

**SITE INVESTIGATION
INSTALLATION RESTORATION
PROGRAM (IRP)
SITE NO.4 AND SITE NO.5**

VOLUME I

**216th ENGINEERING INSTALLATION SQUADRON
& 234th COMBAT COMMUNICATIONS SQUADRON
CALIFORNIA AIR NATIONAL GUARD
HAYWARD AIR NATIONAL GUARD STATION
HAYWARD, CALIFORNIA**

MARCH 1996

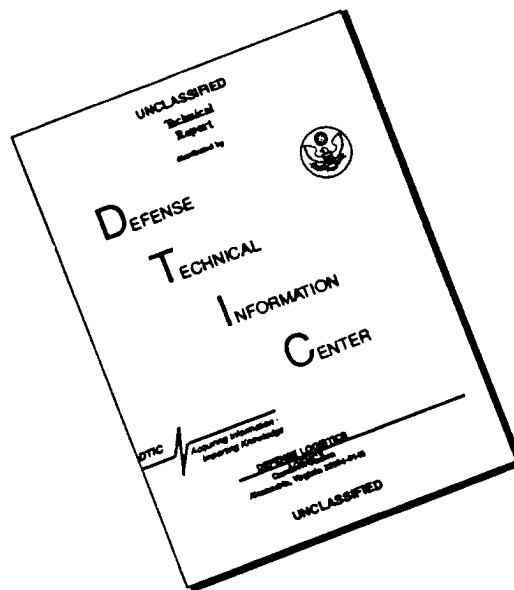


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CALIFORNIA AIR NATIONAL GUARD
HAYWARD AIR NATIONAL GUARD STATION
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IRP SI Report
216th EIS and 234th CCSQ
Hayward ANGS, Hayward, California

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LIST OF ACRONYMS

AFB	Air Force Base
ANG	Air National Guard
ANGS	Air National Guard Station
BG	Background
BH	Borehole
BLS	Below Land Surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
° C	Degrees Centigrade
CCSQ	Combat Communications Squadron
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DHS	Department of Health Services
DRMO	Defense Reutilization and Marketing Office
EIS	Engineering Installation Squadron
° F	Degrees Fahrenheit
FID	Flame Ionization Detector
GC	Gas Chromatograph
gpd/ft ²	gallons per day per square foot
GW	Groundwater Sample
HSA	Hollow-stem auger
HQ ANG/CEVR	Headquarters, Air National Guard Readiness Center/Installation Restoration Program Branch
ID	Inner diameter
IDW	Investigation Derived Waste
IRP	Installation Restoration Program
JP-4	Jet propulsion fuel #4
LUFT	Leaking Underground Fuel Tank
MAP	Municipal Airport
MCL	Maximum Contaminant Level
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mmhos	millimhos (specific conductance)
MSL	Mean Sea Level
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MW	Monitoring Well
NOV	Notice of Violation
OpTech	Operational Technologies Corporation
PA	Preliminary Assessment
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
PPE	Personal protective equipment
ppm	parts per million

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LIST OF ACRONYMS (Concluded)

ppmV	parts per million per Volume
PRG	Preliminary Remedial Goal
PVC	Polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
RBH	Replacement Borehole
SA	Site Assessment
SARA	Superfund Amendments and Reauthorization Act
SI	Site Investigation
SV	Soil Vapor
TCLP	Toxic Characteristic Leaching Procedure
TEG	Transglobal Environmental Geochemistry, Inc.
TPH	Total Petroleum Hydrocarbons
TPH-D	Total Petroleum Hydrocarbons as Diesel
TPH-G	Total Petroleum Hydrocarbons as Gasoline
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
UTA	Unit Training Assembly
VOCs	Volatile Organic Compounds

INSTALLATION RESTORATION PROGRAM SITE INVESTIGATION

EXECUTIVE SUMMARY

ES 1.0 INTRODUCTION

This Report presents the results of a Site Investigation (SI) conducted at the 216th Engineering Installation Squadron (EIS) and the 234th Combat Communications Squadron (CCSQ), Hayward Air National Guard Station (ANGS), Hayward, California. The investigation was conducted under the authority of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. Work was authorized by Headquarters, Air National Guard Readiness Center/Installation Restoration Program Branch (HQ ANG/CEVR) under the Installation Restoration Program (IRP).

IRP Site No. 4, Leaking Vehicle Maintenance Underground Storage Tank (UST), was established in December 1991 when contamination was encountered during excavation activities at a Cable Training Area. IRP Site No. 5, Abandoned Jet Fuel USTs, was identified in the Preliminary Assessment (PA) Report prepared by Science and Technology, Inc., in January 1991 (Science and Technology Inc., 1991). IRP Site No. 5 formerly contained three abandoned 25,000-gallon JP-4 USTs which were removed in December 1993. It was during the tank removals that contamination was detected.

HQ ANG/CEVR authorized Operational Technologies Corporation (OpTech) to prepare a Work Plan and conduct an SI at IRP Sites No. 4 and No. 5. The investigation was conducted in accordance with the SI Work Plan for IRP Site No. 4 and the Addendum Work Plan for IRP Site No. 5. The investigation at Hayward ANGS commenced on 28 July 1994 and was completed on 12 August 1994, with the exception of conducting slug tests and collecting a third round of groundwater sampling. Slug tests were conducted on 13 October 1994, and a third round of groundwater samples was collected from 5 to 7 December 1994.

ES 2.0 SITE INVESTIGATION FINDINGS

IRP Site No. 4 is located in the southwest portion of Hayward ANGS. The suspected source of contamination is former UST No. 110, a 5,000-gallon gasoline tank, which was reportedly perforated by a gauge stick on 19 March 1986. IRP Site No. 5 is located in the central portion

of Hayward ANG. The suspected source of contamination is the three former 25,000-gallon USTs, which were in use from approximately 1953 until they were abandoned in 1982.

Soil and groundwater samples were collected from IRP Sites No. 4 and No. 5 and submitted for laboratory analysis to determine whether contamination exists at the sites, and if it does exist, to determine the nature and extent of the contamination, and to provide data needed to reach a decision point for the sites. Suspected contamination consists primarily of fuel; therefore, soil and groundwater samples were submitted for analysis of volatile organic compounds (VOCs), total petroleum hydrocarbons (TPH) (both as gasoline (TPH-G) and as diesel (TPH-D)), and lead. Data validation did not uncover any problems that would adversely affect the analytical results of the investigation.

ES 2.1 IRP SITE NO. 4 (LEAKING VEHICLE MAINTENANCE USTS)

Lead was the only analyte confirmed in soil samples collected from IRP Site No. 4. Lead was detected at concentrations ranging from 7.3 to 590.0 milligrams per kilogram (mg/kg). The highest concentrations of lead were detected in soil sampled from a depth of 1.0 to 1.5 feet below land surface (BLS); lead concentrations, below this depth, ranged from 7.3 to 15.0 mg/kg. The California Modified Preliminary Remedial Goal (PRG) for lead is 130 mg/kg for residential sites (a more stringent value than for industrial sites, which is approximately four times as high).

The only lead concentrations that exceed the more stringent PRG for lead were detected in soil samples collected from borings 04-001BH (210 mg/kg) and 04-004BH (590 mg/kg) from a depth of 1.0 foot BLS and 1.5 feet BLS, respectively. According to the United States Geological Survey (USGS) publication Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States (Shacklette and Boerngen, 1984), naturally occurring concentrations of lead in the Hayward area may range from 30 to 700 ppm.

Two monitoring wells (MWs), 04-001MW and 04-002MW, were installed at IRP Site No. 4. Monitoring well 04-002MW was relocated from its originally proposed location with HQ ANG/CEVR approval. As a result of relocating monitoring well 04-002MW, no monitoring well is located downgradient of the former cable training excavation, although both monitoring wells are located downgradient of the UST No. 110 excavation.

TPH-G, TPH-D, and lead were the only analytes detected in groundwater samples collected from IRP Site No. 4. TPH-G was detected at concentrations of 1,000 micrograms per liter ($\mu\text{g/L}$)

and 530 $\mu\text{g/L}$ in the first and second rounds of groundwater samples collected from monitoring well 04-002MW. TPH-G was detected in the third round of samples at 04-002MW and its duplicate (1,400 $\mu\text{g/L}$ and 1,200 $\mu\text{g/L}$, respectively). TPH-D was detected at concentrations of 840 $\mu\text{g/L}$ and 920 $\mu\text{g/L}$ in the third round of groundwater samples at 04-002MW and its duplicate. TPH-D was not detected in background samples.

The California Department of Health Services (DHS) Primary Maximum Contaminant Level (MCL) for lead in groundwater is 50 $\mu\text{g/L}$. Lead was detected at slightly higher than background levels in the first round of samples taken at monitoring well 04-002MW (8,300 $\mu\text{g/L}$ vs. 6,700 $\mu\text{g/L}$ in a background well). Lead was not detected in any of the other groundwater samples collected during the sampling events.

ES 2.2 IRP SITE NO. 5 (ABANDONED JET FUEL USTS)

Lead was detected in soil samples collected from IRP Site No. 5 at concentrations ranging from 8.5 to 37.0 mg/kg. These levels were well below the residential PRG for lead.

Benzene and ethylbenzene were detected at maximum concentrations of 0.03 mg/kg and 0.023 mg/kg, respectively.

TPH-G was detected in samples 05-002RBH, 05-003RBH, and 05-004RBH. The highest concentration of TPH-G was detected in sample 05-004RBH (19.0 mg/kg), located at the north central area of the excavation. This was the only sample to exceed the Leaking Underground Fuel Tank (LUFT) Manual Leaching Potential Analysis chart level (10.0 mg/kg) for soils that can be left in place without threatening groundwater.

Neither lead nor VOCs were detected in any of the groundwater samples collected from the three monitoring wells at IRP Site No. 5.

TPH-G concentrations in groundwater were detected at 550 $\mu\text{g/L}$ in monitoring well 05-001MW. TPH-G concentrations were also detected at 770 $\mu\text{g/L}$, 1,100 $\mu\text{g/L}$, and 1,200 $\mu\text{g/L}$ in monitoring well 05-002MW. However, these concentrations all decreased in value from the first groundwater samples collected in August 1994 to the groundwater samples collected in December 1994. Further data are required to evaluate this decrease.

TPH-D was detected at a concentration of 980 $\mu\text{g/L}$ in the groundwater sample collected from monitoring well 05-002MW in December 1994. However, TPH-D was not detected in any of the groundwater samples collected in August 1994.

During additional groundwater sampling conducted in December 1995, TPH-G was detected in monitoring well 05-002MW at 1,300 $\mu\text{g/L}$ and 300 $\mu\text{g/L}$ in the sample and duplicate sample, respectively.

ES 3.0 RECOMMENDATIONS

ES 3.1 IRP SITE NO. 4 (LEAKING VEHICLE MAINTENANCE USTS)

Based on the results of the SI, the following recommendations are presented for IRP Site No. 4:

- Lead contamination was detected in the upper 1.0 to 1.5 feet of soil at IRP Site No. 4. No further investigation is recommended due to the limited vertical extent of soil contamination.
- TPH contamination was detected in groundwater collected from monitoring wells installed at IRP Site No. 4. Therefore, it is recommended that additional investigative work be performed at this site.

ES 3.2 IRP SITE NO. 5 (ABANDONED JET FUEL USTS)

Based on the results of the SI for IRP Site No. 5, the following recommendations are presented:

- To further delineate the extent of soil contamination, additional soil sampling is recommended along the west and north sides (soil borings 05-002RBH, 05-003RBH, and 05-004RBH) of the excavation.
- Additional groundwater sampling should be conducted at IRP Site No. 5 to further evaluate TPH-G and TPH-D analytical results.
- A risk assessment and a salinity analysis should be conducted. A salinity analysis is required to determine the potability of the water.

SECTION 1.0 INTRODUCTION

This Site Investigation (SI) Report presents the results of the investigation activities conducted at Installation Restoration Program (IRP) Site No. 4 (Leaking Vehicle Maintenance Underground Storage Tanks (USTs)) and IRP Site No. 5 (Abandoned Jet Fuel USTs), located at the 216th Engineering Installation Squadron (EIS) and 234th Combat Communications Squadron (CCSQ), Hayward Air National Guard Station (ANGS) (also referred to as the Station), Hayward, California (Inside Front Cover Figure).

IRP Site No. 4 was established in December 1991 when contaminated soil was noticed during excavation activities at the Cable Training Area located near the southwest corner of the Station. The source of the contamination was thought to be a leaking UST located nearby. An UST Unauthorized Release (Leak)/Contamination Site Report was filed with the Hayward Fire Department on 26 January 1992. On the same date, the Hayward Fire Department presented the Station with a notice of violation (NOV).

Three abandoned 25,000-gallon jet propulsion-4 (JP-4) USTs were identified in a Preliminary Assessment (PA) Report prepared by Science and Technology, Inc., in January 1991 (Science and Technology, Inc., 1991). The site was later identified as IRP Site No. 5 when the USTs were scheduled for removal. During removal of the USTs in December 1993, soil contamination was detected.

Headquarters, Air National Guard Readiness Center/Installation Restoration Program Branch (HQ ANG/CEVR) authorized Operational Technologies Corporation (OpTech) to prepare an SI Work Plan and conduct the SI at IRP Sites No. 4 and No. 5. This investigation was conducted as outlined in the SI Work Plan for IRP Site No. 4 and the Addendum 1 Work Plan for IRP Site No. 5 submitted to HQ ANG/CEVR in December 1993 and May 1994 and approved in June 1994 and July 1994, respectively.

1.1 SUBSURFACE INVESTIGATION

The SI includes those activities deemed necessary for determining the horizontal and vertical extent of hydrocarbon contamination at IRP Sites No. 4 and No. 5.

The specific objectives of the SI are to:

- Provide data to assist in determining the presence or absence of contamination and the type of contamination;
- Obtain information to delineate the horizontal and vertical extent of soil contamination and horizontal extent of groundwater contamination;
- Define hydrogeologic conditions that could affect contaminant migration, containment, or cleanup;
- Support the evaluation of cost-effective remedial technologies and alternatives;
- Support site-specific decisions, such as no further IRP action is warranted, interim abatement or remediation measures are required, or further IRP work is required;
- Gather information to support a Management Action Plan and Corrective Action Plan; and
- Gather information to support a Risk Assessment.

The SI consists of field activities designed to accomplish the SI objectives. These activities include soil vapor surveys for developing the optimum number and locations of soil borings needed to assess soil contamination; the installation of a Station-wide piezometer network for determining local groundwater flow direction and selecting site-specific groundwater monitoring well locations; the installation of soil borings and monitoring wells; specific media sampling; and laboratory analyses to confirm either the presence or the absence of contamination, levels of contamination, and the potential for contaminant migration. Information obtained during the subsurface investigation is also utilized to define the installation and site hydrology, geology, and soil characteristics.

The general approach for the design of SI activities is to sequence the field activities so that data are acquired and used as the field investigation progresses. This approach is done in order to determine the nature and extent of contamination in a relatively short period of time, optimize data collection and data quality, and minimize cost. Information, data, and analytical results

obtained from the SI field investigation provide the technical basis needed to support a risk assessment, corrective action plan, or site closure.

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SECTION 2.0 FACILITY BACKGROUND

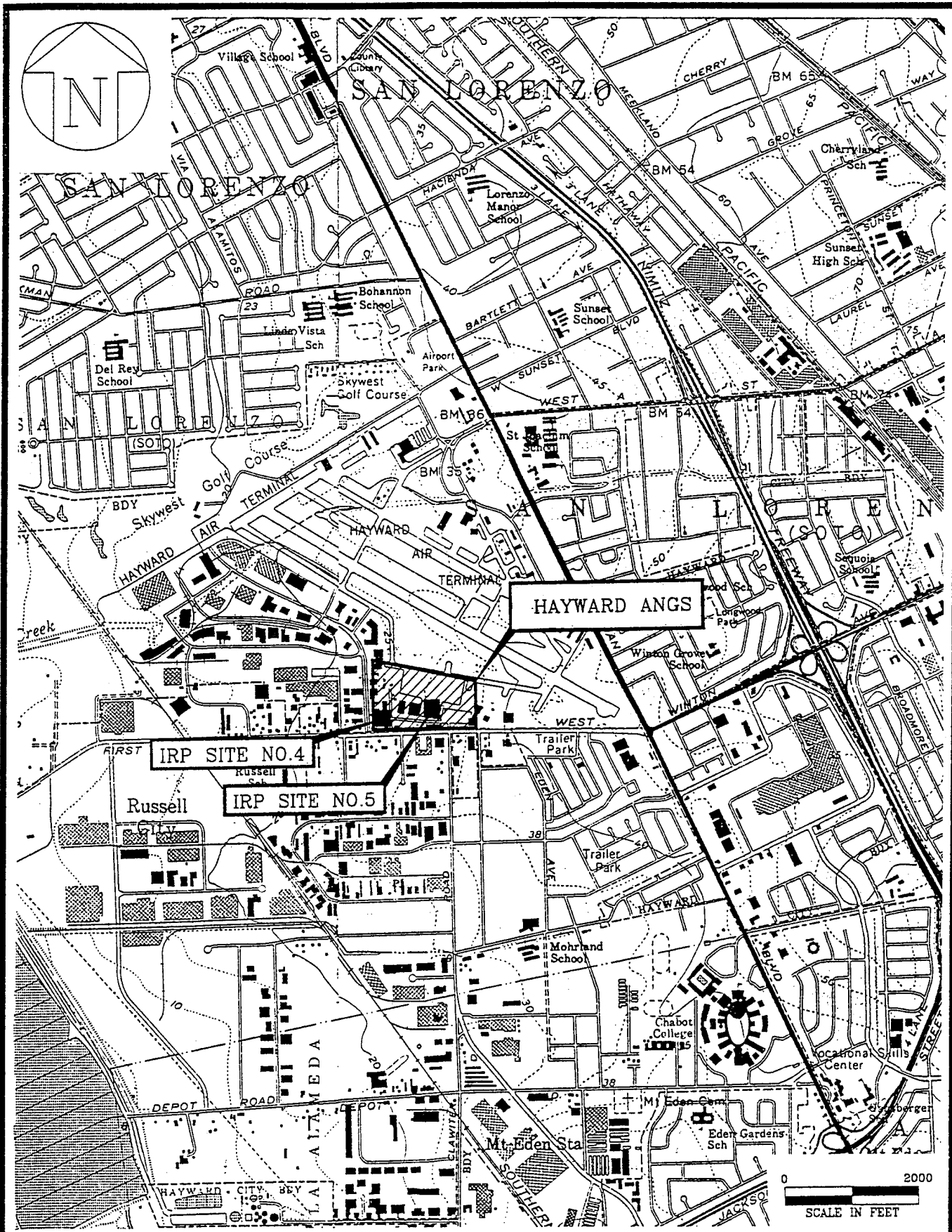
The 216th EIS and 234th CCSQ are located at the Hayward ANGS at 1525 West Winton Avenue in Hayward, California. Hayward ANGS occupies approximately 44 acres of relatively flat terrain and is located just north of West Winton Avenue and south of Hayward Municipal Airport (MAP) (see Figure 2.1).

The mission of the 216th EIS and 234th CCSQ is to install, operate, and maintain mobile communications facilities providing interbase and intrabase communications in support of tactical Air Force operations and State emergencies. The normal working population is approximately 80 people, including a Marine Corps Reserve Training Unit, which has been present at the Station since 1984. The Marines conduct radar operations, maintenance, and training at the Station. The 151st Air Force Band is also a tenant unit at the Station; however, their use of facilities is strictly limited to rehearsals. The Station also serves as a site for Unit Training Assembly (UTA) which meets one weekend per month. During this weekend, the Station population reaches approximately 635.

2.1 FACILITY HISTORY

In 1946, the 194th Fighter Interceptor Squadron, based at Hayward MAP, was assigned to the California Army National Guard. With the creation of the U. S. Air Force in 1947, Hayward became a California Air National Guard Station. The 194th began the transition to jet aircraft in the fall of 1954, and the unit was relocated. However, most of the personnel did not relocate, but remained at Hayward where the Air National Guard (ANG) activated a new unit.

The newly organized unit was Federally recognized in April 1955 as the 129th Air Resupply Squadron. In 1962, the Squadron became part of the 129th Troop Carrier Group. The designation of the group and squadron was changed to Air Commando in 1975, and then to Special Operations. After another aircraft conversion, the Hayward units became the 129th Aerospace Recovery and Rescue Squadron and the 129th Aerospace Recovery and Rescue Group. These units remained at Hayward until the spring of 1980. In 1982, the 216th EIS and 234th CCSQ came to Hayward ANGS.



SOURCE: HAYWARD QUAD N3737.5-W12200/7.5 1959 (PHOTO REVISED 1980); SAN LEANDRO QUAD N3737.5-W12207.5 1959 (PHOTO REVISED 1980).

FIGURE 2.1
HAYWARD PORTRAIT

STATION LOCATION MAP
216th EIS & 234th CCSQ
Hayward ANGS
Hayward, California

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2.2 IRP SITES

2.2.1 IRP Site No. 4 (Leaking Vehicle Maintenance USTs) Description

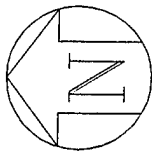
2.2.1.1 Background and Operational History

IRP Site No. 4 is located in the southwest portion of the Station, as shown in Figure 2.2. Two vehicle maintenance USTs, Nos. 110 and 116, were formerly located in the east portion of the site, approximately 50 feet north of Building 3, the Motor Vehicle Shop (see Figure 2.3). UST No. 110, a 5,000-gallon gasoline tank of single-wall steel construction, was located to the north of the wash rack. California ANG records indicate that the UST was installed in 1951 and permanently taken out of service in 1986. UST No. 116 was located approximately 10 feet east of a wash rack. UST No. 116 was a 6,000-gallon diesel tank installed in 1981. Both tanks, along with the associated fuel island, were removed by ANG on 26 January 1994. At the time of the SI, the excavations were still open. The excavation for UST No. 110 measures approximately 20 feet in length, 14 feet in width, and 12 feet in depth. The excavation for UST No. 116 measures approximately 21 feet in length, 15 feet in width, and 9 feet in depth. A 2.5-foot wide trench, measuring 2 feet in depth, connects both excavation sites. The trench extends from the southeast corner of the UST No. 110 excavation to the northwest corner of the UST No. 116 excavation.

The 216th EIS Cable Training Area is located on the west portion of the site. The Cable Training Area measures approximately 100 feet in width and 115 feet in length, and is located approximately 70 feet south of Building 10 and 80 feet west of Building 3 (see Figure 2.3). The Station boundary fence line borders the area on the south and west. The area is covered with soil having little vegetative cover. The former cable training excavation, in which soil contamination was detected, is located in the northeast portion of the Cable Training Area, as indicated on Figure 2.3.

2.2.1.2 Review of Existing Sampling Data

On 19 March 1986, UST No. 110 was reportedly perforated when the gauge stick punctured the bottom of the fuel tank. At the time of the perforation, the tank reportedly contained 2,856 gallons of unleaded gasoline. Station personnel started removing the contents of the tank within three hours of the incident. Due to groundwater infiltration, the UST filled with water. The water table was 7.1 feet below land surface (BLS) and the tank bottom was 10.5 feet BLS. Pumping ceased after approximately 850 gallons of fuel had been removed. Station personnel

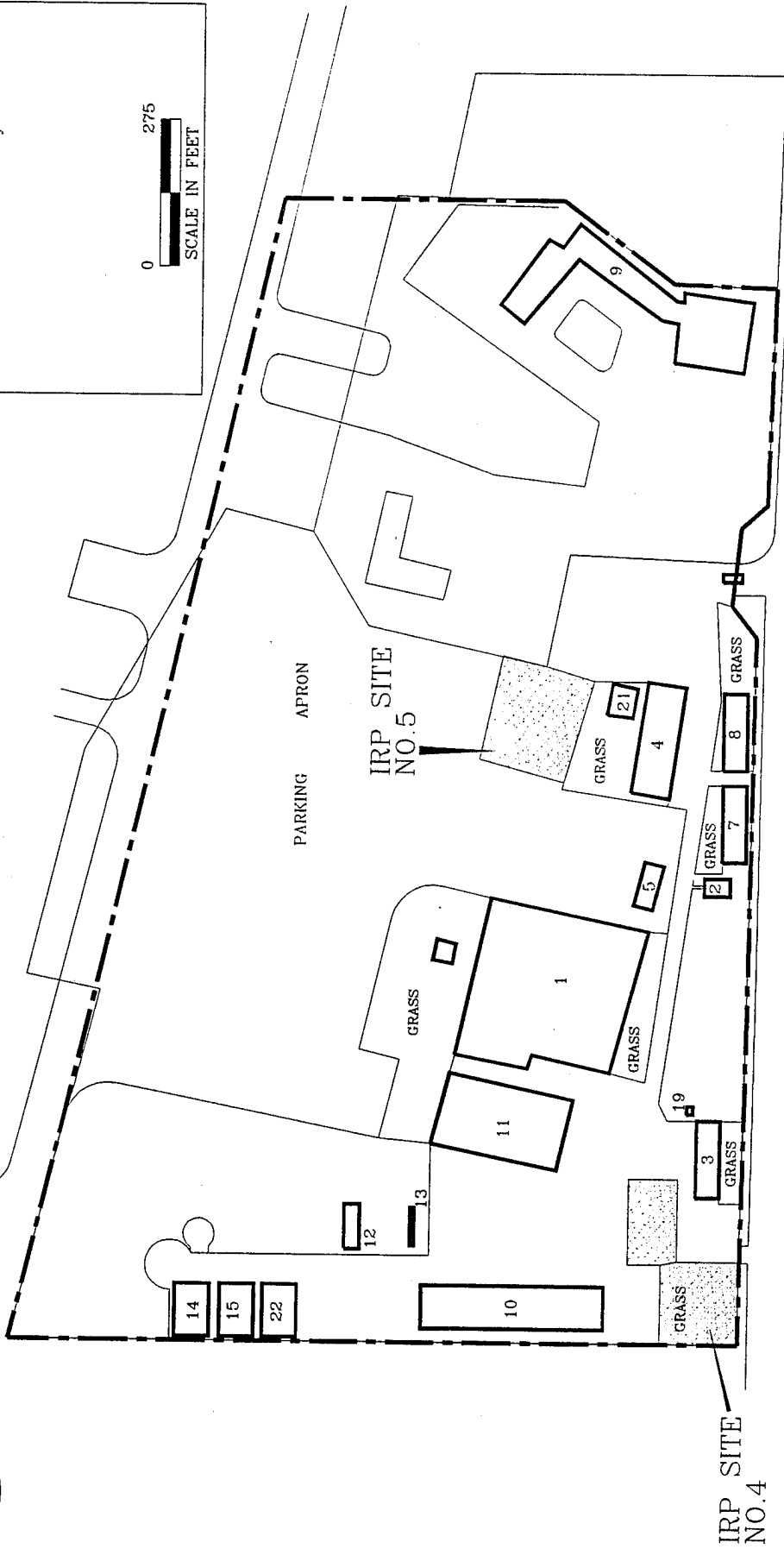


LEGEND

- 14 Building
- IRP Site
- Station Boundary

SCALE IN FEET

0 275



SOURCE: HAYWARD ANG'S BASE PLANS.

FIGURE 2.2

LOCATION OF IRP SITES NO.4 AND NO.5

216th EIS & 234th CCSQ

Hayward ANG'S
Hayward, California

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HAYWARD HAY3-210

DECEMBER 1995

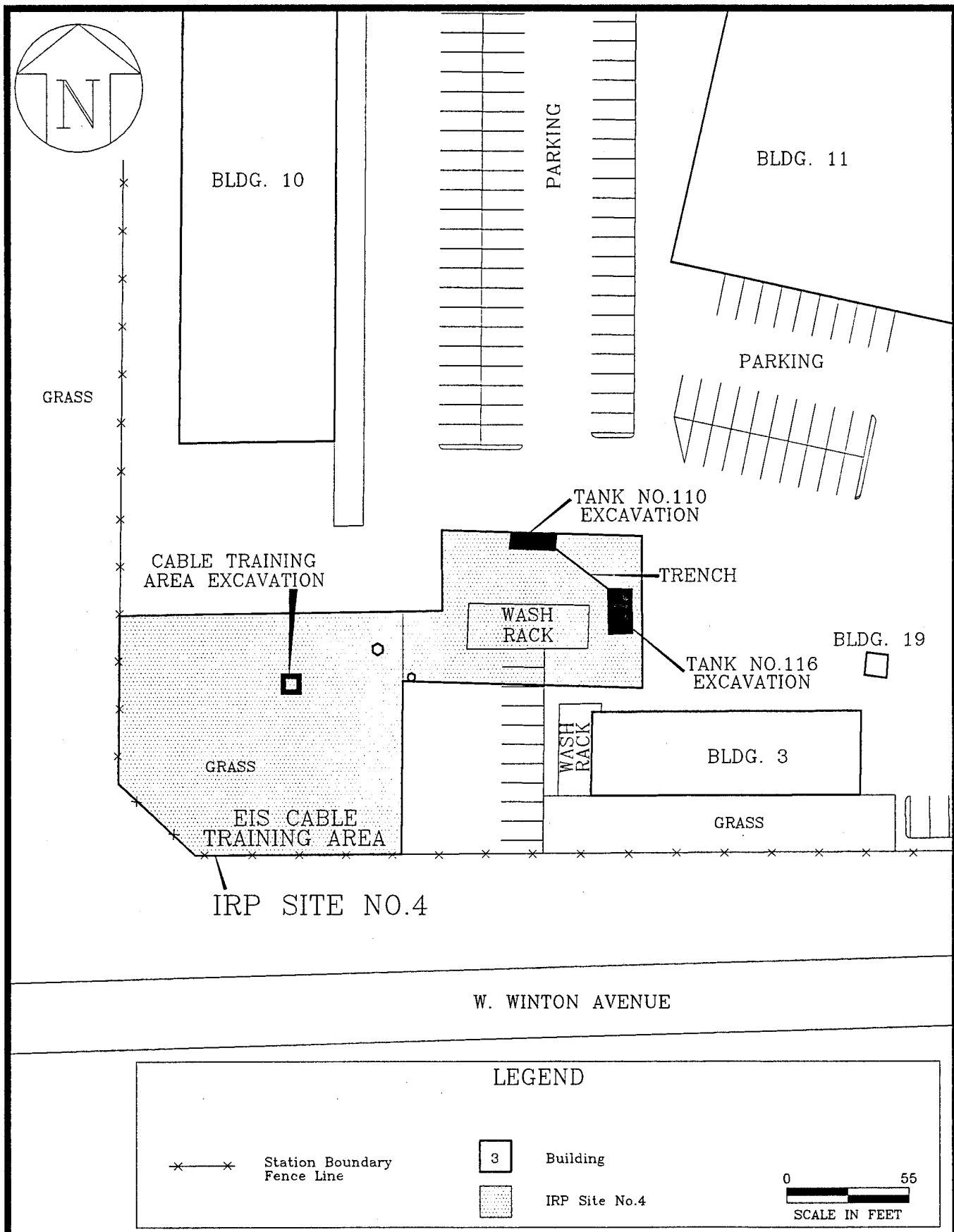


FIGURE 2.3

IRP SITE NO.4 SITE PLAN
 216th EIS & 234th CCSQ
 Hayward ANG
 Hayward, California

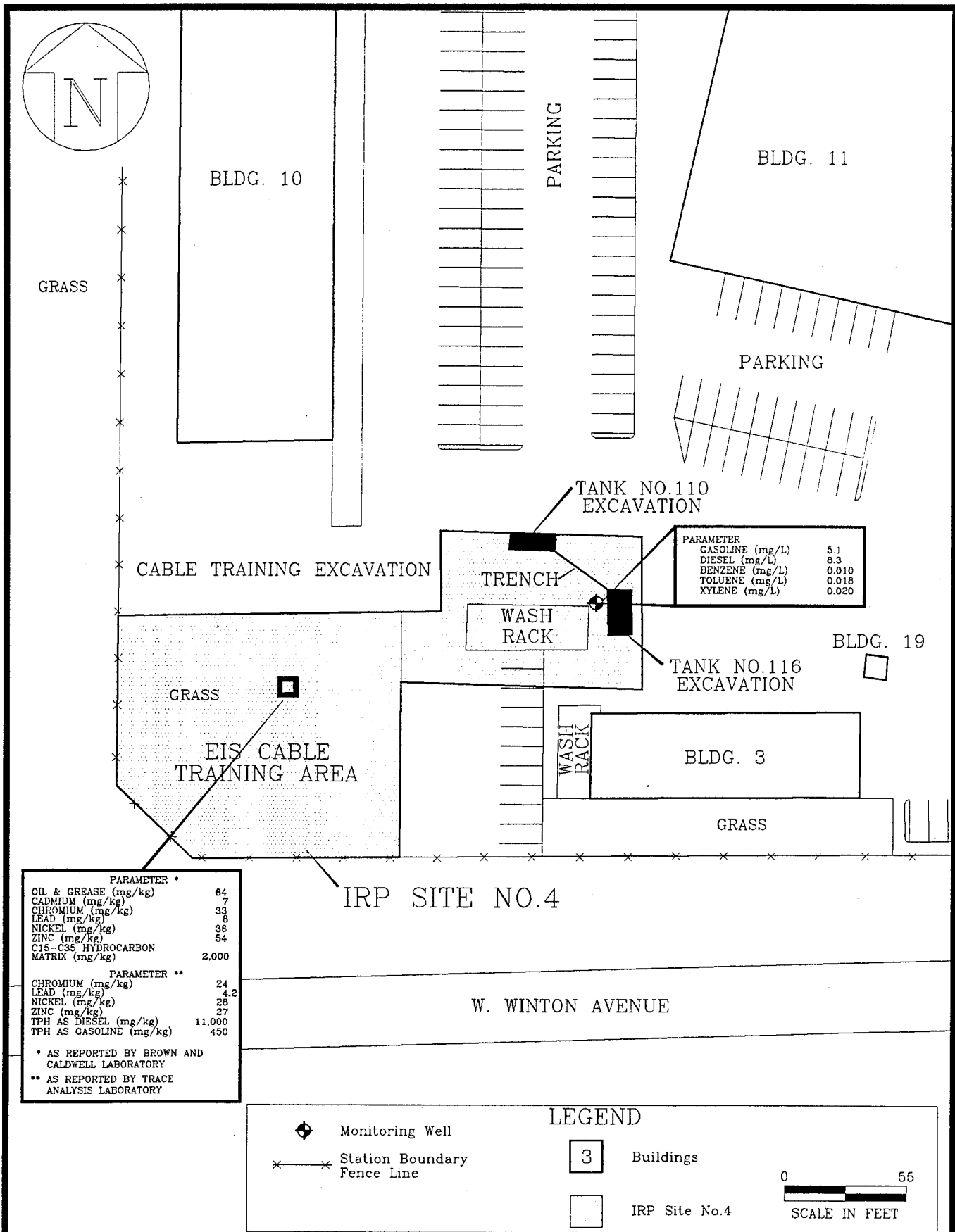
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contracted J. P. Transportation to pump the balance of the fuel. Groundwater immediately began to fill the tank during pumping operations. California ANG records indicate that the tank had apparently stabilized by 21 March 1986 with approximately 2,150 gallons of groundwater remaining in the UST and an estimated 6 gallons of fuel floating on top. A reported inventory reconciliation indicated that approximately 50 gallons of fuel may have been lost.

