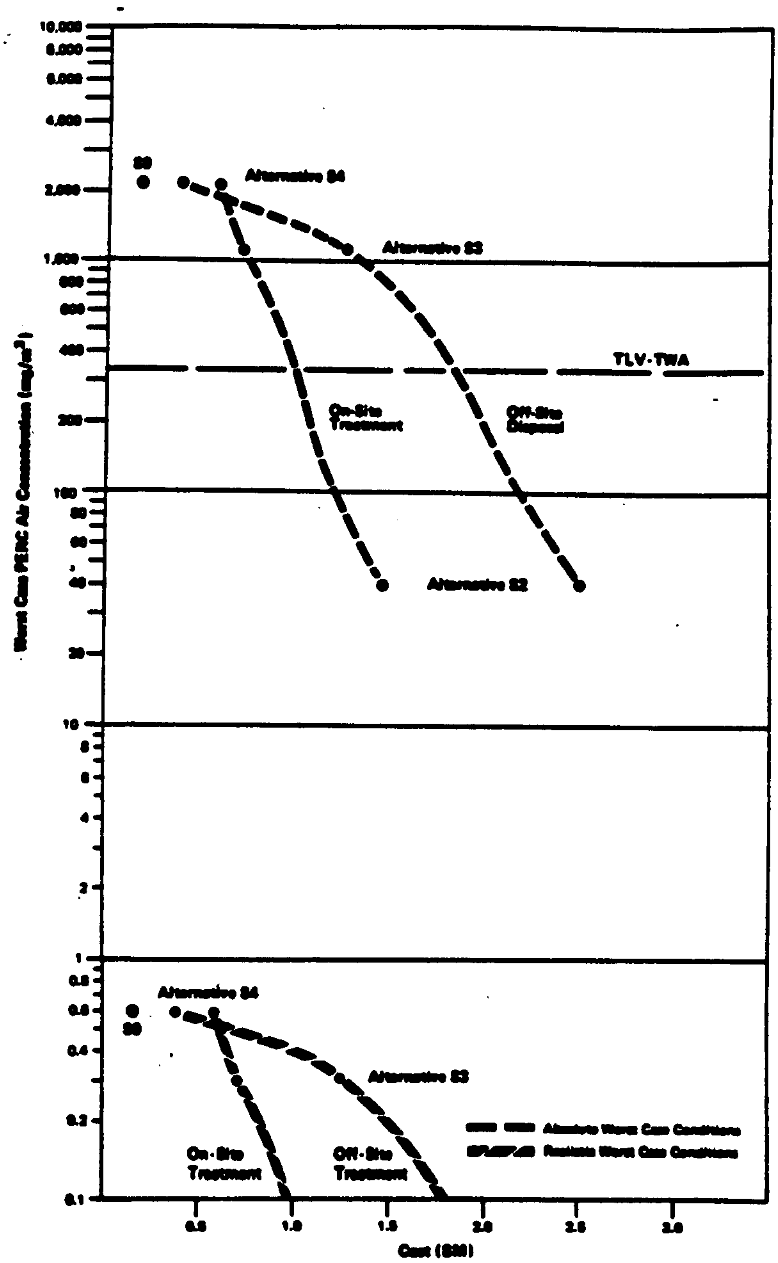
The major concern associated with the no-action alternative was that, under stagnant air conditions, PERC concentrations in portions of the soil unit would be high enough to generate airborne concentrations in excess of the TLV-TWA, if these portions of the soil were exposed through excavation.

The public health evaluation also concluded that, under conditions of minimal air movement, airborne PERC concentrations in an excavation would be well below the TLV-TWA. Thus, the soil unit alternatives should be compared in terms of their costs and ability to reduce the risks associated with potential onsite excavation. Impacts that each alternative have on reducing PERC leaching to groundwater are not considered important because leaching under the no-action alternative represents only an equivalent concentration of 0.04 ug/L at wells H1 and H2.

Each of the soil excavation alternatives provides some degree of risk reduction. Alternative S1--Deep Excavation provides for almost complete risk reduction at a very high cost. Total costs range from $71 million to $3 million, depending upon whether the soils are treated and disposed offsite or onsite. The lowest cost variation for Alternative S1 is onsite treatment (Alternative S1D). Onsite treatment in a kiln, however, is a developmental technology, and could result in impacts to the environment during stockpiling and treating of the soil. The magnitude of the environmental impacts would depend upon the characteristics of the site chosen for the treatment plant. Disposal in an onsite RCRA landfill (Alternative S1C) is similar in total cost to onsite treatment.

One disadvantage to all the excavation alternatives is the potential worker hazard associated with removing contaminated soils from beneath the building. Breathing apparatus would likely be required because airborne PERC concentrations may exceed worker limits.

Partial excavation to remove the most highly contaminated soils can provide a range of risk reduction depending upon the maximum soil concentration limit that is selected. Alternatives S2, S3, and S4 represent those possibilities in that the maximum PERC concentration in soil following implementation of each action would be the detection limit (i.e., 20 ug/kg), 500 ug/kg and 1,000 ug/kg, respectively. Figure 14 gives the approximate cost of partial excavation as a function of the PERC concentration in air that would occur under absolute worst-case conditions (stagnant air in a trench). Approximate cost curves are given for both off-site disposal in a RCRA landfill and onsite treatment.



RISK REDUCTION VS. COST FOR PARTIAL EVALUATION

FIGURE 14

Only Alternative S2, Partial Excavation to the Detection Limit, would reduce potential worst-case airborne concentrations below the TLV-TWA. This alternative provides the same level of risk reduction as Alternative S1 for about $0.8M to $1.6M less because detectable contamination would be removed from the zone of future probable excavation. Thus, Alternative S2 is more cost-effective that Alternative S1.