A monitoring well, located 25 feet southeast of UST No. 110, was installed in May 1986 to a depth of 15 feet BLS (Figure 2.4). Groundwater was encountered at a depth of 8 feet BLS, Alameda County, 1993. A groundwater sample was collected on 22 May 1986 and submitted on 27 May 1986 to Wesco Laboratories in Novato, California, for analysis. The groundwater sample was analyzed for total petroleum hydrocarbons (TPH) (gasoline (TPH-G) and diesel (TPH-D)), benzene, toluene, and xylene using United States Environmental Protection Agency (USEPA) Methods 5020/8015/8020. Gasoline and diesel were detected at concentrations of 5,100 $\mu\text{g/L}$ and 8,300 $\mu\text{g/L}$, respectively, in the groundwater sample collected. Benzene was detected at a concentration of 10 $\mu\text{g/L}$, toluene at 18 $\mu\text{g/L}$, and total xylenes at 20 $\mu\text{g/L}$. The monitoring well has been checked monthly by the 216th Motor Pool personnel for presence of petroleum sheen or free product. No sheen or free product has been observed in the monitoring well.

On 8 December 1991, a thick, black substance was detected in soil during excavation for the installation of an underground telephone cable pull box at the 216th EIS Cable Training Area. A 5- to 7-foot hole was dug using a backhoe. Excavated soil was stockpiled next to the excavation. When the potential contamination was detected, the area was isolated and "off limits" signs were posted. Soil samples were collected and sent to Brooks Air Force Base (AFB), San Antonio, Texas, for analysis. An excerpt from the phone and event log of a representative of the California ANG indicates the sample results were reported as inconclusive on 7 January 1992.

On 26 January 1992, a UST Unauthorized Release (Leak)/Contamination Site Report was filed with the Hayward Fire Department. On the same date, the Hayward Fire Department presented the ANG with an NOV for assessments that had not been conducted on the underground fuel tank release of 19 March 1986. The Hayward Fire Department requested further soil sampling. The requested soil samples were taken from the Cable Training Area excavation on 12 February 1992 and sent to Brown and Caldwell Laboratory, Emeryville, California, and Trace Analysis, Hayward, California, for analysis. All samples were taken from the bottom of the excavation at a depth of 8 to 9 feet BLS.



DRAFT
 FIGURE 2.4

HAYWARD\PREVIOUS

PREVIOUS ANALYTICAL RESULTS
 AT IRP SITE NO.4

216th EIS & 234th CCSQ
 Hayward ANG
 Hayward, California

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MARCH 1986

The soil samples sent to Brown and Caldwell Laboratory were analyzed for parameters and analytical methods listed in Table 2.1. The parameters detected are summarized in Table 2.2 and are shown on Figure 2.4. The soil sample sent to Trace Analysis was analyzed for parameters and analytical methods listed in Table 2.3. The parameters detected at concentrations exceeding detection limits are summarized in Table 2.4 and are shown in Figure 2.4.

Table 2.1
Brown and Caldwell Laboratory Soil Sample Analysis Plan at IRP Site No. 4
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Parameter	Analytical Method
TPH – Volatile/BTEX	SW5030/SW8020
TPH-Diesel and Heavy Oil	SW3550
Oil & Grease	413.1
VOCs	SW8010
SVOCs (PNAs, Creosote and others)	SW8270
Heavy Metals (Cadmium, Lead, Chromium, Zinc, and Nickel)	SW6010

TPH – Total Petroleum Hydrocarbons.

SVOCs – Semivolatile Organic Compounds.

PNAs – Polynuclear Aromatic Hydrocarbons.

VOCs – Volatile Organic Compounds.

BTEX – Benzene, Toluene, Ethylbenzene, and Xylenes.

Table 2.2
Analytes Detected in Soil Sample at IRP Site No. 4
Reported by Brown and Caldwell Laboratory
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Parameter	Detected Concentration (mg/kg)
Oil & Grease	64
Cadmium	7
Chromium	33
Lead	8
Nickel	36
Zinc	54
C15-C35 Hydrocarbon Matrix	2,000

mg/kg – milligrams per kilogram.

2.2.2 IRP Site No. 5 (Abandoned Jet Fuel USTs) Description

2.2.2.1 Background and Operational History

IRP Site No. 5 is located near the center of Hayward ANGS, at the southeast end of the aircraft parking apron, as shown on Figure 2.2. This site was identified in the PA Report prepared by

Table 2.3
Trace Analysis Laboratory Soil Sample Analysis Plan at IRP Site No. 4
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Parameter	Analytical Method
TPH-Diesel	California DHS
TPH-Gasoline	California DHS
BTEX	SW8020
Oil & Grease	SM-5520 D&F
CL HCs	SW8010
SVOCs (PNAs, Creosote, and others)	SW8270
Heavy Metals	
Cadmium	SW7130
Lead	SW7420
Chromium	SW7190
Zinc	SW7950
Nickel	SW7520
PCBs	SW8080

TPH – Total Petroleum Hydrocarbons. SVOCs – Semivolatile Organic Compounds.
 BTEX – Benzene, Toluene, Ethylbenzene, and PNAs – Polynuclear Aromatic Hydrocarbons.
 Xylenes. PCBs – Polychlorinated Biphenyls.
 CL Hcs – Chlorinated Hydrocarbons. DHS – Department of Health Services.

Table 2.4
Analytes Detected in Soil Sample at IRP Site No. 4
Reported by Trace Analysis Laboratory
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Parameter	Detected Concentration (mg/kg)
Chromium	24
Lead	4.2
Nickel	28
Zinc	27
TPH as Diesel	11,000
TPH as Gasoline	450

TPH – Total Petroleum Hydrocarbons. mg/kg – milligrams per kilogram.

Science and Technology, Inc., in January 1991 (Science and Technology, Inc., 1991). The site is the location of three former 25,000-gallon JP-4 USTs, which were installed in 1953. The USTs were abandoned in 1982 (when the 129th Tactical Fighter Group moved to Moffett Field) and were later removed in 1993. Prior to removal, the USTs were oriented in a north-south direction and covered by asphalt. The USTs were identified in the IRP as IRP Site No. 5 (Abandoned Jet Fuel USTs) when they were scheduled for removal. There was no record of any product release from the USTs during their life span. It was during the removal of the USTs in December 1993 that contamination was detected in the native soils.

The site currently consists of an open excavation measuring approximately 63 feet in width, 66 feet in length, and 14 feet in depth. Approximately 1,200 cubic yards of excavated soil were stockpiled off the northwest corner of the excavation during the SI. The remainder of the site is asphalt-covered, with the exception of a narrow strip bordering the east and south sides of the excavation, which is concrete-covered. Access to the former UST excavation is restricted by chain-link fencing. An aircraft hangar is located approximately 200 feet to the west of the site, a smaller building lies to the south, an asphalt-covered parking area (utilized for mobile equipment storage) lies to the east, and the aircraft parking apron lies to the north.

2.2.2.2 Summary of Existing Sampling Data

Three 25,000-gallon USTs, used for storing JP-4, were removed from IRP Site No. 5 on 10 December 1993 by Placer Tank Services of Loomis, California, and transported from the site to Erickson's in Richmond, California, for disposal. Station personnel reported that the tanks were of single-wall steel construction and had no cathodic protection. During the removal of the USTs, soil staining and petroleum-related compound odors were encountered. The site was excavated to approximately 14 feet BLS, at which groundwater was encountered. A petroleum sheen was observed on the groundwater.

Soil samples from the excavation were collected and submitted to Trace Analysis Laboratory, Inc., of Hayward, California for laboratory analysis. Composite samples were taken from the stockpiles of excavated soils. TPH-G and TPH-D were detected at a maximum concentration of 130.0 mg/kg and 95.0 mg/kg, respectively, in soil samples collected from excavated soil. Toluene, ethylbenzene, and xylenes were also detected at concentrations of 0.79 mg/kg, 2.2 mg/kg, and 29.0 mg/kg, respectively. Lead was detected in the excavated soil at a maximum concentration of 19.0 mg/kg. TPH-G and TPH-D were detected at a maximum concentration of 3.8 mg/kg and 150.0 mg/kg, respectively, in soil samples collected from native soil along the UST pit walls. Toluene, ethylbenzene, and xylenes were detected at maximum levels of 0.79 mg/kg, 2.2 mg/kg, and 29.0 mg/kg, respectively. Grab samples of soil taken from points along the edge of the excavation showed low levels of contamination. Only lead was detected consistently at levels ranging from 6.5 to 15.0 mg/kg.

SECTION 3.0 ENVIRONMENTAL SETTING

The environmental setting of Hayward ANGS is presented through discussions of physiography, climate, geology, soils, hydrogeology, surface water, and endangered fish and wildlife. These discussions incorporate both regional and local perspectives.

3.1 PHYSIOGRAPHY AND CLIMATE

Hayward ANGS is located in Alameda County on the eastern shore of San Francisco Bay within the Coast Ranges province of California. The Coast Ranges province is a series of north-northwest trending mountain ranges and intermountain valleys bounded on the west by the Pacific Ocean, and on the east by the Central Valley (Great Valley).

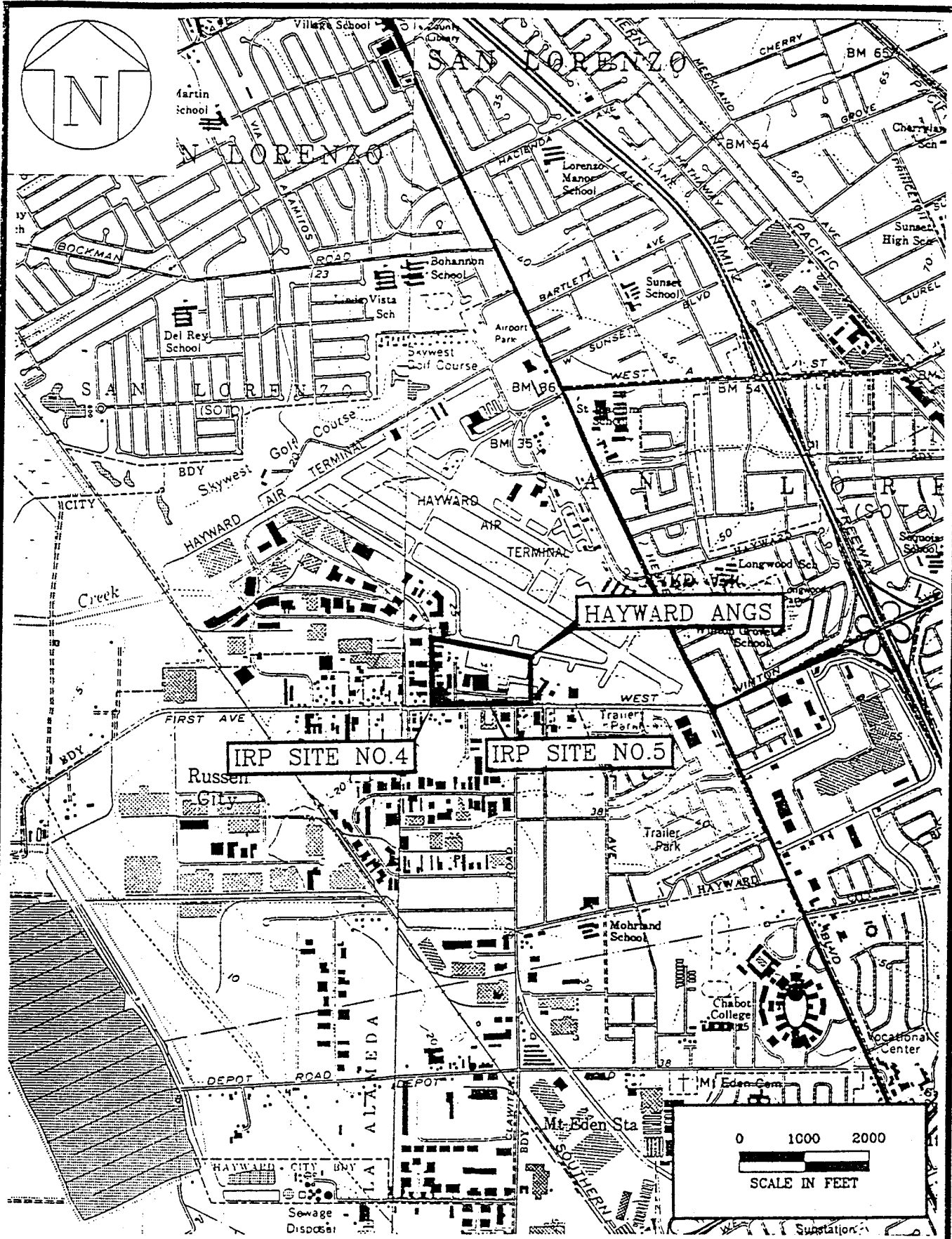
San Francisco Bay is a result of local subsidence of river valleys occurring during the Pleistocene Age. Additionally, it should be noted that the major northernmost east-west cross valley fault of the Central Valley Province, the Stockton Fault, marks the confluence of the Sacramento and San Joaquin Rivers. The waters from the delta flow westward from Suisun Bay into the upper San Francisco Bay (San Pablo Bay) and represent a major fresh water source for the Bay.

Hayward ANGS (Figure 3.1) is located on relatively flat terrain with a surface elevation averaging 30 feet above mean sea level (MSL), and with gentle slopes of less than 1 degree toward the west.

The climate of the San Francisco Bay area is heavily influenced by the westerly winds off the Pacific Ocean. Average annual temperature is 58.6° Fahrenheit (F). Monthly average temperatures range from 49.0° F in January to 67.0° F in September. Annual precipitation at the Station, based on a 29-year record from 1951 to 1980, averages 18.0 inches. Evapotranspiration in the Bay area is 42 inches per year, resulting in a net annual precipitation of minus 24 inches.

3.2 GEOLOGY

In the San Francisco area, the Coast Ranges province is underlain by two depositionally unrelated rock sequences: the eugeosynclinal Franciscan Formation of Jurassic-Cretaceous age, and an early Cretaceous and older sialic sequence. These two sequences appear side by side, separated only by major transcurrent fault zones like the San Andreas.



SOURCE: HAYWARD QUAD N3737.5-W12200/7.5 1959 (PHOTO REVISED 1980); SAN LEANDRO QUAD N3737.5-W12207.5 1959 (PHOTO REVISED 1980).

FIGURE 3.1
HAYWARD PORTRAIT

USGS 7.5' TOPOGRAPHICAL
QUADRANGLE MAP
216th EIS & 234th CCSQ
Hayward ANG'S
Hayward, California

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The Franciscan Formation is a heterogeneous sequence of marine sedimentary and volcanic rocks consisting predominately of massive bedded graywacke with interbedded dark shale and chert along with metamorphic schists. Juxtaposed on these marine and volcanic rocks are granitic and metamorphic sequences that are rich in silica and alumina and are commonly referred to as sial.

The Station is situated on a large pie-shaped structural wedge that includes the Santa Clara Valley, and is bounded on the west by the generally vertical plane of the San Andreas Fault zone and on the east by the Calaveras/Hayward zone. These right-lateral strike-slip fault zones join approximately 40 miles south of the Station in an area east of San Jose.

A thick blanket of late Cretaceous and Cenozoic clastic sedimentary rocks covers large portions of the province. In general, the Cenozoic deposits of late Pliocene and Pleistocene age are mainly nonmarine, unconsolidated gravels, sands, and silts of local derivation but with some interbedded clays and marls. Underlying the Station, these Quaternary sediments are undeformed and include local tidal flat deposits (see Table 3.1 and Figure 3.2).

3.3 SOILS

The northern portion of Hayward ANGS is dominated by the Clear Lake clay series (see Figure 3.3). The Clear Lake clay is a very deep, poorly drained soil formed in alluvium within basins. The surface layer is a very dark gray, neutral, and moderately alkaline clay which extends down to a depth of approximately 37 inches. The subsoil is calcareous, dark gray to grayish-brown clay and silty clay to a depth of about 60 inches. Permeability is low, less than 4.24×10^{-5} centimeters per second.

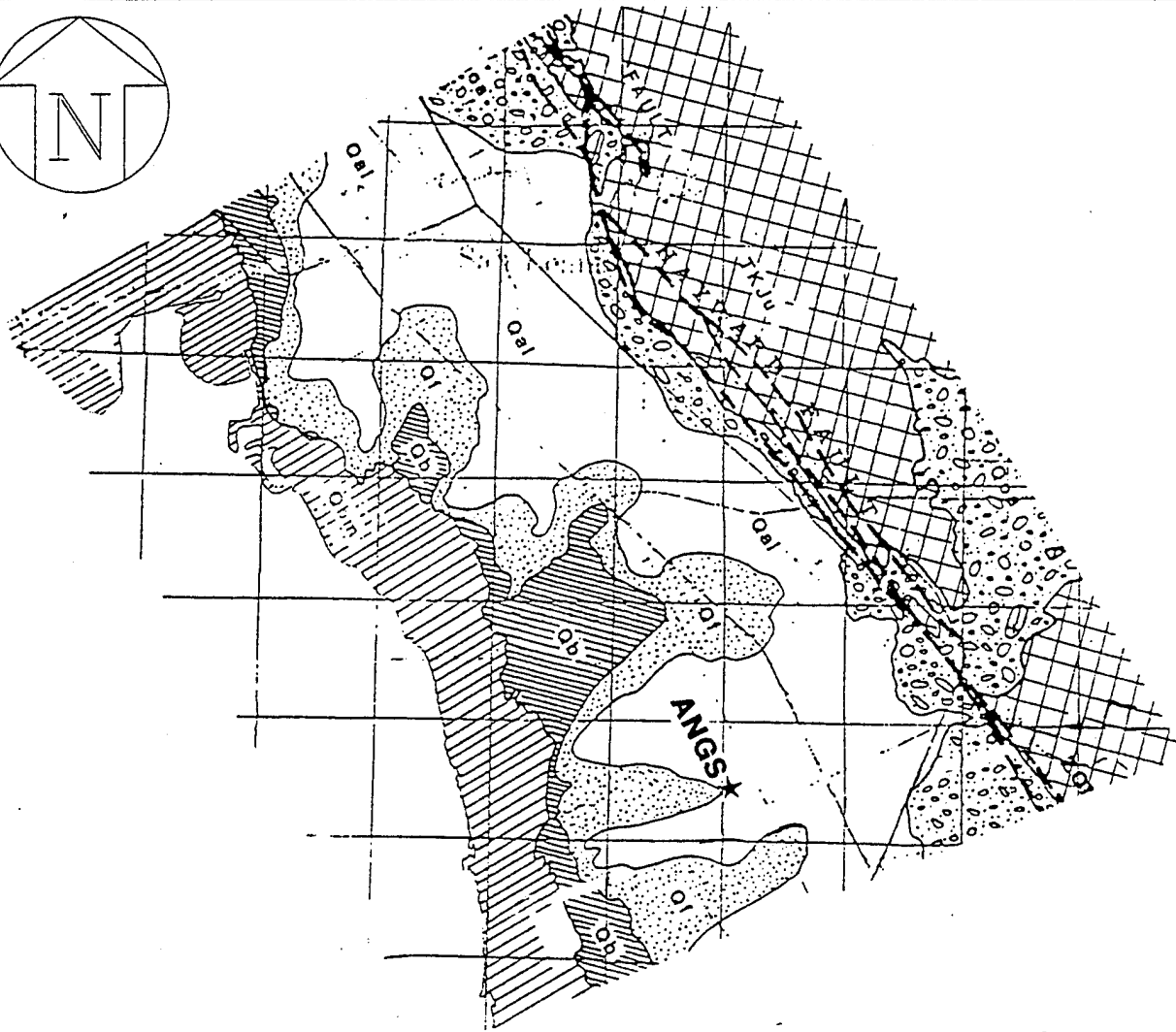
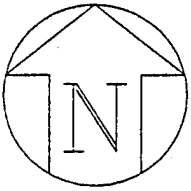
Soils on the southern half of the Station predominantly consist of the Danville silty clay loam series, which is a very deep, well drained soil that formed on low terraces in alluvium. The surface layer is a grayish brown and dark gray, slightly acid, silty clay loam that is approximately 21 inches thick. The subsoil is grayish brown, slightly acid, silty clay to heavily silty clay loam that extends to a depth of about 61 inches. The substratum is a grayish brown, neutral, silty clay loam and extends to a depth of 80 inches or more. Permeability is low (4.24×10^{-5} cm/sec to 1.41×10^{-4} cm/sec). The information pertaining to soils at the Station was derived from the Soil Survey of Alameda County, California, Western Part (U. S. Department of Agriculture, Soil Conservation Service, March 1981).

At IRP Site No. 4, soil layers are by nature distinct entities. From surface to approximately 3 feet down is an organic silty layer varying in color from dark brown to black. This grades into

Table 3.1
Generalized Stratigraphic Column of the Area
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Period	Epoch	Geologic unit	Thickness	General Character	Water-Bearing Properties
Quaternary	Holocene	Younger alluvium (Qal)	Ranges from less than 10 feet to as much as 50 feet.	Unconsolidated, moderately sorted, sand and silt; coarse sand and gravel toward alluvial fan heads and in narrow canyons.	Moderately permeable. Most of deposit lies above zone of saturation, so yields small quantities of groundwater to wells.
		Fluvial deposits (Qf)	Generally less than 15 feet.	Unconsolidated, moderately sorted, fine sand, silt, and clayey silt, with occasional thin beds of coarse sand. Well bedded.	Moderately permeable. A thin surficial deposit. Yields small quantities of groundwater to wells.
	Interfluvial basin deposits (Qb)	Generally less than 10 feet.	Unconsolidated, plastic, moderately to poorly sorted silt and clay, rich in organic material.	Low permeability. Seasonally saturated. Yields small quantities of groundwater to wells.	
	Bay mud (Qbm)	Ranges from less than 1 foot to as much as 120 feet beneath the bay.	Unconsolidated, dark plastic clay and silty clay rich in organic material. Some lenses of silt and sand.	Permeable. Permeability decreases with depth as deposit becomes more consolidated. Yields small quantities of groundwater to wells.	
Pleistocene	Merritt Sand (Qm)	A maximum of about 65 feet.	Loose, well-sorted, fine to medium grained sand; silty, clayey, with lenses of sandy clay and clay.	Permeable, but water-yielding ability varies throughout area. Yields large to small quantities of water to wells. The major groundwater reservoir in the East Bay Plain Area.	
	Older alluvium (Qoa)	A maximum of about 1,100 feet.	Layers of poorly consolidated to unconsolidated clay, silt, sand and gravel.	Low permeability. Locally yields small quantities of water to wells from fractures, and the sandstone and conglomerate units.	
Tertiary, Cretaceous, and Jurassic	Pliocene and Older	Undivided bedrock units (TKJu)	Probably more than 10,000 feet	Mostly consolidated or highly compacted sandstone, shale, and chert; some volcanic rock, serpentine, and conglomerates.	

Source: Hickenbottom, K. and K. Muir, Geohydrology and Groundwater - Quality Overview of the East Bay Plain Area, Alameda County, California, Report 205J.



- CONTACT—Approximately located
- - - HAYWARD FAULT ZONE—Approximately located
- STUDY AREA DRAINAGE BOUNDARY

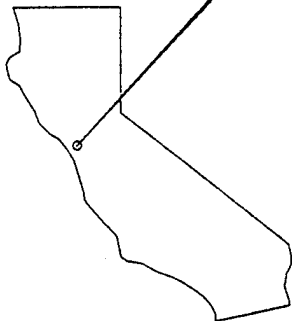
CORRELATION OF MAP UNITS

Qel	Holocene	QUATERNARY
Qf		
Qb	Pleistocene	
Qbm		
Qm		
Qoa	Pliocene and Older	TERTIARY, CRETACEOUS AND JURASSIC
TKJu		

DESCRIPTION OF MAP UNITS

Qel	YOUNGER ALLUVIUM
Qf	FLUVIAL DEPOSITS
Qb	INTERFLUVIAL BASIN DEPOSITS
Qbm	BAY MUD
Qm	MERRITT SAND
Qoa	OLDER ALLUVIUM
TKJu	UNDIVIDED BEDROCK UNITS

Study Area



SOURCE: Hickenbottom, K. and K. Muir, *Geohydrology and Groundwater—Quality Overview of the East Bay Plain Area, Alameda County, California*, Report 205J.

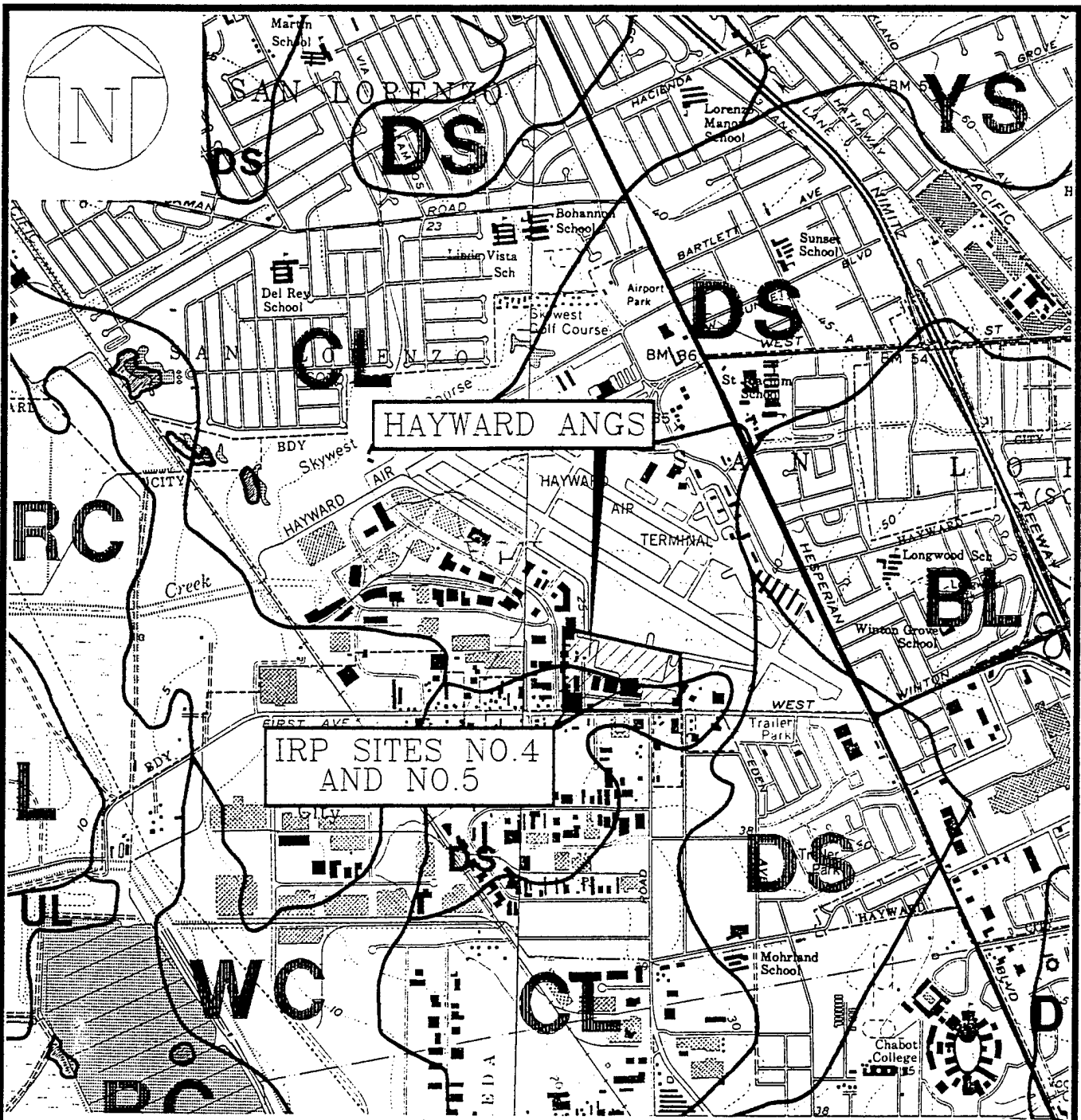
DRAFT
FIGURE 3.2

SURFICIAL GEOLOGIC MAP
OF THE AREA
216th EIS & 234th CCSQ
Hayward ANGS
Hayward, California

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OPERATIONAL TECHNOLOGIES
CORPORATION

MARCH 1996

HAYWARD\PORTRAIT



LEGEND

CL = CLEAR LAKE CLAY	BL = BOTELLA LOAM	HAYWARD ANGS
DS = DANVILLE SILTY CLAY LOAM	WC = WILLOWS CLAY	IRP SITE
YS = YOLO SILT LOAM	RC = REYES CLAY	0 2000
WETLANDS	UL = URBAN LAND	SCALE IN FEET

SOURCE: SOIL SURVEY OF ALAMEDA COUNTY, CALIFORNIA, WESTERN PART (U.S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, MARCH, 1981).

FIGURE 3.3
HAYWARD\HAY3-950

SOIL SURVEY MAP
216th EIS & 234th CCSQ
Hayward ANGS
Hayward, California

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MARCH 1996

a silty clay or silty sand varying in color from brown to dark grey and extends down to a depth of approximately 5 to 10 feet BLS (or this layer may extend down to the bottom of the boring; i.e., 20 to 25 feet). Occurring approximately 10 feet BLS is a silty clay of a very plastic nature. Additionally, the borings at IRP Site No. 4 at approximately 15 to 20 feet depths indicated a wet or saturated sand or silt layer.

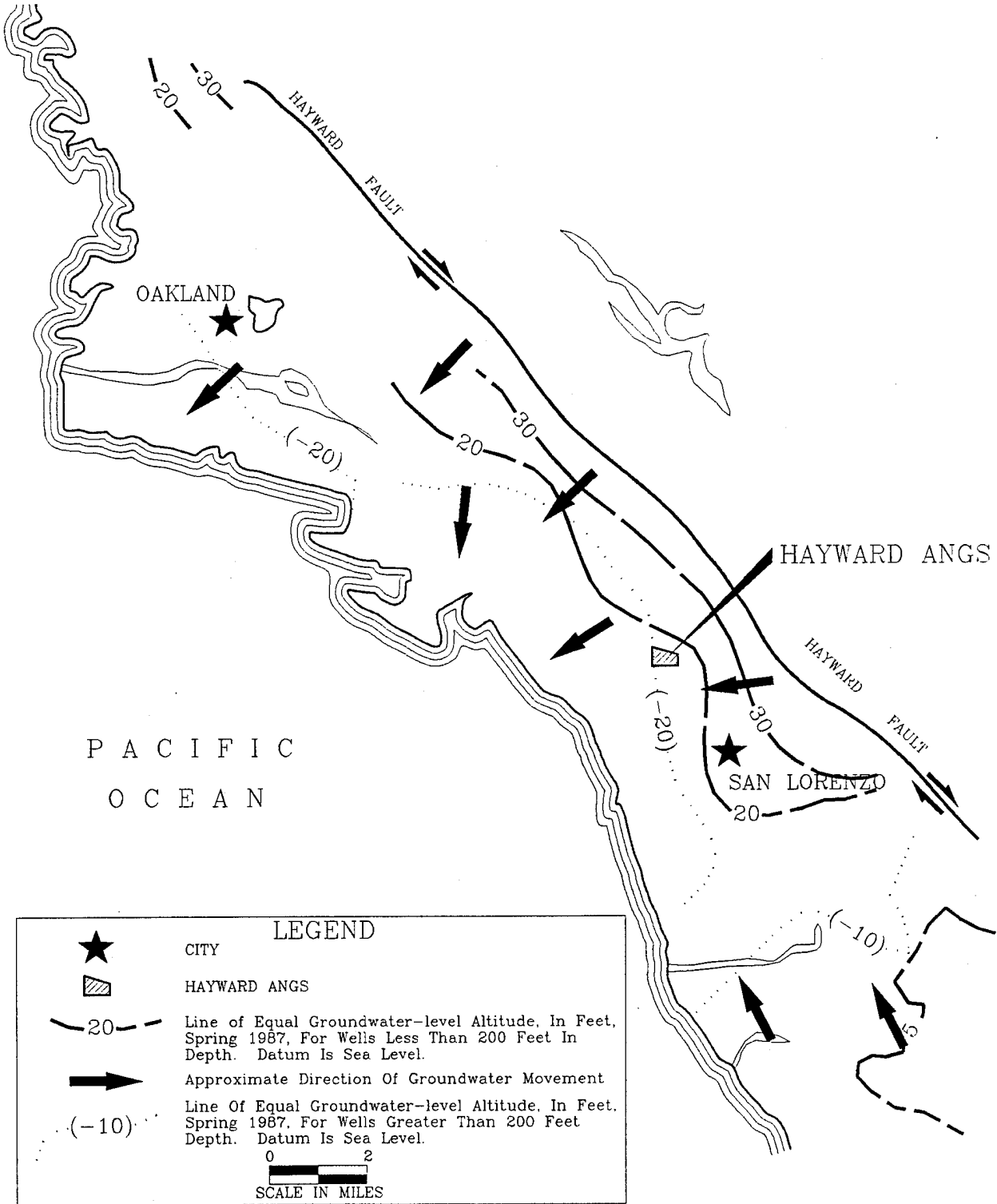
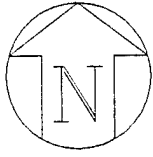
Soils at IRP Site No. 5 also vary from one boring to another, but in general are much like soils described above. The top layer is a blackish organic silt or clayey silt, which extends down approximately 3 or more feet. Under that layer is a usually moist silt of a brown to greenish color extending down to approximately 10 or even 20 feet, depending on the location of the boring. At depths of 20 to 25 feet in some borings is a wet layer of brownish sand or gravelly sand.

3.4 HYDROLOGY

3.4.1 Hydrogeology

The unconsolidated Quaternary deposits, which collectively form the groundwater reservoirs of the East Bay Plain area, all lie west of the Hayward Fault (Hickenbottom and Muir, 1990), as does the Hayward ANGS. An undivided peripheral bedrock sequence of Late Mesozoic age lies east of the Hayward Fault and forms the eastern boundary of the aquifer system. The Quaternary Older Alluvium is considered to be the principal groundwater reservoir in the East Bay Plain area. Groundwater level elevations mapped in the spring of 1987 indicate a range from approximately 20 feet above MSL to 20 feet below MSL (see Figure 3.4). This is a result of some wells in the Older Alluvium having depths of less than 200 feet BLS and others having depths greater than 200 feet BLS. Groundwater movement is westerly toward San Francisco Bay. The water table in the Hayward MAP area varies from 8 to 25 feet BLS. As of July 1994, the water table at Hayward ANGS ranged from 9 to 14 feet BLS.

Subsidence due to groundwater withdrawal has become a serious problem south of Hayward MAP in the Upper Santa Clara Valley; however, it has not affected the Hayward ANGS area because of more efficient groundwater management practices on the east side of San Francisco Bay.



SOURCE: Hickenbottom, K. and K. Muir. Geohydrology and Groundwater-Quality Overview of the East Bay Plain Area, Alameda County, California, Report 205J.

FIGURE 3.4

COMPOSITE GROUNDWATER LEVEL
MAP SHOWING DIRECTION
OF GROUNDWATER MOVEMENT
216th EIS & 234th CCSQ
Hayward ANG S
Hayward, California

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HAYWARD\HAY3-10C

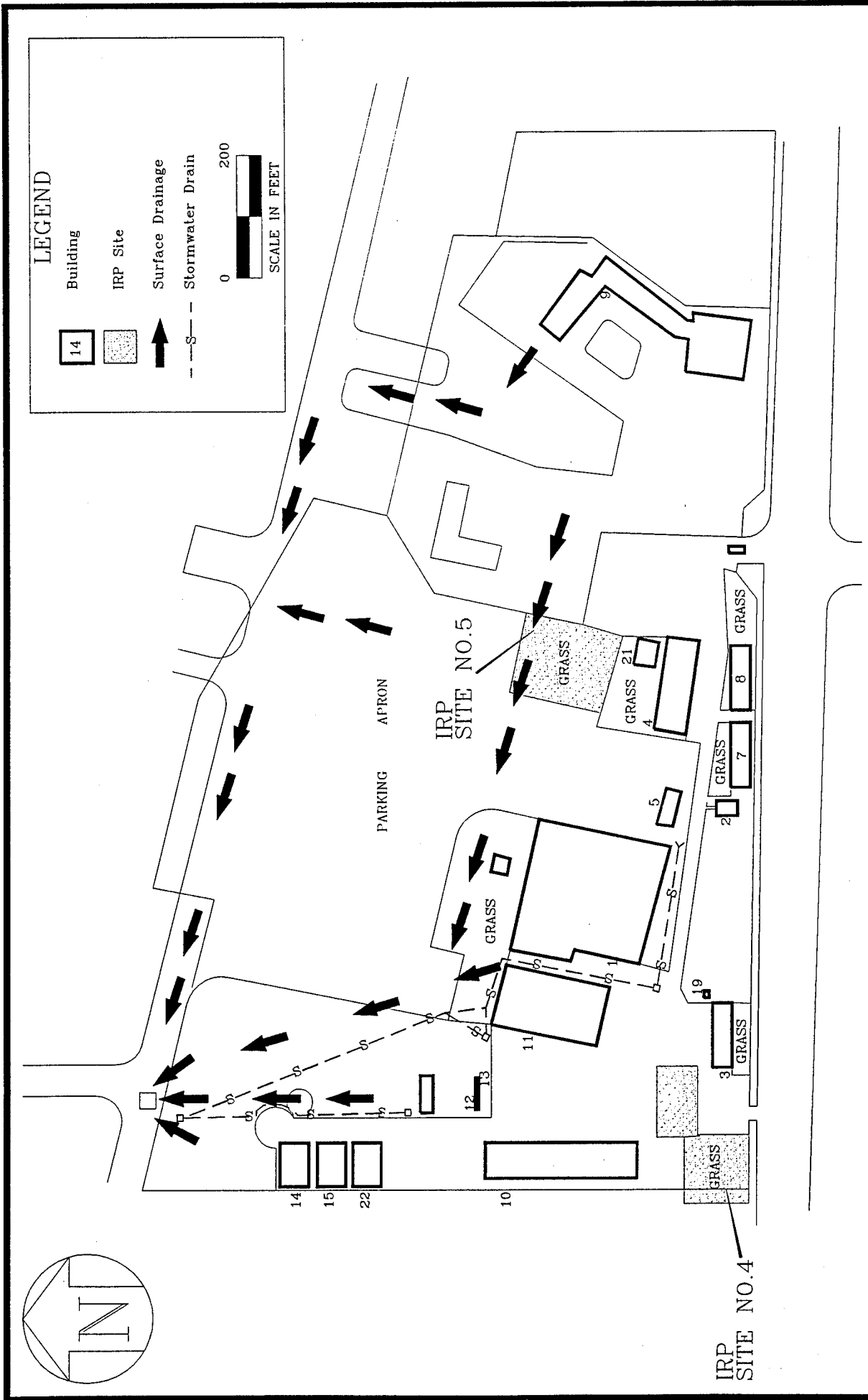
MARCH 1996

3.4.2 Surface Water

Hayward ANGS is located in the Sulphur Creek/San Francisco Bay drainage basin. Through storm drains, the Station drainage flows northward to Sulphur Creek, located along the northern boundary of Hayward MAP and then flows westward into San Francisco Bay (see Figures 3.5 and 3.6). The Station has been classified as being outside the 100-year floodplain.

3.5 ENDANGERED FISH AND WILDLIFE

According to records maintained by the California Department of Fish and Game, Natural Diversity Database, no endangered or threatened species of flora and fauna have been identified within a one-mile radius of the Station (Science and Technology, Inc., 1991). However, minor wetlands are present approximately 1-1/2 miles west of the Station (see Figure 3.3). Also, within a 1-1/2-mile radius of the Station, surface drainage empties into marshes and mud flats on the eastern shore of San Francisco Bay via Sulphur Creek. The Salt Marsh Harvest Mouse (*Reithrodontomys raviventris*) is a threatened species in this area.



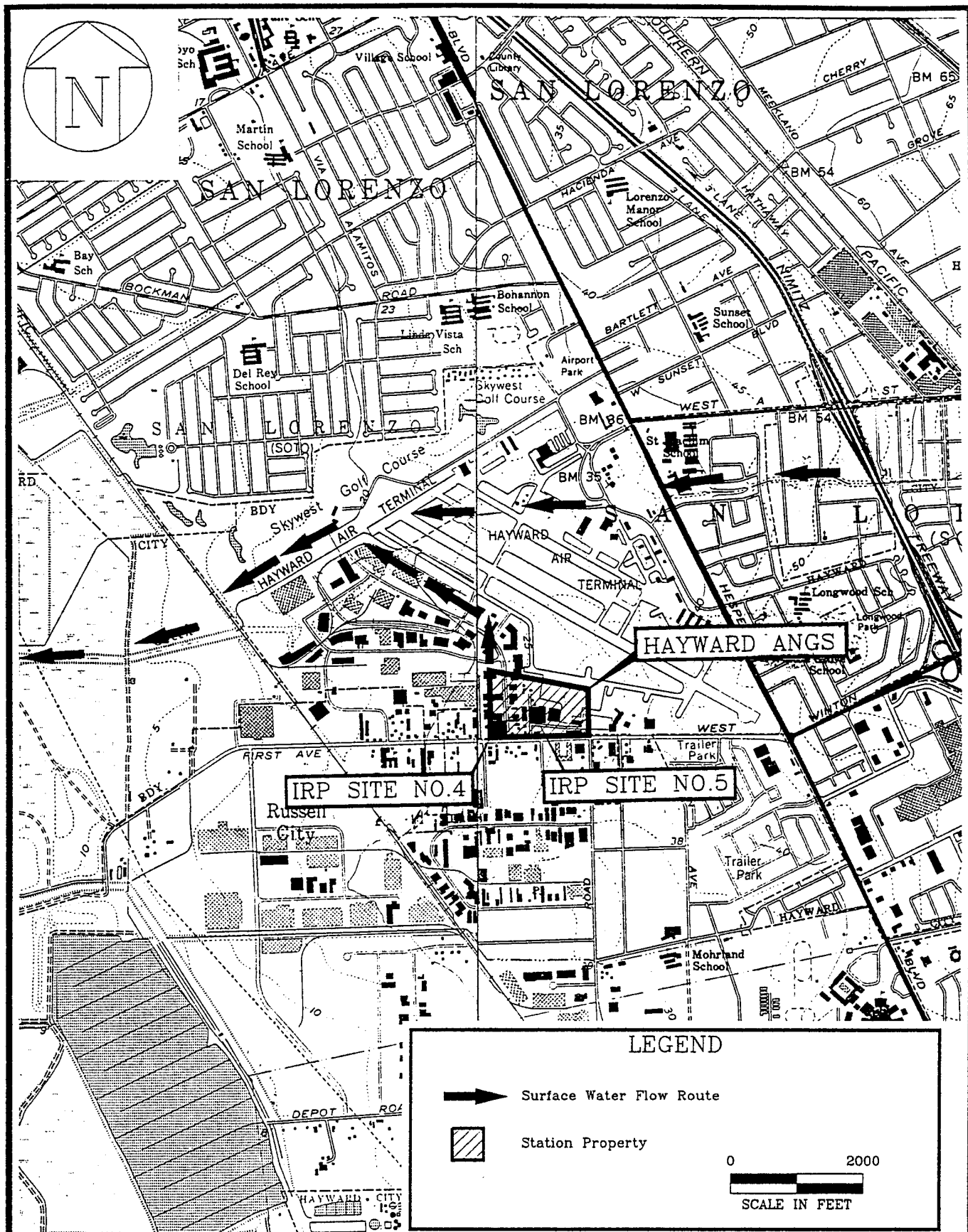
SURFACE WATER DRAINAGE MAP OF THE
 HAYWARD AIR NATIONAL GUARD STATION
 216th EIS & 234th CCSQ
 Hayward ANGS
 Hayward, California

FIGURE 3.5

HAYWARD\HAY3-11D

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SOURCE: HAYWARD QUAD N3737.5-W12200/7.5, 1959 (PHOTO REVISED 1980); SAN LEANDRO QUAD N3737.5-W12207.5, 1959 (PHOTO REVISED 1980).

FIGURE 3.6
 HAYWARD\HAY3-12A

AREA SURFACE WATER RUNOFF MAP
 216th EIS & 234th CCSQ
 Hayward ANGS
 Hayward, California

OPTECH
 OPERATIONAL TECHNOLOGIES
 CORPORATION
 DECEMBER 1995

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SECTION 4.0 FIELD PROGRAM

The purpose of this SI is to provide an accurate assessment of the current horizontal and vertical extent of soil contamination and horizontal extent of groundwater contamination at IRP Sites No. 4 and No. 5, and to provide data needed to support either site closure, decisions regarding corrective action at the site, or a risk assessment. This section describes the field activities performed during the SI to accomplish the above objectives, and the methodologies used. The field investigation at Hayward ANGS commenced on 25 July 1994 and was completed on 12 August 1994, with the exception of conducting slug tests and the final round of groundwater sampling. Slug tests were conducted on 13 October 1994 on all monitoring wells installed during this investigation. The final round of groundwater sampling was conducted from 5 to 7 December 1994.

Additional groundwater samples were collected from the three monitoring wells at IRP Site No. 5 only in December 1995.

4.1 GENERAL INVESTIGATION APPROACH

The field investigation at Hayward ANGS incorporated a soil vapor survey (at IRP Site No. 5 only), installation of piezometers and groundwater monitoring wells, and the drilling of soil borings at IRP Sites No. 4 and No. 5 in order to:

- Determine background groundwater quality and soil conditions;
- Screen soil for chemicals of concern at the site;
- Collect soil samples for laboratory analysis for defining the extent of soil contamination;
- Define the vertical and horizontal extent of contamination at the site;
- Collect groundwater samples for laboratory analysis for defining any existing groundwater contamination; and
- Determine groundwater flow direction.

Soil borings and groundwater monitoring wells were installed to determine the extent of soil and groundwater contamination at the sites. Soil boring and groundwater monitoring well locations were approved by HQ ANG/CEVR. Soil and groundwater samples were also collected from one soil boring and one monitoring well to establish background concentration levels at the Station.

A soil vapor survey and a Station-wide piezometer installation program were conducted prior to the commencement of soil boring and groundwater monitoring well drilling activities. The soil vapor survey was used as a screening tool for determining the optimum number and location of soil borings needed to confirm the absence or presence of hydrocarbon contamination at IRP Site No. 5. Piezometers were installed to determine groundwater flow direction prior to installation of any groundwater monitoring wells and to establish groundwater levels.

4.2 DEVIATIONS FROM THE WORK PLAN

There were deviations from the Work Plans. However, the revised procedures or protocols did not affect the overall objectives of the SI. Deviations from the Work Plans as described below apply to both sites unless otherwise noted.

- A photoionization detector (PID) was used rather than a flame ionization detector (FID), as specified in the Work Plan.
- At IRP Site No. 4, samples were analyzed for lead using method SW6010 rather than SW7420, as specified in the Work Plan. Methods SW6010 and SW6020 are technically equivalent to method SW7420.
- At IRP Site No. 5, samples were analyzed for lead using Methods SW6010, SW6020 and SW7421, rather than SW7420, as specified in the Work Plan. Methods SW6010 and SW7421 are technically equivalent to Method SW7420.
- A background boring, BG-001BH, was drilled when soil samples collected from background monitoring well BG-001MW were not submitted for laboratory analysis.
- The California-style sampler was equipped with stainless steel sleeves, rather than brass, as specified in the Work Plan.

- Three soil samples were collected from each soil boring drilled at IRP Site No. 4, resulting in the collection of two additional soil samples. The Work Plan specified the collection of two soil samples from two borings, and three soil samples from the remaining two borings.
- Upon encountering a gravelly sand at a depth of 30.0 feet BLS in background monitoring well BG-001MW, it was recommended to HQ ANG/CEVR that the screen length in monitoring wells 04-001MW and 04-002MW be changed from 25 feet to 20 feet in length. This recommendation was made to avoid opening a conduit for downward migration of contaminants into deeper sediments, and to avoid groundwater samples being dominated by water from the more transmissive sediments. HQ ANG/CEVR concurred with this recommendation and approval was obtained.
- A tremie pipe was not used during well completion activities, as specified in the Work Plan. Once the 2-inch inner diameter (ID) casing and screen were installed in monitoring wells, the 3.375-inch ID of the augers did not allow adequate room for utilizing a tremie pipe. The hollow-stem augers (HSAs) were used as the tremie.
- A tremie pipe was not used during borehole abandonment, as specified in the Work Plan for IRP Site No. 4.
- Field blanks were not collected and submitted for laboratory analysis during soil sampling for IRP Site No. 4.
- The Work Plan for IRP Site No. 5 called for soil vapor samples to be collected from depths of 5 feet and 10 feet BLS from each sampling location. However, initial sampling results, from sampling locations around the perimeter of the excavation, indicated greater contamination at depths of 10 feet BLS than at 5 feet BLS. Subsequently, the Site Manager recommended that the 5-foot sampling depth in the outer sampling locations be eliminated in order to sample more locations at the 10-foot depth. HQ ANG/CEVR concurred with and approved this recommendation.

- At IRP Site No. 5, all soil vapor samples were not analyzed for both TPH and BTEX, as specified in the Work Plan. Nine of the 44 soil vapor samples collected were analyzed for TPH only.

4.3 FIELD SCREENING ACTIVITIES

4.3.1 Soil and Groundwater Screening

During soil sampling of soil borings and groundwater monitoring wells, the air around the sampler was monitored with a Photovac HL MicroTip PID immediately upon opening the sampler shoe (to maximize the detection of volatiles). All PID readings are indicated on the boring logs included in Appendix C. The PID was calibrated at the start of each day using 100 parts per million (ppm) isobutylene gas. Soil was then field screened using a Photovac 10S55 Portable Gas Chromatograph (GC). The GC, calibrated to screen for BTEX, was used to detect and quantify the presence of these compounds in the headspace from the soil samples collected. The GC was calibrated prior to use each day using a 1 ppm BTEX headspace standard, which was prepared fresh daily by diluting a 2,000-ppm BTEX stock solution. Once the soil sample for laboratory analysis had been prepared, the remaining soil was placed in a 6-ounce wide-mouthed jar for transfer to the field GC. After the soil was prepared for GC analysis, it was allowed to reach ambient air temperature. After 15 minutes, a headspace reading was collected using the field GC. Headspace analysis was used as a tool to determine which sample intervals best characterized the environment of the borehole or demonstrated the highest headspace reading. Data obtained from the field GC and PID were used to determine which soil samples were sent to the laboratory for analysis.

The GC was also used to analyze headspace from groundwater samples. Field screening was conducted to provide the Site Manager with preliminary groundwater quality information. Field screening was used to supplement data from groundwater samples sent to the laboratory for analysis.

Field GC data is summarized in Subsections 5.1.2.1 and 5.1.3.1 and included in Appendix D.

4.3.2 Soil Vapor Survey

Prior to the drilling of soil borings and the installation of monitoring wells, a soil vapor survey was conducted at IRP Site No. 5 to attempt to delineate the extent of suspected TPH and BTEX contamination in the area of the tankhold excavation. Approval was granted by HQ ANG/CEVR

to eliminate the 5-foot soil vapor sampling depth interval (as specified in the Work Plan) in the outer sampling locations in order to sample more locations at a depth of 10 feet BLS and better delineate the vertical extent of suspected contamination. The results of the soil vapor survey were used as a screening tool for developing the optimum number and location of soil borings needed to delineate soil contamination. The results also served as a guide in the final selection of monitoring well locations.

The soil vapor survey was conducted by Transglobal Environmental Geochemistry, Inc. (TEG), of Sacramento, California. A total of 32 soil vapor sampling points formed a base grid with a distance of no more than 40 feet between sampling points. Soil vapor sampling point coordinates were surveyed by a State-registered surveyor.

A Strataprobe™ sampler was used for the soil vapor sampling. The Strataprobe™ drive probe, fitted with 1/8-inch nylaflo tubing and a notched point, was advanced into the ground to the desired sampling depth. Once the desired sampling depth was reached, soil vapor was withdrawn from the nylaflo tubing using a small calibrated syringe connected to an on-off valve. The first three volumes of the sample tube were discarded to purge the tube and fill it with *in-situ* soil vapor. The next 20 cubic centimeters of vapor were withdrawn into the syringe, the syringe plugged, and the sample immediately transferred to the on-site California Department of Health Services (DHS)-certified mobile laboratory for analysis. Samples were analyzed for TPH and BTEX using modified USEPA Method 8015 and USEPA Method SW8020, respectively. Two field duplicates were collected to provide a quality assurance check on analytical procedures and results. Soil vapor sampling results are fully discussed in Subsection 5.4.1.1 and included in Appendix A.

4.3.3 Piezometer Installation

Tonto Drilling Services, Inc., of Fontana, California, was retained as the drilling contractor for installation of piezometers. A Station-wide piezometer network was installed to measure groundwater levels in order to determine groundwater flow direction prior to installation of groundwater monitoring wells. After groundwater flow direction was established, the locations of groundwater monitoring wells were selected.

Auger flights and tools were thoroughly steam-cleaned in the designated decontamination areas before initial use and after the completion of each piezometer.

The piezometers were installed using HSA methods. The HSA drilling method employs a hollow helical steel drill tool that is rotated to advance the boring and lift formation materials (cuttings) to the surface. The flights for the HSA are welded onto steel pipe and a cutter head is attached to the "lead" (bottom) auger to drill the boring. During drilling, a center bit is inserted into the hollow area of the cutter head, which prevents cuttings from re-entering the hollow portion of the auger. Generally, the center bit is flush with, or extends no more than, 1/2 foot below the cutter head. The top-head drive, powered by a truck-mounted engine, mechanically rotates the entire flight of augers. The hollow opening allows the insertion of sampling tools (i.e., California-style or continuous sampler) with the augers in place to prevent caving of the borehole.

The piezometers were installed with a truck-mounted drill rig using HSAs having an outside diameter of 8 inches, to a depth of at least 7 feet below the first occurrence of groundwater. The piezometers were constructed of 2-inch ID, flush threaded, polyvinyl chloride (PVC) casing and screens, and a bottom cap. A 5-foot section of 0.010 slotted screen was installed in each piezometer. The top of each screen was placed approximately 2 feet below the static water level, and a filter pack placed around each screen to a point at least 2 feet above the top of the screen. The filter pack was composed of washed silica sand. A 2-foot bentonite chip seal was placed above each filter pack. Above the bentonite seals, cement/bentonite grout was placed around the casings to the surface.

All of the piezometers were flush-mount completions with the polyvinyl chloride (PVC) casing being cut off approximately 6 inches below the ground surface. The wells were installed with a protective locking lid consisting of a cast-iron valve box assembly. The valve box was placed in the center of the hole with the top just above the ground surface. Cement was placed around the annular space and sloped away from the valve boxes to divert drainage. The wells were fitted with watertight compression casing caps to prevent infiltration of surface water. The well numbers were clearly marked on the valve box assemblies. Piezometer construction diagrams are included in Appendix B. All well assemblies were secured with keyed-alike stainless steel locks. The lock keys were given to the Hayward ANG on-site representative.

The static water levels in the piezometer were allowed to equilibrate for a minimum of 24 hours before water levels were measured using a Solinst water level probe. The piezometer coordinates, top-of-casing elevations, and ground elevations were determined by a registered surveyor.

4.4 CONFIRMATION ACTIVITIES

OpTech engaged subcontractors during the Hayward ANGS SI to furnish the soil vapor survey, drilling and surveying services, and analytical laboratory services.

4.4.1 Soil Borings

Soil borings were installed to obtain soil samples for laboratory analysis; to define the vertical and horizontal extent of detected contaminants at the site; and to establish background soil conditions. Soil samples were also used for determining site geology and subsurface soil characteristics. Tonto Drilling Services, Inc., of Fontana, California was retained as the drilling subcontractor for borehole and monitoring well construction.

Soil borings were drilled using HSA methods, previously described in Subsection 4.3.3. Auger flights and tools were thoroughly steam-cleaned in the designated decontamination area located near the northwest corner of the excavation area, before initial use and after the completion of each borehole.

A total of ten soil borings, four located at IRP Site No. 4, five located at IRP Site No. 5, and one background boring, were drilled for data collection. All work was performed in a manner consistent with State of California laws and regulations. At IRP Site No. 4, soil test borings were drilled to a depth of 21.5 feet BLS, with the exception of the background boring, which was drilled to a depth of 26.5 feet BLS. At IRP Site No. 5, soil test borings were drilled to a depth of 15.5 feet BLS. Soil samples were collected at 5-foot intervals for subsurface characterization and field screening. An 18-inch carbon steel California-style sampler equipped with three 6-inch stainless steel sleeves was used for collecting soil samples for laboratory analysis from 0.5 feet below the land surface and from immediately above the water table for IRP Site No. 4, and from an approximate depth of 1.5 feet BLS and from immediately above the water table from each test boring for IRP Site No. 5. Actual sample depths submitted for laboratory analysis are discussed in Section 5.0 and are shown on the boring logs included in Appendix C. A third sample was collected for laboratory analysis from each of the four soil borings installed at IRP Site No. 4 and the five soil borings from IRP Site No. 5. The third soil sample was selected based on field screening results (highest PID and field GC readings), as well as visual and olfactory observations. Actual sample depths submitted for laboratory analysis are discussed in Section 5.0 and are shown on the boring logs included in Appendix A. The California-style sampler was decontaminated and new stainless steel sleeves inserted before each sampling event.

Borehole abandonment activities conformed to State of California requirements. Borings were backfilled with cement grout after the sampling had been accomplished to prevent the downward migration of contaminants through the open borehole.

Hunter Surveying, Inc., of Orangevale, California was retained as the surveying subcontractor. All relevant buildings at the site, soil vapor survey points, soil boring locations, piezometers and monitoring wells were surveyed. Additionally, coordinates and ground elevations for each soil boring were surveyed. The land surface elevations of each borehole are shown on the boring logs and well construction diagrams included in Appendices B and C, respectively.

4.4.2 Monitoring Well Installation

Monitoring wells were installed to obtain water level data for hydrogeologic characterization of the silt aquifer, to evaluate the horizontal component of groundwater flow, and to obtain groundwater samples for laboratory analysis.

All monitoring wells were installed using HSA methods previously discussed in Subsection 4.3.3. Auger flights and tools were thoroughly steam-cleaned in the designated decontamination area before initial use and after the completion of each monitoring well.

One background monitoring well, BG-001MW, was installed to a depth of 34.0 feet BLS. A 25-foot section of 0.010 slotted screen was installed in the background monitoring well.

Monitoring wells 04-001MW and 04-002MW were drilled to depths of 28.5 feet and 30.5 feet BLS, respectively, at IRP Site No. 4. Monitoring wells were constructed of 2-inch ID, flush threaded, PVC casing and screens, and a bottom cap at IRP Site No. 4. A 20-foot section of 0.010 slotted screen was installed in each of monitoring wells 04-001MW and 04-002MW, as previously discussed in Section 4.2 (Deviations From The Work Plan). At IRP Site No. 5, three monitoring wells, one located upgradient and two downgradient, were drilled to an approximate depth of 29 feet BLS. All monitoring wells were constructed in accordance with current California groundwater well standards.

Soil samples were collected from the monitoring well boreholes at 5-foot intervals for field screening and geologic classification. The top of each screen was placed approximately 8.0 feet BLS to allow for seasonal groundwater fluctuations. A filter pack, composed of washed silica sand, was placed around the screen to a point at least 2 feet above the top of the screen. A

bentonite slurry seal approximately 2 feet thick was placed above each filter pack. Above the bentonite seals, cement/bentonite grout was backfilled around the casings.

All monitoring wells were constructed as flush-mount completions. The PVC casing was cut off approximately 6 inches below the ground surface. The wells were installed with a protective locking lid consisting of a cast-iron valve box assembly. The valve box was placed in the center of the hole with the top just above the ground surface. Cement was placed around the annular space and sloped away from the valve boxes to divert drainage. The well was fitted with a watertight compression casing cap to prevent infiltration of surface water. The well identification numbers were clearly marked on the valve box assemblies. All well assemblies were secured with keyed-alike locks. The lock keys were given to the Hayward ANG on-site representative. Monitoring well coordinates and top-of-casing and ground elevations were determined by a registered surveyor. Monitoring well construction diagrams are included in Appendix B.

The wells were developed between 48 and 72 hours after completion using an electric submersible pump having a pump rate of one gallon per minute. Well development continued until a minimum of five well volumes of groundwater were removed from each wellbore, the water had cleared, and specific conductance and pH readings had stabilized. After development, the wells were allowed to stabilize a minimum of 24 hours prior to sampling.

Monitoring wells were purged prior to sampling. Purging was considered complete when the indicator parameters of pH, temperature, conductivity, and color had stabilized and a minimum of three well volumes of groundwater had been removed.

Groundwater samples were collected using a decontaminated Teflon™ bailer. Line used to lower water sampling equipment into the well was used only for the well being sampled and then discarded. Decontamination of the bailer was performed prior to each sample collection by washing the bailer in an Alconox™ and water solution followed by a triple rinse (potable water, deionized water, and methanol). Preserved samples were placed in containers and sent to the laboratory for analysis.

A rising head slug test, to determine aquifer hydraulic conductivity, was conducted at each new monitoring well installed during the investigation. A decontaminated solid PVC slug, 1.5 inches in diameter and 10 feet in length, was lowered below the water surface. The water level in the wellbore was monitored using a Solinst water level probe until it returned to its initial static elevation. The slug was removed after the pre-displacement water level had been reached, and

the change in water level from its initial static elevation was measured, then recorded at closely spaced intervals using a pressure transducer and a Hermit Model SE1000C Environmental Data Logger. The resulting data was used to compute hydraulic conductivity and is included in Appendix E.

4.4.3 Specific Media Sampling

This subsection summarizes the analytical program followed for soil and groundwater samples collected during the SI to determine the nature, magnitude, and extent of contamination detected at the sites. Also included in this subsection is a brief discussion of quality control procedures followed during the field sampling activities. Core Laboratories of Anaheim, California, was retained to perform the chemical analyses. Provisions were made for proper sample containers, labels, chain-of-custody forms, sample stabilization and preservation, insulated sample shipping containers and packing materials.

4.4.3.1 Soil

Based on requirements of the State of California, subsurface soil samples were analyzed for VOCs by USEPA Method SW8240, TPH both as gasoline and as diesel by USEPA Method SW8015 modified, and lead by USEPA Methods SW6010, SW6020 and SW7421. Table 4.1 summarizes the analytical program at the site.

4.4.3.2 Groundwater

Three groundwater sampling events and analysis occurred during the SI. Based on requirements of the State of California, groundwater samples were analyzed for VOCs by USEPA Method SW624, TPH both as gasoline and as diesel by USEPA Method SW8015 modified, and lead by USEPA Methods SW6010, SW6020, and SW7421. The analytical program is summarized in Table 4.1.

4.4.3.3 Quality Control of Field Sampling

Field duplicate samples, equipment blanks, field blanks, and trip blanks were submitted to the analytical laboratory for assessment of the quality of data resulting from the field sampling program. Field, equipment, and trip blank samples were analyzed to check for procedural contamination and ambient conditions at the site or during sample transportation that may have

Table 4.1
Laboratory Analyses Summary Table
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Site No.	Matrix	Field Parameters	Lab Parameters & Test Methods	Investigative Samples	Number of Field QA/QC Samples					Matrix Totals	
					Trip Blanks	Equipment Blanks	Field Blanks	Field Duplicate	MS/MSD		
4	Soil (Subsurface)	Field Screening using Field GC/PID OVA/FID Soil Classification	VOCs/SW8240	12							
			TPH/SW8015 Mod. Lead/SW6010/SW6020/SW7421	12	2*					1	15
				12						2	15
4	Groundwater	Temperature, pH, Specific Conductance	VOCs/SW624	6							
			TPH/SW8015 Mod. Lead/SW6010/SW6020/SW7421	6	1*	1			1	8	
				6					1	8	
BG	Soil (Subsurface)	Field Screening using Field GC/PID OVA/FID Soil Classification	VOCs/SW8240	2							
			TPH/SW8015 Mod. Lead/SW6010/SW6020/SW7421	2	1*					2	
				2						2	
5	Groundwater	Temperature, pH, Specific Conductance	VOCs/SW624	3							
			TPH/SW8015 Mod. Lead/SW6010/SW6020/SW7421	3						1	4
				3					1	4	
5	Soil (Subsurface)	Field Screening using Field GC/PID OVA/FID Soil Classification	VOCs/SW8240	16							
			TPH/SW8015 Mod. Lead/SW6010/SW6020/SW7421	16	2*	2			2	21	
				16					2	21	
5	Groundwater	Temperature, pH, Specific Conductance	VOCs/SW624	9							
			TPH/SW8015 Mod. Lead/SW6010/SW6020/SW7421	9	4*	2			1	12	
				9					2	12	

* - Trip and Equipment Blanks are not counted in Matrix Totals.
 QA/QC - Quality Control/Quality Assurance.
 MS/MSD - Matrix Spike/Matrix Spike Duplicate.
 GC - Gas Chromatograph.
 PID - Photoionization Detector.
 OVA - Organic Vapor Analyzer.
 FID - Flame Ionization Detector.
 VOCs - Volatile Organic Compounds.
 TPH - Total Petroleum Hydrocarbons.
 Mod. - Modified.

caused sample contamination. Duplicate samples were submitted to provide a quality assurance check on analytical procedures and results.