Both Alternative S3, Partial Excavation to 500 ug/kg, and Alternative S4, Partial Excavation to 1,000 ug/kg, could result in concentrations above the limit. The approximate cost to reduce potential, absolute worst-case concentrations to the TLV-TWA would be approximately $1 million if onsite treatment is used or $1.8 million if offsite disposal is used.

The above comparisons are valid only for absolute worst-case conditions. Under the more realistic conditions of minimal air movement, PERC concentrations would likely be at least three orders of magnitude lower. Minimal air movement would produce concentrations well below the TLV-TWA even given the maximum known PERC concentration in the soil unit (i.e., 3,880 ug/kg). Thus, if one assumes absolute worst-case conditions have a low probability of occurrence, there is little incentive to implement any of the partial excavation alternatives as discussed above.

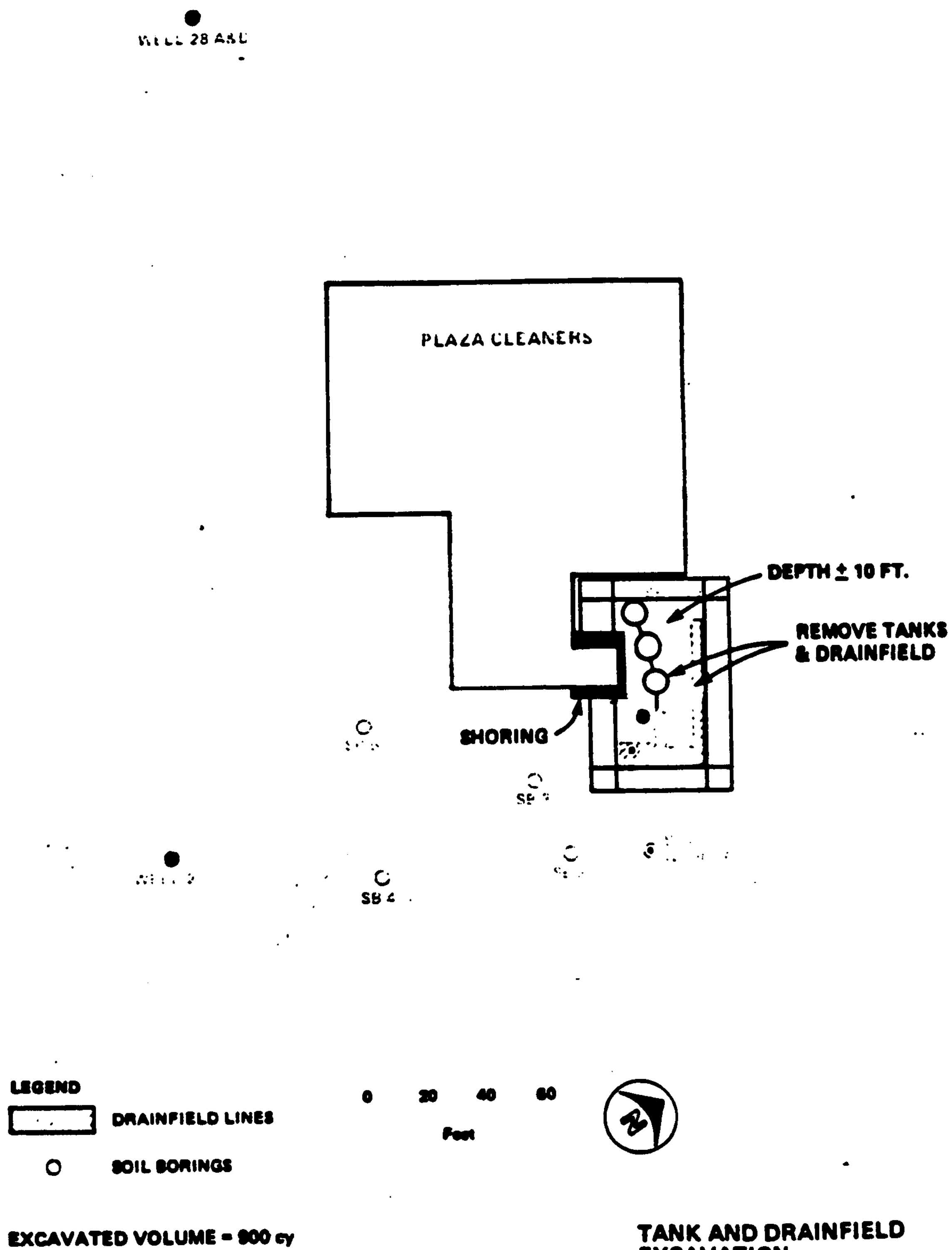
Subsequent to the development and evaluation of the soil excavation alternatives, which are based on achieving target cleanup levels, another partial excavation alternative was introduced for consideration. Alternative S9 consists of excavating and removing the septic tanks, drainfield piping, and directly associated soils. Excavation under the building would not be done. Excavated soil and construction materials would be disposed in a licensed landfill.

Although the contents of the tanks were previously pumped, some question remains whether the tanks have bottoms or not, and whether all the contents were removed. In other words, it is suspected that sludges may exist in the tanks, drainfield, and adjacent soils, and that this material may have higher levels of contamination than were measured in the RI soil sampling.

The performance, reliability, implementability, and safety of Alternative S9 would be the same as those for the other partial soil excavation alternatives discussed earlier, except that the worker hazard for excavating under the building would be eliminated.

This alternative would consist of excavating approximately 900 cubic yards to remove the tanks and drainfield piping to a depth of about 10 feet. Some building shoring would be required (Figure 15).

Costs for this alternative are estimated in the following table.