The frequency of quality control sampling was set at one field duplicate and one equipment blank for every 10 or fewer investigative soil samples; and one field duplicate, one equipment blank, and one field blank for every 10 or fewer investigative water samples. Core Laboratories prepared VOC analysis trip blank, consisting of distilled, de-ionized, ultra pure water, and was included along with each shipment of samples to detect contamination among transportation of samples to the lab. One matrix spike/matrix spike duplicate (MS/MSD) was collected for every 20 or fewer investigative soil samples. Matrix samples provide information about the effect of the sample matrix on the analytical methodology.

Quality control for field pH instrumentation consisted of calibration using two standard reference solutions. This procedure was performed at least once per day, or more often as necessary. Field conductivity measurement instrumentation was calibrated daily using standard solutions of known conductivity.

4.4.3.3.1 Soil Sample Preservation

Soil samples collected with a California-style sampler were contained in stainless steel sleeves. Immediately upon removal from the sampler, the sleeve ends were covered with a Teflon™ barrier, aluminum foil, and fitted with a plastic cap. Prepared samples were double-bagged and sealed in zip-lock plastic bags, then immediately placed on ice within an ice chest that was maintained at a temperature of 4° Centigrade (C) or less. Samples were shipped to the laboratory within 24 hours.

4.4.3.3.2 Groundwater Sample Preservation

Groundwater samples to be analyzed for VOCs and TPH were preserved with no more than 2 drops of a 1:1 solution of hydrochloric acid per 40-milliliter glass vial having Teflon™-lined lids. Lead samples were stored in a 1-liter high density polyethylene bottle with a Teflon™-lined lid, and preserved with a solution of 1:1 nitric acid to achieve a pH of less than 2. Prepared samples are placed on ice and shipped via Federal Express to the laboratory for analysis.

4.5 INVESTIGATION DERIVED WASTES

During the SI, a certain amount of waste material, including personal protective equipment (PPE), drill cuttings, purge water, and investigation derived wastes (IDW), were produced as a result of SI activities. Drill cuttings were produced during the installation of soil borings and monitoring wells. Drill cuttings were preliminarily characterized by monitoring for organic vapor emissions with a Photovac HL MicroTip PID and screening with a Photovac 10S55 Portable GC. All soil cuttings from each drilling location were drummed separately in steel 55-gallon drums at the time of drilling. Additionally, all well development and purge water was also drummed separately for each well location.

Miscellaneous wastes (e.g., gloves, Visqueen™ sheeting, and wipes) which came in contact with drill cuttings having PID readings of less than 100 ppm, when field-screened as described in Subsection 4.3.1, were disposed of in a general refuse container. IDW generated during the drilling of borings and/or wells which had PID readings in excess of 100 ppm were drummed in steel, plastic-lined 55-gallon drums.

All drums were properly marked to indicate their contents, the collection date, contractor's name and phone number, and borehole/well identification number. Guidance for the final disposition of drummed materials is provided in Subsection 4.5.1.

4.5.1 Drums Containing Soil

Soil cuttings for each drilling location were drummed separately. Table 4.2 lists the drilling locations for which drums have been marked "Soil," the recommended disposition of those drums, and the rationale for each recommendation.

The Toxicity Characteristic Leaching Procedure (TCLP)-20 standard referenced in Table 4.2 refers to a method used to determine if contaminant levels in the soil may exceed the TCLP standard. Analyte concentrations are compared to 20 times the TCLP regulatory level. This represents an estimate of the minimum concentration of the analyte that would have to be present in the soil for a TCLP analysis to potentially lead to a positive result.

For lead, the TCLP regulatory level is 5 mg/kg. Multiplying this value by 20, results in a value of 100 mg/kg as the minimum concentration of lead in soil that would have to be present in order for a TCLP analysis to potentially lead to a positive result. Drums containing soils that have

**Table 4.2
Recommended Disposition of Drums
216th EIS and 234th CCSQ, Hayward ANG, Hayward, California**

Drilling Location ID Number	Recommended Disposition	Rationale
BG-001BH	Soil can be disposed on-site in accordance with applicable regulations.	Soil sample analyses did not detect contamination.
04-001BH	TCLP should be run for lead, prior to disposition.	Lead was detected at a concentration exceeding the TCLP-20 value of 100 mg/kg.
04-002BH	Soil can be disposed on-site, in accordance with applicable regulations.	Lead was not detected at a concentration exceeding the TCLP-20 value of 100 mg/kg.
04-003BH	Soil can be disposed on-site, in accordance with applicable regulations.	Lead was not detected at a concentration exceeding the TCLP-20 value of 100 mg/kg.
04-004BH	TCLP should be run for lead, prior to disposition.	Lead was detected at a concentration exceeding the TCLP-20 value of 100 mg/kg.
BG-001MW	Soil should be disposed through DRMO.	Field screening with the GC indicated BTEX contamination.
04-001MW	Soil can be disposed on-site, in accordance with applicable regulations.	Field screening with the GC, calibrated to screen for BTEX, did not detect contamination.
04-002MW	Soil should be disposed through DRMO.	Field screening with the GC indicated BTEX contamination.
BG-001MW	Water should be disposed through DRMO.	Lead was detected at a concentration exceeding California DHS Primary MCL. Additionally, gasoline was detected in groundwater.
04-001MW	Water should be disposed through DRMO.	Gasoline was detected in groundwater.
04-002MW	Water should be disposed through DRMO.	Lead was detected at a concentration exceeding California DHS Primary MCL. Additionally, gasoline was detected in groundwater.
05-001RBH	Soil can be disposed on-site in accordance with applicable regulations.	Lead was detected at concentrations well below the TCLP-20 value of 100 mg/kg.
05-002RBH	Soil should be disposed through DRMO.	Gasoline constituents were detected in soils.
05-003RBH	Soil should be disposed through DRMO.	Gasoline constituents were detected in soils. Field screening with the GC indicated BTEX contamination.

Table 4.2 (Concluded)
Recommended Disposition of Drums
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Drilling Location ID Number	Recommended Disposition	Rationale
05-004RBH	Soil should be disposed through DRMO.	Gasoline constituents were detected in soils. Field screening with the GC indicated BTEX contamination.
05-005RBH	Soil can be disposed on-site in accordance with applicable regulations.	Lead was detected at concentrations well below the TCLP-20 value of 100 mg/kg.
05-001MW	Soil can be disposed on-site in accordance with applicable regulations.	Field screening with the GC, calibrated to screen for BTEX, did not detect contamination.
05-002MW	Soil should be disposed through DRMO.	Field screening with the GC indicated BTEX contamination.
05-003MW	Soil should be disposed through DRMO.	Field screening with the GC indicated BTEX contamination.
PZ-001	Soil can be disposed on-site in accordance with applicable regulations.	PID readings less than 100 ppm.
PZ-002	Soil can be disposed on-site in accordance with applicable regulations.	PID readings less than 100 ppm.
PZ-003	Soil can be disposed on-site in accordance with applicable regulations.	PID readings less than 100 ppm.
05-001MW	Water should be disposed through DRMO.	Gasoline constituents were detected in groundwater.
05-002MW	Water should be disposed through DRMO.	Gasoline constituents were detected in groundwater.
05-003MW	Water can be disposed on-site in accordance with applicable regulations.	Laboratory groundwater sample analysis did not detect contamination.

BG - Background.
DRMO - Defense Reutilization and Marketing Office.
BH - Borehole.
RBH - Replacement Borehole.
GC - Gas Chromatograph.
MW - Monitoring Well.
BTEX - Benzene, Toluene, Ethylbenzene, and Xylenes.
mg/kg - milligrams per kilogram.

TCLP - Toxic Characteristic Leaching Procedure.
DHS - Department of Health Services.
LUFT - Leaking Underground Fuel Tank.
MCL - Maximum Contaminant Level.
ppm - parts per million.
PZ - Piezometer Well.
PID - Photoionization Detector.

total lead levels above 100 mg/kg may exceed the TCLP regulatory standard. A TCLP analysis should therefore be conducted.

4.5.2 Drums Containing Non-Potable Water

Development and purge water were drummed separately for each well location. The monitoring well locations for which drums have been marked "Purge and Development Water," the recommended disposition of those drums, and the rationale for each recommendation are also included in Table 4.2.

SECTION 5.0 INVESTIGATIVE FINDINGS

5.1 BACKGROUND SAMPLING RESULTS

5.1.1 Background Sampling Locations

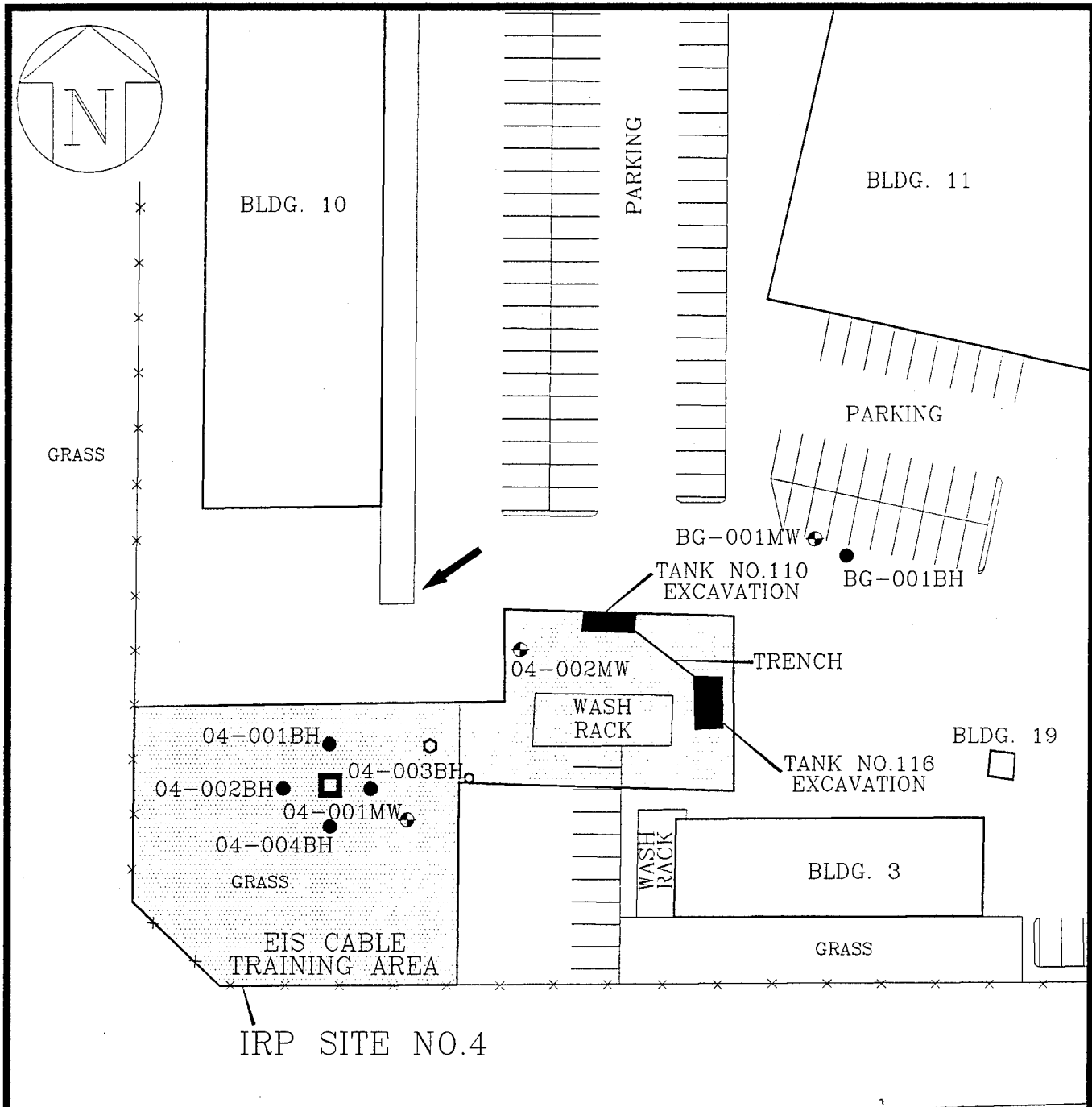
One evaluation criteria for the significance of environmental contaminant concentrations is based on a comparison of the observed levels to known background conditions and regulatory-based standards, where applicable. Establishing soil and groundwater background levels is necessary for conducting a risk assessment, establishing cleanup criteria, and making decisions on further site actions.

Background data at Hayward ANGS for both IRP Sites No. 4 and No. 5 was obtained from one soil boring, BG-001BH, and one monitoring well, BG-001MW, which were used to obtain soil and groundwater samples, respectively (see Figure 5.1). Monitoring well BG-001MW is located 95 feet north of Building 3 and 160 feet east-southeast of Building 10. Soil boring BG-001BH is located 12 feet east of BG-001MW. BG-001BH was drilled because soil samples collected from BG-001MW were not submitted for laboratory analysis. The location of BG-001BH was selected because it is away from any known or suspected sources of contamination and is upgradient of IRP Site No. 4.

Soil and groundwater samples were collected for laboratory analysis from background locations to determine naturally occurring concentration levels, or contaminant concentrations already existing in the area due to general environmental conditions. Analytical results obtained during this sampling event represent background conditions against which contaminant concentrations at IRP Sites No. 4 and No. 5 were compared.

5.1.1.1 Soil Description

Background soil boring BG-001BH was drilled to a depth of 26.5 feet BLS and soil samples were collected on 12 August 1994. Black to dark brown organic silt was encountered from 6 inches to 3.0 feet BLS, brown very fine-grained sand and silt was encountered from 3.0 feet to 26.0 feet BLS, and brown sand was encountered from 26.0 feet BLS to total depth. Saturated conditions were encountered at a depth of 9.5 feet BLS. Monitoring well BG-001MW was drilled to a depth of 34.0 feet BLS, and soil samples collected for field screening with a Photovac 10S55 Portable GC, on 1 August 1994. Black to dark brown organic silt was



IRP SITE NO.4

W. WINTON AVENUE

LEGEND	
	Monitoring Well Location
	Soil Boring Location
	Station Boundary Fence Line
	Former Cable Training Area Excavation
	Groundwater Flow Direction
	Building
	IRP Site No. 4

0 55
SCALE IN FEET

FIGURE 5.1

BACKGROUND SOIL BORING AND
MONITORING WELL LOCATIONS
216th EIS & 234th CCSQ
Hayward ANG
Hayward, California

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encountered from 6 inches to 3.0 feet BLS; brown to dark gray sandy silt, silt, and clayey silt were encountered from 3.0 feet to 30.0 feet BLS; and brown gravelly sand was encountered from 30.0 feet BLS to total depth. Saturated conditions were encountered at a depth of 9.5 feet BLS. Complete lithologic logs are included in Appendix C.

5.1.2 Soil Sampling Results

5.1.2.1 Field GC Screening Results of Soil Samples

Six soil samples collected during the drilling of BG-001MW were field screened with a Photovac 10S55 Portable GC, calibrated to screen for BTEX. Due to insufficient sample recovery, soil samples collected from BG-001BH were not field screened using the GC. Table 5.1 summarizes the maximum concentrations detected in soil samples collected from BG-001MW. Complete GC data is included in Appendix D.

Table 5.1
Maximum Field GC Concentrations Detected in Soil Samples
Collected from Background Monitoring Well BG-001MW
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Compound	Sample Interval (feet BLS)	Maximum Concentrations Detected in Soil Samples (mg/kg)
Benzene	10.5	0.19
Toluene	10.5	23.65
Ethylbenzene	10.5	0.918
Xylenes	10.5	0.805

GC - Gas Chromatograph.
 mg/kg - milligrams per kilogram.

BLS - Below Land Surface.

The highest parameter concentrations were detected in the soil sampled at 10.5 feet BLS, which was screened three times to confirm the high readings. Benzene was detected at concentrations ranging from 0.004 to 0.19 mg/kg, toluene from 4.73 to 23.65 mg/kg, ethylbenzene from 0.06 to 0.918 mg/kg, and o-xylene from 0.161 to 0.805 mg/kg. Toluene was also detected at a concentration of 0.02 mg/kg in the sample collected at 20.5 feet BLS, at 0.093 mg/kg in the sample collected at 25.5 feet BLS, and at 0.057 mg/kg in the sample collected at 30.5 feet BLS.

5.1.2.2 Soil Sampling Analytical Results

Two investigative soil samples were collected from BG-001BH for laboratory analysis. Soil samples were collected from 1.5 feet BLS and 9.0 feet BLS, and were analyzed for VOCs by USEPA Method SW8240, TPH (both as diesel and as gasoline) by USEPA Method 8015 (modified), and lead by USEPA Method SW6010.

VOC surrogate recoveries ranged from 96 to 111 percent, which is within acceptable limits. Quality assurance/quality control (QA/QC) sample analytical results are reported in Appendix F. A complete listing of the results for all analytical parameters for each sample is given in Appendix G.

The VOC carbon disulfide was detected at a concentration of 0.008 mg/kg in the soil sample collected from BG-001BH at 1.5 feet BLS, but was not detected in the sample collected at 9.0 feet BLS. Carbon disulfide is a common laboratory contaminant, which is used in the extraction process.

TPH and lead were not detected in the soil samples collected from BG-001BH.

5.1.3 Groundwater Sampling Results

Two groundwater samples and one duplicate sample were collected from BG-001MW on 10 August 1994 to determine background groundwater quality.

5.1.3.1 Field GC Screening Results of Groundwater Samples

Two groundwater samples, collected from BG-001MW during the first round of groundwater sampling in August, were field screened with a Photovac 10S55 Portable GC, and calibrated to screen for BTEX. Table 5.2 summarizes the maximum concentrations detected in groundwater samples collected from BG-001MW. Complete GC data is included in Appendix D.

Toluene was detected at a concentration of 271 $\mu\text{g/L}$ in the first groundwater sample and at 304 $\mu\text{g/L}$ in the second. Benzene, ethylbenzene, and xylenes were not detected in the groundwater samples collected from BG-001MW.

Table 5.2
Maximum Field GC Concentrations Detected in Groundwater Samples
Collected from Background Monitoring Well BG-001MW
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Compound	Maximum Concentrations Detected in Groundwater Samples ($\mu\text{g/L}$)
Toluene	304

GC – Gas Chromatograph.

$\mu\text{g/L}$ – micrograms per liter.

5.1.3.2 Groundwater Sampling Analytical Results

Two investigative and one duplicate groundwater samples were collected on 10 August 1994 from BG-001MW for laboratory analysis. Another background groundwater sample was obtained on 7 December 1994. Groundwater samples were analyzed for VOCs by USEPA Method SW624, TPH (both as diesel and as gasoline) by USEPA Method 8015 modified, and lead by USEPA Methods SW6010 and SW6020.

VOC surrogate recoveries ranged from 94 to 101 percent, which is within acceptable limits. QA/QC sample analytical results are reported in Appendix F. A complete listing of the results for all analytical parameters for each sample is given in Appendix G.

Neither TPH-D nor VOCs were detected in groundwater samples collected from BG-001MW.

TPH-G and lead were detected in groundwater samples collected from BG-001MW (see Table 5.3).

TPH-G was detected at a concentration of 250 $\mu\text{g/L}$ in the second groundwater sample collected and 190 $\mu\text{g/L}$ in the third groundwater sample collected, but was not detected in either the first sample or in the duplicate sample. Lead was detected at a concentration of 6,700 $\mu\text{g/L}$ in the duplicate groundwater sample, which exceeds the California DHS Primary Maximum Contaminant Level (MCL) of 50 $\mu\text{g/L}$, but was not detected in either the first, second, or third sample.

Table 5.3
Analytical Results of Groundwater Samples
Collected from Background Monitoring Well BG-001MW
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Sample ID Number	Date	Gasoline ($\mu\text{g/L}$)	Lead ($\mu\text{g/L}$)
BG-001MW-A	10 August 1994	100U	1,000U*
BG-001MW-A duplicate	10 August 1994	100U	6,700
BG-001MW-B	10 August 1994	250	1,000U*
BG-001MW-C	7 December 1994	190	50U
California DHS Primary MCL		NA	50

BG – Background.

MW – Monitoring Well.

$\mu\text{g/L}$ – micrograms per liter.

U – Compound was analyzed for but not detected.

Number preceding "U" indicates the detection limit.

DHS – Department of Health Services.

MCL – Maximum Contaminant Level.

NA – Not Available.

* – Detection limit raised due to laboratory dilution during analysis.

5.2 STATION-WIDE RESULTS

5.2.1 Piezometer Installation Results

Three piezometers were installed on 27 and 28 July 1994 to determine groundwater flow direction prior to installation of any groundwater monitoring wells. Piezometer PZ-001 was drilled to a depth of 22.0 feet BLS, PZ-002 was drilled to a depth of 20.5 feet BLS, and PZ-003 was drilled to a depth of 22.0 feet BLS. All three piezometers had screens set from 15 to 20 feet BLS. Piezometer locations at Hayward ANGS are shown in Figure 5.2.

Water level measurements taken from the piezometers on 29 July 1994 indicated groundwater flow direction to be to the southwest.

5.2.2 Subsurface Geology

Soil samples, collected from nine soil borings and five monitoring wells at IRP Sites No. 4 and No. 5, were used to provide geologic information for describing the subsurface geology. Complete lithologic logs for the borings and monitoring wells installed during this investigation are presented in Appendix C.

At IRP Site No. 4, fill material, consisting of yellowish-brown to dark brown gravelly silt, was encountered in the soil borings from surface to a depth of 1.5 feet BLS. Underlying the fill material is black organic silt to a depth of 3.0 feet BLS. The predominant lithology encountered from 3.0 feet to 30.5 feet BLS is yellowish-brown to olive brown silt and silty clay. Saturated

conditions were encountered at a depth of 10.5 feet BLS. Hydrogeologic cross sections depicting the subsurface geology at IRP Site No. 4 are indexed on Figure 5.3 and shown in Figures 5.4 and 5.5.

At IRP Site No. 5, asphalt was present at the sampling locations from the ground surface to a depth of 6 inches. Fill material beneath the asphalt, which consisted of dry gravelly silt and brown silty sand, was encountered in the soil borings to a depth of 1.5 feet BLS. Underlying the fill material was dry black organic silt to a depth of 2.5 feet BLS. The predominant lithology encountered from 2.5 feet to 15.5 feet BLS was brown to dark greenish-gray silt and silty clay. Moist to saturated conditions were encountered at depths of approximately 10.0 feet BLS. Hydrogeologic cross sections depicting the subsurface geology at IRP Site No. 5 are indexed on Figure 5.6 and shown in Figures 5.7 and 5.8.

5.2.3 Groundwater Conditions

Two monitoring wells were installed at IRP Site No. 4, and three wells were installed at IRP Site No. 5. The monitoring wells were used to provide geologic information and water level data, and for collection of soil and groundwater investigative samples. Site-specific investigative results are discussed later in this subsection.

Groundwater was encountered in monitoring wells at both sites under unconfined conditions at a depth of 10.0 to 10.5 feet BLS. On 3 August 1994, monitoring well 04-001MW at IRP Site No. 4 was drilled to a total depth of 28.5 feet BLS. On 2 August 1994, monitoring well 04-002MW was drilled to a depth of 30.5 feet BLS. On 4 August 1994, monitoring wells 05-001MW, 05-002MW and 05-003MW at IRP Site No. 5 were drilled to depths of 29.0 feet, 29.5 feet, and 28.5 feet BLS, respectively. With the exception of monitoring well 05-001MW, all wells had screens set from 8.0 to 28.0 feet BLS in a water-bearing silt. In monitoring well 05-001MW, the screen was set from 8.5 to 20.0 feet BLS.

Temperature, pH, and specific conductance (millimhos (mmhos)) were measured prior to the collection of the first, second, third, and fourth groundwater samples as well as during well development. First round data is included in Table 5.4.

Water temperature varied from 70.0° F to 74.0° F. The pH varied from 6.21 to 6.74. Specific conductance varied from 1,019 to 1,330 millimhos (mmhos).

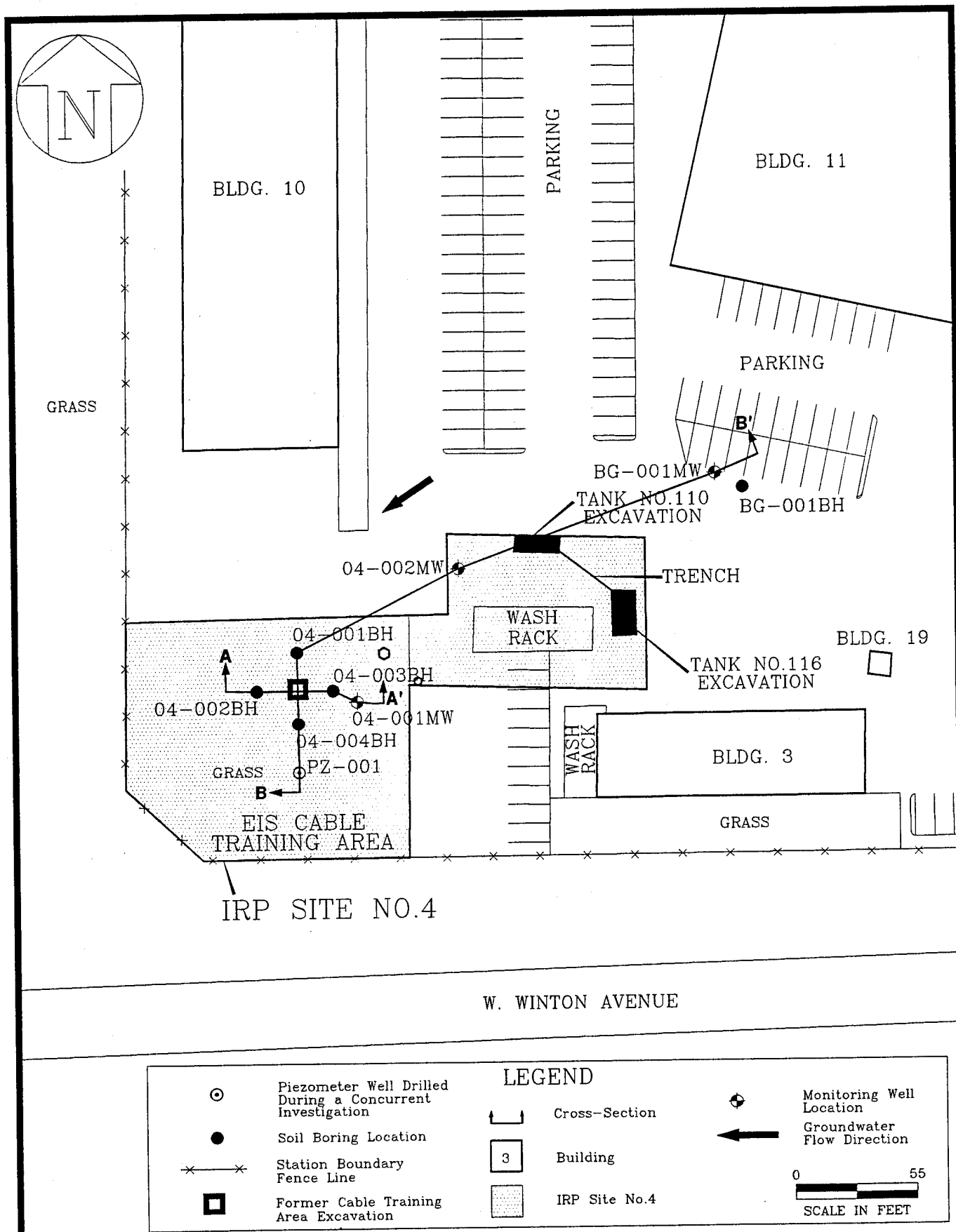
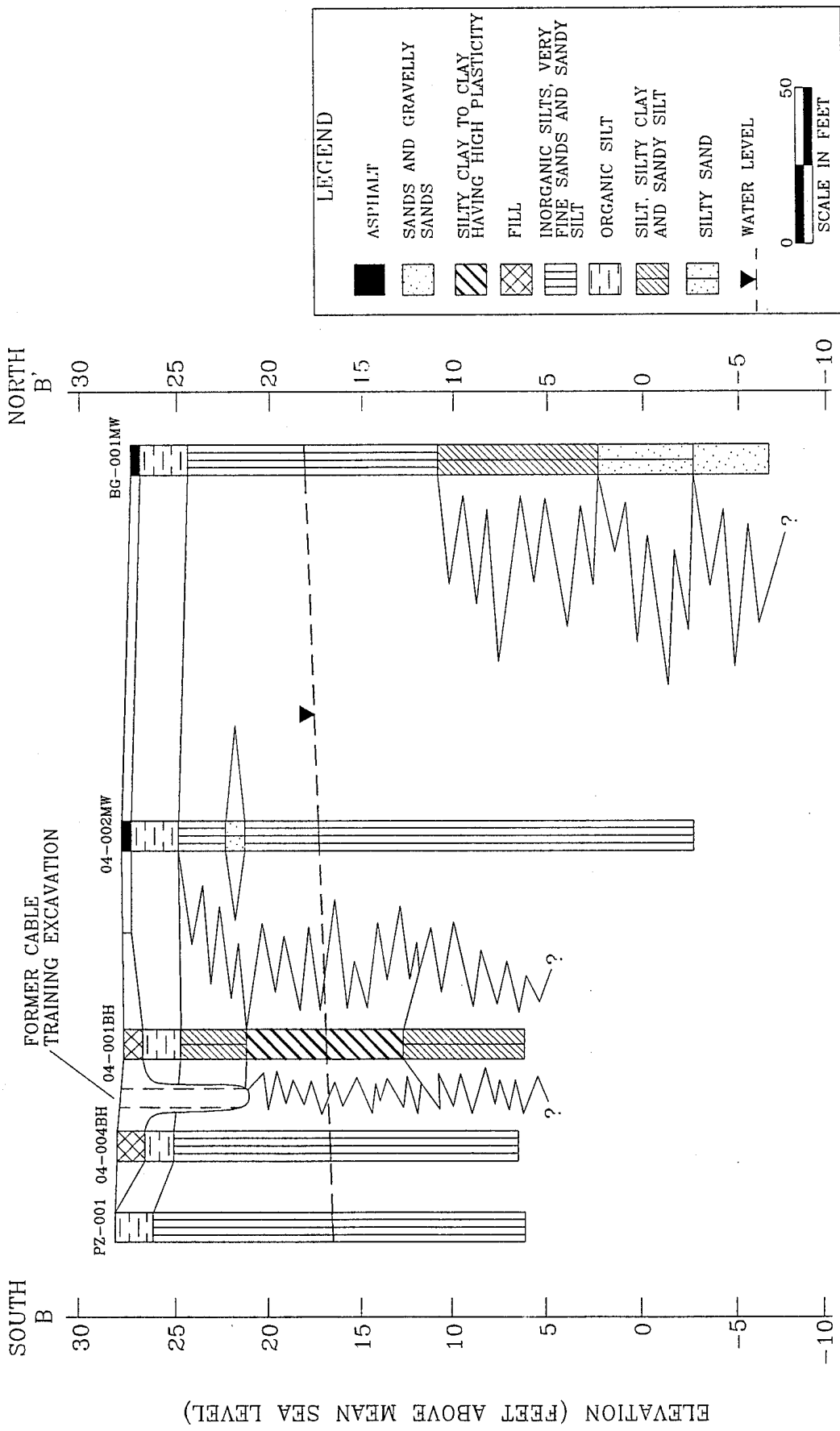


FIGURE 5.3 LOCATION OF HYDROGEOLOGIC CROSS-SECTIONS A-A' AND B-B' AT IRP SITE NO.4
 216th EIS & 234th CCSQ
 Hayward ANG
 Hayward, California

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HYDROGEOLOGIC CROSS-SECTION B-B'
 AT IRP SITE NO.4 ON 10 AUGUST 1994
 216th EIS & 234th CCSQ
 Hayward ANGCS
 Hayward, California

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FIGURE 5.5

HAYWARD\CROSS5-7

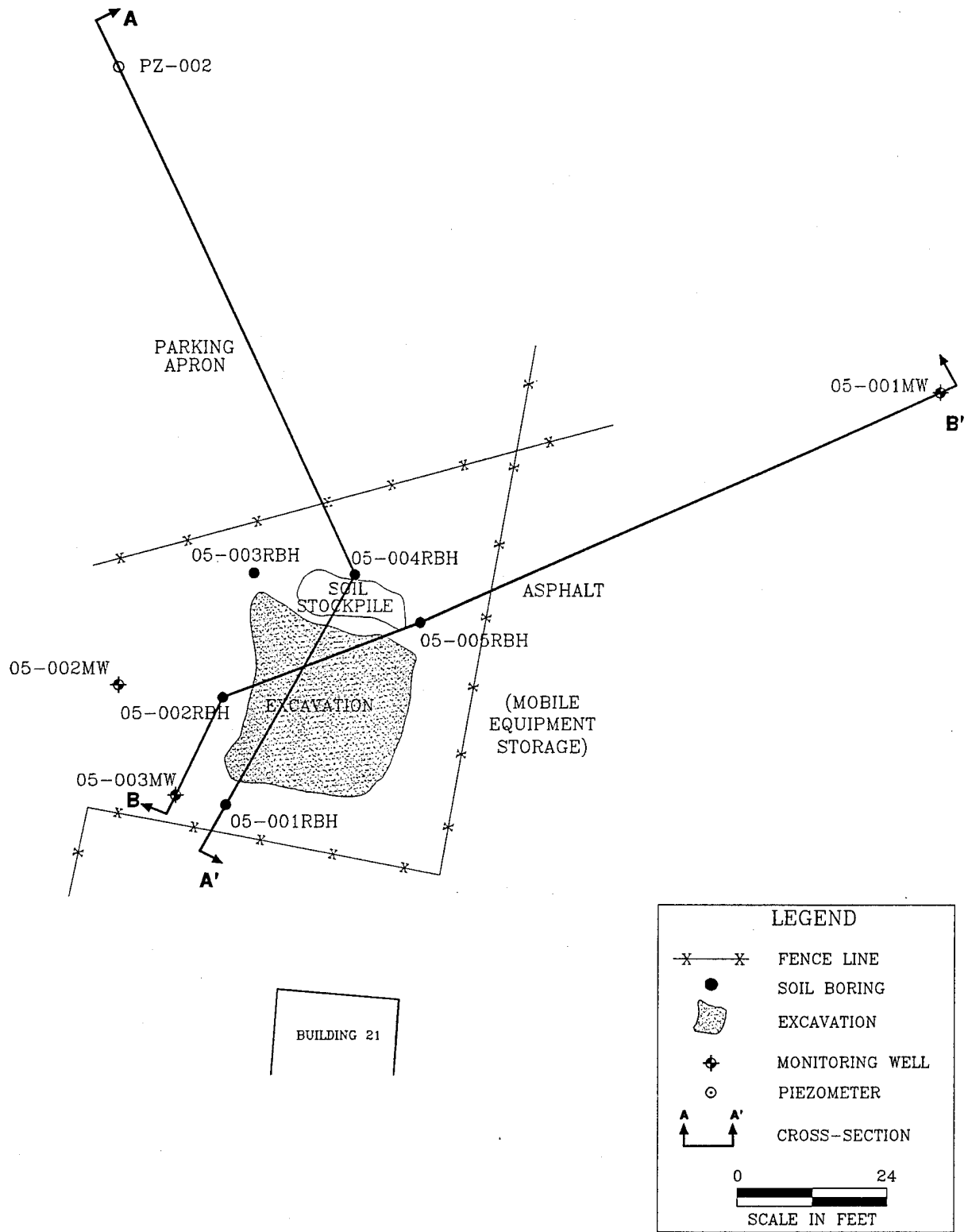
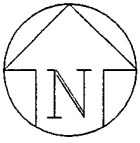


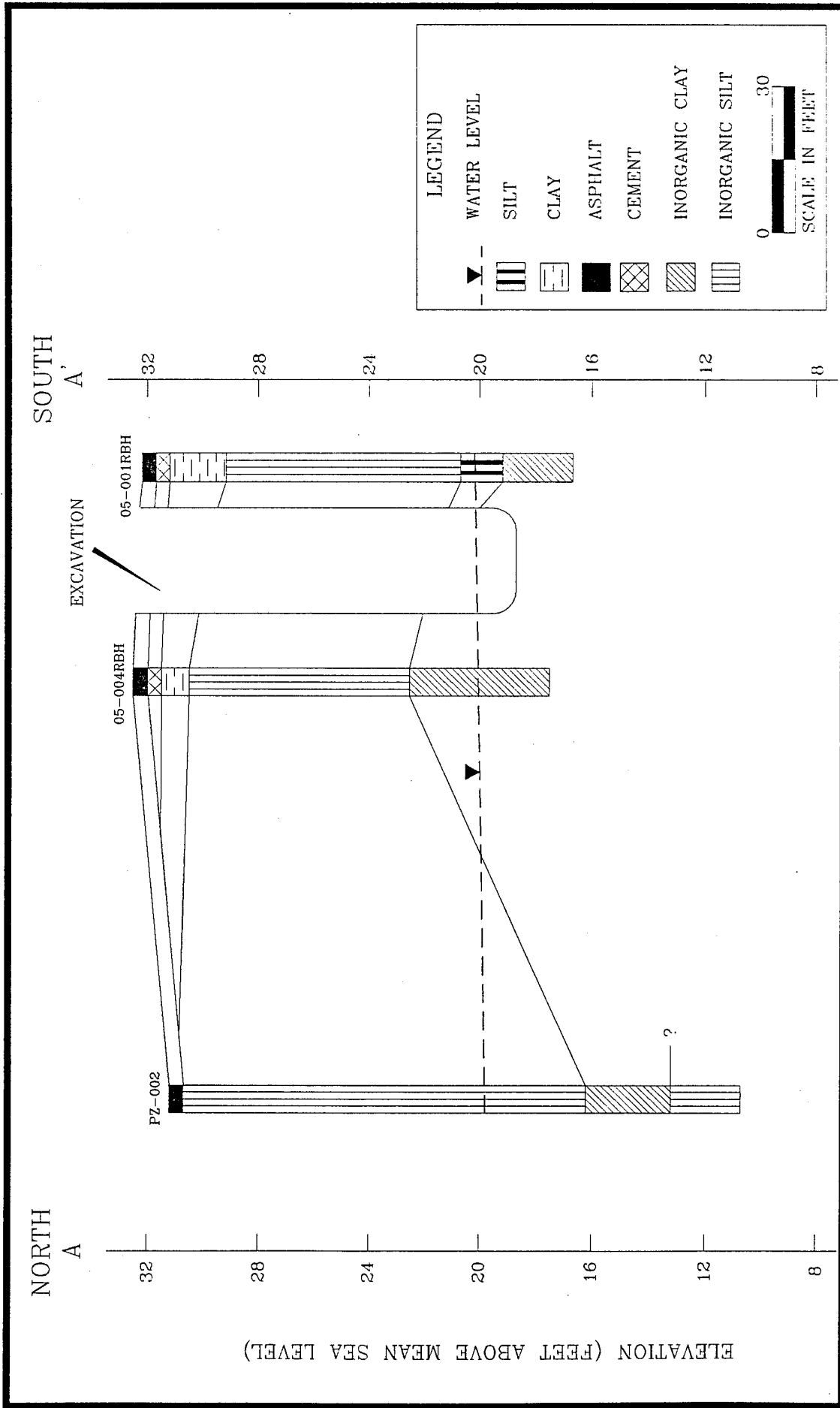
FIGURE 5.6

LOCATION OF HYDROGEOLOGIC
CROSS-SECTIONS A-A' AND B-B'
AT IRP SITE NO.5
216th EIS & 234th CCSQ
Hayward ANG
Hayward, California

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HYDROGEOLOGIC CROSS-SECTION A-A'
 AT IRP SITE NO.5 ON 6 AUGUST 1994
 216th EIS & 234th CCSQ
 Hayward ANG
 Hayward, California

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MARCH 1996

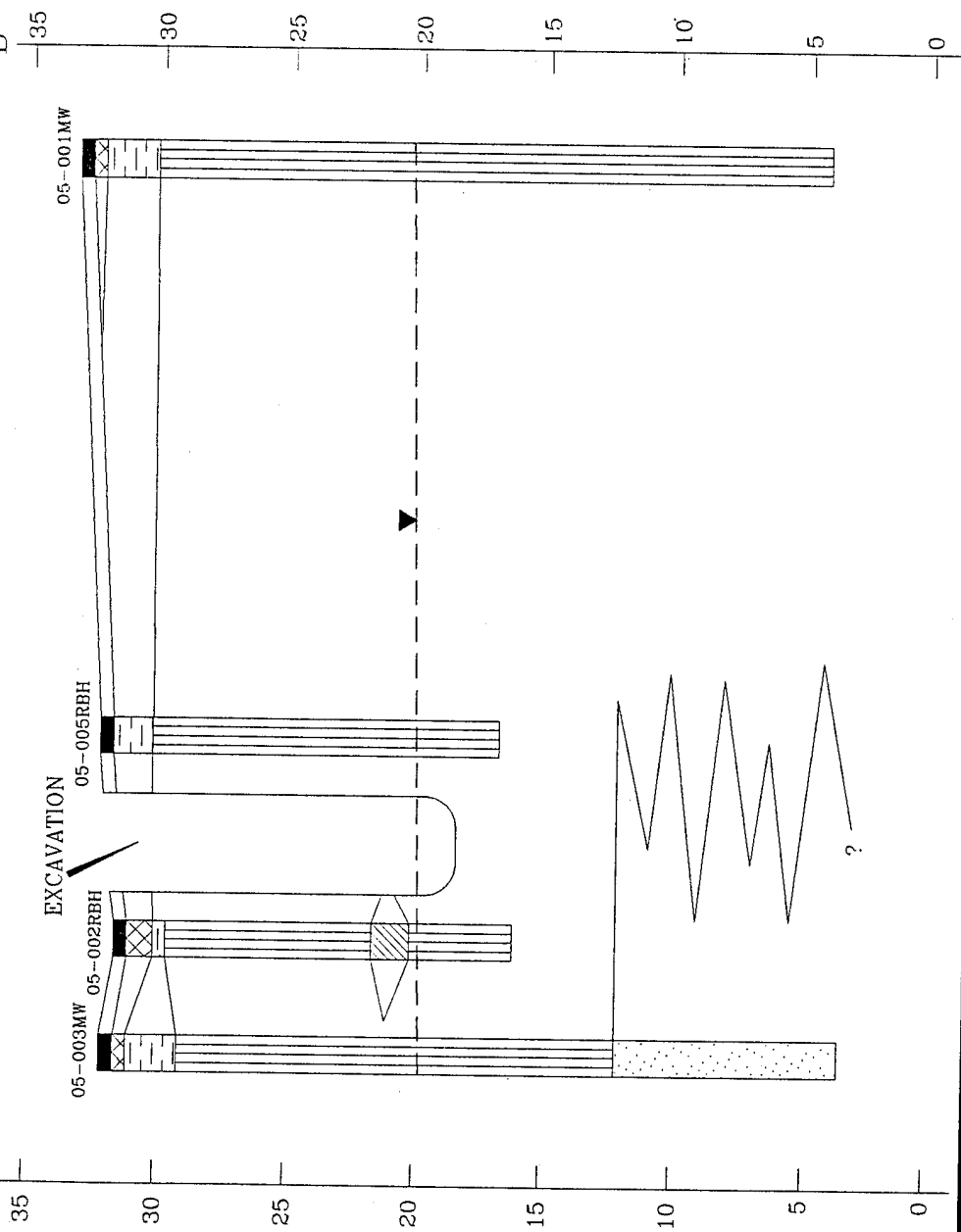
FIGURE 5.7

HAYWARD/CROSSA

SOUTHWEST
B

NORTHEAST
B

ELEVATION (FEET ABOVE MEAN SEA LEVEL)



HYDROGEOLOGIC CROSS-SECTION B-B'
 AT IRP SITE NO.5 ON 6 AUGUST 1994
 216th EIS & 234th CCSQ
 Hayward ANG
 Hayward, California

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MARCH 1996

FIGURE 5.8

HAYWARD/CROSSEB

Table 5.4
Temperature, pH, and Specific Conductance Measurements
Recorded During Well Development at IRP Sites No. 4 and No. 5
216th EIS and 234th CCSQ, Hayward ANG, Hayward, California

Monitoring Well Number	Temperature (° F)	pH	Specific Conductance (mmhos)
BG-001MW	72.9	6.65	1,330
04-001MW	70.9	6.40	1,292
04-002MW	72.1	6.59	1,140
05-001MW	70.0	6.21	1,221
05-002MW	72.8	6.29	1,281
05-003MW	74.0	6.74	1,019

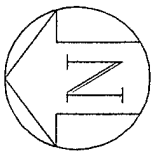
BG - Background.
 MW - Monitoring Well.

° F - Degrees Fahrenheit.
 mmhos - millimhos.

Water level measurements were taken at all monitoring wells after well development and prior to sampling in August and December 1994. At IRP Site No. 4, measurements from an existing monitoring well, located near the UST No. 116 excavation and piezometer PZ-001, were included as control points to define groundwater flow direction and hydraulic gradient at the site. Groundwater flow direction across both sites varies from west/southwest to west/northwest at an average hydraulic gradient ranging from 0.003 to 0.005 feet per foot. Figures 5.9 and 5.10 are Station-wide potentiometric surface maps for 10 August and 7 December 1994, respectively.

The hydraulic conductivity of the shallow water-bearing zone at both sites was estimated by conducting rising head slug tests in all monitoring wells. Slug tests were performed on 13 October 1994. Each test was performed by placing a clean solid PVC "slug" into the well to displace a known volume of groundwater. After displaced groundwater levels restabilized within the well, the slug was retrieved rapidly from the monitoring well. The rate of the respondent water level rise within the well was recorded by measuring water pressure transients using a transducer interfaced with an automatic data logger. Specific details regarding the field methods and raw data outputs are provided in Appendix E.

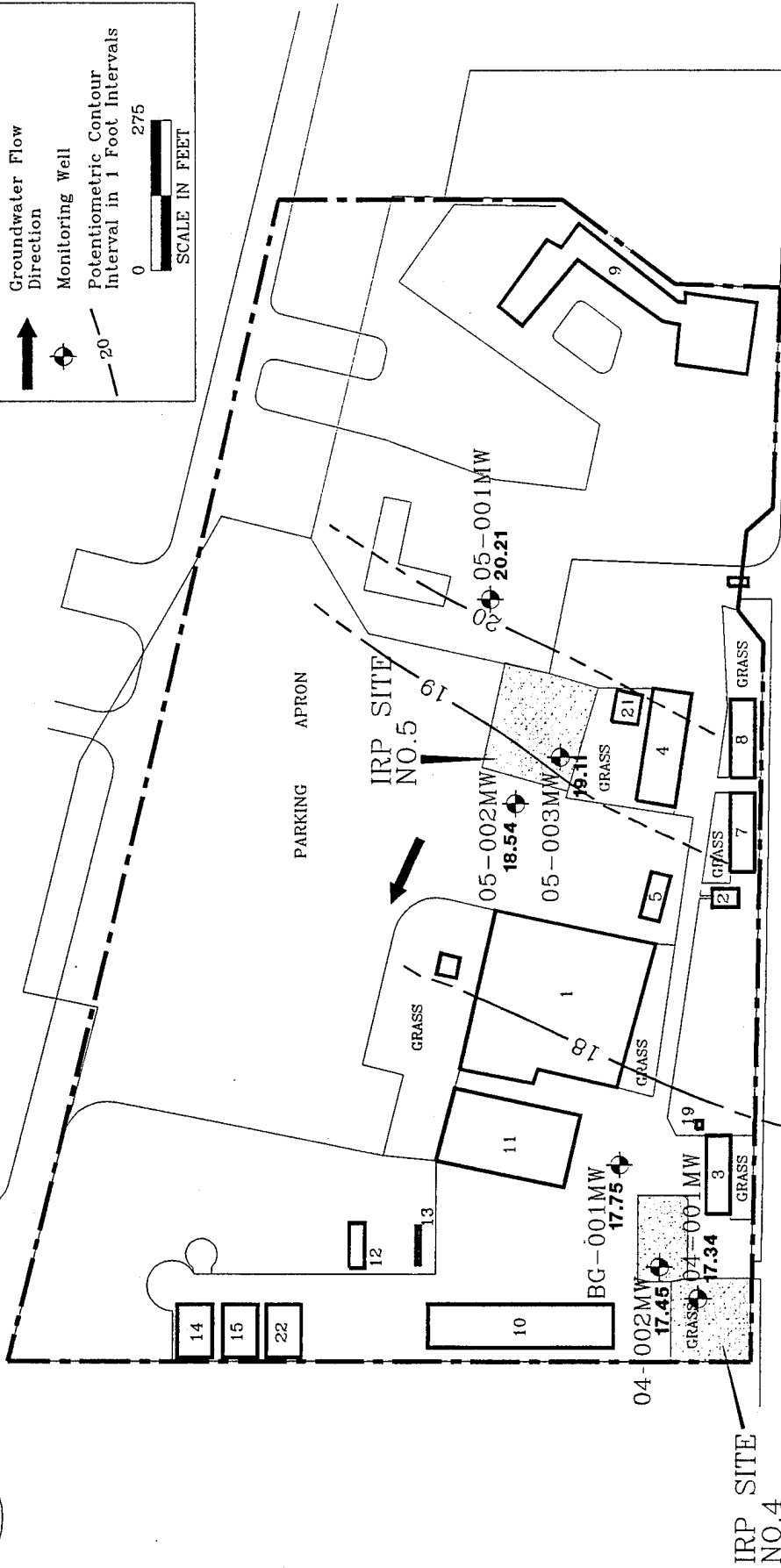
Slug test data was analyzed by the Bouwer and Rice Method (Bouwer and Rice, 1976). This method employs the computer program, "AQTESOLV" Version 2 by Geraghty & Miller, Inc. The method is applicable to determining values of hydraulic conductivity in unconfined aquifers. The solution equation for the method, along with a description of the solution elements and critical assumptions, is provided in Appendix E.



LEGEND

- Building
- Station Boundary
- Groundwater Flow Direction
- Monitoring Well
- Potentiometric Contour Interval in 1 Foot Intervals
- IRP Site

0 275
SCALE IN FEET



SOURCE: HAYWARD ANGS BASE PLANS.

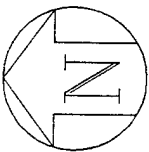
POTENTIOMETRIC SURFACE MAP
ON 10 AUGUST 1994
216th EIS & 234th CCSQ
Hayward ANGS
Hayward, California

FIGURE 5.9

HAYWARD HAYS-2LO

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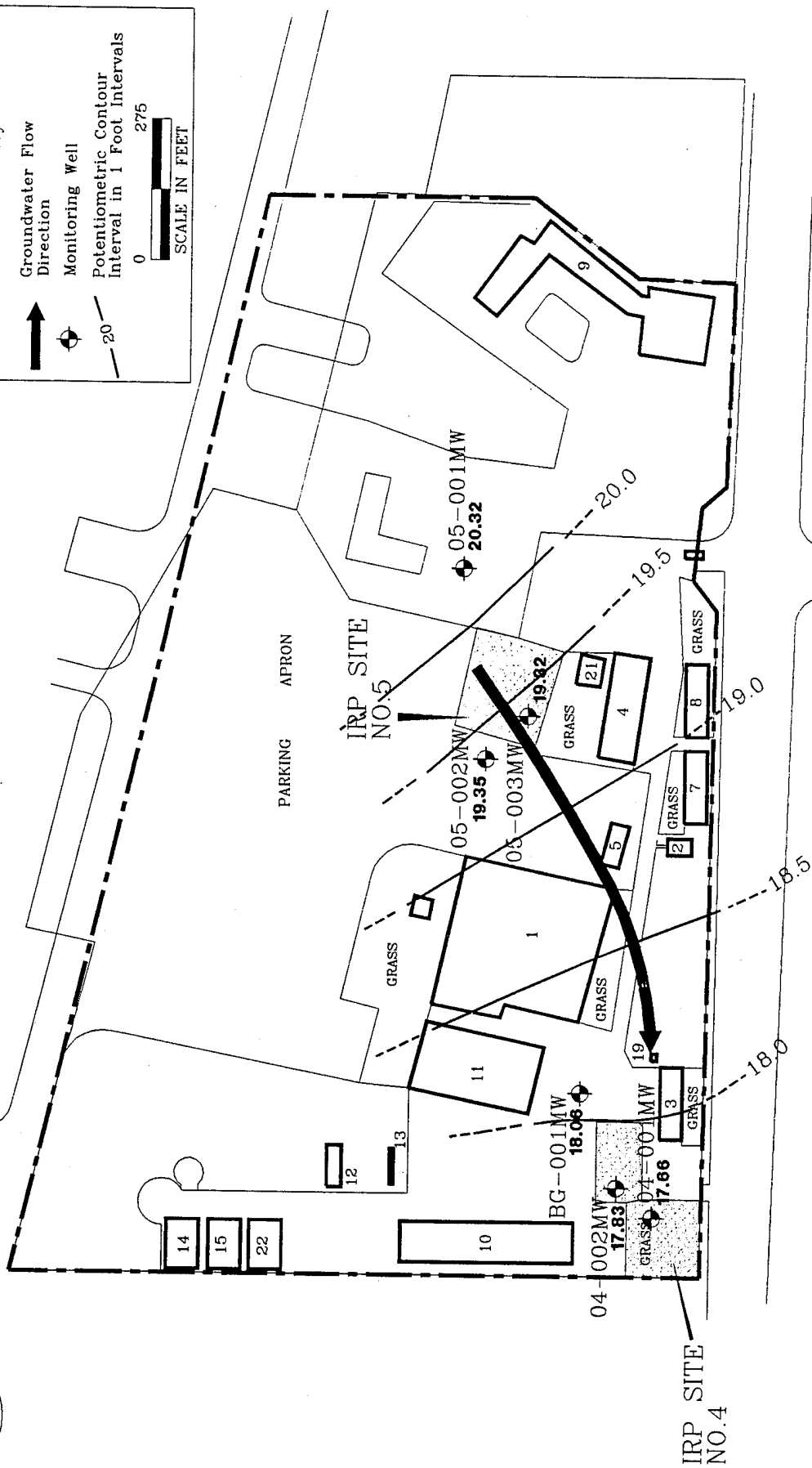
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LEGEND

- Building (represented by a rectangle with a number inside)
- Station Boundary (represented by a dashed line)
- Groundwater Flow Direction (represented by a thick black arrow)
- Monitoring Well (represented by a circle with a dot and a number)
- IRP Site (represented by a shaded area)
- Potentiometric Contour Interval in 1 Foot Intervals (represented by a dashed line with a number)

SCALE IN FEET
0 275



SOURCE: HAYWARD ANG'S BASE PLANS.

POTENTIOMETRIC SURFACE MAP
ON 7 DECEMBER 1994
216th EIS & 234th CCSQ
Hayward ANG'S
Hayward, California

FIGURE 5.10

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The estimated hydraulic conductivity of the saturated zones at IRP Sites No. 4 and No. 5 is presented in Table 5.5.

Table 5.5
Summary of Slug Test Results Performed at IRP Sites No. 4 and No. 5
on 13 October 1994
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Monitoring Well Number and Site	Horizontal Hydraulic Conductivity (gal/day/ft ²)	Horizontal Hydraulic Conductivity (cm/sec)
BG-001MW – Background	204.88	9.66 x 10 ⁻³
04-001MW – IRP Site No. 4	984.82	4.64 x 10 ⁻²
04-002MW – IRP Site No. 4	378.90	1.79 x 10 ⁻²
05-001MW – IRP Site No. 5	85.15	4.02 x 10 ⁻³
05-002MW – IRP Site No. 5	13.43	6.33 x 10 ⁻⁴
05-003MW – IRP Site No. 5	58.47	2.76 x 10 ⁻³

gal/day/ft² – gallons per day per square foot. cm/sec – centimeters per second.
 BG – Background. MW – Monitoring Well.

Averaged groundwater flow velocities were calculated from the slug test data using the following equation:

$$V = 0.134 \frac{KI}{n_e}$$

Where:

- V = Groundwater velocity in feet per day;
- K = Horizontal hydraulic conductivity in gal/day/ft²;
- I = Hydraulic gradient in feet per foot; and
- n_e = Aquifer net effective porosity, dimensionless.

The following values were used:

K = Values for hydraulic conductivity (gpd/ft²) as estimated in monitoring wells 04-001MW, 04-002MW, 5-001MW, 05-002MW, and 05-003MW (Table 5.5).

I = 0.004 feet per foot: averaged values for groundwater gradient measured on 10 August and 7 December 1994.

n = 0.21: 50% of average values common to unconsolidated silt (Driscoll, 1986).

Based on the slug test and groundwater gradient data collected during this investigation, the average groundwater flow velocity estimated at IRP Site No. 4 ranges from 190 to 916 feet per year; at IRP Site No. 5 it ranges from 11 to 80 feet per year.

5.3 IRP SITE NO. 4 (LEAKING VEHICLE MAINTENANCE USTs) FINDINGS

IRP Site No. 4 is shown in Figure 5.11. The site location with respect to nearby sanitary sewers and water lines is shown in Figure 5.12.

5.3.1 Soil Investigation Findings

Four soil borings were installed at IRP Site No. 4 to obtain soil samples for laboratory analysis, to define any existing soil contamination, and to aid in defining the vertical and horizontal extent of contamination. Soil samples were also used to characterize site geology and subsurface soil conditions.

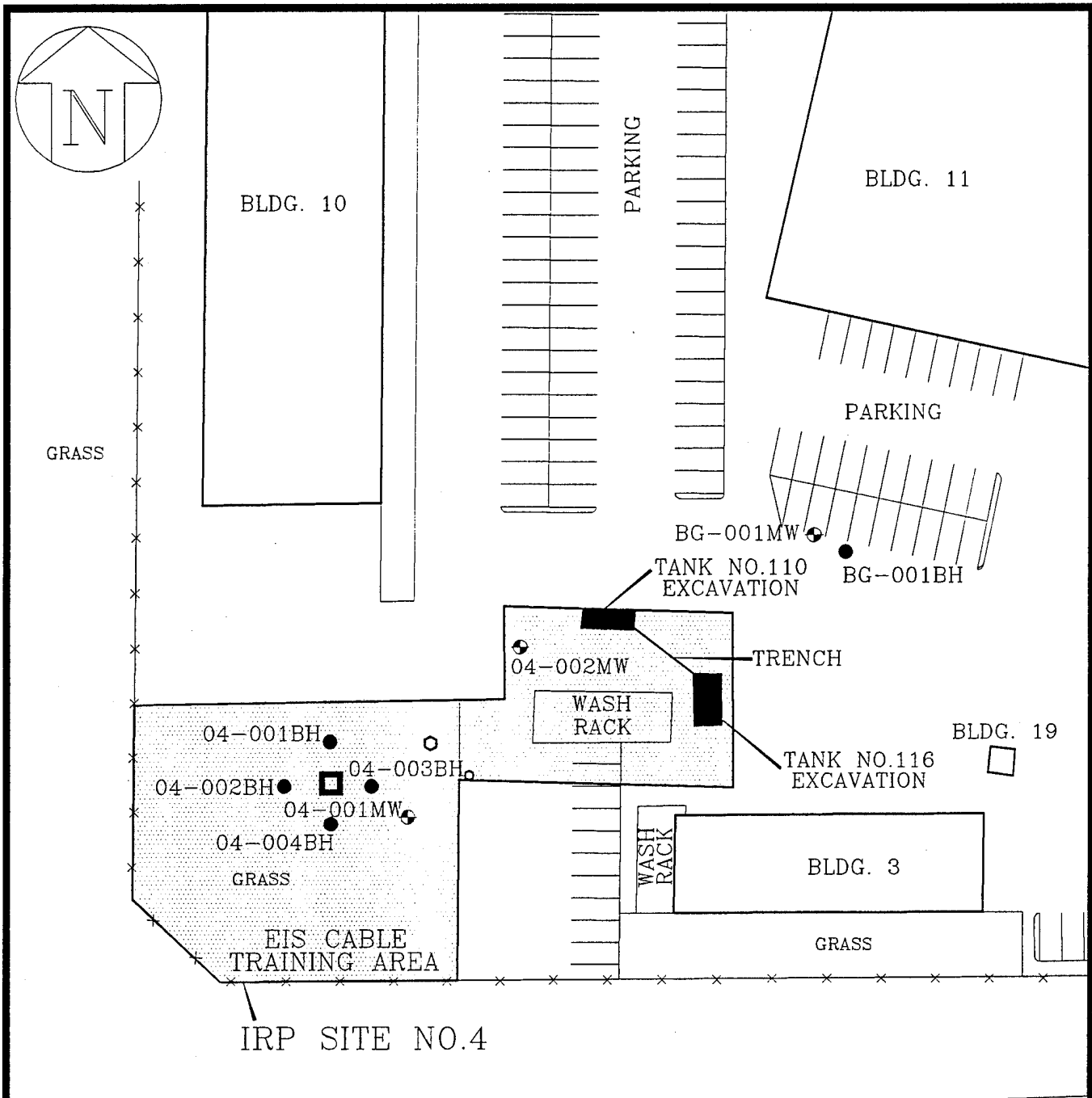
5.3.1.1 Soil Boring Locations

Soil borings were located around the perimeter of the former excavation in the cable training area. The actual excavation was located further to the south than depicted in the Work Plan, so all boring locations were relocated south of their respective, originally proposed, location. The soil boring locations are indicated on Figure 5.11.

5.3.1.2 Nature and Extent of Soil Contamination

5.3.1.2.1 Field GC Screening Results of Soil Samples

At IRP Site No. 4, 33 soil samples were collected, 21 from four soil borings drilled on 28 July 1994, and 12 from two monitoring wells drilled on 2 and 3 August 1994. These were field screened with a Photovac 10S55 Portable GC, calibrated to screen for BTEX. Complete GC data is included in Appendix D.



IRP SITE NO.4

W. WINTON AVENUE

LEGEND	
	Monitoring Well Location
	Soil Boring Location
	Station Boundary Fence Line
	Former Cable Training Area Excavation
	Building
	IRP Site No. 4

0 55
SCALE IN FEET

FIGURE 5.11

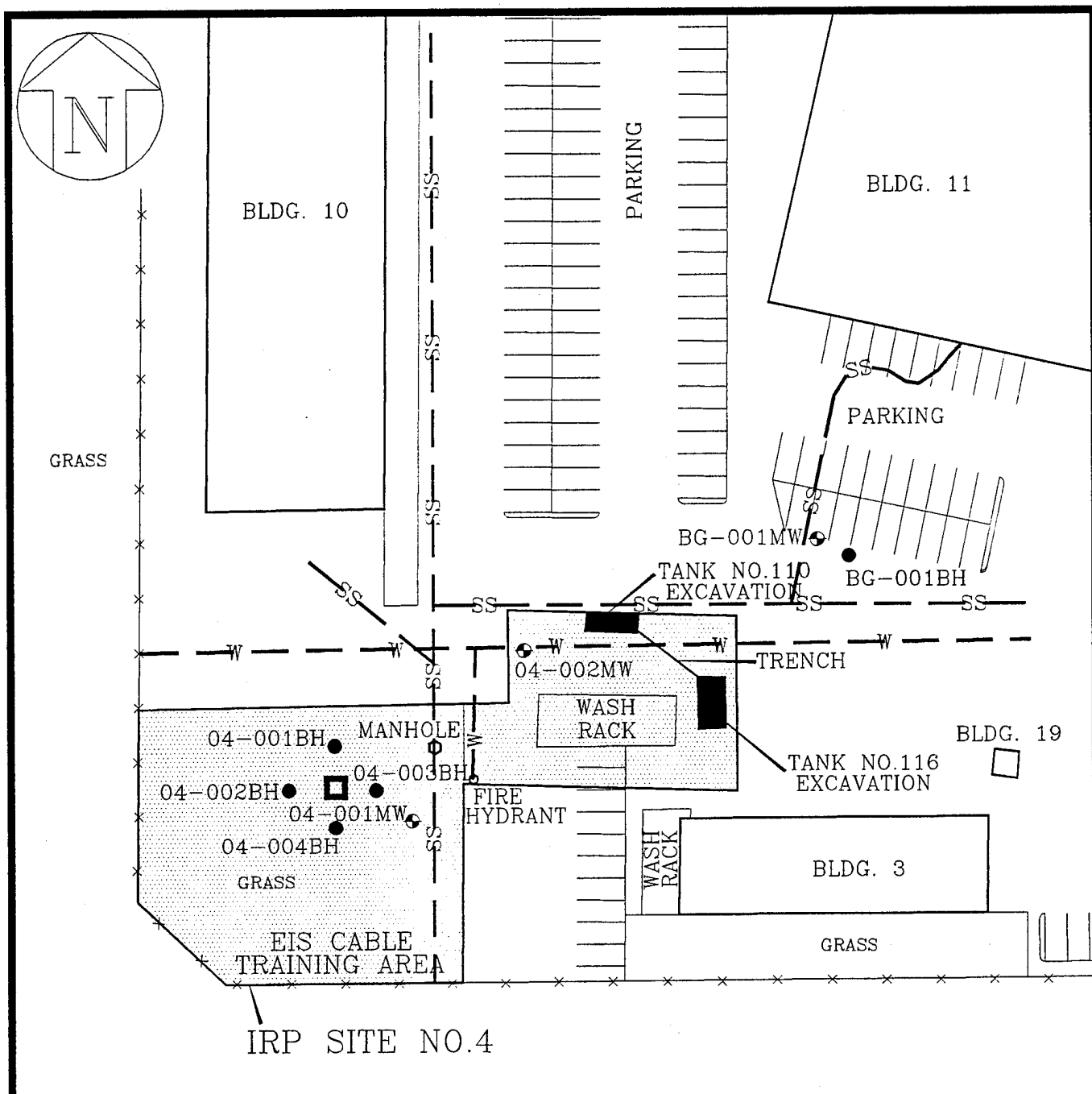
IRP SITE NO.4 SITE PLAN

216th EIS & 234th CCSQ
Hayward ANG S
Hayward, California

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IRP SITE NO.4

W. WINTON AVENUE

LEGEND	
	Monitoring Well Location
	Soil Boring Location
	Station Boundary Fence Line
	Former Cable Training Area Excavation
	Sanitary Sewer
	Water
	Building
	IRP Site No. 4

0 55
SCALE IN FEET

FIGURE 5.12

LOCATION OF SANITARY SEWER AND
WATER LINES AT IRP SITE NO.4
216th EIS & 234th CCSQ
Hayward ANG5
Hayward, California

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Parameters were detected only in soil from 04-001BH and 04-002MW. The highest concentrations of toluene and o-xylene were detected in the soil from 04-002MW-10.5' (see Figure 5.13). The highest concentrations of benzene and ethylbenzene were detected in the soil from 04-001BH-11.5' (Figure 5.13). At IRP Site No. 4, field screening displayed toluene was detected at concentrations ranging from 0.021 mg/kg to 5.22 mg/kg in five of the 33 soil samples analyzed; o-xylene from 0.12 mg/kg to 1.26 mg/kg in two of the samples; and benzene and ethylbenzene at a concentration of 0.328 mg/kg and 0.641 mg/kg, respectively, in one of the samples.