TANK AND DRAINFIELD EXCAVATION ALTERNATIVE S9

FIGURE 15

TABLE 14

ALTERNATIVE S9--TANK EXCAVATION

Construction	Costs ($)
Excavate 900 cubic yards	$ 5,070
Remove tanks and drainpipe	400
Haul and dispose-Arlington	125,000
Building shoring-70 l ft	48,200
Backfill	11,430
Construction Subtotal	$190,100
Health and Safety 15% of site costs	9,800
Mobilization and temporary facilities, 7.5% of above onsite	5,600
Bonds and insurance, 1.5% of above onsite	1,200
Contingency, 30% of above onsite	24,500
Estimated Construction Total	$231,200
Engineering and Design Table 4-8	$ 12,750
Services During Construction Table 4-11	9,500
Subtotal, Initial Cost	$ 253,450
Annual O&M	-0-
Project PW	$ 253,450

The public health result of the alternative would be to reduce the risks associated with potential future excavation in this area. This reduction in risk would result from the removal of soils previously characterized as containing about 3,800 ug/L PERC and from the removal of the tanks and drain piping, which may have contaminated sludges.

The excavation would not remove contaminated soil to a predetermined level, as with the other soils removal alternatives, and would leave some contaminated soil with PERC concentrations of approximately 1,000 ug/L.

However, it would remove the most contaminated soil from the area around the buried utility lines, which would be a likely area for future excavation. The resulting health risk would be equivalent to that of Alternative S2.

The institutional issues for Alternative S9 are the same as those for Alternative S4 , discussed in Chapter 4.

Alternative S5--Capping provides a relatively low cost means of addressing potential risks posed by onsite excavation. While this alternative does not eliminate the source, it does provide a physical barrier that would reduce the potential for inadvertent excavation. Alternative S5 is three to nine times less costly than the least expensive partial excavation alternative.

The most cost-effective alternative is Alternative S6--Administrative Restrictions. This alternative provides for the notification that a potential hazard exists in onsite soils and that appropriate precautions should be taken during excavation. Such a notification would reduce risk at essentially no cost. The one disadvantage of this alternative is that it provides no risk reduction for inadvertent excavation.

The least costly combination of alternatives that would provide some level of risk reduction would be Alternatives S5C and S6. Alternative S6 would provide notification to most individuals who would conduct onsite excavation, while Alternative S5C would limit the possibility for inadvertent excavation. A potential health threat would still exist, however, because the contamination would remain in place. This threat could be reduced only through excavation and removal or treatment. The most cost-effective excavation alternative would involve partial removal of the most highly contaminated soils, septic tanks, and drainfield followed by disposal in a landfill, Alternative S9. Inplace treatment by vapor extraction is a promising but developmental process that may effectively remove the volatiles at a lower cost than excavation.

Aquifer Unit Alternatives Analyses

The major concerns associated with the no-action alternative is that there are potential health risks posed by using contaminated groundwater not being captured by wells H1 and H2, and that the stripping towers and wells H1 and H2 were not treating the water under the most cost-effective operation parameters. The latter is of concern because the minimum operating time for the entire treatment system will be on the order of 8 to 12 years.

Alternative A1, Extraction Well Near MW 32, would eventually reduce the potential health risk posed by that portion of the plume not currently being captured by wells H1 and H2. Based on the water quality samples collected to date, PERC concentrations vary between 4.3 and 6.9 ug/L. Concentrations in this range fall between the 10^{-5} (8.8 ug/L) and 10^{-6} (0.88 ug/L) excess lifetime cancer risk levels for PERC. The lowest cost variation (Alternative A1A) for this alternative would involve disposal to a storm sewer. The present-worth cost of this action is about $125,000. Cleanup of the escaping plume would take about 5 to 7 years. Cleanup time for the entire aquifer would not be affected, however, because of the continuing input to the aquifer from the till. Disposal to a storm sewer would require interagency coordination with WDOE and the local storm sewer agency.

Based on a 1984 survey of private wells in the study area, there is currently no use of groundwater in the vicinity of the uncaptured portion of the plume. Thus, there is currently no one at risk. Alternative A1 would only protect unknown, future users of the groundwater. In addition, the installation of an extraction well near MW 32 would not reduce the potential risk immediately. Complete cleanup would take an estimated 5-7 years.

Alternative A2, Extraction Well in the till, would not be cost-effective. It is highly likely that the extent of cleanup would be localized because of the limited water-yielding capacity of the till and potential discontinuities in the gravel lens. Alternative A2 would have a minimal impact on reducing the mass of contamination in the till zone, estimated at about 0.9 pound per year removed, out of 1,300 total in the till.

Alternative A3, H1-H2 Pump Changes, would address only the issue of operating costs. Of the two variations, the alternative involving the installation of variable-frequency controllers (Alternative A3B) would be most cost-effective. The controllers would result in an annual saving of about $12,700 a year.

Reduced operating costs would also be realized by implementing Alternative A4--Treatment System Changes. In particular, the variation involving changes to the air supply fans would be the most cost-effective. This variation would produce an annual saving of $8,500. If both A3B, Variable Frequency Controllers and A4B, Fan Speed Reduction, are implemented, and annual cost saving of about $21,000 would result, as shown in the following table.

TABLE 15

COMPARISON OF COSTS FOR NO CHANGE WITH ALTERNATIVES A3B AND A4B ON H1-H2 TREATMENT SYSTEM

	Initial Cost	Annual O&M	Annual Savings	PW-10 YR
No Change				
Treatment system	--	$43,800		--
Well pump power	--	31,200		--
Total	--	$75,000		$460,800
Pump and Fan Changes				
Treatment system with fan speed reduction	1,600	35,325	8,475	--
Well pump power with variable frequency controllers	$57,780	$18,527	12,673	--
	$59,380	$53,852	$21,148	$390,250

Only Alternative A4A, Increasing the Well Pumping Rate, would address potential health risks. Increasing the zone of capture would produce a small decrease in the size of the uncaptured portion of the plume. This decrease would not be instantaneous, however, and would not preclude someone from installing a private drinking water well.

Alternative A5--Monitoring, does not directly address either cleanup and detects the presence of contamination from known, potential, upgradient sources.

The administrative restrictions under Alternative S6 would include a limitation on the installation of new drinking water wells in the area. This alternative is highly cost-effective because it provides for a substantial reduction in potential health risks at essentially no cost.

Assuming continued operation of the H1-H2 treatment system (the no-action alternative), Alternatives A3B and A4B would provide substantial cost savings over the projected aquifer cleanup time frame of 10 to 12 years. Implementation of Alternative S6 would substantially reduce the potential health risk and the need to clean up the uncaptured portion of the plume.

SUMMARY OF RECOMMENDED INITIAL REMEDIAL ACTION

Aquifer Unit

The following actions are recommended as the most cost-effective, technically sound alternatives and will protect public health and the environment (Table 16):

- Continue operation of the H1-H2 treatment system to continue cleanup of the aquifer (Alternative A6). The aquifer cleanup level will be addressed in a later decision.

- Install variable-frequency controllers on the well pump motors to reduce energy requirements and thereby reduce costs (Alternative A3B).

- Change fan drives to reduce treatment tower air flow to reduce energy requirements and thereby reduce costs (Alternative A4B).

- Install additional monitoring wells, upgrade existing wells, and continue routine sampling and analysis of the aquifer to monitor the progress of its cleanup and to provide an early warning of potential new aquifer contaminants (Alternative A5).

- Place administrative restrictions on the installation and use of wells to minimize the potential for use of contaminated groundwater (Alternative S6).

Installation of an extraction well to remove the contamination that is escaping the zone of capture of wells H1-H2 is considered unnecessary to protect public health, and not cost-effective. It is not proposed because there is no one at risk from this source, and the administrative restriction on new wells will preclude future well use. Increasing the flow rate at H1-H2 will increase the zone of capture and the rate of aquifer cleanup but will not affect the ultimate cleanup time. The longer term contamination input from the till is not affected by the pumping rate. This action would not capture all of the small separate plume that has escaped the existing zone of influence.

The appropriate final groundwater treatment level will be determined as additional information is gained through the operation of the systems stripping tower and the groundwater monitoring network.

TABLE 16
SUMMARY OF RECOMMENDED REMEDIAL ACTION

Alternative	Description	Expected Results	Term	Costs Initial	Costs Annual O&M	Remarks
A6	Continue treatment at W1-W2.	Aquifer cleanup.	10 to 12 years	$0	Wells: $31,200	Current O&M cost.
		Treated water quality well below limits for contaminants.			Treatment: $43,800	Current O&M cost.
					$75,000	Existing Well/ Treatment O&M.
A3B	Install variable-frequency controllers.	Reduce energy requirements and well pump power cost. No effect on treatment system or flow.	10 to 12 years	$57,780	$18,500	Saves $12,700 per year on O&M costs.
A4B	Reduce fan speed.	Reduce energy requirement and treatment system cost with negligible effect on treatment.	10 to 12 years	$1,600	$35,300	Saves $8,500 per year on O&M costs.
					$53,800	Well/Treatment O&M in revisions A3B and A4B
A5	Monitoring wells, sampling, and analysis	Monitor aquifer cleanup. Early warning of new sources.	10 to 12 years	$22,140	$31,900	
S6	Administrative restrictions on wells and excavation.	Restrict uncontrolled use of contaminated aquifer and exposure to contaminated soil.	Soils: permanent Wells: 10 to 12 years	$0	$0	
S9	Excavate and remove septic tanks and drain field at Plaza Cleaners.	Reduce worker exposure if uncontrolled excavation occurs.	Permanent	$253,450	$0	
				$334,970	$85,700	Proposed Action Totals with S9 excavation alternative

Soils Unit

The following actions are recommended for the soils unit as the most cost-effective, technically sound alternatives which will protect public health and the environment (Table 16):

- Excavate and remove the septic tanks and drain field piping on the Plaza Cleaners property to reduce the risks associated with uncontrolled excavation by removing the most contaminated soil and comply with other environmental laws (Alternative S9).

- Place administrative restrictions on excavation into the contaminated soils to reduce the risks associated with uncontrolled excavation (Alternative S6).

Other, more extensive soil excavation at the Plaza Cleaners property than that proposed is considered unnecessary to protect public health and not cost-effective because the soil contamination presents a potential threat to public health only if it is excavated, which can be adequately controlled by low-cost administrative restrictions.

Excavation and removal of the septic tank, drain field piping, and administrative restrictions are proposed as the means to reduce the possibility for uncontrolled excavation into the contaminated soil on Plaza Cleaners property and to reduce the worker risk in the event that uncontrolled excavation does occur. The lower cost alternative of an asphalt cap and administrative restriction would provide a degree of worker protection, in that the cap would be a physical barrier to uncontrolled excavation. However, as the contamination remains in place, if excavation for whatever reason were to occur in this area, this alternative would not change the workers exposure.

The Regional Administrator shall have the authority to approve changes or additions to the treatment of on-site soils with other methods, including soil aeration, which are found to be equivalent in cost and effectiveness of the method. The feasibility of other treatment methods may be evaluated during the design of the initial remedial action.

CONSISTENCY WITH OTHER ENVIRONMENTAL LAWS

All facets of the proposed action will be consistent with the technical requirements of other environmental laws. The off-site transportation and disposal of contaminated soils will be in accordance with appropriate RCRA regulations, including manifesting of wastes and shipment to a RCRA approved facility. Operation of aeration towers for the treatment of contaminated groundwater will be conducted consistent with the appropriate Clean Air Act regulations for emissions of volatile organics into the air.

Safe Drinking Water Act--There are drinking water health advisories established by the EPA Office of Drinking Water, Criteria and Standards Division, and the Tacoma-Pierce County Health Department for the contaminants present at wells H1 and H2. Groundwater from wells H1 and H2, intended to be used as drinking water, will continue to use these advisories to treat the water to the 10^{-6} risk level for the contaminants present.

Clean Air Act--The Puget Sound Air Pollution Control Agency (PSAPCA) controls air discharges. A permit has been issued for the H1 and H2 treatment facilities. PSAPCA must be notified of any changes to the facility or operating conditions that would increase the discharge. The air stripping towers at the extraction well (at the source) will meet all technical requirements for an air discharge.