The soil from 04-002MW-10.5' was screened three times to confirm high readings. Toluene was detected at concentrations ranging from 2.29 mg/kg to 5.22 mg/kg, and o-xylene from 0.7446 to 1.26 mg/kg.

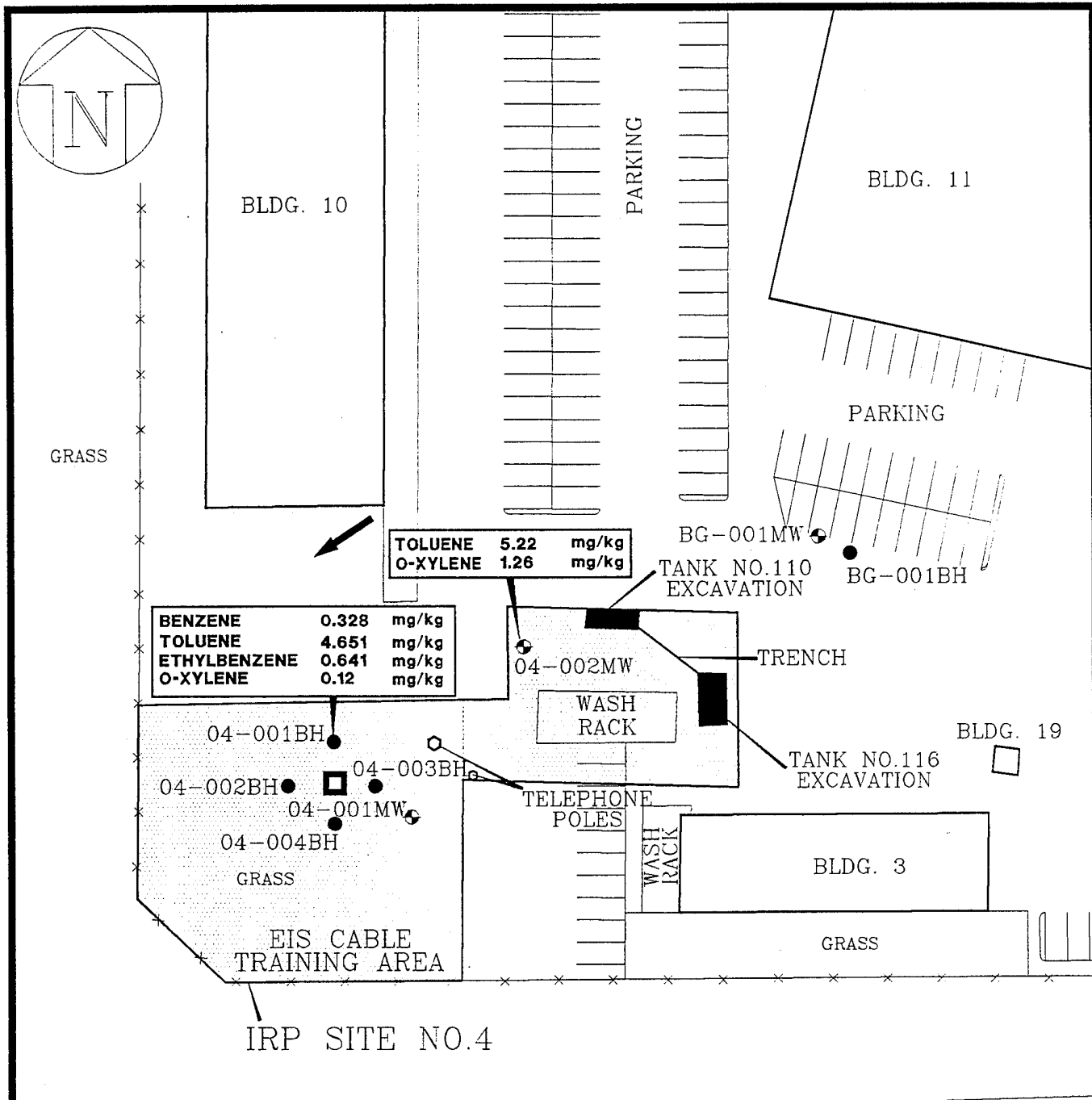
Benzene was detected at a concentration of 0.328 mg/kg, toluene at 4.551 mg/kg, ethylbenzene at 0.641 mg/kg, and o-xylene at 0.12 mg/kg in the soil from 04-001BH-11.5'. Analytical results on the soil sample submitted for analysis from this depth did not confirm the presence of these compounds. Toluene was also detected at concentrations of 0.021 mg/kg and 0.056 mg/kg in the samples collected from a depth of 15.5 and 21.5 feet BLS, respectively. The presence of toluene was not confirmed in the soil sample submitted for analysis from a depth of 21.0 feet BLS.

5.3.1.2.2 Soil Sample Analytical Results

Four soil borings were drilled at IRP Site No. 4, from which 12 investigative and two duplicate soil samples were collected for laboratory analysis. The borings were installed to a depth of 21.5 feet BLS and soil samples collected on 28 July 1994.

Acetone and methylene chloride were the only VOCs detected in soil samples collected from IRP Site No. 4. Acetone was detected at a concentration of 0.014 mg/kg in one soil sample, and methylene chloride was detected at concentrations of 0.005 mg/kg and 0.006 mg/kg in five of the soil samples collected from IRP Site No. 4. Acetone and methylene chloride are suspected to be laboratory contaminants and probably do not represent site contamination.

VOC surrogate recoveries ranged from 82 to 112 percent, which is within acceptable limits, except for samples 04-001BH-1' and 04-003BH-1', which were outside of quality control limits. VOC matrix spike recoveries ranged from 94 to 152 percent, which is within acceptable ranges.



IRP SITE NO.4

W. WINTON AVENUE

LEGEND		Note: Concentration values reflect highest Analyte Concentration detected at location (Not depth-specific)	
	Monitoring Well Location		 Groundwater Flow Direction
	Soil Boring Location		
	Station Boundary Fence Line		 Building
	Former Cable Training Area Excavation	 IRP Site No. 4	
			 SCALE IN FEET

FIGURE 5.13

FIELD GC SCREENING RESULTS
 FROM SOIL AT IRP SITE NO.4
 216th EIS & 234th CCSQ
 Hayward ANG5
 Hayward, California

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QA/QC sample analytical results are reported in Appendix F. A complete listing of the results for all analytical parameters for each sample is given in Appendix G.

TPH was not detected in soil samples collected from IRP Site No. 4.

Lead was detected in soil samples collected from IRP Site No. 4 at concentrations ranging from 7.3 to 590.0 mg/kg (Table 5.6). The highest concentrations of lead were detected in soil sampled from a depth of 1.0 to 1.5 feet BLS; lead concentrations below this depth ranged from 7.3 to 15.0 mg/kg.

Table 5.6
Lead Detected in Soil Samples Collected from IRP Site No. 4
216th EIS and 234th CCSQ, Hayward ANG, Hayward, California

Sample ID Number	Lead (mg/kg)
04-001BH-1'	210.0
04-001BH-11'	7.3
04-001BH-21'	8.3
04-002BH-1'	11.0
04-002BH-6'	10.0
04-002BH-11'	5.0U
04-003BH-1'	59.0
04-003BH-6'	11.0
04-003BH-11'	8.6
04-004BH-1.5'	590.0
04-004BH-1.5' duplicate	20.0
04-004BH-6'	15.0
04-004BH-7'	14.0
04-004BH-11.5'	5.0U
04-004BH-11.5' duplicate	5.0U
Background	10.0U
LUFT Value	200

mg/kg – milligrams per kilogram.
 BH – Borehole.
 LUFT – Leaking Underground Fuel Tank.

U – Compound was analyzed for but not detected.
 Number preceding "U" indicates the detection limit.
 ' – feet Below Land Surface.

The highest concentrations of lead were detected in the soil from 04-001BH and 04-004BH. Lead was detected at a concentration of 590.0 mg/kg in the sample from 04-004BH-1.5', but was detected at only 20 mg/kg in the duplicate sample. Lead was detected at a concentration of 210.0 mg/kg in the sample from 04-001BH-1.0'. Lead was detected at a concentration of 59.0 mg/kg in the sample from 04-003BH-1.0'. The only lead concentrations that exceed the total lead value of 200 ppm, derived from the Leaking Underground Fuel Tank (LUFT) Manual

Leaching Potential Analysis chart, were detected in samples from 04-001BH-1.0' and 04-004BH-1.5'.

5.3.2 Groundwater Investigation Findings

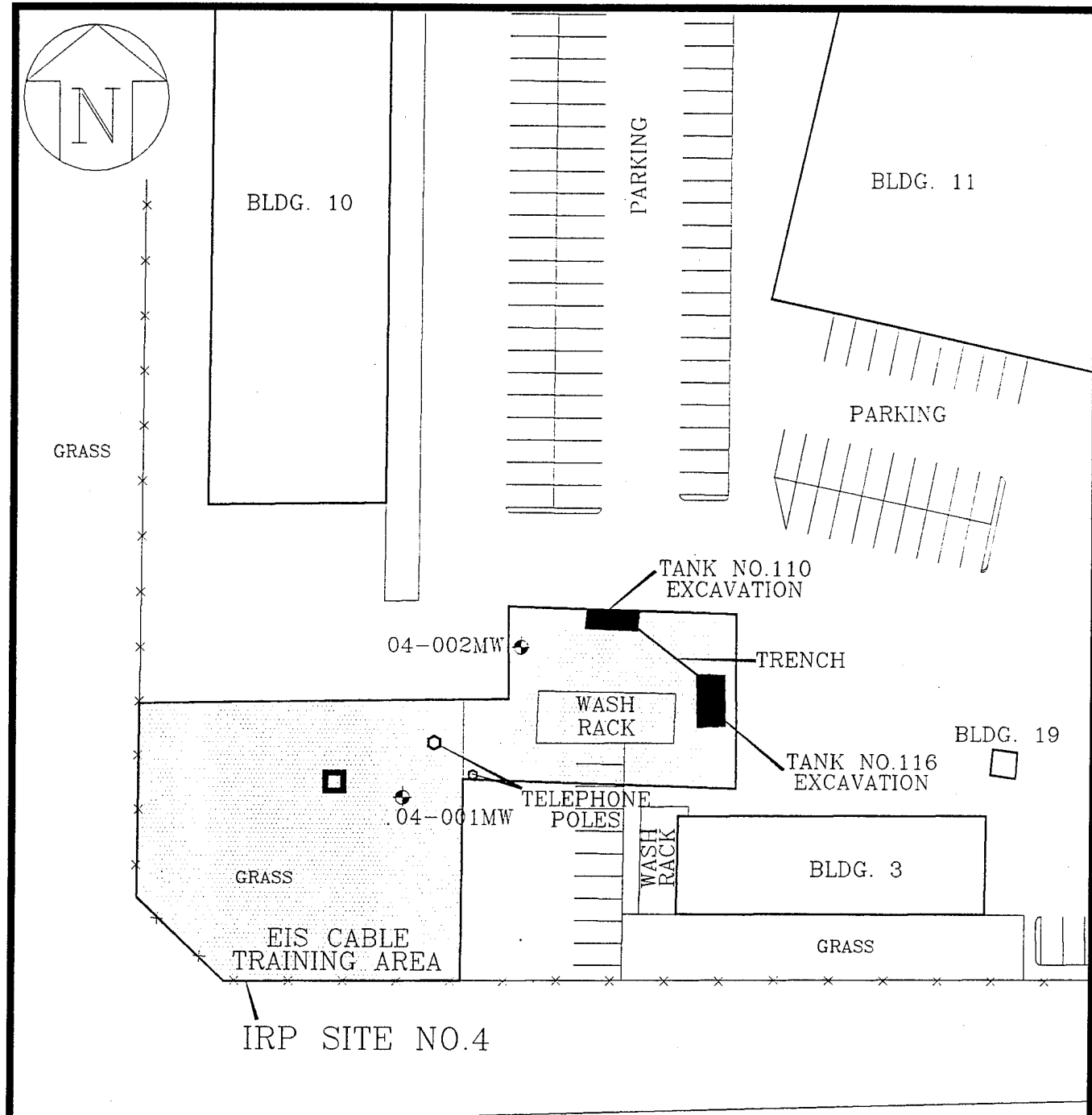
At IRP Site No. 4, two monitoring wells were used to obtain water level data for hydrogeologic characterization of the aquifer and to evaluate the horizontal component of groundwater flow. Six investigative groundwater samples were submitted for laboratory analysis from the two monitoring wells installed to characterize the site; these results are discussed in the following subsections.

5.3.2.1 Groundwater Monitoring Well Locations

The monitoring well locations at IRP Site No. 4 are shown on Figure 5.14. Monitoring well 04-002MW was not drilled at the location originally proposed in the Work Plan, but was relocated approximately 25 feet southwest of the UST No. 110 excavation. Monitoring well 04-002MW was originally proposed in the Work Plan as a downgradient well to the former cable training excavation. However, because contamination was indicated by field screening in soil borings drilled around the former cable training excavation, 04-002MW was relocated immediately downgradient of the UST No. 110 excavation. UST No. 110 was the suspected source of the contamination previously detected in the Cable Training Area. ANGR/CEVR was notified on 1 August 1994 of revised monitoring well locations, and approval was obtained prior to drilling. It should be noted that as a result of relocating 04-002MW, no monitoring well is installed downgradient of the former cable training excavation.

5.3.2.2 Nature and Extent of Groundwater Contamination

Three sets of groundwater samples were collected from monitoring wells 04-001MW and 04-002MW. The first round of sampling on 04-001MW was conducted on 10 August 1994, the second on 11 August 1994, and the third on 7 December 1994. The first and second rounds of sampling were conducted on 04-002MW on 10 August 1994 and the third round of sampling was conducted on 7 December 1994. Groundwater conditions encountered at IRP Site No. 4 are discussed in Subsection 5.2.3.



IRP SITE NO.4

W. WINTON AVENUE

LEGEND

	Monitoring Well Location		Building
	Station Boundary Fence Line		IRP Site No. 4
	Former Cable Training Area Excavation		

0 55
SCALE IN FEET

FIGURE 5.14

**MONITORING WELL LOCATIONS
AT IRP SITE NO.4**
216th EIS & 234th CCSQ
Hayward ANGS
Hayward, California

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5.3.2.2.1 Field GC Screening Results of Groundwater Samples

Four groundwater samples were field screened with a Photovac 10S55 Portable GC and calibrated to screen for BTEX. Table 5.7 summarizes the maximum GC concentrations detected in groundwater samples collected from IRP Site No. 4. Complete GC data is included in Appendix D.

Table 5.7
Maximum Field GC Concentrations Detected in Groundwater Samples
Collected from IRP Site No. 4
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Compound	Maximum Concentrations Detected in Groundwater Samples ($\mu\text{g/L}$)
Benzene	178
Toluene	165
Ethylbenzene	17

GC - Gas Chromatograph.

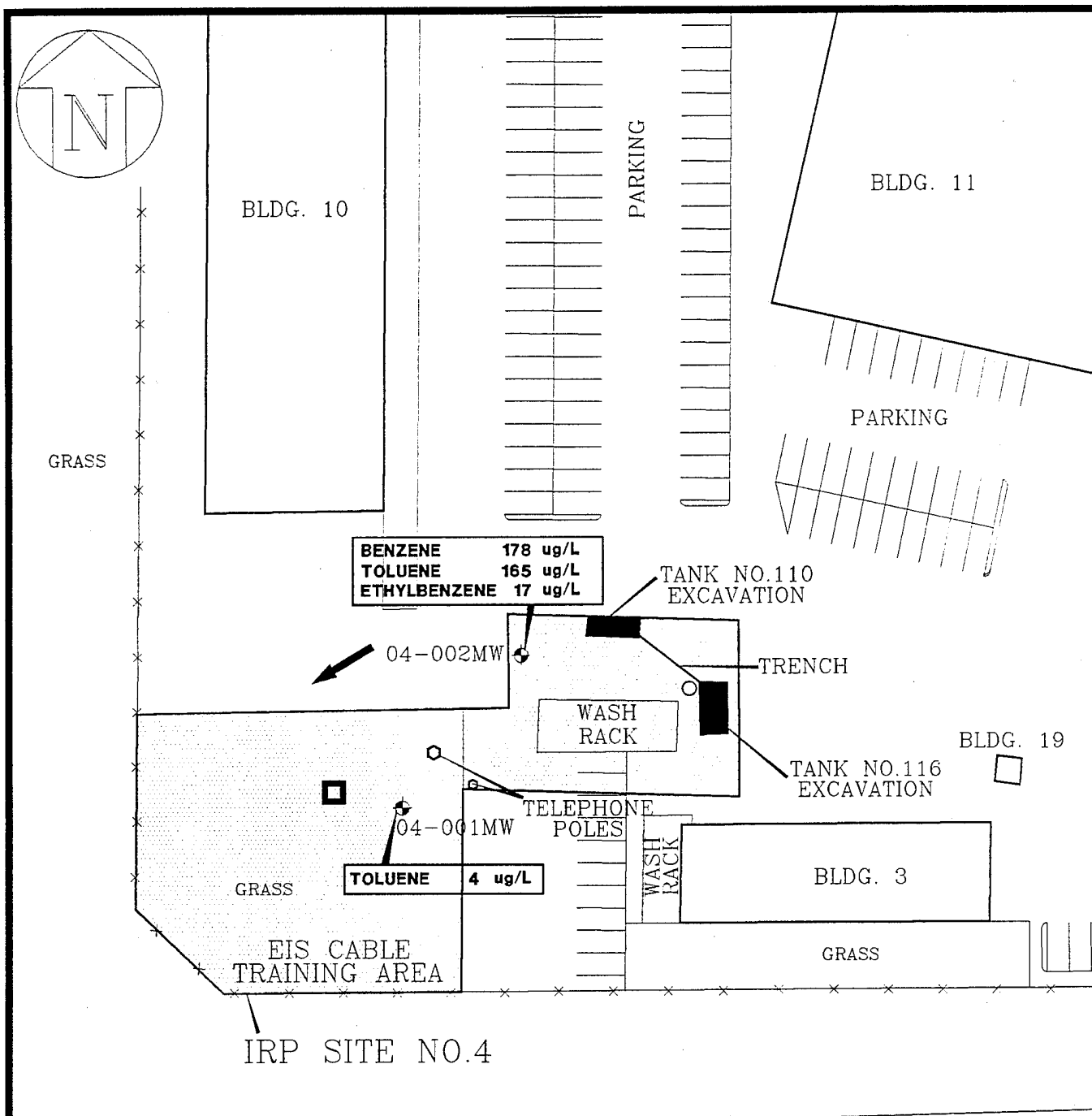
$\mu\text{g/L}$ - micrograms per liter.

The highest concentrations of BTEX components were detected in groundwater from 04-002MW (see Figure 5.15). Benzene was detected at a concentration of 178 $\mu\text{g/L}$ and toluene at 165 $\mu\text{g/L}$ in the first groundwater sample collected; toluene and ethylbenzene were detected at concentrations of 82 $\mu\text{g/L}$ and 17 $\mu\text{g/L}$, respectively, in the second groundwater sample collected. Toluene was detected at a concentration of 4 $\mu\text{g/L}$ in the first groundwater sample collected from 04-001MW, but was not detected in the second sample collected. Xylenes were not detected in groundwater samples. The presence of BTEX components was not confirmed in the groundwater samples submitted for laboratory analysis.

5.3.2.2.2 Groundwater Sampling Analytical Results

VOCs were not detected in groundwater samples collected from the monitoring wells.

TPH-G, lead, and TPH-D were detected in groundwater samples collected from IRP Site No. 4 at concentrations exceeding background (see Table 5.8). TPH-G was detected at concentrations of 1,000 $\mu\text{g/L}$ and 530 $\mu\text{g/L}$ in the first groundwater samples collected from 04-002MW. TPH-G was detected in the third sample at 04-002MW and its duplicate (1,400 $\mu\text{g/L}$ and 1,200 $\mu\text{g/L}$, respectively). Lead was detected at 8,300 $\mu\text{g/L}$ in the second groundwater sample collected from 04-002MW. TPH-D was detected at concentrations of 840,000 $\mu\text{g/L}$ and 920,000 $\mu\text{g/L}$ in the third sample at 04-002MW and its duplicate. TPH-D was not detected in



W. WINTON AVENUE

LEGEND

	Monitoring Well Location		Existing Monitoring Well		Groundwater Flow Direction
	Station Boundary Fence Line		Building		
	Former Cable Training Area Excavation		IRP Site No. 4	 SCALE IN FEET	

FIGURE 5.15

FIELD GC SCREENING RESULTS
FROM GROUNDWATER AT IRP SITE NO.4
 216th EIS & 234th CCSQ
 Hayward ANGS
 Hayward, California

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Table 5.8
Analysis Results for Groundwater Samples Collected at IRP Site No. 4
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Sample ID Number	TPH-G ($\mu\text{g/L}$)	TPH-D ($\mu\text{g/L}$)	Lead ($\mu\text{g/L}$)
04-001MW-A	530	10,000U	1,000U
04-001MW-B	100U	10,000U	1,000U
04-001MW-C	100U	50U	50U
04-002MW-A	100U	10,000U	8,300
04-002MW-B	530	10,000U	1,000U
04-002MW-C	1,400	840	50U
04-002MW (Duplicate)	1,200	920	50U
BG-001MW-A	100U	10,000U	1,000U
BG-001MW-A (Duplicate)	100U	10,000U	6,700
BG-001MW-B	250	10,000U	1,000U
BG-001MW-C	190	50U	50U
California DHS Primary MCL	NA	NA	50

MW – Monitoring Well.
 A and B – 10 August 1994.
 C – 7 December 1994.
 U – Compound was analyzed for but not detected.

Number preceding "U" indicates the detection limit.
 $\mu\text{g/L}$ – micrograms per liter.
 DHS – Department of Health Services.
 NA – Not Applicable.

TPH – Total Petroleum Hydrocarbons.
 TPH-D – TPH as diesel.
 TPH-G – TPH as gasoline.

background samples. Lead was detected at a concentration exceeding the California DHS Primary MCL of 50 $\mu\text{g/L}$.

VOC surrogate recovery ranged from 88 to 107 percent, which is within acceptable limits. QA/QC sample analytical results are reported in Appendix F. A complete listing of the results for all analytical parameters for each sample is given in Appendix G.

5.4 IRP SITE NO. 5 (ABANDONED JET FUEL USTs) FINDINGS

IRP Site No. 5 is located near the center of Hayward ANGS (see Figure 5.16).

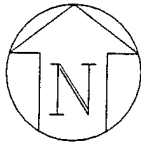
5.4.1 Screening Activities Results

5.4.1.1 Soil Vapor Survey Results

A soil vapor survey was conducted by TEG on 25 and 26 July 1994. The soil vapor survey was conducted to characterize the nature and extent of subsurface BTEX and TPH contamination. BTEX was analyzed by USEPA Method SW8020, and TPH was analyzed by Modified USEPA

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IRP SITE NO.5



LEGEND			
	EXCAVATION		EXCAVATED SOIL
	IRP SITE NO.5		BUILDING
			FENCE LINE
			SCALE IN FEET

FIGURE 5.16

IRP SITE NO.5 SITE PLAN
 216th EIS & 234th CCSQ
 Hayward ANG5
 Hayward, California

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Method 8015. A total of 32 sampling points formed a base grid around the perimeter of the excavation, with a distance of no more than 40 feet between sampling points. The location of soil vapor sampling points is illustrated on Figure 5.17.

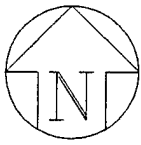
The proposed sampling locations were modified as the soil vapor survey progressed. The Work Plan proposed collecting soil vapor samples from depths of 5 feet and 10 feet BLS at each sampling location. However, initial sampling results indicated greater contamination at depths of 10 feet BLS than at 5 feet BLS. The Site Manager recommended that the 5-foot sampling depth be eliminated in the remaining locations and additional sampling locations be selected for sampling at 10 feet BLS to better identify the vertical extent of contamination. ANGR/CEVR concurred and approved this recommendation. As a consequence, several soil vapor sampling points originally proposed in the sampling plan (SV-12, SV-13, SV-14, SV-15, and SV-22) were not sampled, but additional sampling points were added in areas around the excavation in which contamination was suspected.

A total of 44 soil vapor samples, which included two duplicate samples, were collected and analyzed for TPH. Thirty-five of the 44 soil vapor samples were also analyzed for BTEX. Eleven soil vapor samples were collected from a depth of 5 feet BLS and 33 samples were collected from a depth of 10 feet BLS.

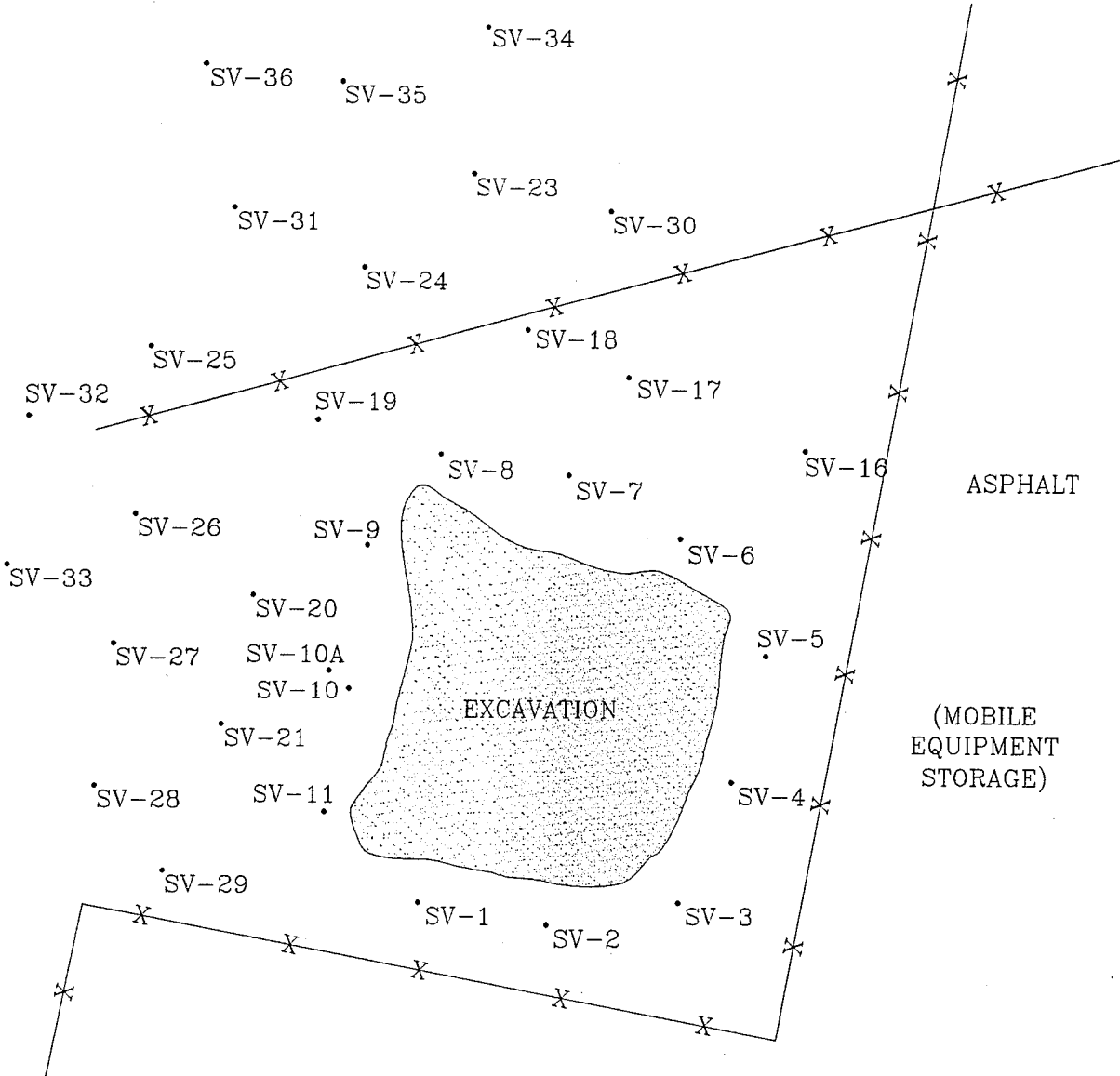
The detection limits for benzene, toluene, ethylbenzene, and xylenes were 0.01 parts per million by volume (ppmV), and the detection limit for TPH was 1.0 ppmV. Benzene was detected at concentrations ranging from 0.07 ppmV to 391.93 ppmV in 32 of the 35 samples analyzed, toluene from 0.04 ppmV to 103.71 ppmV in 21 of the samples, ethylbenzene from 0.46 ppmV to 20.34 ppmV in 11 of the samples, and total xylenes from 0.07 ppmV to 33.29 ppmV in 18 of the 35 samples analyzed. Total BTEX concentrations ranged from 0.11 ppmV to 510.68 ppmV in 30 of the 35 samples analyzed. TPH was detected in all of the 44 samples analyzed at concentrations ranging from 24 ppmV to 45,340 ppmV.

Isoconcentrations for total BTEX, TPH, benzene, ethylbenzene, toluene, and xylenes are shown in Figures 5.18, 5.19, 5.20, 5.21, 5.22, and 5.23, respectively. A complete listing of the soil vapor survey analytical results is given in Appendix A.

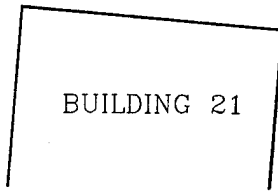
The highest concentrations of detected parameters were in sampling locations located near the northwest corner of the UST excavation. The highest concentrations of TPH and benzene were detected in soil vapor samples collected from SV-8; TPH and benzene were detected at



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NOTE:
 THE LOCATION OF POINT NUMBERS
 12, 13, 14, 15, AND 22 ARE NOT
 SHOWN BECAUSE THEY WERE
 ELIMINATED FROM THE SAMPLING PLAN.