RCRA--The decisions regarding closure of the site and the level of groundwater quality to be achieved are deferred. In order to be consistent with 40 CFR 264 Subpart F of the regulations, groundwater corrective action is required until the concentration of hazardous constituents at the point of compliance for a site achieves one of the following: Maximum Concentration Limits (MCL), where designated for particular substances; and Alternate Concentration Limit (ACL), which would provide adequate protection of public health and the environment; or background levels.

EPA is not prepared at this time to determine the appropriate level of groundwater corrective action at this site. Operation of the groundwater treatment system has substantially reduced the amount of contaminants in the outwash aquifer. Using data and information which will be continually collected during the stripping towers' operation period, EPA will make a determination as to the level of cleanup which would adequately protect health and the environment. Under CERCLA, the groundwater treatment system would be operated until this level of treatment is achieved, unless that level proved technically infeasible or placed an unreasonable burden upon the Fund.

Where RCRA closure regulations are applicable, they would require that all hazardous wastes at a site be removed, treated on site, or capped in such a way as to minimize the migration of contaminants from the site. At this site, contaminated soils would be evaluated at the Plaza Cleaners property to determine to what degree the remedial action on the soils unit had impacted the soils at Plaza Cleaners.

In conjunction with the establishment of a groundwater treatment level, EPA would evaluate the level of contaminants which could be left in the soil without the necessity of a cap at the site.

OPERATIONS AND MAINTENANCE (O&M)

Activities Required for One Year After Initial Remedial Action

Wells H1 and H2

As of October 15, 1985, the Lakewood Water District will assume all the O&M cost associated with the stripping towers at wells H1 and H2. This includes weekly inlet/outlet water sampling and analysis for the contaminants of concern, pump maintenance and inspection, general equipment observations, and maintaining data records.

Monitoring Wells

Approximately monthly sampling and analysis for the contaminants of concern, will be conducted. Well levels and other physical parameters will also be measured.

Soil Unit

As presently proposed, there will be no O&M required on this alternative.

Reporting

Bi-monthly reporting on the consolidated data from the aquifer unit will be required.

Future Actions

Stripping towers at H1 and H2 will need to be operated for approximately 10 to 12 years.

Monitoring wells will need to be operated for the time period coinciding with operation of the treatment system.

If additional soil unit work is implemented it may require O&M.

SCHEDULE

Approve Initial Remedial Action	9/85
Sign ROD	9/85
Design Initiated by EPA	10/85
Sign State Superfund Contract	11/85
Construction Procurement by EPA	4/86
Construction Initiated by EPA quired.	6/86

COMMUNITY RELATIONS RESPONSIVENESS SUMMARY

Ponders Corner (Lakewood)
Lakewood, Washington

Introduction

The public comment period on the Remedial Investigation/Feasibility Study occurred between July 10, 1985, and August 12, 1985. A public meeting was held on July 23, 1985, at the Lakewood Branch of the Pierce County Library. The meeting was attended by 10 persons, including representatives from the State of Washington Department of Ecology and the Tacoma-Pierce County Health Department. In addition, the Department of Ecology submitted written comments. EPA's response to these comments is attached.

This document describes the concerns raised and comments made on EPA's study.

Previous Activity at Site

In 1984, EPA and the State of Washington constructed a water treatment system at this site which started operation in the fall of that year. The result has been resumption of service by the two wells affected by the contamination. The water currently being provided by the wells meets the criteria set by the Tacoma-Pierce County Health District and EPA's drinking water standards. Concerns raised during the treatment planning and construction phase were addressed in a previous Responsiveness Summary accompanying the Record of Decision for the treatment system.

Concerns Raised During RI/FS Process

Very little public interest was noticed during the RI/FS process. EPA issued press releases prior to any major activity, as well as sending out fact sheets to the mailing list periodically. In late June, a fact sheet announcing the availability of the RI Report and the FS, the public comment period, and the date of the public meeting, was sent.

Only a few people attended the meeting. Questions raised generally requested specifics of the investigation. The major questions raised were:

1. How does EPA know the contamination comes from the dry cleaning establishment and not other sources?

   A. EPA's monitoring well system has traced the contamination to the area occupied by the cleaners. This has been confirmed by soil borings.

2. What would happen to soil excavated from the site?

   A. Any contaminated soil or septic tank would go to a permitted hazardous waste disposal facility.

3. What is happening at the cleaners now?

   A. The cleaners has installed a recycling system and is capturing solvents. Water from the washing operations is discharged to the area's newly installed sewer system.

4. How long were people drinking contaminated water?

   A. That information is unknown. The contamination was discovered during a national survey conducted by EPA in 1981. The cleaners had been in operation for a number of years, so theoretically, the wells could have been contaminated for some time.

5. Is EPA sure the problem is not related to the American Lake Gardens site (another Superfund site located about a mile away)?

   A. Yes. Analysis of monitoring well samples indicates that the two problems are unrelated.

Summary

Essentially all of the public comments received were in favor of EPA's recommended action.

Attachment

FEASIBILITY STUDY

1. The estimated nature and extent of contamination for the uncaptured portion of the plume was questioned because of the limited available data near MW-32. While the exact nature and extent cannot be established with the existing monitoring well network, sufficient data are available to develop an estimate. Given the direction of regional groundwater movement and associated contaminant migration to the northwest, the southwestern extent of the uncaptured plume must be limited because contamination has never been detected in MW-31. The northwestern boundary is also limited because no PERC was detected in MW-32 in February 1985 and PERC concentrations increased through May 1985 indicating recent migration of the leading edge of the plume past MW-32. The southeastern boundary is controlled by the limits of the zone of capture. The location of the northeastern boundary was estimated based on the northeastern extent of contamination in the main plume and the direction of regional groundwater movement. The above provides the basis for the estimated extent of contamination shown in Figures 1-16 and 1-17.