LEGEND

- X-X- FENCE LINE
- SOIL VAPOR POINT
- [Stippled Area] EXCAVATION

0 55
 SCALE IN FEET

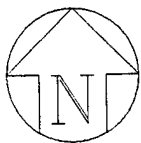
FIGURE 5.17

HAYWARD VAPOR

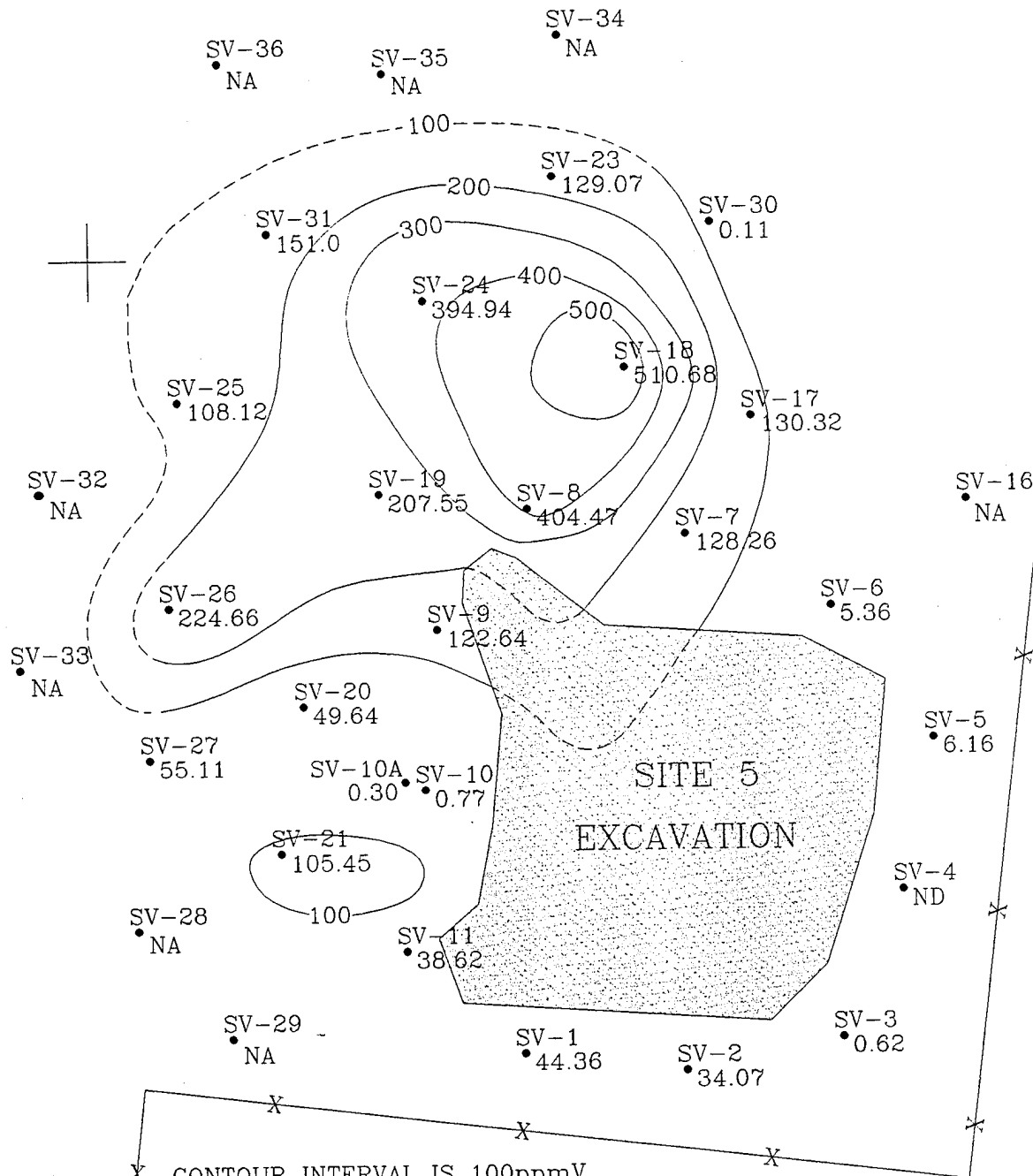
SOIL VAPOR SAMPLING
 LOCATIONS AT IRP SITE NO.5
 216th EIS & 234th CCSQ
 Hayward ANG
 Hayward, California

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CONTOUR INTERVAL IS 100ppmV

LEGEND	
SV-3	SOIL VAPOR SAMPLING POINT
-X-X-	FENCE LINE
44.36	44.36 ppmV
NA	ANALYSIS NOT REQUESTED
ND	NON DETECT

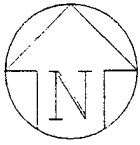
NOTE: THE LOCATION OF POINT NUMBERS 12, 13, 14, 15, AND 22 ARE NOT SHOWN BECAUSE THEY WERE ELIMINATED FROM THE SAMPLING PLAN.

SCALE IN FEET

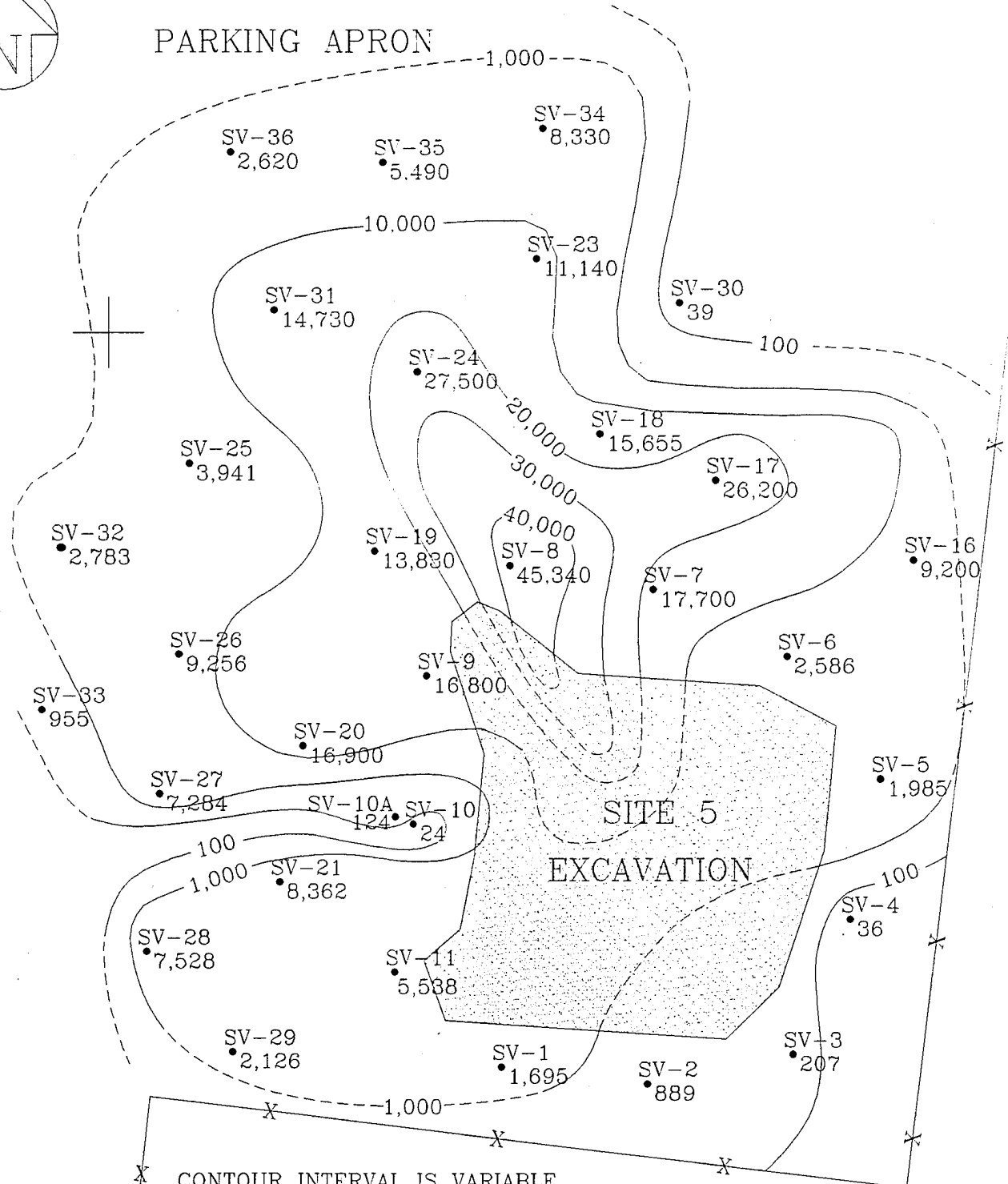
FIGURE 5.18
 HAYWARD, SITE5

ISOCONCENTRATION MAP OF BTEX CONCENTRATIONS (ppmV) DETECTED DURING SOIL VAPOR SURVEY
 216th EIS & 234th CCSQ
 Hayward ANG
 Hayward, California

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CONTOUR INTERVAL IS VARIABLE

LEGEND	
SV-39	SOIL VAPOR SAMPLING POINT 39 ppmV
-X-X-	FENCE LINE

NOTE: THE LOCATION OF POINT NUMBERS 12, 13, 14, 15, AND 22 ARE NOT SHOWN BECAUSE THEY WERE ELIMINATED FROM THE SAMPLING PLAN.

0 45
SCALE IN FEET

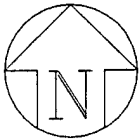
FIGURE 5.19

ISOCONCENTRATION MAP OF TPH CONCENTRATIONS (ppmV) DETECTED DURING SOIL VAPOR SURVEY
 216th EIS & 234th CCSQ
 Hayward ANG
 Hayward, California

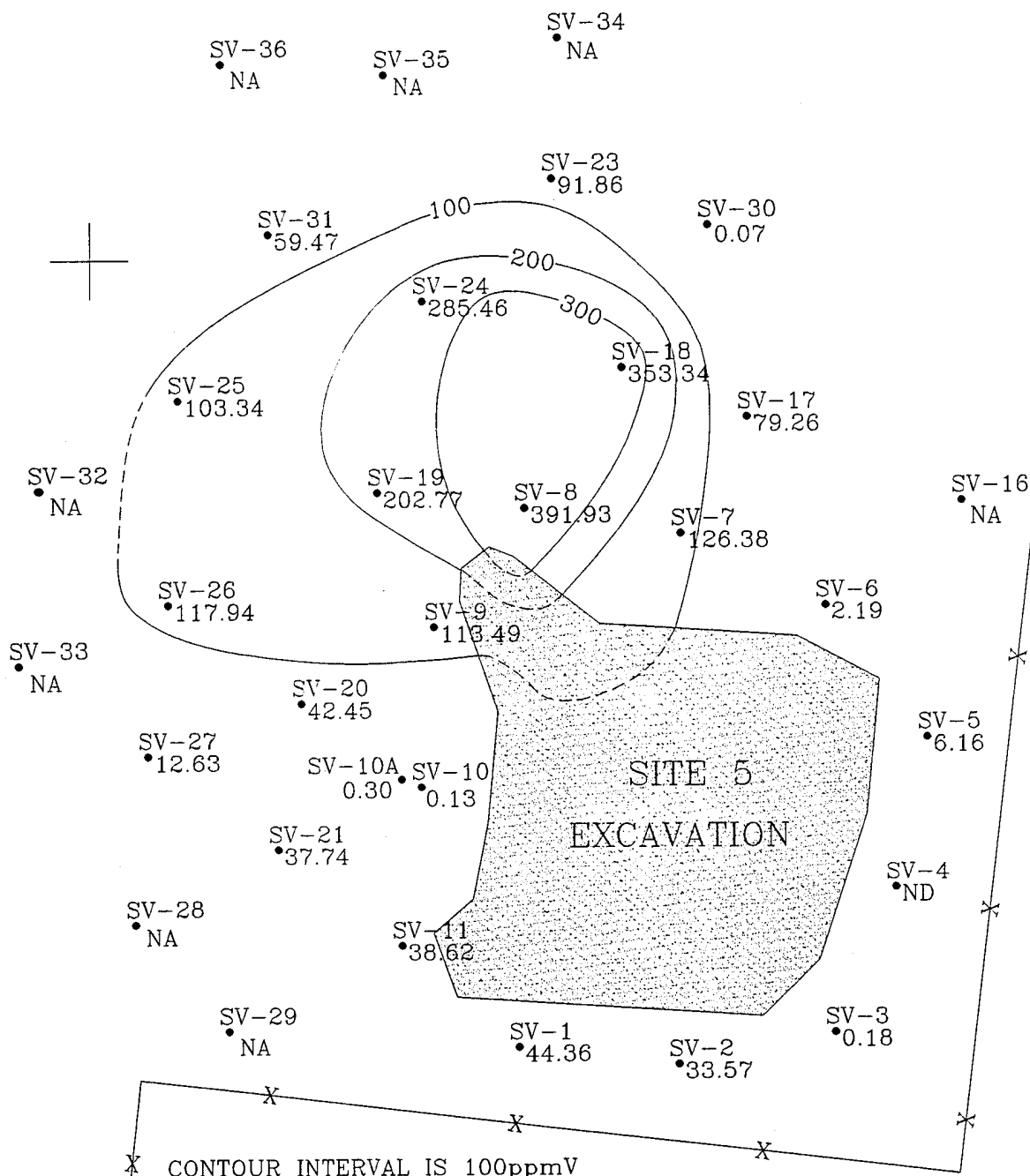


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CONTOUR INTERVAL IS 100ppmV

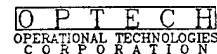
LEGEND	
SV-3	SOIL VAPOR SAMPLING POINT
X—X	FENCE LINE
2.19	2.19 ppmV
NA	ANALYSIS NOT REQUESTED
ND	NON DETECT

NOTE: THE LOCATION OF POINT NUMBERS 12, 13, 14, 15, AND 22 ARE NOT SHOWN BECAUSE THEY WERE ELIMINATED FROM THE SAMPLING PLAN.

0 45
SCALE IN FEET

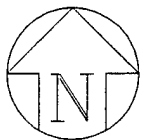
FIGURE 5.20

ISOCONCENTRATION MAP OF BENZENE CONCENTRATIONS (ppmV) DETECTED DURING SOIL VAPOR SURVEY
 216th EIS & 234th CCSQ
 Hayward ANG
 Hayward, California

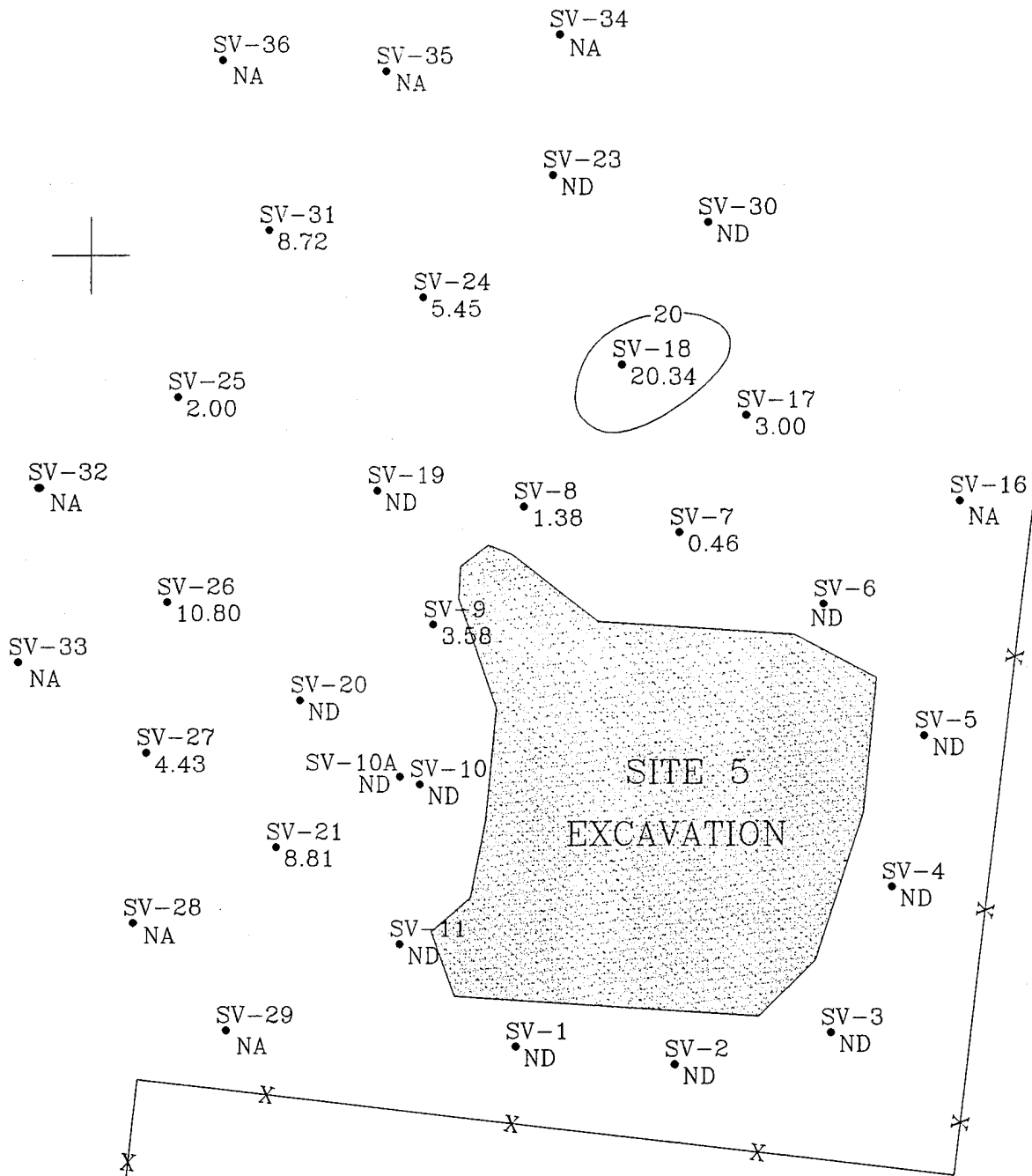


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LEGEND	
SV-3	SOIL VAPOR SAMPLING POINT
-X-X-	FENCE LINE
10.80	10.80 ppmV
NA	ANALYSIS NOT REQUESTED
ND	NON DETECT

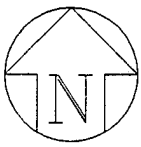
NOTE: THE LOCATION OF POINT NUMBERS 12, 13, 14, 15, AND 22 ARE NOT SHOWN BECAUSE THEY WERE ELIMINATED FROM THE SAMPLING PLAN.

0 45
SCALE IN FEET

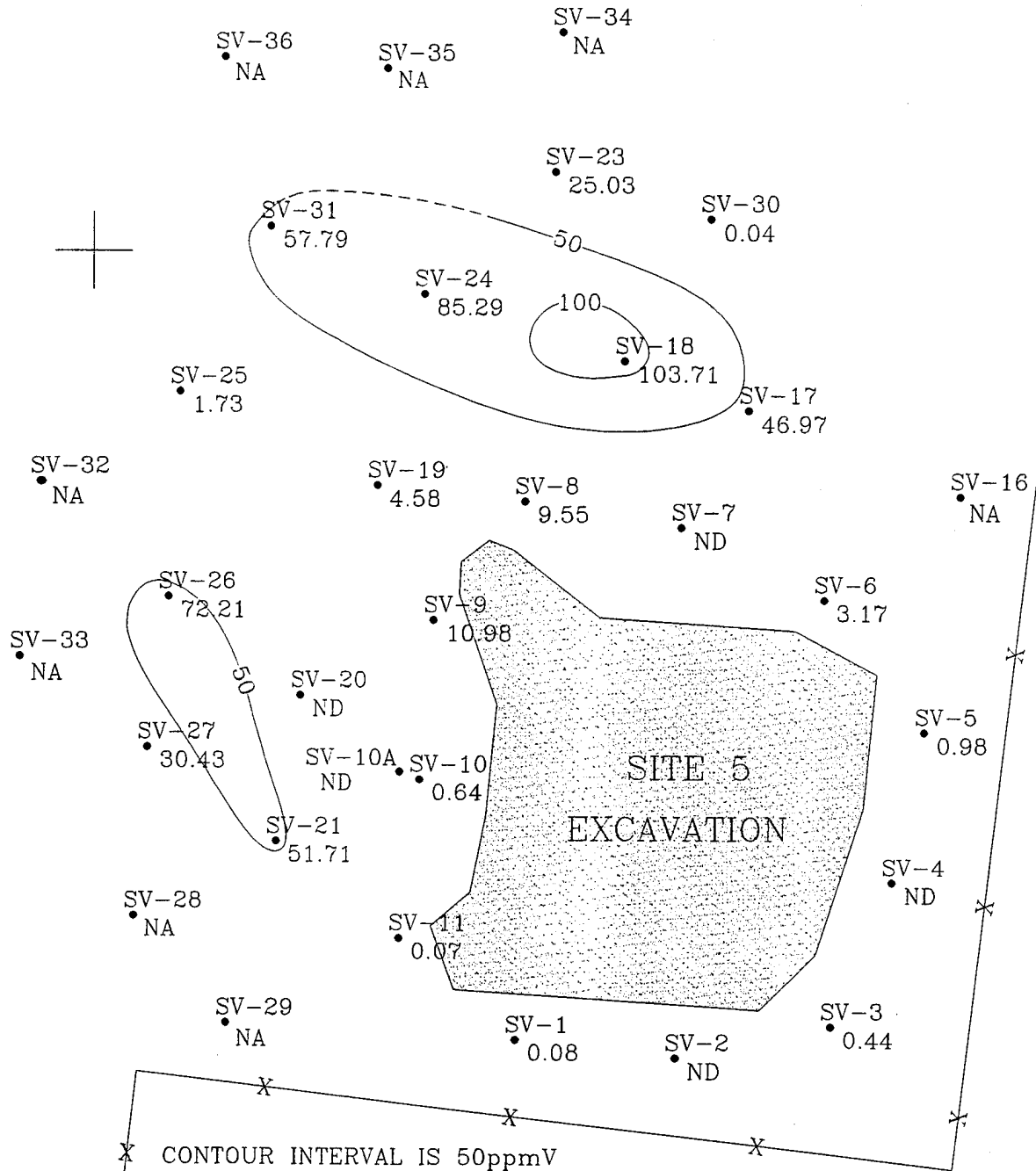
FIGURE 5.21 ISOCONCENTRATION MAP OF ETHYL-BENZENE CONCENTRATIONS (ppmV) DETECTED DURING SOIL VAPOR SURVEY 216th EIS & 234th CCSQ Hayward ANG5 Hayward, California



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CONTOUR INTERVAL IS 50ppmV

LEGEND	
SV-3	SOIL VAPOR SAMPLING POINT
-X-X-	FENCE LINE
0.08	0.08 ppmV
NA	ANALYSIS NOT REQUESTED
ND	NON DETECT

NOTE: THE LOCATION OF POINT NUMBERS 12, 13, 14, 15, AND 22 ARE NOT SHOWN BECAUSE THEY WERE ELIMINATED FROM THE SAMPLING PLAN.

0 45
SCALE IN FEET

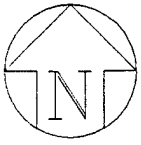
FIGURE 5.22

HAYWARD\SITES

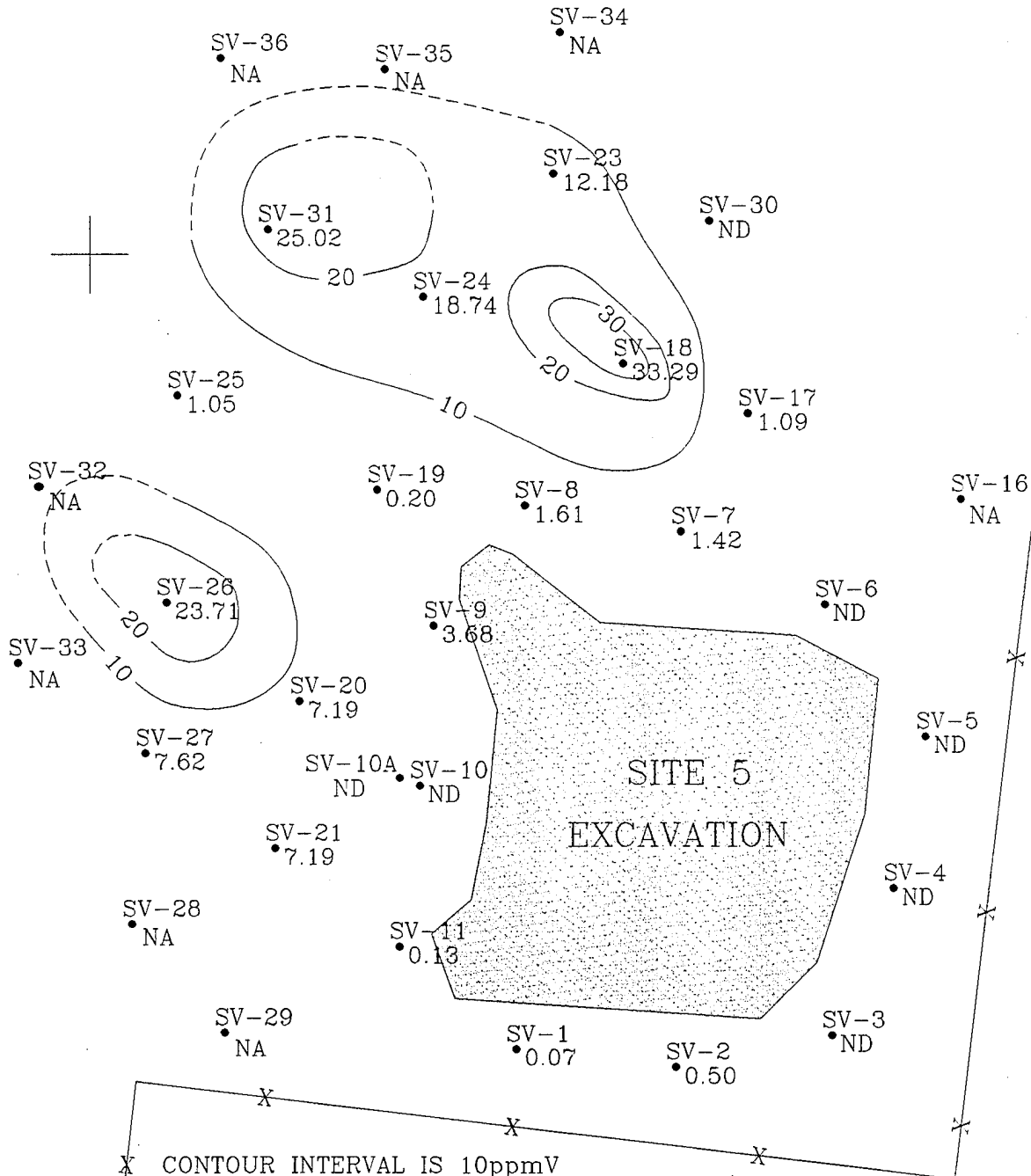
ISOCONCENTRATION MAP OF TOLUENE CONCENTRATIONS (ppmV) DETECTED DURING SOIL VAPOR SURVEY
 216th EIS & 234th CCSQ
 Hayward ANGS
 Hayward, California

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LEGEND	
SV-3	SOIL VAPOR SAMPLING POINT
-X-X-	FENCE LINE
0.07	0.07 ppmV
NA	ANALYSIS NOT REQUESTED
ND	NON DETECT

NOTE: THE LOCATION OF POINT NUMBERS 12, 13, 14, 15, AND 22 ARE NOT SHOWN BECAUSE THEY WERE ELIMINATED FROM THE SAMPLING PLAN.

0 45
SCALE IN FEET

FIGURE 5.23

ISOCONCENTRATION MAP OF XYLENE CONCENTRATIONS (ppmV) DETECTED DURING SOIL VAPOR SURVEY
216th EIS & 234th CCSQ
Hayward ANG
Hayward, California

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concentrations of 45,340 ppmV and 391.93 ppmV, respectively (see Figures 5.19 and 5.20, respectively). TPH was also detected at concentrations of 27,500 ppmV and 26,200 ppmV at SV-24 and SV-17, respectively. Benzene was also detected at concentrations of 353.34 ppmV and 285.46 ppmV at SV-18 and SV-24. The highest concentrations of ethylbenzene, toluene, and xylenes were detected at SV-18 (see Figures 5.21 through 5.23). Ethylbenzene was detected at a concentration of 20.34 ppmV, toluene at 103.71 ppmV, and xylenes at 33.20 ppmV. The greatest concentrations of total BTEX were detected at SV-18, SV-8, and SV-24 at 510.68 ppmV, 404.47 ppmV, and 394.94 ppmV, respectively (see Figure 5.18).

5.4.2 Soil Investigation Findings

At IRP Site No. 5, soil samples collected from five soil borings and three monitoring wells were used to provide geologic information for describing subsurface geology. Sixteen investigative soil samples were submitted for laboratory analysis to provide an assessment of the presence and type of soil contamination present.

5.4.2.1 Soil Boring Locations

The soil boring locations at IRP Site No. 5 are indicated on Figure 5.24. Soil borings 05-002BH and 05-003BH, originally proposed in the Work Plan to the east and southeast of the excavation, respectively, were relocated because they were overlain by concrete. Subsequently, three soil borings were located along the north perimeter of the excavation, one boring was located immediately west of the excavation, and one boring was located off the southwest corner of the excavation.

5.4.2.2 Nature and Extent of Soil Contamination

5.4.2.2.1 Field GC Screening Results of Soil Samples

Thirty-five soil samples were collected, 20 from five soil borings drilled on 5 and 6 August 1994, and 15 from three monitoring wells drilled at IRP Site No. 5 on 4 and 5 August 1994.

These soil samples were field screened with a Photovac 10S55 Portable GC, calibrated to screen for BTEX. Table 5.9 summarizes the maximum concentrations detected in the soil samples. Complete GC data is included in Appendix D.

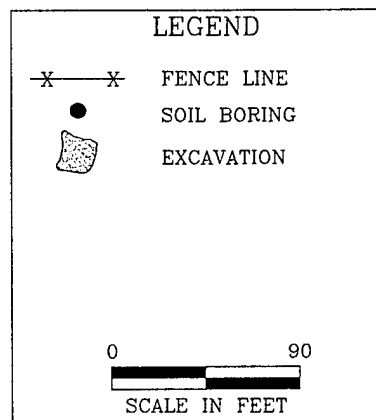
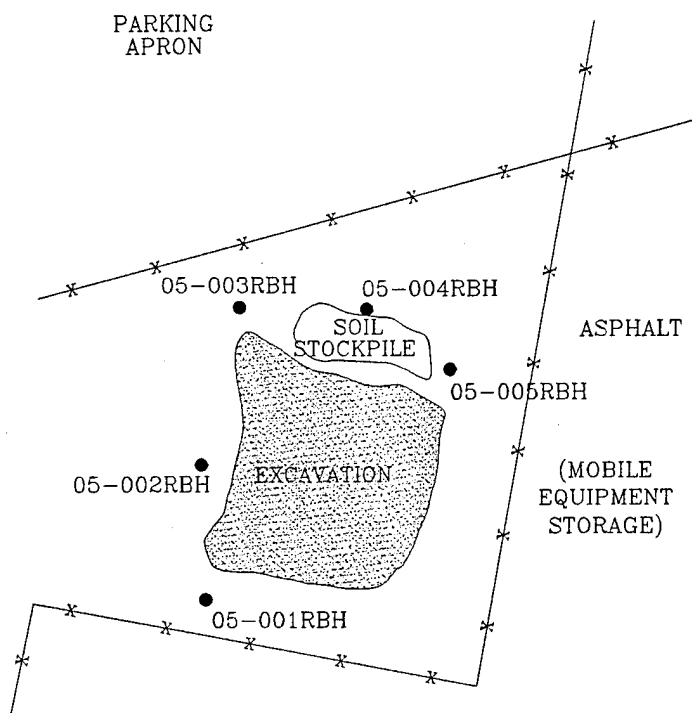
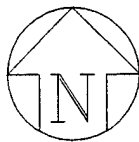


FIGURE 5.24

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SOIL BORING LOCATIONS
AT IRP SITE NO.5
216th EIS & 234th CCSQ
Hayward ANG
Hayward, California

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Table 5.9
Maximum Field GC Concentrations Detected in Soil Samples
Collected from IRP Site No. 5
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Compound	Sample Interval (feet BLS)	Maximum Detected in Soil Samples (mg/kg)
Total BTEX	10.5	606.0 ¹
Benzene	10.5	27.6 ²
Toluene	10.5	470.0 ¹
Ethylbenzene	10.5	39.6 ¹
m,p-Xylene	10.5	10.68 ²
o-Xylene	10.5	68.5 ¹

GC – Gas Chromatograph.
mg/kg – milligrams per kilogram.
BLS – Below Land Surface.

¹50 to 1 injection.
²20 to 1 injection.

Benzene and o-xylene were detected at concentrations ranging from 0.005 mg/kg to 27.6 mg/kg and 0.032 mg/kg to 68.5 mg/kg, respectively, in 12 of the 35 samples collected; toluene from 0.012 mg/kg to 470.0 mg/kg in 22 of the samples; ethylbenzene from 0.003 mg/kg to 39.6 mg/kg in 13 of the samples; and m,p-xylenes from 0.005 mg/kg to 10.68 mg/kg in six of the samples.

The highest concentrations of BTEX were detected in the sample collected from 05-004RBH-10' (see Figure 5.25). The soil sample was screened twice in order to confirm the high readings. Benzene was detected at a maximum concentration of 27.6 mg/kg, toluene at 470.0 mg/kg, ethylbenzene at 39.6 mg/kg, m,p-xylenes at 10.68 mg/kg, and o-xylene at 68.5 mg/kg. BTEX compounds were also noted in the sample from 05-003RBH-10.5'. Benzene was detected at a maximum concentration of 3.21 mg/kg, toluene at 27.0 mg/kg, ethylbenzene at 3.4 mg/kg, m,p-xylenes at 1.0 mg/kg, and o-xylene at 8.3 mg/kg.

High concentrations of BTEX were also detected in the soil samples collected from 05-002MW and 05-003MW. Soil samples were screened twice to confirm the high readings. Benzene was detected at a maximum concentration of 0.127 mg/kg, toluene at 9.79 mg/kg, ethylbenzene at 35.29 mg/kg, m,p-xylenes at 1.115 mg/kg, and o-xylene at 8.85 mg/kg in the sample from 05-002MW-10.5'. In the sample collected from 05-003MW-15.5', benzene was detected at a maximum concentration of 0.47 mg/kg, toluene at 7.85 mg/kg, ethylbenzene at 0.549 mg/kg, and xylenes at 0.205 mg/kg.