   Since monitoring was initiated, PERC concentrations have increased to 6.9 µg/L. Given that MW-30 is approximately upgradient of MW-32 under nonpumping conditions, it is unlikely that the maximum PERC concentrations at MW-32 would ever exceed the maximum of 38 µg/L measured at MW-30. This concentration is roughly five times greater than the 7 µg/L concentration used to analyze the potential impacts of the uncaptured portion of the plume. This plume will ultimately migrate to Gravelly Lake. A more exact definition of the nature and extent of contamination would require the installation of additional monitoring wells.

2. The feasibility study states that 1,2-DCE has not been detected in soil or the aquifer since July 1984. This refers only to data collected during the remedial investigation. The cis isomer of 1,2-DCE was detected on two occasions in well water from H1 and H2. Well water sampling was conducted to monitor the performance of the air stripping towers.

3. A question was raised as to whether any action had been taken to assure that private wells in the vicinity of the plume will not be used in the future. A 1984 survey of private wells in the area found that none of the wells in the immediate vicinity of the plume were in use. To date, no action has been taken to assure these wells will not be used. Future restrictions on well

installation and use would occur through the implementation of Alternative S6, Administrative Restrictions. These restrictions would likely be implemented and enforced by the Washington Department of Ecology and/or Washington Department of Social and Health Services.

4. A question was raised as to how Alternative S7, Vapor Extraction System would be designed and tested. It was envisioned that the design of the system would be phased. Phase 1 would involve the installation of a pair of vacuum extraction wells. A vacuum pump attached to one of the wells would be used to estimate the radius of influence, approximate vapor concentrations and potential removal efficiency that could be expected. Data collected during Phase 1 would be used to determine the exact number of extraction wells and to size the vacuum pump and dilution fan. Phase 2 would involve the installation and operation of the system. The costs given in the feasibility study were based on this type of design procedure and the quantities given in the feasibility study.

5. The feasibility study provides a recommendation for general, rather than specific, locations of additional monitoring wells under Alternative A5, Monitoring. The specific location of each additional well will be controlled by the availability of property suitable for well installation and permission of property owners. Recommended locations for wells will be included in the predesign report that EPA will prepare subsequent to the responsiveness summary and record of decision (ROD).

6. A question was raised as to what impact continued input of contamination from the till and soil unit would have on the minimum operational time of the air stripping system, and how different alternatives would affect this time. Based on the available information, it appears that leaching of contamination from the till is the main factor controlling the minimum operational time. Appendix E provides an analysis that shows that the till may contribute PERC to Wells H1 and H2 in excess of the drinking water standard for a period of approximately 10 years. At the end of 10 years, the average PERC concentration in the till is estimated to be about 500 µg/kg. This time frame is equivalent to the time required to capture the existing plume under current pumping conditions. Because the till will continue to contribute contamination regardless of how fast the plume is captured, the operational time will not be reduced by those alternatives involving increased pumping (i.e., Alternative A1, Extraction Near MW-32 and Alternative A4A, Treatment System Changes,

Water Flow Increase). The operational time is also not affected by any of the soil unit alternatives. As the results in Appendix C show, the potential contribution of contamination from the soil under current conditions is negligible. After 10 years, the average PERC concentration in soil would decrease by five times. Alternatives directed at soil excavation would reduce the already negligible contribution, as would capping the site. As the results in Appendix C indicate, PERC concentrations in soil would decrease only slightly after 10 years if a cap was installed. The only alternative that would theoretically shorten the operational time is Alternative A2, Extraction from the Till. This alternative does not appear to be feasible given the low water-yielding capacity of the till.

A related question was raised concerning what impact the length of operation time would have on the cost-effectiveness of different alternatives. Basically, increasing the length of the operational time would increase the O&M costs of each alternative, but would not significantly affect their relative cost-effectiveness.

It is important to note the actual operation time will be more accurately evaluated by the results of ongoing monitoring of the aquifer unit, including the till zone, if Alternative A5, Monitoring is implemented.

7. A question was raised regarding the use of a depth of 13 feet to define the vertical extent of contamination in the soil unit. Both the remedial investigation and feasibility study recognize that there are pockets of soil contamination below this depth. These pockets are small in volume and contain soil with low PERC concentrations. Compared to the mass of PERC contained in the upper 13 feet of soil, the mass of contamination below 13 feet is small.

8. A question was raised regarding the possibility of locating and plugging the dry well(s) that may have been installed in the vicinity of the drainfield. Both EPA and the Washington Department of Ecology conducted extensive excavation programs behind Plaza Cleaners to locate the septic tanks, drainfield, and dry well(s). Neither was able to locate or confirm the presence of a dry well or wells. For this reason, locating the dry well(s) was considered to be impractical.

9. The feasibility study discusses potential concerns associated with contamination detected in three McChord Air Force Base monitoring wells: AZ01, AZ02, and AZ03. Well construction information for these monitoring

wells indicates that AZ01 and AZ02 are screened in the Steilacoom Gravel and Vashon Till units. AZ03 is screened in the Vashon Till and Colvos Sand units; apparently, the Advance Outwash is absent in this location. Because the wells are screened over intervals ranging from 60 to 80 feet in thickness, it is difficult to determine which aquifer (i.e., perched aquifer in the Steilacoom Gravel or the underlying semiconfined aquifer), if any, is being monitored. Work conducted to date by the Air Force suggests that the Vashon Till may provide a barrier to the horizontal and vertical migration of contaminants detected in the vicinity of these wells. The Air Force is currently conducting additional site characterization studies.

It is difficult to estimate when, if at all, a plume from McChord would reach Wells H1 and H2. Alternative A5, Monitoring, would involve the installation of two new monitoring wells and continued monitoring of selected existing wells to provide for early detection of any plume migrating from McChord.

10. The use of historical measurements of decreasing contamination levels at Wells H1 and H2 to estimate an aquifer cleanup time was suggested. Appendix L, in the feasibility study, discusses such an analysis. Cleanup times were estimated based on the 6 months of available data. The estimated times were found to be unrealistically short and, at best, can only be used as absolute minimum cleanup times.

11. A question was raised regarding the approach used in Appendix E to calculate the total mass of each contaminant in the aquifer unit. It was suggested that masses be calculated as follows:

Total mass contamination = mass in solution + mass adsorbed.

$$= Cw \cdot V \cdot n_s + Cs \cdot V \cdot \rho_b (1-n_s)$$

While the first term on the right-hand side is correct, the second term is not. The units for this term are inconsistent given the following:

Cs = mass of contaminant/mass of solids, μg/gm

V = total volume, cm^3

ρ_b = mass of solids/total volume, gm/cm^3

$(1-n_s)$ = volume of solids/total volume, cm^3/cm^3

ρ_b would have to be defined as the mass of solids per volume of solids for the units to be consistent; this is not the correct definition of the bulk density. The equations in Appendix E, and the associated derivation, are correct.

12. A question was raised about the risk associated with inhalation of the stripping tower exhaust and suggested that the Cancer Assessment Group (CAG) method should be used. CAG data for PERC are not available at this time. Therefore, the comparison to occupational standards was included to provide a perspective on the risk. Note that the stack discharge concentration should be 0.175 mg/m^3 and that this would be about 0.05 percent of the ACGIH threshold limit.

13. Comments were received to the effect that carbon adsorption should be evaluated for the stack discharge from the soil vapor extraction alternative and for the stack discharge of the air stripping alternative on the uncaptured portion of the plume. In both of these situations, the total amount of contamination is a few pounds at most (estimated at 5 pounds in the soils unit subject to Alternative S7 and at about 6 pounds in the plume around MW-32 subject to Alternative A1). These amounts are small enough to present essentially no risk to the public even if released in as short a time as a single day. The release times for these alternatives would actually be much longer and the solvent concentration would be reduced by dilution and dispersion. For comparison, the PSAPCA permit for the Tacoma Well 12A system allows 40 pounds per day to be discharged to the air. At Ponders Corner, the permit is based on 17 pounds per day combined PERC and TCE. This latter value is reported to be about the weight of volatile material lost by evaporation each day at a gas station. Carbon adsorption was therefore considered to provide no needed health protection and would be costly.

14. A question was asked as to what was envisioned for a horizontal barrier in the chapter on screening technologies. A horizontal grout layer, installed through multiple wells was envisioned. This technology was considered to be impractical in this case to assure a continuous, tight barrier under the variable soil conditions found in the till.

15. Questions were asked as to why a treatment option was not considered for Alternative A2, Collection from the Till, and why additional wells were not considered rather than using just MW-20B. The water producing capability of the till is very low. Each of the four wells installed in the till have been difficult, and at times impossible to sample because of a lack of water. Extraction would therefore not be practical and the

selection of treatment or disposal options is immaterial.

16. Feasibility Study, page 1-13, Figure 1-6 units, should be GPD/FT x 1 x 10^{-5}.

17. Feasibility Study, page 1-45, Table 1-6. The last three columns should reference footnote "c".

18. Feasibility Study, page 4-25, Table 4-5. The water flow is the total for both towers; the air flow is the flow rate per tower.

19. Feasibility Study, page 1-49, first paragraph. 1.75 mg/m^3 should be 0.175 mg/m^3 and 0.5 percent should be 0.05 percent.

20. According to staff at the United States Geological Survey, Clover Creek does not flow continuously in the vicinity of Ponders Corner. Regardless, as the feasibility study states, the level of potential contamination in Clover Creek would be well below freshwater aquatic life criteria.

REMEDIAL INVESTIGATION

1. The 30-foot isopach contours in Figure 4.8 should be connected to form a saddle just west of monitoring Wells MW-11 and MW-24.

2. The contact between the Advance Outwash and Colvos Sand units, shown in Figure 4.13, should occur at a higher elevation around MW-20. According to Table 4.1, the contact occurs at elevation 172.5, or at the bottom of the screened interval. The elevation of the contact is correct in Figures 4.14, 4.15, and 4.16.

3. The labeling of different geologic units in Figures 4.3 and 4.4 is intended to provide their approximate thickness and approximate elevation of individual contacts. As Figure 4.2 shows, the elevation of the contact between the Steilacoom Gravel and Vashon Till varies across the site.

4. Appendix C of the remedial investigation identifies several questions related to the quality assurance/ quality control (QA/QC) procedures that were used. At the time the remedial investigation report was being prepared, certain QA/QC information had not been provided by the CLP. In addition, certain backup information for non-CLP analyses had not been provided to the contractor that prepared the remedial investigation. All of this information is now on file with either the EPA or the responsible non-CLP laboratories. The

following provides responses to specific questions that were raised.

C.2 a. The method for soil analysis is available from the EPA Manchester laboratory. Results of calibration, duplicate analysis, laboratory blanks, and matrix spikes have been provided to the EPA from Manchester following this report date. All QC is within a range that would not alter the results of this report.

b. Calibration data can be provided, but it is within acceptable limits of the EPA.

c. The analytical methods used can be provided as well as data evaluation material. This material would not affect the results of this report.

C.6 a. A memorandum dated April 9, 1985 from Ecology & Environment, Inc., reports QA of Radian's analytical data was found acceptable.

b. The semivolatile compounds identified at low concentrations have no effect on this study.

C.10 a. EPA QC data have been provided to the EPA from Manchester and is within acceptable limits.

b. All analyses were completed within allowed holding times. Dates are on file.

5. An explanation was requested for the detection of chloroform in MW-32 in February 1985 (see Table 3.2 in the remedial investigation). The compound was only detected in one well at a concentration approaching the detection limit of 1 μg/L. Since no other samples detected chloroform, it is concluded that this identification is an anomaly.