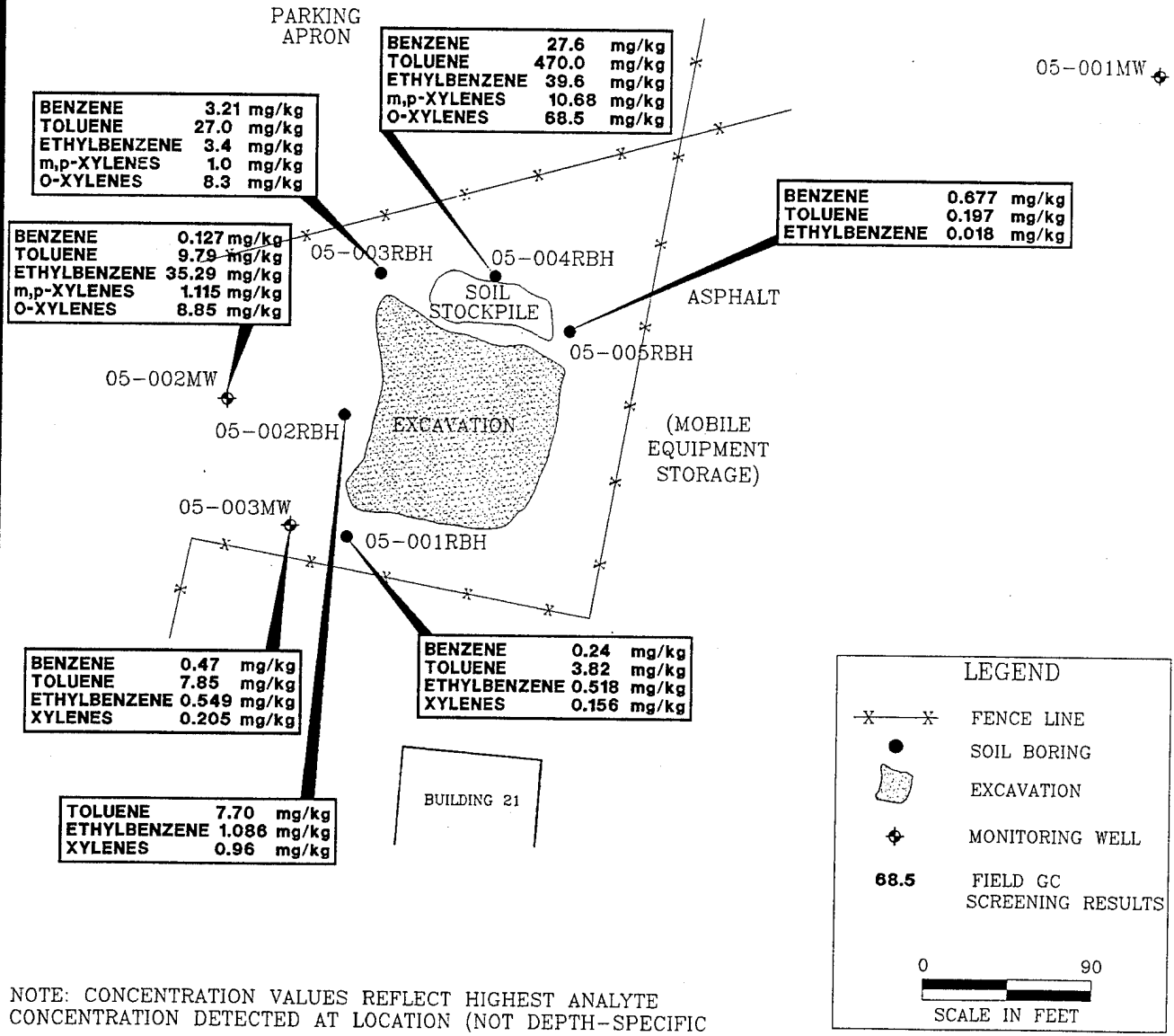
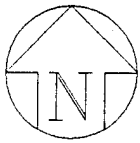


FIGURE 5.25

FIELD GC SCREENING RESULTS
 FROM SOIL AT IRP SITE NO.5
 216th EIS & 234th CCSQ
 Hayward ANG
 Hayward, California

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5.4.2.2.2 Soil Sampling Analytical Results

Five soil borings were drilled at IRP Site No. 5, from which 15 investigative, two duplicate and one MS/MSD soil samples were collected for laboratory analysis. The borings were drilled to a depth of 15.5 feet BLS and soil samples collected on 29 July 1994. The samples were packed in ice and shipped by Federal Express to the analytical laboratory in Anaheim, California on the same day; however, the samples were not received by the laboratory until 1 August, at which time the samples had reached room temperature. Therefore, the borings were re-drilled, in locations as close as possible to the borings originally sampled, and resampled on 4 and 5 August 1994. The replacement borings are indicated in the data tables by the "RBH" designation after the borehole number.

The VOCs benzene, ethylbenzene, acetone, carbon disulfide, and methylene chloride were detected in soil samples collected from IRP Site No. 5 (see Table 5.10). Benzene was detected at a concentration of 0.03 mg/kg in the sample from 05-003RBH-11.0'. Soil samples submitted

Table 5.10
Volatile Organic Compounds Detected in Soil Samples Collected from IRP Site No. 5
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Sample Location Number	Sample Depth (feet BLS)	Acetone (mg/kg)	Benzene (mg/kg)	Ethylbenzene (mg/kg)	Carbon Disulfide (mg/kg)	Methylene Chloride (mg/kg)
05-002RBH	2.0	0.01U	0.005U	0.006	0.005U	0.005U
05-002RBH	11.0	0.059	0.025U	0.025U	0.03	0.025U
05-003RBH	1.5	0.01U	0.005U	0.005U	0.006	0.005U
05-003RBH	11.0	0.05U	0.03	0.025U	0.03	0.025U
05-004RBH	1.5	0.01U	0.005U	0.023	0.005U	0.005U
05-005RBH	6.5 - 8.0	0.029	0.005U	0.005U	0.005U	0.005U
05-005RBH	11.5 - 13.0 dup	0.01U	0.005U	0.005U	0.005U	0.005

RBH - Replacement Borehole.
mg/kg - milligrams per kilogram.
U - Compound analyzed for but not detected.

BLS - Below Land Surface.
dup - duplicate.

for analysis did not confirm the high benzene concentrations detected during the soil vapor survey. Ethylbenzene was detected at concentrations of 0.006 mg/kg and 0.023 mg/kg in samples from 05-002RBH-2.0' and 05-004RBH-1.5', respectively. Acetone was detected at concentrations of 0.029 mg/kg and 0.059 mg/kg in samples from 05-005RBH-6.5'-8.0' and 05-002RBH-11.0', respectively. Carbon disulfide was detected at 0.006 mg/kg, 0.03 μ g/kg, and 0.03 μ g/kg in samples from 05-003BH-1.5', 05-002RBH-11.0', and 05-003RBH-11.0',

respectively. Methylene chloride was detected at 0.005 mg/kg in sample 05-005RBH-Dup-11.0'-13.0'. Carbon disulfide was also detected at 0.052 mg/kg in one field blank; and 2-butanone was detected at 0.014 mg/kg in one equipment blank. Acetone, 2-butanone, carbon disulfide and methylene chloride are suspected to be laboratory contaminants and probably do not represent site contamination.

VOC surrogate recoveries ranged from 87 to 110 percent, which are within acceptable limits, with the exception of five soil samples which had high recovery for d8-toluene and three samples with high recovery for 4-bromofluorobenzene. Re-analysis confirmed this to be a matrix problem. VOC spike, matrix spike, and duplicate recoveries ranged from 91 to 102 percent and 93 to 100 percent, respectively, which are within acceptable quality control ranges. QA/QC sample analytical results are reported in Appendix F. A complete listing of the results for all analytical parameters for each sample is given in Appendix G.

TPH-G was detected in samples from IRP Site No. 5 (see Table 5.11). TPH-G was detected at concentrations ranging from 1.1 mg/kg to 19.0 mg/kg, with the highest concentration detected in the sample from 05-004RBH-6.0'. Boring 05-004RBH is located north of the excavation in an area where high TPH concentrations were detected during the soil vapor survey. A value of 19.0 mg/kg exceeds the LUFT Manual Leaching Potential Analysis Chart level (10.0 mg/kg) for soils that may be left in place without threatening groundwater.

TPH-D was not detected in any of the soil samples analyzed. However, TPH-D was detected at a concentration of 620,000 $\mu\text{g/L}$ in equipment blank EB-6. The suspected diesel contamination in sample EB-6 could not be positively identified viewing the chromatogram and raw data. This could be attributed to some tail-ending gasoline compounds or other similar petroleum hydrocarbons. It was confirmed by the laboratory as being a false-positive identification and not being a true diesel identification. All associated samples run with this work order were non-detect samples.

Lead was detected in soil samples collected at concentrations ranging from 8.5 to 37.0 mg/kg (see Table 5.12). The highest concentrations of lead were detected in soil from 1.5 to 2.0 feet BLS. Lead was not detected below this depth in samples collected from 05-001RBH, 05-002RBH, and 05-005RBH.

The highest concentrations of lead were detected in the samples collected from 05-003RBH and 05-004RBH. Borings 05-003RBH and 05-004RBH are located northwest and north of the excavation, respectively (see Figure 5.25). Lead was detected at concentrations ranging from

Table 5.11
TPH-G Detected in Soil Samples Collected from IRP Site No. 5
216th EIS and 234th CCSQ, Hayward ANG, Hayward, California

Sample Location Number	Sample Depth (feet BLS)	TPH-G (mg/kg)
05-001RBH	1.5	0.1U
05-001RBH	11.5	0.1U
05-001RBH	11.5 duplicate	0.1U
05-001RBH	14.0 - 15.5	0.1U
05-002RBH	2.0	2.2
05-002RBH	11.0	1.1
05-002RBH	15.0	0.5U
05-003RBH	1.5	0.5U
05-003RBH	11.0	3.2
05-003RBH	15.0	1.2
05-004RBH	1.5	0.5U
05-004RBH	6.0	19.0
05-004RBH	11.0	8.4
05-005RBH	1.5	0.5U
05-005RBH	6.0	0.5U
05-005RBH	6.5 - 8.0	0.1U
05-005RBH	11.5	0.1U
05-005RBH	11.5 - 13.0 duplicate	0.1U

RBH - Replacement Borehole.
 BLS - Below Land Surface.
 mg/kg - Milligrams per kilogram.
 TPH-G - total petroleum hydrocarbons as Gasoline.

U - Compound was analyzed for but not detected. Number preceding "U" indicates the detection limit.

8.5 to 18.0 mg/kg in samples collected from 05-003RBH, with the highest concentration detected at 1.5'. Lead was detected at concentrations of 37.0 mg/kg and 16.0 mg/kg in samples from 05-004RBH-1.5' and 6.0', respectively.

None of the lead concentrations detected in soil samples collected from IRP Site No. 5 exceeded the total lead value of 200 ppm, derived from the LUFT Manual Leaching Potential Analysis chart.

5.4.3 Groundwater Investigation Findings

At IRP Site No. 5, three monitoring wells were installed to obtain water level data for hydrogeologic characterization of the aquifer and to evaluate the horizontal component of

Table 5.12
Lead Detected in Soil Samples Collected from IRP Site No. 5
216th EIS and 234th CCSQ, Hayward ANG, Hayward, California

Sample Location Number	Sample Depth (feet BLS)	Lead (mg/kg)
05-001RBH	1.5	16.0
05-001RBH	11.5	5.0U
05-001RBH	11.5 duplicate	5.0U
05-001RBH	14.0 - 15.5	5.0U
05-002RBH	2.0	8.7
05-002RBH	11.0	5.0U
05-002RBH	15.0	5.0U
05-003RBH	1.5	18.0
05-003RBH	11.0	8.5
05-003RBH	15.0	11.0
05-004RBH	1.5	37.0
05-004RBH	6.0	16.0
05-004RBH	11.0	5.0U
05-005RBH	1.5	12.0
05-005RBH	6.0	10.0U
05-005RBH	6.5 - 8.0	10.0U
05-005RBH	11.5	10.0U
05-005RBH	11.5 - 13.0 duplicate	10.0U
Background		10.0U
LUFT Value		200

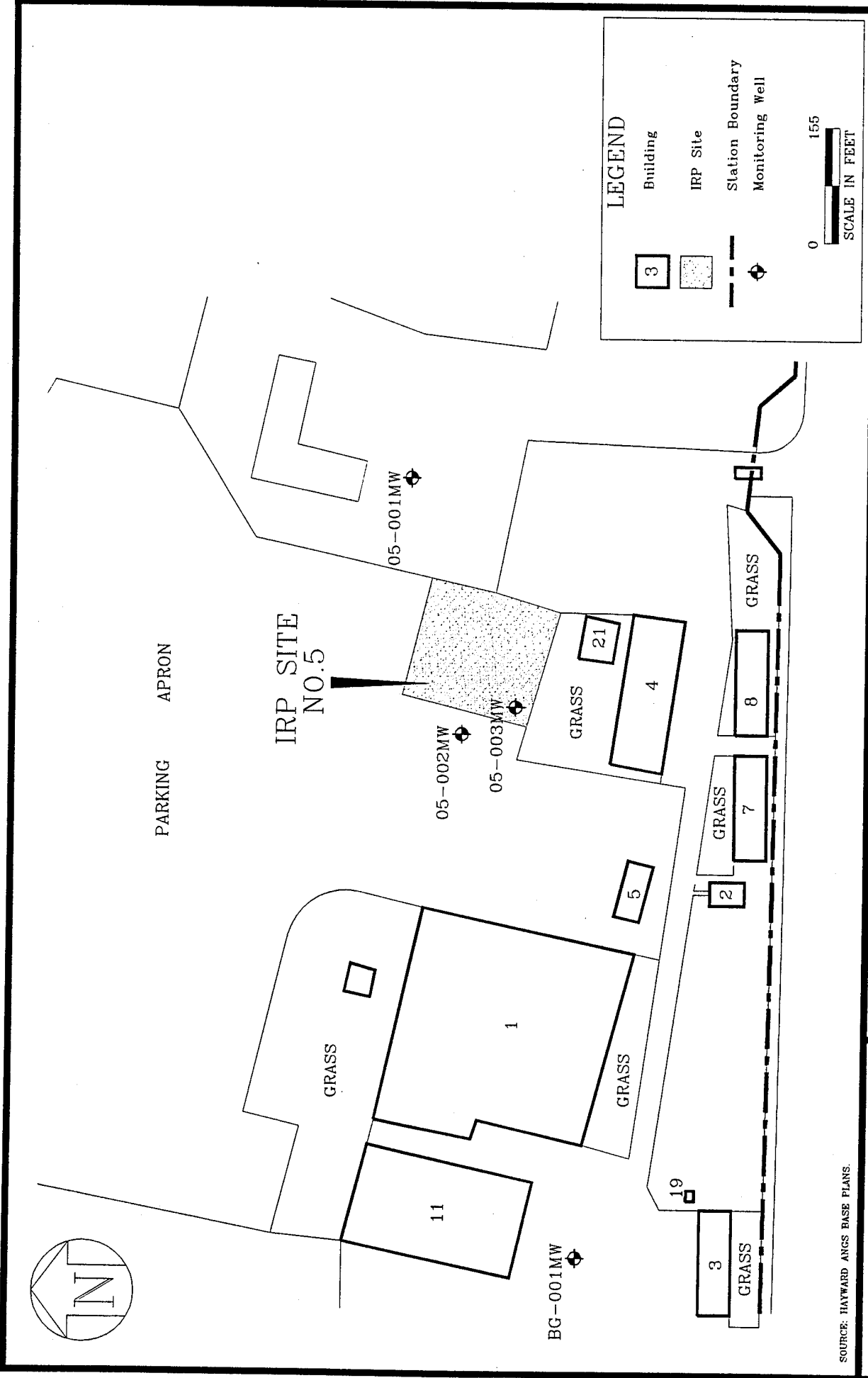
mg/kg – milligrams per kilogram.
 LUFT – Leaking Underground Fuel Tank.
 RBH – Replacement Borehole.

BLS – Below Land Surface.
 U – Compound was analyzed for but not detected.
 Number preceding "U" indicates the detection limit.

groundwater flow, which were discussed in Subsection 5.2.3. During the groundwater sampling conducted in August 1994, six investigative groundwater samples and one duplicate groundwater sample were submitted for laboratory analysis from the three monitoring wells installed at IRP Site No. 5. During the third round of groundwater sampling conducted in December 1994, one investigative groundwater sample from each monitoring well was submitted for analysis.

5.4.3.1 Groundwater Monitoring Well Locations

The monitoring well locations are shown on Figure 5.26. Three monitoring wells were installed at IRP Site No. 5 in order to obtain groundwater samples for laboratory analysis and provide an assessment of the presence and of the type of groundwater contamination existing at the site.



LOCATION OF MONITORING WELLS
 AT IRP SITE NO.5
 216th EIS & 234th CCSQ
 Hayward ANGS
 Hayward, California

FIGURE 5.26
 HAYWARDWELL-6

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SOURCE: HAYWARD ANGS BASE PLANS.

Monitoring wells 05-001MW and 05-002MW were not drilled at the locations originally proposed in the Work Plan. Based on the results of the soil vapor survey and field screening of soil borings, the Site Manager recommended that 05-001MW and 05-002MW be relocated. ANGRC/CEVR was notified on 1 August 1994 of the revised monitoring well locations, and ANGRC/CEVR approval was obtained prior to drilling of monitoring wells. Monitoring well 05-001MW was relocated approximately 250 feet northeast of the UST excavation. Monitoring well 05-002MW, which was originally proposed in the Work Plan as a downgradient well south of the excavation, was relocated to the west side of the excavation, approximately 200 feet from the originally proposed location. Monitoring well 05-003MW was drilled in the originally proposed location.

5.4.3.2 Nature and Extent of Groundwater Contamination

Three groundwater samples were collected from each of the monitoring wells installed at IRP Site No. 5. Two groundwater samples were collected from monitoring well 05-001MW on 9 August and from monitoring wells 05-002MW and 05-003MW on 11 August 1994. Six investigative and one duplicate groundwater sample were collected for laboratory analysis during the August sampling. During the third round of the sampling conducted on 7 December 1994, one investigative groundwater sample was collected from each monitoring well for laboratory analysis.

5.4.3.2.1 Groundwater Sampling Analytical Results

Groundwater samples were collected from 05-001MW, 05-002MW, and 05-003MW. Two groundwater samples were collected for analysis from 05-001MW on 9 August 1994, and two groundwater samples and a duplicate sample were collected from 05-002MW and 05-003MW on 11 August 1994. Another round of samples was taken on 7 December 1994. The last round of sampling was taken on 5 December 1995. The order of groundwater sampling at each monitoring well is indicated by the suffix "A," "B," "C," and "D," respectively, in Table 5.13, which summarizes the analytical results for groundwater samples.

VOCs were not detected in groundwater samples collected from monitoring wells at IRP Site No. 5. VOC surrogate recovery ranged from 90 to 115 percent, which is within acceptable limits, with the exception of two samples that had high recoveries for 4-bromofluorobenzene. QA/QC sample analytical results are reported in Appendix F. A complete listing of the results for all analytical parameters for each sample is given in Appendix G.

TPH-G was detected in groundwater samples collected from 05-001MW and 05-002MW. Detected concentrations exceeded background. The highest TPH-G concentrations were detected in groundwater samples from 05-002MW, located downgradient to the site. TPH-G was detected at concentrations of 1,200 $\mu\text{g/L}$ and 1,100 $\mu\text{g/L}$ in the groundwater samples collected in August 1994, and at 770 $\mu\text{g/L}$ during the December 1994 sampling event. TPH-G was also detected at concentrations of 550 $\mu\text{g/L}$ and 160 $\mu\text{g/L}$ in groundwater samples from 05-001MW in August 1994, but were not detected during the December 1994 sampling event.

TPH-D was detected at a concentration of 980 $\mu\text{g/L}$ in the groundwater sample collected from 05-002MW in December 1994, but were not detected in previous groundwater samples.

An additional round of groundwater sampling was conducted at the three monitoring wells at IRP Site No. 5 in December 1995 (indicated by the suffix "D" in Table 5.13). With the exception of 05-002MW, all results were below detection limits. At monitoring well 05-002MW, TPH-G was detected in the sample and duplicate sample at 1,300 $\mu\text{g/L}$ and 300 $\mu\text{g/L}$, respectively.

Lead was not detected in any groundwater samples collected at IRP Site No. 5.

Table 5.13
Analytical Results for Groundwater Samples Collected at IRP Site No. 5
216th EIS and 234th CCSQ, Hayward ANGS, Hayward, California

Sample ID/Event	VOCs ¹ (µg/L)	TPH ² (Gasoline) (µg/L)	TPH ² (Diesel) (µg/L)	Total Lead ³ (µg/L)
05-001 MW-A	All analytes ND	550	10,000U	5U
05-001 MW-B	All analytes ND	160	10,000U	5U
05-001 MW-C	All analytes ND	100U	50U	50U
05-001 MW-D	All analytes ND	50U	10,000U	5U
05-002 MW-A	All analytes ND	1,200	10,000U	1,000U
05-002 MW-B	All analytes ND	1,100	10,000U	1,000U
05-002 MW-C	All analytes ND	770	980	50U
05-002 MW-D	All analytes ND	1,300	10,000U	5U
05-002 MW-D Dup	All analytes ND	300	10,000U	5U
05-003 MW-A	All analytes ND	100U	10,000U	1,000U
05-003 MW-A Dup	All analytes ND	100U	10,000U	1,000U
05-003 MW-B	All analytes ND	100U	10,000U	1,000U
05-003 MW-C	All analytes ND	100U	50U	50U
05-003 MW-D	All analytes ND	50U	10,000U	5U
California DHS Primary MCL	NA	NA	NA	50

Note: No groundwater samples were taken from standing water in the excavation pit.

¹Method 624.

²Method 8015 modified.

³Methods 6010 (1994 samples) and 6020 (1995 samples).

Sampling dates: A - 10 August 1994.
 B - 10 August 1994.
 C - 7 December 1994.
 D - 5 December 1995.

MW - Monitoring Well.

Dup - Duplicate.

U - Analyte not detected. Number indicates detection limit for that sample.

NA - Not Applicable.

µg/L - micrograms per liter.

"-" - Not analyzed.

VOCs - Volatile Organic Compounds.

ID - Identification.

TPH - Total Petroleum Hydrocarbons.

MCL - Maximum Contaminant Level.

ND - Not Detected.

DHS - Department of Health Services.

SECTION 6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 SUMMARY

Studies were conducted at IRP Site No. 4 (Leaking Vehicle Maintenance USTs) and at IRP Site No. 5 (Abandoned Jet Fuel USTs), located at the 216th EIS and the 234th CCSQ, Hayward ANGS, Hayward, California. IRP Site No. 4 was established in December 1991 when contamination was encountered during excavation activities at the Cable Training Area. IRP Site No. 5, with its three abandoned USTs formerly containing jet fuel, was first identified in a January 1991 PA Report.

6.2 CONCLUSIONS

IRP Site No. 4 is located in the southwest portion of Hayward ANGS. The suspected source of contamination is former UST No. 110, a 5,000-gallon gasoline tank, which was reportedly perforated by a gauge stick on 19 March 1986. IRP Site No. 5 is located in the central portion of Hayward ANGS. The suspected source of contamination is the three former 25,000-gallon USTs, which were in use from approximately 1953 until they were abandoned in 1982.

Soil and groundwater samples were collected from IRP Sites No. 4 and No. 5 and submitted for laboratory analysis to determine whether contamination exists at the site, and if it does exist, to determine the nature and extent of the contamination, and to provide data needed to reach a decision point for the site. Suspected contamination consists primarily of gasoline; therefore, soil and groundwater samples were submitted for analysis of VOCs, TPH (both as gasoline and as diesel), and lead. Data evaluation did not uncover any problems that would adversely affect the analytical results of the investigation.

6.2.1 Soil Contamination

6.2.1.1 IRP Site No. 4

Lead was the only analyte confirmed in soil samples collected from IRP Site No. 4. Lead was detected at concentrations ranging from 7.3 to 590.0 mg/kg. The highest concentrations of lead were detected in soil sampled from a depth of 1.0 to 1.5 feet BLS; lead concentrations, below this depth, ranged from 7.3 to 15.0 mg/kg. A lead value of 200 mg/kg is derived from the LUFT Manual Leaching Potential Analysis chart for low and medium risk situations. Lead contamination detected at lesser concentrations may not require further investigation.

The only lead concentrations that exceed the total lead LUFT Manual value of 200 ppm were detected in soil samples collected from borings 04-001BH (210 mg/kg) and 04-004BH (590 mg/kg) from a depth of 1.0 foot BLS and 1.5 feet BLS, respectively. According to the United States Geological Survey (USGS) publication Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States (Shacklette and Boerngen, 1984), naturally occurring concentrations of lead in the Hayward area may range from 30 to 700 ppm.

6.2.1.2 IRP Site No. 5

Benzene and ethylbenzene were detected at maximum concentrations of 0.03 mg/kg and 0.023 mg/kg, respectively.

TPH-G was detected in samples 05-002RBH, 05-003RBH, and 05-004RBH. The highest concentration of TPH-G was detected in sample 05-004RBH (19 mg/kg), located at the north central area of the excavation. This was the only sample to exceed the LUFT Manual Leaching Potential Analysis chart level (10 mg/kg) for soils that can be left in place without threatening groundwater.

Lead was detected in soil samples collected from IRP Site No. 5 at concentrations ranging from 8.5 to 37.0 mg/kg. These levels were well below the lead value of 200 ppm derived from the LUFT Manual Leaching Potential Analysis chart for low and medium risk situations.

6.2.2 Groundwater Contamination

6.2.2.1 IRP Site No. 4

Monitoring well 04-002MW was relocated from its originally proposed location, with ANGRC/CEVR approval. As a result of relocating monitoring well 04-002MW, no monitoring well is located downgradient of the former cable training excavation.

TPH-G, TPH-D, and lead were the only analytes detected in groundwater samples collected from IRP Site No. 4. TPH-G was detected at concentrations of 1,000 $\mu\text{g/L}$ and 530 $\mu\text{g/L}$ in the first and second rounds of groundwater samples collected from monitoring well 04-002MW. TPH-G was detected in the third round of samples at 04-002MW and its duplicate (1,400 $\mu\text{g/L}$ and 1,200 $\mu\text{g/L}$ respectively). TPH-D was detected at concentrations of 840 $\mu\text{g/L}$ and 920 $\mu\text{g/L}$ in the third round of groundwater samples at 04-002MW and its duplicate. TPH-D was not detected in background samples.

The California DHS Primary MCL for lead in groundwater is 50 $\mu\text{g/L}$. Lead was detected at slightly higher than background levels in the first groundwater sample taken at monitoring well 04-002MW (8,300 $\mu\text{g/L}$ vs. 6,700 $\mu\text{g/L}$). Lead was not detected in any of the other groundwater samples.

6.2.2.2 IRP Site No. 5

Neither lead nor VOCs were detected in any of the confirmatory groundwater samples collected from the three monitoring wells at IRP Site No. 5. During the August 1994 groundwater sampling event, however, VOCs were detected in groundwater screening samples collected from monitoring wells 05-002MW and 05-003MW at maximum concentrations of 164 $\mu\text{g/L}$ and 266 $\mu\text{g/L}$, respectively.

TPH-G concentrations in groundwater were detected at 770 $\mu\text{g/L}$, 1,100 $\mu\text{g/L}$, and 1,200 $\mu\text{g/L}$ in monitoring well 05-002MW. However, these concentrations all decreased in value from the first round of groundwater samples collected in August 1994 to the third round of samples collected in December 1994. Further data is required to evaluate this decrease.

TPH-G concentrations in groundwater were detected at 550 $\mu\text{g/L}$ at monitoring well 05-001MW.

TPH-D was detected at a concentration of 980 $\mu\text{g/L}$ in the groundwater sample collected from monitoring well 05-002MW in December 1994. However, TPH-D was not detected in any of the groundwater samples collected in August 1994. Therefore the results are inconsistent.

During groundwater sampling conducted in December 1995, TPH-G was detected in monitoring well 05-002MW at 1,300 $\mu\text{g/L}$ and 300 $\mu\text{g/L}$ in the sample and duplicate sample, respectively.

6.3 RECOMMENDATIONS

Based on the results of the SI conducted, the following recommendations are presented for IRP Site No. 4:

- Lead contamination was detected in the upper 1.0 to 1.5 feet of soil at IRP Site No. 4. Further investigation is recommended to delineate the extent of soil contamination.

- TPH contamination was detected in groundwater collected from monitoring wells installed at IRP Site No. 4. Therefore, it is recommended that additional investigative work be performed at this site.

Based on the results of the SA conducted for IRP Site No. 5, the following recommendations are presented:

- In order to further delineate the extent of soil contamination, additional soil sampling is recommended along the west and north sides (soil borings 05-002RBH, 05-003RBH, and 05-004RBH) of the excavation.
- Additional groundwater sampling should be conducted at IRP Site No. 5 to evaluate TPH-G and TPH-D analytical results.
- A risk assessment and a salinity analysis should be conducted. A salinity analysis is required to determine the potability of the water.

SECTION 7.0 REFERENCES

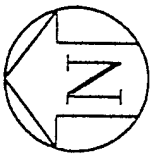
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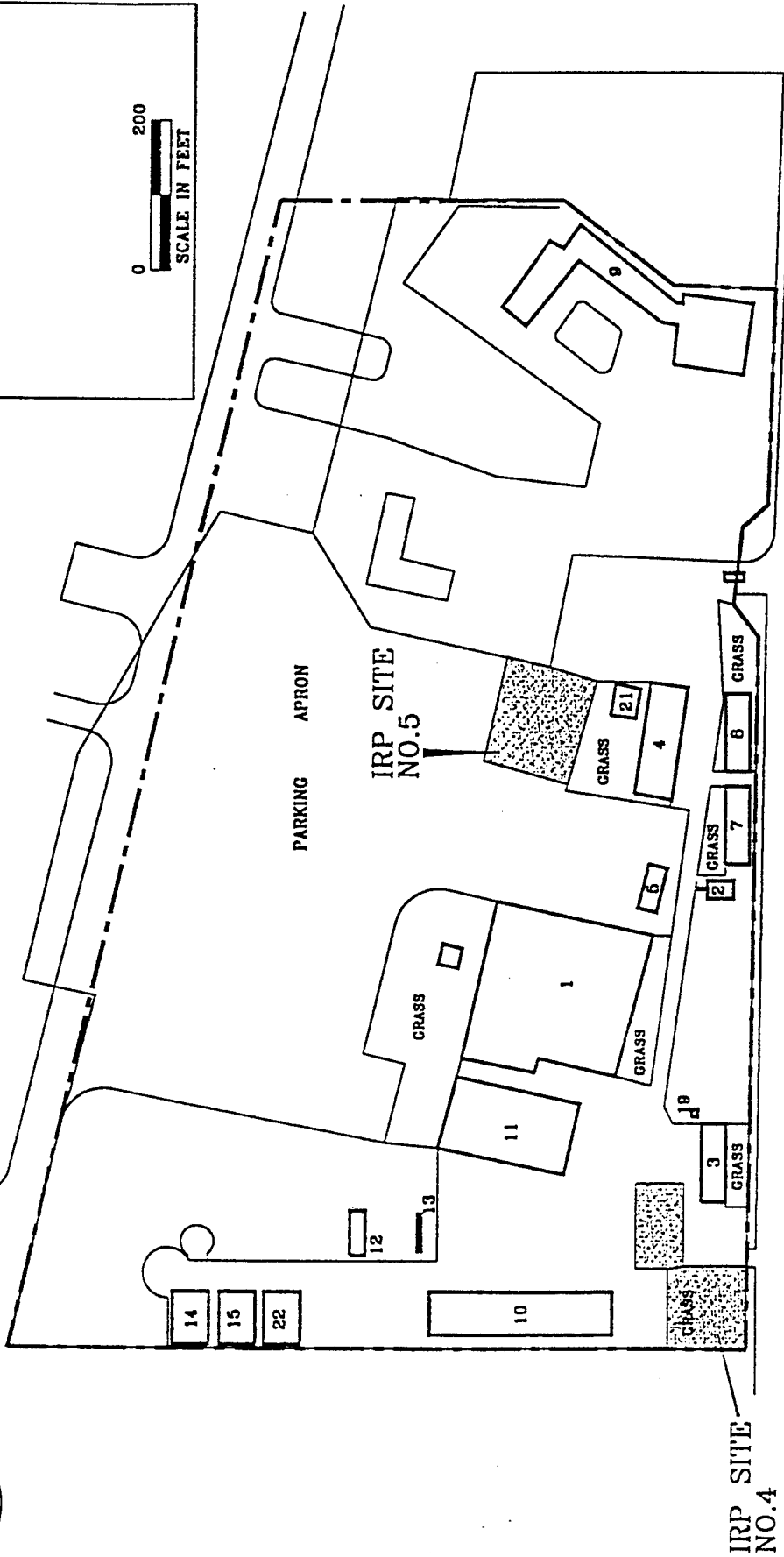
LEGEND

14 Building

IRP Site

Station Boundary

0 200
SCALE IN FEET



SOURCE: HAYWARD ANGCS BASE PLANS.

**INSIDE
BACK
COVER**
HAYWARD ANGCS-513

LOCATION OF IRP SITE NO. 5 AND SITE NO. 4

216th EIS & 234th CCSQ
Hayward ANGCS
Hayward, California

OPTTECH
OPERATIONAL TECHNOLOGIES
CORPORATION

MAY 1996