6. Several comments on the RI report were related to the estimated mass of PERC in the soil unit. (p 3-8, Table 3.4.) The calculations were revised and corrected as indicated in the attached letter and revised pages 3-8 and 3-9.

7. RI, page 1-12, Figure 1.5. The legend should indicate PERC Concentration isopleth in ppb.

8. RI, page 1-16. The paragraph on Section 6 should be replaced by "Section 6 identifies the basis for

concern for public health and the environment resulting from the contamination found."

9. Section C.5 of Appendix C states that a very high concentration of chloroform was detected in tap water on January 11, 1985. The reported concentration was 2,501 µg/L. The source of the tap water is uncertain. Sources of decontamination water included the drill rig, apartment complex next to Plaza Cleaners, and Plaza Cleaners itself. The latter two probably obtain their water from the Lakewood Water District. Other analysis of decontamination water did not detect unusual concentrations of chloroform.

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August 8, 1985

Mr. Robert Schilling
CH2M HILL
1500 114th Avenue, S.E.
Bellevue, Washington 98004-2050

Dear Bob:

PONDER'S CORNER RI REPORT

Megan White, of the Washington State Department of Ecology, called me on August 6, 1985. She said that she was unable to duplicate the values for the mass of PERC, which are shown in Table 3.4, page 3-8 of the Ponder's Corner RI report. I traced the documentation back to the original work sheets. The formula used to obtain the values for mass in grams is correct, but all the values in the hand-written Table 3.4 were calculated based on an average PERC concentration of 442 ug/Kg for all contour intervals at all depths. Table 3.4 and the narrative on the next page have been revised to reflect the use of average concentrations for each interval. Average concentrations used for the 0-100, 100-500, 500-1,000, and more than 1,000 ug/Kg intervals are 50, 250, 750, and 1,500 ug/Kg, respectively.

Because this table was not used in the FS report for calculating health impacts or evaluating remedial alternatives, it will have no impact on the decision-making process. However, the revised table and page should be sent to all copy holders as an addendum to the RI report.

Very truly yours,

Ronald Schalla

Ronald Schalla
Project Manager

RS:np

Table 3.3. Estimated Volume of Contaminated Soil in Layers Under Plaza Cleaners, in cu ft

Depth Interval (ft)	Volume (cu ft) of Contaminated Soil with PERC Concentrations (ug/Kg) of (0-100)	(100-500)	(500-1,000)	(>1,000)	Total Volume of Soil in Interval
0.0- 5.0	14,200	21,900	3,820	6,120	46,040
5.0- 7.0	2,910	4,390	3,160	950	11,410
7.0- 8.5	2,240	2,370	2,280	740	7,630
8.5-11.5	7,190	4,060	2,550	476	14,276
11.5-12.5	2,000	1,290	29	0	3,319
Total Volume of Contaminated Soil Under Plaza Cleaners					82,675 cu ft

Table 3.4. Estimated Mass of Chlorinated Hydrocarbons in Unsaturated Layers Under Plaza Cleaners, in grams

Depth Interval (ft)	Estimated Mass of PERC in grams at Concentrations (ug/Kg) of* (0-100)	(100-500)	(500-1,000)	(>1,000)	Total Weight of Contaminant
0.0- 5.0	40.2	310	162	519	1,031
5.0- 7.0	8.2	62.0	134	80.7	285
7.0- 8.5	6.3	33.5	96.8	62.8	199
8.5-11.5	20.3	57.4	108	40.4	226
11.5-12.5	5.7	18.2	1.2	0	25
Total Mass of PERC Under Plaza Cleaners					1,766 grams

*Assumes the average PERC concentrations for each interval are 50, 250, 750, and 1,500 ug/Kg, respectively.

the areal extent of the plume at each depth interval evaluated and the thickness of each interval. Contaminant concentrations were further divided into four ranges: 0-100 ug/Kg, 100-500 ug/Kg, 500-1,000 ug/Kg, and 1,000 ug/Kg, to determine the quantity of contaminated soil for areas of low, moderate, high, and very high concentration within the plume.

The weight of contaminants for each depth interval and each range of concentrations is the product of the average contaminant concentration of each interval, the volume of contaminated soil, and the soil density. A value of 2,000 Kg/m^3 was used for soil density. This value is typical of gravelly soils such as those found on the Plaza Cleaners site.

The results of the laboratory analyses of soil samples from soil borings and test pits are shown in Tables 3.5 and 3.6. Only PERC was considered as a contaminant in the soil. Where detected, concentrations of PERC ranged from 11 to 1,400 ug/Kg in the soil borings. Measurable concentrations were found in five of the seven soil borings. No 1,2-DCE or TCE were found in any of the soil borings. PERC was detected in all six of the test pits, ranging in concentration from 29 to 3,880 ug/Kg. Minor amounts of both 1,2-DCE and TCE were detected in one of the test pits. Quantities found were 1 to 4 ug/Kg of 1,2-DCE and 1 to 5 ug/Kg of TCE. Because these compounds were detected in soil that was also contaminated with PERC, their extent was not evaluated separately.

The depth intervals evaluated were chosen for several reasons. The top 5 ft were evaluated together because no surface samples were obtained. Only one test pit was sampled in this interval, however, most of the soil borings were sampled at 2.5 and 5.0 ft. Locations of the test pits and test pit longitudinal sections are shown in Figure 3.2. PERC concentrations in the test pits are shown in Figure 3.3. PERC concentrations in the 0.0- to 5.0-ft interval, based on test pit and soil boring data, are shown in Figure 3.4. Few of the soil borings were sampled in the next interval, 5 to 7 ft. However, this interval was sampled in several of the test pits and represents the area just above the upper drainfield at the Plaza Cleaners site. PERC concentrations in the 5.0- to 7.0-ft interval appear in Figure 3.5. The 7.0- to 8.5-ft interval includes most of the upper drainfield and was sampled in four of the seven soil borings and several of the test pits. Concentrations